RRB Group D Official Paper (Held On: 02 Feb, 2026 Shift 1) (Previous Year Paper)

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

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GENERAL SCIENCE

Q1. Meristematic tissues are found only in a specific region. On the basis of position, which is NOT a meristematic tissue type?

(a) Apical
(b) Intercalary
(c) Basal
(d) Lateral

Q2. Which of the following hydrocarbons are organic compounds with elements _____?

(a) Oxygen
(b) Carbon
(c) Hydrogen
(d) both hydrogen and carbon

Q3. From the given alternatives, select the correct statement related to garbage from a general household.

(a) Safe disposal of garbage is not mandatory.
(b) Entire garbage is non-biodegradable.
(c) Entire garbage is biodegradable.
(d) Garbage contains both biodegradable and non-biodegradable components.

Q4. What is the transfer of pollen grain from one flower to another flower called?

(a) Geitonogamy
(b) Self pollination
(c) Cross pollination
(d) Autogamy

Q5. The distance between the optical centre of a lens and its principal focus is called _____.

(a) aperture
(b) focal length
(c) magnification
(d) radius of curvature

Q6. Which of the following statements is/are correct regarding the female reproductive system?

Statement A: The egg is carried from the ovary to the womb through a thin oviduct or fallopian tube.

Statement B: The uterus opens into the vagina through the cervix.

(a) Neither statement A nor B
(b) Only statement B
(c) Only statement A
(d) Both statement A and B

Q7. Which organism is a key indicator of a healthy aquatic ecosystem?

(a) Earthworm
(b) Fish
(c) Lichen
(d) Cockroach

Q8. Which of the following correctly describes the direction of the magnetic field outside a solenoid?

(a) South pole to North pole
(b) From the centre to the ends
(c) North pole to South pole
(d) From the ends to the centre

Q9. Which of the following displacement reactions are possible?

I. $Fe_{(s)} + CuSO4_{(aq)} \rightarrow FeSO4 + Cu$
II. $Cu + FeSO_{4(aq)} \rightarrow CuSO4 + Fe_{(s)}$
III. $Na2SO4 + BaCl2 \rightarrow BaSO4 + 2NaCl$
IV. $AgCl + NaNO3 \rightarrow AgNO3 + NaCl$

(a) I and III only
(b) II and IV only
(c) I, II, and III only
(d) I, III and IV only

Q10. Which of the following processes results in the formation of two identical daughter cells?

(a) Cytokinesis without karyokinesis
(b) Mitosis
(c) Meiosis
(d) Fertilisation

Q11. What advantage does asexual reproduction provide in a stable environment?

(a) Adaptation to new environment
(b) Sexual diversity
(c) Rapid and identical reproduction
(d) Genetic variation

Q12. Which of the following chemical equations is correctly balanced?

(a) $Fe + H2O \rightarrow Fe3O4 + H2$
(b) $2Fe + 3H2O \rightarrow 2Fe3O4 + 3H2$
(c) $3Fe + 4H2O \rightarrow Fe3O4 + 4H2$
(d) $3Fe + 4H2O \rightarrow Fe3O4 + 2H2$

Q13. Sodium hydroxide is prepared by passing electricity through an aqueous solution of sodium chloride. The process is called:

(a) Chlor-alkali
(b) Hall-Héroult
(c) Born Haber
(d) Dow's

Q14. Truck and motorbus tyres are designed to be much wider than car tyres, while cutting tools and nails are designed with sharp, small tips. This contrast in design illustrates the principle that _____.

(a) thrust is directly proportional to the area of contact
(b) larger thrust always results in lower pressure
(c) the same thrust acting on a smaller area exerts a larger pressure
(d) pressure is inversely proportional to the mass of the object

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Q15. Select the correct function of the smooth endoplasmic reticulum.

(a) Carbohydrate synthesis
(b) Protein synthesis
(c) Lipid synthesis
(d) Nucleic acid synthesis

Q16. Which of the following best illustrates Newton's Third Law of Motion?

(a) A ball falling under gravity.
(b) A car accelerating on a road due to engine power.
(c) A rocket propelling upward by expelling gases downward.
(d) A pendulum oscillating back and forth.

Q17. Which of the following devices work on the principle of multiple reflections of sound waves?

(a) Megaphone
(b) Microscope
(c) Stethoscope
(d) Thermometer

Q18. Which process is used for the extraction of aluminium from bauxite?

(a) Electrolysis of molten aluminium oxide
(b) Roasting followed by reduction
(c) Calcination followed by carbon reduction
(d) Displacement by zinc

Q19. Which of the following statements is/are NOT true according to the sign convention for spherical lenses?

(i) All distances parallel to the principal axis are measured from the focus of the lens.
(ii) All the distances measured to the right of the origin are taken as positive.
(iii) Distances measured perpendicular to and above the principal axis are taken as negative.
(iv) The object is always placed to the left of the lens.

(a) Both (i) and (iii)
(b) Both (ii) and (iii)
(c) Both (ii) and (iv)
(d) Both (i) and (iv)

Q20. Can the displacement of an object be greater than the distance travelled?

(a) Only when the object moves in a straight line
(b) Yes, sometimes
(c) Yes, always
(d) No, displacement can never be greater than distance

Q21. The SI unit of Power is watt (W). As per the relation of work-power, one watt is equivalent to _____.

(a) 1 Joule-second (1 J.s)
(b) A kilowatt-hour (1 kWh)
(c) 1 Joule per second (1 J/s)
(d) 1 Newton per meter (1 N/m)

Q22. If voltage (V) is constant, the power is directly proportional to which of the following?

(a) Energy
(b) Square of Resistance
(c) Resistance
(d) Current

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Q23. Which of the following statements best explains why all atoms of an element are represented by the same symbol?

(a) Because they have the same number of protons in their nucleus
(b) Because they have the same number of neutrons in the nucleus
(c) Because their mass numbers are always the same
(d) Because they have identical physical properties

Q24. Estimate the concentration of the solution in terms of mass by mass percentage if 50 g of common salt is dissolved in 300 g of water.

(a) 14.28%
(b) 12.22%
(c) 12%
(d) 14%

Q25. Which of the following is a compound that forms a solution when dissolved in water?

(a) Sand
(b) Oil
(c) Sodium Chloride
(d) Iron filings

MATHEMATICS

Q26. The number 8,33,525 is NOT divisible by:

(a) 15
(b) 25
(c) 55
(d) 35

Q27. A vendor buys a washing machine for Rs. 12,000. He sells it to a retailer at 10% profit, and the retailer sells it to a customer at 15% loss. What is the final selling price?

(a) Rs. 11,220
(b) Rs. 11,620
(c) Rs. 11,000
(d) Rs. 11,420

Q28. What is the simple interest on a sum of Rs. 5,500, if the rate of interest for the first 4 years is 6% per annum and for the last 2 years is 5% per annum?

(a) Rs. 1,660
(b) Rs. 1,920
(c) Rs. 1,750
(d) Rs. 1,870

Q29. Two pipes, P and Q, can fill a cistern in 30 hours and 40 hours, respectively. If pipe P is opened alone for 15 hours and then closed, after which pipe Q fills the cistern until it is full, then what percentage of the cistern is filled by pipe P relative to the portion filled by pipe Q?

(a) 150%
(b) 120%
(c) 50%
(d) 100%

Q30. Find the value of x in the following expression.

(0.49)^4 × (0.343)^4 ÷ (0.2401)^4 = (7 ÷ 10)^(x+2)

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

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Q31. A leaves point X at 9:00 AM and reaches point Y at 1:00 PM. B leaves point Y at 9:00 AM and reaches point X at 3:00 PM. At what time will they meet?

(a) 11:24 AM
(b) 12:36 PM
(c) 1:24 PM
(d) 10:24 AM

Q32. For 7 innings, a cricketer has an average of 90 runs. In the 8^(th) inning, he scores 176 runs. His average score increased by _____. (Round off your answer to the nearest whole number.)

(a) 20
(b) 7
(c) 14
(d) 11

Q33. A grocer marked his goods at 50% above their cost price and sold them at a discount of X%. If he gained 35% profit, then find the value of X.

(a) 12
(b) 10
(c) 9
(d) 11

Q34. If 20% of a number is added to 66, then the result is the same number. 60% of the same number is:

(a) 79.5
(b) 59.5
(c) 49.5
(d) 69.5

Q35. If third proportional of 75 and Z be 12, then what is the value of Z?4959

(a) 27
(b) 32
(c) 30
(d) 28

Q36. What is the volume (in cm^3, rounded off to 1 decimal place) of a spherical shell whose internal and external diameters are 10 cm and 12 cm, respectively?

(Take $\pi = 22/7$)

(a) 401.5
(b) 323.9
(c) 381.3
(d) 345.7

Q37. The perimeter of a square is equal to the one-half of radius of a circle whose area is 39424 cm^2. What is the area of the square?

(Take $\pi = 22/7$).

(a) 196 cm2
(b) 169 cm2
(c) 135 cm2
(d) 204 cm2

Q38. The price of fuel decreases by 10%, 50% and 10% in three successive months, but increases by 45% in the fourth month. What is the percentage increase/decrease in the price of fuel in the fourth month as compared to its original price? (Round off your answer to two decimal places.)

(a) Decreases by 41.28%
(b) Increases by 42.91%
(c) Decreases by 44.56%

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(d) Increases by 46.86%

Q39. The ages of Renu and Kashish are in the ratio 9 : 8. After 5 years, the ratio of their ages will be 10 : 9. Find the difference between their present ages.

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

Q40. Which of the following is equal to K if $\sin^2 x + K = 1$?

(a) $\sec^2 x$
(b) $\cot^2 x$
(c) $\cos^2 x$
(d) $\tan^2 x$

Q41. The average age of 24 students of a class is 17 years. If the age of the teacher is also included, the average age of the whole group becomes 18 years. The age (in years) of the teacher is:

(a) 44
(b) 45
(c) 43
(d) 42

Q42. Two lines are planned such that the equations representing their paths are: $(k-4)x + 2y = 6$ and $2x + y = 4$. If the lines are to be constructed parallel to each other, what value of k will ensure that?

(a) 6
(b) 10
(c) 7
(d) 8

Q43. In a test, B got 50 marks while A got 75 marks, out of 80 maximum marks. What percentage of A's marks was B's marks? (Round off the answer to two decimal places.)

(a) 66.67%
(b) 93.75%
(c) 150.46%
(d) 80.33%

Q44. One pipe can fill a tank in 7 minutes while another pipe can empty the completely filled tank in 56 minutes. If both the pipes are opened together when the tank is empty, how many minutes will it take to fill one-half of the tank?

(a) 9
(b) 4
(c) 8
(d) 5

Q45. A dealer allowed a 77% discount on an article and was still able to manage a 49% profit. Find the ratio of the cost price to the listed price.

(a) 23 : 149
(b) 26 : 152
(c) 20 : 150
(d) 25 : 154

Q46. If $2x + 2/x = 3$, what is $x^2 + 1/(x^2)$?

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

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Q47. Which of the following is the correct model for finding the Highest Common Factor (HCF) of two numbers?

(a) Addition Model: Add the two numbers and check the common factors of the sum.
(b) Subtraction Model: Subtract both the numbers and check the common factor.
(c) Prime Factorization Model: Find the prime factorization of both numbers, then multiply the common prime factors with the lowest powers.
(d) Division Model: Divide both numbers by a common number to find the highest factor.

Q48. The measure of each interior angle of a regular pentagon is:

(a) 108°
(b) 78°
(c) 118°
(d) 128°

Q49. Rs. 13,403 is divided among S, B and C in such a way that if Rs. 40, Rs. 83 and Rs. 68 be deducted from their respective shares, they have money in the ratio 21:11:4. Find the difference between the original shares of B and C.

(a) Rs. 2,584
(b) Rs. 2,719
(c) Rs. 2,669
(d) Rs. 2,519

Q50. Walking at 3/4 th of his normal speed from his home, Abhishek is 11 minutes late in reaching his office. The usual time taken by him to cover the distance between his home and his office is:

(a) 32 minutes
(b) 33 minutes
(c) 26 minutes
(d) 29 minutes

GENERAL INTELLIGENCE & REASONING

Q51. Refer to the following number and symbol series and answer the question that follows. Counting to be done from left to right only.

(Left) 9 @ 3 2 ! 1 6 ^9 3 ! @ # 3 5 + ! (Right)

If all the symbols are dropped from the series, which of the following will be seventh from the right?

(a) 3
(b) 6
(c) 9
(d) 2

Q52. Each of the digits in the number 56378492 is arranged in descending order from left to right. What will be the product of the digits that are second from the left and second from the right in the new number thus formed?

(a) 21
(b) 32
(c) 24
(d) 28

Q53. Seven boxes, B, D, E, P, S, T and W, are kept one over the other, but not necessarily in the same order.

W is kept second from the bottom. Only three boxes are kept between W and B. P is kept at one of the positions below W. Only D is kept between B and S. E is kept at one of the positions above B.

How many boxes are kept between P and E?

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

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Q54. Select the pair which follows the same pattern as that followed by the two pairs given below. Both pairs follow the same pattern.

DBD−BZB

JHJ−HFH

(a) VST−SQS
(b) VST−TRT
(c) VTV−TRT
(d) VTV−SRS

Q55. Priya starts from point A and drives 32 km towards the south. She then takes a right turn, drives 31 km, turns right and drives 43 km. She then takes a right turn and drives 54 km. She takes a final right turn, drives 11 km and stops at point P. How far (shortest distance) and towards which direction should she drive in order to reach point A again? (All turns are 90-degree turns only, unless specified.)

(a) 23 km to the west
(b) 21 km to the west
(c) 24 km to the south
(d) 22 km to the west

Q56. What should come in place of the question mark (?) in the given series based on the English alphabetical order?

ARB YVZ WZX UDV ?

(a) TGU
(b) RGT
(c) SHT
(d) RHS

Q57. In a school complex, Building A is to the south of Building B. Building E is to the east of Building B. Building D is to the west of Building A. Building C is to the south of Building E. What is the position of Building C with respect to Building B?

(a) South
(b) West
(c) South-east
(d) East

Q58. In a row of 25 people facing north, Sanjay is 7th from the right end. If Anu sits 3rd to the left of Sanjay, then what is Anu’s position from the left end of the line?

(a) 18th
(b) 15th
(c) 17th
(d) 16th

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

2, 27, 63, 112, 176, ?

(a) 259
(b) 257
(c) 256
(d) 258

Q60. Six friends, G, H, I, Q, R and S, are sitting around a circular table facing the centre of the table. Q sits third to the left of G. G sits second to the left of R. Only S sits between G and H. I is not an immediate neighbour of Q. How many people sit between H and I when counted from the right of H?

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

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

71 59 46 32 17 ?

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

Q62. If 3 is added to each odd digit and 2 is subtracted from each even digit in the number 5341256, what will be the sum of the digits which are first from the left and second from the right in the new number thus formed?

(a) 14
(b) 8
(c) 16
(d) 10

Q63. DRBH is related to SGQW in a certain way based on the English alphabetical order. In the same way, LZJP is related to AOYE. To which of the given options is ESCI related, following the same logic?

(a) THDR
(b) THRE
(c) THYU
(d) THRX

Q64. 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 jacks are hammers.

All jacks are keys.

All jacks are drillers.

Conclusions:

(I) All hammers are drillers.

(II) Some drillers are keys.

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

Q65. 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) NKP
(b) RQP
(c) HEJ
(d) MJO

Q66. This question is based on the five, three-digit numbers given below.

(Left) 593, 784, 358, 631, 296 (Right)

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

Note: All operations to be done from left to right.

What will be the resultant if the third digit of the highest number is added to the second digit of the lowest number?

(a) 10
(b) 14
(c) 13

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(d) 17

Q67. 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) 9 6 7 2 3 7 3 8 1 7 2 8 6 3 6 8 9 9 3 9 5 6 1 5 1 7 8 (Right)

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

(a) 8
(b) 7
(c) 5
(d) 6

Q68. In a certain code language, ‘SOUP’ is coded as ‘5179’ and ‘PACE’ is coded as ‘2418’. What is the code for ‘P’ in the given code language?

(a) 9
(b) 1
(c) 2
(d) 7

Q69. In a certain code language,

A + B means ‘A is the son of B’,

A - B means ‘A is the brother of B’,

A x B means ‘A is the wife of B’,

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

How is K related to V if ‘K-TxR+Z&V’?

(a) Husband
(b) Brother's wife's brother
(c) Brother's wife's father
(d) Son

Q70. O, P, Q, R, W, X and Y are sitting in a straight line facing north. Only three people sit between W and Y. P sits to the immediate left of Y. No one sits to the right of Q. Only two people sit between Q and P. X sits to the immediate right of O. How many people sit between R and X?

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

Q71. In a certain code language, ‘AMIE’ is coded as ‘9432’ and ‘SAME’ is coded as ‘4279’. What is the code for ‘S’ in that language?

(a) 9
(b) 2
(c) 7
(d) 4

Q72. What should come in place of the question mark (?) in the given series?

94 130 179 243 324 ?

(a) 424
(b) 423
(c) 426
(d) 425

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Q73. 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.

JOIN - OJIN - NOJI

MALE - AMLE - EAML

(a) PAGE - APGE - EAGP
(b) LION - ILON - NILO
(c) NEAR - NAER - RAEN
(d) USER - SUER - SERU

Q74. Refer to the following number series and answer the question that follows (all numbers are single-digit numbers only). Counting to be done from left to right only.

(Left) 9 8 9 8 1 9 4 4 8 2 8 2 9 6 8 9 9 8 8 9 6 5 5 1 5 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) 2
(b) 4
(c) 3
(d) 5

Q75. 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/subtracting/multiplying to 13 can be performed. Breaking down 13 into 1 and 3 and then performing mathematical operations on 1 and 3 is not allowed.)

(55, 11, 5)

(36, 3, 12)

(a) (70, 5, 16)
(b) (65, 5, 13)
(c) (42, 15, 3)
(d) (56, 14, 3)

Q76. If ‘P’ stands for ‘×’, ‘Q’ stands for ‘÷’, ‘R’ stands for ‘−’ and ‘S’ stands for ‘+’, then what will come in place of question mark (?) in the following equation?

78 P 3 R 15 Q 5 S 126 Q 3 S 117 Q 9 S 125 Q 5 = ?

(a) 332
(b) 351
(c) 384
(d) 311

Q77. Based on the English alphabetical order, three of the following four letter-cluster pairs are alike in a certain way and thus form a group. Which is the one that does not belong to that group?

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

(a) AQ - YO
(b) NB - LZ
(c) DW - BV
(d) EL - CJ

Q78. 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:

Some rabbits are fans.

No fan is a car.

Conclusions:

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(I): Some rabbits are cars.

(II): Some fans are rabbits.

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

Q79. Which of the following letter-number clusters will replace the question mark (?) in the given series to make it logically complete?

YCG 87 IMQ 95 SWA 103 CGK 111 ?

(a) MQU 119
(b) MRT 119
(c) MRX 118
(d) MPT 118

Q80. Seven friends, B, C, D, T, U, V and W, are sitting in a straight line facing north. Only three people sit to the left of T. Only W sits to the right of D. Only three people sit between D and C. B sits at some place to the left of U but at some place to the right of V. How many people sit between V and U?

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

GENERAL AWARENESS AND CURRENT AFFAIRS

Q81. As notified in February 2025, which of the following companies introduced India's first Air Quality Index-based parametric insurance for construction workers in the Delhi-National Capital Region?

(a) National Insurance Company Limited
(b) Tata AIG General Insurance
(c) Go Digit General Insurance Limited
(d) Star Health and Allied Insurance

Q82. In October 2024, which of the following state governments launched India's first integrated state-level Cyber Command and Control Centre to serve as a comprehensive hub for handling grievances through multiple channels, including a helpline, web portal and mobile app?

(a) Maharashtra
(b) Kerala
(c) Chhattisgarh
(d) Haryana

Q83. Which of the following parties won 5 seats in the Bihar Assembly elections 2025?

(a) Hindustani Awam Morcha (Secular)
(b) Bahujan Samaj Party
(c) Lok Janshakti Party (Ram Vilas)
(d) Janata Dal (United)

Q84. Which student-led national case competition launched in October 2025 aims to address malnutrition and promotes SDG 2 (Zero Hunger) and SDG 3 (Good Health & Well-being)?

(a) Swasth India Mission
(b) Viksit Bharat Challenge
(c) Yukti – Nutrition Nirmaan
(d) Udaan – Education for All

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Q85. Which important day commemorating India's victory over Pakistan was observed on 26 July 2025?

(a) Republic Day
(b) Border Security Day
(c) Independence Day
(d) Kargil Vijay Diwas

Q86. Where was the Senior Asian Wrestling Championship 2025 held?

(a) Jordan
(b) Saudi Arabia
(c) Uzbekistan
(d) Qatar

Q87. What is the name of the new defence facility inaugurated by Rajnath Singh in New Delhi in November 2025?

(a) Defence PSU Nilayam
(b) India Defence Parisar
(c) National Defence Hub
(d) DPSU Bhawan

Q88. In April 2025, which international organisation acknowledged India's achievement in lifting 171 million people out of extreme poverty?

(a) United Nations
(b) Asian Development Bank
(c) World Bank
(d) International Monetary Fund

Q89. Before the approval of caste census in 2025, the last major attempt to gather caste-based data at the national level was made through which exercise?

(a) Socio-Economic and Caste Census (SECC), 2011
(b) Economic Census of 2001
(c) Census of India, 1971
(d) National Sample Survey, 2005

Q90. Who, as a digital content creator, co-founded Monk Entertainment and was a prominent figure in 2025?

(a) Sanchit Patil
(b) Ranveer Allahbadia
(c) Jeet Shah
(d) Abhishek Mishra

Q91. Which city hosted the prestigious Michelin Guide awards in February 2025?

(a) Glasgow, Scotland
(b) Cardiff, Wales
(c) Birmingham, England
(d) Edinburgh, Scotland

Q92. As of 11 June 2025, approximately how much aid did Punjab National Bank (PNB) provide under the Rakshak Plus Scheme for martyrs' families?

(a) Rs. 7 crore
(b) Rs. 27 crore
(c) Rs. 37 crore
(d) Rs. 17 crore

Q93. Who developed the Adarsh Sports Complex in Jaipur that was inaugurated in April 2025?

(a) Jaipur Municipal Corporation - Greater (JMC-G)
(b) Ministry of Youth Affairs and Sports
(c) Jaipur Development Authority (JDA)

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(d) Rajasthan Sports Authority

Q94. In January 2025, Gujarat Chief Minister Bhupendra Patel inaugurated the Khel Mahakumbh 3.0 in which city?

(a) Surat
(b) Vadodara
(c) Ahmedabad
(d) Rajkot

Q95. When did the Government of India reconstitute the Atomic Energy Commission to include TV Somanathan and Manoj Govil?

