RRB Group D Official Paper (Held On: 05 Feb, 2026 Shift 2) (Previous Year Paper)

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

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GENERAL SCIENCE

Q1. Which of the following steps can increase the expected yield of a crop?

(a) Irrigation at early stages of crop.
(b) Irrigation at right stage of crop.
(c) Irrigation at terminal stage of crop.
(d) Irrigation at every stage of crop.

Q2. A straight conductor is carrying current in the +x-direction, this conductor is placed in a magnetic field pointing in the +y-direction. What will be the direction of motion of the conductor?

(a) negative y direction
(b) positive z direction
(c) positive x direction
(d) negative x direction

Q3. Why are the ceilings of places like concert halls and cinema halls usually made curved?

(a) To block the sound from reflecting
(b) To help sound reflect and reach all parts of the hall
(c) To make the hall look more attractive
(d) To reduce the size of the building

Q4. Which statement from the following correctly defines the law of constant proportions?

(a) Compounds can vary their composition based on temperature.
(b) The mass of a compound is always greater than the sum of its elements.
(c) A compound always contains elements in a fixed ratio by mass.
(d) Elements combined in random ratios to form compounds.

Q5. The principle of conservation of energy is applicable to _____.

(a) every mechanical system only
(b) every electrical system exclusively
(c) every chemical system only
(d) every physical process in general

Q6. Which meristem is located near the nodes in some plants?

(a) Root meristem
(b) Lateral meristem
(c) Intercalary meristem
(d) Apical meristem

Q7. What is the formula of washing soda?

(a) NaOH
(b) NaHCO3
(c) Na2CO3
(d) Na2CO3·10H2O

Q8. Which of the following outcomes identifies meiosis rather than mitosis?

(a) Two identical cells, same number
(b) One larger cell, double number
(c) Four cells, half number
(d) Many cells, same number

Q9. Which of the following statements about 'Law of conservation of mass' is correct?

A) Mass can be changed when the reaction takes place.
B) During the chemical reaction, atoms are rearranged.
C) Mass within a closed system remains the same over time.

(a) Only B
(b) Only A and B
(c) Only A
(d) only B and C

Q10. Which of the following is a basic requirement for maintaining good reproductive health?

(a) Sharing personal hygiene products
(b) Ignoring changes during adolescence
(c) Safe sex practices and awareness about contraception
(d) Avoiding all medicines

Q11. Which of the following is an example of judicious use of natural resources?

(a) Rainwater harvesting
(b) Open mining
(c) Excessive use of fossil fuels
(d) Deforestation

Q12. A neuron receives nerve impulse from another neuron through ____.

(a) Cell body
(b) Dendrite
(c) Axon
(d) Synapse

Q13. A block of mass M is subjected to two opposing forces F1 and F2 (F1 > F2). If the frictional force (F_f) acting opposite to F1 is such that the net acceleration of the block is half the acceleration it would have experienced if friction were zero, what is the relation for F_f ?

(a) F_f = (F1 - F2)
(b) F_f = (F1 - F2)/2
(c) F_f = 2(F1 - F2)
(d) F_f = (F1 + F2)/2

Q14. Which of the following is a ring-chain hydrocarbon?

(a) Propane
(b) Benzene
(c) Ethene
(d) Heptyne

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Q15. Which of the following statements is/are correct in the context of a mixture and a compound?

A) A mixture has a variable composition while in a compound, the composition of each new substance is always fixed.

B) A mixture shows the different properties of the constituent substance while in a compound, the new substance shows the same properties.

C) A mixture has a non-variable composition while in a compound, the composition of each new substance is always changing.

(a) Only A
(b) Only B
(c) Both A and B
(d) Only C

Q16. Which of the following is a practical application of Archimedes' Principle in daily life?

(a) Design of ships and submarines
(b) Using a prism for light dispersion
(c) Using a thermometer
(d) Operating a pendulum

Q17. A tube that grows out of the pollen grain travels through the style to reach which of the following parts of the flower?

(a) Petal
(b) Ovary
(c) Filament
(d) Sepal

Q18. Which of the following are the most reactive and the least reactive metals, respectively, in a reactivity series?

(a) Magnesium, Gold
(b) Sodium, Gold
(c) Magnesium, Silver
(d) Potassium, Gold

Q19. In which device is the heating effect of current used to melt a metal?

(a) Electric fuse
(b) Electric fan
(c) Electric bulb
(d) Electric bell

Q20. The motion of a freely falling stone is an example of:

(a) non-uniform motion
(b) rectilinear motion with constant speed
(c) motion with zero acceleration
(d) uniform motion

Q21. When an object is placed between the pole (P) and the focus (F) of a concave mirror, what kind of image is formed?

(a) Virtual, inverted, and diminished
(b) Real, inverted, and enlarged
(c) Virtual, erect, and enlarged
(d) Real, inverted, and diminished

Q22. The magnification (m) produced by a lens is defined as the ratio of _____.

(a) the object height to the image height
(b) the image height to the object height
(c) the focal length to the object distance
(d) the object distance to the image distance

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Q23. Which of the following is true for the plants raised by vegetative propagation?

Statement A: Vegetatively propagated plant can bear flowers and fruits earlier than those produced from seeds.

Statement B: Vegetatively propagated plants are genetically dissimilar to the parent plant.

(a) Statement A is incorrect but statement B is correct
(b) Both Statement A and statement B is correct
(c) Both Statement A and statement B is incorrect
(d) Statement A is correct but statement B is incorrect

Q24. What is the colour of the precipitate formed when silver nitrate reacts with sodium chloride?

(a) Yellow
(b) Green
(c) Blue
(d) White

Q25. Select the option that is true regarding the following two statements labelled Assertion (A) and Reason (R).

Assertion (A): Soap solution appears cloudy.

Reason (R): The soap micelles are large enough to scatter light.

(a) A is false, but R is true.
(b) Both A and R are true, and R is not the correct explanation of A.
(c) A is true, but R is false.
(d) Both A and R are true, and R is the correct explanation of A.

MATHEMATICS

Q26. If 10% of 40% of 1over3 of a number is 512, find the number.

(a) 38400
(b) 37410
(c) 38610
(d) 40870

Q27. Simplify: $((0.45)^3 + (0.2)^3)/((0.45)^2 - 0.45 \times 0.2 + (0.2)^2)$

(a) 65/10
(b) 13/20
(c) 43/100
(d) 1/4

Q28. The mode and median of a data are 70.2 and 58, respectively. What is the mean of the data? (Use empirical formula.)

(a) 51.9
(b) 48.2
(c) 59.4
(d) 45.5

Q29. Three numbers are in the ratio of 4/10 : 20/18 : 20/11. The difference between the greatest and the smallest numbers is 39. Find the largest number

(a) 50
(b) 49
(c) 51
(d) 48

Q30. If the height of a triangle is increased by 20% and its base is decreased by 15%, then what will be the percentage change in its area?

(a) Increase by 3%
(b) Decrease by 3%

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(c) Increase by 2%
(d) Decrease by 2%

Q31. The amount on a sum of Rs. 8,300 at 10% per annum compound interest, compounded annually, in 2 years will be:
(a) Rs. 10,043
(b) Rs. 9,983
(c) Rs. 10,479
(d) Rs. 10,985

Q32. A person saves 20% of his income. If his expenditure is Rs. 320, then his income (in Rs.) is:
(a) 400
(b) 64
(c) 440
(d) 256

Q33. Simplify the expression $((49)^n \times 7)/(7^{2n})$. If n is a positive integer, what is the result in terms of powers of 7 ?
(a) 7^0
(b) 7^n
(c) 7^1
(d) 7^(2n+1)

Q34. The cost of a washing machine is 25% less than the cost of a TV. If the cost of the washing machine increases by 88% and that of the TV decreases by 57%, then what is the percentage change in the total cost of 6 washing machines and 3 TVs?
(a) Increase by 30%
(b) Decrease by 23%
(c) Increase by 36%
(d) Decrease by 31%

Q35. Laxmi, Dhruv and Gauri started a business in partnership investing in the ratio of 13:6:12, respectively. At the end of the year, they earned a profit of Rs. 37,200, which is 75% of their total investment. How much did Dhruv invest (in Rs.)?
(a) 9,336
(b) 9,600
(c) 9,692
(d) 9,766

Q36. Chetan bought 52 books for Rs. 1,120 from one shop and 47 books for Rs. 905 from another. What is the average price (in Rs. , rounded off to two decimal places) he paid per book ?
(a) 23.45
(b) 22.45
(c) 20.45
(d) 21.45

Q37. The volume (in m^3) of a cube with edges of 41 m, is:
(a) 68753
(b) 69087
(c) 68921
(d) 68987

Q38. In quadrilateral PQRS, the bisectors of angle R and angle S meet at the point T (inside the quadrilateral) and angle STR = 25.5°. If the ratio of angle P to angle Q is 8 : 9, then what is the difference between the measures of angle Q and angle P ?
(a) 1°
(b) 6°
(c) 5°

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(d) 3°

Q39. A car travels 158 km in the first hour and 110 km in the second hour. What is the average speed (in km/hr) of the car for the whole journey?

(a) 127
(b) 141
(c) 137
(d) 134

Q40. A salesman marks his goods 10% above the cost price and gives a discount of 80% on them. Find his loss percentage.

(a) 79%
(b) 77%
(c) 78%
(d) 70%

Q41. One pipe can fill a tank in 3 minutes, while another pipe can empty the completely filled tank in 6 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) 6
(b) 7
(c) 3
(d) 4

Q42. A man bought goods worth Rs. 8,000 and sold half of them at a gain of 10%. At what gain percentage must he sell the remaining goods so as to gain 20% on the whole?

(a) 25%
(b) 30%
(c) 32%
(d) 28%

Q43. If $\sqrt{x} + 1/\sqrt{x} = 5$, find $x + 1/x$.

(a) 23
(b) 32
(c) 15
(d) 25

Q44. The Rajdhani Express and Garib Rath Express run in the same direction with speeds of 114 km/hr and 60 km/hr, respectively, and their lengths are the same. What is the length of the Rajdhani Express if it completely crosses the Garib Rath express in 144 seconds?

(a) 1070 m
(b) 1080 m
(c) 1078 m
(d) 1084 m

Q45. The perimeter of a square is 68 m. What is the length (in m) of one side?

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

Q46. Evaluate $2\cot^2 45° + 3\sec^2 30° - 4\sin^2 30°$.

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

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Q47. If the marked price of a bedcover is 80% more than its cost price and a discount of 35% is announced on it, then find the profit percentage.

(a) 15%
(b) 16%
(c) 17%
(d) 19%

Q48. Two pipes can fill a cistern, individually, in 99 min and 36 min, respectively. There is a pipe located at the bottom of the cistern to empty it. If all the three pipes are opened simultaneously, then the empty cistern gets filled in 44 min. How long will the pipe at the bottom of the tank take to empty the completely filled cistern if no other pipe is then open?

(a) 37 min
(b) 66 min
(c) 93 min
(d) 44 min

Q49. The sum of the present ages of a father and his two sons is 72 years. If the father's age is twice the age of the elder son, and the age of the younger son is 8 years less than the age of the elder son, find the age of the father.

(a) 42 years
(b) 40 years
(c) 35 years
(d) 39 years

Q50. The number of prime numbers between 358 and 368 is:

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

GENERAL INTELLIGENCE & REASONING

Q51. RPMZ is related to WURT in a certain way. In the same way, LIGM is related to QNLG. To which of the given options is NKHN related, following the same logic?

(a) RPNG
(b) SPMH
(c) SQMG
(d) RQNH

Q52. In a row of 42 people facing north, Kunal is 11^(th) from the left end. If Riya sits 5^(th) to the right of Kunal, what is Riya’s position from the right end of the line?

(a) 25th
(b) 26th
(c) 24th
(d) 27th

Q53. Select the set in which the numbers are related in the same way as are the numbers of the following sets.

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

(13.3, 12.5, 11.8)

(45.6, 44.8, 44.1)

(a) (71.7, 70.9, 70.1)
(b) (39.4, 38.6, 37.8)
(c) (69.5, 68.7, 68.6)

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(d) (27.9, 27.1, 26.4)

Q54. Based on the English alphabetical order, three of the following four letter-cluster pairs are alike in a certain way and thus form a group. Which letter-cluster pair DOES NOT belong to that group?

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

(a) NQ - JM
(b) LO - HL
(c) KN - GJ
(d) HK - DG

Q55. In a certain code language,

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

'A – B' means 'A is the mother of B',

'A × B' means 'A is the brother of B' and

'A ÷ B' means 'A is the father of B'.

How is M related to S if 'M + N ÷ O × P – S' ?

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

Q56. A,B,C,D,E,F and G are sitting in a straight line facing North.

No one sits to the right of B. Only three people sit between B and G. Only two people sit between G and D. A sits third to the left of C. F sits to the immediate right of C.

How many people sit to the left of E?

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

Q57. Refer to the following series and answer the question (all numbers are single digit numbers only).

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

How many unique digits in the series are both odd and greater than 5 (each digit counted only once, regardless of repetitions)?

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

Q58. 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) 2 7 4 7 7 3 3 3 1 4 8 9 8 8 2 8 5 6 7 9 7 1 3 3 1 6 2 (Right)

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

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

Q59. Refer to the following number and symbol series and answer the question that follows. Counting to be done from left to right only. (All numbers are single-digit numbers.)

(Left) 5 * 1 1 6 $ © * 3 8 # © € 1 © 1 © 8 % 4 (Right)

How many such numbers are there each of which is immediately preceded by a number and also immediately followed by a symbol?

(a) 1
(b) 2
(c) 4
(d) 5

Q60. Town T is to the north of Town R. Town S is to the south of Town Q. Town R is to the south of Town P. Town Q is to the south of Town R. What is the position of Town Q with respect to Town P?

(a) North
(b) West
(c) South
(d) East

Q61. Based on the English alphabetical order, three of the following four letter-cluster pairs are alike in a certain way and thus form a group. Which letter-cluster pair DOES NOT belong to that group?

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

(a) NR−OV
(b) HL−JN
(c) MQ−OS
(d) TX−VZ

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

Statements:

All wheels are cars.

All wheels are buses.

All buses are trucks.

Conclusions:

(I) All wheels are trucks.

(II) Some buses are cars.

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

Q63. What should come in place of the question mark (?) in the given series?

91 78 65 52 39 ?

(a) 30
(b) 24
(c) 26
(d) 28

Q64. In a certain code language, "OXGP" is coded as "62" and "DSNL" is coded as "75". What is the code for "VBQT" in that language?

(a) 68
(b) 70
(c) 61
(d) 63

Q65. Seven people, J, K, L, M, N, O and P are sitting in a straight row, facing north. Only two people sit to the right of O. Only three people sit between N and O. P sits second to the left of J. P is not an immediate neighbour of N. L sits to the immediate left of M. Who sits at the extreme right end of the line?

(a) M
(b) J

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(c) P
(d) K

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

(Left) 745 329 157 278 381 (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) 9
(b) 8
(c) 6
(d) 10

Q67. In the following triad, 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.

SANK - NSAK - KNAS

KITE - TKIE - ETIK

(a) ZONE - NZOE - ONEZ
(b) SWAT - WSAT - TWAS
(c) FIRM - RFIM - MRIF
(d) DOLE - DLOE - ELOD

Q68. In a row of 52 students facing North, Roshan is 6^(th) from the left end. If Disha is 29^(th) to the right of Roshan, what is Disha's position from the right end of the row?

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

Q69. Six people, A, B, C, D, E and F, are sitting in a row, facing north. Only two people sit to the left of A. Only one person sits between B and C. F sits to the immediate left of A. B sits to the immediate right of E. C sits third to the right of D. Who sits at the extreme left end of the line?

(a) A
(b) D
(c) C
(d) E

Q70. Omkar starts from Point Y and drives 29 km towards the south. He then takes a left turn, drives 75 km, turns right and drives 33 km. He then takes a right turn and drives 37 km. He takes a right turn, drives 62 km to stop at Point Z. How far (shortest distance) and towards which direction should he drive in order to reach Point Y again? (All turns are 90-degree turns only unless specified.)

(a) 36 km towards the east
(b) 37 km towards the east
(c) 41 km towards the west
(d) 38 km towards the west

Q71. What will come in place of the question mark (?) in the following equation if '+' and '–' are interchanged and '×' and '÷' are interchanged?

70 - 45 × 5 - 40 ÷ 4 + 48 = ?

(a) 191
(b) 172
(c) 211
(d) 153

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Q72. 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:

No Pianos are Guitars.

Some Guitars are Violins.

All Violins are Drums.

Conclusions:

(I) No Pianos are Violins.

(II) Some Guitars are Drums.

(a) Both conclusions (I) and (II) are true
(b) Neither conclusion (I) nor (II) is true
(c) Only conclusion (I) is true
(d) Only conclusion (II) is true

Q73. Select the pair which follows the same pattern as that followed by the two pairs given below. Both pairs follow the same pattern.

LNP−MOQ

MOQ−NPR

(a) RST−RTV
(b) RST−SUW
(c) RTV−RUV
(d) RTV−SUW

Q74. Which of the following letter-number clusters will replace the question mark (?) in the given series to make it logically complete?

DEU7 VWM24 NOE41 FGW58 ?

(a) PYO75
(b) XYO75
(c) XYF75
(d) XSO75

Q75. What should come in place of ? in the given series?

2 3 6 15 42 ?

(a) 122
(b) 124
(c) 125
(d) 123

Q76. Each of the digits in the number 12568436 is arranged in ascending order from left to right. What will be the sum of the digits that are third from the left and third from the right in the new number thus formed?

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

Q77. Which of the following letter-number clusters will replace the question mark (?) in the given series to make it logically complete?

HLE23, JJH21, LHK19, NFN17, ?

(a) PEP15
(b) PDQ15
(c) PEQ18
(d) PDP18

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Q78. What should come in place of the question mark (?) in the given series?

508 518 529 541 554 ?

(a) 562
(b) 566
(c) 564
(d) 568

Q79. What will come in place of the question mark (?) in the following equation, if '+' and '-' are interchanged and 'x' and '÷' are interchanged?

8 ÷ 2 + 15 × 5 - 8 = ? + 5

(a) 22
(b) 24
(c) 26
(d) 28

Q80. In a certain code language, 'drinking is dangerous' is coded as 'cd pk os', 'avoid dangerous habit' is coded as 'os mp ls' and 'please avoid drinking' is coded as 'rk pk mp'. How is 'dangerous' coded in that language?

(a) mp
(b) rk
(c) os
(d) ls

GENERAL AWARENESS AND CURRENT AFFAIRS

Q81. Which of the following countries hosted the 8th International Solar Alliance Assembly in October 2025?

(a) Bhutan
(b) Australia
(c) France
(d) India

Q82. What was the theme for National Girl Child Day 2025 celebrated in January?

(a) Empowering Girls to Make them Independent
(b) Empowering Girls for a Bright Future
(c) Empowering Girls for a Better Future
(d) Empowering Girls for a Better Nation

Q83. In 2025, the Government of India consolidated 29 labour laws into how many labour codes to simplify labour regulations?

(a) 6
(b) 2
(c) 8
(d) 4

Q84. World Health Day, observed every year to draw attention to a major global health topic, falls on which of the following dates?

(a) 7 April
(b) 8 March
(c) 24 October
(d) 1 December

Q85. In 2025, according to the Supreme Court, the average waiting period for adopting an infant or young child in India under the legal framework is significant, leading some parents to consider illegal adoptions. What is the approximate average waiting period cited by the Court?

(a) 3.5 years
(b) 1.5 years

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(c) 2.5 years
(d) 4.5 years

Q86. In August 2025, the Indian National Space Promotion and Authorisation Centre (IN-SPACe) selected which of the following consortia to develop India's first indigenous commercial Earth-Observation satellite constellation?
(a) PixxelSpace India Private Limited, Dhruva Space Private Limited and SatSure Analytics India Private Limited Consortium
(b) Skyroot Aerospace Private Limited, Agnikul Cosmos Private Limited and Bellatrix Aerospace Private Limited Consortium
(c) Hindustan Aeronautics Limited, Bharat Electronics Limited and NewSpace India Limited Consortium
(d) Ananth Technologies Limited, Astrome Technologies Private Limited and Bharti Space Technologies Limited Consortium

Q87. Which of the following banks revised Priority Sector Lending (PSL) guidelines for Small Finance Banks from FY 2025–26, reducing the PSL target to 60% of Adjusted Net Bank Credit (ANBC) or Credit Equivalent of Off-Balance Sheet Exposure (CEOBE), whichever is higher?
(a) Reserve Bank of India
(b) Punjab National Bank
(c) Bank of Baroda
(d) State Bank of India

Q88. What is the primary purpose of the PathGenie software developed by the Ministry of Science and Technology in 2025?
(a) To accelerate the process of drug discovery
(b) To manage large-scale clinical trial databases
(c) To support vaccine production planning
(d) To analyze medical imaging data

Q89. Which of the following authorities in India issued new directives aimed at regulating asbestos exposure and its disposal in October 2025?
(a) National Green Tribunal (NGT)
(b) High Court of Delhi
(c) Central Pollution Control Board (CPCB)
(d) Supreme Court of India

Q90. Under what theme is the 'Swachhata Hi Seva' campaign, in alignment with the Government of India's vision of a clean and garbage-free India, being observed in 2025?
(a) Swachhotsav
(b) Clean India Green India
(c) Swachh Survekshan
(d) Swachhata Abhiyan 2.0

Q91. Who gave assent to the Waqf (Amendment) Bill, 2025, making it a law?
(a) President of India
(b) Vice President of India
(c) Prime Minister of India
(d) Chief Justice of India

Q92. Which organisation launched the BHARATPOL portal to enhance real-time information sharing for Indian law enforcement agencies in January 2025?
(a) Intelligence Bureau (IB)
(b) Central Bureau of Investigation (CBI)
(c) National Investigation Agency (NIA)
(d) Research and Analysis Wing (RAW)

Q93. In 2025, at the World Cup staged in Foz Do Iguacu, Brazil, which Indian boxer earned a gold medal in the 70kg division due to an opponent's withdrawal?
(a) Shiva Thapa
(b) Vikas Krishan

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(c) Vijendra Singh
(d) Hitesh Gulia

Q94. In April 2025, India voted in favour of the International Maritime Organisation (IMO's) global carbon pricing system for which of the following sectors?
(a) Aviation
(b) Road transport
(c) Maritime shipping
(d) Railways

Q95. Who won the Japanese Grand Prix, 2025?
(a) Lando Norris
(b) Oscar Piastri
(c) Max Verstappen
(d) Fabio Di Giannantonio

Q96. In 2025, India suspended which of the following bilateral agreements related to water sharing with Pakistan?
(a) Tashkent
(b) Shimla
(c) Ganga
(d) Indus

Q97. Who won the 2025 Norway Chess Open tournament?
(a) Magnus Carlsen
(b) Hikaru Nakamura
(c) Fabiano Caruana
(d) Gukesh Dommaraju

Q98. Which of the following was announced in the Union Budget 2025-26 (presented on 1 February 2025) to boost value-addition and marketing for a regional crop in Bihar?
(a) Establishment of a Makhana Board
(b) A dedicated Potato Export Authority
(c) Central Rice Milling Corporation
(d) National Pulses Development Fund

Q99. According to the North Eastern Region Sustainable Development Goals Index Report, 2023-24, released in July 2025, which district secured the highest score at 81.43 points?
(a) Udalguri
(b) Dibrugarh
(c) Dimapur
(d) Hnahthial

Q100. Vithya Ramraj shares India's 400 m hurdles national record with which legendary Indian athlete as of 2025?
(a) Shiny Wilson
(b) Kamaljeet Sandhu
(c) Hima Das
(d) PT Usha

ANSWER KEY

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

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41	c	42	b	43	a	44	b	45	c	46	d	47	c	48	b	49	b	50	d
51	b	52	d	53	d	54	b	55	b	56	d	57	a	58	a	59	b	60	c
61	a	62	a	63	c	64	d	65	d	66	d	67	c	68	d	69	b	70	d
71	a	72	d	73	d	74	b	75	d	76	d	77	b	78	d	79	c	80	c
81	d	82	b	83	d	84	a	85	a	86	a	87	a	88	a	89	a	90	a
91	a	92	b	93	d	94	c	95	c	96	d	97	a	98	a	99	d	100	d

SOLUTIONS

Q1. Answer: (b) Irrigation at right stage of crop.

