RRB Group D Official Paper (Held On: 21 Dec, 2025 Shift 2) (Previous Year Paper)

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

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GENERAL SCIENCE

Q1. Which of the following methods ensures prevention of transmission of sexually transmitted diseases during sexual intercourse?

(a) Tubectomy
(b) Vasectomy
(c) Using oral pills
(d) Using condoms

Q2. What defines two elements as isobars?

(a) Same number of electrons
(b) Same number of neutrons
(c) Same mass number but different atomic numbers
(d) Same atomic number

Q3. If the surface area increases for the same thrust (force), then the pressure on the surface _____.

(a) decreases
(b) remains the same
(c) becomes zero
(d) increases

Q4. Why does the amount of DNA NOT keep doubling during sexual reproduction in animals?

(a) Because both gametes get halved after fertilisation to form the zygote
(b) Because both gametes get doubled before fertilisation to form the zygote
(c) Because both gametes get halved before fertilisation to form the zygote
(d) Because both gametes get doubled after fertilisation to form the zygote

Q5. How do plants excrete their waste products?

(a) By removing wastes directly through root hairs only
(b) By converting all wastes into oxygen and carbon dioxide
(c) By releasing them through special excretory organs called nephrons
(d) By storing them in vacuoles or excreting through falling leaves and resins

Q6. What is the key realization that can lead to more sustainable use of natural resources?

(a) Selfish exploitation causes environmental harm and misery
(b) Unlimited growth is always beneficial
(c) Only future generations must benefit from resources
(d) Rules alone can ensure conservation

Q7. If a body's velocity changes from +20 m/s to –10 m/s in 4 seconds, the acceleration is _____.

(a) – 5.0 m/s²
(b) • 5.0 m/s²
(c) – 7.5 m/s²
(d) • 7.5 m/s²

Q8. A sample of brass is melted and poured into a mold to make a musical instrument. Which of the following correctly explains why brass is classified as a homogeneous mixture?

(a) The components of brass are uniformly distributed and cannot be distinguished visually
(b) The components of brass are chemically bonded and cannot be separated
(c) Brass is made of only one type of atom and hence appears uniform
(d) Brass is an example of a compound formed by the reaction of zinc and copper

Q9. In electrolytic refining, the pure metal is used as:

(a) sulphur
(b) an electrolyte
(c) a cathode
(d) an anode

Q10. A block of mass 1 kg is dropped from the top of a building of height X m. What will be the value of X if the block hits the ground with a velocity of 20 m/s?

(Take the value of g = 10 m/s²)

(a) 2 m
(b) 20 m
(c) 200 m
(d) 0.2 m

Q11. Soap molecules arrange themselves in which form to perform cleaning action?

(a) Micelles
(b) Precipitation
(c) Crystal
(d) Colloid

Q12. What is the primary chemistry behind a displacement reaction?

(a) Two reactants combine to generate one product
(b) Compounds disintegrate into two or more components
(c) Ion exchange occurs between two substances
(d) One element displaces another from a compound

Q13. The magnification of a concave mirror is −1. Which of the following statements is correct about the position of the object?

(a) Object is beyond the centre of curvature
(b) Object is between focus and pole
(c) Object is at focus
(d) Object is at the centre of curvature

Q14. Atoms of different elements with different _____ numbers but the same ____ number are known as isobars.

(a) mass, mass
(b) atomic, mass
(c) atomic, atomic
(d) mass, atomic

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Q15. The power of a lens is given as the reciprocal of its:

(a) Thickness
(b) Focal length (in metres)
(c) Diameter
(d) Radius

Q16. In a reflex arc, which of the following represents the correct path of the impulse?

(a) Receptor → Spinal cord → Motor neuron → Muscle
(b) Receptor → Spinal cord → Brain → Muscle
(c) Receptor → Brain → Spinal cord → Muscle
(d) Receptor → Motor neuron → Spinal cord → Muscle

Q17. Which of the following carbon compounds shows the presence of a branched chain structure?

(a) Butane (C4H10)
(b) Ethane (C2H6)
(c) Cyclohexane (C6H12)
(d) Methane (CH4)

Q18. Which of the following cell organelles have cisterns and is involved in the formation of lysosomes?

(a) Chromoplast
(b) Golgi apparatus
(c) Leucoplast
(d) Mitochondria

Q19. Which animal is known to communicate using infrasound?

(a) Dolphin
(b) Rhinoceros
(c) Bat
(d) Rat

Q20. Which of the following options best describes a component of a flower's reproductive system?

(a) Stamen includes both anther and filament.
(b) Ovary is located in the stamen.
(c) Pistil functions as the male part.
(d) Pollen is created in the ovule.

Q21. What type of ions exchange between reactants in a double displacement reaction?

(a) Both positive - positive ions and negative - negative ions
(b) Negative - negative ions
(c) Positive - positive ions
(d) Positive - negative ions

Q22. A single-turn coil of radius R produces a magnetic field B at its centre. If the same wire is wound into a coil of n turns (each of radius R/n) carrying the same current I, what will be the value of the new field at the centre?

(a) n^2B
(b) n B
(c) B
(d) B/n

Q23. The parenchyma cells in plants are:

(a) dead and compactly arranged without spaces
(b) dead and elongated with lignified walls
(c) living and loosely arranged with intercellular spaces
(d) living and thickened at corners without spaces

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Q24. Which of the following equations does NOT correctly represent the relationship between physical quantities for an object moving with uniform acceleration?

(a) 2as = v2 + u2
(b) v = u + at
(c) s = ut + 1/2at2
(d) v2 - u2 = 2as

Q25. The resistance of a conductor depends on the:

(a) Length, area of cross-section, material of the conductor, and temperature
(b) Voltage applied across the conductor
(c) Current flowing through it
(d) Length and area of cross-section only

MATHEMATICS

Q26. A person who spends 75% of his monthly income is able to save Rs. 4,827 per month. His monthly expenses (in Rs.) are:

(a) 14,435
(b) 14,395
(c) 14,481
(d) 14,394

Q27. Three numbers are in the ratio 4/8 : 11/16 : 18/21. The difference between the greatest and the smallest numbers is 40. Find the largest number.

(a) 96
(b) 98
(c) 97
(d) 95

Q28. If the fourth proportional to P, 25 and 8 is 4, then find the value of P.

(a) 52
(b) 50
(c) 49
(d) 48

Q29. What is the mode of the following data?

41, 48, 54, 50, 54, 48, 42, 43, 48, 42, 53, 45, 44, 50, 49, 45, 43, 48, 42, 48

(a) 54
(b) 50
(c) 41
(d) 48

Q30. If $x + 1/x = 17$, then the value of $(x^2 + 1/(x^2))$ is:

(a) 287
(b) 291
(c) 283
(d) 289

Q31. The sum of two numbers is 32. If one number is 5 more than twice the other, then find the smaller number.

(a) 9
(b) 13
(c) 11
(d) 7

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Q32. The difference of the present ages of two friends Gopal and Manoj is 2 years. If the ratio of their ages after 18 years from now will be 21 : 22, then find the sum of their respective ages 10 years ago from now (in years).

(a) 39
(b) 46
(c) 32
(d) 30

Q33. Find the LCM of the numbers 780, 2080 and 2600.

(a) 6240
(b) 10400
(c) 31200
(d) 15600

Q34. Two trains, 248 m and 142 m in length are running in opposite directions. The first runs at the rate of 34 km/hr and the second at the rate of 74 km/hr. How long will they take to cross each other?

(a) 12 seconds
(b) 13 seconds
(c) 18 seconds
(d) 19 seconds

Q35. Walking at 3/4 of his normal speed from his home, Tarun is 19 minutes late in reaching his office. The usual time taken by him to cover the distance between his home and his office is :

(a) 66 minutes
(b) 59 minutes
(c) 53 minutes
(d) 57 minutes

Q36. Which of the following numbers is divisible by both 2 and 5?

(a) 134
(b) 130
(c) 135
(d) 133

Q37. The monthly incomes of two friends Rakesh and Shivam, are in the ratio 5 : 9, respectively, and each of them saves Rs. 39,000 every month. If the ratio of their monthly expenditure is 1 : 3, find the monthly income of Rakesh(in Rs.).

(a) 66,000
(b) 64,000
(c) 65,000
(d) 91,000

Q38. A dealer purchased a washing machine for Rs. 7660. If he allows a discount of 12% on its marked price and still gains 10%, then the marked price of the machine is :

(a) Rs. 8575
(b) Rs. 9975
(c) Rs. 9575
(d) Rs. 8975

Q39. Simplify the given expression.

$189 \div 9 + 117 \div 13 \times 5 - 12$ of $4 + 9 \times 7$

(a) 87
(b) 81
(c) 89
(d) 83

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Q40. The mean and the mode of a set of data are 53.1 and 14.1, respectively. Find the median of the data, using the empirical formula.

(a) 42.8
(b) 40.5
(c) 40.1
(d) 41.8

Q41. A man buys 9 identical articles for a total of Rs. 16. If he sells each of them for Rs. 2.8, then his profit percentage will be _____%.

(a) 58.5
(b) 37.51
(c) 36.51
(d) 57.5

Q42. In a parallelogram, the length of its two adjacent parallel sides are 11.9 cm and a cm where a is the smaller side. If the perpendicular distance between the two longer and shorter sides are 3.9 cm and 5.1 cm, find the perimeter of the parallelogram.

(a) 48.2 cm
(b) 45.6 cm
(c) 38 cm
(d) 42 cm

Q43. A cistern has a hole at the bottom through which water leaks. A tap can fill the cistern in 7 hours and the hole at the bottom can empty the fully filled cistern in 8 hours. If both the tap and the hole are open, then what will be the time taken to completely fill the empty cistern?

(a) 56 hours
(b) 66.5 hours
(c) 75 hours
(d) 36.6 hours

Q44. In triangle ABC, BD perpendicular to AC at D and angle DBC = 71°. E is a point on BC such that angle CAE = 55°. What is the measure of angle AEB ?

(a) 73°
(b) 66°
(c) 79°
(d) 74°

Q45. If the curved surface area of a cylinder of height 6 cm is 264 cm^2, then its volume is: (Use π=22/7)

(a) 950 cm3
(b) 924 cm^3
(c) 944 cm3
(d) 824 cm3

Q46. A dealer marks his goods at 37% above the cost price and allows a discount of 16% on the marked price. What is his gain or loss percentage?

(a) 16.51% loss
(b) 12.76% loss
(c) 15.08% gain
(d) 14.66% loss

Q47. Find the simple interest (in Rs.) on Rs. 2,000 at 7% per annum rate of interest for the period from 3 February 2023 to 17 April 2023.

(a) 28
(b) 29
(c) 27
(d) 26

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Q48. One pipe can fill a tank in 6 minutes, while another pipe can empty the completely filled tank in 15 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) 5
(b) 11
(c) 10
(d) 6

Q49. From the top of a 50 m high tower, the angle of depression to a car on the ground is 30°, and the angle of elevation to a balloon directly above the car is 60°. Find the height of the balloon from the ground.

(a) 250 metres
(b) 150 metres
(c) 100 metres
(d) 200 metres

Q50. The price of fuel decreases by 45%, 55% and 50% in three successive months, but increases by 40% in the fourth month. What is the percentage increase/decrease in the price of fuel in the fourth month as compared to its original price? (Round off the answer to two decimal places.)

(a) Increases by 81.11%
(b) Decreases by 82.68%
(c) Decreases by 78.11%
(d) Increases by 85.23%

GENERAL INTELLIGENCE & REASONING

Q51. Refer to the given number series and answer the question that follows. Counting to be done from left to right only. All numbers are single-digit numbers.

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

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

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

Q52. FTBJ is related to OCKS in a certain way based on the English alphabetical order. In the same way, PDLT is related to YMUC. To which of the given options is QEMU related, following the same logic?

(a) ZVDE
(b) ZNVD
(c) ZNJU
(d) ZNMK

Q53. In a certain code language,

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

'A – B' means 'A is the sister of B',

'A × B' means 'A is the son of B' and

'A ÷ B' means 'A is the brother of B'.

How is D related to K if 'D + E – F ÷ G × K'?

(a) Wife
(b) Sister
(c) Mother
(d) Daughter

Q54. What should come in place of the question mark (?) in the given series?

5 9 16 26 39 ?

(a) 55
(b) 51
(c) 60
(d) 58

Q55. If 'A' stands for '÷', 'B' stands for '×', 'C' stands for '+' and 'D' stands for '−', what will come in place of the question mark (?) in the following equation?

70 B 4 D (50 A 5) B 11 C (24 A 2) B 4 C 10 = ?

(a) 200
(b) 253
(c) 228
(d) 172

Q56. This question is based on the five, three-digit numbers given below.

(Left) 783 791 531 563 594 (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 second digit of the highest number is added to the second digit of lowest number?

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

Q57. What should come in place of the question mark (?) in the given series based on the English alphabetical order?

DRT UIK LZB CQS ?

(a) THJ
(b) THY
(c) TJH
(d) THU

Q58. Select the triad which follows the same pattern as that followed by the two triads given below. Both triads follow the same pattern.

ME-KC-IL

PH-NF-LO

(a) WO-UM-SX
(b) WO-UM-SV
(c) ZO-VM-SX
(d) ZO-UM-SX

Q59. Six people, A, B, C, D, E and F, are sitting in a row, facing north. A sits third to the left of E. E sits second to the left of F. D sits to the immediate right of E. B sits to the immediate left of C. How many people sit between C and F?

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

Q60. Based on the English alphabetical order, three of the following four letter-clusters are alike in a certain way and thus form a group. Which letter-cluster DOES NOT belong to that group?

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

(a) XZW
(b) MNL
(c) RSQ

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(d) IJH

Q61. If 'A' stands for '÷', 'B' stands for '×', 'C' stands for '+' and 'D' stands for '−', what will come in place of the question mark (?) in the following equation?

(80 A 8) B 5 C 14 B 2 D 11 B 3 C 72 A 4 = ?

(a) 74
(b) 63
(c) 59
(d) 41

Q62. Which of the following letter-number clusters will replace the question mark (?) in the given series to make it logically complete?

ZSL 18, VOH 29, RKD 40, NGZ 51, JCV 62, ?

(a) FYL 73
(b) FYR 73
(c) FYI 73
(d) FOR 73

Q63. Based on the English alphabetical order, three of the following four letter-clusters are alike in a certain way and thus form a group. Which letter-cluster DOES NOT belong to that group?

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

(a) RTP
(b) EHB
(c) KNH
(d) ORL

Q64. In a certain code language, 'let you know' is coded as 'nj rc bh' and 'know the people' is coded as 'nh kp rc'. How is 'know' coded in that language? (All codes are two-letter codes.)

(a) rc
(b) kp
(c) nj
(d) bh

Q65. What should come in place of the question mark (?) in the given series?

103 119 135 151 167 ?

(a) 185
(b) 183
(c) 180
(d) 179

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

Statements:

All bags are cars.

All aeroplanes are cars.

Conclusions:

(I) Some bags are aeroplanes.

(II) Some cars are aeroplanes.

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

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Q67. This question is based on the five, three-digit numbers given below.

(Left) 453 125 410 183 473 (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 third digit of the lowest number?

(a) 8
(b) 7
(c) 11
(d) 5

Q68. What will come in the place of the question mark (?) in the following equation, if '+' and '−' are interchanged and '×' and '÷' are interchanged?

44 ÷ 6 + 195 × 3 - 473 = ?

(a) 741
(b) 691
(c) 672
(d) 776

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

29 35 42 50 59 69 ?

(a) 72
(b) 75
(c) 95
(d) 80

Q70. Select the pair which follows the same pattern as that followed by the two pairs given below. Both pairs follow the same pattern.

HQL : ISO

DGS : EIV

(a) MDR:OPS
(b) KFS:SAU
(c) BTS:DFG
(d) BIR:CKU

Q71. Seven people, A, B, C, D, E, F and G, are sitting in a row, facing north.

Only two people sit to the left of G. Only three people sit between G and C. Only one person sits between C and E. A sits to the immediate left of B. F is not an immediate neighbour of C.

How many people sit to the right of F?

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

Q72. All 40 students in a class are standing in a row facing north. Rohan is 18th from the right end while Kajal is 22nd from the left end. How many people stand between Rohan and Kajal?