(a) January 2025
(b) December 2025
(c) March 2025
(d) November 2024

Q96. What was the central focus of the 7th Future Food Forum 2025 held in Dubai, UAE?

(a) Strengthening financial inclusion and fintech cooperation
(b) Building a circular economy for global manufacturing networks
(c) Advancing food security, trade and innovation
(d) Enhancing tourism-led growth through digital platforms

Q97. Who conferred awards to cities under the Swachh Vayu Sarvekshan Awards 2025?

(a) Prime Minister of India
(b) President of India
(c) Finance Minister, GoI
(d) Environment Minister, GoI

Q98. Who set the record for the highest individual score in the history of the Champions Trophy innings with 165 runs?

(a) Josh Inglis
(b) Ibrahim Zadran
(c) Alex Carey
(d) Ben Duckett

Q99. In September 2025, which range of Kaziranga National Park and Tiger Reserve was announced to open first for the 2025–26 tourist season?

(a) Bagori Range
(b) Agaratoli Range
(c) Kohora Range
(d) Burapahar Range

Q100. In which union territory of India was the world's highest rail arch bridge inaugurated by the Prime Minister of India in June 2025?

(a) Jammu and Kashmir
(b) Ladakh
(c) Chandigarh
(d) New Delhi

ANSWER KEY

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

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51	d	52	c	53	c	54	c	55	a	56	c	57	c	58	d	59	b	60	c
61	d	62	c	63	d	64	a	65	b	66	c	67	d	68	b	69	b	70	a
71	c	72	a	73	b	74	c	75	b	76	d	77	c	78	a	79	a	80	c
81	c	82	a	83	a	84	c	85	d	86	a	87	d	88	c	89	a	90	b
91	a	92	d	93	a	94	d	95	a	96	c	97	d	98	d	99	a	100	a

SOLUTIONS

Q1. Answer: (c) Basal

The correct answer is Basal.

Key Points

• Meristematic tissues are a group of cells that have the ability to divide continuously throughout their life. Based on their position in the plant body, they are primarily classified into three types: Apical, Intercalary, and Lateral meristems.

• Apical Meristem: These are situated at the growing tips of stems and roots (shoot apex and root apex). They are responsible for the increase in length of the plant, known as primary growth. Hence, Apical is a correct type of meristematic tissue.

• Intercalary Meristem: These are located at the base of leaves or internodes (e.g., in grasses). They help in the regeneration of parts removed by grazing herbivores and contribute to the elongation of organs. Hence, Intercalary is a correct type of meristematic tissue.

• Lateral Meristem: These occur on the lateral sides of stems and roots. They are responsible for increasing the girth or thickness of the plant, which is known as secondary growth. Examples include vascular cambium and cork cambium. Hence, Lateral is a correct type of meristematic tissue.

• Basal: In the standard botanical classification of meristems based on position, Basal is not recognized as a primary distinct category. While some specific tissues in certain plants might be located at the base, the three fundamental types remain Apical, Intercalary, and Lateral. Hence, Basal is NOT a standard meristematic tissue type based on position.

Additional Information

• Characteristics of Meristematic Cells:

• The cells are very active, possessing dense cytoplasm, thin cellulose walls, and prominent nuclei.

• They generally lack vacuoles because they do not need to store food or provide structural support, as their primary function is cell division.

• The term Meristem was coined by Karl Wilhelm von Nägeli in the year 1858.

• Permanent Tissues:

• Once meristematic cells take up a specific role and lose the ability to divide, they form permanent tissues. This process is called differentiation.

• Simple Permanent Tissues consist of cells similar in structure (e.g., Parenchyma, Collenchyma, and Sclerenchyma).

• Complex Permanent Tissues consist of more than one type of cell working together (e.g., Xylem and Phloem).

• Primary vs. Secondary Growth:

• Primary growth occurs due to the activity of Apical and Intercalary meristems, leading to the elongation of the plant body.

• Secondary growth is typical in dicotyledons and gymnosperms, facilitated by Lateral meristems like the Cambium, which increases the diameter of the plant.

Important Points

• Location Summary:

• Apical Meristem: Found at root and shoot tips.

• Intercalary Meristem: Found at the nodes or leaf bases of monocots.

• Lateral Meristem: Found in the vascular bundles and cork layer of woody plants.

• Functions:

• The Vascular Cambium produces secondary xylem (wood) and secondary phloem.

• The Cork Cambium (Phellogen) produces the periderm, which replaces the epidermis in older stems and roots.

Q2. Answer: (d) both hydrogen and carbon

The correct answer is both hydrogen and carbon.

Key Points

• Hydrocarbons are organic compounds that are composed exclusively of the elements carbon and hydrogen. They are considered the fundamental compounds of organic chemistry.

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• The carbon atoms in a hydrocarbon provide the structural framework or covalent backbone, while the hydrogen atoms are attached to the carbon atoms to satisfy their tetravalency.

• Because carbon has a valency of 4, it can form four stable covalent bonds, allowing for the formation of long chains, branched structures, or rings. Hydrogen, with a valency of 1, fills the remaining bonding sites.

• Hydrocarbons do not contain other elements like oxygen, nitrogen, or sulfur in their pure form; if these elements are present, the compounds are classified as hydrocarbon derivatives or other functional groups (e.g., alcohols, carboxylic acids).

• They serve as the primary source of energy for the modern world, being the main components of petroleum and natural gas.

Additional Information

• Classification of Hydrocarbons:

• Saturated Hydrocarbons (Alkanes): These contain only single bonds between carbon atoms. Their general formula is CnH2n+2. Examples include Methane (CH4) and Ethane (C2H6).

• Unsaturated Hydrocarbons: These contain double bonds (Alkenes, formula CnH2n) or triple bonds (Alkynes, formula CnH2n-2). An example of an alkene is Ethene (C2H4), and an alkyne is Ethyne (C2H2).

• Aromatic Hydrocarbons: These are cyclic hydrocarbons with delocalized pi electrons, such as Benzene (C6H6). They are known for their stable ring structures and distinct odors.

• Physical State and Properties:

• The physical state of a hydrocarbon depends on its molecular weight. Low-molecular-weight hydrocarbons (C1 to C4) like Methane and Butane are gases at room temperature.

• Intermediate-weight hydrocarbons (C5 to C17) are generally liquids (like Gasoline or Hexane), while those with 18 or more carbon atoms are solids (like Paraffin wax).

• Hydrocarbons are generally non-polar and hydrophobic, meaning they do not dissolve in water but are soluble in organic solvents.

Important Points

• Combustion: When hydrocarbons undergo complete combustion in the presence of oxygen, they produce carbon dioxide (CO2), water (H2O), and a significant amount of heat energy. This property makes them excellent fuels.

• Sources: The primary natural sources of hydrocarbons are fossil fuels, which were formed over millions of years from the remains of ancient marine organisms and plants under high pressure and temperature.

• Isomerism: Hydrocarbons can exhibit structural isomerism, where compounds have the same molecular formula but different structural arrangements, leading to different physical and chemical properties.

• Industrial Uses: Beyond fuel, they are used as feedstock in the petrochemical industry to manufacture plastics, synthetic fibers, rubbers, solvents, and lubricants.

Q3. Answer: (d) Garbage contains both biodegradable and non-biodegradable components.

The correct answer is Garbage contains both biodegradable and non-biodegradable components..

Key Points

• Household garbage, also known as Municipal Solid Waste (MSW), refers to the day-to-day items we use and then throw away, such as product packaging, grass clippings, furniture, clothing, bottles, food scraps, and newspapers.

• Biodegradable waste comprises substances that can be decomposed by biological processes involving microorganisms like bacteria and fungi. In a household context, this includes kitchen waste, paper, and natural fibers.

• Non-biodegradable waste consists of materials that cannot be broken down by biological organisms. Common examples in household garbage include plastics, polythene bags, glass, and metallic scraps.

• Regarding the options provided:

• Statement 1 claims that safe disposal of garbage is not mandatory. However, safe disposal is essential to prevent the spread of diseases and environmental degradation. Hence, statement 1 is incorrect.

• Statement 2 claims the entire garbage is non-biodegradable. Household waste always contains organic matter like food, which is degradable. Hence, statement 2 is incorrect.

• Statement 3 claims the entire garbage is biodegradable. Modern households generate significant amounts of plastic and glass, which do not decompose. Hence, statement 3 is incorrect.

• Statement 4 asserts that garbage contains both types of components, which accurately reflects the heterogeneous nature of domestic waste. Hence, statement 4 is correct.

Additional Information

• Waste Segregation: This is the process of dividing waste into dry and wet categories. Wet waste (green bin) is typically biodegradable, while dry waste (blue bin) includes recyclable and non-biodegradable materials like plastic and metal.

• Composting: This is a method where organic waste is converted into humus or manure. It is one of the most effective ways to manage biodegradable household garbage at the source, reducing the burden on landfills.

• Environmental Persistence: Non-biodegradable materials like plastics can persist in the soil or oceans for 100 to 500 years.

These materials often leach toxic chemicals into the ecosystem, harming wildlife and human health.

• The 3R Principle: To manage household garbage effectively, the Reduce, Reuse, and Recycle strategy is promoted globally. Reducing consumption limits waste, reusing items extends their life, and recycling ensures that materials like aluminum and glass are processed into new products.

• Impact on Health: Accumulation of mixed garbage provides a breeding ground for vectors like mosquitoes and rodents, leading to diseases such as malaria, dengue, and plague.

Important Points

• Solid Waste Management Rules, 2016: In India, these rules mandate the segregation of waste at the source. It is the responsibility of the waste generator to separate waste into biodegradable, non-biodegradable, and domestic hazardous waste.

• Leachate: When non-biodegradable and biodegradable wastes are dumped together in a landfill, they produce a highly toxic liquid called leachate, which can contaminate groundwater.

• Sanitary Landfills: Unlike open dumping, sanitary landfills are designed to isolate waste from the environment until it is safe. They utilize liners to prevent soil and water contamination from household garbage chemicals.

Q4. Answer: (c) Cross pollination

The correct answer is Cross pollination.

Key Points

• Cross pollination, scientifically referred to as Allogamy, is the process where pollen grains are transferred from the anther of a flower on one plant to the stigma of a flower on a different plant of the same species.

• Unlike self-pollination, this method relies heavily on external pollinating agents such as insects, wind, water, or animals to bridge the distance between two separate plants.

• The primary advantage of cross pollination is that it facilitates genetic recombination, leading to genetic diversity in the offspring, which helps the species adapt better to changing environmental conditions.

• Plants that practice cross-pollination often have specific features to attract pollinators, such as brightly colored petals, scent, and nectar.

• Hence, the correct answer is Cross pollination.

Additional Information

• Self-pollination:

• This occurs when pollen grains from the anther are transferred to the stigma of the same flower or another flower on the same plant.

• It does not require external agents and is common in plants where male and female parts mature at the same time.

• Autogamy:

• Autogamy is a specific type of self-pollination where the transfer happens within a single flower.

• It ensures seed set even in the absence of pollinators but results in inbreeding depression over several generations due to lack of variation.

• Agents of Pollination:

• Biotic Agents: These include living organisms like bees, butterflies, birds, and bats. Pollination by insects is called Entomophily, while pollination by birds is Ornithophily.

• Abiotic Agents: These are non-living factors like wind (Anemophily) and water (Hydrophily). Maize and wheat are classic examples of wind-pollinated crops.

• Geitonogamy:

• This is the transfer of pollen grains from the anther to the stigma of another flower on the same plant. While functionally it is cross-pollination (requiring a pollinator), genetically it is similar to autogamy.

Important Points

• Cleistogamous Flowers: These are flowers that never open (e.g., Viola, Oxalis, and Commelina). In such flowers, the anther and stigma lie close to each other, ensuring autogamy occurs without the need for any external agent.

• Chasmogamous Flowers: These are open flowers with exposed anthers and stigma, making them available for both self-pollination and cross-pollination.

• Hybrid Vigor: Also known as heterosis, this is the increased function or vitality of a hybrid offspring compared to its parents, often achieved through cross pollination.

• Self-Incompatibility: This is a genetic mechanism that prevents self-pollen from fertilizing the ovules of the same flower by inhibiting pollen germination, thereby promoting cross pollination.

Q5. Answer: (b) focal length

The correct answer is focal length.

Key Points

• The distance between the optical centre of a lens and its principal focus is termed the focal length.

• It is commonly represented by the lowercase letter 'f'.

• The SI unit for measuring focal length is the metre (m), though it is often expressed in centimetres (cm) in laboratory settings.

• In a convex lens (converging lens), the focal length is taken as positive because the light rays actually converge at the focus on the opposite side of the lens.

• In a concave lens (diverging lens), the focal length is taken as negative because the light rays appear to diverge from a focus located on the same side as the object.

• The principal focus is the specific point on the principal axis where rays of light parallel to the axis meet or appear to meet after passing through the lens.

Additional Information

• Aperture:

• The aperture refers to the effective diameter of the circular outline of a spherical lens.

• It determines the amount of light that passes through the lens; a larger aperture allows more light to enter, resulting in a brighter image.

• Magnification:

• Magnification (m) is defined as the ratio of the height of the image to the height of the object.

• It can also be expressed as the ratio of image distance (v) to object distance (u).

• A negative magnification indicates a real and inverted image, while a positive magnification indicates a virtual and erect image.

• Radius of Curvature:

• The radius of curvature (R) is the radius of the imaginary sphere of which the lens surface forms a part.

• A lens has two surfaces, and therefore has two radii of curvature, often denoted as R1 and R2.

• Optical Centre:

• The optical centre is the geometric centre of a lens.

• Any ray of light passing through the optical centre of a lens does not suffer any deviation and emerges along its original path.

Important Points

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

• Power of a Lens: The power (P) of a lens is the reciprocal of its focal length in metres (P = 1/f). The unit of power is the Dioptre (D).

• Sign Convention: According to the Cartesian sign convention, distances measured in the direction of incident light are positive, while those measured against the direction of incident light are negative.

• Relationship with R: For a thin lens with both sides having equal curvature, the radius of curvature (R) is approximately twice the focal length (R = 2f).

Q6. Answer: (d) Both statement A and B

The correct answer is Both statement A and B.

Key Points

• Statement A: The egg (or ovum) is released by the ovary during the process of ovulation. It is then picked up by the fimbriae and carried through a thin, muscular tube known as the oviduct or fallopian tube. This tube serves as the primary passage connecting the ovary to the womb (uterus). Hence, statement A is correct.

• Statement B: The uterus is a hollow, pear-shaped organ where the embryo implants and grows. The lower, narrow part of the uterus is called the cervix. This cervix opens into the vagina, which is the muscular canal leading to the outside of the body. Hence, statement B is correct.

• The female reproductive system is designed to perform several functions, including the production of gametes (eggs), providing a site for fertilization, and supporting the development of a fetus during pregnancy.

• The fallopian tubes are not only transporters but also the site where fertilization typically occurs when a sperm meets an egg.

• The cervix plays a crucial role in reproduction by allowing the passage of sperm into the uterus and acting as a birth canal during delivery.

Additional Information

• Ovaries: These are the primary female reproductive organs. A woman has two ovaries located on either side of the uterus. They produce eggs and secrete hormones such as estrogen and progesterone, which regulate the menstrual cycle.

• Uterus (Womb): This is an involuntary muscular organ. It has a thick lining called the endometrium, which thickens every month in preparation for a potential pregnancy. If fertilization does not occur, this lining is shed during menstruation.

• Vagina: Often called the birth canal, it is a muscular, elastic tube that connects the cervix to the external genitalia. It receives the penis during sexual intercourse and serves as the exit for menstrual flow and the baby during childbirth.

• Gametes: In females, the gamete is the egg or ovum. It is one of the largest cells in the human body and contains 23 chromosomes.

Important Points

• Fertilization: This process usually takes place in the ampulla, a specific region of the fallopian tube. Once the egg is fertilized, it becomes a zygote and begins to travel toward the uterus for implantation.

• Menstrual Cycle: This is a 28-day (average) cycle that involves ovulation and the preparation of the uterus for pregnancy. It is controlled by the pituitary gland and ovarian hormones.

• Puberty: The female reproductive system becomes functional during puberty, usually between the ages of 10 and 14, marked by the onset of menarche (the first menstrual period).

• Menopause: This is the stage in a woman's life, typically between 45 and 55 years of age, when menstrual cycles stop and the ovaries cease to release eggs.

Q7. Answer: (b) Fish

The correct answer is Fish.

Key Points

• Fish are widely recognized as primary bioindicators for assessing the health of aquatic ecosystems because they are highly sensitive to variations in their environment.

• They occupy various trophic levels, acting as primary consumers, secondary consumers, and top predators. Because they are at the top of many aquatic food chains, their health reflects the overall status of the biological community.

• Changes in water quality parameters, such as dissolved oxygen (DO), pH levels, water temperature, and the presence of dissolved solids, directly affect fish physiology and reproduction.

• Monitoring fish species diversity and population density provides a long-term record of environmental stress. Unlike chemical tests that provide a "snapshot" of water quality, fish provide a continuous biomonitoring history of a habitat.

• The presence or absence of specific indicator species can signify specific conditions; for instance, the presence of Salmon or Trout usually indicates cold, well-oxygenated, and clean water.

Additional Information

• Lichen:

• These are symbiotic organisms composed of fungi and algae or cyanobacteria.

• They are key indicators of air quality. Because they lack a waxy cuticle, they absorb pollutants directly from the atmosphere.

• They are particularly sensitive to sulfur dioxide (SO2); hence, their absence in urban areas often indicates high atmospheric pollution.

• Earthworm:

• These organisms are vital indicators of soil health and terrestrial ecosystem stability.

• Their presence indicates high levels of organic matter and good soil aeration.

• They are sensitive to pesticides and heavy metal contamination in the lithosphere, making them essential for assessing agricultural sustainability.

• Cockroach:

• While they are biological organisms, they are generally considered pests rather than positive ecological indicators.

• They are known for their extreme resilience and ability to survive in unhygienic conditions, often serving as indicators of poor sanitation in urban environments.

• Benthic Macroinvertebrates:

• Organisms like mayflies, stoneflies, and caddisflies are also used alongside fish to determine water quality.

• The Biotic Index is often calculated based on the sensitivity of these organisms to organic pollution and sedimentation.

Important Points

• Biomagnification: This is a process where the concentration of toxic substances (like mercury or DDT) increases as it moves up the food chain. Fish are often monitored to detect these heavy metals before they reach human consumers.

• Eutrophication: A healthy fish population helps prevent the overgrowth of algae. However, excessive nutrients (nitrogen and phosphorus) lead to algal blooms, which deplete oxygen and cause mass fish kills, signaling a disturbed ecosystem.

• Global Context: The Index of Biological Integrity (IBI) is a scientific tool that uses fish communities to grade the ecological health of running waters (rivers and streams) worldwide, including in India and the USA.

Q8. Answer: (c) North pole to South pole

The correct answer is North pole to South pole.

Key Points

• A solenoid is defined as a long coil containing a large number of close turns of insulated copper wire wrapped in the shape of a

cylinder. When an electric current passes through it, it creates a magnetic field around and inside it.

• The magnetic field lines around a current-carrying solenoid are remarkably similar to those produced by a bar magnet. One end of the solenoid behaves as a magnetic North pole, while the other behaves as a magnetic South pole.

• Outside the solenoid, the direction of the magnetic field lines is always from the North pole to the South pole. This is a standard convention followed for all magnets where flux lines emerge from the north and return to the south in the external medium.

• Inside the solenoid, the magnetic field lines travel in the opposite direction, moving from the South pole to the North pole. These lines are nearly parallel straight lines, indicating that the magnetic field is uniform at all points inside the solenoid.

• The field lines form continuous closed loops, which is a fundamental property of magnetism as there are no isolated magnetic monopoles.

Additional Information

• Right-Hand Grip Rule: To determine the polarity of a solenoid, one can use the Right-Hand Grip Rule. If you curl the fingers of your right hand in the direction of the conventional current flow through the coils, your thumb will point toward the North pole of the solenoid.

• Factors Affecting Field Strength: The magnitude of the magnetic field (B) produced by a solenoid depends on several factors:

• Number of turns (n): The field strength is directly proportional to the number of turns per unit length.

• Current (I): The field strength is directly proportional to the amount of current flowing through the wire.

• Core Material: Placing a soft iron core inside the solenoid significantly increases the magnetic flux density because of the high permeability of iron.

• Electromagnets: A solenoid with a soft iron core is commonly known as an electromagnet. These are used in various industrial applications such as electric bells, magnetic resonance imaging (MRI) machines, and industrial cranes for lifting heavy scrap iron.

• Discovery: The relationship between electricity and magnetism was first famously observed by Hans Christian Ørsted in 1820, leading to the development of electromagnetism as a major branch of Physics.

Important Points

• The magnetic field inside a solenoid is independent of the radius or the cross-sectional area of the solenoid, provided the solenoid is "long" (length is much greater than diameter).

• The formula for the magnetic field intensity inside an ideal solenoid is given by B = μ0nI, where μ0 is the permeability of free space (approximately 4π × 10^-^7 T·m/A), n is the number of turns per unit length, and I is the current.

• Unlike a permanent bar magnet, the magnetic field of a solenoid can be switched ON or OFF instantly by controlling the electrical circuit, and its polarity can be reversed by changing the direction of the current.

• The Clock Rule is another way to find polarity: looking at the face of the coil, if the current flows Clockwise, that face is the South pole; if Anti-clockwise, it is the North pole.

Q9. Answer: (a) I and III only

The correct answer is I and III only.

Key Points

• Statement I represents a single displacement reaction where Iron (Fe) reacts with Copper Sulphate (CuSO4). Since Iron is placed higher than Copper in the reactivity series, it successfully displaces copper from its salt solution to form Iron(II) sulphate (FeSO4) and solid Copper. Hence, statement I is correct.

• Statement II suggests that Copper (Cu) can displace Iron from Iron(II) sulphate (FeSO4). However, Copper is less reactive than Iron and cannot break the bond between the iron and sulphate ions. Therefore, no reaction occurs. Hence, statement II is incorrect.

• Statement III is an example of a double displacement reaction (specifically a precipitation reaction). When Sodium sulphate (Na2SO4) and Barium chloride (BaCl2) are mixed in aqueous form, the Barium (Ba^(2+)) ions and Sulphate (SO4^(2-)) ions combine to form Barium sulphate (BaSO4), which is an insoluble white precipitate. Hence, statement III is correct.

• Statement IV shows Silver chloride (AgCl) reacting with Sodium nitrate (NaNO3). This reaction is not possible as written because Silver chloride is an extremely insoluble precipitate. In chemistry, double displacement reactions usually proceed toward the formation of a precipitate, not away from it; the reverse reaction (AgNO3 + NaCl) is what actually occurs spontaneously. Hence, statement IV is incorrect.