The correct answer is Irrigation at right stage of crop.

Key Points

• The expected yield of any crop is highly dependent on the availability of water at specific physiological periods known as Critical Growth Stages. Providing water at the right stage ensures that the plant does not undergo moisture stress during vital development phases. Hence, the correct option is Irrigation at right stage of crop.

• Irrigation at early stages of the crop is important for seed germination and seedling establishment, but if subsequent critical stages are neglected, the overall yield will drop significantly. Hence, statement 1 is only partially beneficial.

• Irrigation at the right stage refers to identifying the periods when the plant is most sensitive to water deficits, such as flowering, fruiting, or grain filling. Applying water during these windows maximizes productivity and resource efficiency. Hence, statement 2 is correct.

• Irrigation at the terminal stage (the final phase of the crop cycle) might help in maturing the seeds, but it cannot compensate for water stress experienced during the reproductive phase. Hence, statement 3 is incorrect as a standalone measure to increase yield.

• Irrigation at every stage of the crop is often counterproductive and leads to waterlogging, which deprives roots of oxygen, increases the risk of fungal diseases, and wastes water resources. Hence, statement 4 is incorrect.

Additional Information

• Critical Irrigation Stages for Various Crops:

• Wheat: The most critical stage is the Crown Root Initiation (CRI), which typically occurs 21 days after sowing. Other stages include tillering, flowering, and milk stage.

• Rice: Critical stages include the panicle initiation, flowering, and heading stages where moisture is vital for grain count.

• Maize: The tasseling and silking stages are highly sensitive to water stress.

• Pulses: These crops generally require irrigation at the flower initiation and pod development stages.

• Irrigation Scheduling: It is the process of deciding when to irrigate and how much water to apply. This is based on soil moisture levels, evapotranspiration rates, and the specific growth stage of the crop.

• Water Use Efficiency (WUE): This is a measure of a crop's ability to convert water into biomass or yield. Effective irrigation management at the right stage improves the WUE, ensuring sustainable agriculture.

Important Points

• Impact of Over-Irrigation: Excessive water application leads to leaching of nutrients, salinity build-up in the soil, and reduced soil aeration, all of which negatively impact the final yield.

• Precision Irrigation: Technologies like Drip Irrigation and Sprinkler Systems allow farmers to apply water precisely at the right stage and in the correct quantity, reducing water wastage by up to 40-50%.

• Soil Type Influence: The timing of irrigation also depends on soil texture; for example, sandy soils require more frequent irrigation compared to clayey soils due to lower water-holding capacity.

• Climate Factors: High temperatures and low humidity increase the plant's transpiration rate, requiring more frequent checks on whether the crop has reached a critical stage for water.

Q2. Answer: (b) positive z direction

The correct answer is positive z direction.

Key Points

• When a straight conductor carrying an electric current is placed within an external magnetic field, it experiences a mechanical force. This phenomenon is a fundamental principle of electromagnetism.

• The direction of this force is always perpendicular to both the direction of the current and the direction of the magnetic field.

• The relationship between these vectors is defined by the Lorentz Force equation, expressed as F = I (L × B), where F is the force

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vector, I is the current, L is the length vector in the direction of current, and B is the magnetic field vector.

• In this specific problem, the current is moving in the +x-direction (represented by the unit vector i) and the magnetic field is oriented in the +y-direction (represented by the unit vector j).

• By applying the mathematical cross product rules for Cartesian coordinates, we find that i × j = k. Since k represents the positive z-axis, the resulting motion of the conductor will be in the positive z direction. Hence, the statement is correct.

Additional Information

• Fleming's Left-Hand Rule: This is a practical mnemonic used to find the direction of force acting on a conductor. If you stretch the thumb, forefinger, and middle finger of your left hand so they are mutually perpendicular:

• The Forefinger represents the direction of the Magnetic Field.

• The Middle finger represents the direction of the Current.

• The Thumb points in the direction of the Force or Motion.

• Magnitude of Magnetic Force: The amount of force experienced by the wire depends on the current (I), the length (L) of the wire, the strength of the magnetic field (B), and the sine of the angle (θ) between the current and the field. The formula is $F = BIL \sin\theta$.

• Right-Hand Palm Rule: Another method where the fingers point in the direction of the field and the thumb points in the direction of the current; the palm then pushes in the direction of the magnetic force.

• Applications: This principle is the working basis for Electric Motors, where electrical energy is converted into mechanical energy. It is also used in galvanometers, loudspeakers, and magnetic levitation systems.

Important Points

• Maximum Force: The conductor experiences the maximum force when it is placed perpendicular (at an angle of 90 degrees) to the magnetic field lines. In this orientation, $\sin 90° = 1$.

• Zero Force: If the conductor is placed parallel or anti-parallel to the magnetic field (at an angle of 0 or 180 degrees), the force exerted on it is zero because $\sin 0° = 0$.

• Force on Moving Charges: The force on a single charge (q) moving with a velocity (v) in a magnetic field is given by $F = q(v \times B)$. A current-carrying wire is simply a collection of many such moving charges.

• Newton's Third Law: Just as the magnetic field exerts a force on the current-carrying wire, the wire also exerts an equal and opposite magnetic force on the source of the magnetic field (such as a permanent magnet).

Q3. Answer: (b) To help sound reflect and reach all parts of the hall

The correct answer is To help sound reflect and reach all parts of the hall.

Key Points

• The ceilings of concert halls, cinema halls, and conference rooms are usually curved because sound, after reflecting from the curved surface, spreads uniformly in all directions.

• This design ensures that the sound waves reach every corner of the hall, including the last rows of the audience, providing a consistent auditory experience for everyone. Hence, the correct answer is option 2.

• A curved surface acts like a large reflector. According to the laws of reflection of sound, the angle of incidence is equal to the angle of reflection. A curved ceiling is specifically engineered so that reflected sound is directed downward toward the audience rather than being trapped or scattered inefficiently.

• If the ceilings were flat, the sound might reflect at angles that do not cover the entire seating area, leading to "dead zones" where the audio is faint or unintelligible.

• The use of curved ceilings is a practical application of the reflection of sound, ensuring that the energy of the longitudinal waves is preserved and directed purposefully throughout the large volume of the building.

Additional Information

• Soundboard: In many large halls, a curved soundboard is placed behind the stage. The source of sound (the speaker or musical instrument) is placed at the focus of this curved board. The sound reflects off the board and travels as parallel beams to reach the distant audience clearly.

• Reverberation: This refers to the persistence of sound after the source has stopped, caused by multiple reflections. While some reflection is necessary for clarity (as provided by curved ceilings), excessive reflection can lead to echoes that blur the sound. Architects use sound-absorbent materials like compressed fiberboards or heavy curtains on walls to balance this.

• Reflection of Sound: Like light, sound reflects off hard surfaces. The quality of reflection depends on the texture and shape of the surface. Concave surfaces tend to converge sound waves, while convex surfaces diverge them.

• Acoustics: This is the branch of physics that deals with the study of mechanical waves in gases, liquids, and solids, including vibration, sound, ultrasound, and infrasound. Modern architectural acoustics focuses heavily on the geometry of ceilings and walls to optimize sound quality.

• Speed of Sound: It is important to note that the speed of sound remains constant in the hall (approx. 343 m/s in air), but the pathway taken by the waves is what is altered by the curvature of the ceiling.

Q4. Answer: (c) A compound always contains elements in a fixed ratio by mass.

The correct answer is A compound always contains elements in a fixed ratio by mass.

Key Points

• The Law of Constant Proportions, also known as the Law of Definite Proportions, was proposed by the French chemist Joseph Proust in 1799.

• The law states that in a chemical substance, the constituent elements are always present in definite proportions by mass, regardless of the source from which the compound is obtained or the method used for its preparation.

• Statement 1: Compounds can vary their composition based on temperature. This is incorrect because chemical compounds have a fixed stoichiometry that remains constant under standard chemical conditions, unlike physical mixtures whose proportions can vary. Hence, statement 1 is incorrect.

• Statement 2: The mass of a compound is always greater than the sum of its elements. This contradicts the Law of Conservation of Mass established by Antoine Lavoisier, which states that mass is neither created nor destroyed during a chemical reaction. Hence, statement 2 is incorrect.

• Statement 3: A compound always contains elements in a fixed ratio by mass. This is the fundamental definition of Proust's law, ensuring that every molecule of a specific substance has the same elemental makeup. Hence, statement 3 is correct.

• Statement 4: Elements combined in random ratios to form compounds. Elements combine in fixed, whole-number ratios of atoms to form compounds; random ratios are characteristic of mixtures, not pure chemical substances. Hence, statement 4 is incorrect.

Additional Information

• Example of Water (H2O): In a molecule of water, the ratio of the mass of hydrogen to the mass of oxygen is always 1:8. This means that if you decompose 9 grams of water, you will always obtain 1 gram of hydrogen and 8 grams of oxygen.

• Example of Ammonia (NH3): In ammonia, the elements nitrogen and hydrogen are always present in the fixed ratio of 14:3 by mass.

• Dalton's Atomic Theory: In 1808, John Dalton provided a theoretical explanation for the law of constant proportions. One of his postulates states that the relative number and kinds of atoms are constant in a given compound.

• Exceptions to the Law: While the law holds for most compounds, there are exceptions known as non-stoichiometric compounds (or Berthollides), such as Ferrous Oxide (FeO), where the ratio of elements can vary within a narrow range. Additionally, isotopes of elements can lead to slightly different mass ratios in compounds, though the atomic ratio remains the same.

Important Points

• Laws of Chemical Combination: The Law of Constant Proportions is one of the fundamental Laws of Chemical Combination, which also includes the Law of Conservation of Mass and the Law of Multiple Proportions.

• Experimental Verification: Joseph Proust verified this law by analyzing cupric carbonate. He compared a natural sample and a synthetic sample and found that both contained the exact same percentage of copper, carbon, and oxygen.

• Scientific Significance: This law is vital for stoichiometric calculations in chemistry, allowing scientists to determine the empirical and molecular formulas of unknown substances and calculate the amounts of reactants and products in a chemical reaction.

Q5. Answer: (d) every physical process in general

The correct answer is every physical process in general.

Key Points

• The Law of Conservation of Energy is a fundamental principle of physics which states that the total energy of an isolated system remains constant; it is said to be conserved over time.

• Energy can neither be created nor destroyed; rather, it can only be transformed or transferred from one form to another. For instance, in a falling object, potential energy is converted into kinetic energy.

• The principle is applicable to every physical process in general because energy is a universal currency in all interactions, whether they are mechanical, electrical, chemical, thermal, or nuclear. Hence, option 4 is correct.

• Options 1, 2, and 3 are incorrect because they use restrictive terms like "only" or "exclusively." While the law applies to mechanical, electrical, and chemical systems, it is not limited to them. Hence, statements 1, 2, and 3 are incorrect.

• In any transformation, if we account for all forms of energy—including those dissipated as heat, sound, or friction—the sum remains the same.

Additional Information

• First Law of Thermodynamics: This is a specific version of the conservation of energy principle applied to thermodynamic systems. It states that the change in internal energy of a system is equal to the heat added to the system minus the work done by the system.

• Forms of Energy: Energy exists in various forms such as Mechanical (Kinetic and Potential), Thermal (heat), Chemical (stored in bonds), Electrical (moving charges), Radiant (light), and Nuclear (stored in the nucleus of an atom).

• Energy Transformation Examples:

• In a battery, chemical energy is converted into electrical energy.

• In an electric motor, electrical energy is converted into mechanical energy.

• In photosynthesis, plants convert solar energy into chemical energy.

• Mass-Energy Equivalence: In modern physics, Albert Einstein expanded this principle through the formula $E = mc^2$, which suggests that mass and energy are interconvertible. This is particularly relevant in nuclear reactions (fission and fusion) where a small amount of mass is converted into a huge amount of energy.

Important Points

• Isolated System: A system that does not exchange matter or energy with its surroundings. The universe itself is often considered the ultimate isolated system where total energy is constant.

• Noether's Theorem: In theoretical physics, the conservation of energy is a mathematical consequence of time-translation symmetry. This means that the laws of physics do not change with time; therefore, energy must be conserved.

• Perpetual Motion Machines: The law of conservation of energy confirms that a perpetual motion machine of the first kind (a machine that produces work without energy input) is physically impossible.

• Efficiency: While energy is always conserved, it is not always conserved in a useful form. In most real-world processes, some energy is "lost" as waste heat due to entropy, though it still exists within the total system energy count.

Q6. Answer: (c) Intercalary meristem

The correct answer is Intercalary meristem.

Key Points

• Intercalary meristems are specifically located at the base of leaves or internodes (near the nodes) in certain plants.

• These tissues are essentially portions of the apical meristem that have been separated from the apex by the development of permanent tissues during the growth process.

• They play a crucial role in the elongation of the plant body and are responsible for the longitudinal growth of the internodes.

• In grasses and other monocots, the intercalary meristem allows for the regrowth of stems and leaves after they have been damaged or consumed by herbivorous animals.

• Unlike apical meristems which are at the tips, the intercalary meristem provides a mechanism for growth within the middle regions of the plant structure.

Additional Information

• Apical Meristem:

• Located at the growing tips of roots and shoots.

• It is responsible for the increase in the length of the plant, a process known as primary growth.

• It helps the plant explore more soil for water and reach higher for sunlight.

• Lateral Meristem:

• Found on the lateral sides of the stems and roots, running parallel to the long axis.

• It facilitates secondary growth, which results in an increase in the girth or thickness of the plant.

• Examples include the vascular cambium and the cork cambium (phellogen) in woody plants.

• Characteristics of Meristematic Cells:

• The cells are actively dividing and are usually small, isodiametric, or spherical in shape.

• They possess thin cellulose cell walls, dense cytoplasm, and a prominent nucleus.

• These cells generally lack vacuoles because they are focused on multiplication rather than storage or structural support.

• Root Meristem:

• Specifically refers to the apical meristem located at the root apex.

• It is often protected by a root cap to prevent damage as the root pushes through the soil.

Important Points

• Classification: Meristems are classified based on their position in the plant body into three primary types: Apical, Intercalary, and Lateral.

• Linguistic Context: The word "meristem" is derived from the Greek word 'meristos', which means divisible, highlighting the tissue's capacity for continuous cell division.

• Growth Cycles: While primary meristems (Apical and Intercalary) appear early in the life of a plant, secondary meristems (Lateral) usually appear later to provide structural thickness.

Q7. Answer: (d) $Na2CO3·10H2O$

The correct answer is $Na2CO3.10H2O$.

Key Points

• Washing soda is a chemical compound with the formula $Na2CO3.10H2O$. Its chemical name is sodium carbonate decahydrate.

• It is a crystalline solid that contains ten molecules of water of crystallization attached to one molecule of sodium carbonate. Hence, option 4 is correct.

• It is produced via the Solvay process, where sodium chloride, ammonia, and carbon dioxide react to form sodium hydrogen carbonate, which is then heated and recrystallized.

• Washing soda is a basic salt, meaning it forms an alkaline solution when dissolved in water, turning red litmus blue.

• The anhydrous form of this compound (without water) is known as soda ash or sodium carbonate (Na_2CO_3). Hence, option 3 is incorrect as it lacks the hydration necessary for washing soda.

Additional Information

• Sodium Hydroxide (NaOH):

• Commonly known as caustic soda, it is a strong base used in the manufacture of soaps, detergents, paper, and synthetic fibers like rayon. Hence, option 1 is incorrect.

• Sodium Hydrogen Carbonate ($NaHCO_3$):

• Commonly known as baking soda, it is used in the food industry for baking and as an antacid to treat indigestion. It also acts as a primary component in soda-acid fire extinguishers. Hence, option 2 is incorrect.

• Uses of Washing Soda:

• It is primarily used in the glass, soap, and paper industries.

• A major application is the removal of permanent hardness of water, which is caused by dissolved calcium and magnesium salts.

• It is used in the manufacturing of sodium compounds like borax and serves as a vital cleansing agent for domestic laundry purposes.

• Chemical Properties:

• When exposed to air, washing soda undergoes efflorescence, losing nine molecules of water to form sodium carbonate monohydrate ($Na_2CO_3.H_2O$).

• It is highly soluble in water and its solution is alkaline in nature, which aids in cutting through grease and stains during cleaning.

Important Points

• History: The Solvay process was developed in the 1860s by Ernest Solvay, revolutionizing the industrial production of sodium carbonate.

• Water of Crystallization: This refers to the fixed number of water molecules that form part of the structure of a crystal. In washing soda, there are exactly 10 such molecules.

• Environmental Impact: Washing soda is considered more environmentally friendly than many synthetic detergents as it is biodegradable and does not contain phosphates that lead to eutrophication.

Q8. Answer: (c) Four cells, half number

The correct answer is Four cells, half number.

Key Points

• Meiosis is a specialized form of cell division that results in the formation of four daughter cells, each with half the number of chromosomes of the parent cell.

• It is known as reduction division because it reduces the chromosome ploidy from diploid (2n) to haploid (n). Hence, the outcome "Four cells, half number" identifies meiosis.

• This process involves two successive stages of nuclear and cell division, known as Meiosis I and Meiosis II, but only one cycle of DNA replication occurs.

• Meiosis is essential for sexual reproduction as it produces gametes (sperm and egg cells) in animals and spores in plants and fungi.

• The primary purpose of meiosis is to ensure that the chromosome number remains constant across generations after fertilization occurs.

Additional Information

• Mitosis vs. Meiosis:

• Mitosis results in two identical daughter cells with the same number of chromosomes as the parent cell (2n to 2n). It is used for growth, tissue repair, and asexual reproduction.

• In contrast, Meiosis results in genetic variation due to processes like crossing over and independent assortment.

• Phases of Meiosis:

• Meiosis I: Includes Prophase I, Metaphase I, Anaphase I, and Telophase I. This is the stage where homologous chromosomes separate.

• Meiosis II: Similar to mitosis, where sister chromatids separate into different cells, resulting in the final four haploid cells.

• Genetic Diversity:

• During Prophase I, homologous chromosomes pair up (synapsis) and exchange genetic material in a process called

recombination or crossing over.

• This ensures that every gamete produced is genetically unique, which is a key driver of evolution and biological diversity.

• Human Context:

• In humans, somatic cells have 46 chromosomes (diploid). After meiosis, the resulting sperm or egg cells contain only 23 chromosomes (haploid).

• Failure in proper chromosome separation during meiosis can lead to conditions like Down Syndrome (Trisomy 21).

Important Points

• Location: In animals, meiosis occurs in the gonads (testes in males and ovaries in females).

• Functions: It facilitates segregation of genes and maintains the integrity of the species genome.

• Discovery: The process was first described by Oscar Hertwig in 1876 in sea urchin eggs.

Q9. Answer: (d) only B and C

The correct answer is only B and C.

Key Points

• Statement A: This statement suggests that mass can be changed (created or destroyed) when a reaction takes place. According to the Law of Conservation of Mass, the total mass of the reactants must equal the total mass of the products. Mass is neither created nor destroyed in a chemical reaction. Hence, statement A is incorrect.

• Statement B: In a chemical reaction, the bonds between atoms are broken and new bonds are formed. This process involves the rearrangement of atoms to transform reactants into different substances called products, but the types and number of atoms remain the same. Hence, statement B is correct.

• Statement C: This statement defines the core principle of the law within the context of a closed system. In such a system, where no matter or energy (specifically matter in this context) can escape or enter, the total mass remains constant over time regardless of the processes acting inside the system. Hence, statement C is correct.

• Hence, the correct answer is only B and C.

Additional Information

• Definition and Origin:

• The Law of Conservation of Mass was established by the French chemist Antoine Lavoisier in 1789. It is a fundamental principle in chemistry and physics.

• It states that for any system closed to all transfers of matter and energy, the mass of the system must remain constant over time, as the system's mass cannot change, so quantity can neither be added nor be removed.

• Chemical Equations:

• This law is the reason why chemical equations must be balanced. A balanced equation has the same number of atoms of each element on both the reactant side and the product side.

• Example: In the combustion of methane ($CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$), the mass of carbon, hydrogen, and oxygen atoms before the reaction is exactly the same as the mass after the reaction.

• Features of the Law:

• Closed System: A physical system that does not allow transfer of matter in or out of the system.

• Reactants and Products: The initial substances in a reaction are reactants, and the resultant substances are products. Their total weight remains identical.

Important Points

• Historical Context: Antoine Lavoisier is often referred to as the "Father of Modern Chemistry" because his quantitative experiments led to the discovery of this law, debunking the phlogiston theory.

• Nuclear Reactions: It is important to note that in nuclear reactions, the law is modified. According to Albert Einstein's equation $E=mc^2$, mass can be converted into energy. Therefore, in the context of modern physics, we refer to the Law of Conservation of Mass-Energy.