(a) 1
(b) 2
(c) 0
(d) 3

Q73. Seven boxes, B, D, E, P, S, T and W, are kept one over the other but not necessarily in the same order. Only four boxes are kept between E and W. Only D is kept above E. Only two boxes are kept between P and T. S is kept immediately above B. T is not kept immediately above S. Which box is kept fourth from the top?

(a) P

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(b) T
(c) S
(d) B

Q74. Six people L, M, N, P, Q and R are sitting around a circular table facing towards the centre of the table.

There are exactly two people between P and N.

M sits second to the right of N.

R sits second to the right of M.

L sits to the immediate left of N.

Who is an immediate neighbour of both N and M?

(a) L
(b) R
(c) Q
(d) P

Q75. Tommy walks north for 30 metres, turns right, and walks 10 metres. Then he turns left and walks 25 metres to reach his school. In which direction is Tommy's school from his starting point? (All turns are 90-degree turns only, unless specified.)

(a) South
(b) North
(c) South-east
(d) North-east

Q76. In a certain code language, 'stop disturbing people' is coded as 'ls ck rp' and 'people need peace' is coded as 'cd ok rp'. How is 'people' coded in that language?

(a) ok
(b) ck
(c) rp
(d) cd

Q77. Refer to the following number series and answer the question that follows (all numbers are single-digit numbers only).

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

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

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

Q78. Read the given statements and conclusions carefully. Assuming that the information given in the statements is true, even if it appears to be at variance with commonly known facts, decide which of the given conclusions logically follow(s) from the statements.

Statements:

All watches are shirts.

All watches are pants.

Some pants are belts.

Conclusions:

(I) Some belts are watches.

(II) Some pants are shirts.

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

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Q79. Ritwik starts from Point A and drives 46 km towards east. He then takes a right turn, drives 54 km, turns right and drives 56 km. He then takes a right turn and drives 63 km. He takes a final right turn, drives 10 km and stops at Point P. How far (shortest distance) and towards which direction should he drive in order to reach Point A again? (All turns are 90 degrees turns only unless specified)

(a) 8 km to the south
(b) 7 km to the south
(c) 10 km to the north
(d) 9 km to the south

Q80. Select the set in which the numbers are related in the same way as are the numbers of the following sets.

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

(424, 212, 212)

(508, 302, 206)

(a) (560, 263, 297)
(b) (525, 175, 360)
(c) (521, 238, 273)
(d) (460, 280, 160)

GENERAL AWARENESS AND CURRENT AFFAIRS

Q81. According to SBI's January 2025 report, what was India's rural poverty rate in FY24?

(a) 4.86%
(b) 5.7%
(c) 40.9%
(d) 7.2%

Q82. Who won the Best Director award at the 71^(st) National Film Awards, held in 2025 (honoring 2023 films)?

(a) Atlee — Jawan
(b) Karan Johar — Rocky Aur Rani Kii Prem Kahaani
(c) Meghna Gulzar — Sam Bahadur
(d) Sudipto Sen — The Kerala Story

Q83. Which project by Ministry of IT won the Gold Award for using new technologies to help citizens at the 22^(nd) National Awards for e-Governance 2025?

(a) Mine Treatment System
(b) Bhashini Project
(c) KAVACH System
(d) Kharoli Village Panchayat

Q84. Which male athlete set new world indoor records in both the 1500 m (3:29.63 en route) and the mile (3:45.14) on 13 Feb 2025?

(a) Cole Hocker
(b) Grant Fisher
(c) Yared Nuguse
(d) Jakob Ingebrigtsen

Q85. Which of the following cities hosted the 'Save The Earth Conclave: Bamboo for a Resilient Future'?

(a) Mumbai
(b) Lucknow
(c) Surat
(d) New Delhi

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Q86. Who among the following headed the three-member committee formed in August 2025 to assess the Dharali disaster damage in Uttarakhand?

(a) CEO of Indian Civil Aviation Authority
(b) Home Minister of India, Amit Shah
(c) Uttarakhand Revenue Secretary, Surendra Pandey
(d) Uttarakhand Chief Minister, Pushkar Singh Dhami

Q87. In which of the following districts of Madhya Pradesh is Kuno National Park located?

(a) Sheopur
(b) Shivpuri
(c) Balaghat
(d) Guna

Q88. Which of the following missions led to the establishment of a National Biobank at the CSIR–Institute of Genomics and Integrative Biology (IGIB), New Delhi, in July 2025?

(a) Bharat GeneBank Initiative
(b) Phenome India Project
(c) India Biotech 2030 Mission
(d) Genome India Mission

Q89. Which of the following days marks the anniversary of the entry into force of the United Nations Charter (the day the UN was formally established)?

(a) 24 October
(b) 10 December
(c) 7 April
(d) 5 June

Q90. In June 2025, which Indian state withdrew the three-language policy for schools and formed a committee headed by educationist Narendra Jadhav to suggest the way forward?

(a) Karnataka
(b) Gujarat
(c) Maharashtra
(d) Tamil Nadu

Q91. Which Constitutional Amendment Bill, introduced in the Lok Sabha in 2025, seeks to provide for the removal of the Prime Minister, Chief Minister, or any Minister who remains in custody for 30 consecutive days for a serious criminal offence?

(a) The Constitution (One Hundred and Twenty-Eighth Amendment) Bill, 2025
(b) The Constitution (One Hundred and Thirtieth Amendment) Bill, 2025
(c) The Constitution (One Hundred and Twenty-Ninth Amendment) Bill, 2025
(d) The Constitution (One Hundred and Thirty-First Amendment) Bill, 2025

Q92. Who is the author of the memoir Mother Mary Comes to Me, launched in September 2025?

(a) Arundhati Roy
(b) Vikram Seth
(c) Salman Rushdie
(d) Kiran Desai

Q93. As stated by French President Emmanuel Macron on 9 June 2025, how many countries had ratified the High Seas Treaty by that date?

(a) 65
(b) 60
(c) 49
(d) 55

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Q94. In May 2025, Bihar Chief Minister Nitish Kumar inaugurated new sports facilities at a university in Rajgir, located in which district?

(a) Nalanda district
(b) Gaya district
(c) Patna district
(d) Vaishali district

Q95. The Environment Audit Rules, 2025, are aligned with which national reform agenda in India?

(a) Skill India
(b) Digital India
(c) Ease of Doing Business
(d) Make in India

Q96. Which of the following is the correct Act, set to be replaced by the Indian Ports Bill, 2025, passed by the Upper House of Parliament on 18 August 2025?

(a) Indian Ports Act of 1908
(b) Indian Ports Act of 1909
(c) Indian Ports Act of 1911
(d) Indian Ports Act of 1910

Q97. Who among the following was appointed as the new Securities and Exchange Board of India (SEBI) Chairman in February 2025, becoming the first serving Finance Secretary to assume the role?

(a) Ajay Tyagi
(b) Sunil Sanghai
(c) Tuhin Kanta Pandey
(d) Sanjay Malhotra

Q98. Which athlete broke the Australian national 200 m record with a time of 20.02 seconds at the Golden Spike meet in Ostrava in 2025?

(a) Gout Gout
(b) Aidan Murphy
(c) Reynier Mena
(d) Armand Duplantis

Q99. On 9 May 2025, Finance Minister Nirmala Sitharaman directed banks to stay fully alert and ready in light of which specific situation?

(a) Implementation of a new banking tax
(b) Increasing prevalence of phishing scams
(c) Launch of a digital-only banking model
(d) Heightened geopolitical tensions near border regions

Q100. Where was the India Open Badminton Super 750 tournament held in January 2025?

(a) Hyderabad
(b) Bengaluru
(c) Pune
(d) New Delhi

ANSWER KEY

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

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

SOLUTIONS

Q1. Answer: (d) Using condoms

The correct answer is option4. The detailed solution will be updated soon.

Q2. Answer: (c) Same mass number but different atomic numbers

p data-end="57" data-start="0">The correct answer is Same mass number but different atomic numbers.

Key Points

• Isobars are defined as atoms of different chemical elements that possess the same mass number but have different atomic numbers.

• The mass number (represented as A) is the total sum of protons and neutrons in the nucleus. In isobars, this sum remains constant across different elements.

• Because they have different atomic numbers (represented as Z), isobars belong to different places in the Periodic Table and represent entirely different chemical elements. Hence, statement 3 is correct.

• A classic example of isobars includes Argon (Atomic Number 18), Potassium (Atomic Number 19), and Calcium (Atomic Number 20). All three can have a mass number of 40.

• In these elements, the number of nucleons (protons + neutrons) is 40, even though the number of protons and electrons varies (18, 19, and 20 respectively).

Additional Information

• Isotopes:

• Isotopes are atoms of the same element that have the same atomic number but different mass numbers. This occurs due to a difference in the number of neutrons.

• Example: Protium, Deuterium, and Tritium are isotopes of Hydrogen with mass numbers 1, 2, and 3 respectively. Hence, statement 4 is incorrect.

• Isotones:

• Isotones are atoms of different elements that have the same number of neutrons but different atomic numbers and mass numbers.

• Example: Carbon-14 (8 neutrons) and Oxygen-16 (8 neutrons). Hence, statement 2 is incorrect.

• Isoelectronic Species:

• These are atoms, ions, or molecules that have the same number of electrons.

• Example: The Neon atom, Sodium ion (Na+), and Magnesium ion (Mg2+) all contain 10 electrons. Hence, statement 1 is incorrect.

Important Points

• Chemical and Physical Properties:

• Isobars have different chemical properties because their electronic configurations are different (owing to different atomic numbers).

• They generally have different physical properties as well, though they may share similarities in properties that depend heavily on atomic mass.

• Nuclear Physics Context:

• In nuclear physics, the study of isobars is vital for understanding Beta Decay. During beta-minus decay, a neutron turns into a proton, increasing the atomic number by 1 while the mass number remains the same, thus creating an isobar.

• Mattauch's isobar rule states that if two adjacent elements on the periodic table have isotopes of the same mass number, one of them must be radioactive.

Q3. Answer: (a) decreases

The correct answer is decreases.

Key Points

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• Pressure is defined as the physical force exerted on an object per unit area. It is mathematically expressed as Pressure = Thrust / Area.

• Thrust is the total force acting perpendicularly on a surface. When the thrust remains constant, the pressure depends solely on the surface area over which the force is distributed.

• Since Pressure is inversely proportional to the Area (P prop. to 1/A), any increase in the surface area will lead to a decrease in the pressure experienced by that surface.

• Conversely, if the surface area is decreased while the thrust remains the same, the pressure on the surface will increase significantly.

• The SI unit of pressure is the Pascal (Pa), which is equivalent to one Newton per square meter (1 N/m^2). This unit is named after the French scientist Blaise Pascal.

Additional Information

• Applications of Increasing Area:

• Foundations of buildings are made wide so that the weight of the structure (thrust) is distributed over a larger area, thereby reducing the pressure on the ground and preventing the building from sinking.

• School bags are provided with broad straps rather than thin strings. This ensures the weight of the bag is spread over a larger surface area of the shoulder, making it less painful to carry by reducing pressure.

• Tractors and heavy trucks are equipped with wide tyres to ensure the heavy load does not exert enough pressure to sink the vehicle into soft mud or sand.

• Applications of Decreasing Area:

• A sharp knife has a very small surface area at its cutting edge. This allows a small force to produce a very high pressure, making it easy to cut through materials.

• Nails and pins have pointed tips (extremely small area) so that even a gentle hammer strike produces enough pressure to penetrate a wooden plank or a wall.

• Liquid and Gas Pressure:

• In fluids (liquids and gases), pressure is exerted in all directions. The pressure in a liquid increases with depth due to the weight of the overhead liquid column.

• Atmospheric pressure is the pressure exerted by the weight of the atmosphere. At sea level, its value is approximately 101,325 Pa or 1 atmosphere (atm).

Important Points

• The relationship between force and pressure is a fundamental principle in physics and engineering used to design safety equipment and heavy machinery.

• Scalars and Vectors: While force is a vector quantity (having both magnitude and direction), pressure is a scalar quantity because it relates the magnitude of the normal force to the area.

• Dimensions: The dimensional formula for pressure is $[ML^{-1}T^{-2}]$.

• The concept of thrust and pressure explains why a person can walk on snow more easily using skis (large area, low pressure) than wearing normal shoes (small area, high pressure).

Q4. Answer: (c) Because both gametes get halved before fertilisation to form the zygote

The correct answer is Because both gametes get halved before fertilisation to form the zygote.

Key Points

• In sexually reproducing organisms, the gametes (sperm and egg) are produced through meiosis.

• Meiosis reduces the chromosome number and DNA content to half, producing haploid (n) gametes from diploid (2n) cells.

• During fertilisation, the male and female gametes fuse to form a diploid (2n) zygote.

• Thus, the halving of the chromosome number during gamete formation prevents the DNA/chromosome number from doubling in every generation.

• Hence, the correct answer is Option 3 – Because both gametes get halved before fertilisation to form the zygote.

Additional Information

• Diploid cells (2n): Contain two sets of chromosomes, one set from each parent.

• Haploid gametes (n): Contain only one set of chromosomes.

• Meiosis: Reduces the chromosome number from 2n to n.

• Fertilisation: Combines two haploid gametes (n + n) to restore the diploid condition (2n).

Important Points

• Before meiosis: Diploid cell = 2n.

• After meiosis: Gametes = n.

• Fertilisation: n + n = 2n (zygote).

• Purpose of meiosis: To maintain a constant chromosome number across generations in sexually reproducing organisms.

• Exam Tip: Remember the sequence: 2n → Meiosis → n → Fertilisation → 2n.

Q5. Answer: (d) By storing them in vacuoles or excreting through falling leaves and resins

The correct answer is By storing them in vacuoles or excreting through falling leaves and resins.

Key Points

• Excretion in plants is significantly different from animals because plants do not possess a specialized excretory system or specific organs like kidneys.

• One of the primary methods plants use to manage metabolic waste is storage in cellular vacuoles. These vacuoles are membrane-bound sacs within the cell that sequester toxic or unnecessary substances, keeping them away from the vital cytoplasm.

• Plants often accumulate waste products in older leaves. When these leaves reach a certain concentration of waste, they turn yellow and fall off (a process known as abscission), thereby removing the waste from the plant's body. Hence, statement 4 is correct.

• Another common strategy involves the deposition of waste products as resins and gums. These are often found in old xylem tissues that are no longer active in water transport.

• Plants also eliminate certain waste substances into the soil directly through their root systems. However, this is just one of many methods, not the exclusive way. Hence, statement 1 is incorrect.

• While plants exchange oxygen and carbon dioxide, they do not "convert all wastes" into these gases. Solid and liquid metabolic byproducts require different disposal routes. Hence, statement 2 is incorrect.

• Nephrons are the microscopic functional units of kidneys found in vertebrates. Plants completely lack these complex multi-cellular excretory organs. Hence, statement 3 is incorrect.

Additional Information

• Gaseous Waste Management:

• During the day, plants produce oxygen as a byproduct of photosynthesis. Some of this is used for respiration, and the excess is released through stomata.

• At night, carbon dioxide produced during respiration is the main gaseous waste expelled.

• Small openings on the woody stems called lenticels also facilitate the exchange of these gases.

• Water Excretion:

• Plants remove excess water through the process of transpiration, where water evaporates from the stomata on the leaf surface.

• In certain conditions, plants may also release liquid water droplets through specialized structures called hydathodes, a process known as guttation.

• Secondary Metabolites:

• Many plant wastes are "useful" wastes known as secondary metabolites, such as alkaloids (e.g., quinine, morphine), essential oils, and tannins.

• Latex, a milky fluid found in plants like rubber trees, is also a form of plant byproduct stored in specialized cells called laticifers.

Important Points

• Calcium Oxalate: Some plants convert liquid waste into solid crystals of calcium oxalate, known as raphides. These are often needle-shaped and are stored in vacuoles to prevent them from interfering with metabolic processes.

• Heartwood: In large trees, the central, non-functional part of the trunk called heartwood acts as a permanent storage site for tannins, resins, and oils. This not only disposes of waste but also makes the wood more durable and resistant to fungal and insect attacks.

• Bark Shedding: Certain trees deposit waste materials in their bark. As the tree grows, the outer bark peels or sheds, taking the accumulated waste products with it.

Q6. Answer: (a) Selfish exploitation causes environmental harm and misery

The correct answer is Selfish exploitation causes environmental harm and misery.

Key Points

• The core realization for sustainable resource management is that unregulated selfish exploitation of natural resources inevitably leads to ecological degradation and human suffering. This is often described in environmental economics as the Tragedy of the Commons.