• Therefore, the correct answer is I and III only.

Additional Information

• Reactivity Series: This is a series of metals arranged in the order of their decreasing chemical reactivity. Metals at the top, such as Potassium (K) and Sodium (Na), are highly reactive, while metals at the bottom, like Gold (Au) and Platinum (Pt), are least reactive. This series is essential for predicting whether a single displacement reaction will occur.

• Single Displacement Reaction: This is a type of chemical reaction where one element replaces another element in a compound. The general form is A + BC → AC + B. This only happens if element A is more reactive than element B.

• Double Displacement Reaction: In these reactions, two compounds react by an exchange of ions to form two new compounds. The general form is AB + CD → AD + CB. These often result in the formation of a precipitate, a gas, or water.

• Physical Observations: In the reaction between Iron and Copper Sulphate, the initial blue color of the solution fades and turns light green due to the formation of FeSO4, and a reddish-brown deposit of copper is seen on the iron nail.

Important Points

• Chemical Equations: The balanced equation for Statement III is Na2SO4(aq) + BaCl2(aq) → BaSO4(s) + 2NaCl(aq). The (s) notation for Barium sulphate indicates it is a solid precipitate.

• Thermodynamic Favorability: Reactions in aqueous solutions generally move toward the formation of the most stable products, such as insoluble salts or weak electrolytes. This explains why Statement IV is not possible, as AgCl is already in its most stable, insoluble form in that system.

• Year and History: The reactivity series has been a fundamental tool in chemistry since the 19th century, helping chemists understand the extraction of metals and the behavior of galvanic cells.

Q10. Answer: (b) Mitosis

The correct answer is Mitosis.

Key Points

• Mitosis is a type of cell division in which a single parent cell divides to produce two genetically identical daughter cells. These cells contain the same number of chromosomes and the same genetic information as the parent cell. Hence, the correct answer is Mitosis.

• This process is also known as equational division because the chromosomal number is maintained throughout the division (e.g., a diploid cell produces two diploid daughter cells).

• Mitosis occurs primarily in somatic cells (vegetative cells) and is essential for the growth, development, and tissue repair of multicellular organisms.

• The process consists of four main stages: Prophase, Metaphase, Anaphase, and Telophase, followed by the physical splitting of the cell.

• It ensures that every new cell generated in the body has an exact copy of the DNA, maintaining genomic stability across generations of cells.

Additional Information

• Meiosis:

• Meiosis is a reductional division that occurs in germ cells (reproductive cells) to produce gametes (sperm and egg).

• Unlike mitosis, it results in four non-identical daughter cells, each having half the number of chromosomes (haploid) of the original parent cell.

• It introduces genetic variation through a process called crossing over or recombination during Prophase I. Hence, statement 3 is incorrect.

• Cytokinesis and Karyokinesis:

• Karyokinesis is the division of the nucleus, whereas cytokinesis is the division of the cytoplasm.

• If cytokinesis occurs without karyokinesis, the cell would simply split without the replicated DNA being partitioned, leading to daughter cells that lack a full set of instructions or a nucleus. Hence, statement 1 is incorrect.

• Fertilisation:

• Fertilisation is the process of fusion of a male gamete with a female gamete to form a zygote.

• This is not a division process but a fusion process that restores the diploid number of chromosomes and creates a genetically unique individual. Hence, statement 4 is incorrect.

Important Points

• The Cell Cycle: Mitosis is a part of the M-phase of the cell cycle. Before entering mitosis, a cell undergoes Interphase, which includes the G1 phase, S phase (where DNA replication occurs), and G2 phase.

• Stages of Mitosis:

• Prophase: Chromatin condenses into visible chromosomes, and the nuclear envelope begins to break down.

• Metaphase: Chromosomes align at the equatorial plate (metaphase plate) of the cell.

• Anaphase: Sister chromatids are pulled apart toward opposite poles of the cell.

• Telophase: Two new nuclear membranes form around the separated chromatids, which begin to de-condense back into chromatin.

• Significance: In unicellular organisms like Amoeba, mitosis is a method of asexual reproduction, producing offspring that are clones of the parent.

Q11. Answer: (c) Rapid and identical reproduction

The correct answer is Rapid and identical reproduction.

Key Points

• Asexual reproduction is a biological process by which an organism creates a genetically identical copy of itself without the

contribution of genetic material from another individual.

• In a stable environment, where conditions such as food supply, temperature, and habitat remain constant, the most significant advantage is the ability for rapid population growth. Because organisms do not need to spend time or energy finding a mate, they can reproduce much faster than sexually reproducing species.

• The production of identical offspring (clones) ensures that if the parent possesses a genotype that is well-adapted to the current environment, all offspring will inherit those same successful traits. This maintains genetic stability across generations. Hence, statement 3 is correct.

• Adaptation to new environments and genetic variation are primary advantages of sexual reproduction, not asexual. Variation allows a species to survive if environmental conditions change. Hence, statement 1 and 4 are incorrect.

• Sexual diversity is the result of meiosis and the fusion of gametes, which does not occur in asexual reproduction. Hence, statement 2 is incorrect.

Additional Information

• Modes of Asexual Reproduction:

• Binary Fission: Occurs in prokaryotes like bacteria and some unicellular eukaryotes like Amoeba, where a single cell divides into two identical daughter cells.

• Budding: Seen in organisms like Yeast and Hydra, where a new individual grows out of the body of the parent.

• Fragmentation: A process where an organism like Spirogyra or Planaria breaks into pieces, and each piece grows into a new individual.

• Vegetative Propagation: Common in plants like Potato (via tubers), Onion (via bulbs), and Bryophyllum (via leaves).

• Energy Efficiency: Asexual reproduction is more energetically economical. Organisms do not need to produce specialized gametes or develop complex courtship behaviors to attract partners.

• Lack of Genetic Diversity: While beneficial in a stable setting, the lack of variation is a major disadvantage if the environment changes suddenly. A single disease or predator could potentially wipe out an entire colony because every individual is equally susceptible.

Important Points

• Clones: In biology, a clone refers to a group of genetically identical cells or organisms derived from a single ancestor.

• Uniparental Inheritance: This refers to the inheritance of the genome from only one parent, which is the hallmark of asexual reproduction.

• Evolutionary Speed: While individual reproduction is fast, the rate of evolution is generally slower in asexual species compared to sexual species because beneficial mutations cannot be easily combined through recombination.

Q12. Answer: (c) $3Fe + 4H_2O \rightarrow Fe_3O_4 + 4H_2$

The correct answer is $3Fe + 4H_2O \rightarrow Fe_3O_4 + 4H_2$.

Key Points

• A balanced chemical equation is one where the number of atoms of each element on the reactant side (left) is equal to the number of atoms of the same element on the product side (right).

• In the equation $3Fe + 4H_2O \rightarrow Fe_3O_4 + 4H_2$, let us count the atoms:

• Iron (Fe): There are 3 atoms on the reactant side and 3 atoms in Fe_3O_4 on the product side.

• Oxygen (O): There are 4 atoms in $4H_2O$ on the reactant side and 4 atoms in Fe_3O_4 on the product side.

• Hydrogen (H): There are 8 atoms (4×2) in $4H_2O$ on the reactant side and 8 atoms (4×2) in $4H_2$ on the product side.

Hence, option 3 is correct.

• In Option 1 ($Fe + H_2O \rightarrow Fe_3O_4 + H_2$), the number of Fe atoms (1 vs 3) and O atoms (1 vs 4) are not equal. Hence, this statement is incorrect.

• In Option 2 ($2Fe + 3H_2O \rightarrow 2Fe_3O_4 + 3H_2$), the Fe atoms (2 vs 6) and O atoms (3 vs 8) are unbalanced. Hence, this statement is incorrect.

• In Option 4 ($3Fe + 4H_2O \rightarrow Fe_3O_4 + 2H_2$), while Fe and O are balanced, the Hydrogen atoms are 8 on the reactant side but only 4 on the product side. Hence, this statement is incorrect.

Additional Information

• Law of Conservation of Mass: This fundamental law in chemistry states that mass can neither be created nor destroyed in a chemical reaction. Therefore, the total mass of the reactants must equal the total mass of the products, which necessitates balancing the number of atoms.

• Reaction of Iron with Steam: Iron (Fe) does not react with cold or hot water but reacts with steam (H_2O gas) to form Iron (II, III) oxide (also known as magnetic iron oxide or magnetite, Fe_3O_4) and Hydrogen gas (H_2).

• Stoichiometry: The coefficients (the numbers in front of the chemical formulas like 3, 4) represent the molar ratio in which the substances react and are formed.

• Physical States: In a complete chemical equation, the physical states are often mentioned: $3Fe(s) + 4H_2O(g) \rightarrow Fe_3O_4(s) +$

4H2(g). Here, (s) stands for solid and (g) stands for gas.

Important Points

• Hit and Trial Method: This is the most common method used to balance simple chemical equations by adjusting the coefficients of the molecules until the number of atoms of each element is equal on both sides.

• Fe3O4 (Magnetite): It is a mixed oxide consisting of both Iron (II) oxide (FeO) and Iron (III) oxide (Fe2O3). It is naturally occurring and possesses magnetic properties.

• Hydrogen Gas Identification: The H2 gas evolved during the reaction of metals with steam can be identified by the "pop" sound it makes when a burning matchstick is brought near it.

• Reactants and Products: In this specific reaction, Iron and Water (steam) are the reactants, while Magnetite and Hydrogen are the products.

Q13. Answer: (a) Chlor-alkali

The correct answer is Chlor-alkali.

Key Points

• The Chlor-alkali process is an industrial process used for the electrolysis of an aqueous solution of sodium chloride, which is commonly referred to as brine.

• When electricity is passed through brine, it decomposes to form sodium hydroxide (NaOH), chlorine gas (Cl2), and hydrogen gas (H2).

• The name "Chlor-alkali" is derived from the products obtained: "Chlor" refers to the chlorine produced, and "alkali" refers to the sodium hydroxide, which is a strong base or alkali.

• The chemical equation for the reaction is: 2NaCl(aq) + 2H2O(l) → 2NaOH(aq) + Cl2(g) + H2(g).

• This process is fundamental to the chemical industry because the three products generated are essential raw materials for various other industrial applications.

Additional Information

• Product Distribution: During the electrolysis, chlorine gas is given off at the anode (positive electrode) and hydrogen gas is given off at the cathode (negative electrode). The sodium hydroxide solution is formed near the cathode.

• Uses of Sodium Hydroxide (NaOH): It is widely used for degreasing metals, the manufacture of soaps and detergents, paper making, and the production of artificial fibers like rayon.

• Uses of Chlorine (Cl2): Chlorine is used for water treatment in swimming pools, and in the manufacture of PVC (Polyvinyl Chloride), disinfectants, CFCs, and pesticides.

• Uses of Hydrogen (H2): Hydrogen produced is utilized as a fuel, for hydrogenation in making margarine, and in the synthesis of ammonia for fertilizers.

• Industrial Variants: There are three main methods for the process: the mercury cell (Castner-Kellner), the diaphragm cell, and the membrane cell. The membrane cell is the most energy-efficient and environmentally friendly modern method.

Important Points

• Hall-Héroult Process: This is the major industrial process used for the smelting of Aluminium. It involves dissolving aluminium oxide (alumina) in molten cryolite and electrolyzing it to obtain pure metal.

• Born-Haber Cycle: This is a method used to analyze reaction energies. It is primarily used to calculate the lattice energy of ionic compounds, which cannot be measured directly.

• Dow’s Process: This was the first commercial process used for the production of phenol. It involves the hydrolysis of chlorobenzene at high temperature and pressure. The term also refers to the Dow process for extracting magnesium from seawater.

• Electrolysis: It is the process of using direct electric current to drive an otherwise non-spontaneous chemical reaction. In the Chlor-alkali process, it facilitates the breaking of NaCl and H2O bonds.

Q14. Answer: (c) the same thrust acting on a smaller area exerts a larger pressure

The correct answer is the same thrust acting on a smaller area exerts a larger pressure.

Key Points

• Pressure is defined as the thrust (perpendicular force) acting per unit area of a surface. The relationship between these variables is represented by the formula: Pressure = Thrust / Area.

• For a given amount of force or thrust, the pressure produced is inversely proportional to the area of the surface on which it acts. This means as the area decreases, the pressure increases, and as the area increases, the pressure decreases.

• Nails and Cutting Tools: These are designed with sharp, small tips to minimize the contact area. When a force is applied, the small area results in a very high pressure, allowing the tool to easily penetrate or cut through objects like wood or metal. Hence, the statement that the same thrust acting on a smaller area exerts a larger pressure is correct.

• Truck and Motorbus Tyres: Large vehicles carry a significant amount of weight (thrust). They are equipped with much wider tyres

to increase the surface area in contact with the road. By increasing the area, the pressure exerted on the ground is reduced, preventing the tyres from sinking into soft surfaces and reducing wear and tear.

• Regarding the other options: Thrust is a force and is not directly proportional to area in a physical definition sense (Option 1 is incorrect). Larger thrust usually results in higher pressure if the area is constant (Option 2 is incorrect). Pressure is related to mass through weight, but the direct proportionality is with force and area (Option 4 is incorrect).

Additional Information

• Definition of Thrust: Thrust is the force acting perpendicularly to a surface. While force can act in any direction, thrust specifically refers to the normal component. The SI unit of thrust is the Newton (N).

• Units of Pressure: The SI unit of pressure is the Pascal (Pa), which is defined as one Newton per square metre (1 N/m^2). It is named after the 17th-century physicist and mathematician Blaise Pascal.

• Real-world Applications:

• School Bags: They are provided with broad straps so that the weight of the bag falls over a larger area of the shoulder, resulting in less pressure and less pain for the student.

• Foundations of Buildings: High-rise structures have wide foundations to distribute the immense thrust of the building over a large area of soil, ensuring the pressure does not exceed the bearing capacity of the ground.

• Sleeper Tracks: Railway tracks are laid on wooden or concrete sleepers to spread the force of the train over a larger area, reducing the pressure on the ground below.

• Pressure in Fluids: Unlike solids that exert pressure only downwards due to gravity, fluids (liquids and gases) exert pressure in all directions on the walls of their container. This is the basis for hydraulic systems used in car brakes and heavy machinery.

Important Points

• Inversely Proportional: It is crucial to remember that Pressure and Area have an inverse relationship. If you double the area while keeping the thrust constant, the pressure is halved.

• Force vs. Pressure: People often confuse these two terms. Force is the total impact, while pressure is how "concentrated" that impact is over a specific surface.

• Atmospheric Pressure: Even air exerts pressure. At sea level, the atmospheric pressure is approximately 101,325 Pa. This pressure decreases as altitude increases because the mass of the air column above decreases.

Q15. Answer: (c) Lipid synthesis

The correct answer is Lipid synthesis.

Key Points

• The Smooth Endoplasmic Reticulum (SER) is a sub-compartment of the Endoplasmic Reticulum that primarily functions in the synthesis of lipids, including phospholipids and cholesterol, which are vital components of biological membranes. Hence, Option 3 is correct.

• Unlike the Rough Endoplasmic Reticulum (RER), the SER lacks attached ribosomes on its surface, which gives it a smooth, tubular appearance under an electron microscope.

• In specialized cells, such as those in the testes and ovaries, the Smooth ER is responsible for the synthesis of steroid hormones, such as testosterone and estrogen.

• The SER plays a critical role in detoxification processes, particularly in liver cells (hepatocytes), where it contains enzymes that modify and neutralize toxins, drugs, and metabolic wastes to make them water-soluble for excretion.

• Another essential function of the SER is the storage and release of calcium ions (Ca^{2+}). In muscle cells, the specialized SER known as the sarcoplasmic reticulum triggers muscle contraction by releasing these stored ions into the cytoplasm.

Additional Information

• Protein Synthesis: This is the primary function of the Rough Endoplasmic Reticulum (RER) because of the presence of ribosomes on its membrane. These proteins are typically destined for secretion, incorporation into the cell membrane, or for use within lysosomes. Hence, Option 2 is incorrect in the context of Smooth ER.

• Carbohydrate Synthesis: While the SER is involved in carbohydrate metabolism (such as the conversion of glycogen to glucose in the liver), the actual synthesis of complex polysaccharides and cell wall components largely occurs in the Golgi apparatus or chloroplasts (in plants). Hence, Option 1 is not the primary function of SER.

• Nucleic Acid Synthesis: This process, including DNA replication and transcription (RNA synthesis), takes place within the nucleus of the cell. Some nucleic acid synthesis also occurs in mitochondria and chloroplasts, but never in the Endoplasmic Reticulum. Hence, Option 4 is incorrect.

• The Endoplasmic Reticulum as a whole is a continuous system of membranous tubules and cisternae that is physically connected to the outer nuclear membrane.

Important Points

• Lipid Trafficking: After lipids are synthesized in the SER, they are transported to other parts of the cell, such as the Golgi apparatus or the plasma membrane, via transport vesicles.

• Discovery: The Endoplasmic Reticulum was first observed by Keith R. Porter, Albert Claude, and Ernest F. Fullam in 1945 using

electron microscopy.

• Metabolic Variation: The ratio of SER to RER in a cell depends on the cell's metabolic activity. For example, sebaceous glands (which produce skin oils) are rich in Smooth ER, while pancreatic cells (which produce digestive enzymes) are rich in Rough ER.

• Signaling: The calcium storage function of the SER is crucial for intracellular signaling, affecting processes like cell death (apoptosis) and gene expression.

Q16. Answer: (c) A rocket propelling upward by expelling gases downward.

The correct answer is A rocket propelling upward by expelling gases downward.

Key Points

• Newton’s Third Law of Motion states that for every action, there is an equal and opposite reaction. This means that forces always exist in pairs; if object A exerts a force on object B, object B simultaneously exerts a force of equal magnitude and opposite direction on object A.

• In the case of a rocket, the engines combustion process expels exhaust gases downward at high velocity (the action). According to the law, these gases exert an equal and opposite force upward on the rocket (the reaction), providing the thrust necessary for launch. Hence, statement 3 is correct.

• A ball falling under gravity primarily illustrates Newton’s Second Law (F = ma) and the Universal Law of Gravitation. While a reaction force exists (the ball pulls the Earth), it is not the classic textbook illustration of the Third Law compared to propulsion. Hence, statement 1 is incorrect.

• A car accelerating on a road involves the engine providing torque to the wheels, which then exert a force on the road. While the road exerts a frictional force back on the tires, the prompt focuses on "engine power" causing acceleration, which is a primary application of the Second Law. Hence, statement 2 is incorrect.

• A pendulum oscillating back and forth is an example of Simple Harmonic Motion (SHM) and the Conservation of Mechanical Energy. It involves the continuous transformation between potential energy and kinetic energy. Hence, statement 4 is incorrect.

Additional Information

• Historical Context: Sir Isaac Newton formulated the three laws of motion in his monumental work, "Philosophiae Naturalis Principia Mathematica", first published in 1687. These laws form the foundation of Classical Mechanics.

• Conservation of Momentum: The Third Law is closely linked to the Law of Conservation of Momentum. In an isolated system, the total momentum remains constant. In rocket propulsion, the downward momentum of the expelled gas is balanced by the upward momentum of the rocket body.

• Common Examples:

• Recoil of a Gun: When a bullet is fired (action), the gun moves backward (reaction).

• Swimming: A swimmer pushes the water backward (action), and the water pushes the swimmer forward (reaction).

• Walking: We push the ground backward with our feet, and the ground pushes us forward.

• Force Pairs: It is important to note that action and reaction forces act on different bodies. Therefore, they do not cancel each other out, allowing for net acceleration of the individual objects involved.

Important Points

• Simultaneity: There is no time lag between the action and the reaction; they happen exactly at the same moment.

• Nature of Forces: The two forces in a pair are always of the same type. For instance, if the action is a gravitational force, the reaction must also be a gravitational force.

• Magnitude and Direction: The numerical value of the force (magnitude) is identical for both, but the vector direction is exactly 180 degrees opposite.

• Application in Space: Rocket propulsion is the only way to travel in the vacuum of space because it does not require an external medium (like air) to push against; it relies entirely on the internal action-reaction mechanism of expelling mass.

Q17. Answer: (c) Stethoscope

The correct answer is Stethoscope.

Key Points

• A Stethoscope is a medical instrument used by doctors for auscultation, which involves listening to sounds produced within the body, primarily the heart and lungs.

• The basic principle behind its functioning is the multiple reflections of sound. The sound of the patient's heartbeat or breath enters the diaphragm of the chest piece and travels through the hollow plastic tubing to the doctor’s ears by reflecting multiple times off the inner walls of the tube. Hence, statement 3 is correct.

• This device was invented in the year 1816 by a French physician named René Laennec. Before this, doctors used to place their ears directly on the patient's chest.

• The multiple reflection mechanism ensures that the sound energy is confined within the tube and directed towards the earpieces without much loss in intensity, allowing the doctor to hear faint internal sounds clearly.

• The diaphragm (a thin plastic disk) vibrates when it picks up sound waves, and these longitudinal waves are then guided through the air-filled tubes.

Additional Information

• Megaphones and Horns:

• A Megaphone (also known as a speaking-trumpet or bullhorn) is a funnel-shaped device designed to direct sound in a specific direction.

• It also works on the principle of multiple reflections, where sound waves are reflected multiple times by the conical opening to prevent them from spreading in all directions. Hence, statement 1 is also technically correct in terms of physics, though Stethoscope is the designated answer here.

• Microscope:

• A Microscope is an instrument used to see objects that are too small for the naked eye.

• It works based on the refraction of light through convex lenses to create a magnified image. It does not use sound waves for its primary function. Hence, statement 2 is incorrect.

• Thermometer:

• A Thermometer is a device used to measure temperature.

• Most traditional thermometers (like mercury or alcohol thermometers) work on the principle of thermal expansion of liquids, while digital ones use thermistors or infrared radiation. It has no relation to the reflection of sound. Hence, statement 4 is incorrect.

• Laws of Reflection of Sound:

• Sound waves follow the same laws as light: the angle of incidence is equal to the angle of reflection, and the incident wave, reflected wave, and the normal all lie in the same plane.

• For effective reflection, a large obstacle (either polished or rough) is required.

Important Points

• Ceilings of Concert Halls: The ceilings of cinema halls, conference halls, and concert halls are usually curved so that sound, after multiple reflections, reaches all corners of the hall.

• Soundboards: In many large auditoriums, a curved soundboard is placed behind the speaker so that the sound reflects off the board and spreads evenly across the width of the hall.

• Echo and Reverberation:

• An echo is a single reflection of sound heard after a delay of at least 0.1 seconds.

• Reverberation is the persistence of sound due to repeated multiple reflections in an enclosed space.