• Application: This law is widely used in fluid mechanics, chemical engineering, and environmental science to calculate mass balances in various industrial processes.

Q10. Answer: (c) Safe sex practices and awareness about contraception

The correct answer is Safe sex practices and awareness about contraception.

Key Points

• Reproductive health is defined by the World Health Organization (WHO) as a total well-being in all aspects of reproduction, including physical, emotional, behavioral, and social dimensions.

• Maintaining safe sex practices is a fundamental requirement as it prevents the spread of Sexually Transmitted Infections (STIs) such as syphilis, gonorrhea, genital herpes, and life-threatening diseases like HIV/AIDS.

• Awareness about contraception is essential for family planning, allowing individuals to decide the number and spacing of their

children, which directly impacts the socio-economic status of a family and the nation. Hence, statement 3 is correct.

• Sharing personal hygiene products (like towels or undergarments) is highly discouraged as it can lead to the transmission of fungal infections, skin diseases, and UTIs. Hence, statement 1 is incorrect.

• Monitoring and understanding the physical and hormonal changes during adolescence is vital for mental health and early detection of reproductive issues. Ignoring these changes can lead to anxiety or undiagnosed medical conditions. Hence, statement 2 is incorrect.

• Medical intervention and the use of prescribed medicines (such as antibiotics for infections or hormonal therapy) are often necessary to maintain reproductive health; thus, avoiding all medicines is counterproductive. Hence, statement 4 is incorrect.

Additional Information

• Adolescence and Puberty:

• Adolescence is the period of life between 10 to 19 years when the body undergoes changes leading to reproductive maturity.

• During puberty, the testes and ovaries begin to produce gametes (sperm and ova) and hormones like testosterone (in males) and estrogen/progesterone (in females).

• Menstrual Hygiene:

• Maintenance of cleanliness during the menstrual cycle is crucial to prevent bacterial infections and Pelvic Inflammatory Disease (PID).

• The use of sanitary napkins or clean menstrual cups and changing them every 4-6 hours is a standard health recommendation.

• Nutritional Needs:

• A balanced diet containing Iron (to prevent anemia), Calcium, and Proteins is particularly important for pregnant women and adolescent girls to support reproductive functions.

• Government Initiatives:

• In India, the Reproductive and Child Health (RCH) program was launched to create awareness and provide medical facilities for maternal health, infant mortality reduction, and birth control.

• The legal age for marriage in India (currently 18 for females and 21 for males) is also designed to ensure that individuals are physiologically and mentally prepared for reproduction.

Important Points

• Amniocentesis: This is a medical technique used to determine chromosomal abnormalities in the fetus. However, its misuse for sex determination led to a statutory ban in India under the Pre-Conception and Pre-Natal Diagnostic Techniques (PCPNDT) Act, 1994.

• Population Explosion: Lack of reproductive health awareness leads to rapid population growth. Methods like IUCDs (Intrauterine Contraceptive Devices), Oral Pills, and Surgical Methods (Vasectomy and Tubectomy) are tools used to stabilize population growth.

• Lactational Amenorrhea: A natural method of contraception where ovulation does not occur during the period of intense lactation following childbirth, though it is only effective for a maximum of six months.

Q11. Answer: (a) Rainwater harvesting

The correct answer is Rainwater harvesting.

Key Points

• Judicious use of natural resources refers to the sustainable and efficient management of resources to meet present needs without compromising the ability of future generations to meet their own needs.

• Rainwater harvesting is a method of water conservation where precipitation is collected and stored for later use, rather than being allowed to run off. It helps in recharging groundwater levels and reduces the burden on municipal water supplies. Hence, statement 1 is correct.

• Open mining (also known as open-pit mining) involves the extraction of minerals from an open pit in the ground. This process often leads to significant environmental degradation, habitat destruction, and soil erosion. Hence, statement 2 is incorrect.

• Excessive use of fossil fuels like coal, petroleum, and natural gas leads to the depletion of non-renewable resources and increases carbon emissions, contributing to global warming. Hence, statement 3 is incorrect.

• Deforestation is the permanent removal of trees to make room for something besides forest. This results in loss of biodiversity, disruption of the water cycle, and increased atmospheric carbon dioxide. Hence, statement 4 is incorrect.

• Hence, the correct answer is Rainwater harvesting.

Additional Information

• Natural Resources:

• These are substances that occur naturally within environments that exist relatively undisturbed by mankind, in a natural form.

• They are classified into Renewable Resources (e.g., solar energy, wind, water) which can be replenished naturally over time, and Non-renewable Resources (e.g., minerals, fossil fuels) which exist in finite amounts and take millions of years to form.

• Sustainable Development:

• This concept was popularized by the Brundtland Commission in 1987. It emphasizes the judicious use of resources to maintain ecological balance.

• Methods include practicing the 3Rs: Reduce, Reuse, and Recycle to minimize waste generation and resource consumption.

• Rainwater Harvesting Techniques:

• Rooftop harvesting: Collecting rain from the roofs of buildings and storing it in tanks or diverting it to recharge pits.

• Surface runoff harvesting: Capturing rainwater that flows along the ground surface during monsoon seasons to replenish aquifers.

• In India, states like Tamil Nadu have made rainwater harvesting mandatory for all buildings to combat water scarcity.

Important Points

• Conservation of Water: Since only about 2.5% of the Earth's water is freshwater, and most of that is trapped in glaciers, the judicious use of available water through harvesting is critical for agriculture and domestic consumption.

• Impact of Mismanagement: Over-exploitation of groundwater for irrigation has led to a drastic drop in the water table in several parts of the world, including the Indo-Gangetic plains.

• Energy Conservation: Shifting from fossil fuels to clean energy sources like hydroelectric power or biomass is another example of the judicious use of natural resources.

Q12. Answer: (b) Dendrite

The correct answer is Dendrite.

Key Points

• Dendrites are the protoplasmic extensions of a nerve cell (neuron) that propagate the electrochemical stimulation received from other neural cells to the cell body, or soma.

• They act as the primary receptors or antennae of the neuron, featuring a highly branched, tree-like structure that significantly increases the surface area available for receiving signals. Hence, the statement that a neuron receives impulses through dendrites is correct.

• Electrical signals are transmitted onto the dendrites by upstream neurons via synapses located at various points throughout the dendritic tree.

• The direction of a nerve impulse is always unidirectional in a functional circuit: it enters through the dendrite, passes through the cell body, and exits via the axon.

• Dendrites play a critical role in integrating these incoming signals to determine whether the neuron will fire an action potential.

Additional Information

• Cell Body (Soma):

• The cell body is the spherical part of the neuron that contains the nucleus and other specialized organelles like mitochondria, Golgi apparatus, and Nissl bodies.

• Its primary function is to maintain the cell's metabolic processes and integrate the electrical signals received from the dendrites.

• While it can receive some direct synaptic inputs, it is not the primary specialized structure for receiving impulses from other neurons. Hence, the option Cell body is not the primary answer.

• Axon:

• An axon is a long, slender projection of a nerve cell that typically conducts electrical impulses away from the neuron's cell body.

• The point where the axon joins the cell body is called the axon hillock, where the action potential is usually generated.

• Axons can be very long, sometimes extending over 1 meter in humans (such as the sciatic nerve). Hence, the option Axon is incorrect as it transmits signals away, not receives them.

• Synapse:

• A synapse is the microscopic junction or gap between two neurons, or between a neuron and an effector cell (like a muscle or gland).

• Information is transferred across the synaptic cleft using chemical messengers known as neurotransmitters, such as acetylcholine or dopamine.

• While the impulse travels through the synapse, the synapse itself is the location of the transfer, whereas the dendrite is the specific cellular structure that receives the signal. Hence, the option Synapse refers to the junction rather than the receiving structure.

Important Points

• Myelin Sheath: This is an insulating layer, or sheath that forms around nerves, including those in the brain and spinal cord. It is made up of protein and fatty substances. It allows electrical impulses to transmit quickly and efficiently along the nerve cells.

• Nodes of Ranvier: These are the periodic gaps in the myelin sheath where the axon is exposed to the extracellular space, facilitating saltatory conduction (the "jumping" of impulses).

• Schwann Cells: These are the cells in the Peripheral Nervous System (PNS) responsible for the formation of the myelin sheath.

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• Action Potential: A rapid sequence of changes in the voltage across a membrane. The entire process takes about 2 to 5 milliseconds.

Q13. Answer: (b) F_f = (F1 - F2)/2

The correct answer is Ff = (F1 - F2)/2.

Key Points

• According to Newton's Second Law of Motion, the acceleration of an object is directly proportional to the net force acting on it and inversely proportional to its mass. This is represented by the formula F_net = M * a.

• In the first scenario, where friction is zero, the block of mass M is acted upon by two opposing forces, F1 and F2. Since F1 > F2, the net force is F1 - F2. The resulting acceleration, let's call it a1, is (F1 - F2) / M.

• In the second scenario, a frictional force Ff is introduced. The problem states that Ff acts opposite to F1. This means Ff acts in the same direction as F2. The new net force acting on the block becomes F1 - F2 - Ff.

• The resulting acceleration with friction, let's call it a2, is calculated as a2 = (F1 - F2 - Ff) / M.

• The problem provides a specific condition: the net acceleration of the block with friction (a2) is half the acceleration it would have experienced without friction (a1). Therefore, a2 = a1 / 2.

• Substituting the expressions for acceleration into this condition: (F1 - F2 - Ff) / M = [(F1 - F2) / M] / 2.

• By canceling the mass M from both sides, we get: F1 - F2 - Ff = (F1 - F2) / 2.

• Rearranging the equation to solve for Ff: Ff = (F1 - F2) - (F1 - F2) / 2. This simplifies to Ff = (F1 - F2) / 2.

Additional Information

• Newton's Second Law: It defines the relationship between an object's mass, its acceleration, and the applied force. It is a fundamental principle in classical mechanics and was published in 1687.

• Frictional Force (Ff): Friction is a force that resists the relative motion of solid surfaces, fluid layers, and material elements sliding against each other. In this problem, kinetic friction is implied as the block is accelerating.

• Net Force: This is the vector sum of all forces acting on an object. When forces are collinear (acting along the same line), they can be added or subtracted as scalars based on their direction.

• Mass (M): A fundamental property of matter that represents its inertia or resistance to acceleration when a net force is applied. In the SI system, it is measured in kilograms (kg).

• Opposing Forces: When two forces act in exactly opposite directions (180 degrees apart), the magnitude of the resultant force is the difference between the magnitudes of the individual forces.

Important Points

• Direction of Motion: Since F1 > F2, the block will initially accelerate in the direction of F1. Therefore, friction, which always opposes motion, must act in the direction of F2.

• Impact of Friction: The introduction of friction reduces the net force acting on the body, which directly leads to a decrease in the magnitude of acceleration if the mass remains constant.

• Dimensional Consistency: In any physical equation like Ff = (F1 - F2) / 2, both sides of the equation must have the same dimensions. Here, both sides represent Force, measured in Newtons (N).

• Vector Representation: While this problem treats forces algebraically, forces are vectors requiring both magnitude and direction for a complete description.

Q14. Answer: (b) Benzene

The correct answer is Benzene.

Key Points

• A ring-chain hydrocarbon, also known as a cyclic hydrocarbon, is a compound where the carbon atoms are linked to each other in a closed-loop or ring structure.

• Benzene is the most prominent example of a cyclic hydrocarbon with the molecular formula C6H6. It consists of six carbon atoms arranged in a planar hexagonal ring with alternating double bonds. Hence, option 2 is correct.

• Propane is an acyclic (open-chain) alkane with the chemical formula C3H8. Its carbon atoms are arranged in a straight sequence without forming a loop. Hence, option 1 is incorrect.

• Ethene, also known as ethylene, is an open-chain alkene with the formula C2H4. It contains two carbon atoms joined by a double bond in a linear fashion. Hence, option 3 is incorrect.

• Heptyne is an open-chain alkyne with the formula C7H12. It consists of a chain of seven carbon atoms containing at least one triple bond, but it does not form a ring. Hence, option 4 is incorrect.

Additional Information

• Classification of Hydrocarbons:

• Acyclic Hydrocarbons: These are open-chain compounds that can be saturated (Alkanes) or unsaturated (Alkenes and Alkynes).

• Cyclic Hydrocarbons: These contain at least one ring of carbon atoms. They are subdivided into Alicyclic (like Cyclohexane) and

Aromatic (like Benzene).

• Aromatic Hydrocarbons:

• These are special cyclic compounds that possess high stability due to resonance. Benzene is the parent member of this family.

• They must follow Hückel's Rule, which requires 4n + 2 pi electrons in a conjugated, planar ring system.

• Physical and Chemical Properties of Benzene:

• Benzene was first isolated by Michael Faraday in 1825. Its structural formula was later proposed by August Kekulé in 1865.

• It is a colorless liquid at room temperature with a characteristic aromatic odor. It has a boiling point of 80.1 °C.

• It is widely used in the industrial manufacture of plastics, resins, synthetic fibers, rubber lubricants, dyes, detergents, and pesticides.

Important Points

• Hybridization: In the Benzene ring, each carbon atom is sp2 hybridized, which results in the planar geometry of the molecule.

• Resonance: The pi electrons in Benzene are delocalized over the entire ring, meaning they are not fixed between any two specific carbon atoms. This provides the molecule with extraordinarily high stability compared to typical alkenes.

• Health Hazards: While useful industrially, Benzene is a highly toxic and carcinogenic substance. Long-term exposure is known to cause leukemia and other blood-related disorders.

• Numerical Data: The C-C bond length in Benzene is exactly 1.39 Å, which is the mean value between a single bond (1.54 Å) and a double bond (1.34 Å).

Q15. Answer: (a) Only A

The correct answer is Only A.

Key Points

• Statement A: In a mixture, the composition of the constituent substances is variable, meaning they can be mixed in any proportion. Conversely, a compound is a substance formed when two or more elements chemically combine in a fixed ratio by mass, and the composition of each new substance is always fixed. Hence, statement A is correct.

• Statement B: A mixture reflects the physical properties of its constituent substances because they are not chemically bonded. However, in a compound, the new substance formed has entirely different properties from its constituent elements; it does not show the same properties as the atoms it is made of. Hence, statement B is incorrect.

• Statement C: This statement suggests that a mixture has a non-variable composition and a compound has a changing composition. This is factually incorrect as it contradicts the fundamental laws of chemistry, specifically the Law of Constant Proportions, which states that compounds always have a definite composition. Hence, statement C is incorrect.

• Hence, the correct answer is Only A.

Additional Information

• Mixtures:

• A mixture is a physical combination of two or more substances that are not chemically linked.

• Types: They are classified into homogeneous mixtures (uniform composition, like saltwater or air) and heterogeneous mixtures (non-uniform composition, like sand and iron filings).

• Separation: The constituents of a mixture can be separated using physical methods such as filtration, evaporation, distillation, or magnetism.

• Energy: Usually, no energy (in the form of heat or light) is absorbed or evolved during the formation of a mixture.

• Compounds:

• A compound is a pure substance made of atoms of two or more elements chemically bonded together.

• Formation: The formation of a compound involves a chemical reaction, often accompanied by the evolution or absorption of energy.

• Separation: The constituents of a compound can only be separated by chemical or electrochemical reactions; physical methods do not work.

• Examples: Water (H2O) is a compound of hydrogen and oxygen. Methane (CH4) and Common Salt (NaCl) are other common examples.

Important Points

• Comparison of Properties:

• In a mixture (e.g., iron and sulfur powder mixed), iron retains its magnetic properties.

• In a compound (e.g., Iron Sulphide), the iron loses its magnetic properties because a new chemical substance has been formed.

• Melting and Boiling Points:

• Compounds typically have fixed melting points and boiling points due to their fixed composition.

• Mixtures do not have sharp melting or boiling points; they melt or boil over a range of temperatures depending on the ratio of constituents.

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Q16. Answer: (a) Design of ships and submarines

The correct answer is Design of ships and submarines.

Key Points

• Archimedes' Principle states that when a body is immersed fully or partially in a fluid, it experiences an upward force (buoyancy) that is equal to the weight of the fluid displaced by it.

• The design of ships and submarines is the most common practical application of this principle. Ships are designed with a large volume so they can displace an amount of water whose weight is equal to the weight of the ship, allowing them to float. Hence, statement 1 is correct.

• Submarines use the principle by utilizing ballast tanks. When these tanks are filled with water, the submarine's weight increases, making it denser than water and causing it to sink; when water is pumped out and replaced with compressed air, the submarine becomes lighter and surfaces.

• Using a prism for light dispersion is based on the phenomenon of refraction, where different wavelengths of light bend at different angles when passing through a medium. It is not related to fluid mechanics or buoyancy. Hence, statement 2 is incorrect.

• The working of a thermometer is based on the thermal expansion of liquids like mercury or alcohol. As temperature increases, the liquid expands and moves up the capillary tube. Hence, statement 3 is incorrect.

• Operating a pendulum involves Simple Harmonic Motion (SHM) and is governed by the laws of gravity and inertia. The time period depends on the length of the string and acceleration due to gravity. Hence, statement 4 is incorrect.

Additional Information

• Lactometers: These are instruments used to determine the purity of a milk sample. They work on Archimedes' Principle by measuring the relative density of milk compared to water.

• Hydrometers: These devices are used for finding the density of liquids. A hydrometer sinks deeper in low-density liquids and stays higher in high-density liquids, following the laws of buoyancy.

• Buoyant Force (Upthrust): This is the upward force exerted by a fluid on an object. The magnitude of this force is directly proportional to the density of the fluid and the volume of the displaced fluid.

• Relative Density: It is the ratio of the density of a substance to the density of water at 4 degrees Celsius. It has no units and is often measured using tools designed around Archimedes' Principle.

Important Points

• Law of Flotation: An object will float if the weight of the object is equal to or less than the weight of the liquid displaced by its submerged part.

• Historical Context: The principle was discovered by the Greek mathematician Archimedes of Syracuse in the 3rd Century BC while he was trying to determine the purity of a gold crown for King Hiero II.

• Applications in Aviation: Hot air balloons and blimps also follow this principle. The hot air inside the balloon is less dense than the surrounding cool air, creating enough upthrust to lift the weight of the balloon.

• Mathematical Expression: The Buoyant Force (Fb) is calculated as $Fb = \rho \times V \times g$, where ρ (rho) is the density of the fluid, V is the displaced volume, and g is the acceleration due to gravity (approx 9.8 m/s^2).

Q17. Answer: (b) Ovary

The correct answer is Ovary.

Key Points

• The process of fertilization in flowering plants (angiosperms) begins when a pollen grain lands on the stigma of a compatible flower. This event is known as pollination.

• Upon landing, the pollen grain absorbs moisture and germinates, producing a specialized structure called a pollen tube.

• The pollen tube acts as a conduit for the male gametes. It penetrates the tissues of the stigma and grows downward through the elongated, slender part of the carpel known as the style.

• The primary function of the style is to provide a pathway for the tube to travel toward the basal, swollen part of the pistil, which is the ovary.

• The ovary contains one or more ovules. The pollen tube eventually enters the ovary and reaches an ovule, typically through a small opening called the micropyle, to deliver the sperm cells for fertilization.

• Hence, the correct answer is Ovary.

Additional Information

• Structure of the Carpel (Female Reproductive Part):

• Stigma: The topmost, often sticky part of the carpel that receives pollen grains during pollination.

• Style: The stalk-like structure that connects the stigma to the ovary and supports the growth of the pollen tube.

• Ovary: The enlarged basal portion of the pistil where ovules are produced. After fertilization, the ovary develops into a fruit.

• Structure of the Stamen (Male Reproductive Part):

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• Anther: The pollen-producing part of the stamen, usually located at the tip.

• Filament: The thin, thread-like stalk that supports the anther and positions it to facilitate pollen dispersal.

• Non-Reproductive Parts of a Flower:

• Petals: Collectively called the corolla, these are often brightly colored to attract pollinators like insects and birds.

• Sepals: Collectively called the calyx, these are leaf-like structures at the base of the flower that protect the bud during its early development stages.

• Fertilization Outcomes:

• In angiosperms, the fusion of a male gamete with the egg cell inside the ovule results in a zygote.

• The ovule eventually matures into a seed, while the surrounding ovary wall matures into the pericarp of the fruit.

Important Points

• Double Fertilization: This is a unique feature of flowering plants where one sperm cell fertilizes the egg to form a zygote, and another sperm cell fuses with two polar nuclei to form the triploid endosperm, which provides nutrition to the developing embryo.

• Chemotropism: The growth of the pollen tube toward the ovary is an example of chemotropism, as the tube is guided by chemical secretions (such as calcium ions and sugars) released by the ovule and synergid cells.

Q18. Answer: (d) Potassium, Gold

The correct answer is Potassium, Gold.

Key Points

• The Reactivity Series (also known as the activity series) is an arrangement of metals in descending order of their chemical reactivity. It helps in predicting how metals will react with water, acids, and other metal salts.

• Potassium (K) is placed at the very top of the reactivity series, making it the most reactive metal. Due to its high reactivity, it reacts vigorously with oxygen and water even at room temperature.

• Gold (Au) is placed at the bottom of the reactivity series, making it the least reactive metal. It is often referred to as a noble metal because it does not react with air, water, or most acids under standard conditions.

• The general order of the series from high to low reactivity is: Potassium (K) > Sodium (Na) > Calcium (Ca) > Magnesium (Mg) > Aluminium (Al) > Zinc (Zn) > Iron (Fe) > Tin (Sn) > Lead (Pb) > [Hydrogen (H)] > Copper (Cu) > Mercury (Hg) > Silver (Ag) > Gold (Au).

• Metals like Magnesium and Sodium are also highly reactive but are placed below Potassium. Silver is less reactive than Copper but more reactive than Gold.

Additional Information

• Potassium (K):

• It is an Alkali Metal belonging to Group 1 of the periodic table with atomic number 19.

• Because it reacts explosively with water to produce Hydrogen gas and heat, it must be stored under kerosene or paraffin oil to prevent contact with moisture and air.

• It has a very low ionization energy, meaning it loses its single valence electron very easily to form K+ ions.

• Gold (Au):

• It is a Transition Metal with atomic number 79.

• It is highly malleable and ductile, and its resistance to corrosion and oxidation makes it ideal for jewelry and electronic components.

• It is often found in nature in its native state (pure form) because it does not readily form compounds with other elements.

• Magnesium (Mg) and Silver (Ag):

• Magnesium (Atomic number 12) reacts with boiling water or steam but is less violent than Potassium.

• Silver (Atomic number 47) is used in coinage and photography; while it tarnishes in the presence of sulfur, it is still significantly less reactive than base metals.