• When individuals or entities prioritize short-term profits over long-term stability, they deplete renewable resources (like forests and fisheries) and non-renewable resources (like minerals and fossil fuels) beyond their carrying capacity.

• This exploitation results in environmental harm, such as biodiversity loss, soil erosion, and climate change, which directly causes socio-economic misery by destroying livelihoods and reducing the quality of life for present and future populations.

• Recognizing the interconnectedness of ecosystems helps society understand that sustainable use is not just an ethical choice

but a biological necessity for survival.

Additional Information

• Sustainable Development: This concept was famously defined in the Brundtland Report (also known as Our Common Future) in 1987 as development that meets the needs of the present without compromising the ability of future generations to meet their own needs.

• The Three Pillars: Sustainability is built on three interconnected pillars: Environmental Protection, Social Equity, and Economic Viability. Focusing solely on unlimited growth (Option 2) ignores the biophysical limits of Earth.

• Intergenerational Equity: This legal and ethical principle suggests that natural resources belong to all generations. While future generations must benefit (Option 3), the realization must also encompass the current generation's responsible consumption to avoid immediate misery.

• The Role of Regulation: While rules and legislation are essential for conservation (Option 4), they are often insufficient without a collective realization and cultural shift toward stewardship and voluntary compliance.

Important Points

• Resource Depletion Data: According to the Global Footprint Network, humanity is currently using nature 1.75 times faster than our planet's ecosystems can regenerate, leading to ecological overshoot.

• United Nations SDGs: The Sustainable Development Goals (SDGs), specifically Goal 12 (Responsible Consumption and Production) and Goal 15 (Life on Land), were adopted in 2015 to provide a global blueprint for mitigating selfish exploitation.

• Economic Impact: The Dasgupta Review (2021) on the Economics of Biodiversity highlighted that our global economy is embedded within nature, not external to it, meaning environmental harm eventually results in economic collapse.

Q7. Answer: (c) – 7.5 m/s²

The correct answer is – 7.5 m/s².

Key Points

• Acceleration is defined as the rate of change of velocity of an object with respect to time. It is a vector quantity, meaning it possesses both magnitude and direction.

• The mathematical formula to calculate average acceleration (a) is given by: a = (v - u) / t, where v is the final velocity, u is the initial velocity, and t is the time interval.

• In the given problem, the initial velocity (u) is +20 m/s, the final velocity (v) is -10 m/s, and the time taken (t) is 4 seconds.

• Substituting the values into the formula: a = (-10 m/s - 20 m/s) / 4 s. This simplifies to a = -30 / 4, which equals -7.5 m/s².

• The negative sign indicates that the acceleration is acting in the opposite direction to the initial motion, or that the body is experiencing retardation relative to the positive direction. Hence, the correct answer is – 7.5 m/s².

Additional Information

• SI Unit of Acceleration: The standard unit for measuring acceleration in the International System of Units (SI) is the meter per second squared (m/s²).

• Vector Nature: Since velocity is a vector, any change in either the speed or the direction of motion results in acceleration. In this case, the body not only slowed down but also reversed its direction (moving from positive to negative velocity).

• Uniform vs. Non-Uniform Acceleration: Uniform acceleration occurs when the velocity changes by equal amounts in equal intervals of time. Non-uniform acceleration occurs when the rate of change of velocity varies over time.

• Retardation/Deceleration: When the acceleration of a body is in the direction opposite to its velocity, it is often referred to as deceleration or retardation. It results in a decrease in the magnitude of velocity (speed) until the object stops or reverses.

Important Points

• Sign Convention: In physics, direction is often indicated by positive (+) and negative (-) signs. A change from +20 m/s to -10 m/s implies a total change in velocity of 30 m/s in the negative direction.

• Instantaneous vs. Average: While the formula (v-u)/t provides the average acceleration over the 4-second interval, instantaneous acceleration refers to the acceleration at a specific moment in time, calculated using derivatives (dv/dt).

• Graphical Representation: On a velocity-time graph, the slope of the line represents the acceleration. A downward-sloping line indicates negative acceleration.

Q8. Answer: (a) The components of brass are uniformly distributed and cannot be distinguished visually

The correct answer is The components of brass are uniformly distributed and cannot be distinguished visually.

Key Points

• Brass is categorized as a homogeneous mixture because it is a solid solution where the solute (zinc) and solvent (copper) are mixed uniformly at the atomic level.

• In a homogeneous mixture, the composition is consistent throughout the entire sample, and there are no visible boundaries of separation between the constituent elements. Hence, statement 1 is correct.

• Unlike chemical compounds, the elements in an alloy are not chemically bonded in fixed proportions. They are physically

blended in a molten state and retain their individual chemical identities. Hence, statement 2 is incorrect.

• Brass is an alloy, which by definition is a mixture of two or more elements (at least one being a metal). It consists of copper and zinc atoms, rather than being made of a single type of atom. Hence, statement 3 is incorrect.

• A compound is a substance formed when two or more elements chemically react to form a new substance with entirely different properties. Brass is a physical mixture of metals that exhibits variable composition. Hence, statement 4 is incorrect.

• The uniformity of brass ensures that any small sample taken from the musical instrument will have the same ratio of copper to zinc as any other sample from the same mold.

Additional Information

• Composition of Brass: It typically consists of approximately 60% to 70% Copper (Cu) and 30% to 40% Zinc (Zn). The exact percentage can be adjusted to alter the hardness, color, and ductility of the metal.

• Properties: Brass is highly prized for its malleability (easier to shape than bronze or zinc) and its acoustic properties, which make it ideal for musical instruments like trumpets, horns, and bells.

• Corrosion Resistance: Due to the presence of Copper, brass is highly resistant to corrosion, making it useful for plumbing fixtures, marine hardware, and electrical terminals.

• Substitutional Alloy: Brass is specifically a substitutional alloy, meaning the Zinc atoms replace Copper atoms within the metallic crystal lattice.

• Applications: Beyond music, it is used in ammunition casings, decorative items, and low-friction applications like locks, gears, and bearings.

Important Points

• Alloys vs. Mixtures: Alloys are considered mixtures because they show the properties of their constituents and can have variable compositions (unlike compounds which have a fixed formula).

• Separation: While homogeneous mixtures cannot be separated by simple physical methods like filtration, the components of brass can be separated using metallurgical processes that exploit different melting points or chemical reactivities.

• History: Brass has been known to humans since ancient times (roughly 500 BC), though it was often produced by smelting copper ores rich in zinc before pure zinc was identified as an element.

• Identification: To the naked eye or under a standard microscope, a homogeneous mixture like brass appears as a single pure substance, which is a key characteristic of solid solutions.

Q9. Answer: (c) a cathode

The correct answer is a cathode.

Key Points

• In the process of electrolytic refining, the pure metal always serves as the cathode, which is the negative electrode in the electrolytic cell.

• A thin strip or rod of pure metal is placed at the cathode to act as a starter sheet upon which the refined metal will deposit.

• The impure metal (the metal to be refined) is made the anode, which is the positive electrode.

• When an electric current is passed through the circuit, the metal atoms from the impure anode lose electrons and enter the electrolyte as positive ions.

• These positive metal ions are then attracted to the negative cathode, where they gain electrons (undergo reduction) and deposit as pure metal atoms.

• The concentration of the electrolyte remains constant throughout the process because the rate at which metal dissolves from the anode is equal to the rate at which it deposits on the cathode.

Additional Information

• The Electrolyte:

• The electrolyte used in this process is a soluble salt solution of the same metal that is being refined.

• For example, in the electrolytic refining of copper, the electrolyte is usually a solution of acidified copper sulphate (CuSO4).

• Commonly Refined Metals:

• This method is widely utilized for the purification of various non-ferrous metals such as Copper (Cu), Zinc (Zn), Tin (Sn), Nickel (Ni), Silver (Ag), and Gold (Au).

• It is particularly effective for obtaining metals with a very high degree of purity, often exceeding 99.9%.

• Mechanism at Electrodes:

• At the Anode: The reaction involves oxidation, where the metal M becomes M(n+) + ne(-).

• At the Cathode: The reaction involves reduction, where the metal ions M(n+) + ne(-) become the pure metal M.

• Treatment of Impurities:

• Soluble impurities go into the electrolyte solution and remain there.

• Insoluble impurities, which do not dissolve, fall to the bottom of the tank just below the anode.

Important Points

• Anode Mud: This refers to the collection of insoluble impurities that settle under the anode. In many cases, anode mud contains valuable elements such as antimony, selenium, tellurium, silver, gold, and platinum. The recovery of these precious metals often covers the cost of the refining process.

• Copper Refining: In the specific case of copper, the impure anode is often referred to as blister copper. As the process proceeds, the anode gradually gets thinner while the cathode becomes thicker and heavier with pure copper.

• Voltage and Current: The process requires a carefully controlled Direct Current (DC) and a specific voltage to ensure that only the desired metal ions are reduced at the cathode, preventing the deposition of unwanted impurities.

Q10. Answer: (b) 20 m

The correct answer is 20 m.

Key Points

• The motion of the block can be described using the Equations of Motion formulated by Sir Isaac Newton. These equations relate displacement, velocity, acceleration, and time for an object moving with constant acceleration.

• In this problem, the block is "dropped," which implies that its initial velocity (u) is 0 m/s. The height from which it is dropped is X, and it hits the ground with a final velocity (v) of 20 m/s.

• The acceleration due to gravity (g) acting on the block is given as 10 m/s^2. Since the motion is downward, the acceleration is positive in the direction of displacement.

• To find the height X, we use the Third Equation of Motion: v^2 = u^2 + 2as, where v is the final velocity, u is the initial velocity, a is the acceleration, and s is the displacement (height X).

• Substituting the values: (20)^2 = (0)^2 + 2 * 10 * X. This simplifies to 400 = 20 * X. Dividing 400 by 20, we find that X = 20 meters. Hence, the correct answer is 20 m.

Additional Information

• Conservation of Energy:

• This problem can also be solved using the principle of Conservation of Mechanical Energy. At the top of the building, the block has Potential Energy (PE) equal to mgh.

• As the block falls, its potential energy is converted into Kinetic Energy (KE), which is 1/2 * m * v^2 at the moment of impact.

• Equating the two (mgh = 1/2 * m * v^2), the mass (m) cancels out from both sides, proving that the height is independent of the mass of the object.

• Calculation: 10 * X = 0.5 * (20)^2 yields 10X = 200, resulting in X = 20 m.

• Role of Mass in Free Fall:

• The question specifies a mass of 1 kg. In the absence of air resistance, all objects fall at the same rate regardless of their mass. This was famously demonstrated by Galileo Galilei at the Leaning Tower of Pisa.

• Whether the block was 1 kg or 100 kg, the height required to reach a velocity of 20 m/s would remain 20 m.

• Acceleration due to Gravity:

• The standard value of g on Earth is approximately 9.81 m/s^2, but for competitive exams and simplified calculations, it is often rounded to 10 m/s^2.

• Gravity is a vector quantity that always acts toward the center of the Earth.

Important Points

• Units and Measurements:

• It is essential to ensure all units are in the SI system (Standard International). Here, velocity is in m/s, acceleration is in m/s^2, and height is in meters (m).

• If the velocity was given in km/h, it would need to be converted by multiplying by 5/18 before using the kinematic equations.

• Kinematic Equations:

• First Equation: v = u + at (used to find time or velocity).

• Second Equation: s = ut + 1/2 * at^2 (used to find displacement when time is known).

• Third Equation: v^2 = u^2 + 2as (used when time is unknown, as in this specific question).

• Assumptions:

• These calculations assume a vacuum or negligible air resistance. In a real-world scenario with significant air friction, the block would hit the ground with a lower velocity than 20 m/s when dropped from 20 m.

Q11. Answer: (a) Micelles

The correct answer is Micelles.

Key Points

• Soap molecules are sodium or potassium salts of long-chain carboxylic acids (fatty acids). They possess a unique structure

consisting of a hydrophilic (water-loving) ionic head and a hydrophobic (water-fearing) hydrocarbon tail.

• When soap is dissolved in water, the molecules orient themselves in a specific cluster called a Micelle. In this arrangement, the hydrophobic tails aggregate together at the interior of the cluster to stay away from water, while the ionic heads face outward, interacting with the water molecules.

• The cleaning action occurs because most dirt and stains are oily or greasy in nature. The hydrophobic end of the soap molecule attaches itself to the oil or dirt particle, while the hydrophilic end remains attached to the water.

• This results in the formation of an emulsion where the oily dirt is trapped at the center of the micelle. Since the surfaces of these micelles are similarly charged (usually negative), they repel each other and remain suspended in the water as a colloid, preventing the dirt from re-depositing on the clothes. Hence, the correct answer is Micelles.

Additional Information

• Chemical Composition of Soap:

• Common soaps are made from fats and oils reacting with Sodium Hydroxide (NaOH) or Potassium Hydroxide (KOH). This chemical reaction is known as Saponification.

• Common fatty acids used include stearic acid, palmitic acid, and oleic acid. Sodium stearate ($C_{17}H_{35}COONa$) is a typical example of a soap molecule.

• Hard Water and Scum Formation:

• In hard water, which contains high concentrations of Calcium (Ca^{2+}) and Magnesium (Mg^{2+}) ions, soap reacts with these ions to form an insoluble, greyish-white precipitate called scum.

• Because of this precipitation, a large amount of soap is wasted before it can start forming micelles for cleaning.

• Detergents vs. Soap:

• Detergents are generally ammonium or sulphonate salts of long-chain carboxylic acids.

• Unlike soaps, the charged ends of detergents do not form insoluble precipitates with the calcium and magnesium ions in hard water. Therefore, detergents are effective for cleaning even in hard water conditions.

• Mechanism of Action:

• The cleansing process involves agitation (scrubbing or rotating in a washing machine), which helps pull the micelles (containing the trapped dirt) away from the surface of the fabric into the bulk of the water.

• Soap lowers the surface tension of water, allowing it to wet surfaces more effectively and penetrate deeper into the fibers of the cloth.

Important Points

• Hydrophobic Effect: This is the primary driving force behind micelle formation. The non-polar hydrocarbon tails are "pushed" together by water molecules that prefer to bond with each other and the polar heads of the soap.

• Tyndall Effect: Because a soap solution containing micelles is a colloidal system, it is capable of scattering a beam of light, a phenomenon known as the Tyndall effect.

• Shape: While often represented as spheres, micelles can take various shapes depending on the concentration of soap and the temperature, including ellipsoidal or cylindrical forms.

• Critical Micelle Concentration (CMC): This is the specific concentration of surfactants above which micelles form and all additional surfactants added to the system go to micelles. Below this concentration, soap molecules exist individually on the surface or in the bulk of the liquid.

Q12. Answer: (d) One element displaces another from a compound

The correct answer is One element displaces another from a compound.

Key Points

• A displacement reaction is a type of chemical reaction in which a more reactive element removes or displaces a less reactive element from its compound. It is often represented by the general formula: $A + BC \rightarrow AC + B$.

• In this reaction, the element A must be more chemically reactive than the element B for the displacement to occur. If A is less reactive than B, no reaction will take place.

• Statement 1: "Two reactants combine to generate one product" describes a Combination Reaction (also known as a Synthesis Reaction), such as the formation of water from hydrogen and oxygen. Hence, statement 1 is incorrect.

• Statement 2: "Compounds disintegrate into two or more components" describes a Decomposition Reaction, where a single reactant breaks down, often requiring energy in the form of heat, light, or electricity. Hence, statement 2 is incorrect.

• Statement 3: "Ion exchange occurs between two substances" refers to a Double Displacement Reaction (or Metathesis), where parts of two ionic compounds are exchanged to make two new compounds. Hence, statement 3 is incorrect.

• Statement 4: "One element displaces another from a compound" is the fundamental definition of a Single Displacement Reaction. This process is governed by the Electrochemical Series or Reactivity Series. Hence, statement 4 is correct.

Additional Information

• The Reactivity Series: This is a vertical arrangement of metals in the decreasing order of their reactivity. Potassium (K) and

Sodium (Na) are at the top (most reactive), while Gold (Au) and Platinum (Pt) are at the bottom (least reactive).

• Example of Metal Displacement: When an Iron (Fe) nail is placed in a Copper Sulphate ($CuSO_4$) solution, the blue color of the solution fades and turns light green. This happens because Iron is more reactive than Copper and displaces it to form Iron Sulphate ($FeSO_4$).