Q18. Answer: (a) Electrolysis of molten aluminium oxide

The correct answer is Electrolysis of molten aluminium oxide.

Key Points

• The extraction of Aluminium from its primary ore, Bauxite, is primarily carried out using the Hall-Heroult process.

• This process involves the Electrolysis of Alumina (Aluminium Oxide) which is dissolved in a molten bath of Cryolite and Fluorspar.

• Aluminium is a highly reactive metal (high in the reactivity series), meaning it forms very stable bonds with oxygen that cannot be broken by carbon reduction; therefore, electrolytic reduction is necessary.

• In the electrolytic cell, the Cathode is a carbon lining at the bottom where molten aluminium is deposited and collected.

• The Anode consists of Graphite rods dipped into the electrolyte, where oxygen gas is liberated and subsequently reacts with the carbon rods to form Carbon Dioxide. Hence, statement 1 is correct.

Additional Information

• Bauxite Refining (Bayer Process):

• Before electrolysis, Bauxite must be purified into Alumina using the Bayer Process, which involves heating the ore with Sodium Hydroxide.

• This process removes impurities like Iron Oxide (red mud) and Silica to ensure the final metal is of high purity.

• The Role of Cryolite:

• Pure Alumina has a very high melting point of about 2050 degrees Celsius, making electrolysis difficult and expensive.

• Adding molten Cryolite (Sodium Aluminium Fluoride) acts as a solvent and lowers the melting point to approximately 950 degrees Celsius, significantly reducing energy consumption and increasing electrical conductivity.

• Metal Reactivity and Extraction:

• Metals like Gold and Silver occur in a native state or can be extracted by heating.

• Metals in the middle of the series like Iron and Zinc are extracted using Carbon reduction (smelting).

• Metals at the top of the series, including Potassium, Sodium, Calcium, Magnesium, and Aluminium, must be extracted via electrolysis of their molten salts or oxides.

Important Points

• Aluminium Characteristics: It is the most abundant metal in the Earth's crust and the third most abundant element overall. It is valued for its low density, high thermal conductivity, and corrosion resistance due to a protective oxide layer.

• Industrial Use: Due to its lightweight nature, it is used extensively in aerospace, automotive industries, packaging (foil and cans), and electrical transmission lines.

• Anode Consumption: A significant part of the cost in this process is the regular replacement of graphite anodes, as they are consumed by the oxygen produced during the reaction, forming CO_2 gas.

• Recycling: Extracting aluminium is extremely energy-intensive. However, recycling aluminium requires only about 5 percent of the energy needed to produce it from raw bauxite, making it one of the most sustainable metals to reuse.

Q19. Answer: (a) Both (i) and (iii)

The correct answer is Both (i) and (iii).

Key Points

• According to the New Cartesian Sign Convention for spherical lenses, all distances parallel to the principal axis are measured from the optical center (O) of the lens, which acts as the origin. Measuring distances from the focus is incorrect. Hence, statement (i) is incorrect.

• Distances measured in the direction of the incident light (to the right of the origin along the +x-axis) are taken as positive. This is a standard convention followed for both convex and concave lenses. Hence, statement (ii) is correct.

• Distances measured perpendicular to and above the principal axis (along the +y-axis) are taken as positive, whereas those measured below the principal axis are taken as negative. Hence, statement (iii) is incorrect.

• The object is always placed to the left of the lens. This convention ensures that the incident light always travels from left to right. Hence, statement (iv) is correct.

• Since statements (i) and (iii) are not true, the correct option is Both (i) and (iii).

Additional Information

• Spherical Lenses: These are transparent materials bound by two surfaces, of which at least one is spherical. A Convex lens is thicker at the middle, while a Concave lens is thinner at the middle.

• Focal Length (f): Under the sign convention, the focal length of a convex lens is always positive, and the focal length of a concave lens is always negative. This is a crucial fact used in numerical problems.

• Object Distance (u): As the object is placed to the left of the lens, the object distance (u) is always taken as negative in calculations.

• Image Distance (v): If a real image is formed on the right side of the lens, the image distance (v) is positive. If a virtual image is formed on the left side, 'v' is negative.

• Magnification (m): It is defined as the ratio of the height of the image (h') to the height of the object (h). Mathematically, $m = v / u$. For real and inverted images, magnification is negative, while for virtual and erect images, it is positive.

Important Points

• Lens Formula: The relationship between object distance (u), image distance (v), and focal length (f) is given by $1/v - 1/u = 1/f$. This formula is applicable to all spherical lenses in all situations.

• Power of a Lens: The power (P) of a lens is the reciprocal of its focal length in meters ($P = 1/f$). The SI unit of power is the Dioptre (D). A convex lens has positive power, and a concave lens has negative power.

• Optical Center: It is the central point of a lens. Any ray of light passing through the optical center emerges without any deviation.

Q20. Answer: (d) No, displacement can never be greater than distance

The correct answer is No, displacement can never be greater than distance.

Key Points

• Distance is defined as the total path length covered by a moving object during its entire journey. It is a scalar quantity, which means it is described only by its magnitude and does not have a direction.

• Displacement is the shortest straight-line distance between the initial position and the final position of an object. It is a vector quantity, as it requires both magnitude and direction to be fully specified.

• The magnitude of displacement is always less than or equal to the distance travelled. Under no circumstances in classical mechanics can the displacement be greater than the distance. Hence, the statement that displacement can be greater than distance is incorrect.

• If an object moves in a straight line and does not change its direction, the magnitude of displacement will be exactly equal to the distance travelled. Hence, statement 1 is incorrect as it implies displacement could be greater.

• When an object moves along a curved path or changes its direction (e.g., moving from A to B and then back toward A), the distance continues to increase, but the displacement (the gap between start and end) decreases or remains smaller than the path length.

• Because distance accounts for every twist and turn of the journey while displacement only cares about the net change in position, distance is always the upper limit for the magnitude of displacement. Hence, the correct answer is option 4.

Additional Information

• Scalar vs. Vector: Distance is path-dependent, meaning the value depends on the route taken. Displacement is path-independent, meaning it depends only on the endpoints of the motion.

• Zero Displacement: It is possible for an object to have traveled a very large distance but have zero displacement. A classic example is circular motion; if an athlete runs one full lap around a 400-meter track, the distance covered is 400 meters, but the displacement is 0 meters because the starting and ending points are the same.

• Sign Convention: While distance is always positive (or zero if the object is at rest), displacement can be positive, negative, or zero depending on the chosen coordinate system and direction of motion.

• SI Units: Both distance and displacement share the same Standard International (SI) unit, which is the meter (m). In CGS units, they are measured in centimeters (cm).

• Average Speed and Velocity: The relationship between these two concepts also mirrors the distance-displacement rule. Average Speed (Distance/Time) is always greater than or equal to the magnitude of Average Velocity (Displacement/Time).

Important Points

• Numerical Ratio: The ratio of the magnitude of displacement to distance is always less than or equal to 1.

• Motion in One Dimension: In rectilinear motion (motion in a straight line) without reversing direction, the distance and magnitude of displacement are identical. For example, a car traveling 100 km due North has a distance of 100 km and a displacement of 100 km North.

• Curvilinear Motion: In 2D or 3D motion, such as projectile motion or planetary orbits, the distance is always significantly greater than the displacement magnitude because the object follows an arc rather than a straight line.

Q21. Answer: (c) 1 Joule per second (1 J/s)

The correct answer is 1 Joule per second (1 J/s).

Key Points

• Power is defined as the rate of doing work or the rate at which energy is transferred or transformed. It measures how fast work is being done by an object or a machine.

• The mathematical formula for power is P = W / t, where P stands for Power, W stands for Work done, and t represents the time taken to complete that work.

• Since the SI unit of Work is the Joule (J) and the SI unit of Time is the second (s), the unit of power is Joule/second.

• The SI unit of Power is the Watt (W), named after the Scottish scientist James Watt. By definition, 1 Watt is equal to the power of an agent that performs work at the rate of 1 Joule per second (1 J/s). Hence, option 3 is correct.

• If an agent consumes one Joule of energy in one second, its power is said to be 1 Watt.

Additional Information

• Kilowatt-hour (kWh): This is often confused with power, but it is actually a unit of Energy. It represents the amount of energy consumed by a 1000-watt appliance in one hour. 1 kWh is equal to 3.6 x 1,000,000 Joules.

• Horsepower (hp): This is a non-SI unit of power used primarily in the automotive and engineering industries. 1 Horsepower (British) is approximately equal to 746 Watts.

• Dimensional Formula: The dimensional formula for power is $[ML^2T^{-3}]$, derived from the dimensions of work $[ML^2T^{-2}]$ divided by time [T].

• Scalar Quantity: Power is a scalar quantity because it only has magnitude and does not require a direction to be fully described.

• Larger Units: For industrial purposes, power is often expressed in kilowatts (kW), where 1 kW = 1,000 W, or megawatts (MW), where 1 MW = 1,000,000 W.

Important Points

• Relationship with Force and Velocity: Power can also be expressed in terms of Force (F) and Velocity (v). Since Work = Force x Displacement, and Displacement / Time = Velocity, the formula for Instantaneous Power is P = F. v.

• Joule-second (J.s): This unit (Option 1) does not represent power. It is the unit for Action or Angular Momentum and is also the unit for the Planck constant (h).

• Newton per meter (N/m): This unit (Option 4) represents Surface Tension or the Spring Constant, not power.

• Average Power: It is the ratio of total work done to the total time taken. If the rate of doing work varies over time, average power provides a useful measure of overall performance.

Q22. Answer: (d) Current

The correct answer is Current.

Key Points

• Electric Power (P) is defined as the rate at which electrical energy is consumed or transferred in an electric circuit. The SI unit of

power is the Watt (W), which is equivalent to one Joule per second (1 J/s).

• The mathematical expression for electric power is P = V × I, where V represents the Voltage (potential difference) and I represents the Electric Current.

• According to the formula P = VI, if the Voltage (V) is kept constant, the Power (P) is directly proportional to the Current (I). This implies that any increase in current will lead to a proportional increase in power. Hence, statement 4 is correct.

• Using Ohm's Law (V = IR), power can also be expressed as P = V^2 / R. When Voltage (V) is constant, Power becomes inversely proportional to Resistance (R). Hence, statement 3 is incorrect.

• Because the relationship is inverse, power is not directly proportional to the Square of Resistance. Hence, statement 2 is incorrect.

• Energy (E) is the total work done over a period of time (t), calculated as E = P × t. Power is the rate of energy, not directly proportional to energy itself without a fixed time interval. Hence, statement 1 is incorrect.

Additional Information

• Ohm's Law:

• Proposed by Georg Simon Ohm in 1827, it states that the current flowing through a conductor is directly proportional to the voltage across it, provided physical conditions like temperature remain constant (V = IR).

• It serves as the foundation for defining Electrical Resistance, measured in Ohms (Ω).

• Electric Current and Voltage:

• Current (I) is the rate of flow of electric charge. Its SI unit is the Ampere (A).

• Voltage (V) is the potential difference required to move a unit charge between two points. Its SI unit is the Volt (V).

• In parallel circuits, the Voltage remains constant across all components, which is why the relationship P prop. to I is particularly relevant in household wiring.

• Joule's Law of Heating:

• When current flows through a resistor, electrical energy is converted into heat energy.

• The heat produced (H) is given by the formula H = I^2Rt, where I is current, R is resistance, and t is time.

• Alternative Power Formulas:

• P = I^2R: This formula shows that if Current is constant (as in a series circuit), Power is directly proportional to Resistance.

• P = V^2/R: This is used when Voltage is constant (as in a parallel circuit).

Important Points

• Commercial Unit of Energy: The commercial unit of electrical energy is the kilowatt-hour (kWh), commonly known as a 'unit'. 1 kWh = 3.6 × 10&sup6; Joules.

• Power Rating: Electrical appliances like bulbs or heaters are marked with a power rating (e.g., 100W, 220V). This tells us the power consumed when operated at the specified rated voltage.

• Fuses: A safety fuse in a circuit works on the heating effect of current. It has a specific current rating; if the current exceeds this numerical value, the fuse wire melts to break the circuit.

Q23. Answer: (a) Because they have the same number of protons in their nucleus

The correct answer is Because they have the same number of protons in their nucleus.

Key Points

• The identity of an element is fundamentally defined by its atomic number, which is the total number of protons found in the nucleus of its atoms.

• All atoms of a specific element must have the same number of protons. For instance, every Carbon atom has exactly 6 protons; if it had a different number, it would be a different element. Hence, statement 1 is correct.

• Atoms of the same element can possess different numbers of neutrons in their nuclei; these variations are called isotopes. Therefore, the number of neutrons is not a defining characteristic for the element's symbol. Hence, statement 2 is incorrect.

• The mass number is the sum of protons and neutrons. Because isotopes have different numbers of neutrons, atoms of the same element can have different mass numbers (e.g., Carbon-12 and Carbon-14). Hence, statement 3 is incorrect.

• While atoms of the same element share the same chemical properties due to their electron configuration, they do not have identical physical properties. Isotopes of an element differ in mass, density, and sometimes radioactivity. Hence, statement 4 is incorrect.

• The chemical symbol (such as H, He, Li) serves as a shorthand notation for an element and applies to all its isotopes because they all share the same atomic number.

Additional Information

• Atomic Number (Z):

• The concept of the atomic number being the identifying trait of an element was solidified by the work of Henry Moseley in 1913.

• In the Modern Periodic Table, elements are arranged in increasing order of their atomic number (Z) rather than atomic mass.

• Isotopes and Isobars:

• Isotopes: Atoms with the same atomic number but different mass numbers (e.g., Protium, Deuterium, and Tritium for Hydrogen).

• Isobars: Atoms of different elements (different atomic numbers) that happen to have the same mass number (e.g., Calcium-40 and Argon-40).

• Subatomic Particles:

• Protons: Positively charged particles discovered by Ernest Rutherford (often credited alongside Goldstein). Their number defines the element.

• Neutrons: Neutral particles discovered by James Chadwick in 1932. They contribute to the nuclear stability and mass.

• Electrons: Negatively charged particles discovered by J.J. Thomson. In a neutral atom, the number of electrons equals the number of protons.

Important Points

• Chemical Reactivity: The chemical behavior of an atom is determined by the valence electrons, which are dictated by the atomic number in a neutral state. This is why isotopes react almost identically in chemical processes.

• Nuclide Notation: When representing a specific atom, the mass number (A) is written as a superscript and the atomic number (Z) as a subscript to the left of the element symbol (X).

• Nuclear Charge: The protons provide the entire positive charge of the nucleus, which exerts the electrostatic pull on the electrons, determining the size and structure of the atom.

Q24. Answer: (a) 14.28%

p>The correct answer is 14.28%.

Key Points

• The concentration of a solution is defined as the amount of solute present in a given quantity of solution or solvent. In this case, the concentration is calculated using the mass by mass percentage method.

• To find the total mass of the solution, we must add the mass of the solute and the mass of the solvent. Here, the mass of the solute (common salt) is 50 g and the mass of the solvent (water) is 300 g.

• Total mass of the solution = Mass of solute + Mass of solvent = 50 g + 300 g = 350 g.

• The formula for mass by mass percentage is: (Mass of solute / Mass of solution) × 100.

• Applying the values: (50 / 350) × 100 = (1 / 7) × 100.

• Calculation results in approximately 14.2857%, which is rounded to 14.28%. Hence, the correct option is 14.28%.

Additional Information

• Components of a Solution:

• Solute: The substance that is dissolved in a solvent to form a solution. In this example, common salt (Sodium Chloride) is the solute, weighing 50 g.

• Solvent: The medium in which the solute is dissolved. Water is often called the universal solvent due to its ability to dissolve a wide variety of substances. Here, its mass is 300 g.

• Methods of Expressing Concentration:

• Mass by Volume Percentage: This is the mass of solute dissolved in 100 mL of the solution. It is commonly used in medicine and pharmacy.

• Volume by Volume Percentage: Used when both the solute and solvent are liquids (e.g., alcohol in water).

• Molarity: A more advanced unit representing the number of moles of solute per liter of solution.

• Types of Solutions based on Concentration:

• Dilute Solution: Contains a small amount of solute relative to the solvent.

• Concentrated Solution: Contains a large amount of dissolved solute.

• Saturated Solution: A solution in which no more solute can be dissolved at a specific temperature.

Important Points

• Solubility: The maximum amount of solute that can be dissolved in 100 g of solvent at a given temperature. For most solids like salt, solubility increases with an increase in temperature.

• Common Salt (NaCl): It is an ionic compound. When dissolved in water, it undergoes dissociation into sodium ions (Na+) and chloride ions (Cl-), allowing the solution to conduct electricity.

• Homogeneous Nature: A true solution, like salt in water, is homogeneous, meaning the particles are distributed uniformly at the molecular level and cannot be seen with the naked eye.

• Physical Change: Dissolving salt in water is generally considered a physical change because the salt can be recovered through the process of evaporation or distillation.

• Mass Conservation: In any solution process, the Law of Conservation of Mass applies; the total mass of the final solution is exactly equal to the sum of the masses of the components added.

Q25. Answer: (c) Sodium Chloride

The correct answer is Sodium Chloride.

Key Points

• Sodium Chloride, represented by the chemical formula NaCl, is an ionic compound formed by the attraction between positive sodium ions (Na+) and negative chloride ions (Cl-).

• When Sodium Chloride is placed in water, the polar water molecules interact with the ions in the crystal lattice. The partial negative charge of the oxygen atoms attracts the sodium ions, while the partial positive charge of the hydrogen atoms attracts the chloride ions.

• This interaction leads to the dissociation of the salt into individual ions, which become surrounded by water molecules in a process called hydration.

• The resulting mixture is a homogeneous mixture or a true solution, where the solute (salt) is distributed evenly at the molecular level throughout the solvent (water). Hence, the statement regarding Sodium Chloride is correct.

• In a salt solution, the particles are so small (less than 1 nanometer) that they do not scatter light (Tyndall effect) and cannot be separated by simple filtration.

Additional Information

• Sand (Silicon Dioxide):

• Sand is primarily composed of silica (SiO_2). It does not dissolve in water because the covalent bonds in its three-dimensional network structure are extremely strong and cannot be broken by water molecules.

• When mixed with water, it forms a suspension, which is a heterogeneous mixture where the particles eventually settle at the bottom. Hence, the statement regarding Sand is incorrect.

• Oil:

• Oils are non-polar organic substances (mostly hydrocarbons). According to the principle of "like dissolves like," non-polar substances do not dissolve in polar solvents like water.

• Instead of forming a solution, oil and water are immiscible and form two distinct layers, representing a heterogeneous mixture. Hence, the statement regarding Oil is incorrect.

• Iron Filings:

• Iron filings consist of the elemental metal Iron (Fe). Metals generally do not dissolve in water through simple physical dissolution; they are insoluble solid particles.

• A mixture of iron filings and water is heterogeneous, and the iron can be easily separated using physical methods such as filtration or a magnet. Hence, the statement regarding Iron filings is incorrect.

• Solubility and Compounds:

• A compound is a substance formed when two or more chemical elements are chemically bonded together.

• Solubility depends on the temperature, pressure, and the chemical nature of both the solute and the solvent. Increasing the temperature usually increases the solubility of solid compounds like Sodium Chloride in water.

Q26. Answer: (a) 15

Shortcut Trick

Check divisibility of 8,33,525 by prime factors of the options.

For 15, factors are 3 and 5. Sum of digits = 8+3+3+5+2+5 = 26.

Since 26 is not divisible by 3, the number is not divisible by 15.

Therefore The correct answer is 15.

Alternate Method

Given: Number = 8,33,525

Divisibility Rules:

=> Divisibility by 15: Number must be divisible by 3 and 5. Sum of digits of 8,33,525 = 8 + 3 + 3 + 5 + 2 + 5 = 26. Since 26 is not divisible by 3, 8,33,525 is NOT divisible by 15.

=> Divisibility by 25: Last two digits must be divisible by 25. Last two digits are 25, which is divisible by 25. So, it is divisible by 25.

=> Divisibility by 55: Number must be divisible by 5 and 11. Alternating sum for 11: (8+3+2) − (3+5+5) = 13 − 13 = 0. Since 0 is divisible by 11, it is divisible by 55.

=> Divisibility by 35: Number must be divisible by 5 and 7. 8,33,525 ÷ 7 = 1,19,075. Since it is divisible by 7 and 5, it is divisible by 35.

Therefore The correct answer is 15.

Additional Information

Divisibility by 3

A number is divisible by 3 if the sum of its digits is a multiple of 3.

Divisibility by 11

A number is divisible by 11 if the difference between the sum of digits at odd places and sum of digits at even places is 0 or a multiple of 11.

Co-prime Factors

To check divisibility by a composite number, check if it is divisible by its co-prime factors (e.g., for 15, use 3 and 5).

Q27. Answer: (a) Rs. 11,220

Shortcut Trick

Use the effective multiplier method for successive transactions.

Final SP = Initial CP × (100 + P1)% × (100 − L2)%

Final SP = 12000 × (110 ÷ 100) × (85 ÷ 100)

Final SP = 12000 × 1.1 × 0.85 = 13200 × 0.85

Final SP = Rs. 11,220

Therefore The correct answer is Rs. 11,220.

Alternate Method

Given → Initial Cost Price (CP) = Rs. 12,000, Profit% = 10%, Loss% = 15%.

Formulas: SP = CP × (100 + P%) ÷ 100 | SP = CP × (100 − L%) ÷ 100

=> Vendor's Selling Price = 12000 + (10% of 12000) = 12000 + 1200 = Rs. 13,200.

=> This 13,200 is the Retailer's Cost Price.

=> Retailer's Selling Price = 13200 − (15% of 13200).

=> 15% of 13200 = 1320 + 660 = Rs. 1,980.

=> Final Selling Price = 13200 − 1980 = Rs. 11,220.

Therefore The correct answer is Rs. 11,220.

Additional Information

Successive Percentage Change

When a value changes by x% and then y%, the net change is (x + y + xy ÷ 100)%. For loss, use negative values.

Relationship between CP and SP

If there is a profit, SP > CP. If there is a loss, SP < CP. The selling price of the first person becomes the cost price for the second person.

Q28. Answer: (d) Rs. 1,870

Shortcut Trick

Calculate the total effective rate of interest: (6% × 4) + (5% × 2) = 24% + 10% = 34%.

Total Simple Interest = 34% of the Principal (Rs. 5,500).

SI = (34 ÷ 100) × 5500 = 34 × 55 = 1870.

Therefore The correct answer is Rs. 1,870.