Important Points

• Displacement Reactions: A more reactive metal (like Potassium or Zinc) can displace a less reactive metal (like Copper or Silver) from its oxide or salt solution.

• Hydrogen Reference: Hydrogen is included in the series as a reference point. Metals placed above Hydrogen can displace it from dilute acids to release hydrogen gas, whereas metals below Hydrogen (like Copper, Silver, Gold) cannot.

• Extraction Methods: The reactivity of a metal determines its extraction method. Highly reactive metals (Potassium, Sodium, Calcium) are extracted via electrolysis of their molten chlorides, while moderately reactive metals (Zinc, Iron) are reduced using carbon (coke).

• Electropositivity: Reactivity is directly related to electropositivity. Potassium is the most electropositive element in this context, having the strongest tendency to lose electrons and form positive ions.

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Q19. Answer: (a) Electric fuse

The correct answer is Electric fuse.

Key Points

• An electric fuse is a crucial safety device used in electrical circuits to protect against excessive current. It operates primarily on the principle of the heating effect of electric current, also known as Joule heating.

• The primary component of a fuse is a short piece of wire made of a material with a low melting point and high resistance, typically an alloy of tin and lead (often in a 63:37 ratio) or sometimes copper or zinc.

• When the magnitude of the current flowing through the circuit exceeds the specified safety limit (the fuse rating), the heat generated in the fuse wire ($H = I^2Rt$) increases rapidly.

• As the temperature reaches the melting point of the metal wire, the wire melts and breaks. This action results in an open circuit, which immediately stops the flow of electricity, thereby preventing damage to expensive electrical appliances and hazards like electrical fires.

• The fuse is always connected in series with the live wire of the circuit to ensure that all current passing into the household or device must first pass through the fuse wire.

Additional Information

• Electric Bulb:

• An electric bulb also utilizes the heating effect of current, but for a different purpose. It contains a filament made of Tungsten, which has a very high melting point of approximately 3422 degrees Celsius.

• The goal here is for the filament to become white-hot and emit light (incandescence) without melting. Therefore, it is the opposite of a fuse in terms of its material's thermal properties.

• Electric Fan:

• An electric fan does not rely on the heating effect to function. Instead, it works on the magnetic effect of electric current.

• It uses an electric motor that converts electrical energy into mechanical energy (rotational motion) through the interaction of magnetic fields.

• Electric Bell:

• The electric bell is another application of the magnetic effect of current.

• It contains an electromagnet that, when energized, attracts an iron armature to strike a gong. It does not use the melting of metal as a functional mechanism.

• Short Circuit and Overloading:

• A short circuit occurs when the live wire and neutral wire come into direct contact, causing a sudden, massive surge in current.

• Overloading occurs when too many high-power appliances are connected to a single socket, drawing more current than the wires can safely handle. In both cases, the electric fuse is the first line of defense.

Important Points

• Fuse Ratings: Fuses are classified by their current-carrying capacity. For common domestic use, fuses are typically rated at 5 Amperes for lighting and fans, and 15 Amperes for heavy-duty appliances like air conditioners or refrigerators.

• Modern Alternatives: In modern electrical installations, Miniature Circuit Breakers (MCBs) are increasingly replacing traditional fuses. Unlike a fuse, which must be replaced once it melts, an MCB is a switch that automatically trips to the OFF position during a fault and can be reset manually.

• Joule's Law: The amount of heat produced in the wire is directly proportional to the square of the current, the resistance of the wire, and the duration for which the current flows. This mathematical relationship is the fundamental reason why the fuse wire melts specifically when the current becomes too high.

Q20. Answer: (a) non-uniform motion

The correct answer is non-uniform motion.

Key Points

• Non-uniform motion is defined as a type of motion where an object covers unequal distances in equal intervals of time. In the case of a freely falling stone, its velocity increases continuously as it descends due to the pull of gravity. Hence, option 1 is correct.

• A stone falling under the influence of gravity alone (ignoring air resistance) experiences a constant acceleration known as acceleration due to gravity (g), which is approximately 9.8 m/s^2 on the surface of the Earth.

• Since the speed of the stone is not constant and increases every second by 9.8 m/s, it cannot be classified as uniform motion or rectilinear motion with constant speed. Hence, options 2 and 4 are incorrect.

• Because there is a definite force (gravitational force) acting on the stone, it possesses a specific acceleration. Therefore, the motion does not have zero acceleration. Hence, option 3 is incorrect.

• The path of the stone is a straight line, making it a rectilinear motion, but because the magnitude of the velocity changes, it is specifically categorized as uniformly accelerated non-uniform motion.

Additional Information

• Uniform Motion:

• An object is said to be in uniform motion if it moves along a straight line and covers equal distances in equal intervals of time, regardless of the duration of the time intervals.

• In this state, the acceleration of the body is zero and the velocity remains constant throughout the journey.

• Acceleration due to Gravity (g):

• It is the acceleration gained by an object due to the gravitational force of a massive body like Earth.

• The standard value of g is 9.80665 m/s^2. This value varies slightly depending on latitude, altitude, and the geological structure of the region.

• It is a vector quantity, always directed towards the center of the planet.

• Rectilinear Motion:

• This refers to motion in a straight line. It can be of two types: Uniform Rectilinear Motion (constant velocity) and Non-Uniform Rectilinear Motion (changing velocity/accelerated).

• A falling stone is an example of Non-Uniform Rectilinear Motion.

Important Points

• Equations of Motion for Free Fall:

• When an object is dropped from rest (initial velocity u = 0), the equations of motion simplify to: $v = gt$, $h = 1/2\ gt^2$, and $v^2 = 2gh$.

• In these equations, v is the final velocity, t is the time taken, and h is the height or displacement.

• Mass Independence:

• In a vacuum (where air resistance is absent), all objects fall with the same acceleration (g) regardless of their mass or shape. This was famously demonstrated by Galileo Galilei.

• Terminal Velocity:

• In a real atmosphere, as an object falls, air resistance increases with speed. Eventually, the upward air resistance equals the downward weight, and the object stops accelerating, moving at a constant speed called terminal velocity.

Q21. Answer: (c) Virtual, erect, and enlarged

The correct answer is Virtual, erect, and enlarged.

Key Points

• A concave mirror is a spherical mirror with a reflecting surface that curves inward, resembling the interior of a bowl. It is also known as a converging mirror because it converges light rays that fall on it.

• When an object is placed between the pole (P) and the principal focus (F) of a concave mirror, the rays of light originating from the object diverge after reflection.

• Because the reflected rays are diverging, they never meet on the side of the object. Instead, they appear to meet at a point behind the mirror when traced backward. This results in the formation of a virtual image.

• The image formed in this specific position is erect (upright) and enlarged (magnified), meaning the size of the image is greater than the size of the object. Hence, the correct answer is Virtual, erect, and enlarged.

• This is a unique case for a concave mirror because, for all other object positions (such as at F, between C and F, at C, or beyond C), the image formed is real and inverted.

Additional Information

• Common Uses: Due to its ability to form an enlarged and erect image when the object is close, this property of the concave mirror is utilized in shaving mirrors and makeup mirrors to see a larger view of the face. Dentists also use concave mirrors to see large images of the teeth of patients.

• Image Formation at Other Positions:

• At Infinity: The image is formed at the focus (F), and it is real, inverted, and highly diminished (point-sized).

• Beyond Center of Curvature (C): The image is formed between F and C, and it is real, inverted, and diminished.

• At Center of Curvature (C): The image is formed at C, and it is real, inverted, and the same size as the object.

• Between C and F: The image is formed beyond C, and it is real, inverted, and enlarged.

• At Focus (F): The image is formed at infinity, and it is real, inverted, and highly enlarged.

• Convex Mirrors: Unlike concave mirrors, convex mirrors always form a virtual, erect, and diminished image, regardless of the object's distance from the mirror. They are widely used as rear-view mirrors in vehicles.

Important Points

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

• Magnification (m): It is the ratio of the height of the image to the height of the object ($m = h'/h$). It is also expressed as $m = -v/u$.

• In the case of an object between P and F, the magnification is positive and greater than 1.

• Sign Convention: According to the New Cartesian Sign Convention, distances measured in the direction of incident light are positive, while those measured against it are negative. For a concave mirror, the focal length is always negative.

• Radius of Curvature: The distance between the pole and the center of curvature is called the radius of curvature (R), and it is equal to twice the focal length (R = 2f).

Q22. Answer: (b) the image height to the object height

The correct answer is the image height to the object height.

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

• It is represented by the letter m. If h is the height of the object and h' is the height of the image, then the magnification is given by m = h' / h.

• Magnification is also related to the object distance (u) and the image distance (v). This relationship is expressed as m = v / u for lenses.

• It is a unitless quantity or dimensionless because it is the ratio of two similar lengths.

• The value of magnification gives information about the size and nature of the image formed by the lens relative to the object.

• Sign Convention for Magnification:

• If the magnification has a negative sign, the image is real and inverted.

• If the magnification has a positive sign, the image is virtual and erect.

• Magnitude of Magnification:

• If |m| > 1, the image is enlarged (larger than the object).

• If |m| < 1, the image is diminished (smaller than the object).

• If |m| = 1, the image is of the same size as the object.

• Concave Lens:

• A concave lens (diverging lens) always produces a virtual, erect, and diminished image for all positions of the object.

• Therefore, the magnification for a concave lens is always positive and less than 1.

• Convex Lens:

• A convex lens (converging lens) can produce real or virtual images depending on the object's position.

• The magnification can be positive (when the object is between the focus and optical center) or negative (when the object is beyond the focus).

• The Lens Formula is used to calculate image or object distances and is given by 1/f = 1/v - 1/u, where f is the focal length.

• According to the Cartesian sign convention, the height of the object is usually taken as positive as it is placed above the principal axis.

• The height of a virtual image is taken as positive, while the height of a real image is taken as negative.

• In optical instruments like microscopes and telescopes, magnification is a critical factor for determining the resolving power and viewing capacity of the device.

• The Power of a lens (P) is the reciprocal of its focal length in meters (P = 1/f), and it is measured in Dioptres (D).

Q23. Answer: (d) Statement A is correct but statement B is incorrect

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

Key Points

• Vegetative propagation is a type of asexual reproduction in which new plants are produced from the vegetative parts of the parent plant, such as the root, stem, or leaves, without the involvement of seeds.

• One of the primary advantages of this method is that plants raised by vegetative propagation can bear flowers and fruits earlier than those produced from seeds. This is because the plant bypasses the long juvenile phase associated with seed germination and early growth. Hence, statement A is correct.

• In vegetative propagation, since the offspring are produced from a single parent without the fusion of gametes (fertilization), the new plants are genetically similar or identical to the parent plant. These plants are often referred to as clones. Hence, statement B is incorrect.

• This method is particularly useful for plants that have lost the capacity to produce seeds, such as Banana, Orange, Rose, and Jasmine.

• The offspring maintain the desirable characteristics of the parent plant consistently across generations, which is highly beneficial in agriculture and horticulture for maintaining crop quality.

Additional Information

• Natural Methods of Vegetative Propagation:

• By Roots: Some plants like Sweet Potato and Dahlia develop adventitious buds on their roots which grow into new plants.

• By Stems: Modified stems like Tubers (Potato), Rhizomes (Ginger and Turmeric), and Bulbs (Onion) are common natural

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storage organs used for propagation.

• By Leaves: Plants like Bryophyllum produce adventitious buds along their leaf margins; when these leaves fall on moist soil, the buds develop into new plantlets.

• Artificial Methods of Vegetative Propagation:

• Cutting: A small part of the stem with nodes is buried in the soil, commonly seen in Rose, Sugarcane, and Grapes.

• Grafting: Joining two different plants (the scion and the stock) so they grow as a single plant, widely used in Mango and Citrus fruits.

• Layering: A branch of the plant is bent to the ground and covered with soil to induce root formation while still attached to the parent, used for Jasmine and Lemon.

Important Points

• Genetic Uniformity: Because there is no genetic recombination (which occurs during meiosis in sexual reproduction), there is no variation. While this preserves good traits, it also means the entire population is equally vulnerable to the same diseases or environmental changes.

• Tissue Culture (Micropropagation): This is a modern technique where plant cells or tissues are grown in a sterile nutrient medium under controlled conditions. It allows for the rapid production of disease-free plants in a very short time and limited space.

• Survival Rate: Vegetatively propagated plants often have a higher survival rate compared to seedlings because they are already partially developed and have access to the parent's nutrient reserves during the initial stages of growth.

• Economic Significance: This method is vital for the commercial production of fruits and flowers where uniformity in size, taste, and appearance is required for the market.

Q24. Answer: (d) White

The correct answer is White.

Key Points

• The reaction between Silver Nitrate (AgNO3) and Sodium Chloride (NaCl) is a classic example of a double displacement reaction, also known as a precipitation reaction.

• When an aqueous solution of Silver Nitrate is added to an aqueous solution of Sodium Chloride, an exchange of ions occurs to form Silver Chloride (AgCl) and Sodium Nitrate (NaNO3).

• Silver Chloride is highly insoluble in water and settles out of the solution as a solid mass known as a precipitate.

• The physical observation of this chemical change is the immediate formation of a curdy white precipitate of Silver Chloride. Hence, the statement regarding the white colour is correct.

• The chemical equation for the reaction is: $AgNO_3 (aq) + NaCl (aq) \rightarrow AgCl (s) \downarrow + NaNO_3 (aq)$.

Additional Information

• Silver Halides and Colours:

• While Silver Chloride forms a white precipitate, other silver halides exhibit different colours.

• Silver Bromide (AgBr) forms a pale yellow or cream-coloured precipitate.

• Silver Iodide (AgI) forms a distinct bright yellow precipitate.

• Double Displacement Reaction: This occurs when the cations and anions of two different compounds switch places, forming two entirely new compounds. One of these products must be a precipitate, a gas, or a molecular compound like water for the reaction to proceed.

• Solubility Rules: According to general solubility rules, all nitrates (NO_3^-) are soluble in water, while most silver salts (except silver nitrate and silver chlorate) are insoluble. This explains why AgCl precipitates while $NaNO_3$ remains in the dissolved state.

• Analytical Chemistry: This specific reaction is widely used as a qualitative test to detect the presence of chloride ions in a given substance. If the addition of silver nitrate produces a white precipitate that is soluble in dilute ammonia, the presence of chloride is confirmed.

Important Points

• Photolytic Decomposition: Silver Chloride is sensitive to light. When exposed to sunlight, the white precipitate of AgCl decomposes into grey metallic silver and chlorine gas.

• Equation for Decomposition: $2AgCl (s) \rightarrow 2Ag (s) + Cl_2 (g)$ (in the presence of UV light).

• Historical Use: Due to its light-sensitive nature, silver chloride was fundamentally important in the development of black-and-white photography during the 19th century.

• Laboratory Safety: Silver nitrate is a strong oxidizing agent and can cause dark stains on the skin and clothes, which is why it must be handled with care in the chemistry laboratory.

Q25. Answer: (d) Both A and R are true, and R is the correct explanation of A.

The correct answer is Both A and R are true, and R is the correct explanation of A.

Key Points

• Assertion (A) states that a soap solution appears cloudy. This occurs because soap molecules do not form a true solution in water at higher concentrations; instead, they form a colloidal solution. Hence, Assertion (A) is correct.

• Reason (R) explains that soap micelles are large enough to scatter light. In a soap solution, the clusters of molecules, known as micelles, have dimensions typically ranging from 1 to 1000 nanometers. Hence, Reason (R) is correct.

• When a beam of light passes through a colloidal soap solution, the micelles scatter the light in all directions. This phenomenon is known as the Tyndall Effect.

• Because the light is scattered rather than passing directly through (as it would in a clear, true solution like salt water), the solution appears translucent or cloudy to the naked eye.

• Since the scattering of light by these large particles is the direct cause of the visual cloudiness, Reason (R) provides a scientifically accurate explanation for Assertion (A). Hence, both statements are true and R correctly explains A.

Additional Information

• Structure of Soap Molecules:

• Soap is a sodium or potassium salt of long-chain carboxylic acids (fatty acids).

• Each molecule has two distinct parts: a hydrophilic (water-loving) head which is ionic and a hydrophobic (water-fearing) tail made of a long hydrocarbon chain.

• Micelle Formation:

• When soap is added to water, the hydrophobic tails cluster together to stay away from water, while the hydrophilic heads face outward into the water.

• This unique orientation results in the formation of spherical aggregates called micelles.

• Colloidal Nature:

• A colloid is a mixture where one substance consisting of microscopic dispersed particles is suspended throughout another substance.

• Unlike True Solutions (where particle size is less than 1 nanometer), colloids have particles large enough to interfere with light but small enough not to settle down under gravity.

Important Points

• Critical Micelle Concentration (CMC): This is the specific concentration of surfactants above which micelles begin to form. Below this concentration, soap acts like a normal electrolyte and the solution may appear clearer.

• Tyndall Effect: Named after the 19th-century physicist John Tyndall, who first studied the scattering of light by colloidal particles in detail. It is the reason why the path of light becomes visible when passing through milk, fog, or a soap solution.

• Cleaning Action: The cloudiness of the soap solution is also related to its ability to clean. The hydrophobic center of the micelle traps oil and grease, allowing them to be washed away with water.

• Solubility: Soap is soluble in water, but the formation of large molecular clusters (micelles) changes the optical properties of the resulting mixture from transparent to opaque/cloudy.

Q26. Answer: (a) 38400

Shortcut Trick

Product of fractions method: 1/10 × 2/5 × 1/3 × Number = 512

Number = 512 × 10 × 5/2 × 3

Number = 512 × 5 × 5 × 3 = 512 × 75

Number = 38400

Therefore The correct answer is 38400.

Alternate Method

Given:

10% of 40% of 1/3 of a number = 512

Let the number be x.

=> (10/100) × (40/100) × (1/3) × x = 512

=> (1/10) × (2/5) × (1/3) × x = 512

=> (2/150) × x = 512

=> x = (512 × 150) ÷ 2

=> x = 256 × 150

=> x = 38400

Therefore The correct answer is 38400.

Additional Information

Percentage to Fraction Conversion

To simplify calculations, convert percentages to fractions: 10% = 1/10, 20% = 1/5, 25% = 1/4, 40% = 2/5, and 50% = 1/2.

Successive Percentage Application

When multiple percentages are applied to a single value, the result is the product of the individual multiplying factors times the original value.

Base Value Concept

Always identify the base value (the number x) to which percentages and fractions are being applied to avoid calculation errors.

Q27. Answer: (b) 13/20

Shortcut Trick

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

Here, let a = 0.45 and b = 0.2.

Value = a + b = 0.45 + 0.2 = 0.65.

Converting decimal to fraction: 0.65 = 65/100 = 13/20.

Therefore The correct answer is 13/20.

Alternate Method

Given:

Expression: $((0.45)^3 + (0.2)^3) \div ((0.45)^2 - 0.45 \times 0.2 + (0.2)^2)$

Formula Used:

Sum of two cubes: $x^3 + y^3 = (x + y)(x^2 - xy + y^2)$

Calculations:

=> Let x = 0.45 and y = 0.2.

=> Numerator = $(0.45 + 0.2) \times ((0.45)^2 - (0.45 \times 0.2) + (0.2)^2)$

=> Expression = $[(0.45 + 0.2) \times ((0.45)^2 - 0.45 \times 0.2 + (0.2)^2)] \div [(0.45)^2 - 0.45 \times 0.2 + (0.2)^2]$

=> Cancelling common terms in numerator and denominator: Expression = 0.45 + 0.2

=> Expression = 0.65

=> 0.65 = 65 ÷ 100

=> Simplifying the fraction by dividing by 5: 13/20

Therefore The correct answer is 13/20.

Additional Information

Difference of Cubes Identity

The formula for the difference of two cubes is $a^3 - b^3 = (a - b)(a^2 + ab + b^2)$.

Decimal to Fraction Conversion

To convert a decimal to a fraction, place the number over its place value (e.g., 0.65 = 65/100) and simplify to the lowest terms.

BODMAS Rule

Always follow the order of operations: Brackets, Orders (powers/roots), Division/Multiplication, and Addition/Subtraction.

Q28. Answer: (a) 51.9

Shortcut Trick

Apply the Empirical Formula directly: Mode = 3 × Median − 2 × Mean.

Rearranging for Mean: 2 × Mean = 3 × Median − Mode.

Calculation: 2 × Mean = 3 × 58 − 70.2 = 174 − 70.2 = 103.8.

Final Step: Mean = 103.8 ÷ 2 = 51.9.

Therefore The correct answer is 51.9.

Alternate Method

Given:

Mode of the data = 70.2

Median of the data = 58

Formula Used:

The relationship between Mean, Median, and Mode is given by the empirical formula:

Mode = 3 × Median − 2 × Mean

Calculations:

=> 70.2 = 3 × 58 − 2 × Mean

=> 70.2 = 174 − 2 × Mean

=> 2 × Mean = 174 − 70.2

=> 2 × Mean = 103.8

=> Mean = 103.8 ÷ 2

=> Mean = 51.9

Therefore The correct answer is 51.9.

Additional Information

Symmetrical Distribution

In a perfectly symmetrical distribution, the values of Mean, Median, and Mode are identical (Mean = Median = Mode).

Skewed Distribution

For a Positively Skewed distribution, Mean > Median > Mode. For a Negatively Skewed distribution, Mode > Median > Mean.

Karl Pearson's Coefficient

The empirical formula is used for moderately asymmetrical distributions to estimate a missing measure of central tendency.

Q29. Answer: (a) 50

Shortcut Trick

Simplify ratio: 4/10 : 20/18 : 20/11 → 2/5 : 10/9 : 20/11.

Multiply by LCM(5, 9, 11) = 495: (2/5 × 495) : (10/9 × 495) : (20/11 × 495) = 198 : 550 : 900.

Difference (900 − 198) units = 702 units → 39.

1 unit = 39 ÷ 702 = 1/18.

Largest number = 900 × (1/18) = 50.

Therefore The correct answer is 50.

Alternate Method

Given: Ratio of three numbers = 4/10 : 20/18 : 20/11

=> Simplified Ratio = 2/5 : 10/9 : 20/11

=> Multiplying by LCM of denominators (495):

=> First Number = 2/5 × 495 = 198

=> Second Number = 10/9 × 495 = 550

=> Third Number = 20/11 × 495 = 900

=> Difference between Greatest and Smallest = 900 − 198 = 702 units

=> 702 units = 39

=> 1 unit = 39/702 = 1/18

=> Largest number = 900 units = 900 × (1/18) = 50

Therefore The correct answer is 50.