• Hydrogen Displacement: Many metals like Zinc (Zn) or Magnesium (Mg) react with dilute acids (such as HCl) to displace Hydrogen. For instance, $Zn + 2HCl \rightarrow ZnCl_2 + H_2$.

• Applications: Displacement reactions are widely used in metallurgy for the extraction of metals, in Thermite welding for repairing railway tracks, and in batteries to generate electricity.

• Halogen Displacement: Non-metals also undergo these reactions. For example, Chlorine (Cl_2) can displace Bromine (Br_2) from a solution of Potassium Bromide (KBr) because Chlorine is more electronegative and reactive.

Important Points

• Thermodynamics: These reactions are generally exothermic, meaning they release heat energy to the surroundings as the bonds in the products are more stable than the reactants.

• Redox Nature: Most displacement reactions are Redox Reactions, involving the oxidation of the more reactive element (losing electrons) and the reduction of the less reactive element (gaining electrons).

• Reaction Speed: The speed or rate of reaction often depends on the distance between the two metals in the reactivity series; the further apart they are, the more vigorous the reaction tends to be.

Q13. Answer: (d) Object is at the centre of curvature

The correct answer is Object is at the centre of curvature.

Key Points

• The magnification (m) of a spherical mirror is defined as the ratio of the height of the image (h') to the height of the object (h). It is also expressed in terms of object distance (u) and image distance (v) as $m = -v/u$.

• In this question, the magnification is -1. The negative sign indicates that the image formed is real and inverted. Hence, the image is formed in front of the mirror.

• The numerical value 1 indicates that the size of the image is exactly equal to the size of the object ($|v| = |u|$).

• For a concave mirror, the image is of the same size as the object only when the object is placed at the centre of curvature (C). In this specific case, the image is also formed at the centre of curvature, is real, and is inverted. Hence, the statement "Object is at the centre of curvature" is correct.

• If the object is beyond the centre of curvature, the image is formed between the focus (F) and the centre of curvature (C) and is diminished ($|m| < 1$). Hence, option 1 is incorrect.

• If the object is between the focus (F) and the pole (P), the image formed is virtual, erect, and magnified, meaning the magnification would be positive and greater than 1. Hence, option 2 is incorrect.

• If the object is at the focus (F), the image is formed at infinity and is highly magnified. Hence, option 3 is incorrect.

Additional Information

• Concave Mirror: It is a spherical mirror whose reflecting surface is curved inwards, towards the centre of the sphere. It is also known as a converging mirror because it converges light rays that fall on it.

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

• Sign Convention: According to the New Cartesian Sign Convention, the pole (P) of the mirror is taken as the origin. The object distance (u) is always negative. For a concave mirror, the focal length (f) and the radius of curvature (R) are always negative.

• Radius of Curvature (R): The distance between the pole and the centre of curvature is called the radius of curvature. It is related to the focal length by the equation $R = 2f$.

• Uses of Concave Mirrors: They are commonly used in shaving mirrors to see a larger image of the face, in torches and searchlights to get powerful parallel beams of light, and by dentists to see large images of teeth.

Important Points

• If m is positive, the image is virtual and erect.

• If m is negative, the image is real and inverted.

• If $|m| > 1$, the image is enlarged.

• If $|m| < 1$, the image is diminished.

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

• A plane mirror always has a magnification of +1, meaning the image is virtual, erect, and of the same size as the object.

• A convex mirror always produces a virtual, erect, and diminished image, so its magnification is always positive and less than 1.

Q14. Answer: (b) atomic, mass

The correct answer is atomic, mass.

Key Points

• Isobars are defined as atoms of different chemical elements that have the same mass number (total number of nucleons) but different atomic numbers (number of protons).

• The term isobar was suggested by Alfred Walter Stewart in the year 1918. It is derived from the Greek words "isos" meaning equal and "baros" meaning weight.

• Because isobars have different atomic numbers, they occupy different positions in the periodic table and possess different chemical properties.

• Examples of isobars include Argon (atomic number 18), Potassium (atomic number 19), and Calcium (atomic number 20), all of which can have a mass number of 40.

• Since their mass numbers are the same, their physical properties, which depend on the mass of the atom, may be quite similar, though their electronic configurations differ significantly.

Additional Information

• Atomic Number (Z):

• It represents the number of protons found in the nucleus of every atom of that element.

• It uniquely identifies a chemical element. For instance, any atom with 6 protons is an atom of Carbon.

• Mass Number (A):

• It is the sum of the total number of protons and neutrons in an atomic nucleus.

• While the atomic number is usually constant for an element, the mass number can vary, leading to the formation of isotopes.

• Isotopes:

• These are atoms of the same element that have the same atomic number but different mass numbers.

• Example: Hydrogen has three isotopes: Protium (1 proton, 0 neutrons), Deuterium (1 proton, 1 neutron), and Tritium (1 proton, 2 neutrons).

• Isotones:

• These are atoms of different elements that have the same number of neutrons but different atomic numbers and mass numbers.

• Example: Carbon-14 (6 protons, 8 neutrons) and Oxygen-16 (8 protons, 8 neutrons) are isotones.

Important Points

• Nucleons is the collective term used for protons and neutrons, both of which reside in the nucleus of an atom.

• The number of electrons in a neutral atom is equal to its atomic number. Since isobars have different atomic numbers, they have a different number of electrons, leading to their distinct chemical reactivity.

• In nuclear physics, isobars are relevant in beta decay. In beta minus decay, a neutron turns into a proton, meaning the atomic number increases by 1 while the mass number remains constant, effectively creating an isobar of the parent atom.

• The atomic mass of an element is the weighted average of the masses of its naturally occurring isotopes and is measured in atomic mass units (amu).

Q15. Answer: (b) Focal length (in metres)

The correct answer is Focal length (in metres).

Key Points

• The power of a lens is defined as the ability of the lens to converge or diverge light rays falling on it. It is mathematically expressed as the reciprocal of its focal length.

• The standard formula used to calculate the power (P) is P = 1/f, where f must be measured in metres.

• The SI unit of power of a lens is the Dioptre, which is denoted by the symbol D. One Dioptre is equal to 1 m^-1.

• A convex lens has a positive focal length, and therefore, its power is always positive. This is because it converges light rays at a real focus.

• A concave lens has a negative focal length, resulting in a negative power value. This lens is known for diverging light rays.

• The power of a lens is directly related to its refractive index and the radii of curvature of its surfaces, as described by the lens maker's formula.

Additional Information

• Combination of Lenses: When two or more thin lenses are placed in contact, the total power (P) of the combination is the algebraic sum of the individual powers of the lenses (P = P1 + P2 + P3...). This principle is widely used in designing camera lenses and microscopes.

• Focal Length and Power Relationship: A lens with a short focal length has more power because it bends light rays more sharply, leading to a higher degree of convergence or divergence. Conversely, a lens with a long focal length has less power.

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• Optical Instruments: Opticians prescribe corrective lenses using power instead of focal length. For example, a prescription of +2.0 D indicates a convex lens with a focal length of 0.5 metres (50 cm).

• Refractive Index Influence: The power of a lens also depends on the medium in which it is placed. If a lens is immersed in a liquid with a higher refractive index than air, its focal length increases, and its power decreases.

Important Points

• Myopia (Short-sightedness): To correct this vision defect, a concave lens with negative power is used. This helps in diverging the incoming light so the image forms correctly on the retina.

• Hypermetropia (Long-sightedness): This condition is corrected using a convex lens with positive power, which increases the converging power of the eye's optical system.

• Calculation Tip: Always remember to convert the focal length from centimetres to metres before using the power formula. For instance, if f = 25 cm, then f = 0.25 m, and P = 1/0.25 = 4 D.

• Physical Dimensions: While thickness and diameter (aperture) affect the intensity of light and aberrations, they do not directly define the numerical "power" of the lens in the same way the focal length does.

Q16. Answer: (a) Receptor → Spinal cord → Motor neuron → Muscle

The correct answer is Receptor → Spinal cord → Motor neuron → Muscle.

Key Points

• A reflex arc is a neural pathway that controls a reflex action, which is an immediate, involuntary response to a stimulus.

• The process begins at the Receptor (like the skin or eyes), which perceives the stimulus (such as heat or pain).

• From the receptor, the impulse is carried by a sensory neuron (also known as an afferent neuron) to the Central Nervous System (CNS), specifically the Spinal cord.

• In the Spinal cord, the interneuron processes the signal and immediately relays it to a Motor neuron (also known as an efferent neuron) without waiting for the brain to provide a conscious command.

• The Motor neuron then transmits the impulse to the Effector, which is usually a Muscle or a gland, to perform the necessary action.

• The sequence Receptor → Spinal cord → Motor neuron → Muscle correctly identifies the bypass of the brain to ensure speed. Hence, option 1 is correct.

• The sequence Receptor → Spinal cord → Brain → Muscle implies that the brain must process the reflex before the muscle acts, which would be too slow for a reflex. Hence, option 2 is incorrect.

• The sequence Receptor → Brain → Spinal cord → Muscle describes a conscious voluntary action rather than an involuntary reflex. Hence, option 3 is incorrect.

• The sequence Receptor → Motor neuron → Spinal cord → Muscle is anatomically incorrect because motor neurons carry impulses away from the spinal cord, not toward it. Hence, option 4 is incorrect.

Additional Information

• Sensory Neurons (Afferent): These specialized nerve cells are responsible for converting external stimuli from the environment into internal electrical impulses. They carry signals from the peripheral nervous system to the CNS.

• Motor Neurons (Efferent): These are neurons located in the CNS that project their axons outside the CNS to directly or indirectly control muscles and glands.

• Reflex Action: This is a rapid, automatic response to a stimulus. Examples include the knee-jerk reflex, blinking when an object approaches the eye, or withdrawing a hand from a hot surface.

• Evolutionary Advantage: The primary function of the reflex arc is survival. By bypassing the conscious brain, the body can react to dangerous stimuli in milliseconds, significantly reducing the risk of tissue damage.

• Interneurons: These are found within the Spinal cord and act as the "middleman," connecting sensory and motor neurons to allow for a quick circuit.

Important Points

• Types of Reflexes:

• Monosynaptic Reflex: A simple reflex arc consisting of only one synapse between the sensory and motor neuron (e.g., the Patellar reflex).

• Polysynaptic Reflex: A reflex involving one or more interneurons between the sensory and motor components (e.g., the withdrawal reflex from pain).

• Anatomy of the Spinal Cord: The grey matter of the spinal cord is where the synapses of the reflex arc occur. It contains the cell bodies of motor neurons and interneurons.

• Synapse: This is the microscopic gap between two neurons where the electrical impulse is converted into a chemical signal (using neurotransmitters) to cross to the next cell.

• Stimulus: Any change in the environment (internal or external) that is capable of eliciting a nerve impulse.

Q17. Answer: (a) Butane (C4H10)

The correct answer is Butane (C4H10).

Key Points

• Butane (C4H10) is an alkane with four carbon atoms. It is the first hydrocarbon in the series that can form a branched chain structure known as isobutane (or 2-methylpropane), where one carbon atom is attached to the center carbon of a three-carbon chain. Hence, option 1 is correct.

• Ethane (C2H6) consists of two carbon atoms connected by a single bond. Because it only has two carbons, they can only be arranged in a straight line, making branching impossible. Hence, option 2 is incorrect.

• Cyclohexane (C6H12) is a cycloalkane where six carbon atoms are joined in a closed-ring structure. While it contains multiple carbons, its primary arrangement is cyclic rather than a branched open chain. Hence, option 3 is incorrect.

• Methane (CH4) is the simplest hydrocarbon, containing only one carbon atom bonded to four hydrogen atoms. Since there is only one carbon, there is no possibility of any chain formation or branching. Hence, option 4 is incorrect.

• In organic chemistry, branching occurs when at least one carbon atom is bonded to three or four other carbon atoms, a phenomenon that requires a minimum of four carbon atoms in an open-chain alkane.

Additional Information

• Structural Isomerism:

• This is a form of isomerism where compounds have the same molecular formula but different structural arrangements of atoms.

• Butane has two structural isomers: n-Butane (straight chain) and isobutane (branched chain).

• As the number of carbon atoms increases, the number of possible isomers increases significantly. For example, Pentane (C5H12) has three isomers, while Hexane (C6H14) has five.

• Hydrocarbon Classification:

• Alkanes: Saturated hydrocarbons with the general formula CnH2n+2. They contain only single covalent bonds.

• Alkenes and Alkynes: Unsaturated hydrocarbons containing double or triple bonds, respectively.

• Cycloalkanes: Saturated hydrocarbons where the carbon atoms are arranged in a ring, following the formula CnH2n.

• Physical Properties of Branched Chains:

• Branching generally lowers the boiling point of a compound compared to its straight-chain isomer.

• This is because a branched-chain molecule has a more spherical shape, which reduces the surface area and weakens the Van der Waals forces between molecules.

• For instance, n-butane has a boiling point of approximately -0.5 degrees Celsius, while isobutane boils at -11.7 degrees Celsius.

Important Points

• Carbon's Tetravalency: Carbon has four valence electrons, allowing it to form four covalent bonds. This property, known as tetravalency, combined with catenation (the ability to link with other carbon atoms), allows the formation of complex straight, branched, and cyclic structures.

• Nomenclature: According to IUPAC rules, the branched isomer of butane is named 2-methylpropane because the longest continuous chain has three carbons (propane) and a methyl group is attached to the second carbon.

• Natural Occurrence: Butane is a highly flammable, colorless gas that is easily liquefied. It is commonly used as a fuel in LPG (Liquefied Petroleum Gas) cylinders and cigarette lighters.

Q18. Answer: (b) Golgi apparatus

The correct answer is Golgi apparatus.

Key Points

• The Golgi apparatus, also known as the Golgi complex or Golgi body, is a membrane-bound organelle found in eukaryotic cells. It consists of a series of flattened, stacked pouches called cisternae.

• It was first discovered by the Italian biologist Camillo Golgi in 1898 while he was examining nerve cells. The cisternae are typically 0.5µm to 1.0µm in diameter and are stacked parallel to each other.

• The primary function of the Golgi apparatus is the processing, packaging, and secretion of proteins and lipids. It acts as the shipping center of the cell, modifying products received from the Endoplasmic Reticulum (ER).

• The Golgi apparatus is directly involved in the formation of lysosomes. Lysosomes are formed by the budding of vesicles from the trans-face (shipping side) of the Golgi complex, containing concentrated hydrolytic enzymes.

• The organelle possesses a distinct polarity, with a cis face (forming face) that receives materials from the ER and a trans face (maturing face) where modified materials are dispatched in secretory vesicles.

Additional Information

• Chromoplast:

• Chromoplasts are a type of plastid found in plant cells that contain pigments other than chlorophyll.

• They are responsible for the yellow, orange, and red colors seen in flowers, fruits, and aging leaves due to the presence of

carotenoid pigments.

• Unlike the Golgi apparatus, they do not contain cisternae and are not involved in lysosome formation.

• Leucoplast:

• Leucoplasts are colorless plastids primarily used for the storage of nutrients in plants.

• They are categorized into Amyloplasts (store starch), Elaioplasts (store oils/fats), and Aleuroplasts (store proteins).

• These are typically found in non-photosynthetic tissues like roots, bulbs, and seeds.

• Mitochondria:

• Known as the "Powerhouse of the cell," mitochondria are responsible for cellular respiration and the production of ATP (Adenosine Triphosphate).

• They have a double-membrane structure. The inner membrane is folded into cristae (not cisternae) to increase surface area for oxidative phosphorylation.

• Mitochondria contain their own DNA (mtDNA) and ribosomes, allowing them to be semi-autonomous.

• Lysosomes:

• These are suicide bags of the cell, containing digestive enzymes that break down waste materials, cellular debris, and foreign particles.

• The acidic pH within lysosomes is maintained to optimize the activity of acid hydrolases.

Important Points

• The term "cisternae" is specifically used for the flattened sacs in the Golgi apparatus and the Endoplasmic Reticulum, whereas "cristae" refers to the folds of the inner mitochondrial membrane.

• The Endomembrane System includes the nuclear envelope, ER, Golgi apparatus, lysosomes, vacuoles, and the plasma membrane, all working together to transport and process cellular materials.

• In plant cells, the Golgi apparatus is often referred to as Dictyosomes, which are usually more scattered and smaller than those found in animal cells.

Q19. Answer: (b) Rhinoceros

The correct answer is Rhinoceros.