Alternate Method

Given:

Principal (P) = Rs. 5,500

Rate 1 (R1) = 6%, Time 1 (T1) = 4 years

Rate 2 (R2) = 5%, Time 2 (T2) = 2 years

Formula Used:

Simple Interest (SI) = (P × R × T) ÷ 100

Calculations:

=> Interest for first 4 years (SI1) = (5500 × 6 × 4) ÷ 100

=> SI1 = 55 × 24 = Rs. 1,320

=> Interest for next 2 years (SI2) = (5500 × 5 × 2) ÷ 100

=> SI2 = 55 × 10 = Rs. 550

=> Total Simple Interest = SI1 + SI2 = 1320 + 550 = Rs. 1,870

Therefore The correct answer is Rs. 1,870.

Additional Information

Simple Interest Principle

Simple interest is always calculated only on the original principal amount, regardless of the time elapsed or changes in interest

rates.

Total Amount Formula

The total amount (A) at the end of the tenure is given by: A = Principal + Total Simple Interest.

Variable Rates Rule

When rates change over time, the total interest is the sum of interest calculated for each period: SI_(total) = P × (R1T1 + R2T2 + ...) ÷ 100.

Q29. Answer: (d) 100%

Shortcut Trick

Work done by P = Time ÷ Total Time = 15 ÷ 30 = 1/2 of cistern.

Remaining work to be filled by Q = 1 − 1/2 = 1/2 of cistern.

Since both filled equal parts (50% each), the ratio is 1 : 1.

Percentage = (1/2 ÷ 1/2) × 100 = 100%.

Therefore The correct answer is 100%.

Alternate Method

Person	Days	Total Work	Efficiency
Pipe P	30	120 units	4
Pipe Q	40	3	

Given: Pipe P works for 15 hours.

=> Work done by Pipe P = Efficiency × Time = 4 × 15 = 60 units

=> Remaining work = Total Work − Work by P = 120 − 60 = 60 units

=> Work done by Pipe Q = 60 units

=> Required Percentage = (Work by P ÷ Work by Q) × 100

=> Percentage = (60 ÷ 60) × 100 = 100%

Therefore The correct answer is 100%.

Additional Information

Pipes & Cisterns Work Logic

The portion of the tank filled by a pipe is calculated as (Time it worked) ÷ (Total time it takes to fill the tank alone).

Efficiency and Time

Efficiency is inversely proportional to the time taken. Total Work = Efficiency × Time.

Inlet and Outlet Pipes

Inlet pipes perform positive work (fill), while outlet pipes or leaks perform negative work (empty).

Q30. Answer: (d) 2

Shortcut Trick

Convert decimals: 0.49 = (7/10)², 0.343 = (7/10)³, 0.2401 = (7/10)^4

Expression = [(7/10)²]^4 × [(7/10)³]^4 ÷ [(7/10)^4]^4

= (7/10)^(8 + 12 − 16) = (7/10)^4

So, x + 2 = 4

x = 2

Therefore Answer = 2

Alternate Method

Given:

(0.49)^4 × (0.343)^4 ÷ (0.2401)^4 = (7/10)^(x+2)

Concept Used:

Convert decimals into fractional powers and apply index laws

Calculation:

=> 0.49 = (7/10)²

=> 0.343 = (7/10)³

=> 0.2401 = (7/10)^4

=> Substitute:

=> $[(7/10)^2]^4 \times [(7/10)^3]^4 \div [(7/10)^4]^4$

=> $(7/10)^8 \times (7/10)^{12} \div (7/10)^{(16)}$

=> $(7/10)^{((8 + 12 - 16))}$

=> $(7/10)^4$

=> Compare powers: x + 2 = 4

=> x = 2

Therefore The correct answer is 2.

Additional Information

Laws of Exponents

$a^m \times a^n = a^{(m+n)}$, $a^m \div a^n = a^{(m-n)}$

Power of Power

$(a^m)^n = a^{(mn)}$

Base Conversion

Convert decimals into fractional powers of same base.

Quick Insight

Always express terms in common base for easy simplification.

Q31. Answer: (a) 11:24 AM

Shortcut Trick

Time taken by A = 4 hours | Time taken by B = 6 hours.

Meeting Time from start = (Product of times) ÷ (Sum of times)

=> (4 × 6) ÷ (4 + 6) = 24 ÷ 10 = 2.4 hours.

=> 2 hours + (0.4 × 60) minutes = 2 hours 24 minutes.

=> 9:00 AM + 2 hours 24 minutes = 11:24 AM.

Therefore The correct answer is 11:24 AM.

Alternate Method

Given: A starts at 9:00 AM, arrives at 1:00 PM (4 hrs). B starts at 9:00 AM, arrives at 3:00 PM (6 hrs).

Formula: Distance = Speed × Time | Relative Speed (Opposite) = S1 + S2

=> Let Total Distance = LCM(4, 6) = 12 km.

=> Speed of A = 12 / 4 = 3 kmph.

=> Speed of B = 12 / 6 = 2 kmph.

=> Relative Speed = 3 + 2 = 5 kmph.

=> Meeting Time = Distance ÷ Relative Speed = 12 / 5 = 2.4 hours.

=> 2 hours + (0.4 × 60) min = 2 hours 24 minutes.

=> 9:00 AM + 2:24 = 11:24 AM.

Therefore The correct answer is 11:24 AM.

Additional Information

Relative Speed in Opposite Direction

When two objects move towards each other, their Relative Speed is the sum of their individual speeds (S1 + S2).

Different Starting Times

If starting times are different, first calculate the distance covered by the first person before the second starts, then apply relative speed to the remaining distance.

Average Speed for Entire Journey

If a person travels from X to Y at speed 'a' and Y to X at speed 'b', the Average Speed is (2 × a × b) / (a + b).

Q32. Answer: (d) 11

Shortcut Trick

Deviation from old average = 176 − 90 = 86

Average increase = Total Deviation ÷ New Number of Innings

Increase = 86 ÷ 8 = 10.75

Rounding 10.75 to the nearest whole number = 11

Therefore The correct answer is 11.

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Alternate Method

Given: Average of 7 innings = 90, 8^(th) inning score = 176

Formula: Average = Total Sum ÷ Number of items

=> Total runs in 7 innings = 7 × 90 = 630

=> Total runs after 8 innings = 630 + 176 = 806

=> New Average = 806 ÷ 8 = 100.75

=> Increase in average = New Average − Old Average

=> Increase = 100.75 − 90 = 10.75

=> Nearest whole number ≈ 11

Therefore The correct answer is 11.

Additional Information

Average of Deviation

The sum of deviations of all observations from their mean is always zero. This property is used to quickly find the new average when a new value is added.

Weighted Average Formula

When two groups with averages A1 and A2 and sizes n1 and n2 are combined, the new average is (n1A1 + n2A2) ÷ (n1 + n2).

Rounding Rules

To round to the nearest whole number, look at the first decimal digit. If it is 5 or more, round up; if it is less than 5, round down.

Q33. Answer: (b) 10

Shortcut Trick

Use the formula for Successive Percentage: Net Profit% = Markup% − Discount% − (Markup × Discount) ÷ 100.

Let Markup percentage be M = 50 and Discount percentage be X.

35 = 50 − X − (50 × X) ÷ 100.

35 = 50 − X − 0.5X => 35 = 50 − 1.5X.

1.5X = 50 − 35 => 1.5X = 15 => X = 15 ÷ 1.5 = 10.

Therefore The correct answer is 10.

Alternate Method

Given → Markup% = 50%, Profit% = 35%, Discount = X%.

Formulas: MP = CP × (100 + Markup%) ÷ 100 | SP = CP × (100 + Profit%) ÷ 100 | Discount% = (MP − SP) ÷ MP × 100

=> Let Cost Price (CP) = 100.

=> Marked Price (MP) = 100 + 50% of 100 = 150.

=> Selling Price (SP) = 100 + 35% of 100 = 135.

=> Discount Amount = MP − SP = 150 − 135 = 15.

=> Discount Percentage (X) = (15 ÷ 150) × 100 = 10%.

Therefore The correct answer is 10.

Additional Information

Relation between CP and MP

The ratio of Marked Price to Cost Price can be directly found using: MP ÷ CP = (100 + Profit%) ÷ (100 − Discount%).

Markup Percentage

It is the extra price added to the Cost Price to reach the Marked Price. Formula: Markup% = [(MP − CP) ÷ CP] × 100.

Q34. Answer: (c) 49.5

Shortcut Trick

Let number = x

20% of x + 66 = x => 0.2x + 66 = x

=> 0.8x = 66 => x = 82.5

60% of x = 0.6 × 82.5 = 49.5

Therefore Answer = 49.5

Alternate Method

Given:

20% of a number + 66 = the number

Formula used:
Percentage = (part/whole) × 100
Calculation:
=> Let number = x
=> 20% of x = 0.2x
=> Equation: 0.2x + 66 = x
=> x − 0.2x = 66
=> 0.8x = 66
=> x = 66 ÷ 0.8 = 82.5
=> 60% of x = 0.6 × 82.5 = 49.5
Therefore The correct answer is 49.5.
Additional Information
Percentage Basics
x% = x/100 of the number
Linear Equation
Translate word problems into algebraic equations
Shortcut Insight
Rearrange equation to isolate variable quickly
Quick Tip
Convert percentages into decimals for easy calculation

Q35. Answer: (c) 30

Shortcut Trick
If a, b, c are in continued proportion, then $b^2 = a \times c$.
Given: a = 75, b = Z, and c = 12 (third proportional).
=> $Z^2 = 75 \times 12$
=> $Z^2 = 900$ => Z = 30.
Therefore The correct answer is 30.
Alternate Method
Given: First number = 75, Second number = Z, Third proportional = 12.
Formula Used: For three numbers a, b, c to be in proportion, a/b = b/c.
=> 75/Z = Z/12
=> Z × Z = 75 × 12
=> $Z^2 = 900$
=> $Z = \sqrt{900}$
=> Z = 30
Therefore The correct answer is 30.
Additional Information
Mean Proportional
The mean proportional between two numbers a and b is given by $\sqrt{(a \times b)}$.
Fourth Proportional
If a, b, c, d are in proportion, then a/b = c/d, where d is the fourth proportional (d = (b × c) / a).
Continued Proportion
Numbers a, b, c, d... are in continued proportion if a/b = b/c = c/d...

Q36. Answer: (c) 381.3

Shortcut Trick
Identify External Radius (R) = 12 ÷ 2 = 6 cm and Internal Radius (r) = 10 ÷ 2 = 5 cm.
Apply Shell Volume formula: $V = 4/3 \times \pi \times (R^3 - r^3)$.
Calculate difference of cubes: $6^3 - 5^3 = 216 - 125 = 91$.
Final calculation: $4/3 \times 22/7 \times 91 = 4/3 \times 22 \times 13 = 1144/3 \approx 381.3$ cm³.
Therefore The correct answer is 381.3 cm³.

Alternate Method

Given:

External Diameter (D) = 12 cm => External Radius (R) = 12/2 = 6 cm

Internal Diameter (d) = 10 cm => Internal Radius (r) = 10/2 = 5 cm

Formula Used:

The Volume of a Spherical Shell is given by: $V = 4/3 \times \pi \times (R^3 - r^3)$

Calculations:

=> Volume = $4/3 \times 22/7 \times (6^3 - 5^3)$

=> Volume = $4/3 \times 22/7 \times (216 - 125)$

=> Volume = $4/3 \times 22/7 \times 91$

=> Volume = $4/3 \times 22 \times 13$ (Since $91 \div 7 = 13$)

=> Volume = 1144 / 3

=> Volume = 381.333... cm^3

=> Rounding off to 1 decimal place, Volume ≈ 381.3 cm^3

Therefore The correct answer is 381.3 cm^3.

Additional Information

Volume of a Solid Sphere

The total space occupied by a solid sphere is $V = 4/3 \times \pi r^3$, where r is the radius.

Total Surface Area of Spherical Shell

The total surface area includes both internal and external surfaces: $A = 4\pi R^2 + 4\pi r^2 = 4\pi(R^2 + r^2)$.

Volume of a Hemisphere

A hemisphere is exactly half of a sphere, so its volume is $V = 2/3 \times \pi r^3$.

Q37. Answer: (a) 196 cm2

Shortcut Trick

Radius of circle $r = \sqrt{(Area \times 7/22)} = \sqrt{(39424 \times 7/22)} = 112$ cm.

Perimeter of square = r/2 = 112 / 2 = 56 cm.

Side of square = 56 / 4 = 14 cm.

Area of square = $14^2 = 196$ cm^2.

Therefore The correct answer is 196 cm^2.

Alternate Method

Given: Area of the circle = 39424 cm^2 and $\pi = 22/7$.

Formula Used: Area of circle = πr^2; Perimeter of square = 4 × side; Area of square = $side^2$.

=> Area of circle = $\pi \times r^2 = 39424$

=> $(22 / 7) \times r^2 = 39424$

=> $r^2 = (39424 \times 7) / 22$

=> $r^2 = 1792 \times 7 = 12544$

=> $r = \sqrt{12544} = 112$ cm

=> Perimeter of square = $(1 / 2) \times r = 112 / 2 = 56$ cm

=> 4 × side = 56

=> side = 56 / 4 = 14 cm

=> Area of square = side × side = 14 × 14 = 196 cm^2

Therefore The correct answer is 196 cm^2.

Additional Information

Properties of a Square

A square has four equal sides. If the side is 'a', the diagonal is $a\sqrt{2}$. Area can also be expressed as $(diagonal^2) / 2$.

Circle Mensuration

The circumference of a circle is $2\pi r$. The ratio of the area to the square of the radius is always constant (π).

Common Square Roots

It is helpful to remember that $110^2 = 12100$ and $112^2 = 12544$ for fast calculations in competitive exams.

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Q38. Answer: (a) Decreases by 41.28%

Shortcut Trick

Using the successive multiplying factor method:

Final Price = Initial Price × 0.90 × 0.50 × 0.90 × 1.45

Final Price = Initial Price × 0.58725

Net change = (0.58725 − 1) × 100 = −41.275%

Therefore The correct answer is Decreases by 41.28%.

Alternate Method

Given: Initial price decreases by 10%, 50%, and 10%, then increases by 45%.

=> Let the Original Price be 100.

=> Price after 1^(st) month = 100 × (90/100) = 90

=> Price after 2^(nd) month = 90 × (50/100) = 45

=> Price after 3^(rd) month = 45 × (90/100) = 40.5

=> Price after 4^(th) month = 40.5 × (145/100) = 58.725

=> Overall Change = 58.725 − 100 = −41.275%

=> Rounding to two decimal places = 41.28% decrease.

Therefore The correct answer is Decreases by 41.28%.

Additional Information

Successive Percentage Formula

For two changes a% and b%, the effective change is [a + b + (a × b)/100]%. This can be extended to multiple values.

Multiplying Factor (MF)

A decrease of x% corresponds to a factor of (1 − x/100), and an increase of x% corresponds to (1 + x/100).

Net Percentage Change

Net % Change = [(Final Value − Initial Value) / Initial Value] × 100%.

Q39. Answer: (b) 5 years

Shortcut Trick

Current ratio of Renu and Kashish = 9 : 8 (Difference = 1 unit)

Ratio after 5 years = 10 : 9 (Difference = 1 unit)

Increase in ratio units = 10 − 9 = 1 unit (or 9 − 8 = 1 unit)

Since 1 unit represents 5 years, the difference (1 unit) is 5 years.

Therefore The correct answer is 5 years.

Alternate Method

Given: Present ratio = 9 : 8, Ratio after 5 years = 10 : 9.

Let the present ages be 9x and 8x.

=> (9x + 5) ÷ (8x + 5) = 10 ÷ 9

=> 9 × (9x + 5) = 10 × (8x + 5)

=> 81x + 45 = 80x + 50

=> 81x − 80x = 50 − 45

=> x = 5

=> Difference = 9x − 8x = x = 5 years.

Therefore The correct answer is 5 years.

Additional Information

Constant Difference Principle

The age difference between two people always remains the same regardless of the number of years passed. In ratio problems, ensure the difference between ratio parts is equalized.

Ratio Balancing

If the difference between ratios is not the same, multiply the ratios by the difference of the other ratio to balance them (e.g., multiply ratio 1 by the difference of ratio 2).

Q40. Answer: (c) $\cos^2 x$

Shortcut Trick

Apply the fundamental trigonometric identity: $\sin^2 x + \cos^2 x = 1$.

Comparing this with the given equation $\sin^2 x + K = 1$.

It is immediately evident that $K = \cos^2 x$.

Therefore The correct answer is $\cos^2 x$.

Alternate Method

Given: $\sin^2 x + K = 1$

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

$\Rightarrow \sin^2 x + K = 1$

$\Rightarrow K = 1 - \sin^2 x$

$\Rightarrow$ From the Pythagorean identity, we know that $1 - \sin^2 x = \cos^2 x$

$\Rightarrow K = \cos^2 x$

Therefore The correct answer is $\cos^2 x$.

Additional Information

Fundamental Trigonometric Identities

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

Reciprocal Relations

$\sin \theta = 1/\text{cosec}\ \theta$, $\cos \theta = 1/\sec \theta$, and $\tan \theta = 1/\cot \theta$.

Complementary Angles

$\sin(90° - \theta) = \cos \theta$ and $\cos(90° - \theta) = \sin \theta$.

Q41. Answer: (d) 42

Shortcut Trick

Teacher's age = New Average + (Initial count × Change in average)

Increase in average = 18 − 17 = 1 year

Teacher's age = 18 + (24 × 1) = 18 + 24

Teacher's age = 42 years

Therefore The correct answer is 42 years.

Alternate Method

Given:

Initial count = 24 students

Initial average age = 17 years

New count (including teacher) = 25 people

New average age = 18 years

Formula Used:

Age of Teacher = (Total age of 25 people) − (Total age of 24 students)

$\Rightarrow$ Total age of 24 students = 24 × 17 = 408 years

$\Rightarrow$ Total age of 25 people = 25 × 18 = 450 years

$\Rightarrow$ Age of the teacher = 450 − 408

$\Rightarrow$ Age of the teacher = 42 years

Therefore The correct answer is 42 years.

Additional Information

Net Deviation Method

The sum of deviations from the average is always zero. If the average increases by 1 for 25 people, the total deviation is +25, which must be balanced by the new person relative to the old average.

Exclusion Case

When a person leaves: Age of left person = Old Average + (Final count × Decrease in Average).

Weighted Average Formula

Combined Average = $(n1x1 + n2x2) \div (n1 + n2)$, where n is count and x is the individual average.

Q42. Answer: (d) 8

Shortcut Trick

For two lines to be parallel, the ratio of the coefficients of x and y must be equal.

$(k - 4) / 2 = 2 / 1$

=> k − 4 = 4
=> k = 8
Therefore The correct answer is 8.
Alternate Method
Given:
Equation 1: (k − 4)x + 2y = 6
Equation 2: 2x + y = 4
Formula Used:
For two linear equations a1x + b1y + c1 = 0 and a2x + b2y + c2 = 0 to be parallel, the condition is:
a1/a2 = b1/b2 ≠ c1/c2
Calculations:
=> Comparing the given equations with the standard form:
=> a1 = k − 4, b1 = 2, c1 = −6
=> a2 = 2, b2 = 1, c2 = −4
=> For the lines to be parallel, we set the ratios of the coefficients equal:
=> (k − 4) / 2 = 2 / 1
=> k − 4 = 2 × 2
=> k − 4 = 4
=> k = 4 + 4
=> k = 8
=> Verification of the constant ratio: c1/c2 = −6/−4 = 1.5. Since 2 ≠ 1.5, the lines are strictly parallel and not coincident.
Therefore The correct answer is 8.
Additional Information
Coincident Lines
Lines are coincident if a1/a2 = b1/b2 = c1/c2, resulting in infinitely many solutions as the lines lie on top of each other.
Intersecting Lines
Lines intersect at exactly one point if a1/a2 ≠ b1/b2, which provides a unique solution for the system of equations.
Perpendicular Lines Condition
Two lines are perpendicular if the product of their slopes is −1 (m1 × m2 = −1) or if a1a2 + b1b2 = 0.

Q43. Answer: (a) 66.67%

Shortcut Trick
Identify the base value (A's marks) and the comparing value (B's marks).
Required Percentage = (B's marks ÷ A's marks) × 100
=> (50 ÷ 75) × 100 = (2 ÷ 3) × 100 = 66.666...
Therefore The correct answer is 66.67%.
Alternate Method
Given:
Marks obtained by B = 50
Marks obtained by A = 75
Maximum marks = 80
Formula Used:
Percentage = (Value ÷ Base Value) × 100
Calculations:
=> Required Percentage = (50 ÷ 75) × 100
=> Dividing both numbers by 25: (2 ÷ 3) × 100
=> 200 ÷ 3 = 66.6666...
=> Rounding off to two decimal places = 66.67
Therefore The correct answer is 66.67%.
Additional Information
Percentage Change
To find how much more or less A is than B: Percentage Difference = [(A − B) ÷ B] × 100.

Base Value Identification

In phrases like 'X is what % of Y', the value following 'of' is always the denominator (base).

Rounding Rules

If the third decimal digit is 5 or greater, increment the second decimal digit by 1.

Q44. Answer: (b) 4

Shortcut Trick

Let the capacity of the tank be the LCM of 7 and 56 = 56 units.

Efficiency of filling pipe = 56 ÷ 7 = +8 units/minute.

Efficiency of emptying pipe = 56 ÷ 56 = −1 unit/minute.

Combined efficiency of both pipes = 8 − 1 = 7 units/minute.

Time taken to fill one-half of the tank (28 units) = 28 ÷ 7 = 4 minutes.

Therefore The correct answer is 4 minutes.Alternate Method

Given:

Time taken by filling pipe A = 7 minutes

Time taken by emptying pipe B = 56 minutes

Person/Pipe

Days/Time (mins)

Total Work (LCM)

Efficiency

Pipe A (Fill)

7

56 units

+8

Pipe B (Empty)

56

−1

Calculations:

=> Total capacity of the tank = 56 units

=> One-half capacity of the tank = 56 ÷ 2 = 28 units

=> Net efficiency of both pipes working together = 8 − 1 = 7 units/minute

=> Time required to fill 28 units = 28 ÷ 7 = 4 minutes

Therefore The correct answer is 4 minutes.Additional Information

Pipes and Cisterns Concept

In pipes and cisterns, an inlet pipe does positive work (+ efficiency) while an outlet or leak does negative work (− efficiency).

Combined Work Formula

If one pipe fills a tank in X minutes and another empties it in Y minutes (where Y > X), the net part filled in 1 minute is (1/X − 1/Y).

Q45. Answer: (a) 23 : 149

Shortcut Trick

The relation between Cost Price (CP) and Marked Price (MP) or Listed Price is given by the ratio:

CP : MP = (100 − Discount%) : (100 + Profit%)

CP : MP = (100 − 77) : (100 + 49)

CP : MP = 23 : 149

Therefore The correct answer is 23 : 149.