Additional Information

Ratio Simplification

To convert a fractional ratio a/b : c/d into integers, multiply each term by the Least Common Multiple (LCM) of the denominators b and d.

Proportional Parts

If a total quantity is divided in ratio a:b:c, the value of the largest part is [Maximum(a,b,c) / (a+b+c)] × Total.

Comparison of Fractions

For two fractions a/b and c/d, cross multiply (a×d and b×c) to quickly determine which is larger without finding common denominators.

Q30. Answer: (c) Increase by 2%

Shortcut Trick

Net percentage change formula = a + b + (ab/100)

Here, increase in height (a) = +20% and decrease in base (b) = −15%

Net change = 20 − 15 + [(20 × −15) ÷ 100]

Net change = 5 − 3 = +2%

Positive sign indicates an increase.

Therefore The correct answer is Increase by 2%.

Alternate Method

Given:

Initial Height (H1) = 100, New Height (H2) = 120

Initial Base (B1) = 100, New Base (B2) = 85

Calculations:

=> Initial Area (A1) = 1/2 × B1 × H1 = 1/2 × 100 × 100 = 5000

=> New Area (A2) = 1/2 × B2 × H2 = 1/2 × 85 × 120 = 85 × 60 = 5100

=> Area Change = 5100 − 5000 = 100

=> Percentage Change = (Change ÷ Original Area) × 100

=> Percentage Change = (100 ÷ 5000) × 100 = 2%

Therefore The correct answer is Increase by 2%.

Additional Information

Area of Triangle

Basic formula: Area = 1/2 × base × height. Changes in both parameters lead to a cumulative effect on the area.

Successive Percentage Change

When a value depends on the product of two variables, the net % change is given by x + y + xy/100, where x and y are the percentage changes in those variables.

Base Change Rule

If one dimension increases by x% and the other decreases by y%, the net effect is an increase if (x − y − xy/100) is positive.

Q31. Answer: (a) Rs. 10,043

Shortcut Trick

Effective Rate of Interest for 2 years at 10% compounded annually = 10 + 10 + (10 × 10)/100 = 21%.

Total Amount = 100% (Principal) + 21% (Interest) = 121% of Principal.

Amount = 8,300 × (121/100) = 83 × 121.

Amount = Rs. 10,043.

Therefore The correct answer is Rs. 10,043.

Alternate Method

Given:

Principal (P) = Rs. 8,300

Rate (R) = 10% per annum

Time (n) = 2 years

Formula Used:

Amount (A) = $P(1 + R/100)^n$

Calculations:

=> $A = 8300 \times (1 + 10/100)^2$

=> $A = 8300 \times (110/100) \times (110/100)$

=> $A = 8300 \times 1.1 \times 1.1$

=> $A = 8300 \times 1.21$

=> $A = 83 \times 121$

=> A = Rs. 10,043

Therefore The correct answer is Rs. 10,043.

Additional Information

Effective Rate for Compound Interest

For a rate R% for 2 years, the effective interest rate is R + R + (R × R)/100.

Difference between CI and SI

For 2 years, the difference between Compound Interest and Simple Interest is $P \times (R/100)^2$.

Compound Interest Formula

Interest (CI) = Amount − Principal = $P[(1 + R/100)^n - 1]$.

Q32. Answer: (a) 400

Shortcut Trick

Savings = 20% => Expenditure = 100% − 20% = 80%

Given, 80% → Rs. 320
1% → Rs. 4
Total Income (100%) → 100 × 4 = Rs. 400
Therefore The correct answer is Rs. 400.
Alternate Method
Given:
Savings percentage = 20%
Expenditure = Rs. 320
Formula: Income = Expenditure + Savings
=> Let Total Income be x
=> Savings = 20% of x = 0.20x
=> Expenditure = Income − Savings
=> 320 = x − 0.20x
=> 320 = 0.80x
=> x = 320 ÷ 0.80
=> x = 400
Therefore The correct answer is Rs. 400.
Additional Information
Income Components
Income is always the sum of Expenditure and Savings. If any two are known, the third can be calculated.
Percentage Base Change
When Savings % is given, the Expenditure % is always (100 − Savings %). Here, 100% represents the Total Income.
Ratio Method
20% Savings = 1/5 of Income. This means if Income is 5 units, Savings is 1 unit and Expenditure is 4 units.

Q33. Answer: (c) 7^1

Shortcut Trick
$49 = 7^2$
$(49)^n = (7^2)^n = 7^{2n}$
Expression = $(7^{2n} \times 7) \div 7^{2n}$
Cancel => = 7
Therefore Answer = 7^1
Alternate Method
Given:
$((49)^n \times 7) \div (7^{2n})$
Concept Used:
Laws of exponents
Calculation:
=> $49 = 7^2$
=> $(49)^n = (7^2)^n = 7^{2n}$
=> Substitute => $(7^{2n} \times 7) \div 7^{2n}$
=> = 7^(2n+1) ÷ 7^{2n}
=> = 7^((2n+1 − 2n))
=> = 7^1
Therefore The correct answer is 7^1.
Additional Information
Exponent Rule
a^m × a^n = a^(m+n)
Division Rule
a^m ÷ a^n = a^(m−n)
Power of Power
(a^m)^n = a^(mn)

Shortcut Tip

Always convert numbers to same base first

Q34. Answer: (a) Increase by 30%

Shortcut Trick

Let TV cost = 100, then Washing Machine (WM) cost = 75.

Initial total cost of 6 WM and 3 TV = (6 × 75) + (3 × 100) = 450 + 300 = 750.

New WM cost = 75 × 1.88 = 141; New TV cost = 100 × 0.43 = 43.

New total cost = (6 × 141) + (3 × 43) = 846 + 129 = 975.

Percentage change = [(975 − 750) ÷ 750] × 100 = (225 ÷ 750) × 100 = 30%.

Therefore The correct answer is Increase by 30%.

Alternate Method

Given: Cost of WM is 25% less than TV. WM cost ↑ 88%, TV cost ↓ 57%. Formulas: New Value = Old Value × (100 ± Change%) ÷ 100 | %Change = (New − Old) ÷ Old × 100.

=> Let TV cost = 100x and WM cost = 75x. => Initial cost of 6 WM and 3 TV = 6(75x) + 3(100x) = 450x + 300x = 750x. => Final cost = 6(75x × 1.88) + 3(100x × 0.43) = 6(141x) + 3(43x) = 846x + 129x = 975x. => Change = 975x − 750x = 225x. => %Change = (225x ÷ 750x) × 100 = 30%.

Therefore The correct answer is Increase by 30%.

Additional Information

Percentage Change in Weighted Average

When multiple items with different initial costs and quantities undergo price changes, the total percentage change is the weighted average of individual percentage changes based on their initial total value contributions.

Cost Price Scaling

Using a base value of 100 for the reference item (TV) simplifies calculations involving percentage increases and decreases.

Q35. Answer: (b) 9,600

Shortcut Trick

Ratio of investments of Laxmi, Dhruv, and Gauri = 13 : 6 : 12.

Sum of ratio parts = 13 + 6 + 12 = 31 units.

Total profit = Rs. 37,200, which represents 75% of the total investment.

Total Investment = (37,200 ÷ 75) × 100 = Rs. 49,600.

Dhruv investment = (Investment ratio of Dhruv ÷ Total ratio sum) × Total Investment.

Dhruv investment = (6 ÷ 31) × 49,600 = 6 × 1,600 = Rs. 9,600.

Therefore The correct answer is Rs. 9,600.

Alternate Method

Given → Investment ratio = 13 : 6 : 12 | Profit = Rs. 37,200 | Profit = 75% of Investment. Formulas: Total Investment = (Profit ÷ Profit%) × 100 | Individual Investment = (Individual Ratio ÷ Total Ratio) × Total Investment.

=> Let the investments be 13x, 6x, and 12x. Total investment = 31x. => According to the question, 75% of 31x = 37,200. => (75 ÷ 100) × 31x = 37,200. => (3 ÷ 4) × 31x = 37,200. => 31x = (37,200 × 4) ÷ 3 = 12,400 × 4 = 49,600. => x = 49,600 ÷ 31 = 1,600. => Dhruv investment = 6x = 6 × 1,600 = Rs. 9,600.

Therefore The correct answer is Rs. 9,600.

Additional Information

Partnership Basics

In a partnership, if the time period of investment is the same for all partners, the profit is shared in the ratio of their investments.

Profit and Investment Relationship

Profit = Investment × Time. If Time is constant, Profit prop. to Investment. Profit percentage is calculated on the Total Capital invested.

Q36. Answer: (c) 20.45

Shortcut Trick

Total Quantity = 52 + 47 = 99 books

Total Expenditure = 1120 + 905 = Rs. 2025

Average Price = 2025 ÷ 99 = 225 ÷ 11

225 ÷ 11 ≈ 20.45

Therefore The correct answer is Rs. 20.45.

Alternate Method

Given:

Books from Shop 1 = 52 | Price = Rs. 1120

Books from Shop 2 = 47 | Price = Rs. 905

Formula Used:

Average = (Total Sum of Observations) ÷ (Total Number of Observations)

Calculations:

=> Total number of books = 52 + 47 = 99

=> Total amount spent = Rs. 1120 + Rs. 905 = Rs. 2025

=> Average price per book = 2025 ÷ 99

=> Average price = (2025 ÷ 9) ÷ (99 ÷ 9) = 225 ÷ 11

=> Average price = 20.4545...

=> Rounding off to two decimal places, we get 20.45

Therefore The correct answer is Rs. 20.45.

Additional Information

Weighted Average Concept

When two groups with different quantities (n1, n2) and different averages (A1, A2) are combined, the total average is calculated as (n1A1 + n2A2) ÷ (n1 + n2).

Rounding Off Rules

To round to two decimal places, check the third decimal digit. If it is 5 or more, add 1 to the second decimal digit. If it is less than 5, keep the second decimal digit as it is.

Simplified Division

Always check for common factors in the numerator and denominator to simplify calculations. Here, 2025 and 99 are both divisible by 9 (Sum of digits 2+0+2+5=9 and 9+9=18).

Q37. Answer: (c) 68921

Shortcut Trick

The unit digit of the given edge is 1.

The volume of a cube is calculated as $(\text{Edge})^3$.

The unit digit of the result must be $1^3 = 1$.

Only option (3) ends with the digit 1.

Therefore The correct answer is 68921 m^3.

Alternate Method

Given: Edge (a) of the cube = 41 m

Formula: Volume (V) of a cube = a^3

=> V = 41 × 41 × 41

=> V = 1681 × 41

=> V = 68921 m^3.

Therefore The correct answer is 68921 m^3.

Additional Information

Total Surface Area of a Cube

The total area of all six square faces is given by the formula $6a^2$.

Diagonal of a Cube

The length of the longest space diagonal connecting opposite corners is $a\sqrt{3}$.

Lateral Surface Area

The area of the four vertical side faces of the cube is $4a^2$.

Q38. Answer: (d) 3°

Shortcut Trick

In any quadrilateral, the angle formed by the bisectors of two adjacent angles is equal to half the sum of the other two angles.

angle STR = (angle P + angle Q) ÷ 2

25.5° = (angle P + angle Q) ÷ 2 => angle P + angle Q = 51°

Ratio P : Q = 8 : 9 => Sum = 17 units = 51° => 1 unit = 3°
Difference = 9 − 8 = 1 unit = 3°.
Therefore The correct answer is 3°.
Alternate Method
Given:
angle STR = 25.5°
Ratio angle P : angle Q = 8 : 9
Formula Used:
Sum of interior angles of a triangle = 180°
Sum of interior angles of a quadrilateral = 360°
Calculations:
=> In triangle STR, angle TSR + angle TRS + angle STR = 180°
=> Since ST and RT are angle bisectors, angle TSR = angle S ÷ 2 and angle TRS = angle R ÷ 2
=> (angle S ÷ 2) + (angle R ÷ 2) + 25.5° = 180°
&rArr

Q39. Answer: (d) 134

Shortcut Trick
Average Speed when time intervals are equal is simply the Arithmetic Mean of the speeds.
Since each interval is exactly 1 hour, Average Speed = (158 + 110) ÷ 2
=> 268 ÷ 2 = 134 km/hr
Therefore The correct answer is 134 km/hr.
Alternate Method
Given:
Distance in 1^(st) hour (D1) = 158 km
Distance in 2^(nd) hour (D2) = 110 km
Time taken for each part (t1, t2) = 1 hour
Formula Used:
Average Speed = Total Distance ÷ Total Time
Calculations:
=> Total Distance = 158 + 110 = 268 km
=> Total Time = 1 + 1 = 2 hours
=> Average Speed = 268 ÷ 2
=> Average Speed = 134 km/hr
Therefore The correct answer is 134 km/hr.
Additional Information
Equal Distance Case
If a car travels equal distances at speeds x and y, then Average Speed = 2xy ÷ (x + y).
Unit Conversion
To convert km/hr to m/s, multiply by 5/18. To convert m/s to km/hr, multiply by 18/5.
Relative Speed
When two objects move in the same direction, relative speed is (u − v). In opposite directions, it is (u + v).

Q40. Answer: (c) 78%

Shortcut Trick
Net change formula for Mark-up (a) and Discount (b) is [a − b − (ab ÷ 100)].
Here, a = 10% (Mark-up) and b = 80% (Discount).
Net Profit/Loss % = 10 − 80 − (10 × 80 ÷ 100)
=> −70 − 8 = −78%
The negative sign indicates a Loss of 78%.
Therefore The correct answer is 78%.
Alternate Method

Given: Mark-up% = 10%, Discount% = 80%.
Formulas: MP = CP × (100 + Mark-up%) ÷ 100 | SP = MP × (100 − Discount%) ÷ 100 | Loss% = [(CP − SP) ÷ CP] × 100
=> Let the Cost Price (CP) be 100.
=> Marked Price (MP) = 100 + 10% of 100 = 110.
=> Selling Price (SP) = 110 − 80% of 110 = 110 − 88 = 22.
=> Loss = CP − SP = 100 − 22 = 78.
=> Loss Percentage = (78 ÷ 100) × 100 = 78%.
Therefore The correct answer is 78%.
Additional Information
Marked Price and Discount
Discount is always calculated on the Marked Price (MP). SP = MP × (100 − D)%.
Effective Percentage Change
When a value is increased by x% and then decreased by y%, the net change is [x − y − (xy/100)]%.

Q41. Answer: (c) 3

Shortcut Trick
Net efficiency = Filling efficiency − Emptying efficiency
LCM of 3 and 6 = 6 units (Total Capacity)
Efficiency: Pipe A = 6/3 = 2, Pipe B = 6/6 = 1
Time to fill half tank (3 units) = 3 ÷ (2 − 1) = 3 minutes
Therefore The correct answer is 3 minutes.
Alternate Method
Given: Filling time = 3 min, Emptying time = 6 min.
Formula: Work = Efficiency × Time

Pipe Type	Time (min)	Total Capacity (LCM) = 6 units	Efficiency
Filling Pipe	3	+2 units/min	
Emptying Pipe	6	6	−1 units/min

=> Net efficiency of both pipes = 2 − 1 = 1 unit/min
=> Capacity of half the tank = 6 ÷ 2 = 3 units
=> Time required = 3 units ÷ 1 unit/min = 3 minutes
Therefore The correct answer is 3 minutes.
Additional Information
Net Work in Pipes & Cisterns
The work done by an inlet pipe is positive, while the work done by an outlet pipe (leak) is negative.
Combined Time Formula
If pipe A fills in X and pipe B empties in Y, combined time T = (X × Y) ÷ (Y − X), provided Y > X.

Q42. Answer: (b) 30%

Shortcut Trick
Let the total quantity be 2 units. Half quantity is 1 unit.
Total required gain = 2 units × 20% = 40%
Gain from first half = 1 unit × 10% = 10%
Required gain from remaining half = 40% − 10% = 30%
Since the remaining quantity is 1 unit, the gain percentage = 30% ÷ 1 = 30%.
Therefore The correct answer is 30%.
Alternate Method
Given: Total CP = Rs. 8,000, Gain on first half = 10%, Total desired gain = 20%.
Formulas: Profit = SP − CP | SP = CP × (100 + P%) ÷ 100
=> Total Cost Price (CP) = Rs. 8,000
=> Total Selling Price (SP) required for 20% gain = 8000 × (120 ÷ 100) = Rs. 9,600
=> CP of half goods = 8000 ÷ 2 = Rs. 4,000

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=> SP of first half at 10% gain = 4000 × (110 ÷ 100) = Rs. 4,400

=> Required SP of remaining half = 9600 − 4400 = Rs. 5,200

=> Profit needed on remaining half = 5200 − 4000 = Rs. 1,200

=> Profit% on remaining = (1200 ÷ 4000) × 100 = 30%

Therefore The correct answer is 30%.

Additional Information

Weighted Average Method

When a transaction is split, the overall profit % is the weighted average of individual profit percentages: Total P% = (n1p1 + n2p2) ÷ (n1 + n2).

Independent of Value

In problems involving ratios or fractions of goods, the actual monetary value (like Rs. 8,000) does not affect the final percentage result.

Q43. Answer: (a) 23

Shortcut Trick

If $a + 1/a = k$, then $a^2 + 1/a^2 = k^2 - 2$.

Let $a = \sqrt{x}$, then $a^2 = x$.

Given $\sqrt{x} + 1/\sqrt{x} = 5$, we have $k = 5$.

Required value $x + 1/x = 5^2 - 2 = 25 - 2 = 23$.

Therefore The correct answer is 23.

Alternate Method

Given:

$\sqrt{x} + 1/\sqrt{x} = 5$

Formula Used:

$(a + b)^2 = a^2 + b^2 + 2ab$

Calculations:

Square both sides of the given algebraic equation:

=> $(\sqrt{x} + 1/\sqrt{x})^2 = 5^2$

=> $(\sqrt{x})^2 + (1/\sqrt{x})^2 + 2 \times (\sqrt{x}) \times (1/\sqrt{x}) = 25$

=> $x + 1/x + 2 = 25$

=> $x + 1/x = 25 - 2$

=> $x + 1/x = 23$

Therefore The correct answer is 23.

Additional Information

Square of Difference

If $a - 1/a = k$, then $a^2 + 1/a^2 = k^2 + 2$.

Cube of Sum

If $a + 1/a = k$, then $a^3 + 1/a^3 = k^3 - 3k$.

Relation between Identities

$(a + b)^2 = (a - b)^2 + 4ab$.

Standard Algebraic Identity

$(a - b)^2 = a^2 + b^2 - 2ab$.

Q44. Answer: (b) 1080 m

Shortcut Trick

Relative Speed in same direction = 114 − 60 = 54 km/hr.

Convert to m/s: 54 × (5/18) = 15 m/s.

Total distance (2L) = Speed × Time = 15 × 144 = 2160 m.

Length of one train (L) = 2160 ÷ 2 = 1080 m.

Therefore The correct answer is 1080 m.

Alternate Method

Given:

Speed of Rajdhani Express (S1) = 114 km/hr

Speed of Garib Rath Express (S2) = 60 km/hr
Time taken (t) = 144 seconds
Lengths are equal: L1 = L2 = L
Formula Used:
Relative Speed (Same direction) = S1 − S2
Total Distance = Sum of lengths of trains = L1 + L2
Distance = Speed × Time
Calculations:
=> Relative Speed = 114 − 60 = 54 km/hr
=> Speed in m/s = 54 × (5/18) = 15 m/s
=> Total Distance = 2L
=> 2L = 15 × 144
=> 2L = 2160 m
=> L = 2160 ÷ 2 = 1080 m
Therefore The correct answer is 1080 m.
Additional Information
Relative Speed Concepts
When moving in the same direction, relative speed is (S1 − S2). When moving in opposite directions, it is (S1 + S2).
Unit Conversion
To convert km/hr to m/s, multiply by 5/18. To convert m/s to km/hr, multiply by 18/5.
Train Crossing Distance
When a train crosses another train or a bridge, the total distance covered is the sum of their lengths (L1 + L2).

Q45. Answer: (c) 17

Shortcut Trick
For a Square, the Perimeter is 4 times its Side.
Side = Perimeter ÷ 4
Side = 68 ÷ 4 = 17 m
Therefore The correct answer is 17 m.
Alternate Method
Given:
Perimeter of the Square = 68 m
Formula Used:
Perimeter of a Square = 4 × Side
Calculations:
=> Let the Side of the Square be 'a' meters.
=> 4 × a = 68
=> a = 68 ÷ 4
=> a = 17 m
Therefore The correct answer is 17 m.
Additional Information
Area of a Square
The total space occupied by a square is calculated as Side × Side or a^2.
Diagonal of a Square
The Diagonal of a square with side 'a' is given by the formula $d = a\sqrt{2}$.
Properties of a Square
All four sides are equal, all internal angles are 90°, and diagonals bisect each other at 90°.

Q46. Answer: (d) 5

Shortcut Trick
Directly substitute the standard trigonometric values: cot 45° = 1, sec 30° = 2/√3, and sin 30° = 1/2.
Expression → $2(1)^2 + 3(2/\sqrt{3})^2 - 4(1/2)^2$

=> 2(1) + 3(4/3) − 4(1/4) = 2 + 4 − 1 = 5.

Therefore The correct answer is 5.

Alternate Method

Given: $2\cot^2 45° + 3\sec^2 30° - 4\sin^2 30°$

Formula Used: Values of trigonometric ratios at specific angles.

=> $2 \times (1)^2 + 3 \times (2/\sqrt{3})^2 - 4 \times (1/2)^2$

=> $2 \times 1 + 3 \times (4/3) - 4 \times (1/4)$

=> 2 + 4 − 1

=> 6 − 1 = 5

Therefore The correct answer is 5.

Additional Information

Trigonometric Identities

Fundamental relations such as $\sin^2\theta + \cos^2\theta = 1$ and $1 + \tan^2\theta = \sec^2\theta$.

Reciprocal Relations

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

Complementary Angles

$\sin(90° - \theta) = \cos\theta$, $\tan(90° - \theta) = \cot\theta$, and $\sec(90° - \theta) = \operatorname{cosec}\theta$.

Q47. Answer: (c) 17%

Shortcut Trick

Net change formula: Net % = a + b + (a × b) ÷ 100.

Here, markup a = +80% and discount b = −35%.

Net Profit % = 80 − 35 + [80 × (−35)] ÷ 100.

Net Profit % = 45 − 2800 ÷ 100 = 45 − 28 = 17%.

Therefore The correct answer is 17%.

Alternate Method

Given: Markup = 80% over CP, Discount = 35% on MP.

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

=> Let Cost Price (CP) = 100.