Key Points

• Infrasound refers to sound waves with frequencies below the lower limit of human audibility, which is typically less than 20 Hz.

• Rhinoceroses are well-known in the animal kingdom for their ability to communicate using infrasound. They use these low-frequency sounds to maintain contact with other individuals and coordinate social behavior, especially in environments where visibility is low.

• Research indicates that Rhinoceros vocalizations can reach frequencies as low as 5 Hz to 10 Hz, allowing the sound to travel over long distances and through dense vegetation. Hence, the correct answer is Rhinoceros.

• In contrast, animals like Dolphins, Bats, and Rats are primarily associated with ultrasound, which consists of frequencies higher than 20,000 Hz (the upper limit of human hearing).

• Bats and Dolphins use high-frequency ultrasonic pulses for echolocation, enabling them to navigate and hunt prey with extreme precision. Hence, the other options are incorrect in the context of infrasound.

Additional Information

• Infrasound Characteristics:

• Infrasonic waves have long wavelengths, which allows them to bypass obstacles and travel vast distances without significant loss of energy.

• Natural phenomena such as earthquakes, volcanic eruptions, and lightning also produce infrasound.

• Apart from Rhinoceroses, other large mammals like Elephants, Whales (specifically baleen whales), Giraffes, and Hippopotamuses are known to communicate using infrasonic rumbles.

• Ultrasound Applications:

• Ultrasound (frequencies above 20 kHz) is widely used by Microbats for hunting insects. They emit pulses and listen to the echoes to determine the size, location, and speed of their prey.

• Dolphins use ultrasound for underwater navigation and social bonding, with some clicks reaching frequencies up to 150 kHz.

• In human technology, ultrasound is utilized in medical imaging (sonography) and industrial non-destructive testing.

• Audible Range:

• The standard audible range for a healthy young human is 20 Hz to 20,000 Hz. As humans age, the sensitivity to higher frequencies typically declines.

• Many animals have evolved specialized hearing to occupy niches outside this range to avoid competition or to facilitate specialized survival strategies.

Important Points

• Elephants: They use infrasound to communicate between herds that are several kilometers apart. These "secret" conversations help them find water sources or mates.

• Pigeons: Surprisingly, Pigeons are capable of hearing very low-frequency infrasound (down to 0.5 Hz), which may help them in navigation by detecting the "acoustic signature" of distant mountains or oceans.

• Rats: While often associated with ultrasound for social chirping (at 22 kHz or 50 kHz), they do not use infrasound for primary communication.

• Scientific Studies: Studies conducted on Sumatran Rhinoceroses in captivity have confirmed their use of infrasonic signals, which share similarities with the vocalizations of Humpback Whales.

Q20. Answer: (a) Stamen includes both anther and filament.

The correct answer is Stamen includes both anther and filament.

Key Points

• The stamen is the male reproductive organ of a flower. It consists of a long, slender stalk called the filament and a sac-like structure at the tip called the anther. Hence, statement 1 is correct.

• The ovary is the basal, swollen part of the pistil (or carpel), which is the female reproductive part. It is not located within the stamen. Hence, statement 2 is incorrect.

• The pistil (also known as the carpel) functions as the female reproductive part of the flower, consisting of the stigma, style, and ovary. Hence, statement 3 is incorrect.

• Pollen grains are produced within the anther (the male part) through a process called microsporogenesis. The ovule is the structure inside the ovary that contains the female gamete and develops into a seed after fertilization. Hence, statement 4 is incorrect.

Additional Information

• Structure of the Pistil:

• Stigma: The receptive sticky tip of the pistil that serves as a landing platform for pollen grains during pollination.

• Style: An elongated tube that connects the stigma to the ovary, through which the pollen tube grows.

• Ovary: The enlarged basal portion containing ovules. After fertilization, the ovary typically matures into a fruit.

• Structure of the Stamen:

• Anther: Usually bilobed in angiosperms, it contains pollen sacs where pollen grains are stored and released.

• Filament: The stalk that supports the anther, positioning it to effectively distribute pollen to pollinators like bees, butterflies, or the wind.

• Flower Classification:

• Bisexual Flowers: Flowers that contain both stamens and pistils (e.g., Hibiscus, Lily, and Rose).

• Unisexual Flowers: Flowers that contain either only stamens or only pistils (e.g., Papaya, Watermelon, and Corn).

Important Points

• Pollination: This is the transfer of pollen grains from the anther to the stigma. It can be self-pollination (within the same flower or plant) or cross-pollination (between different plants of the same species).

• Fertilization: Once pollen lands on the stigma, it germinates to form a pollen tube that carries male gametes to the ovule inside the ovary. The fusion of male and female gametes forms a zygote.

• Double Fertilization: A unique characteristic of angiosperms (flowering plants) where one male gamete fuses with the egg to form a zygote, and another fuses with polar nuclei to form the endosperm (nutritive tissue for the embryo).

• Non-Reproductive Parts: Petals (corolla) are often brightly colored to attract pollinators, while sepals (calyx) protect the flower in its bud stage.

Q21. Answer: (d) Positive - negative ions

The correct answer is Positive - negative ions.

Key Points

• A double displacement reaction, also known as a metathesis reaction, is a chemical process involving the exchange of ions between two compounds to form new compounds.

• In these reactions, the positive ions (cations) and negative ions (anions) of the reactants switch places. Specifically, the cation of the first reactant combines with the anion of the second reactant, while the cation of the second reactant pairs with the anion of the first.

• The general chemical equation for this reaction is AB + CD → AD + CB. In this formula, A and C represent positively charged ions, while B and D represent negatively charged ions.

• The reaction occurs primarily in aqueous solutions where the ions are free to move and interact. The driving force for such a reaction is typically the formation of a precipitate, a gas, or a stable molecular compound like water.

• Because the fundamental nature of the bond formation involves a cation attracting an anion to maintain electrical neutrality, the

exchange is characterized as occurring between positive and negative ions.

Additional Information

• Precipitation Reactions: This is a common subtype where two soluble salts react to form an insoluble solid. For example, when Silver Nitrate (AgNO3) is mixed with Sodium Chloride (NaCl), the Silver (Ag+) ions and Chloride (Cl-) ions bond to form Silver Chloride (AgCl), which appears as a white precipitate.

• Neutralization Reactions: These occur between an acid and a base. The Hydrogen (H+) ion from the acid and the Hydroxyl (OH-) ion from the base exchange to form Water (H2O), while the remaining positive and negative ions form a salt. A classic example is HCl + NaOH → NaCl + H2O.

• Gas Formation: Some double displacement reactions result in the production of a gas. For instance, the reaction between Sodium Sulfide (Na2S) and Hydrochloric Acid (HCl) produces Hydrogen Sulfide (H2S) gas and Sodium Chloride.

• Applications: Double displacement is used extensively in industrial chemistry, qualitative analysis to detect specific ions, and in water treatment. Ion exchange resins used in water softeners operate on this principle to remove Calcium (Ca2+) and Magnesium (Mg2+) ions.

Important Points

• Oxidation State: Unlike Redox reactions, the oxidation state of the atoms typically does not change during a double displacement reaction. The atoms simply rearrange their ionic partnerships.

• Solubility Rules: To predict if a double displacement will occur, chemists use solubility rules. If both predicted products are soluble (stay as ions in the water), no net reaction has actually taken place; this is often called "no reaction."

• Contrast with Single Displacement: In a single displacement reaction, one element replaces another in a compound (e.g., Zn + CuSO4 → ZnSO4 + Cu). In double displacement, there is a mutual exchange between two compounds.

• Ionic Equations: These reactions are best represented by Net Ionic Equations, which highlight only the species that undergo a chemical change, excluding spectator ions that remain dissolved in the solution.

Q22. Answer: (a) n^2B

The correct answer is n^2B.

Key Points

• The magnetic field (B) at the center of a circular coil carrying a current (I) is directly proportional to the number of turns (N) and inversely proportional to the radius (R) of the coil.

• The mathematical formula for the magnetic field at the center of a circular loop is B = (mu_0 * N * I) / (2 * R), where mu_0 is the permeability of free space.

• In the initial case, for a single-turn coil (N = 1) with radius R, the field is B = (mu_0 * I) / (2 * R). Hence, this represents the baseline magnetic field strength.

• In the second case, the same wire is wound into a coil of n turns. This means the new number of turns N' = n.

• The new radius (R') is given as R/n. This is because the total length of the wire remains constant, so increasing the turns must reduce the radius proportionally. Hence, the change in radius is a direct consequence of the change in turns.

• The new magnetic field B' is calculated as: B' = (mu_0 * n * I) / (2 * (R/n)). Simplifying this expression gives B' = n^2 * [(mu_0 * I) / (2 * R)].

• Comparing the two equations, we find that B' = n^2 * B. Hence, the correct answer is n^2B.

Additional Information

• Magnetic Field Induction: This phenomenon is a part of electromagnetism, specifically explained by the Biot-Savart Law, which relates magnetic fields to the magnitude, direction, length, and proximity of the electric current.

• Dependence on Current: If the current (I) were doubled while keeping the turns and radius constant, the magnetic field would also double, showing a linear relationship.

• Permeability (mu_0): The constant mu_0 has a standard value of 4 * pi * 10^-7 T*m/A. It represents how easily magnetic flux can be established in a vacuum.

• Right-Hand Thumb Rule: This rule is used to determine the direction of the magnetic field. If the fingers of the right hand curl in the direction of the current in the loop, the thumb points in the direction of the magnetic field at the center.

• Applications: The principle of increasing turns to strengthen a magnetic field is widely used in transformers, electric motors, generators, and electromagnets found in industrial machinery.

Important Points

• Length of Wire Constraint: In such problems, it is crucial to remember that the length of the wire (L) is L = 2 * pi * R * N. If N is multiplied by n, R must be divided by n to keep L constant.

• Squared Relationship: The field strength at the center increases with the square of the number of turns (n^2) when the same length of wire is used because both the increase in turns and the decrease in radius contribute equally to the field enhancement.

• Units: The SI unit for the magnetic field is the Tesla (T), named after Nikola Tesla. Another commonly used unit is the Gauss (G), where 1 Tesla = 10,000 Gauss.

• Center vs. Axis: The formula used here is specifically for the center of the coil. The field at a distance x along the axis of the coil would follow a different formula involving (R^2 + x^2)^3/2 in the denominator.

Q23. Answer: (c) living and loosely arranged with intercellular spaces

The correct answer is living and loosely arranged with intercellular spaces.

Key Points

• Parenchyma is the most fundamental and versatile type of simple permanent tissue found in plants. It consists of living cells that possess a functional nucleus and cytoplasm.

• The cells of parenchyma are typically loosely arranged, which results in the presence of prominent intercellular spaces between individual cells. Hence, statement 3 is correct.

• The cell walls of parenchyma are thin and primarily composed of cellulose. These cells are usually isodiametric, meaning they are roughly equal in all dimensions, appearing spherical, oval, or polygonal.

• Parenchyma cells serve as the "filler" tissue in the soft parts of plants, such as the cortex of roots, the pith of stems, and the mesophyll of leaves.

• Unlike certain other tissues, parenchyma cells are not dead at maturity; they remain metabolically active to perform vital functions like secretion and regeneration. Hence, statement 1 and 2 are incorrect as they describe dead tissues.

Additional Information

• Classification of Simple Tissues:

• Collenchyma: These are living cells that provide mechanical support and flexibility. They are characterized by being thickened at the corners due to the deposition of cellulose and pectin, often leaving no intercellular spaces. Hence, statement 4 is incorrect.

• Sclerenchyma: This tissue consists of dead cells at maturity. The walls are heavily thickened with lignin, a chemical substance that acts as cement and hardens them. These cells are compactly arranged and provide structural rigidity to parts like the husk of a coconut.

• Specialized Forms of Parenchyma:

• Chlorenchyma: When parenchyma cells contain chlorophyll, they are known as chlorenchyma. These are responsible for performing photosynthesis in green leaves and stems.

• Aerenchyma: In aquatic plants, parenchyma cells develop large air cavities to provide buoyancy, helping the plants float on water.

• Functions of Parenchyma:

• Storage: One of the primary roles is the storage of food (starch), water, and waste products (tannins, resins).

• Photosynthesis: Through chlorenchyma, it helps in the synthesis of organic compounds.

• Wound Healing: Because these cells retain the ability to divide (meristematic potential) even at maturity, they play a critical role in healing plant injuries.

Important Points

• Comparison of Cell Walls: While Parenchyma has thin cellulosic walls, Collenchyma has unevenly thickened walls (at corners), and Sclerenchyma has uniformly thick lignified walls.

• Location: Parenchyma is found in almost all organs of the plant, including roots, stems, leaves, flowers, and fruits.

• Protoplasm: Since they are living cells, parenchyma cells contain a dense protoplasm and a large central vacuole.

• Shape: Though often isodiametric, they can also be elongated in specific areas like the palisade parenchyma of a leaf.

Q24. Answer: (a) 2as = v2 + u2

The correct answer is 2as = v2 + u2.

Key Points

• The equations of motion describe the basic concepts of a moving object, such as its velocity, displacement, and acceleration, relative to time. These are specifically valid for motion with uniform acceleration (constant acceleration).

• The equation v = u + at is known as the first equation of motion. It shows the relationship between final velocity (v), initial velocity (u), acceleration (a), and time (t). Hence, statement 2 is correct.

• The equation s = ut + 1/2at2 is the second equation of motion. It is used to calculate the displacement (s) of an object over a period of time when the initial velocity and acceleration are constant. Hence, statement 3 is correct.

• The equation v2 - u2 = 2as is the third equation of motion. It relates final velocity, initial velocity, acceleration, and displacement without involving the variable of time. Hence, statement 4 is correct.

• The expression 2as = v2 + u2 does not correctly represent a standard kinematic relationship. In the correct formula, the initial velocity squared (u2) must be subtracted from the final velocity squared (v2) to equal 2as. Hence, statement 1 is incorrect.

• These equations were famously summarized in Sir Isaac Newton's work, Philosophiæ Naturalis Principia Mathematica, published in 1687, which laid the foundation for classical mechanics.

Additional Information

• Definitions of Variables:

• Initial Velocity (u): The velocity of the object at time t = 0. It is measured in meters per second (m/s).

• Final Velocity (v): The velocity of the object after time t has elapsed, measured in m/s.

• Acceleration (a): The rate of change of velocity. For these equations to hold true, a must be constant. It is measured in meters per second squared (m/s2).

• Displacement (s): The shortest distance between the starting and ending points, a vector quantity measured in meters (m).

• Graphical Representation:

• In a Velocity-Time (v-t) graph, the slope represents the acceleration of the object.

• The area under the curve of a Velocity-Time graph represents the total displacement covered by the object.

• A straight line in a v-t graph indicates uniform acceleration, whereas a horizontal line indicates zero acceleration (constant velocity).

• Motion Under Gravity:

• A common application of these equations is free fall. In this case, acceleration (a) is replaced by acceleration due to gravity (g), which is approximately 9.8 m/s2 on Earth.

• When an object is thrown upward, the value of g is taken as negative because it acts in the opposite direction of motion.

Important Points

• Conditions for Validity: These equations are only applicable when the object moves in a straight line and the acceleration remains uniform. They cannot be used for circular motion or variable acceleration without calculus.

• Retardation/Deceleration: If the final velocity is less than the initial velocity, the acceleration is negative, often referred to as retardation or deceleration.

• Special Cases:

• If an object starts from rest, the initial velocity (u) is taken as 0.

• If an object comes to a stop (brakes applied), the final velocity (v) is taken as 0.

• Vector Nature: Since displacement, velocity, and acceleration are vectors, their direction (positive or negative) must be consistently maintained throughout the calculation.

Q25. Answer: (a) Length, area of cross-section, material of the conductor, and temperature

The correct answer is Length, area of cross-section, material of the conductor, and temperature.

Key Points

• The resistance of a conductor is a property that opposes the flow of electric current through it. It is mathematically expressed by the formula R = ρ(L/A), where ρ is the resistivity, L is the length, and A is the area of cross-section.

• Length (L): The resistance of a conductor is directly proportional to its length. This means if the length of the wire is doubled, the resistance also doubles because electrons have to travel a longer distance and face more collisions. Hence, the statement regarding length is correct.

• Area of Cross-section (A): Resistance is inversely proportional to the area of cross-section of the conductor. A thicker wire (larger area) provides a wider path for electrons, resulting in lower resistance, whereas a thinner wire has higher resistance. Hence, the statement regarding the area of cross-section is correct.