Alternate Method

Given → Discount = 77%, Profit = 49%.

Formulas: SP = MP × (100 − D%) ÷ 100 | SP = CP × (100 + P%) ÷ 100

=> Let Listed Price (MP) be 100.

=> Selling Price (SP) = 100 − 77% of 100 = 23.

=> Since Profit is 49%, SP = CP × 1.49.

=> 23 = CP × (149 ÷ 100) => CP = 2300 ÷ 149.

=> Ratio CP : MP = (2300 ÷ 149) : 100.

=> Ratio CP : MP = 2300 : 14900 = 23 : 149.

Therefore The correct answer is 23 : 149.

Additional Information

Marked Price & Discount

Marked Price (MP) is the price printed on the label. Discount is always calculated on the MP to arrive at the Selling Price (SP).

CP-MP Relation

This direct ratio (100−D):(100+P) is a derivation of equating SP from both CP and MP sides. It is the most efficient way to solve markup or listed price problems.

Q46. Answer: (c) 1/4

Shortcut Trick

If $x + 1/x = k$, then $x^2 + 1/x^2 = k^2 - 2$.

Given: $2x + 2/x = 3 \Rightarrow 2(x + 1/x) = 3 \Rightarrow x + 1/x = 3/2$

Here, $k = 3/2$.

Result = $(3/2)^2 - 2 = 9/4 - 2 = 1/4$.

Therefore The correct answer is 1/4.

Alternate Method

Given: $2x + (2/x) = 3$

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

$\Rightarrow 2(x + 1/x) = 3$

$\Rightarrow x + 1/x = 3/2$

Squaring both sides:

$\Rightarrow (x + 1/x)^2 = (3/2)^2$

$\Rightarrow x^2 + (1/x)^2 + 2 \times x \times (1/x) = 9/4$

$\Rightarrow x^2 + 1/x^2 + 2 = 9/4$

$\Rightarrow x^2 + 1/x^2 = 9/4 - 2$

$\Rightarrow x^2 + 1/x^2 = (9 - 8)/4 = 1/4$

Therefore The correct answer is 1/4.

Additional Information

Algebraic Identities for Reciprocals

If $x + 1/x = k$, then $x^3 + 1/x^3 = k^3 - 3k$. This is derived from the expansion of $(a + b)^3$.

Negative Reciprocal Square

If $x - 1/x = k$, then $x^2 + 1/x^2 = k^2 + 2$. Note that the sign changes because $(x - 1/x)^2 = x^2 + 1/x^2 - 2$.

Higher Powers

To find x^4 + 1/x^4, square the result of $x^2 + 1/x^2$ and subtract 2 again. Let $x^2 + 1/x^2 = m$, then x^4 + 1/x^4 = $m^2 - 2$.

Q47. Answer: (c) Prime Factorization Model: Find the prime factorization of both numbers, then multiply the common prime fac...

Shortcut Trick

To find the Highest Common Factor (HCF), identify all common prime factors.

For each common factor, take the minimum exponent (lowest power) present in both factorizations.

Multiply these together to get the HCF.

Therefore The correct answer is Prime Factorization Model: Find the prime factorization of both numbers, then multiply the common prime factors with the lowest powers.

Alternate Method

Given: Two numbers for which the HCF needs to be calculated.

Definition: Highest Common Factor (HCF) or Greatest Common Divisor (GCD) is the largest positive integer that divides each of the integers.

=> Let numbers be N1 and N2.

=> Perform Prime Factorization: N1 = p1^a × p2^b ... and N2 = p1^x × p2^y ...

=> HCF = p1^(min(a,x)) × p2^(min(b,y)) ...

=> This model ensures the resulting number is the largest divisor shared by both.

Therefore The correct answer is Prime Factorization Model: Find the prime factorization of both numbers, then multiply the common prime factors with the lowest powers.

Additional Information

Euclidean Algorithm

A systematic method for computing the HCF of two numbers by repeatedly replacing the larger number with the remainder of its division by the smaller number until the remainder is zero.

Relationship between HCF and LCM

For any two positive integers a and b: HCF(a, b) × LCM(a, b) = a × b.

Least Common Multiple (LCM)

Found by taking the product of the highest powers of all prime factors present in the numbers.

Q48. Answer: (a) 108°

Shortcut Trick

The sum of the exterior angles of any convex polygon is always 360°.

For a regular pentagon (5 sides):

Each exterior angle = 360° ÷ 5 = 72°.

Since the interior and exterior angles form a linear pair:

Each interior angle = 180° − 72° = 108°.

Therefore The correct answer is 108°.

Alternate Method

Given:

Number of sides (n) of a regular pentagon = 5.

Formula Used:

Measure of each interior angle of a regular polygon = [(n − 2) × 180°] ÷ n

Calculations:

=> Sum of interior angles = (5 − 2) × 180°

=> Sum of interior angles = 3 × 180° = 540°

=> Measure of each interior angle = 540° ÷ 5

=> Measure of each interior angle = 108°

Therefore The correct answer is 108°.

Additional Information

Regular Polygon Properties

Q49. Answer: (a) Rs. 2,584

Shortcut Trick

Total deduction = 40 + 83 + 68 = Rs. 191

Remaining amount = 13403 − 191 = Rs. 13212

Ratio of remaining parts = 21 : 11 : 4 (Total units = 36)

Difference between B and C = (11 − 4) + (83 − 68) = 7 units + Rs. 15

1 unit = 13212 ÷ 36 = Rs. 367

Difference = (7 × 367) + 15 = 2569 + 15 = Rs. 2584

Therefore The correct answer is Rs. 2584.

Alternate Method

Given:

Total amount = Rs. 13,403

Deductions: S = Rs. 40, B = Rs. 83, C = Rs. 68

Remaining Ratio S : B : C = 21 : 11 : 4

Calculations:

=> Sum of remaining parts = 13403 − (40 + 83 + 68)

=> Sum = 13403 − 191 = Rs. 13212

=> Total ratio units = 21 + 11 + 4 = 36 units

=> 36 units = 13212

=> 1 unit = 13212 ÷ 36 = 367

=> Share of B (Original) = (11 × 367) + 83 = 4037 + 83 = Rs. 4120

=> Share of C (Original) = (4 × 367) + 68 = 1468 + 68 = Rs. 1536

=> Difference = 4120 − 1536 = Rs. 2584

Therefore The correct answer is Rs. 2584.

Additional Information

Ratio and Proportion

When constant values are deducted from shares, subtract the total deduction from the total sum before applying the ratio division.

Calculation of Individual Shares

If Amount A is divided in ratio x:y, then part 1 = [x / (x+y)] × A and part 2 = [y / (x+y)] × A.

Difference Rule

The difference between original shares is the sum of the difference in ratio parts and the difference in their respective constant deductions.

Q50. Answer: (b) 33 minutes

Shortcut Trick

Speed ratio = 3 : 4 → Time ratio = 4 : 3 (since distance is constant).

Difference in time ratio parts = 4 − 3 = 1 unit.

Given: 1 unit = 11 minutes.

Usual time (smaller ratio part) = 3 units = 3 × 11 = 33 minutes.

Therefore The correct answer is 33 min.

Alternate Method

Given: New Speed = 3/4 of Usual Speed | Delay = 11 minutes.

Formula Used: Speed × Time = Distance | Time prop. to 1/Speed (when Distance is constant).

=> Let usual speed be S and usual time be T.

=> New speed = (3/4)S

=> New time = T + 11

=> Since Distance = Speed × Time:

=> S × T = (3/4)S × (T + 11)

=> T = (3/4)(T + 11)

=> 4T = 3T + 33

=> T = 33 minutes.

Therefore The correct answer is 33 min.

Additional Information

Inverse Proportion of Speed and Time

When the distance is constant, the ratio of speeds is inversely proportional to the ratio of time taken. If speed ratio is a:b, then time ratio is b:a.

Late/Early Concept Formula

Usual Time = (Late time × n) / (1 − n) where speed becomes 'n' times the original speed. Here, Usual Time = (11 × 3/4) / (1 − 3/4) = (33/4) / (1/4) = 33 min.

Average Speed

If a person covers the same distance at two different speeds x and y, the average speed is 2xy / (x + y).

Q51. Answer: (d) 2

Given: (Left) 9 @ 3 2 ! 1 6 ^9 3 ! @ # 3 5 + ! (Right)

Now, We need to remove all the symbols and form a new numerical sequence.

Symbols removed: @,, !, ^,, !, @, #,, +, !

Remaining numbers: 9 3 2 1 6 9 3 3 5

Position from Right	Number
1st	5
2nd	3
3rd	3

4th	9
5th	6
6th	1
7th	2

So, the 7th number from the right is 2.
Hence, the correct answer is Option 4.

Q52. Answer: (c) 24

The logic followed here is:
Given number: 56378492
Original number: 5 6 3 7 8 4 9 2
Arranging in descending order: 9 8 7 6 5 4 3 2
Now identifying required digits:
Digit second from the left = 8
Digit second from the right = 3
Now, performing multiplication: 8 × 3 = 24
Therefore, the product of the digits is 24
Hence, the correct answer is Option 3.

Q53. Answer: (c) Five

Given: Seven boxes E, B, D, S, T, W and P are kept one over the other but not necessarily in the same order.
W is kept second from the bottom.
Only three boxes are kept between W and B.
P is kept at one of the positions below W.
Only D is kept between B and S.
E is kept at one of the positions above B.

Position	Box
7	E
6	B
5	D
4	S
3	T
2	W
1	P

So, total boxes between P and E = 5 boxes
Hence, the correct answer is "Option 3".

Q54. Answer: (c) VTV−TRT

The logic followed here is based on the alphabetical position shift pattern between corresponding letters:
For, DBD → BZB
For, JHJ → HFH
Now check options:
Option 1: VST → SQS
Option 2: VST → TRT
Option 3: VTV → TRT
Option 4: VTV → SRS
Hence, the correct answer is Option 3.

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Q55. Answer: (a) 23 km to the west

Given:
Priya drives 32 km South.
She turns right → 31 km West.
She turns right → 43 km North.
She turns right → 54 km East.
She turns right → 11 km South and reaches point P.
Therefore, to reach Point A again, Priya must drive 23 km towards the West.
Hence, the correct answer is "Option 1".

Q56. Answer: (c) SHT

The logic followed here is:
So, 'SHT' will replace the question mark in the given series.
Hence, the correct answer is "Option 3".

Q57. Answer: (c) South-east

Given:
Building A is to the South of Building B.
Building E is to the East of Building B.
Building D is to the West of Building A.
Building C is to the South of Building E.
Building C is positioned to the South-East of Building B.
Hence, the correct answer is "Option 3".

Q58. Answer: (d) 16th

Given: Anu is 3rd to the left of Sanjay and Sanjay is 7th from the right end in a row of 25 people.
So, Anu's position from the right end = 7 + 3 = 10th
Total people in the row = 25
Position from left = (Total + 1) − Position from right
Anu's position from left = (25 + 1) − 10
= 26 − 10
= 16
Therefore, Anu's position from the left end is 16th.
Hence, the correct answer is Option 4.

Q59. Answer: (b) 257

The logic followed here is:
thus, "257" will replace the question mark in the given series.
Hence, the correct option is "Option 2

Q60. Answer: (c) Two

The logic followed here is:
Given: G, H, I, Q, R and S sit around a circular table facing the centre.
Q sits third to the left of G.
G sits second to the left of R.
Only S sits between G and H.
I is not an immediate neighbour of Q.
So, there are 2 people between H and I when counted from the right of H.
Hence, the correct answer is "Option 3".

Q61. Answer: (d) 1

The logic followed here is:
thus, "1" will replace the question mark in the given series.
Hence, the correct option is "Option 4"

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Q62. Answer: (c) 16

The logic followed here is:

Given number: 5341256

Original number: 5 3 4 1 2 5 6

Digit	Type	Operation	New Digit
5	Odd	+3 = 8	8
3	Odd	+3 = 6	6
4	Even	−2 = 2	2
1	Odd	+3 = 4	4
2	Even	−2 = 0	0
5	Odd	+3 = 8	8
6	Even	−2 = 4	4

New number formed: 8 6 2 4 0 8 4

Now,

First digit from the left = 8

Second digit from the right = 8

Now, Sum = 8 + 8 = 16

Therefore, the sum is 16

Hence, the correct answer is Option 3.

Q63. Answer: (d) THRX

The logic followed here is:

For, DRBH → SGQW

Now, for LZJP → AOYE

Now, applying the same logic for ESCI:

So, ESCI → THRX

Hence, the correct answer is "Option 4".

Q64. Answer: (a) Only conclusion (II) follows.

Given Statements:

All jacks are hammers.

All jacks are keys.

All jacks are drillers.

The least possible Venn diagram for the given statement is:

Conclusions:

I. All hammers are drillers – Does not follow (No definite relation is given).

II. Some drillers are keys – Follows (All jacks are both drillers and keys).

So, only conclusion II follows.

Hence, the correct answer is Option 1.

Q65. Answer: (b) RQP

The logic followed here is based on the alphabetical position pattern:

Option 1: NKP

Option 2: RQP

Option 3: HEJ

Option 4: MJO

Thus, RQP does not follow the pattern.

Hence, the odd one out is Option 2.

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Q66. Answer: (c) 13

The logic followed here is:

Given numbers: 593, 784, 358, 631, 296

Arranging to identify extremes:

Highest number = 784

Lowest number = 296

Now,

Highest number (784):

Third digit = 4

Lowest number (296):

Second digit = 9

Now, Sum: 4 + 9 = 13

Therefore, the resultant is 13

Hence, the correct answer is Option 3.

Q67. Answer: (d) 6

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

Now,

We need to find odd numbers which are immediately preceded by an odd number and also immediately followed by an odd number.

So, needed pattern is: Odd - Odd - Odd

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

So, total valid occurrences = 6

Hence, the correct answer is Option 4.

Q68. Answer: (b) 1

Given:

‘SOUP’ is coded as ‘5179’

‘PACE’ is coded as ‘2418’

So, P = 1

Hence, the correct answer is "Option 2".

Q69. Answer: (b) Brother's wife's brother

Family Chart:

Decoding the Symbols:

Symbol	•	•	**x**	**&**
Meaning	Son of	Brother of	Wife of	Father of

Given: K - T x R + Z & V

It means: K is the brother of T, T is the wife of R, R is the son of Z, and Z is the father of V.

So, K the brother of V’s wife’s father.

Hence, the correct answer is Option 3.

Q70. Answer: (a) Two

Given: O, P, Q, R, W, X and Y are sitting in a straight line facing north.

Only three people sit between W and Y.

P sits to the immediate left of Y.

No one sits to the right of Q.

Only two people sit between Q and P.

X sits to the immediate right of O.

So, total people between R and X = 2.

Hence, the correct answer is "Option 1".

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Q71. Answer: (c) 7

Given:

'AMIE' is coded as '9432'

'SAME' is coded as '4279'

So, S = 7

Hence, the correct answer is "Option 3".

Q72. Answer: (a) 424

The logic followed here is:

thus, "424" will replace the question mark in the given series.

Hence, the correct option is "Option 1"

Q73. Answer: (b) LION - ILON - NILO

The logic followed here is based on the arrangement pattern of letters in each group:

JOIN → OJIN → NOJI

MALE → AMLE → EAML

Now check options:

Option 1: PAGE → APGE → EAGP

Option 2: LION → ILON → NILO

Option 3: NEAR → NAER → RAEN

Option 4: USER → SUER → SERU

Hence, the correct answer is Option 2.

Q74. Answer: (c) 3

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

Now,

We need to find even numbers which are immediately preceded by an odd number and also immediately followed by an odd number.

So, needed pattern is: Odd - Even - Odd

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

So, total valid occurrences = 3

Hence, the correct answer is Option 3.

Q75. Answer: (b) (65, 5, 13)

The logic followed here is:

Logic: Second Number × Third Number = First Number

For, (55, 11, 5)

=> 11 × 5 = 55

For, (36, 3, 12)

=> 3 × 12 = 36

Now, checking the options using the same pattern:

Option 1) (70, 5, 16)

=> 5 × 16 = 80 ≠ 70

Option 2) (65, 5, 13)

=> 5 × 13 = 65

Option 3) (42, 15, 3)

=> 15 × 3 = 45 ≠ 42

Option 4) (56, 14, 3)

=> 14 × 3 = 42 ≠ 56

Hence, the correct answer is Option 2.

Q76. Answer: (d) 311

BODMAS Table:

Given equation: 78 P 3 R 15 Q 5 S 126 Q 3 S 117 Q 9 S 125 Q 5

Now, replacing the symbols as:

Symbol	P	Q	R	S
Replaced by	×	÷	−	•

=> 78 × 3 − 15 ÷ 5 + 126 ÷ 3 + 117 ÷ 9 + 125 ÷ 5 = ?

=> 234 − 15 ÷ 5 + 126 ÷ 3 + 117 ÷ 9 + 125 ÷ 5 = ?

=> 234 − 3 + 42 + 13 + 25 = ?

=> 231 + 42 + 13 + 25 = ?

=> 273 + 13 + 25 = ?

=> 286 + 25 = ?

=> 311

Hence, the correct answer is Option 4.

Q77. Answer: (c) DW - BV

The logic followed here is based on the alphabetical position pattern:

Option 1: AQ − YO

Option 2: NB − LZ

Option 3: DW − BV

Option 4: EL − CJ

Thus, DW − BV does not follow the pattern.

Hence, the odd one out is Option 3.

Q78. Answer: (a) Only conclusion (II) follows

Given Statements:

Some rabbits are fans.

No fan is a car.

The least possible Venn diagram for the given statement is:

Conclusions:

I. Some rabbits are cars – Does not follow (No definite relation is given).

II. Some fans are rabbits – Follows (Conversion of “Some rabbits are fans”).

So, only conclusion II follows.

Hence, the correct answer is Option 1.

Q79. Answer: (a) MQU 119

The logic followed here is:

So, 'MQU 119' will replace the question mark in the given series.

Hence, the correct answer is "Option 1".

Q80. Answer: (c) Three

Given: Seven friends B, C, D, T, U, V and W are sitting in a straight line facing north.

Only three people sit to the left of T.

Only W sits to the right of D.

Only three people sit between D and C.

B sits somewhere left of U but right of V.

Between them are 3 people.

Hence, the correct answer is "Option 3".

Q81. Answer: (c) Go Digit General Insurance Limited

The correct answer is Go Digit General Insurance Limited.

Key Points

• In February 2025, Go Digit General Insurance Limited launched India’s first Air Quality Index (AQI)-based parametric insurance specifically designed for construction workers.

• This innovative insurance product is aimed at providing a financial safety net for workers in the Delhi-National Capital Region (NCR) whose livelihoods are severely impacted by construction bans during peak pollution months.

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• The insurance follows a parametric model, which means the payout is not based on actual loss assessment but is automatically triggered when AQI levels exceed a pre-defined threshold (such as 400 or "Severe" category) for a specific number of days.

• This initiative primarily addresses the challenges faced by unorganized sector laborers during the implementation of the Graded Response Action Plan (GRAP) Stage III and Stage IV, which often leads to a complete halt of outdoor construction activities.

• The policy is designed to compensate for the loss of daily wages, ensuring that the most vulnerable segments of the urban workforce can sustain their living expenses during environmental crises.

Additional Information

• Parametric Insurance:

• Unlike traditional indemnity insurance that compensates for the actual cost of damage, parametric insurance pays out a fixed amount based on the occurrence of a specific trigger event.

• Common triggers include wind speed in hurricanes, rainfall levels in droughts, or in this case, AQI levels as recorded by the Central Pollution Control Board (CPCB).

• AQI and Delhi-NCR:

• The Air Quality Index (AQI) is a tool used by government agencies to communicate to the public how polluted the air currently is.

• In Delhi-NCR, pollution typically spikes during November to February due to stubble burning, vehicular emissions, and climatic inversions.

• The Commission for Air Quality Management (CAQM) enforces GRAP to mitigate these effects, often banning non-essential construction.

• Go Digit General Insurance:

• Founded in 2017 and headquartered in Bengaluru, Karnataka, the company is backed by Fairfax Financial Holdings.

• It was founded by Kamesh Goyal and has become a leading insurtech player in India, listing on the National Stock Exchange (NSE) and Bombay Stock Exchange (BSE) in May 2024.

• Socio-Economic Impact:

• There are approximately 10 to 12 lakh construction workers in the Delhi-NCR area.

• A construction ban can result in a loss of 15 to 20 working days in a season, leading to a income reduction of nearly Rs. 10,000 to Rs. 15,000 per worker, making such insurance products vital for poverty alleviation.

Important Points

• Digital Transformation: The Go Digit AQI policy leverages real-time data and digital claim settlements, reducing the administrative overhead and time usually associated with insurance claims for the poor.

• Climate Adaptation: This product is considered a significant step in climate risk adaptation, helping the labor force build resilience against increasing urban environmental hazards.

• Regulatory Oversight: All such parametric products in India are regulated and approved by the Insurance Regulatory and Development Authority of India (IRDAI) to ensure transparency and solvency.

Q82. Answer: (a) Maharashtra

The correct answer is Maharashtra.

Key Points

• In October 2024, the Maharashtra government inaugurated India’s first integrated state-level Cyber Command and Control Centre (C4) at Mahape, Navi Mumbai.

• The facility was officially launched by the Deputy Chief Minister of Maharashtra, Devendra Fadnavis, who also holds the Home portfolio.

• This center serves as a comprehensive hub for handling cybercrime grievances through multiple channels, including the national helpline 1930, a dedicated web portal, and a mobile application.

• The project is part of a larger initiative to modernize the state's police force and provides a single-window system for citizens to report digital frauds, phishing, and other cyber-related offenses.

• The C4 is equipped with advanced technology to ensure 24/7 monitoring and faster response times for cyber incidents across the state. Hence, the correct answer is Maharashtra.

Additional Information

• Maharashtra Cyber Security Project:

• The Cyber Command and Control Centre is a core component of the Maharashtra Cyber Security Project, which has an estimated budget of approximately Rs 837 crore.

• The project was executed with Larsen & Toubro (L&T) as the primary technology partner, ensuring the deployment of world-class digital infrastructure.

• It aims to integrate all district-level cyber labs into a centralized system for better coordination and data sharing among law enforcement agencies.

• Technological Features:

• The center utilizes Artificial Intelligence (AI) and Machine Learning (ML) tools to track financial trails in cyber frauds and predict emerging digital threats.

• It houses a Cert-Maharashtra (Computer Emergency Response Team) and a Centre of Excellence to train police personnel in the latest investigation techniques.

• The facility includes specialized units for digital forensics, social media monitoring, and threat intelligence.

Important Points

• Human Resources: The center is staffed by over 150 cyber experts and specially trained Maharashtra State Police personnel to manage complex investigations.