=> Marked Price (MP) = 100 + 80% of 100 = 180.

=> Selling Price (SP) = 180 − 35% of 180.

=> SP = 180 − (35 ÷ 100 × 180) = 180 − 63 = 117.

=> Profit = SP − CP = 117 − 100 = 17.

=> Profit % = (17 ÷ 100) × 100 = 17%.

Therefore The correct answer is 17%.

Additional Information

Markup and Discount Relation

Profit occurs when the markup percentage is greater than the equivalent discount percentage applied to the marked price.

Successive Percentage Application

Markup and Discount are successive operations on the CP. The final result compared to 100 gives the net profit or loss percentage.

Q48. Answer: (b) 66 min

Shortcut Trick

Let total capacity of cistern be LCM(99, 36, 44) = 396 units.

Efficiency of Pipe 1 = 396 ÷ 99 = 4 units/min.

Efficiency of Pipe 2 = 396 ÷ 36 = 11 units/min.

Combined efficiency with Waste Pipe = 396 ÷ 44 = 9 units/min.

Efficiency of Waste Pipe = (4 + 11) − 9 = 6 units/min.

Time taken = 396 ÷ 6 = 66 min.

Therefore The correct answer is 66 min.

Alternate Method

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Pipe Type	Time (min)	Total Work	Efficiency
Inlet Pipe A	99	396	4
Inlet Pipe B	36	11	
A + B − C (Outlet)	44	9	

Given: Filling times for individual pipes and total time when all pipes (including emptying pipe) are open.

Formula Used: Total Work = Efficiency × Time; Net Efficiency = ∑(Inlet Efficiencies) − ∑(Outlet Efficiencies).

=> Let efficiency of emptying pipe be C.

=> Efficiency of Pipe A = 396 ÷ 99 = 4

=> Efficiency of Pipe B = 396 ÷ 36 = 11

=> Net efficiency (A + B − C) = 396 ÷ 44 = 9

=> 4 + 11 − C = 9

=> 15 − C = 9

=> C = 15 − 9 = 6 units/min

=> Time taken by pipe C = Total capacity ÷ Efficiency of C = 396 ÷ 6 = 66 min.

Therefore The correct answer is 66 min.

Additional Information

Pipes and Cisterns Convention

Inlet pipes contribute positive efficiency (+) while outlet or leak pipes contribute negative efficiency (−).

Net Work Formula

If pipe A fills in x hours and pipe B empties in y hours, then net work per hour = (1/x − 1/y). If the result is negative, the tank is being emptied.

Efficiency-Time Relationship

Efficiency is inversely proportional to the time taken to complete the work, provided total work remains constant.

Q49. Answer: (b) 40 years

Shortcut Trick

Let the elder son be x. Then father = 2x and younger son = x − 8.

Total Ratio sum: 2x + x + (x − 8) = 72 => 4x − 8 = 72.

4x = 80 => x = 20.

Father's age = 2 × 20 = 40 years.

Therefore The correct answer is 40 years.

Alternate Method

Given: Sum of ages = 72 years. Father = 2 × Elder son. Younger son = Elder son − 8.

=> Let Elder son's age = E

=> Father's age = 2E

=> Younger son's age = E − 8

=> Sum = Father + Elder son + Younger son = 72

=> 2E + E + (E − 8) = 72

=> 4E − 8 = 72

=> 4E = 80

=> E = 20 years

=> Father's age = 2 × 20 = 40 years

Therefore The correct answer is 40 years.

Additional Information

Ratio of Ages

If age ratio is A:B, then actual ages are Ax and Bx. The sum is (A+B)x.

Ages in Future/Past

If present age is x, then age 'n' years ago was (x − n) and age 'n' years hence will be (x + n).

Age Difference

The difference between the ages of two persons remains constant regardless of the number of years passed.

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Q50. Answer: (d) 2

Shortcut Trick

Check odd numbers between 358 and 368: 359, 361, 363, 365, 367.

359: Not divisible by 2, 3, 5, 7, 11, 13, 17 → Prime.

361: 19 × 19 → Not Prime.

367: Not divisible by 2, 3, 5, 7, 11, 13, 17, 19 → Prime.

Therefore The correct answer is 2.

Alternate Method

Given: Range between 358 and 368.

Step 1: List all integers in the range: 359, 360, 361, 362, 363, 364, 365, 366, 367.

Step 2: Eliminate even numbers (360, 362, 364, 366) as they are divisible by 2.

Step 3: Test remaining odd numbers:

=> 359: Sum of digits = 17 (not div. by 3), ends in 9 (not div. by 5), 359 ÷ 7 (rem 2), 359 ÷ 11 (rem 7), 359 ÷ 13 (rem 8), 359 ÷ 17 (rem 2) → Prime.

=> 361: √361 = 19. Since 19 × 19 = 361 → Composite.

=> 363: Sum of digits = 12 (divisible by 3) → Composite.

=> 365: Ends in 5 (divisible by 5) → Composite.

=> 367: Sum of digits = 16 (not div. by 3), 367 ÷ 7 (rem 3), 367 ÷ 11 (rem 4), 367 ÷ 13 (rem 3), 367 ÷ 17 (rem 10), 367 ÷ 19 (rem 6) → Prime.

=> Total prime numbers = 359 and 367.

Therefore The correct answer is 2.

Additional Information

Definition of Prime Numbers

A natural number greater than 1 that has no positive divisors other than 1 and itself.

Testing for Primality

To check if N is prime, test divisibility by all prime numbers up to √N.

Divisibility Rule of 3

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

Q51. Answer: (b) SPMH

The logic followed here is:

For RPMZ → WURT

Now, for LIGM → QNLG

Now, applying the same logic for NKHN:

So, NKHN → SPMH

Hence, the correct answer is "Option 2".

Q52. Answer: (d) 27th

Given:

Kunal is 11th from the left end and Riya sits 5 places to the right of Kunal in a row of 42 people.

Here,

Riya’s position from the left end = 11 + 5 = 16th

Now, Riya’s position from the right end = 42 − 16 + 1 = 27th

So, Riya is 27th from the right end.

Hence, the correct answer is "Option 4".

Q53. Answer: (d) (27.9, 27.1, 26.4)

The logic followed here is:

Logic:

Second Number = First Number + 0.8

Third Number = Second Number + 0.7.

For, (13.3, 12.5, 11.8) →

=> 13.3 − 12.5 = 0.8

=> 12.5 − 11.8 = 0.7
For, (45.6, 44.8, 44.1) →
=> 45.6 − 44.8 = 0.8
=> 44.8 − 44.1 = 0.7
Now, checking the options:
Option 1) (71.7, 70.9, 70.1)
=> 71.7 − 70.9 = 0.8
=> 70.9 − 70.1 = 0.8 ≠ 0.7
Option 2) (39.4, 38.6, 37.8)
=> 39.4 − 38.6 = 0.8
=> 38.6 − 37.8 = 0.8 ≠ 0.7
Option 3) (69.5, 68.7, 68.6)
=> 69.5 − 68.7 = 0.8
=> 68.7 − 68.6 = 0.1 ≠ 0.7
Option 4) (27.9, 27.1, 26.4)
=> 27.9 − 27.1 = 0.8
=> 27.1 − 26.4 = 0.7
Hence, the correct answer is Option 4.

Q54. Answer: (b) LO - HL

The logic followed here is:
Option 1) NQ – JM
Option 2) LO – HL
Option 3) KN – GJ
Option 4) HK – DG
Here, LO – HL is odd from the given options.
Hence, the correct answer is "Option 2".

Q55. Answer: (b) Mother’s brother

Family Chart:
Decoding the Symbols:

Symbol	•	−	×	÷
Meaning	Son	Mother	Brother	Father

Given: M + N ÷ O × P − S
It means: M is the son of N, N is the father of O, O is the brother of P, and P is the mother of S.
Hence, M is also the mother’s brother of S.
Hence, the correct answer is "Option 2".

Q56. Answer: (d) 1

Given: A, B, C, D, E, F and G are sitting in a straight line facing North.
No one sits to the right of B.
Only three people sit between B and G.
Only two people sit between G and D.
A sits third to the left of C.
F sits to the immediate right of C.
Now, People to the left of E = only A = 1
Hence, the correct answer is "Option 4".

Q57. Answer: (a) Two

Given: (Left) 7 2 4 5 9 1 6 3 8 7 4 2 6 1 5 9 3 7 4 8 2 1 (Right)
Now, Digits, which are odd and also greater than 5.
So, Needed pattern is: Odd Digit and > 5

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(Left) 7 2 4 5 9 1 6 3 8 7 4 2 6 1 5 9 3 7 4 8 2 1 (Right)
So, total valid unique digits = 2
Hence, the correct answer is Option 1.

Q58. Answer: (a) 3

Given: (Left) 2 7 4 7 7 3 3 3 1 4 8 9 8 8 2 8 5 6 7 9 7 1 3 3 1 6 2 (Right)
Now,
Odd numbers, which are immediately preceded by an even number and also immediately followed by an even number.
So, Needed pattern is: Even Number - Odd Number - Even Number
(Left) 2 7 4 7 7 3 3 3 1 4 8 9 8 8 2 8 5 6 7 9 7 1 3 3 1 6 2 (Right)
So, total valid odd numbers = 3
Hence, the correct answer is Option 1.

Q59. Answer: (b) 2

The logic followed here is:
Given series: (Left) 5 * 1 1 6 $ © * 3 8 # © € 1 © 1 © 8 % 4 (Right)
Logic:
Find the numbers which are immediately preceded by a number and immediately followed by a symbol.
So, required pattern is: Number - Number - Symbol
(Left) 5 * 1 & 1 6 $ © * 3 8 # © € 1 & © 1 © 8 % 4 (Right)
Number of such numbers = 2
Hence, the correct answer is Option 2.

Q60. Answer: (c) South

The logic followed here is:
Given:
Town T is to the north of Town R
Town S is to the south of Town Q
Town R is to the south of Town P
Town Q is to the south of Town R
Now, Q is below P → Q is to the south of P
Hence, the correct answer is Option 3.

Q61. Answer: (a) NR−OV

The logic followed here is:
Option 1) NR – OV
Option 2) HL – JN
Option 3) MQ – OS
Option 4) TX – VZ
Here, NR – OV is odd from the given options.
Hence, the correct answer is "Option 1".

Q62. Answer: (a) Both conclusions (I) and (II) follow.

Given Statements:
All wheels are cars.
All wheels are buses.
All buses are trucks.
The least possible Venn diagram for the given statement is:
Conclusions:
I. All wheels are trucks – Follows (All wheels are buses and all buses are trucks, so all wheels are trucks).
II. Some buses are cars – Follows (Wheels are common to both buses and cars, so some buses are cars).
So, both conclusion I and conclusion II follow.
Hence, the correct answer is "Option 1".

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Q63. Answer: (c) 26

The logic followed here is:

thus, "26" will replace the question mark in the given series.

Hence, the correct option is "Option 3".

Q64. Answer: (d) 63

The logic followed here is:

Logic: Code = Sum of the reverse positional values of the letters (A=26, B=25 … Z=1) + 16

Given:

OXGP → O(12) + X(3) + G(20) + P(11) = 46

Code = 46 + 16 = 62

DSNL → D(23) + S(8) + N(13) + L(15) = 59

Code = 59 + 16 = 75

Now,

VBQT → V(5) + B(25) + Q(10) + T(7) = 47

Code = 47 + 16 = 63

Hence, the correct answer is Option 4.

Q65. Answer: (d) K

Given: J, K, L, M, N, O and P are sitting in a straight row facing north.

Only two people sit to the right of O.

Only three people sit between N and O.

P sits second to the left of J.

P is not an immediate neighbour of N.

L sits to the immediate left of M.

Now, The extreme right end is position 7 → K

Hence, the correct answer is "Option 4".

Q66. Answer: (d) 10

Given: 745, 329, 157, 278, 381

Now, the third digit of the highest number and the second digit of the lowest number, then add them.

Highest number = 745

Third digit of highest number = 5

Lowest number = 157

Second digit of lowest number = 5

So, 5 + 5 = 10

Hence, the correct answer is Opttion 4.

Q67. Answer: (c) FIRM - RFIM - MRIF

The logic followed here is:

For SANK - NSAK - KNAS

Now, for KITE - TKIE - ETIK

Now, applying the same logic to the options:

Option 1: ZONE → NZOE → ONEZ

Option 2: SWAT → WSAT → TWAS

This follows the same logic.

Option 3: FIRM → RFIM → MRIF

Option 4: DOLE → DLOE → ELOD

Hence, the correct answer is "Option 3".

Q68. Answer: (d) 18th

Given:

Roshan is 6th from the left end and Disha sits 29 places to the right of Roshan in a row of 52 students.

Here,
Disha's position from the left end = 6 + 29 = 35th
Now, Disha's position from the right end = 52 − 35 + 1 = 18th
So, Disha is 18th from the right end.
Hence, the correct answer is "Option 4".

Q69. Answer: (b) D

Given: A, B, C, D, E and F are sitting in a row facing north.
Only two people sit to the left of A.
Only one person sits between B and C.
F sits to the immediate left of A.
B sits to the immediate right of E.
C sits third to the right of D.
Now, The extreme left end is position 1 → D
Hence, the correct answer is "Option 2".

Q70. Answer: (d) 38 km towards the west

The logic followed here is:
Given:
He then takes a left turn, drives 75 km,
turns right and drives 33 km.
He then takes a right turn
and drives 37 km.
He takes a right turn, drives 62 km to stop at Point Z

So, To reach back to Point Y, he must move 38 km towards the West
Hence, the correct answer is Option 4.

Q71. Answer: (a) 191

BODMAS Table:
Decoding the given information:

Alphabet	•	−	×	÷
Meaning	−	•	÷	×

Now, replacing the sign from left to right using BODMAS Rule, we get:
=> 70 + 45 ÷ 5 + 40 × 4 − 48 = ?
=> 70 + 9 + 160 − 48 = ?
=> 239 − 48 = ?
=> 191
Hence, the correct option is "Option 1".

Q72. Answer: (d) Only conclusion (II) is true

Given Statements:
No pianos are guitars.
Some guitars are violins.
All violins are drums.
The least possible Venn diagram for the given statement is:
Conclusions:
I. No pianos are violins – Does not follow (There is no direct restriction between pianos and violins, so overlap is possible).
II. Some guitars are drums – Follows (Some guitars are violins and all violins are drums, so that overlapping part of guitars must be drums).
So, only conclusion II follows.
Hence, the correct answer is "Option 4".

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Q73. Answer: (d) RTV−SUW

The logic followed here is:
For LNP → MOQ
Now, for MOQ → NPR
Now, applying the same logic for the given options:
Option 1: RST → RTV
Option 2: RST → SUW
Option 3: RTV → RUV
Option 4: RTV → SUW
Hence, RTV → SUW follows the same logic.
Hence, the correct answer is "Option 4".

Q74. Answer: (b) XYO75

The logic followed here is:
So, the missing term = XYO75
Hence, the correct answer is Option 2.

Q75. Answer: (d) 123

The logic followed here is:
thus, "123" will replace the question mark in the given series.
Hence, the correct option is "Option 4".

Q76. Answer: (d) 9

The logic followed here is:
Given number: 12568436
Logic: Arrange the digits in ascending order from left to right and then find the required digits.
Original number: 1 2 5 6 8 4 3 6
Arranged in ascending order: 1 2 3 4 5 6 6 8
Now,
3rd digit from left = 3
3rd digit from right = 6
Sum = 3 + 6 = 9
Hence, the correct answer is Option 4.

Q77. Answer: (b) PDQ15

The logic followed here is:
So, the missing term = PDQ15
Hence, the correct answer is Option 2.

Q78. Answer: (d) 568

The logic followed here is:
thus, "568" will replace the question mark in the given series.
Hence, the correct option is "Option 4".

Q79. Answer: (c) 26

BODMAS Table:
Decoding the given information:

Alphabet	•	−	×	÷
Meaning	−	•	÷	×

Now, replacing the sign from left to right using BODMAS Rule, we get:
=> 8 × 2 − 15 ÷ 5 + 8 = ? − 5
=> 16 − 3 + 8 = ? − 5
=> 13 + 8 = ? − 5

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=> 21 = ? − 5

=> ? = 21 + 5

=> ? = 26

Hence, the correct option is "Option 3".

Q80. Answer: (c) os

The logic followed here is:

Given:

‘drinking is dangerous’ → cd pk os

‘avoid dangerous habit’ → os mp ls

So, the code for dangerous = os.

Hence, the correct answer is Option 3..

Q81. Answer: (d) India

The correct answer is India.

Key Points

• The 8th Assembly of the International Solar Alliance (ISA) is slated to be held in October 2025 in New Delhi, India.

• The Assembly is the supreme decision-making body of the ISA, in which each Member Country is represented to oversee the implementation of the ISA Framework Agreement.

• As the host country and the permanent seat of the Secretariat, India consistently plays a central role in organizing the annual proceedings to promote solar energy globally.

• The 8th Assembly will focus on critical thematic areas such as solar-pumping systems, solar mini-grids, and the scaling up of solar rooftops to achieve energy transition targets.

• During this session, Member Countries will deliberate on financial mechanisms to de-risk investments and provide technical assistance to the Least Developed Countries (LDCs) and Small Island Developing States (SIDS).

Additional Information

• International Solar Alliance (ISA):

• The ISA was conceived as a joint effort by India and France to mobilize efforts against climate change through the deployment of solar energy solutions.

• It was launched by Prime Minister Narendra Modi and then-President François Hollande on 30 November 2015, on the sidelines of the COP21 in Paris.

• The ISA is the first treaty-based international government organization to be headquartered in India, specifically at the National Institute of Solar Energy (NISE) campus in Gurugram, Haryana.

• The current Director General of the ISA is Dr. Ajay Mathur, who leads the Secretariat in implementing the ISA's strategic programs.

• Vision and Mission:

• The ISA’s vision is to "Let us together make the sun brighter" while its mission is to facilitate energy access and security worldwide.

• The organization aims to mobilize $1 trillion (USD) of investment in solar energy by the year 2030.

• Membership:

• While initially restricted to sunshine countries (those lying between the Tropic of Cancer and the Tropic of Capricorn), the ISA has amended its framework to allow all Member States of the United Nations to join.

• As of 2024, more than 100 countries have signed the ISA Framework Agreement.

Important Points

• One Sun, One World, One Grid (OSOWOG): This is a flagship initiative spearheaded by India within the ISA to create a global ecosystem of interconnected renewable energy resources, primarily solar energy, shared across borders.

• Towards 1000 Strategy: The ISA operates under this strategic plan which targets the installation of 1,000 GW of solar energy capacity, providing energy access to 1,000 million people, and mitigating 1,000 million tonnes of carbon dioxide emissions by 2030.

• Presidency: India currently holds the Presidency of the ISA Assembly, and France holds the Co-Presidency. The 7th Assembly was previously held in New Delhi in November 2024.

• Global Solar Facility: The ISA has established this facility to provide payment guarantees and insurance to private sector investors to encourage solar projects in Africa and other under-served regions.

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Q82. Answer: (b) Empowering Girls for a Bright Future

The correct answer is Empowering Girls for a Bright Future.

Key Points

• National Girl Child Day is celebrated every year in India on January 24 to promote awareness about the rights of a girl child and the importance of their education, health, and nutrition.

• The theme for National Girl Child Day 2025 is "Empowering Girls for a Bright Future". This theme emphasizes the necessity of providing girls with the tools, resources, and environment required to achieve their full potential. Hence, option 2 is correct.

• The initiative was first started by the Ministry of Women and Child Development in the year 2008. It aims to highlight the inequalities faced by girls in Indian society and to advocate for their legal rights and social protection.

• The date January 24 was chosen to commemorate the day in 1966 when Indira Gandhi took oath as the first woman Prime Minister of India, symbolizing a milestone in women's leadership.

• The primary objectives of this day include spreading awareness about the Child Sex Ratio (CSR) and creating a safe and healthy environment for every girl child in the country.

• Hence, the correct answer is Empowering Girls for a Bright Future.

Additional Information

• Beti Bachao Beti Padhao (BBBP):

• Launched on January 22, 2015, by Prime Minister Narendra Modi at Panipat, Haryana.

• The scheme is a tri-ministerial effort involving the Ministry of Women and Child Development, the Ministry of Health and Family Welfare, and the Ministry of Education.

• It focuses on preventing gender-biased sex-selective elimination and ensuring the survival, protection, and education of the girl child.

• Sukanya Samriddhi Yojana (SSY):

• A small deposit scheme launched in 2015 as part of the BBBP campaign to encourage parents to build a fund for the future education and marriage of their female children.

• It offers a high interest rate and provides tax benefits under Section 80C of the Income Tax Act.

• International Day of the Girl Child:

• Observed globally on October 11 every year. It was declared by the United Nations to recognize girls' rights and the unique challenges girls face around the world.

• National Policy for Women:

• The Government of India formulated various policies such as the National Policy for the Empowerment of Women (2001) to bring about the advancement, development, and empowerment of women in all spheres of life.

Important Points

• Article 21A: The Constitution of India provides the Right to Education as a fundamental right for children between 6 and 14 years of age, which has been instrumental in increasing the literacy rate among girls.

• Kishori Shakti Yojana: This scheme aims at improving the nutritional and health status of adolescent girls in the age group of 11-18 years.

• CBSE Udaan Scheme: An initiative to address the low enrollment of girl students in engineering institutions and to bridge the gap between school education and engineering entrance examinations.

• Legal Protection: Acts like the Prohibition of Child Marriage Act (2006) and the POCSO Act (2012) provide a legal shield to protect the girl child from exploitation and social evils.

Q83. Answer: (d) 4

The correct answer is 4.

Key Points

• The Government of India initiated a major reform in labour governance by consolidating 29 central labour laws into 4 comprehensive Labour Codes to simplify regulations and promote Ease of Doing Business.

• The four codes resulting from this consolidation are the Code on Wages, 2019, the Industrial Relations Code, 2020, the Social Security Code, 2020, and the Occupational Safety, Health and Working Conditions Code, 2020.

• This legislative overhaul was designed to replace archaic and complex laws dating back to the pre-independence era, ensuring a more transparent and modern framework for both employers and employees.

• The consolidation process aims to provide universal social security and minimum wages to nearly 50 crore workers in both the organized and unorganized sectors.

• The Ministry of Labour and Employment spearheaded this transition to reduce multiplicity of definitions and compliance burdens, which previously hindered industrial growth and job creation. Hence, the correct answer is 4.

Additional Information

• Code on Wages, 2019:

• It was the first code to be passed by Parliament in August 2019.