• Material of the Conductor: Resistance depends on the nature of the material used. Different materials have different resistivities (ρ) due to their unique atomic structures. For example, Silver and Copper have very low resistivity and are excellent conductors, while Nichrome has high resistivity. Hence, the statement regarding the material is correct.

• Temperature: For metallic conductors, the resistance increases with an increase in temperature. As temperature rises, the metal ions vibrate more vigorously, increasing the frequency of collisions between flowing electrons and the ions. Hence, the statement regarding temperature is correct.

• While Ohm's Law states V = IR, the resistance itself does not depend on the voltage applied or the current flowing through it; these are external circuit variables. Resistance is an intrinsic physical property of the conductor. Hence, the correct answer is Length, area of cross-section, material of the conductor, and temperature.

Additional Information

• Resistivity (ρ): This is also known as specific resistance. It is the resistance offered by a conductor of unit length and unit area of cross-section. The SI unit of resistivity is the Ohm-meter (Ωm).

• Conductors vs. Insulators: Materials with very low resistivity are called conductors (like Aluminum and Gold), while those with very high resistivity are insulators (like Glass and Rubber).

• Temperature Coefficient: Metals generally have a positive temperature coefficient of resistance, meaning resistance increases with heat. Conversely, semiconductors like Silicon and Germanium have a negative temperature coefficient, where resistance decreases as temperature increases.

• Superconductivity: This is a phenomenon where certain materials exhibit zero electrical resistance when cooled below a specific critical temperature. This was first discovered by Heike Kamerlingh Onnes in 1911.

Important Points

• SI Unit: The SI unit of resistance is the Ohm, symbolized by the Greek letter Ω (Omega). It is named after the German physicist Georg Simon Ohm.

• Conductance: The reciprocal of resistance is known as conductance (G). Its SI unit is Siemens (S) or mho. A material with high resistance has low conductance.

• Ohmic and Non-Ohmic Conductors: Conductors that obey Ohm's Law (where V is proportional to I) are called Ohmic conductors (like most metals). Those that do not, such as diodes or transistors, are called non-Ohmic.

• Effect of Stretching: If a wire is stretched to double its length, its area of cross-section decreases proportionally (since volume remains constant), causing the resistance to increase by four times (n squared).

Q26. Answer: (c) 14,481

Shortcut Trick

Savings percentage = 100% − 75% = 25%.

Given: 25% units = Rs. 4,827.

Expenses = 75% units = 3 × 25% units.

Monthly Expenses = 3 × 4,827 = Rs. 14,481.

Therefore The correct answer is Rs. 14,481.

Alternate Method

Given:

Spending = 75% of Monthly Income

Savings = Rs. 4,827

Formula Used:

Income = Expenditure + Savings

Calculations:

=> Let Total Income be x.

=> Expenditure = 75% of x = 0.75x

=> Savings = x − 0.75x = 0.25x

=> 0.25x = 4,827

=> x = 4,827 ÷ 0.25 = 4,827 × 4 = 19,308

=> Monthly Expenses = 75% of 19,308

=> Expenses = 0.75 × 19,308 = Rs. 14,481

Therefore The correct answer is Rs. 14,481.

Additional Information

Percentage Change

Percentage increase or decrease is calculated as (Change ÷ Original Value) × 100.

Income-Expenditure Relation

If income increases by a% and expenditure increases by b%, the percentage change in savings depends on the initial ratio of expenditure to savings.

Base Change Rule

To find the total value when a part is known: Total = (Part Value ÷ Part Percentage) × 100.

Q27. Answer: (a) 96

Shortcut Trick

Simplify ratio: 4/8 : 11/16 : 18/21 → 1/2 : 11/16 : 6/7.

Multiply by LCM(2, 16, 7) = 112 → 56 : 77 : 96.

Difference between greatest (96) and smallest (56) = 40 units.

Given 40 units = 40, so 1 unit = 1. Largest number = 96 units = 96.

Therefore The correct answer is 96.

Alternate Method

Given: Ratio of three numbers = 4/8 : 11/16 : 18/21

Step 1: Simplify fractions → 1/2 : 11/16 : 6/7

Step 2: To remove denominators, multiply by LCM of 2, 16, and 7, which is 112.

=> Number 1 = 1/2 × 112 = 56

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=> Number 2 = 11/16 × 112 = 11 × 7 = 77

=> Number 3 = 6/7 × 112 = 6 × 16 = 96

Step 3: Identify greatest and smallest.

=> Greatest = 96x, Smallest = 56x

=> Difference = 96x − 56x = 40x

Step 4: Solve for x using given difference.

=> 40x = 40 => x = 1

=> Largest number = 96 × 1 = 96

Therefore The correct answer is 96.

Additional Information

Ratio Simplification

To simplify a ratio involving fractions, multiply each term by the Least Common Multiple (LCM) of all the denominators to convert them into integers.

Proportional Parts

If a total value V is divided in ratio a:b:c, the largest part is calculated as [Max(a,b,c) / (a+b+c)] × V.

Difference Rule

When the difference between two parts is given, 1 unit value = (Actual Difference) ÷ (Difference in Ratio parts).

Q28. Answer: (b) 50

Shortcut Trick

For fourth proportional: P : 25 :: 8 : 4

Product of extremes = Product of means

P × 4 = 25 × 8

P = 25 × 2 = 50

Therefore The correct answer is 50.

Alternate Method

Given:

First term = P, Second term = 25, Third term = 8, Fourth term = 4

Formula Used:

If a, b, c, d are in proportion, then a/b = c/d

Calculations:

=> P / 25 = 8 / 4

=> P / 25 = 2

=> P = 2 × 25

=> P = 50

Therefore The correct answer is 50.

Additional Information

Fourth Proportional

If four quantities a, b, c, and d are in proportion, then d is called the fourth proportional. Formula: d = (b × c) / a.

Third Proportional

If a, b, and c are in continued proportion (a:b = b:c), then c is the third proportional. Formula: c = b^2 / a.

Mean Proportional

The mean proportional between two numbers a and b is √(a × b).

Q29. Answer: (d) 48

Shortcut Trick

The Mode is defined as the observation that occurs most frequently in the given data set.

By scanning the data, we observe the frequency of each number:

Value 48 occurs 5 times (highest frequency).

Value 42 occurs 3 times, while others occur 2 times or once.

Therefore The correct answer is 48.

Alternate Method

Given Data: 41, 48, 54, 50, 54, 48, 42, 43, 48, 42, 53, 45, 44, 50, 49, 45, 43, 48, 42, 48

Formula Used: Mode = Value with the Maximum Frequency

To find the Mode, we construct a frequency distribution table:

=> Frequency of 41 = 1

=> Frequency of 42 = 3

=> Frequency of 43 = 2

=> Frequency of 44 = 1

=> Frequency of 45 = 2

=> Frequency of 48 = 5

=> Frequency of 49 = 1

=> Frequency of 50 = 2

=> Frequency of 53 = 1

=> Frequency of 54 = 2

=> Since 48 has the maximum frequency of 5.

Therefore The correct answer is 48.

Additional Information

Empirical Relationship

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

Types of Mode

A data set can be Unimodal (one mode), Bimodal (two modes), or Multimodal (more than two modes). If all values occur with the same frequency, there is no mode.

Mean and Median

Mean is the sum of observations divided by their count. Median is the middle value when data is arranged in ascending or descending order.

Q30. Answer: (a) 287

Shortcut Trick

If $x + 1/x = k$, then the value of $x^2 + 1/x^2 = k^2 - 2$.

Here, the given value k = 17.

Required value = $17^2 - 2$

Required value = 289 − 2 = 287.

Therefore The correct answer is 287.

Alternate Method

Given: $x + 1/x = 17$

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

On squaring both sides of the given equation:

=> $(x + 1/x)^2 = (17)^2$

=> $x^2 + (1/x)^2 + 2 \times x \times (1/x) = 289$

=> $x^2 + 1/x^2 + 2 = 289$

=> $x^2 + 1/x^2 = 289 - 2$

=> $x^2 + 1/x^2 = 287$

Therefore The correct answer is 287.

Additional Information

Negative Sign Identity

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

Cubic Algebraic Identity

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

Power of Four Identity

If $x + 1/x = k$, then $x^4 + 1/x^4 = (k^2 - 2)^2 - 2$.

Q31. Answer: (a) 9

Shortcut Trick

Assume the smaller number is x.

The other number is 2x + 5.
Sum: x + (2x + 5) = 32 → 3x = 27.
Solving gives x = 9.
Therefore The correct answer is 9.
Alternate Method
Given: Sum of two numbers = 32. Relation: Larger = 2 × Smaller + 5.
Let the smaller number be x and the larger number be y.
=> x + y = 32 ... (i)
=> y = 2x + 5 ... (ii)
Substitute y from (ii) into (i):
=> x + (2x + 5) = 32
=> 3x + 5 = 32
=> 3x = 32 − 5
=> 3x = 27
=> x = 27 ÷ 3 = 9
Therefore The correct answer is 9.
Additional Information
Linear Equations in One Variable
A linear equation involves a single variable with a power of 1, typically solved by isolating the variable on one side.
Substitution Method
This involves expressing one variable in terms of another and substituting it into a second equation to find the value.
Sum and Difference Problems
If the sum (S) and difference (D) are known, larger number = (S+D)/2 and smaller number = (S−D)/2.

Q32. Answer: (d) 30

Shortcut Trick
The difference in ages remains constant (2 years).
Ratio after 18 years = 21 : 22. Difference in ratio parts = 22 − 21 = 1 unit.
1 unit = 2 years → Gopal = 21 × 2 = 42 years, Manoj = 22 × 2 = 44 years (after 18 years).
Sum 10 years ago = (42 + 44) − 28 (for 18 years back to now + 10 years back) = 86 − 56 = 30 years.
Therefore The correct answer is 30 years.
Alternate Method
Let the present ages of Gopal and Manoj be G and M respectively.
Given: M − G = 2 years (Since Manoj is older in the ratio 21:22).
After 18 years: (G + 18) / (M + 18) = 21 / 22
=> 22(G + 18) = 21(M + 18)
=> 22G + 396 = 21M + 378
=> 21M − 22G = 18
Substitute M = G + 2:
=> 21(G + 2) − 22G = 18 => 21G + 42 − 22G = 18
=> −G = 18 − 42 => G = 24 years, M = 26 years.
Sum of ages 10 years ago = (24 − 10) + (26 − 10) = 14 + 16 = 30 years.
Therefore The correct answer is 30 years.
Additional Information
Constant Age Difference
The numerical difference between the ages of two individuals remains the same at any point in time (past, present, or future).
Ratio Balancing
If the age difference is 'd' and the ratio is a:b, then (b − a) units = d years. This helps in finding ages without complex algebra.

Q33. Answer: (c) 31200

Shortcut Trick
Identify the Highest Common Factor (HCF) first to reduce the numbers.

HCF of 780, 2080, and 2600 is 260.
Divide numbers by 260: 780/260 = 3, 2080/260 = 8, 2600/260 = 10.
LCM of 3, 8, and 10 is 120.
Final LCM = 260 × 120 = 31200.
Therefore The correct answer is 31200.
Alternate Method
Given: Numbers are 780, 2080, and 2600.
Formula Used: Prime Factorization Method for finding LCM.
Prime factorization of each number:
=> 780 = 2 × 2 × 3 × 5 × 13 = $2^2 \times 3^1 \times 5^1 \times 13^1$
=> 2080 = 2 × 2 × 2 × 2 × 2 × 5 × 13 = 2^5 × $5^1 \times 13^1$
=> 2600 = 2 × 2 × 2 × 5 × 5 × 13 = $2^3 \times 5^2 \times 13^1$
=> LCM = Product of highest powers of all prime factors
=> LCM = 2^5 × $3^1 \times 5^2 \times 13^1$
=> LCM = 32 × 3 × 25 × 13
=> LCM = 96 × 325 = 31200
Therefore The correct answer is 31200.
Additional Information
LCM (Least Common Multiple)
The smallest positive integer that is divisible by each of the given numbers. Found using division method or prime factorization.
HCF and LCM Relationship
For two numbers A and B: Product of A × B = HCF(A,B) × LCM(A,B).
LCM of Fractions
LCM of fractions = LCM of Numerators ÷ HCF of Denominators.

Q34. Answer: (b) 13 seconds

Shortcut Trick
Total Distance = Sum of lengths = 248 + 142 = 390 m
Relative Speed = Sum of speeds (opposite direction) = 34 + 74 = 108 kmph
Convert kmph to m/s: 108 × (5/18) = 30 m/s
Time = Distance ÷ Relative Speed = 390 ÷ 30 = 13 sec
Therefore The correct answer is 13 sec.
Alternate Method
Given:
Length of first train (L1) = 248 m
Length of second train (L2) = 142 m
Speed of first train (S1) = 34 km/hr
Speed of second train (S2) = 74 km/hr
Formula Used:
Relative Speed (Opposite Direction) = S1 + S2
Time = (L1 + L2) ÷ Relative Speed
Calculations:
=> Total distance = 248 + 142 = 390 m
=> Relative speed = 34 + 74 = 108 km/hr
=> Speed in m/s = 108 × (5/18) = 6 × 5 = 30 m/s
=> Time taken = 390 ÷ 30
=> Time taken = 13 seconds
Therefore The correct answer is 13 sec.
Additional Information
Relative Speed Concepts
When objects move in opposite directions, relative speed = S1 + S2. When moving in the same direction, relative speed = |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 a Point Object

If a train crosses a pole or a stationary man, the distance traveled is equal to the length of the train itself.

Q35. Answer: (d) 57 minutes

Shortcut Trick

Speed ratio (New : Normal) = 3 : 4

Since distance is constant, Time ratio (New : Normal) = 4 : 3

Difference in time ratio parts = 4 − 3 = 1 unit

Given, 1 unit = 19 minutes

Usual time = 3 units = 3 × 19 minutes = 57 minutes

Therefore The correct answer is 57 min.

Alternate Method

Given:

New Speed = 3/4 × Normal Speed

Late time = 19 minutes

Formula Used:

Distance = Speed × Time

Calculations:

=> Let normal speed be S and usual time be T.

=> Normal Distance = S × T

=> New Speed = 3S/4

=> New Time = T + 19

=> Since distance is same: S × T = (3S/4) × (T + 19)

=> T = (3/4) × (T + 19)

=> 4T = 3T + 57

=> T = 57 minutes

Therefore The correct answer is 57 min.

Additional Information

Inverse Proportion Rule

When distance is constant, speed is inversely proportional to time (S prop. to 1/T). If speed becomes a/b of its original, time becomes b/a of the original.

General Formula for Late/Early

Usual Time = (Late time × Numerator) ÷ (Difference between Denominator and Numerator) when speed is a/b of usual speed.

Average Speed

If a person covers equal distances at speeds x and y, then Average Speed = 2xy/(x + y).

Q36. Answer: (b) 130

Shortcut Trick

?? ??? 2 ??? 5 ??? ????? ?????????, ?? 10 ??? ????? ??????????? (2 × 5 = 10).

10-?? ??????? ???? ??? ???? 0 ?????.

????????? ??????? 130 ??? ????? ???? ??? 0 ??.

Therefore The correct answer is 130.

Alternate Method

??????????: ????? 134, 130, 135, 133.

??????????? ??????:

1. 2-?? ???????: ???? ??? ???????? 0-? ?????? (0, 2, 4, 6, 8).

2. 5-?? ???????: ???? ??? 0 ?????? 5 ??????.

=> ???? (1) 134: 2 ??? ???? (???? ??? 4), ???? 5 ??? ????? ?????.

=> ???? (2) 130: 2 ??? ???? (???? ??? 0), 5 ??? ???? (???? ??? 0).

=> ???? (3) 135: 5 ??? ???? (???? ??? 5), ???? 2 ??? ????? ????? (??????).

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=> ???? (4) 133: 2 ??? 5 ??? ????? ?????.

Therefore The correct answer is 130.

Additional Information

10-?? ???????

?? ????? ???? ??? 0 ????? ?? 10 ??? ????? ????. ?? 2, 5 ??? ?????? ???? ?????.

3-?? ???????

?? ????? ???????? ?? 3-?? ???????? ? ???? 3 ??? ????.

???? ????? ??? ?????

2 ??? ????? ????? ????? ???? ????? ??? ??????? ??? ????? ??? ??????.