• Public Safety: With the rise in digital transactions, the center focuses on reducing the "golden hour" response time to freeze fraudulent transactions before the money is moved out of the banking system.

• National Context: While various states have cyber cells, Maharashtra is the first to implement such a massive, integrated state-level command structure, setting a benchmark for the Government of India's digital security framework.

• Launch Date: The formal inauguration took place on October 10, 2024, marking a significant milestone in India's fight against trans-border and domestic cybercrimes.

Q83. Answer: (a) Hindustani Awam Morcha (Secular)

The correct answer is Hindustani Awam Morcha (Secular).

Key Points

• The Hindustani Awam Morcha (Secular), often abbreviated as HAM-S, is a regional political party in the state of Bihar, India. In the context of the Bihar Assembly Elections 2025, the party successfully secured 5 seats.

• The party was founded by Jitan Ram Manjhi, a former Chief Minister of Bihar, on May 8, 2015, after he left the Janata Dal (United).

• The party primarily represents the interests of the Mahadalit community and other marginalized sections in Bihar. It has been a part of various political alliances, including the National Democratic Alliance (NDA) and the Mahagathbandhan.

• The Bihar Legislative Assembly (Vidhan Sabha) has a total of 243 seats. To form a government, a party or a coalition must cross the majority mark of 122 seats. Small regional parties like HAM-S often play the role of "kingmaker" in close electoral contests.

• In the 2025 elections, the performance of smaller parties proved crucial in determining the power dynamics of the state's governance. Winning 5 seats allowed HAM-S to maintain its relevance in the state's competitive political landscape.

Additional Information

• Janata Dal (United) (JD-U):

• The JD(U) is a major regional party in Bihar, currently led by Nitish Kumar. The party's symbol is an Arrow. It has held the Chief Minister's post for the majority of the last two decades.

• Lok Janshakti Party (Ram Vilas) (LJP-RV):

• Led by Chirag Paswan, this party was formed following a split in the original Lok Janshakti Party (LJP) founded by Ram Vilas Paswan. The party's election symbol is the Helicopter. It focuses on the Dalit and Paswan vote bank in Bihar.

• Bahujan Samaj Party (BSP):

• The BSP is a national party led by Mayawati. While its primary base is in Uttar Pradesh, it regularly contests elections in Bihar to mobilize Scheduled Caste voters. Its symbol is the Elephant.

• Election Commission of India (ECI):

• The ECI is the constitutional body responsible for conducting elections to the Bihar Legislative Assembly. It operates under Article 324 of the Constitution of India.

Important Points

• Seat Distribution: The 243 seats of the Bihar Assembly are distributed across 38 districts. The 2025 elections highlighted the importance of localized campaigning and alliance arithmetic.

• Reserved Seats: Out of the total seats, 38 seats are reserved for Scheduled Castes (SC) and 2 seats are reserved for Scheduled Tribes (ST) in the Bihar Vidhan Sabha.

• Voter Turnout: Elections in Bihar typically see high engagement from rural voters, with the Election Commission implementing various initiatives to increase the participation of women and youth.

• Regional Alliances: The 2025 political landscape was shaped by the two main fronts: the NDA (led by BJP and JD-U) and the Mahagathbandhan (led by RJD and INC).

Q84. Answer: (c) Yukti – Nutrition Nirmaan

The correct answer is Yukti – Nutrition Nirmaan.

Key Points

• Yukti – Nutrition Nirmaan is a premier student-led national case competition officially launched in October 2025 to address the

complex challenges of malnutrition in India.

• The initiative is strategically designed to align with and promote Sustainable Development Goal 2 (Zero Hunger) and Sustainable Development Goal 3 (Good Health & Well-being).

• The competition aims to harness the creative and analytical potential of students from diverse academic backgrounds to propose innovative, scalable, and sustainable solutions for improving nutritional outcomes.

• By focusing on malnutrition, the program targets various facets of the issue, including undernutrition, micronutrient deficiencies, and the rising trend of overweight and obesity among different age groups.

• Participants are encouraged to develop interdisciplinary strategies that combine public policy, technology, and community-level interventions to ensure a malnutrition-free India.

Additional Information

• Sustainable Development Goal 2 (SDG 2):

• Known as Zero Hunger, this goal aims to end hunger, achieve food security, and improve nutrition globally by the year 2030.

• It emphasizes doubling the agricultural productivity and incomes of small-scale food producers to ensure sustainable food production systems.

• Sustainable Development Goal 3 (SDG 3):

• This goal focuses on Good Health and Well-being, ensuring healthy lives and promoting well-being for all at all ages.

• Proper nutrition is considered a foundational pillar for achieving the targets under this goal, as it directly impacts maternal and child mortality rates.

• The Challenge of Malnutrition:

• Malnutrition remains a critical public health concern, manifesting as stunting (low height-for-age), wasting (low weight-for-height), and anemia.

• According to various health surveys, including NFHS-5, a significant percentage of children under 5 years and women of reproductive age in India suffer from nutritional deficiencies.

• Youth-Led Initiatives:

• Competitions like Yukti empower the youth to transition from passive learners to active problem solvers in the national development agenda.

• These platforms serve as a bridge between Higher Educational Institutions (HEIs) and government bodies to foster evidence-based policy making.

Important Points

• POSHAN Abhiyaan: The Prime Minister's Overarching Scheme for Holistic Nourishment, launched in 2018, provides the overarching framework for nutrition-related interventions that competitions like Yukti seek to augment.

• Triple Burden of Malnutrition: Modern nutritional challenges include the coexistence of undernutrition, micronutrient deficiencies (hidden hunger), and overnutrition (obesity), all of which require tailored solutions.

• Viksit Bharat @ 2047: Addressing health and nutrition is a key component of the vision to make India a developed nation by the 100th year of Independence.

• Technological Integration: Modern solutions often involve the use of Data Analytics, AI, and mobile platforms to monitor nutritional delivery and identify malnutrition hotspots in real-time.

Q85. Answer: (d) Kargil Vijay Diwas

The correct answer is Kargil Vijay Diwas.

Key Points

• Kargil Vijay Diwas is observed every year on July 26 to commemorate the victory of the Indian Armed Forces over Pakistan in the Kargil War of 1999.

• The day marks the successful conclusion of Operation Vijay, during which India regained control of the high outposts in the Kargil-Dras sector that had been illegally occupied by Pakistani intruders.

• The Kargil War lasted for more than 60 days, starting in May 1999 and officially ending on July 26, 1999, when Pakistan was completely evicted from Indian territory.

• On 26 July 2025, India observed the 26th anniversary of this historic victory, paying tribute to the 527 soldiers who made the supreme sacrifice for the nation.

• The main celebrations are typically held at the Kargil War Memorial located in Dras, Ladakh, which is often referred to as the second coldest inhabited place in the world. Hence, the correct answer is Kargil Vijay Diwas.

Additional Information

• Other Important National Days:

• Republic Day: Observed on 26 January every year, it commemorates the date on which the Constitution of India came into effect in 1950.

• Independence Day: Observed on 15 August, it marks India's freedom from British rule in 1947.

• Border Security Day: While 1 December is celebrated as the BSF Raising Day, Kargil Vijay Diwas specifically focuses on the joint military victory in the Kargil sector.

• The Kargil Conflict:

• The war was fought at high altitudes ranging from 11,000 to 18,000 feet, making it one of the most difficult mountain warfare operations in history.

• Operation Safed Sagar: This was the code name assigned to the Indian Air Force's role in acting jointly with the Indian Army during the conflict.

• Operation Talwar: This was the Indian Navy's blockade of Pakistani ports (specifically Karachi) during the war to cut off supply lines.

Important Points

• Heroes of Kargil: Several soldiers were awarded the Param Vir Chakra, India's highest military decoration, including Captain Vikram Batra, Lieutenant Manoj Kumar Pandey, Rifleman Sanjay Kumar, and Grenadier Yogendra Singh Yadav.

• Political Leadership: During the 1999 war, Shri Atal Bihari Vajpayee was the Prime Minister of India, and George Fernandes served as the Defence Minister.

• Geographic Location: The conflict took place in the Kargil district of Ladakh, along the Line of Control (LoC). Strategic peaks like Tiger Hill and Tololing were key battlegrounds.

• Global Significance: The Kargil War was the first direct conventional war between two nuclear-armed nations, drawing significant international attention and diplomatic pressure on Pakistan to withdraw.

Q86. Answer: (a) Jordan

The correct answer is Jordan.

Key Points

• The Senior Asian Wrestling Championship 2025 was designated to be hosted in Amman, the capital city of Jordan.

• The event was scheduled to take place from March 25 to March 30, 2025, bringing together elite wrestlers from across the Asian continent.

• This prestigious tournament is organized under the aegis of United World Wrestling (UWW) Asia, which is the continental governing body for the sport.

• The championship typically features three primary disciplines of wrestling: Men's Freestyle, Men's Greco-Roman, and Women's Freestyle.

• Jordan has increasingly become a preferred destination for international wrestling, having successfully hosted the U20 World Wrestling Championships in 2023 and the U17 and U23 Asian Championships in 2024.

• Hosting the Senior Asian Wrestling Championship is a significant milestone for Jordan, reinforcing its position as a growing hub for combat sports in the West Asia region.

Additional Information

• United World Wrestling (UWW):

• It is the international governing body for the sport of amateur wrestling, headquartered in Corsier-sur-Vevey, Switzerland.

• The organization was formerly known as FILA (Fédération Internationale des Luttes Associées) until its rebranding in 2014.

• History of Asian Wrestling Championships:

• The Asian Wrestling Championships first commenced in 1979 for men's freestyle and Greco-Roman events.

• Women's wrestling was officially integrated into the championship program in 1996, highlighting the growth of the sport among female athletes in Asia.

• Previous Host (2024):

• The 2024 edition of the Senior Asian Wrestling Championships was held in Bishkek, Kyrgyzstan, in April 2024.

• Countries like Japan, Iran, Kazakhstan, and India are historically the dominant forces in these continental championships.

• Significance of the Event:

• The championships are crucial for athletes to gain UWW World Ranking points, which determine seeding for major global events such as the World Championships and the Olympic Games.

• The tournament serves as a platform to showcase the technical prowess of Asian wrestlers, who currently hold numerous world and Olympic titles.

Q87. Answer: (d) DPSU Bhawan

The correct answer is DPSU Bhawan.

Key Points

• Defence Minister Rajnath Singh inaugurated DPSU Bhawan, a dedicated office complex for Defence Public Sector Undertakings

(DPSUs), in New Delhi in November 2024.

• The facility is located at Kasturba Gandhi Marg and serves as a centralized hub to facilitate better coordination between the Ministry of Defence and various DPSUs. Hence, the statement regarding the inauguration of DPSU Bhawan is correct.

• The DPSU Bhawan is designed to provide a collaborative workspace for the executives and liaison officers of different defence production entities under one roof.

• The building is equipped with modern amenities, meeting rooms, and high-tech communication systems to streamline administrative functions and decision-making processes.

• This initiative is part of the government's broader vision to enhance ease of doing business within the defence sector and promote synergy among the seven new defence companies and older establishments.

Additional Information

• Defence Public Sector Undertakings (DPSUs):

• There are several DPSUs in India, including giants like Hindustan Aeronautics Limited (HAL), Bharat Electronics Limited (BEL), and Bharat Dynamics Limited (BDL).

• In October 2021, the government dissolved the Ordnance Factory Board (OFB) and converted its 41 factories into seven new DPSUs to improve efficiency and competitiveness.

• These seven companies include Munitions India Limited (MIL), Armoured Vehicles Nigam Limited (AVANI), and Advanced Weapons and Equipment India Limited (AWE India).

• Aatmanirbharta in Defence:

• The Ministry of Defence has set a target of achieving a defence manufacturing turnover of Rs 1.75 lakh crore by 2024-25.

• India's defence exports reached a record high of over Rs 21,000 crore in the financial year 2023-24, showcasing the success of the 'Make in India' program.

• Positive Indigenisation Lists have been notified by the government to ban the import of several hundred items, encouraging local production by DPSUs and private players.

Important Points

• Strategic Significance: The DPSU Bhawan symbolizes the shift towards a more corporate culture within government-owned defence entities, focusing on profitability and global standards.

• Infrastructure: The building was constructed with a focus on sustainability, adhering to Green Building norms to minimize environmental impact in the heart of the National Capital.

• Operational Efficiency: By bringing liaison offices to a single location, the Ministry of Defence aims to reduce red tape and accelerate the procurement and production timelines for Armed Forces requirements.

Q88. Answer: (c) World Bank

The correct answer is World Bank.

Key Points

• In April 2025, the World Bank officially acknowledged India's significant milestone in poverty reduction, noting that the country lifted 171 million people out of extreme poverty.

• The World Bank report highlighted that India's achievement is one of the fastest reductions in poverty globally, driven by sustained economic growth and targeted social welfare programs.

• Key contributors to this success include the massive expansion of Digital Public Infrastructure (DPI), which enabled the seamless delivery of Direct Benefit Transfers (DBT) to the most vulnerable populations.

• The international financial institution praised the effectiveness of schemes like the Pradhan Mantri Garib Kalyan Anna Yojana (PMGKAY), which provided food security to over 800 million citizens, preventing a slide back into poverty during global economic shocks.

• This recognition underscores India's progress toward achieving Sustainable Development Goal 1 (SDG 1), which aims to end poverty in all its forms everywhere by 2030.

Additional Information

• World Bank Group:

• The World Bank was established in 1944 at the Bretton Woods Conference and is headquartered in Washington, D.C., USA.

• It consists of two main institutions: the International Bank for Reconstruction and Development (IBRD) and the International Development Association (IDA).

• Its primary mission is to provide loans, grants, and technical assistance to developing countries to reduce poverty and promote shared prosperity.

• Extreme Poverty Line:

• The World Bank defines extreme poverty as living on less than $2.15 per person per day, based on 2017 Purchasing Power Parity (PPP) prices.

• This international poverty line is used to monitor global progress toward the elimination of severe economic deprivation.

• Other International Organizations:

• United Nations (UN): An intergovernmental organization founded in 1945 to maintain international peace and security and achieve international cooperation.

• International Monetary Fund (IMF): Also founded in 1944, it focuses on global monetary cooperation, financial stability, and international trade.

• Asian Development Bank (ADB): Established in 1966 and headquartered in Manila, Philippines, it focuses on social and economic development in Asia and the Pacific.

Important Points

• Poverty Measurement in India: While the World Bank uses the $2.15 line, India also uses the Multidimensional Poverty Index (MPI), tracked by NITI Aayog, which considers health, education, and standard of living.

• Impact of Digitization: India's JAM Trinity (Jan Dhan accounts, Aadhaar, and Mobile connectivity) has been cited by the World Bank as a global model for financial inclusion.

• Historical Context: India has historically been home to a large number of the world's poor, but rapid GDP growth since the 1991 reforms and recent welfare innovations have drastically changed the demographic landscape.

• Global Poverty Reports: The World Bank periodically releases the Poverty and Shared Prosperity Report, providing the latest data on global trends and the impact of policy interventions.

Q89. Answer: (a) Socio-Economic and Caste Census (SECC), 2011

The correct answer is Socio-Economic and Caste Census (SECC), 2011.

Key Points

• The Socio-Economic and Caste Census (SECC) was launched in June 2011 across all States and Union Territories of India.

• It represented the first major effort to collect detailed caste data at a national scale since the 1931 Census, which was the last time caste-wide data was fully enumerated in British India.

• The SECC 2011 was not conducted under the Census Act of 1948, but rather as a separate administrative exercise to identify beneficiaries for welfare schemes.

• It was carried out through three different agencies: the Ministry of Rural Development (for rural areas), the Ministry of Housing and Urban Poverty Alleviation (for urban areas), and the Office of the Registrar General and Census Commissioner (for the caste and religious enumeration).

• The primary objective was to rank households based on their socio-economic status using specific deprivation indicators, enabling the government to target subsidies and social security benefits more effectively.

Additional Information

• Decennial Census of India:

• The regular Census of India is conducted every 10 years by the Ministry of Home Affairs.

• Since independence, the regular census has only published data for Scheduled Castes (SCs) and Scheduled Tribes (STs), avoiding a comprehensive count of Other Backward Classes (OBCs) or general castes.

• The last completed regular census took place in 2011, while the 2021 Census was delayed due to the COVID-19 pandemic.

• Economic Census:

• This exercise focuses on the structure and activities of entrepreneurial units (both agricultural and non-agricultural) in the country.

• The first Economic Census was conducted in 1977, and the seventh was initiated in 2019. It does not primarily collect caste-based demographic data.

• National Sample Survey (NSS):

• The NSSO (now part of the National Statistical Office - NSO) conducts periodic surveys on employment, consumer expenditure, and literacy.

• While it provides statistical estimates regarding caste groups (like OBCs), it is based on sampling rather than a 100% headcount of the population.

Important Points

• Data Publication: Although the SECC 2011 data regarding socio-economic indicators was released in July 2015, the specific caste data was withheld by the government, citing technical flaws and classification complexities.

• Mandal Commission: In the absence of modern caste data, the Mandal Commission (1979) used the 1931 Census figures to estimate the OBC population at 52%.

• State Initiatives: Due to the delay in a national caste census, states like Bihar conducted their own Caste-based Survey in 2023, which reported that Extremely Backward Classes (EBCs) and OBCs together constitute over 63% of the state's population.

• 2025 Outlook: The central government has indicated that the next Decennial Census, likely beginning in 2025, may incorporate new methodologies or categories to address the long-standing demand for updated caste statistics.

Q90. Answer: (b) Ranveer Allahbadia

The correct answer is Ranveer Allahbadia.

Key Points

• Ranveer Allahbadia, popularly known by his digital alias BeerBiceps, is a leading Indian YouTuber, entrepreneur, and social media influencer.

• In 2017, he co-founded Monk Entertainment (Monk-E) alongside his partner Viraj Sheth. The company began as a talent management agency and has since evolved into a full-service digital marketing and branding firm.

• He is the creator and host of "The Ranveer Show" (TRS), which is widely recognized as India's smartest podcast. The show features interviews with high-profile individuals across fields like geopolitics, science, spirituality, and business.

• By 2025, he has established himself as a central figure in the Indian creator economy, leveraging his influence to promote self-improvement, mental health, and entrepreneurship among the youth.

• He was one of the prominent winners at the inaugural National Creators Award in 2024, where he received the Disruptor of the Year award from the Prime Minister of India.

Additional Information

• Monk Entertainment (Monk-E):

• Headquartered in Mumbai, this agency manages some of India's top digital creators and handles influencer marketing for various global brands.

• The organization specializes in content strategy, video production, and social media management, bridging the gap between traditional brands and the new-age creator economy.

• Early Career and Evolution:

• Ranveer started his YouTube journey in December 2015 with a focus on fitness and nutrition.

• His content transitioned from physical health to mental well-being, grooming, and eventually to entrepreneurial motivation and spirituality.

• Level SuperMind:

• Apart from Monk-E, Ranveer is a co-founder of the Level app (Level SuperMind), a meditation and mindfulness platform designed to improve productivity and cognitive performance.

• The app reflects his commitment to the wellness sector and integrates ancient wisdom with modern technology.

• Global Impact:

• Through his podcast TRS, he has interviewed international figures and global leaders, helping to put Indian digital content on the global map.

• He has been featured in Forbes India 30 Under 30 and various other power lists, acknowledging his impact on the media and entertainment landscape.

Important Points

• Role in Digital India: Ranveer is often cited as an example of the potential of the digital creator ecosystem to drive economic growth and skill development in modern India.

• Diverse Content: His channels cover a variety of languages, including Hindi and English, ensuring a wide reach across different demographics and age groups.

• Strategic Partnerships: Under his leadership, Monk-E has secured partnerships with major tech giants and FMCG companies, influencing how marketing is executed in the Web 3.0 era.

Q91. Answer: (a) Glasgow, Scotland

The correct answer is Glasgow, Scotland.

Key Points

• The city of Glasgow, Scotland, was officially announced as the host for the prestigious Michelin Guide Ceremony Great Britain & Ireland 2025.

• The event took place on February 10, 2025, at the iconic Kelvingrove Art Gallery and Museum, a venue renowned for its architectural beauty and cultural significance.

• This marks a historic occasion as it is the first time the Michelin Guide has held its annual revelation ceremony in Scotland. Hence, option 1 is correct.

• The ceremony is the platform where the new Michelin Stars, Green Stars, and Special Awards for the 2025 edition are revealed to the culinary world.

• The selection of Glasgow highlights the city's rapidly evolving gastronomic scene and its reputation as a major cultural and culinary hub in the United Kingdom.

Additional Information

• The Michelin Guide System:

• One Michelin Star: Denotes "a very good restaurant in its category."

• Two Michelin Stars: Indicates "excellent cooking, worth a detour."

• Three Michelin Stars: The highest accolade, representing "exceptional cuisine, worth a special journey."

• Bib Gourmand: Awarded to restaurants that offer good quality food at a moderate price.

• Michelin Green Star:

• Introduced in 2020, the Green Star recognizes restaurants that are leaders in sustainable gastronomy and environmental accountability.

• Host City History:

• In recent years, the Michelin Guide has moved its ceremony to various cities to celebrate regional culinary excellence. Manchester hosted the event in 2024, while Silverstone in Northamptonshire was the host in 2023.

• Economic and Cultural Impact:

• Hosting the awards provides a significant boost to local tourism and the hospitality sector. For Glasgow, the event was supported by Glasgow Life and Scotland Food & Drink to showcase Scottish produce on a global stage.

Important Points

• Origin: The Michelin Guide was first published in 1900 in France by the Michelin tyre company to encourage motorists to travel more, thereby increasing tyre sales.

• Anonymity: The Michelin Inspectors are famously anonymous and behave like regular customers to ensure the integrity and independence of their reviews.

• Scope: The Great Britain & Ireland guide covers England, Scotland, Wales, and the Republic of Ireland.

• Culinary Diversity: While Edinburgh (Option 4) has traditionally held the most stars in Scotland, Glasgow has gained international attention with restaurants such as Cail Bruich and Unalome by Graeme Cheevers.

Q92. Answer: (d) Rs. 17 crore

The correct answer is Rs. 17 crore.

Key Points

• As of 11 June 2025, Punjab National Bank (PNB) has provided financial assistance amounting to approximately Rs. 17 crore to the families of martyrs under its specialized scheme.

• The aid was disbursed as part of the PNB Rakshak Plus scheme, which is specifically designed to provide social security and financial protection to the members of the Indian Armed Forces and their dependents.

• This initiative highlights the bank's commitment to supporting the families of soldiers who made the supreme sacrifice in the line of duty.

• The financial support includes Personal Accident Insurance (PAI) claims, which are processed efficiently to ensure that the bereaved families receive timely assistance without extensive administrative delays.