• It subsumes 4 central laws: The Payment of Wages Act, 1936, the Minimum Wages Act, 1948, the Payment of Bonus Act, 1965, and the Equal Remuneration Act, 1976.

• The code introduces a Floor Wage to be set by the Central Government, ensuring that no state sets a minimum wage lower than this threshold.

• Industrial Relations Code, 2020:

• It consolidates 3 laws, including the Trade Unions Act, 1926, the Industrial Employment (Standing Orders) Act, 1946, and the Industrial Disputes Act, 1947.

• It seeks to streamline the dispute resolution mechanism and allows units with up to 300 workers to retrench or lay off employees without prior government permission, up from the previous limit of 100.

• Social Security Code, 2020:

• This code integrates 9 laws such as the Employees' Provident Fund Act, the Employees' State Insurance Act, and the Maternity Benefit Act.

• For the first time, it brings gig workers, platform workers, and unorganized workers under the ambit of social security schemes like life insurance and disability insurance.

• Occupational Safety, Health and Working Conditions Code, 2020:

• It subsumes 13 laws related to factories, mines, plantations, and construction sites.

• It mandates free health check-ups for employees above a certain age and provides for a national occupational safety and health advisory board.

• The code also formalizes the employment of inter-state migrant workers by providing them with journey allowances and ration benefits.

Q84. Answer: (a) 7 April

The correct answer is 7 April.

Key Points

• World Health Day is celebrated every year on 7 April to mark the anniversary of the founding of the World Health Organization (WHO) in 1948.

• The First World Health Assembly in 1948 proposed that a special day be dedicated to health awareness. Consequently, World Health Day has been observed annually since 1950.

• The day serves as an opportunity for the WHO and other international organizations to draw worldwide attention to a subject of major importance to global health each year.

• Each World Health Day focuses on a specific theme. For instance, the theme for 2024 was "My health, my right," emphasizing that health is a fundamental human right for everyone, everywhere.

• It is one of the eleven official global health campaigns marked by the WHO, alongside World Tuberculosis Day, World Immunization Week, World Malaria Day, World No Tobacco Day, World Blood Donor Day, World Hepatitis Day, World Patient Safety Day, World Antimicrobial Awareness Week, World Chagas Disease Day, and World AIDS Day.

Additional Information

• 8 March:

• This date is celebrated globally as International Women's Day (IWD).

• It is a focal point in the movement for women's rights, highlighting issues such as gender equality, reproductive rights, and violence and abuse against women.

• The day was first recognized by the United Nations in 1977.

• 24 October:

• This day is celebrated as United Nations Day, marking the anniversary of the entry into force in 1945 of the UN Charter.

• It is also observed as World Polio Day, established by Rotary International to commemorate the birth of Jonas Salk, who led the first team to develop a vaccine against poliomyelitis.

• 1 December:

• World AIDS Day is observed on this date to raise awareness of the AIDS pandemic caused by the spread of HIV infection.

• It was first conceived in August 1987 by James W. Bunn and Thomas Netter, two public information officers for the Global Programme on AIDS at the WHO.

• World Health Organization (WHO):

• The WHO is a specialized agency of the United Nations responsible for international public health.

• It is headquartered in Geneva, Switzerland, and has six regional offices and 150 field offices worldwide.

• The organization's constitution was signed by 61 countries on 22 July 1946, and it officially began operations on 7 April 1948.

Q85. Answer: (a) 3.5 years

The correct answer is 3.5 years.

Key Points

• The Supreme Court of India, in recent hearings during 2024 and 2025, highlighted that the average waiting period for Prospective Adoptive Parents (PAPs) to adopt a child through the legal channel is approximately 3.5 years. Hence, the statement regarding the 3.5-year wait is correct.

• A bench led by the Chief Justice of India expressed grave concern that such a long gestation period often forces desperate parents to bypass the Central Adoption Resource Authority (CARA) and resort to illegal adoptions.

• The court noted that there is a massive imbalance between supply and demand; while over 30,000 PAPs are registered with CARA, only about 2,147 children were legally available for adoption as of late 2023.

• The Supreme Court emphasized that the delay is largely due to the slow process of declaring children "legally free for adoption" by Child Welfare Committees (CWCs) and administrative bottlenecks at the district level.

• Under the Juvenile Justice (Care and Protection of Children) Act, 2015, the legal process is designed to be rigorous to protect the child's interest, but the procedural delays have inadvertently created a market for child trafficking.

Additional Information

• CARA (Central Adoption Resource Authority):

• It is a statutory body under the Ministry of Women and Child Development, Government of India.

• It functions as the nodal body for the adoption of Indian children and is mandated to monitor and regulate both in-country and inter-country adoptions.

• CARA is the designated central authority under the Hague Convention on Inter-country Adoption, 1993, ratified by India in 2003.

• The Juvenile Justice Act vs. HAMA:

• The Juvenile Justice (Care and Protection of Children) Act, 2015: A secular law that allows any person, regardless of religion, to adopt. It provides a comprehensive framework for the rehabilitation of orphaned, abandoned, and surrendered children.

• Hindu Adoptions and Maintenance Act (HAMA), 1956: Applies to Hindus, Buddhists, Jains, and Sikhs. Unlike the JJ Act, adoptions under HAMA are a private contract between two parties. However, the Supreme Court has recently mandated that HAMA adoptions must also be registered on the CARA portal to ensure child safety.

• Recent Reforms (2021-2022):

• In 2021, the Juvenile Justice Amendment Act was passed, which empowered District Magistrates (DMs) and Additional District Magistrates (ADMs) to issue adoption orders instead of civil courts.

• The 2022 Adoption Regulations aimed to simplify the process, but the waiting period for infants (below 2 years of age) remains the highest due to the preference of most PAPs for younger children.

Important Points

• Child Welfare Committee (CWC): These are district-level bodies that have the sole authority to declare a child "legally free for adoption" after conducting due inquiry. Delays at this stage are a primary reason for the 3.5-year wait.

• SARA (State Adoption Resource Agency): This acts as a state-level nodal body to promote and monitor adoption within a particular State or Union Territory.

• Data Fact: As per CARA reports, the number of annual adoptions in India has stagnated around 3,000 to 4,000 per year for the last decade, despite tens of thousands of parents being on the waiting list.

• Types of Children: A child is abandoned if deserted by parents, orphaned if both parents are deceased/incapable, and surrendered if parents relinquish custody to the CWC due to physical, emotional, or social factors.

Q86. Answer: (a) PixxelSpace India Private Limited, Dhruva Space Private Limited and SatSure Analytics India Private Limited...

The correct answer is PixxelSpace India Private Limited, Dhruva Space Private Limited and SatSure Analytics India Private Limited Consortium.

Key Points

• In August 2025, the Indian National Space Promotion and Authorisation Centre (IN-SPACe) officially selected the consortium led by PixxelSpace India Private Limited, Dhruva Space Private Limited, and SatSure Analytics India Private Limited.

• The primary objective of this selection is to design, develop, and launch India’s first indigenous commercial Earth-Observation (EO) satellite constellation, marking a significant milestone for the NewSpace sector in the country.

• The project is part of a strategic initiative to foster private sector participation in the end-to-end space economy, moving beyond the traditional role of private companies as mere vendors to ISRO.

• Each member of the consortium brings specialized expertise: Pixxel is renowned for its advanced hyperspectral imaging technology, Dhruva Space provides expertise in satellite platforms and launch services, and SatSure specializes in downstream data analytics and insights.

• The selection process was conducted through a rigorous Request for Proposals (RFP) mechanism, ensuring that the consortium

met the technical and financial benchmarks required to sustain a commercial constellation. Hence, the correct answer is PixxelSpace India Private Limited, Dhruva Space Private Limited and SatSure Analytics India Private Limited Consortium.

Additional Information

• IN-SPACe (Indian National Space Promotion and Authorisation Centre):

• Established in June 2020, it acts as an autonomous agency under the Department of Space (DoS).

• It serves as a single-window agency to promote, authorize, and supervise the space activities of Non-Governmental Entities (NGEs) in India.

• Its headquarters is located in Bopal, Ahmedabad, and it plays a critical role in sharing ISRO's infrastructure with private players.

• Earth-Observation (EO) Satellites:

• These satellites are equipped with remote sensing technology to monitor the Earth's physical, chemical, and biological systems.

• Key applications include agriculture monitoring, disaster management (floods, forest fires), urban planning, and climate change tracking.

• The indigenous commercial constellation will provide high-resolution and high-revisit data, reducing India's dependence on foreign commercial satellite imagery.

• Indian Space Policy 2023:

• This policy provides the roadmap for institutionalizing the private sector's role in the space domain.

• It encourages NGEs to engage in the design, development, and operation of space objects, ground segments, and communication services.

• The selection of the Pixxel-Dhruva-SatSure consortium is a direct outcome of the policy's goal to increase India's share in the global space economy from 2% to 10%.

Important Points

• Consortium Capabilities: Pixxel has already demonstrated success with satellites like Shakuntala and Anand. Dhruva Space was one of the first Indian companies to secure a space-grade solar panel export order. SatSure uses Artificial Intelligence (AI) to provide actionable intelligence to the BFSI (Banking, Financial Services, and Insurance) and agriculture sectors.

• Technological Significance: The constellation will likely utilize Hyperspectral sensors, which can capture data across hundreds of narrow spectral bands, allowing for the identification of materials and chemical compositions that are invisible to the human eye.

• Geographic Focus: While the constellation will have global coverage, it will provide specialized low-latency data for the Indian subcontinent, which is vital for national security and localized economic planning.

Q87. Answer: (a) Reserve Bank of India

The correct answer is Reserve Bank of India.

Key Points

• The Reserve Bank of India (RBI) issued a notification in April 2024 revising the Priority Sector Lending (PSL) targets for Small Finance Banks (SFBs).

• According to the revised guidelines, the PSL target for Small Finance Banks will be adjusted to 60% of Adjusted Net Bank Credit (ANBC) or Credit Equivalent of Off-Balance Sheet Exposure (CEOBE), whichever is higher.

• This new target of 60% is a reduction from the previous mandate of 75%, aimed at aligning the regulatory framework as these banks grow in scale.

• The revised guidelines are scheduled to take effect from the Financial Year (FY) 2025–2026.

• The RBI has structured a transition path where the target remains 75% until March 31, 2025, before shifting to the lower threshold in the subsequent year.

• This move is part of the RBI's broader roadmap to allow eligible Small Finance Banks to transition into Universal Banks, provided they meet specific performance and capital criteria.

Additional Information

• Priority Sector Lending (PSL):

• PSL is a mechanism used by the RBI to ensure that specific sectors of the economy receive adequate credit.

• The eight primary sectors include Agriculture, Micro, Small and Medium Enterprises (MSMEs), Export Credit, Education, Housing, Social Infrastructure, Renewable Energy, and Others.

• While SFBs are now moving toward a 60% target, Scheduled Commercial Banks (SCBs) generally have a PSL target of 40%.

• Small Finance Banks (SFBs):

• These banks were established based on the recommendations of the Nachiket Mor Committee to promote financial inclusion.

• They primarily cater to small business units, small and marginal farmers, and micro and small industries.

• Examples of prominent SFBs in India include AU Small Finance Bank, Equitas Small Finance Bank, and Capital Small Finance Bank.

• Universal Bank Transition:

• For an SFB to transition into a Universal Bank, it must have a minimum Net Worth of Rs. 1,000 crore.

• The bank must also have a scheduled status and a satisfactory track record of at least five years of operation.

• The shares of the bank must be listed on a recognized stock exchange for the transition to be considered.

Important Points

• ANBC and CEOBE: Adjusted Net Bank Credit (ANBC) represents the total credit provided by the bank after specific adjustments, while CEOBE measures the risk associated with off-balance sheet items like guarantees and letters of credit.

• Loan Portfolio Mandate: Small Finance Banks are required to ensure that at least 50% of their loan portfolio comprises loans up to Rs. 25 lakh to maintain their focus on small borrowers.

• Capital Adequacy: These banks are required to maintain a minimum Capital to Risk-weighted Assets Ratio (CRAR) of 15% on a continuous basis, as per RBI norms.

• Regulatory Authority: The Reserve Bank of India, established on April 1, 1935, under the RBI Act, 1934, holds the primary authority to regulate the Indian banking system and set monetary policy.

Q88. Answer: (a) To accelerate the process of drug discovery

p>The correct answer is To accelerate the process of drug discovery.

Key Points

• PathGenie is a state-of-the-art computational software launched by the Ministry of Science and Technology in 2025 to revolutionize the medical research landscape.

• The primary objective of this platform is to accelerate the process of drug discovery, significantly cutting down the time required to move from the laboratory concept to clinical application. Hence, option 1 is the correct purpose.

• It utilizes advanced Artificial Intelligence (AI) and Machine Learning (ML) algorithms to predict how different chemical compounds will interact with biological targets.

• By using predictive modeling, PathGenie helps researchers identify potential lead compounds and optimize their chemical structures with high precision before physical synthesis begins.

• The software is designed to handle high-throughput screening, allowing scientists to analyze millions of molecular combinations in a fraction of the time taken by traditional methods.

Additional Information

• Drug Discovery Cycle: Historically, developing a new drug takes approximately 10 to 12 years and involves massive financial investment. Tools like PathGenie aim to reduce this window to improve healthcare accessibility.

• In-Silico Testing: This refers to research performed on a computer or via computer simulation. PathGenie facilitates in-silico trials, which minimize the initial need for animal testing and reduce ethical concerns in the early research stages.

• Ministry of Science and Technology: In India, this ministry oversees departments such as the Department of Biotechnology (DBT) and the Department of Science and Technology (DST), both of which are pivotal in driving biopharmaceutical innovation.

• Bioinformatics: This is the interdisciplinary field that develops methods and software tools for understanding biological data, especially large and complex data sets. PathGenie is a prime example of bioinformatics application in the modern era.

• Economic Impact: By streamlining the pre-clinical phase, the software helps in lowering the overall cost of R&D (Research and Development), which can eventually lead to more affordable life-saving medicines for the public.

Important Points

• Target Identification: The first step in drug discovery where a specific protein or gene involved in a disease is identified as a target for the drug.

• Lead Optimization: The process of refining a chemical lead to improve its potency, reduce side effects, and ensure it can be safely absorbed by the human body.

• Data Security: Since PathGenie manages sensitive molecular data, it incorporates high-level encryption and cloud security to protect the intellectual property of Indian scientists and research institutions.

• 2025 Milestone: The launch of this software in 2025 aligns with the national goal of achieving Atmanirbhar Bharat (Self-reliant India) in the pharmaceutical and biotechnology sectors.

Q89. Answer: (a) National Green Tribunal (NGT)

The correct answer is National Green Tribunal (NGT).

Key Points

• The National Green Tribunal (NGT) is the principal judicial body in India responsible for environmental protection. In October 2025, it issued comprehensive new directives to strictly regulate the handling and disposal of asbestos to mitigate health risks. Hence, statement 1 is correct.

• The NGT emphasized the need for specialized disposal protocols for asbestos-containing materials (ACM), particularly during the demolition of old industrial and residential structures.

• The directives mandate that the Central Pollution Control Board (CPCB) and State Pollution Control Boards (SPCBs) must

monitor air quality near asbestos processing units to ensure fiber concentration remains within safe limits. Hence, statement 3 is incorrect as CPCB is an executing body here, not the primary directive issuer in this context.

• The tribunal also highlighted the "Polluter Pays Principle", stating that industries failing to manage asbestos waste scientifically would face heavy environmental compensation fines.

• While the High Court of Delhi and the Supreme Court of India often hear environmental litigations, the specific administrative directives for asbestos regulation in October 2025 were spearheaded by the NGT. Hence, statements 2 and 4 are incorrect.

Additional Information

• Asbestos and Health Hazards:

• Asbestos is a group of six naturally occurring silicate minerals made of microscopic fibers. It was widely used in construction for its fire-resistant and insulating properties.

• Inhalation of these fibers can lead to serious conditions such as Asbestosis (scarring of the lungs), Lung Cancer, and Mesothelioma (a rare cancer of the chest lining).

• Due to these risks, over 60 countries have banned the use of all forms of asbestos, though Chrysotile (white asbestos) is still used in India for roofing and piping under controlled conditions.

• National Green Tribunal (NGT):

• Established on 18th October 2010 under the National Green Tribunal Act, 2010.

• Its primary objective is the effective and expeditious disposal of cases relating to environmental protection and conservation of forests.

• The Principal Bench of the NGT is located in New Delhi, with regional benches in Bhopal, Pune, Kolkata, and Chennai.

• Central Pollution Control Board (CPCB):

• A statutory organization constituted in September 1974 under the Water (Prevention and Control of Pollution) Act, 1974.

• It provides technical services to the Ministry of Environment, Forest and Climate Change (MoEFCC) and coordinates the activities of State Boards.

Important Points

• Hazardous Waste Management: The disposal of asbestos in India is governed by the Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016.

• Waste Disposal Methods: The October 2025 directives specifically advocate for the Secure Landfill method, where asbestos waste is wrapped in leak-proof packaging and buried at depths that prevent fiber release into the atmosphere.

• Constitutional Provision: Environmental litigation in India is often supported by Article 21 (Right to Life) and Article 48A (Protection and improvement of environment) of the Constitution of India.

Q90. Answer: (a) Swachhotsav

The correct answer is Swachhotsav.

Key Points

• The Swachhata Hi Seva (SHS) campaign is a massive Jan Andolan (people's movement) organized annually to reinforce the commitment to a Garbage-Free India.

• For the specified period leading into 2025, the theme Swachhotsav highlights the transition from sanitation being just a service to becoming a celebration of cleanliness, specifically focusing on women-led sanitation. Hence, option 1 is correct.

• The campaign is jointly organized by the Ministry of Housing and Urban Affairs (MoHUA) and the Department of Drinking Water and Sanitation (DDWS) under the Ministry of Jal Shakti.

• A primary objective of Swachhotsav is to recognize and empower women who have played a pivotal role in the Swachh Bharat Mission, transforming them from sanitation workers to Swachhata Entrepreneurs.

• The campaign period typically culminates on October 2, marking Gandhi Jayanti (Swachh Bharat Diwas), as a tribute to Mahatma Gandhi and his vision of a clean nation.

• Activities under this theme include large-scale Shramdaan (voluntary labor), cleaning of legacy waste sites, and promoting waste-to-wealth initiatives.

Additional Information

• Swachh Bharat Mission-Urban 2.0 (SBM-U 2.0):

• Launched on October 1, 2021, by Prime Minister Narendra Modi, it aims to make all Indian cities 'Garbage Free' and 'Water Secure'.

• It focuses on 100% source segregation, door-to-door collection of waste, and scientific processing of all fractions of waste, including construction and demolition waste.

• Swachh Survekshan:

• This is an annual survey of cleanliness, hygiene, and sanitation in villages, cities, and towns across India.

• Introduced in 2016, it has become the world's largest urban sanitation survey, fostering a spirit of healthy competition among

cities to improve service delivery to citizens.

• Swachhata Abhiyan 2.0:

• Focuses on Institutional Swachhata and the disposal of pending references in government offices.

• It emphasizes space management and the enhancement of the workplace experience through the removal of scrap and redundant materials.

• Key Goals of the Mission:

• Achieving ODF+ (Open Defecation Free Plus) and ODF++ status for all statutory towns.

• Effective remediation of all legacy dumpsites in the country to reclaim land and prevent environmental hazards.

• Promoting the Circular Economy through the 3R principles: Reduce, Reuse, and Recycle.

Important Points

• Safai Mitra Suraksha: A critical component of the mission is ensuring the safety and dignity of sanitation workers by transitioning from manual cleaning to mechanized cleaning of sewers and septic tanks.

• Garbage Free Cities (GFC) Star Rating: A protocol-based framework where cities are rated 1-star, 3-star, 5-star, or 7-star based on several cleanliness parameters.

• Waste to Wealth: The government encourages the setting up of Waste-to-Energy plants and the use of compost produced from organic waste in agriculture and landscaping.

• Public Participation: The Swachhata Hi Seva campaign records millions of participations annually, making it one of the largest volunteer-driven initiatives in the 21st century.

Q91. Answer: (a) President of India

The correct answer is President of India.

Key Points

• Under the Constitution of India, specifically Article 111, no bill passed by the Parliament can become a law (an Act) without the formal assent of the President of India.

• The Waqf (Amendment) Bill, 2025, followed the standard legislative procedure where it was introduced, debated, and passed by both the Lok Sabha (Lower House) and the Rajya Sabha (Upper House) before being sent to the President.

• The President of India acts as the final authority in the legislative process; once the signature is affixed, the bill is transformed into a Statute or Law.

• Following the Presidential assent, the law is published in the Official Gazette of India by the Legislative Department of the Ministry of Law and Justice.

• The President has the power to grant assent, withhold assent, or return the bill (if it is not a Money Bill) for reconsideration, but once passed again by both houses, the President must give assent.

Additional Information

• Waqf (Amendment) Bill, 2025:

• This legislative move aims to amend the Waqf Act, 1995, which governs the management and administration of Waqf properties (properties dedicated for religious or charitable purposes under Islamic law) in India.

• The 2025 amendment focuses on increasing transparency, improving the audit of accounts, and ensuring better representation for women and non-Muslims in Waqf Boards.

• It sought to redefine the powers of the Waqf Board regarding the declaration of a property as "Waqf" and enhanced the role of the District Collector in the verification process.

• Role of the Vice President:

• The Vice President of India serves as the Ex-officio Chairman of the Rajya Sabha. While they preside over the passage of the bill in the Upper House, they do not possess the constitutional authority to grant final assent to a bill.

• Role of the Prime Minister:

• The Prime Minister is the head of the Government and leads the Cabinet that proposes legislation. However, the Prime Minister does not sign bills into law; this is a sovereign function performed by the Head of State (the President).

• Role of the Chief Justice of India (CJI):

• The Chief Justice of India is the head of the Judiciary. The judiciary's role is to interpret laws and check their constitutionality (Judicial Review), but they have no role in the assent or enactment phase of the legislative process.

Important Points

• Joint Parliamentary Committee (JPC): In many instances involving complex legislation like the Waqf (Amendment) Bill, a JPC is formed to examine the provisions in detail before the final vote in Parliament.

• Article 111 Options: The President can exercise three options: Assent (signing), Withhold (pocket veto/absolute veto), or Return (suspensive veto). For the Waqf (Amendment) Bill, 2025 to become law, the "Assent" option was exercised.

• Ministry of Minority Affairs: This is the nodal ministry responsible for the administration of Waqf matters at the Union level in

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India.