Q37. Answer: (c) 65,000

Shortcut Trick

Ratio of Income (R : S) = 5 : 9 (Difference = 4 units)

Ratio of Expenditure (R : S) = 1 : 3 (Difference = 2 units)

To equate savings, make differences equal: Multiply Expenditure ratio by 2 → 2 : 6

Difference in units (Income − Expenditure) = 5 − 2 = 3 units = Rs. 39,000

1 unit = Rs. 13,000 Therefore Rakesh income (5 units) = 5 × 13,000 = Rs. 65,000

Therefore The correct answer is Rs. 65,000.

Alternate Method

Given: Ratio of incomes = 5 : 9 | Ratio of expenditures = 1 : 3 | Savings = Rs. 39,000 each.

Formula Used: Income − Savings = Expenditure

=> Let the incomes of Rakesh and Shivam be 5x and 9x respectively.

=> According to the question: (5x − 39000) / (9x − 39000) = 1 / 3

=> Cross-multiplying: 3(5x − 39000) = 1(9x − 39000)

=> 15x − 1,17,000 = 9x − 39,000

=> 15x − 9x = 1,17,000 − 39,000

=> 6x = 78,000

=> x = 13,000

=> Rakesh monthly income = 5x = 5 × 13,000 = Rs. 65,000

Therefore The correct answer is Rs. 65,000.

Additional Information

Income, Expenditure, and Savings Relationship

The basic accounting identity used in such problems is Income = Expenditure + Savings.

Cross-Multiplication Method for Ratios

When the same amount is added/subtracted from both terms of a ratio, the unit difference method is the fastest way to find the initial values.

Ratio Balancing

To balance two ratios with a constant difference, multiply each ratio by the difference of the other ratio.

Q38. Answer: (c) Rs. 9575

Shortcut Trick

Use the ratio relationship: CP : MP = (100 − Discount%) : (100 + Profit%).

CP : MP = (100 − 12) : (100 + 10) = 88 : 110.

Simplify the ratio: 88 : 110 = 4 : 5.

Given 4 units (CP) = Rs. 7660, then 1 unit = 7660 ÷ 4 = 1915.

Marked Price (5 units) = 5 × 1915 = Rs. 9575.

Therefore The correct answer is Rs. 9575.

Alternate Method

Given: Cost Price (CP) = Rs. 7660, Profit = 10%, Discount = 12%.

Formulas: SP = CP × (100 + P%) ÷ 100 | MP = (SP × 100) ÷ (100 − D%).

=> Step 1: Find Selling Price (SP) = 7660 × (110 ÷ 100) = 766 × 11 = Rs. 8426.

=> Step 2: Since SP is obtained after a 12% discount on MP, SP = 88% of MP.

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=> Step 3: Marked Price (MP) = (8426 ÷ 88) × 100.

=> Step 4: MP = 95.75 × 100 = Rs. 9575.

Therefore The correct answer is Rs. 9575.

Additional Information

Marked Price & Discount

Marked Price is the price printed on the label. Discount is always calculated on the Marked Price unless stated otherwise.

Relation between CP and MP

The direct formula linking CP, MP, Profit, and Discount is: MP ÷ CP = (100 + Profit%) ÷ (100 − Discount%).

Q39. Answer: (b) 81

Shortcut Trick

Apply the BODMAS rule directly: compute 'Of', followed by Division, Multiplication, Addition, and Subtraction.

=> 189 ÷ 9 + 117 ÷ 13 × 5 − 12 of 4 + 9 × 7

=> 21 + 9 × 5 − 48 + 63

=> 21 + 45 − 48 + 63

=> 129 − 48 = 81

Therefore The correct answer is 81.

Alternate Method

Given:

189 ÷ 9 + 117 ÷ 13 × 5 − 12 of 4 + 9 × 7

Concept Used:

BODMAS Rule: First solve Brackets, then Of, Division, Multiplication, Addition, and lastly Subtraction.

Calculation:

=> 189 ÷ 9 + 117 ÷ 13 × 5 − (12 × 4) + 9 × 7

=> 189 ÷ 9 + 117 ÷ 13 × 5 − 48 + 9 × 7

=> 21 + 9 × 5 − 48 + 9 × 7

=> 21 + 45 − 48 + 63

=> 66 − 48 + 63

=> 18 + 63

=> 81

Therefore The correct answer is 81.

Additional Information

BODMAS Rule

The fundamental rule that dictates the order of mathematical operations: Brackets first, then Of (multiplication), Division, Multiplication, Addition, and Subtraction.

VBODMAS Extension

'V' stands for Vinculum (or bar). If an expression contains a horizontal bar over some numbers, that specific part must be evaluated first before applying regular BODMAS.

Unit Digit Method

A quick cross-checking tool where you compute only the last digits of each term. In this expression: 1 + 5 − 8 + 3 = 1, matching the unit digit of the correct answer 81.

Q40. Answer: (c) 40.1

Shortcut Trick

The Empirical relationship between Mean, Median, and Mode is given by:

Median = (Mode + 2 × Mean) ÷ 3

Substituting the values: Median = (14.1 + 2 × 53.1) ÷ 3

Median = (14.1 + 106.2) ÷ 3 = 120.3 ÷ 3 = 40.1

Therefore The correct answer is 40.1.

Alternate Method

Given:

=> Mean (x) = 53.1

=> Mode (Z) = 14.1

Formula Used:

=> Mode = 3 × Median − 2 × Mean

Calculations:

=> 14.1 = 3 × Median − 2 × 53.1

=> 14.1 = 3 × Median − 106.2

=> 3 × Median = 14.1 + 106.2

=> 3 × Median = 120.3

=> Median = 120.3 ÷ 3

=> Median = 40.1

Therefore The correct answer is 40.1.

Additional Information

Empirical Formula Applicability

This relationship, Mode = 3 Median − 2 Mean, is valid for moderately skewed distributions. It is also known as Karl Pearson's formula.

Symmetrical Distribution

In a perfectly symmetrical distribution (like the Normal Distribution), the Mean, Median, and Mode are all equal: Mean = Median = Mode.

Positively Skewed Distribution

When the tail on the right side is longer, the distribution is positively skewed. In this case: Mean > Median > Mode.

Negatively Skewed Distribution

When the tail on the left side is longer, the distribution is negatively skewed. In this case: Mean < Median < Mode.

Q41. Answer: (d) 57.5

Shortcut Trick

Total Cost Price (CP) of 9 articles = Rs. 16.

Total Selling Price (SP) of 9 articles = 9 × 2.8 = Rs. 25.2.

Profit = SP − CP = 25.2 − 16 = Rs. 9.2.

Profit% = (Profit ÷ CP) × 100 = (9.2 ÷ 16) × 100.

Profit% = 0.575 × 100 = 57.5%.

Therefore The correct answer is 57.5%.

Alternate Method

Given: Total CP of 9 articles = Rs. 16, SP of 1 article = Rs. 2.8.

Formulas: Profit = SP − CP | Profit% = (Profit ÷ CP) × 100

=> Total Cost Price (CP) = Rs. 16.

=> Total Selling Price (SP) = 9 × 2.8 = Rs. 25.2.

=> Total Profit = 25.2 − 16 = Rs. 9.2.

=> Profit Percentage = (9.2 ÷ 16) × 100 = 57.5%.

Therefore The correct answer is 57.5%.

Additional Information

Profit and Loss Basics

Profit occurs when the Selling Price (SP) is greater than the Cost Price (CP). Formula: Profit = SP − CP.

Profit Percentage Calculation

Profit percentage is always calculated on the Cost Price (CP) unless stated otherwise. Formula: Profit% = (Profit ÷ CP) × 100.

Q42. Answer: (d) 42 cm

Shortcut Trick

In a parallelogram, the area remains constant: Base1 × Height1 = Base2 × Height2

Let longer side be b1 = 11.9 cm and shorter side be b2 = a cm.

=> 11.9 × 3.9 = a × 5.1

=> a = (11.9 × 3.9) ÷ 5.1 = 9.1 cm

Perimeter = 2 × (Sum of adjacent sides) = 2 × (11.9 + 9.1) = 42 cm

Therefore The correct answer is 42 cm.

Alternate Method

Given:

Longer side (L) = 11.9 cm

Shorter side (S) = a cm

Distance between longer sides (h_L) = 3.9 cm

Distance between shorter sides (h_S) = 5.1 cm

Formula Used:

Area of Parallelogram = Base × Perpendicular Height

Perimeter of Parallelogram = 2 × (L + S)

Calculations:

=> Area = L × h_L = S × h_S

=> 11.9 × 3.9 = a × 5.1

=> a = (11.9 × 3.9) / 5.1

=> a = (11.9 × 39) / 51

=> a = (11.9 × 13) / 17

=> a = 0.7 × 13

=> a = 9.1 cm

Now, finding the Perimeter:

=> Perimeter = 2 × (11.9 + 9.1)

=> Perimeter = 2 × 21.0

=> Perimeter = 42 cm

Therefore The correct answer is 42 cm.

Additional Information

Properties of a Parallelogram

Opposite sides are equal and parallel. Opposite angles are equal. Adjacent angles are supplementary (sum = 180°).

Area and Height Relationship

Area = b1h1 = b2h2. This implies that the ratio of sides is inversely proportional to the ratio of their corresponding heights: b1/b2 = h2/h1.

Diagonals of a Parallelogram

The diagonals bisect each other but are not necessarily equal in length or perpendicular. The sum of the squares of the diagonals equals the sum of the squares of the four sides: $d1^2 + d2^2 = 2(a^2 + b^2)$.

Q43. Answer: (a) 56 hours

Shortcut Trick

If a tap fills a cistern in x hours and a leak empties it in y hours, the time taken to fill it is (xy) ÷ (y − x).

Given x = 7 hours and y = 8 hours.

Time = (7 × 8) ÷ (8 − 7) = 56 ÷ 1 = 56 hours.

Therefore The correct answer is 56 hr.

Alternate Method

Given:

Filling Tap time = 7 hours

Emptying Hole time = 8 hours

Entity	Hours	Total Work (LCM)	Efficiency
Filling Tap	7	56 Units	+8
Emptying Hole	8	−7	

Calculations:

=> Total Work (Capacity of Cistern) = LCM of (7, 8) = 56 units

=> Efficiency of Filling Tap = 56 ÷ 7 = +8 units/hr

=> Efficiency of Emptying Hole = 56 ÷ 8 = −7 units/hr

=> Combined Efficiency (Net flow) = 8 − 7 = +1 unit/hr

=> Time taken to fill = Total Work ÷ Combined Efficiency

=> Time = 56 ÷ 1 = 56 hours

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Therefore The correct answer is 56 hr.

Additional Information

Net Efficiency Rule

When pipes/taps work together, their efficiencies are added (positive for filling, negative for emptying) to find the total work per unit time.

Pipes and Cisterns Concept

This topic is an application of Time and Work where filling pipes represent positive work and leaks/outlets represent negative work.

Q44. Answer: (d) 74°

Shortcut Trick

In right-angled ΔBDC, the angle at C is 90° − 71° = 19°.

For ΔAEC, angle AEB is the exterior angle at vertex E.

By the exterior angle property, angle AEB = angle CAE + angle ACE.

angle AEB = 55° + 19° = 74°.

Therefore The correct answer is 74°.

Alternate Method

Given: BD perpendicular to AC at D, angle DBC = 71°, and angle CAE = 55°.

Formula Used: Angle Sum Property of a triangle and the Exterior Angle Theorem.

=> In ΔBDC, angle BDC = 90° (since BD perpendicular to AC).

=> angle BCD = 180° − (angle BDC + angle DBC)

=> angle BCD = 180° − (90° + 71°) = 180° − 161° = 19°.

=> In ΔAEC, angle AEB is the exterior angle at vertex E because B, E, C are collinear.

=> angle AEB = angle CAE + angle ACE

=> angle AEB = 55° + 19° = 74°.

Therefore The correct answer is 74°.

Additional Information

Exterior Angle Theorem

The measure of an exterior angle of a triangle is equal to the sum of the measures of its two remote interior angles.

Angle Sum Property

The sum of all interior angles of any triangle is always 180°.

Complementary Angles

In a right-angled triangle, the two acute angles are complementary, meaning their sum is exactly 90°.

Q45. Answer: (b) 924 cm^3

Shortcut Trick

Relation between Volume (V) and Curved Surface Area (CSA): V = (CSA × r) ÷ 2

First find Radius (r): 2 × (22/7) × r × 6 = 264 => r = 7 cm

Direct Calculation: Volume = (264 × 7) ÷ 2 = 132 × 7 = 924 cm^3

Therefore The correct answer is 924 cm^3.

Alternate Method

Given:

Height (h) of the cylinder = 6 cm

Curved Surface Area (CSA) = 264 cm^2

Formula Used:

Curved Surface Area (CSA) = $2\pi rh$

Volume (V) = $\pi r^2 h$

Calculations:

=> 2 × (22/7) × r × 6 = 264

=> (264/7) × r = 264

=> r = 7 cm

Now, substitute the value of Radius (r) in the Volume formula:

=> Volume = (22/7) × 7 × 7 × 6

=> Volume = 22 × 7 × 6
=> Volume = 154 × 6
=> Volume = 924 cm^3
Therefore The correct answer is 924 cm^3.
Additional Information
Total Surface Area (TSA) of Cylinder
The total surface area includes the curved surface and the area of two circular bases: TSA = $2\pi rh + 2\pi r^2 = 2\pi r(h + r)$.
Volume of a Hollow Cylinder
If the cylinder has an outer radius R and inner radius r, the volume is $V = \pi(R^2 - r^2)h$.
Relation between Cone and Cylinder
For the same radius and height, the volume of a cylinder is exactly three times the volume of a cone ($V_{(cylinder)} = 3 \times V_{(cone)}$).

Q46. Answer: (c) 15.08% gain

Shortcut Trick
Net Profit/Loss% = a + b + (a × b) ÷ 100, where a is Mark-up% and b is Discount% (negative).
Given: a = +37 and b = −16.
Net change = 37 − 16 + (37 × (−16)) ÷ 100.
Net change = 21 − (592 ÷ 100) = 21 − 5.92 = 15.08%.
Positive result indicates a gain.
Therefore The correct answer is 15.08% gain.
Alternate Method
Given → Mark-up = 37% above CP, Discount = 16% on MP.
Formulas → MP = CP × (100 + Mark-up%) ÷ 100 | SP = MP × (100 − Discount%) ÷ 100 | Gain% = (SP − CP) ÷ CP × 100.
=> Let Cost Price (CP) = 100.
=> Marked Price (MP) = 100 + 37% of 100 = 137.
=> Selling Price (SP) = 137 − 16% of 137.
=> SP = 137 − (16 × 137 ÷ 100) = 137 − 21.92 = 115.08.
=> Gain = SP − CP = 115.08 − 100 = 15.08.
=> Gain% = (15.08 ÷ 100) × 100 = 15.08%.
Therefore The correct answer is 15.08% gain.
Additional Information
Relation between CP and MP
The ratio of Marked Price to Cost Price is given by CP ÷ MP = (100 − D%) ÷ (100 + P%).
Successive Percentage Change
When a value is increased by x% and then decreased by y%, the net effect is (x − y − xy ÷ 100)%.

Q47. Answer: (a) 28

Shortcut Trick
Calculate the total number of days: Feb (25) + March (31) + April (17) = 73 days.
Convert days to years: T = 73 ÷ 365 = 1/5 year.
Apply direct SI formula: SI = (2000 × 7 × 1) ÷ (100 × 5).
SI = 20 × 7 ÷ 5 = 4 × 7 = 28.
Therefore The correct answer is Rs. 28.
Alternate Method
Given:
Principal (P) = Rs. 2,000
Rate of Interest (R) = 7% per annum
Time period = 3 February 2023 to 17 April 2023
Formula Used:
Simple Interest (SI) = (P × R × T) ÷ 100
Calculations:
=> Days in February (Non-leap year) = 28 − 3 = 25 days

=> Days in March = 31 days

=> Days in April = 17 days

=> Total days (T) = 25 + 31 + 17 = 73 days

=> Time in years = 73 ÷ 365 = 1/5 year

=> SI = (2000 × 7 × (1/5)) ÷ 100

=> SI = (2000 × 7) ÷ 500

=> SI = 14000 ÷ 500 = 28

Therefore The correct answer is Rs. 28.

Additional Information

Time Calculation Rule

In interest calculation, the day on which money is deposited is generally excluded, and the day on which money is withdrawn is included.