• The Rs. 17 crore figure represents the cumulative total of claims settled for the families of personnel from the Army, Navy, Air Force, and Paramilitary forces who were covered under this institutional arrangement. Hence, the correct option is Rs. 17 crore.

Additional Information

• PNB Rakshak Plus Scheme:

• This is a flagship Salary Savings Account scheme launched by Punjab National Bank for personnel of the Indian Army, Air Force, Navy, Indian Coast Guard, Border Security Force (BSF), Central Reserve Police Force (CRPF), and other paramilitary forces.

• The scheme offers Personal Accident Insurance (Death) cover of up to Rs. 50 lakh and Air Accident Insurance (Death) cover of up to Rs. 1 crore.

• It also includes benefits such as total and partial disability coverage, which provides financial relief in case of service-related injuries.

• The account offers additional perks like zero balance requirements, unlimited free ATM transactions, and concessions on locker rents and home loan interest rates.

• Punjab National Bank (PNB):

• PNB is one of the oldest public sector banks in India, having been established in May 1894 in Lahore.

• The bank was founded by the prominent nationalist leader Lala Lajpat Rai and is headquartered in New Delhi.

• It currently stands as one of the largest public sector banks in the country after its merger with Oriental Bank of Commerce and United Bank of India in 2020.

• The bank plays a crucial role in financial inclusion and national development through various government-backed social welfare schemes.

Important Points

• The PNB Rakshak Plus scheme is a refined version of the previous PNB Rakshak scheme, updated with higher insurance limits

and better educational benefits for the children of the deceased personnel.

• Under the educational assistance clause, the bank provides funds for the education of the girl child or wards of the martyr to ensure their academic future remains secure.

• Claims Settlement Process: The bank has simplified the documentation process for martyrs' families, often appointing dedicated nodal officers to assist with the paperwork to ensure funds reach the beneficiaries quickly.

Q93. Answer: (a) Jaipur Municipal Corporation - Greater (JMC-G)

The correct answer is Jaipur Municipal Corporation - Greater (JMC-G).

Key Points

• The Adarsh Sports Complex in Jaipur was developed and executed by the Jaipur Municipal Corporation - Greater (JMC-G) to provide state-of-the-art sporting facilities to the local residents. Hence, option 1 is correct.

• The complex was officially inaugurated in April 2025, marking a significant milestone in the urban infrastructure development of the capital city of Rajasthan.

• The primary objective of the JMC-G in establishing this complex is to promote a culture of fitness and sports at the grassroot level, ensuring that talented youth have access to professional training environments.

• The development included the construction of multipurpose indoor halls, synthetic tracks, and facilities for sports such as badminton, basketball, and table tennis.

• This initiative reflects the municipal body's commitment to enhancing the Quality of Life in urban areas through the creation of open spaces and recreational hubs.

Additional Information

• Jaipur Municipal Corporation - Greater (JMC-G):

• It is one of the two municipal bodies in Jaipur, created after the bifurcation of the original Jaipur Municipal Corporation in October 2020.

• The jurisdiction of JMC-G includes major areas such as Malviya Nagar, Sanganer, Mansarovar, and Jhotwara.

• The corporation is responsible for urban planning, waste management, and social infrastructure development within its geographical limits.

• Sports Infrastructure in Rajasthan:

• The state government has been actively pushing for decentralized sports growth through the Rajasthan State Sports Council (RSSC), which was established in 1958.

• Jaipur is home to the famous Sawai Mansingh Stadium (SMS Stadium), which serves as a major venue for national and international events.

• Newer projects like the Chaup Cricket Stadium are being developed to make the city a global sports destination.

• Urban Development Schemes:

• Municipal projects in India are often supported by the 15th Finance Commission grants and state-specific schemes like the Mukhyamantri Shahari Jan Sahabhagita Yojana.

• The integration of sports complexes within residential zones is a key feature of modern Smart City initiatives in India.

Important Points

• The Adarsh Sports Complex is specifically designed to meet Olympic-standard specifications for certain indoor sports to encourage competitive participation among school and college students.

• The funding for such municipal projects often involves a mix of Corporation Funds and State Government subsidies aimed at public welfare.

• The Mayor and the Municipal Commissioner play a pivotal role in the approval and timely completion of these large-scale infrastructure projects in Jaipur.

• The inauguration in April 2025 aligns with the state's vision of becoming a leader in the Khelo India rankings by providing localized training centers.

Q94. Answer: (d) Rajkot

The correct answer is Rajkot.

Key Points

• In January 2025, the Honorable Chief Minister of Gujarat, Shri Bhupendra Patel, officially inaugurated the Khel Mahakumbh 3.0 in the city of Rajkot.

• The mega sporting event was launched at the Race Course Ground, marking the start of a month-long competition aimed at fostering a robust sports culture across the state.

• The inauguration ceremony was strategically timed to coincide with National Youth Day on January 12, which celebrates the birth anniversary of Swami Vivekananda.

• Khel Mahakumbh 3.0 is designed to provide a platform for athletes from diverse backgrounds to showcase their talent in over 35

different sports categories.

• The event emphasizes the "Khelshe Gujarat, Jitshe Gujarat" (Gujarat will play, Gujarat will win) spirit, encouraging mass participation from the grass-roots level to the state level.

Additional Information

• Origin of Khel Mahakumbh:

• The Khel Mahakumbh initiative was first conceptualized and launched in the year 2010 by the then Chief Minister of Gujarat and current Prime Minister of India, Shri Narendra Modi.

• It was started to mark the Golden Jubilee (50 years) of the formation of Gujarat state.

• Evolution of the Event:

• Since its inception, the event has seen exponential growth; the first edition had around 16 lakh participants, while recent editions have seen registrations exceeding 50 lakhs to 60 lakhs.

• The Khel Mahakumbh 2.0 was previously inaugurated by the Governor and Chief Minister in Ahmedabad in late 2023.

• Structure and Rewards:

• The competitions are organized across various age groups, including Under-9, Under-11, Under-14, Under-17, Open Age Category, and even Special Khel Mahakumbh for differently-abled athletes.

• The Gujarat Government provides substantial cash prizes and scholarships to the winners at the village, taluka, district, and state levels to encourage professional sports as a career.

• Incentivizing Sports Excellence:

• The state utilizes these events to identify talented athletes for further training at the Swarnim Gujarat Sports University and various high-performance centers.

• The initiative plays a crucial role in preparing athletes for national events like the Khelo India Youth Games and international stages like the Olympics.

Important Points

• Olympic Aspirations: The state of Gujarat is aggressively building world-class sports infrastructure as part of India's bid to host the 2036 Olympic Games in Ahmedabad.

• Diverse Disciplines: Khel Mahakumbh 3.0 includes traditional Indian sports such as Kabaddi, Kho-Kho, and Yogasana, alongside global sports like Athletics, Swimming, Lawn Tennis, and Archery.

• Rajkot's Significance: Rajkot, known as the commercial capital of the Saurashtra region, was chosen for the 3.0 launch to decentralize sporting activities and highlight regional infrastructure.

• Digital Integration: The Sports Authority of Gujarat (SAG) managed the entire registration process through a dedicated online portal and mobile application to ensure transparency and wide reach.

Q95. Answer: (a) January 2025

The correct answer is January 2025.

Key Points

• The Government of India officially reconstituted the Atomic Energy Commission (AEC) in January 2025. This move is part of the periodic update of the commission's membership to include top-tier administrative and financial leadership.

• The newly reconstituted commission now includes T.V. Somanathan, who currently serves as the Cabinet Secretary of India. His inclusion ensures high-level executive coordination between the Department of Atomic Energy (DAE) and the broader government machinery.

• Another key official added to the commission is Manoj Govil, the Secretary in the Department of Expenditure, Ministry of Finance. Having the Expenditure Secretary on the commission is vital for the financial oversight and budgetary planning of India’s capital-intensive nuclear projects.

• The Atomic Energy Commission is the apex body responsible for formulating the policies of the Department of Atomic Energy (DAE), which functions directly under the Prime Minister of India.

• The commission's mandate involves the promotion of nuclear science, research, and the development of nuclear power to meet the country's energy demands and strategic requirements.

• Hence, the correct answer is January 2025.

Additional Information

• Structure of the Atomic Energy Commission:

• The Chairman of the AEC is ex-officio the Secretary to the Government of India in the Department of Atomic Energy. As of recent updates, Dr. Ajit Kumar Mohanty holds this prestigious position.

• The commission typically includes the Cabinet Secretary, the Principal Secretary to the Prime Minister, the Foreign Secretary, and the Finance Secretary as members to provide a multidisciplinary approach to nuclear governance.

• Headquartered in Mumbai, Maharashtra, the AEC oversees various research centers like the Bhabha Atomic Research Centre (BARC) and industrial units like Nuclear Power Corporation of India Limited (NPCIL).

• Historical Background:

• The Atomic Energy Commission was first established in August 1948, shortly after India gained independence. Dr. Homi J. Bhabha served as its first Chairman and is widely regarded as the father of the Indian nuclear program.

• The commission was later reconstituted in 1958 with enhanced executive and financial powers, emphasizing the importance the Government of India placed on self-reliance in atomic energy.

• T.V. Somanathan:

• He is a 1987-batch IAS officer of the Tamil Nadu cadre. Before becoming the Cabinet Secretary in August 2024, he served as the Finance Secretary and Expenditure Secretary, playing a crucial role in managing India's fiscal policy.

• Manoj Govil:

• He is a 1991-batch IAS officer from the Madhya Pradesh cadre. He assumed the role of Expenditure Secretary in the Ministry of Finance, succeeding Somanathan in that specific vertical before being inducted into the AEC.

Important Points

• Strategic Significance: The presence of the Cabinet Secretary and Expenditure Secretary in the AEC is essential for the rapid implementation of the Three-Stage Nuclear Power Programme. This program focuses on utilizing India’s Thorium reserves to ensure long-term energy security.

• Governance: The DAE and AEC are unique in the Indian administrative system as they report directly to the Prime Minister, bypassing traditional ministerial layers to ensure speed and confidentiality in strategic matters.

• Recent Developments: In recent years, the Government of India has been pushing for the expansion of Pressurized Heavy Water Reactors (PHWRs) and the development of Small Modular Reactors (SMRs) to decarbonize the power sector by 2070.

Q96. Answer: (c) Advancing food security, trade and innovation

p data-end="57" data-start="0">The correct answer is Advancing food security, trade and innovation.

Key Points

• The 7th Future Food Forum 2025 was a landmark event held in Dubai, United Arab Emirates (UAE), focusing on the future of the Food and Beverage (F&B) industry.

• The primary focus of this edition was Advancing food security, trade and innovation, which is critical for the region's long-term economic and nutritional stability. Hence, option 3 is correct.

• The forum provided a platform for policymakers, industry leaders, and innovators to discuss strategies for building a more resilient and sustainable food ecosystem.

• It specifically addressed the supply chain challenges and the need for digital transformation within the food manufacturing and distribution sectors to ensure food security.

• The event emphasized that innovation in food technology and trade facilitation are the two main pillars that will drive the growth of the F&B sector in the Middle East.

Additional Information

• Organizing Body:

• The forum was organized by the UAE Food & Beverage Manufacturers Group (F&B Group), which operates under the aegis of the Dubai Chamber of Commerce.

• The group plays a vital role in representing the interests of the manufacturing sector and fostering public-private partnerships to achieve national goals.

• National Food Security Strategy 2051:

• The UAE has a dedicated National Food Security Strategy 2051, which aims to make the country a world-leading hub in innovation-driven food security.

• The 7th Future Food Forum aligns with this strategy by promoting local food production and utilizing modern technologies like Agri-tech and AI.

• Sustainability and ESG:

• A significant portion of the discussion was dedicated to Environmental, Social, and Governance (ESG) principles and the reduction of food waste.

• The forum highlighted the Circular Economy model as a means to reduce the environmental footprint of the global manufacturing networks within the food industry.

Important Points

• Global Trade Hub:

• Dubai serves as a major re-export hub for food products globally, and the forum emphasized streamlining trade policies to enhance export capabilities.

• The Ministry of Economy and the Ministry of Climate Change and Environment are key stakeholders in ensuring the UAE remains at the forefront of global food trade.

• Innovation and Agri-Tech:

• Technological advancements such as Vertical Farming, Hydroponics, and Automated Logistics were showcased as solutions to the challenges of desert agriculture.

• The 2025 forum also focused on the role of Small and Medium Enterprises (SMEs) in driving innovation and providing niche food solutions to the market.

Q97. Answer: (d) Environment Minister, GoI

The correct answer is Environment Minister, GoI.

Key Points

• The awards for the Swachh Vayu Sarvekshan (Clean Air Survey) are typically conferred by the Union Minister for Environment, Forest and Climate Change (MoEFCC).

• For the year 2024-2025, the awards recognize cities that have made significant improvements in air quality and implemented effective measures under the National Clean Air Programme (NCAP).

• The ceremony is usually organized on September 7, which marks the International Day of Clean Air for Blue Skies, an initiative by the United Nations.

• The Swachh Vayu Sarvekshan ranks 131 cities across the country into three categories based on population: Category 1 (above 10 lakh), Category 2 (3 to 10 lakh), and Category 3 (less than 3 lakh).

• The ranking is based on self-assessment reports submitted by cities on the PRANA portal, which are then vetted by the Central Pollution Control Board (CPCB).

Additional Information

• National Clean Air Programme (NCAP):

• Launched in January 2019, it is a long-term, time-bound, national-level strategy to tackle the air pollution problem across the country.

• The original target was to achieve a 20% to 30% reduction in Particulate Matter (PM10 and PM2.5) concentrations by 2024, taking 2017 as the base year.

• The goal was later updated to achieve a 40% reduction in particulate matter concentrations by the year 2026.

• Assessment Parameters:

• Cities are evaluated on eight thematic areas, including control of biomass and municipal solid waste burning, road dust management, construction and demolition waste, vehicular emissions, and industrial pollution.

• Public awareness programs and improvements in PM10 concentrations carry significant weightage in the final score.

• PRANA Portal:

• PRANA stands for Portal for Regulation of Air-pollution in Non-Attainment cities.

• It is a platform used to monitor the implementation of the NCAP and track the progress of city-specific Action Plans.

Important Points

• Ministerial Role: The Environment Minister, currently Shri Bhupender Yadav (as of the recent sessions), plays a pivotal role in steering the MoEFCC towards sustainable urban development and pollution control.

• Top Performing Cities: In recent cycles, cities like Indore, Agra, Thane, and Surat have consistently secured top positions in Category 1 for their exemplary air quality management.

• Non-Attainment Cities: These are 131 cities that consistently failed to meet the National Ambient Air Quality Standards (NAAQS) for over five years. The NCAP specifically targets these urban centers to ensure healthier breathing conditions for millions of citizens.

• Global Context: The International Day of Clean Air for Blue Skies was established by the UN General Assembly in 2019 to emphasize the need for international cooperation to improve air quality globally.

Q98. Answer: (d) Ben Duckett

p>The correct answer is Ben Duckett.

Key Points

• Ben Duckett set a remarkable record by scoring 165 runs, which is highlighted as a significant individual score in high-profile limited-overs cricket.

• The England opening batsman achieved this feat during the 5th ODI against Australia on September 29, 2024.

• His innings of 165 came off just 117 balls, including 13 boundaries and 8 sixes, showcasing an aggressive batting display at the County Ground in Bristol.

• This score surpassed previous records for the highest individual score by an England opener against Australia in ODI history.

• While the ICC Champions Trophy record was historically held by Nathan Astle (145*), the score of 165 by Ben Duckett represents a new benchmark in top-tier international tournament contexts as per recent sporting data. Hence, the statement regarding Ben Duckett is correct.

Additional Information

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• Josh Inglis:

• He is a professional Australian cricketer who plays as a wicketkeeper-batsman.

• Josh Inglis was born in England but moved to Australia at the age of 14.

• He is known for his versatile stroke play and was part of the Australia squad that won the 2023 ICC Cricket World Cup.

• Ibrahim Zadran:

• He is a talented Afghan cricketer who serves as a regular opening batsman for the Afghanistan national team.

• In 2023, Ibrahim Zadran became the first Afghan player to score a century in the history of the ICC Cricket World Cup during a match against Australia.

• He made his international debut in 2019 and has since become a backbone of the Afghanistan batting lineup.

• Alex Carey:

• Alex Carey is an Australian international cricketer who plays as a wicketkeeper.

• He formerly played Australian Rules Football and was the captain of the Greater Western Sydney Giants in the TAC Cup.

• In ODI cricket, Carey is known for his composure under pressure and has been a vital part of Australia's middle order for several years.

• Ben Duckett's Career:

• Ben Duckett represents Nottinghamshire in domestic cricket and has been a key figure in the England "Bazball" era of aggressive play.

• His 165 in 2024 solidified his position as one of the most dangerous left-handed openers in the world.

Important Points

• Tournament History: The ICC Champions Trophy is a prestigious ODI tournament; the 2025 edition is scheduled to be hosted in Pakistan.

• Record Context: Individual scores exceeding 150 are rare in major trophy formats, making Ben Duckett's 165 a standout statistical achievement in 2024.

• Venue Statistics: The Bristol ground is known for being relatively small with a flat pitch, often resulting in high-scoring ODI matches.

Q99. Answer: (a) Bagori Range

The correct answer is Bagori Range.

Key Points

• The Bagori Range, also famously known as the Western Range of Kaziranga National Park and Tiger Reserve, was officially announced to be the first range to open for the 2025–26 tourist season in September 2025.

• Traditionally, the Bagori Range is preferred for the early start of the season because its tracks and terrain usually dry up faster after the monsoon floods compared to the central or eastern sectors.

• The opening of the park generally occurs in a phased manner, starting with Jeep Safaris in the Bagori and Kohora ranges, while Elephant Safaris are introduced later once the ground is sufficiently firm.

• This announcement is crucial for the tourism industry in Assam, as the park remains closed from May to September every year due to the overflow of the Brahmaputra River.

• The Bagori Range is highly popular among tourists specifically for sightings of the Great Indian One-Horned Rhinoceros, as the visibility in this grassland-dominated range is exceptionally high.

Additional Information

• Kaziranga National Park: Located in the Golaghat and Nagaon districts of the state of Assam, India. It was established as a Reserve Forest in 1905, declared a National Park in 1974, and designated a UNESCO World Heritage Site in 1985.

• The Big Five: The park is globally recognized for conserving five major species: the One-Horned Rhinoceros (hosting over 2,600 individuals), the Royal Bengal Tiger, the Asian Elephant, the Wild Water Buffalo, and the Eastern Swamp Deer (Barasingha).

• Tiger Reserve Status: It was declared a Tiger Reserve in 2006 and currently holds one of the highest densities of tigers in the world.

• Geographical Features: The park is situated on the edge of the Eastern Himalaya biodiversity hotspot and is bounded by the Brahmaputra River to the north and the Karbi Anglong Hills to the south. It covers a core area of approximately 430 square kilometers.

• Flora and Avifauna: The vegetation consists of tall elephant grass, marshland, and dense tropical moist broadleaf forests. It is also an Important Bird Area (IBA), home to over 478 species of birds, including migratory species from Central Asia.

Important Points

• Bagori Range (Western Range): This is the primary choice for Jeep Safaris and is known for its high-density population of Rhinos. It is located in the Nagaon district side of the park. Hence, it is the correct answer.

• Kohora Range (Central Range): This range is the administrative hub of the park. It is the most visited range and is the primary

location for Elephant Safaris. However, it was not the first to be announced for the 2025–26 season. Hence, this option is incorrect.

• Agaratoli Range (Eastern Range): Located in the Golaghat district, this range is famous for bird watching and Wild Water Buffaloes. It usually opens slightly later than the Western range due to its proximity to the Brahmaputra. Hence, this option is incorrect.

• Burapahar Range (Ghorakati): This range is situated at the edge of the hills and is excellent for spotting primates like the Hoolock Gibbon and the Capped Langur. It offers trekking opportunities which are unique to this sector. Hence, this option is incorrect.

• Conservation History: The park's protection began after Mary Curzon, the wife of the Viceroy of India, Lord Curzon, visited the area in 1904 and failed to see a single rhinoceros, prompting immediate conservation measures.

Q100. Answer: (a) Jammu and Kashmir

The correct answer is Jammu and Kashmir.

Key Points

• The world’s highest rail arch bridge, known as the Chenab Bridge, is located in the Reasi district of the Union Territory of Jammu and Kashmir.

• The bridge stands at a staggering height of 359 meters (approximately 1,178 feet) above the river bed, making it 35 meters taller than the Eiffel Tower in Paris.

• It was inaugurated for full-scale operations as part of the Udhampur-Srinagar-Baramulla Rail Link (USBRL) project, a massive infrastructure undertaking by the Indian Railways to provide all-weather connectivity to the Kashmir Valley.

• The bridge spans the Chenab River between Bakkal and Kauri. It is a structural marvel designed to withstand high-velocity winds of up to 266 kmph and extreme temperatures.

• Prime Minister Narendra Modi has emphasized this project as a symbol of national integration and a major step toward the socio-economic development of the region. Hence, the correct answer is Jammu and Kashmir.

Additional Information

• USBRL Project Details:

• The Udhampur-Srinagar-Baramulla Rail Link is a 272-km long railway line.

• It is considered one of the most challenging engineering projects in the history of Indian Railways due to the complex Himalayan geology and seismic activity.

• The project involves the construction of numerous tunnels and bridges, including the Anji Khad Bridge, which is India’s first cable-stayed rail bridge.

• Technical Specifications of Chenab Bridge:

• The total length of the bridge is 1,315 meters.

• It has been designed for a lifespan of roughly 120 years.

• The bridge is constructed using special blast-proof steel and can resist earthquakes of the highest intensity (Seismic Zone V).

• The construction involved the use of two of the largest cable cranes in the world for moving structural components across the valley.

• Economic and Strategic Impact:

• The completion of this bridge ensures that the Kashmir Valley is connected to the rest of India via the national railway grid throughout the year, overcoming the winter isolation caused by heavy snow on the Jammu-Srinagar National Highway.

• It facilitates easier movement of goods, services, and defense equipment, boosting the local economy through tourism and trade.

Important Points

• National Project Status: The USBRL project was declared a "Project of National Importance" in 2002.

• Konkan Railway Corporation Limited (KRCL): This organization played a pivotal role as the executing agency for the most difficult stretch of the project, including the Chenab Bridge.

• Comparison with Global Structures: Before the Chenab Bridge, the Beipan River Shuibai Railway Bridge in China (275 meters) held a prominent position, but the Chenab Bridge significantly surpasses its height.

• Employment Generation: The construction of the bridge and the rail link provided direct and indirect employment to thousands of locals in the Jammu and Kashmir region, fostering skill development in high-end engineering and masonry.

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