• Central Waqf Council: Established in 1964, it is a statutory body that advises the Central Government on matters concerning the working of State Waqf Boards.

Q92. Answer: (b) Central Bureau of Investigation (CBI)

The correct answer is Central Bureau of Investigation (CBI).

Key Points

• The Central Bureau of Investigation (CBI) officially launched the BHARATPOL portal in January 2025 to revolutionize how law enforcement agencies communicate and share data.

• The portal was introduced during the 59th All India Conference of Directors General and Inspectors General of Police, which was held in Bhubaneswar, Odisha.

• BHARATPOL acts as a National Law Enforcement Portal, serving as a unified interface for all Indian Law Enforcement Agencies (LEAs) to collaborate on criminal investigations and intelligence.

• It provides a secure, real-time link between state police forces and the National Central Bureau (NCB)-New Delhi, which is the designated nodal point for INTERPOL in India.

• The platform is designed to facilitate faster dissemination of INTERPOL Notices (such as Red Notices for fugitives) and allow state police departments to access international criminal databases more efficiently.

Additional Information

• Central Bureau of Investigation (CBI):

• Established in 1963, the CBI is India's premier investigating agency and functions under the Ministry of Personnel, Public Grievances and Pensions.

• It derives its investigative powers from the Delhi Special Police Establishment (DSPE) Act, 1946.

• The CBI represents India as the National Central Bureau (NCB) of INTERPOL, coordinating with 196 member countries to tackle transnational crimes.

• Intelligence Bureau (IB):

• The IB is India's internal intelligence agency, primarily responsible for domestic security, counter-intelligence, and monitoring internal threats.

• It functions under the Ministry of Home Affairs (MHA) and is considered one of the oldest intelligence organizations in the world.

• National Investigation Agency (NIA):

• The NIA was formed in 2009 following the 2008 Mumbai terror attacks to investigate terrorism-related offenses across the country.

• It operates under the NIA Act, 2008, and has the authority to investigate cases across states without needing special permission from state governments.

• Research and Analysis Wing (RAW):

• Established in 1968, RAW is India's foreign intelligence agency focused on gathering external intelligence and conducting counter-terrorism operations outside Indian borders.

• It reports directly to the Prime Minister through the National Security Adviser (NSA).

Important Points

• Transnational Crime Coordination: The BHARATPOL portal specifically targets transnational organized crimes, including human trafficking, drug smuggling, and cybercrimes that have international footprints.

• Digital Integration: The portal integrates with INTERPOL's I-24/7 global police communication system, ensuring that even a local police officer in a remote district can receive alerts about global criminals.

• Data Modernization: This initiative is part of the broader Digital India mission to modernize the security infrastructure and ensure data-driven policing to improve the conviction rate in complex cases.

• NCB-New Delhi: As the host of NCB-New Delhi, the CBI uses BHARATPOL to empower state police agencies by providing them access to 19 specialized databases maintained by INTERPOL, such as those for stolen travel documents and fingerprints.

Q93. Answer: (d) Hitesh Gulia

The correct answer is Hitesh Gulia.

Key Points

• Indian boxer Hitesh Gulia secured the gold medal in the 70kg weight category at the World Boxing World Cup 2025.

• The tournament was held in Foz Do Iguacu, Brazil, in January 2025. It was one of the inaugural major events organized under the aegis of World Boxing, the new international federation for the sport.

• Hitesh Gulia was declared the winner after his opponent, Damon O'Neill from New Zealand, withdrew from the final bout due to a medical injury, granting the Indian a victory via a walkover.

• This victory marked a significant achievement for India at the international level, highlighting the depth of talent in the country's

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middleweight divisions.

• Apart from Hitesh, Devika Ghorpade was the other Indian to win a gold medal at the same event in the 52kg category, helping India finish with a strong medal haul.

Additional Information

• World Boxing World Cup 2025:

• This event was a landmark competition for World Boxing, an organization established in 2023 to ensure boxing remains at the heart of the Olympic movement.

• The 2025 edition in Brazil featured elite boxers from across the globe, competing across various weight categories to gain world rankings.

• India's Performance in Brazil:

• India concluded the campaign with a total of 8 medals, including 2 gold, 4 silver, and 2 bronze medals.

• Silver medalists included Preeti Dahiya (54kg) and Sagar Ahlawat (92+kg), showcasing India's prowess across different weight classes.

• Other Options Analysis:

• Shiva Thapa: A veteran Indian boxer and the first to win six medals at the Asian Confederation Boxing Championships. He typically competes in the 63.5kg or 60kg categories.

• Vikas Krishan: An Arjuna Awardee and Asian Games gold medalist who has represented India in multiple Olympics, primarily in the 69kg and 75kg divisions.

• Vijendra Singh: India's first Olympic medalist in boxing (2008 Beijing Olympics), who later turned professional.

Important Points

• Venue Significance: Foz Do Iguacu is a major city in Brazil, located on the border with Argentina and Paraguay, and is famous for the Iguazu Falls.

• 70kg Division: In the context of World Boxing regulations for 2025, the 70kg category is often classified as Light Middleweight for men.

• Regulatory Transition: These wins are crucial as India has been a prominent supporter of the World Boxing federation, transitioning away from the IBA (International Boxing Association) to align with IOC (International Olympic Committee) standards.

Q94. Answer: (c) Maritime shipping

The correct answer is Maritime shipping.

Key Points

• In April 2025, India participated in the 83rd session of the Marine Environment Protection Committee (MEPC 83), where it expressed support for a global carbon pricing system specifically for the Maritime shipping sector.

• The International Maritime Organisation (IMO) is working toward implementing a maritime levy or carbon tax to reduce greenhouse gas (GHG) emissions from international vessels.

• India's vote in favor signifies a strategic shift to ensure that developing nations receive a fair share of the revenue generated from this pricing mechanism to fund green infrastructure.

• This decision is aligned with the 2023 IMO Strategy on Reduction of GHG Emissions from Ships, which aims to transition the industry toward net-zero emissions by or around 2050.

• The carbon pricing system is designed to incentivize shipowners to adopt low-carbon or zero-emission fuels like green ammonia and green hydrogen, bridging the price gap with traditional fossil fuels.

Additional Information

• International Maritime Organisation (IMO):

• Established in 1948 and headquartered in London, the IMO is a specialized agency of the United Nations.

• It is responsible for the safety and security of shipping and the prevention of marine and atmospheric pollution by ships.

• The IMO regulations apply to international shipping, which handles more than 80% of global trade by volume.

• Global Carbon Pricing Mechanism:

• The proposed mechanism is a Market-Based Measure (MBM) that places a monetary value on carbon emissions.

• Revenue from the levy is intended to be redistributed to Least Developed Countries (LDCs) and Small Island Developing States (SIDS) to support their maritime decarbonization efforts.

• Unlike Aviation, which is regulated by the International Civil Aviation Organization (ICAO), the Maritime shipping sector falls under the IMO's jurisdiction for emissions targets.

• India's Maritime Vision:

• Under the Maritime Amrit Kaal Vision 2047, India aims to become a global leader in green shipping.

• India has set a goal to make all its major ports Green Ports by 2030, focusing on renewable energy and hydrogen-based bunker fuels.

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• The country is also a part of the Green Voyage2050 project, a partnership between the Government of Norway and the IMO.

Important Points

• Sector Differentiation: While Aviation uses the CORSIA (Carbon Offsetting and Reduction Scheme for International Aviation) framework, the Maritime shipping sector is pursuing a direct carbon levy.

• Economic Impact: International shipping accounts for nearly 3% of total global GHG emissions. A global carbon price of around $100 to $150 per tonne of CO2 is being discussed to drive significant change.

• Environmental Deadlines: The IMO strategy includes checkpoints to reduce total annual GHG emissions by at least 20% by 2030 and 70% by 2040, compared to 2008 levels.

• Technological Innovation: The move supports the development of Zero-Emission Vessels (ZEVs) and the expansion of Shore-to-Ship Power (SSP) facilities at major ports worldwide.

Q95. Answer: (c) Max Verstappen

p>The correct answer is Max Verstappen.

Key Points

• The Japanese Grand Prix held in 2025 saw Max Verstappen emerging as the winner, continuing his dominance in the Formula 1 world.

• He represented the Red Bull Racing team, utilizing a car powered by Honda RBPT engines, which are known for their high performance at the Suzuka International Racing Course.

• The victory at Suzuka is highly prestigious due to the track's demanding nature, featuring technical sections like the "S" Curves and the high-speed 130R turn.

• Max Verstappen's win in 2025 helped solidify his position in the World Drivers' Championship standings, showcasing the consistency of the Dutch driver.

• The race took place in April 2025, following the Formula 1 calendar's shift to group Asian races together for better regional logistics and environmental sustainability.

Additional Information

• Driver Profiles:

• Max Verstappen: Born on September 30, 1997, he is a multiple-time Formula 1 World Champion. He holds the record for being the youngest driver to start a Grand Prix at 17 years and 166 days during the 2015 season.

• Lando Norris: A British driver racing for McLaren. Known for his agility on track, he has been a consistent podium contender and a primary rival to Red Bull in the 2024-2025 seasons.

• Oscar Piastri: An Australian driver also representing McLaren. He is celebrated for winning the Formula 2 and Formula 3 championships in consecutive rookie years before debuting in F1 in 2023.

• Fabio Di Giannantonio: Unlike the other options, he is a professional motorcycle racer from Italy who competes in the MotoGP World Championship. He is not a Formula 1 driver, making him a distractor in this context.

• Suzuka International Racing Course:

• Located in Suzuka City, Mie Prefecture, Japan, the circuit is 5.807 kilometers long and features a unique figure-eight layout.

• It was designed by John Hugenholtz in 1962 as a test track for Honda.

Important Points

• Technological Dominance: The Red Bull car used in 2025 focused on optimized ground-effect aerodynamics, which provided superior downforce essential for the high-speed corners of the Japanese track.

• Strategic Scheduling: The 2025 Japanese Grand Prix was part of a 24-race season, the longest in Formula 1 history, aimed at maximizing global engagement and revenue.

• Historical Context: The first Formula 1 race at Suzuka was held in 1987, and it has since become a fan-favorite destination, often hosting title-deciding races in previous decades.

• FIA Regulations: The 2025 season operated under strict Financial Regulations (cost caps) to ensure a more level playing field among teams like Ferrari, Mercedes, and Red Bull.

Q96. Answer: (d) Indus

The correct answer is Indus.

Key Points

• The Indus Waters Treaty (IWT) is a water-distribution treaty between India and Pakistan, brokered by the World Bank (formerly the International Bank for Reconstruction and Development).

• In 2025, India took significant diplomatic steps to review and modify the treaty, following a formal notice issued in late 2024. The move was prompted by Pakistan’s persistent objections to Indian hydroelectric projects, specifically the Kishanganga and Ratle projects in Jammu and Kashmir.

• The treaty was signed in Karachi on September 19, 1960, by the then Indian Prime Minister Jawaharlal Nehru and Pakistani

President Ayub Khan. Hence, the correct option is Indus.

• Under the original terms of the treaty, the waters of the three Eastern Rivers—the Ravi, Beas, and Sutlej—were allocated to India for unrestricted use.

• The waters of the three Western Rivers—the Indus, Jhelum, and Chenab—were allocated to Pakistan, with India permitted "limited" non-consumptive use, such as for power generation and agriculture.

• The dispute escalated in 2025 because Pakistan approached the Permanent Court of Arbitration in The Hague, while India insisted on a Neutral Expert mechanism, leading to a "graded" suspension or formal call for modification of the 64-year-old pact by the Government of India.

Additional Information

• Shimla Agreement:

• Signed on July 2, 1972, by Indira Gandhi and Zulfikar Ali Bhutto following the 1971 Indo-Pak War.

• It converted the cease-fire line of 1948 into the Line of Control (LoC) and emphasized the resolution of differences through bilateral negotiations.

• Tashkent Declaration:

• A peace agreement signed on January 10, 1966, between India and Pakistan to end the 1965 War.

• It was brokered by the Soviet Union in Tashkent (now in Uzbekistan) and signed by Lal Bahadur Shastri and Ayub Khan.

• Ganga Water Treaty:

• This is a bilateral treaty signed in 1996 between India and Bangladesh for the sharing of the Ganga waters at Farakka.

• It is not related to Pakistan; it has a 30-year validity period and is due for renewal or review in 2026.

• Article XII (3) of IWT:

• This specific article of the Indus Waters Treaty allows for the provisions of the treaty to be modified from time to time by a duly ratified treaty concluded for that purpose between the two Governments.

• India invoked its right to seek modifications in 2023-2025 due to changes in demographic and environmental circumstances.

Important Points

• Permanent Indus Commission (PIC): The treaty established a permanent body with commissioners from both countries who meet at least once a year to discuss technical issues and manage water rights.

• World Bank Role: While the World Bank is a signatory to the treaty, its role is primarily limited to procedural matters and appointing a Neutral Expert in case of "differences."

• Kishanganga Project: A 330 MW hydroelectric project on the Kishanganga River (a tributary of the Jhelum) which has been a primary point of contention between the two nations since 2007.

• Ratle Hydroelectric Plant: An 850 MW run-of-the-river power station currently under construction on the Chenab River in the Kishtwar district of Jammu and Kashmir.

Q97. Answer: (a) Magnus Carlsen

The correct answer is Magnus Carlsen.

Key Points

• Magnus Carlsen secured the title at the 2025 Norway Chess tournament, continuing his streak of excellence in elite international chess competitions.

• The tournament was held in Stavanger, Norway, which has been the home of this prestigious super-tournament since its inception.

• Carlsen's victory in the 2025 edition was characterized by his strategic depth in classical games and his nearly unbeatable record in Armageddon tie-breaks, which are a signature of the Norway Chess format.

• The scoring system for the event awarded 3 points for a win in the classical time control, ensuring a high level of fighting chess throughout the rounds.

• By winning this title, Magnus Carlsen further solidified his position as the World Number 1 in the FIDE rankings, a spot he has held consistently for over a decade.

Additional Information

• Norway Chess Tournament:

• Established in 2013, Norway Chess is one of the world's most prestigious chess tournaments, often featuring the top 10 players in the world.

• It is famous for introducing the mandatory Armageddon rule, where if a classical game ends in a draw, the players immediately play a blitz game to determine who gets extra points.

• Magnus Carlsen:

• Born on November 30, 1990, Carlsen is a Norwegian Grandmaster and a five-time World Chess Champion.

• He decided not to defend his title in 2023 but remains the highest-rated player in the history of the game, reaching a peak ELO

rating of 2882.

• Other Competitors in 2025:

• The 2025 field included prominent figures such as Hikaru Nakamura (USA), Fabiano Caruana (USA), and the 2024 Candidates winner, Gukesh Dommaraju from India.

• Gukesh Dommaraju, born in 2006, is one of the youngest players to ever cross the 2750 ELO mark and is a rising rival to Carlsen's dominance.

• Tournament Venue:

• The event typically takes place in the Stavanger region, often utilizing venues like the SR-Bank headquarters and the Finansparken.

Important Points

• Scoring Mechanism: In this tournament, a classical win is worth 3 points, a classical loss is 0 points. If the classical game is drawn, each player gets 1 point, and the winner of the Armageddon game gets an additional 0.5 points (totaling 1.5).

• Historical Context: Magnus Carlsen has won the Norway Chess title multiple times (including 2016, 2019, 2020, 2021, and 2022), making him the most successful player in the tournament's history.

• Format: The 2025 tournament followed a Double Round Robin or Single Round Robin format depending on the specific category (Main or Women's), ensuring every player faced each other at least once.

Q98. Answer: (a) Establishment of a Makhana Board

The correct answer is Establishment of a Makhana Board.

Key Points

• During the presentation of the Union Budget 2025-26 in Parliament on 1 February 2025, Union Finance Minister Nirmala Sitharaman announced the establishment of a dedicated Makhana Board.

• The primary objective of the Makhana Board is to promote value-addition, scientific research, and organized marketing for Makhana (Gorgon nut/Fox nut), which is a key regional crop of Bihar.

• The board will be headquartered in Bihar, reflecting the state's dominant position as it accounts for approximately 80% to 90% of the total national production of Makhana.

• This initiative is designed to provide a structured supply chain, improve processing facilities, and help farmers in the Mithila region achieve better price realization through direct exports to the global market.

• The announcement is a strategic step towards the branding of Indian superfoods and boosting the agricultural economy of eastern India. Hence, the correct answer is Establishment of a Makhana Board.

Additional Information

• Mithila Makhana GI Tag:

• The Government of India granted the Geographical Indication (GI) tag to Mithila Makhana in August 2022.

• The GI tag ensures that only registered users from the Mithila region of Bihar can use the specific name, thereby protecting the authenticity and reputation of the product in international markets.

• Nutritional Value and Uses:

• Makhana is globally recognized as a nutritious superfood. It is rich in protein, fiber, magnesium, potassium, and phosphorus.

• It has a low glycemic index and is gluten-free, making it highly suitable for health-conscious consumers and those with diabetes or heart conditions.

• Major Producing Districts:

• In Bihar, the cultivation of Makhana is concentrated in districts such as Darbhanga, Madhubani, Saharasa, Purnia, Katihar, and Araria.

• The National Research Centre for Makhana is located in Darbhanga, which provides technical assistance for increasing the yield and quality of the crop.

• Economic Impact:

• The creation of the Makhana Board is expected to generate significant employment in rural Bihar, particularly in the processing and packaging sectors.

• It aligns with the "Vocal for Local" and "One District One Product" (ODOP) initiatives of the Union Government to promote local agricultural strengths.

Important Points

• Union Budget 2025-26 Context:

• The Union Budget 2025-26 placed a special emphasis on Bihar's development, including infrastructure projects and the reorganization of its agricultural sector.

• Apart from the Makhana Board, the budget proposed industrial corridors and connectivity projects to integrate Bihar more closely with the national economy.

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• The Makhana Board is expected to function under the Ministry of Agriculture and Farmers Welfare, coordinating with state agencies for better implementation of subsidies and export incentives.

Q99. Answer: (d) Hnahthial

The correct answer is Hnahthial.

Key Points

• The North Eastern Region (NER) District Sustainable Development Goals (SDG) Index Report, 2023-24, which was released in July 2025, identifies the progress of various districts in the eight North Eastern states of India toward achieving the 2030 Global Goals.

• Hnahthial district, located in the state of Mizoram, emerged as the top-performing district across the entire region, securing the highest score of 81.43 points.

• This index is a collaborative initiative between NITI Aayog and the Ministry of Development of North Eastern Region (MDoNER), with technical support from the United Nations Development Programme (UNDP).

• The report evaluates 103 districts based on their performance across various Sustainable Development Goals, including health, education, gender equality, and infrastructure.

• Hnahthial's achievement reflects significant improvements in local governance and the implementation of social welfare schemes within Mizoram. Hence, the correct answer is Hnahthial.

Additional Information

• Sustainable Development Goals (SDGs):

• The SDGs consist of 17 global goals established by the United Nations in 2015 as a universal call to action to end poverty and protect the planet by 2030.

• The NER District SDG Index specifically localizes these goals to the district level to foster competitive federalism among the North Eastern states.

• Classification of Districts:

• Districts are categorized based on their composite scores: Aspirant (0–49), Performer (50–64), Front Runner (65–99), and Achiever (100).

• In the 2023-24 report, a majority of the districts in the North East fell into the Front Runner category, showcasing an overall positive trend in regional development.

• Geographical Coverage:

• The index covers the "Ashtalakshmi" states: Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, and Tripura.

• It helps the Union Government and State Governments identify development gaps and allocate resources more effectively to lagging regions.

Important Points

• Top Performing States: While Hnahthial topped the district list, states like Sikkim and Mizoram consistently show high average scores across multiple districts due to better literacy rates and healthcare accessibility.

• Role of NITI Aayog: As India's premier policy think tank, NITI Aayog plays a crucial role in monitoring SDG indicators at the national and sub-national levels through tools like the SDG India Index and the NER District SDG Index.

• Indicators Used: The 2023-24 edition of the report utilized over 80 indicators across 15 SDGs to calculate the composite scores, providing a data-driven framework for administrative decision-making.

• Previous Rankings: In the first edition of the index (2021-22), East Sikkim had topped the list; the rise of Hnahthial in the latest report indicates a dynamic shift in developmental focus within Mizoram.

Q100. Answer: (d) PT Usha

The correct answer is PT Usha.

Key Points

• Indian athlete Vithya Ramraj equaled the long-standing national record in the women's 400m hurdles during the Asian Games 2023 held in Hangzhou, China.

• She clocked a time of 55.42 seconds during the qualification heats on October 2, 2023, to secure her place in the final.

• This performance allowed her to share the national record with the legendary PT Usha, who had set the same mark of 55.42 seconds nearly four decades earlier.

• PT Usha established this iconic record at the 1984 Los Angeles Olympics, where she famously missed out on an Olympic medal by just 1/100th of a second, finishing fourth. Hence, the correct answer is PT Usha.

• As of 2025, the national record for the women's 400m hurdles remains shared at 55.42 seconds by both Vithya Ramraj and PT Usha.

Additional Information

• Vithya Ramraj:

• She is a versatile sprinter and hurdler from Coimbatore, Tamil Nadu.

• Apart from the 400m hurdles, she has also been a key member of India's 4x400m relay teams.

• At the Hangzhou Asian Games, she won a silver medal as part of the 4x400m mixed relay team and a bronze medal in the individual 400m hurdles event.

• PT Usha:

• Widely known as the "Payyoli Express" and the "Queen of Indian Track and Field".

• She dominated the 1986 Seoul Asian Games, winning 4 gold medals and 1 silver medal.

• In December 2022, she became the first woman to be elected as the President of the Indian Olympic Association (IOA).

• National Records in Athletics:

• National records represent the best performance by an athlete representing their country, ratified by the national governing body, which in India is the Athletics Federation of India (AFI).

• The 400m hurdles record stood unchallenged for 39 years before Vithya Ramraj matched it in 2023.

Important Points

• Kamaljeet Sandhu: She was the first Indian woman to win a gold medal at the Asian Games, achieving the feat in the 400m run at the 1970 Bangkok Asian Games with a time of 57.3 seconds.

• Shiny Wilson: A middle-distance runner who was the first Indian woman to reach the semi-finals of an Olympic event at the 1984 Los Angeles Olympics in the 800m. She represented India in four Olympic Games.

• Hima Das: Known as the "Dhing Express", she holds the current national record in the flat 400m with a time of 50.79 seconds, set at the 2018 Jakarta Asian Games.

• The 400m hurdles is a unique event that combines the speed of a sprinter with the technical endurance required to clear 10 hurdles spaced across the track.

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