Standard Day Fractions

73 days is a very common period in exams as it equals exactly 1/5 of a 365-day year. Similarly, 146 days = 2/5 year, and 219 days = 3/5 year.

Leap Year Check

Always check if the year is a leap year (divisible by 4). If it is, February has 29 days and the total year has 366 days.

Q48. Answer: (a) 5

Shortcut Trick

Net rate of filling = 1/6 − 1/15 = (5 − 2)/30 = 3/30 = 1/10 per minute.

Time to fill full tank = 10 minutes.

Time to fill one-half of the tank = 10 ÷ 2 = 5 minutes.

Therefore The correct answer is 5 minutes.

Alternate Method

Given: Filling time = 6 min, Emptying time = 15 min.

Formula Used: Total Work = LCM of times; Efficiency = Total Work ÷ Time.

Pipe	Time (min)	Total Capacity (LCM)	Efficiency
Filling Pipe (A)	6	30 units	+5
Emptying Pipe (B)	15	−2	

=> Net Efficiency (A + B) = 5 − 2 = 3 units/min.

=> Target Work = 1/2 × Total Capacity = 1/2 × 30 = 15 units.

=> Time required = Target Work ÷ Net Efficiency = 15 ÷ 3 = 5 minutes.

Therefore The correct answer is 5 minutes.

Additional Information

Inlet and Outlet Pipes

Inlet pipes add water (positive efficiency) while outlet pipes remove water (negative efficiency) from the tank.

Net Rate Formula

If an inlet fills in 'x' and an outlet empties in 'y', net work done in 1 hour = (1/x − 1/y).

Pipes and Cisterns vs Time and Work

The concept is identical to Time and Work, where emptying a tank is equivalent to doing negative work.

Q49. Answer: (d) 200 metres

Shortcut Trick

Let Tower Height be h = 50 m.

Using standard 30°-60°-90° triangle ratios: Distance to car = h × √3 = 50√3 m.

Relative height of balloon from tower top = Distance × tan(60°) = 50√3 × √3 = 150 m.

Total height of balloon = Height of tower + Relative height = 50 + 150 = 200 m.

Therefore The correct answer is 200 metres.

Alternate Method

Given: Height of Tower (AB) = 50 m, Angle of depression = 30°, Angle of elevation = 60°.

Formula Used: tan(θ) = Perpendicular / Base

=> Let distance from tower to car be x.

=> In ΔABC: tan(30°) = 50 / x

=> 1/√3 = 50 / x => x = 50√3 m.

=> Let height of balloon above the tower top level be H.

=> In the upper triangle: tan(60°) = H / x

=> √3 = H / 50√3

=> H = 50√3 × √3 = 150 m.

=> Total Height of Balloon from ground = Tower Height + H = 50 + 150 = 200 m.

Therefore The correct answer is 200 metres.

Additional Information

Angle of Depression and Elevation

The Angle of Depression from an observer to an object below is equal to the Angle of Elevation from the object to the observer due to alternate interior angles.

Trigonometric Ratios for Standard Angles

For heights and distances, remember: tan(30°) = 1/√3, tan(45°) = 1, and tan(60°) = √3.

Q50. Answer: (b) Decreases by 82.68%

Shortcut Trick

Let original price = 100

Net multiplier = (1 − 0.45) × (1 − 0.55) × (1 − 0.50) × (1 + 0.40)

Net multiplier = 0.55 × 0.45 × 0.50 × 1.4 = 0.17325

Net % change = (0.17325 − 1) × 100 = −82.675%

Therefore The correct answer is Decreases by 82.68%.

Alternate Method

Given: Successive decreases of 45%, 55%, 50% and an increase of 40%.

Step-by-step Calculation:

=> Let the initial price of the fuel be 100 units.

=> Price after 1^(st) month decrease of 45% = 100 × (1 − 0.45) = 55

=> Price after 2^(nd) month decrease of 55% = 55 × (1 − 0.55) = 55 × 0.45 = 24.75

=> Price after 3^(rd) month decrease of 50% = 24.75 × (1 − 0.50) = 12.375

=> Price after 4^(th) month increase of 40% = 12.375 × (1 + 0.40) = 12.375 × 1.4 = 17.325

=> Net Change = Final Price − Original Price = 17.325 − 100 = −82.675

=> Net Percentage Decrease = (82.675 / 100) × 100 = 82.675% ≈ 82.68%

Therefore The correct answer is Decreases by 82.68%.

Additional Information

Successive Percentage Formula

For two successive changes of a% and b%, the net change is (a + b + ab/100)%. Negative values are used for decrease.

Multiplying Factor Method

Final Value = Initial Value × (1 ± r1/100) × (1 ± r2/100) × ... This is the most efficient method for multiple successive changes.

Base Change Property

Successive percentage changes are cumulative, meaning each subsequent percentage is calculated on the updated value, not the original base.

Q51. Answer: (a) Two

Given:

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

We need to find the even digits which are:

Immediately preceded by an even digit and immediately followed by an even digit.

Required pattern:

Even digit → Even digit → Even digit

Checking the series:

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

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The even digits satisfying the condition are:

• 6 in (4 6 2)

• 4 in (8 4 2)

Therefore, there are 2 such even digits.

Hence, the correct answer is "Option 1".

Q52. Answer: (b) ZNVD

Given:

FTBJ → OCKS

PDLT → YMUC

Observe the pattern:

For, FTBJ → OCKS

For, PDLT → YMUC

So, each letter is moved 9 positions forward in cyclic alphabetical order.

Now apply the same logic to QEMU:

Therefore, QEMU → ZNVD

Hence, the correct answer is "Option 2".

Q53. Answer: (a) Wife

Given:

'A + B' means 'A is the mother of B'

'A − B' means 'A is the sister of B'

'A × B' means 'A is the son of B'

'A ÷ B' means 'A is the brother of B'

Expression:

D + E − F ÷ G × K

Decode the expression from left to right:

D + E → D is the mother of E.

E − F → E is the sister of F.

F ÷ G → F is the brother of G.

G × K → G is the son of K.

Form the relationship chain:

Therefore, D is the wife of K.

Hence, the correct answer is "Option 1".

Q54. Answer: (a) 55

Given series:

5, 9, 16, 26, 39, ?

Hence, the correct answer is "Option 1".

Q55. Answer: (c) 228

The given equation is:

70 B 4 D (50 A 5) B 11 C (24 A 2) B 4 C 10 = ? →

A	B	C	D
÷	×	•	−

After replacing the letters with their respective arithmetic symbols:

70 × 4 − (50 ÷ 5) × 11 + (24 ÷ 2) × 4 + 10

Step-by-step solution using BODMAS:

=> 70 × 4 − (50 ÷ 5) × 11 + (24 ÷ 2) × 4 + 10

=> 280 - 10 × 11 + 12 × 4 + 10

=> 280 - 110 + 48 + 10

=> 338 - 110

=> 228

Therefore, the value that will come in place of the question mark is 228.

Hence, the correct answeris "Option 2".

Q56. Answer: (d) 12

Logic followed here is: Identify the highest and lowest numbers from the given sequence, then add the second digit of the highest number to the second digit of the lowest number.

For Highest Number

791 is the highest number among (783, 791, 531, 563, 594) →

7	9	1
(1st)	(2nd)	(3rd)

Second digit of the highest number = 9

For Lowest Number

531 is the lowest number among (783, 791, 531, 563, 594) →

5	3	1
(1st)	(2nd)	(3rd)

Second digit of the lowest number = 3

The pattern observed is: (Second digit of highest number) + (Second digit of lowest number).

Resultant:

Resultant = 9 + 3 = 12

Hence, the correct answer is "Option 4".

Q57. Answer: (a) THJ

Given Series:

DRT UIK LZB CQS ?

The pattern followed here is:

Hence, the correct answer is "Option 1".

Q58. Answer: (b) WO-UM-SV

Logic followed here is:

In each triad, the first letters of the pairs decrease by 2, while the second letters follow a pattern of decreasing by 2 and then increasing by 9.

For

Triad 1: ME-KC-IL follows the pattern →

Triad 2: PH-NF-LO follows the pattern →

The pattern observed is: (1st letters: -2, -2 sequence) and (2nd letters: -2, +9 sequence).

Similarly, let's find the pattern for WO-UM-SV:

Therefore, the triad that follows the same pattern is 'WO-UM-SV'.

Hence, the correct answer is "Option 2".

Q59. Answer: (c) Two

Given:

Six people A, B, C, D, E and F are sitting in a row facing north.

A sits third to the left of E.

E sits second to the left of F.

D sits to the immediate right of E.

B sits to the immediate left of C.

People between C and F are:

E and D

Therefore, 2 people sit between C and F.

Hence, the correct answer is "Option 3".

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Q60. Answer: (a) XZW

Given letter-clusters:

XZW

MNL

RSQ

IJH

Observe the pattern:

In three clusters, the letters follow the pattern:

1st letter → +1 → 2nd letter → −1 → 3rd letter

Check each option:

Option 2: MNL

Option 3: RSQ

Option 4: IJH

Option 1: XZW

This does not follow the same pattern.

Therefore, the odd one out is: XZW

Hence, the correct answer is "Option 1".

Q61. Answer: (b) 63

Logic followed here is substituting the given letters with their corresponding mathematical operators and then solving the equation using the BODMAS rule.

The mapping of letters to symbols is as follows:

Letter	A	B	C	D
Symbol	÷	×	•	•

Given equation:

(80 A 8) B 5 C 14 B 2 D 11 B 3 C 72 A 4 = ?

Step 1: Replace the letters with their respective symbols:

(80 ÷ 8) × 5 + 14 × 2 - 11 × 3 + 72 ÷ 4 = ?

=> 10 × 5 + 28 - 33 + 18 = ?

=> 50 + 28 - 33 + 18 = ?

=> 96 - 33 = ?

=> 63 = ?

Therefore, the value that will come in place of the question mark is 63.

Hence, the correct answer is "Option 2".

Q62. Answer: (b) FYR 73

The logic followed here is that each cluster in the series is determined by decreasing the positional values of the letters by a constant value and increasing the numbers by a constant value.

The pattern followed here is:

Combining the letter and number logic, the next cluster is FYR 73.

Hence, the correct answer is "Option 2".

Q63. Answer: (a) RTP

Given letter-clusters:

RTP

EHB

KNH

ORL

Observe the pattern:

In three clusters, the gap between letters follows:

1st → 2nd = +3

2nd → 3rd = −6

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Check each option:
Option 2: EHB
Pattern ratio maintained.
Option 3: KNH
Pattern ratio maintained.
Option 4: ORL
Pattern ratio maintained.
Option 1: RTP
This does not follow the same pattern as the other three.
Therefore, the odd one out is: RTP
Hence, the correct answer is "Option 1".

Q64. Answer: (a) rc

Given:
“let you know” → “nj rc bh”
“know the people” → “nh kp rc”
The common code is:
rc
Therefore, ‘know’ is coded as ‘rc’.
Hence, the correct answer is "Option 1".

Q65. Answer: (b) 183

Shortcut Trick
Identify the difference between consecutive terms in the series.
Difference = 119 − 103 = 16
The series follows a constant addition of 16.
Next term = 167 + 16 = 183
Therefore The correct answer is 183.
Alternate Method
Given series: 103, 119, 135, 151, 167, ?
103
+16
→
119
+16
→
135
+16
→
151
+16
→
167
+16
→
183
The pattern follows a constant addition of 16 to each preceding term to obtain the next term.
=> 103 + 16 = 119
=> 119 + 16 = 135
=> 135 + 16 = 151
=> 151 + 16 = 167
=> 167 + 16 = 183

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Therefore The correct answer is 183.

Additional Information

Arithmetic Progression (AP) Series

A series where the difference between any two consecutive terms is constant. General term a_n = a + (n−1)d.

Common Difference

Calculated by subtracting the first term from the second term (d = T2 − T1).

Types of Series Patterns

Common patterns include prime numbers, squares, cubes, geometric ratios, and nested differences.

Q66. Answer: (d) Only conclusion (II) follows.

Given Statements:

All bags are cars.

All aeroplanes are cars.

Conclusions:

(I) Some bags are aeroplanes:Does not follows (Because, Bags are a subset of cars. Aeroplanes are also a subset of cars.There is no definite relation given between bags and aeroplanes.)

(II) Some cars are aeroplanes: Follows (Because, all aeroplanes are cars, which means at least some cars are aeroplanes.)

Therefore Only conclusion (II) follows.

Hence, the correct answer is "Option 4".

Q67. Answer: (a) 8

Logic followed here is: Identify the highest and lowest numbers from the given sequence, then find the third digit of each and add them together to get the resultant.

Given sequence of numbers:

453, 125, 410, 183, 473

The highest number is 473 →

1st	2nd	3rd
4	7	3

The third digit of the highest number (473) is 3.

The lowest number is 125 →

1st	2nd	3rd
1	2	5

The third digit of the lowest number (125) is 5.

The operation to be performed is: (Third digit of highest number) + (Third digit of lowest number).

Resultant Calculation:

Resultant = 3 + 5 = 8

Therefore, the resultant is 8.

Hence, the correct answer is "Option 1".

Q68. Answer: (c) 672

Shortcut Trick

Perform sign substitution: ÷ → ×, + → −, × → ÷, and − → +.

Expression becomes: 44 × 6 − 195 ÷ 3 + 473

Direct BODMAS calculation: 264 − 65 + 473

Final value: 199 + 473 = 672

Therefore The correct answer is 672.

Alternate Method

Given equation: 44 ÷ 6 + 195 × 3 − 473 = ?

Operations to interchange: + ↔ − and × ↔ ÷

Applying the interchanged signs:

=> 44 × 6 − 195 ÷ 3 + 473

=> 264 − 65 + 473

=> 199 + 473

=> 672

Therefore The correct answer is 672.

Additional Information

BODMAS Rule

Always solve expressions in the order: Brackets, Orders, Division, Multiplication, Addition, and Subtraction.

Symbol Substitution Strategy

When signs are interchanged, rewrite the entire expression once with the new signs to avoid calculation errors.

Sign Properties

For addition and subtraction, group positive terms and negative terms separately to simplify the final calculation step.

Q69. Answer: (d) 80

Given series:

29, 35, 42, 50, 59, 69, ?

Hence, the correct answer is "Option 4".

Q70. Answer: (d) BIR:CKU

Logic followed here is.

Logic: The letters of the first term are shifted forward by an increasing sequence of +1, +2, and +3 to obtain the corresponding letters of the second term.

For

HQL is related to ISO →

DGS is related to EIV →

The pattern observed is: (1st letter + 1), (2nd letter + 2), (3rd letter + 3).

Similarly, let's find the pair that follows the same pattern:

Checking BIR : CKU →

Therefore, the pair 'BIR : CKU' follows the same pattern.

Hence, the correct answer is "Option 4".

Q71. Answer: (d) 3

Given:

Seven people A, B, C, D, E, F and G are sitting in a row facing north.

Only two people sit to the left of G.

Only three people sit between G and C.

Only one person sits between C and E.

A sits to the immediate left of B.

F is not an immediate neighbour of C.

Now find how many people sit to the right of F:

F is at position 4.

People to the right of F are:

E, D and C

So, 3 people sit to the right of F.

Hence, the correct answer is "Option 4".

Q72. Answer: (c) 0

Given:

Total students = 40

Rohan is 18^(th) from the right end.

Position of Rohan from the left end:

= 40 − 18 + 1

= 23

So, Rohan is 23^(rd) from the left end.
Kajal is 22^(nd) from the left end.
Now find the number of people between them:
= 23 − 22 − 1
= 0
Therefore, no person stands between Rohan and Kajal.
Hence, the correct answer is "Option 3".

Q73. Answer: (c) S

Given:
Seven boxes B, D, E, P, S, T and W are kept one over the other.
Only four boxes are kept between E and W.
Only D is kept above E.
Only two boxes are kept between P and T.
S is kept immediately above B.
T is not kept immediately above S.
Step 1:
Only D is kept above E.
So, D is immediately above E.
Step 2:
Only four boxes are between E and W.

Position (Top to Bottom)	Box
1	D
2	E
3	?
4	?
5	?
6	?
7	W

Step 3:
S is immediately above B.
Possible vacant places:
(3,4), (4,5), or (5,6)
Step 4:
Only two boxes are between P and T.
Also, T is not immediately above S.
To satisfy all conditions:

Position (Top to Bottom)	Box
1	D
2	E
3	P
4	S
5	B
6	T
7	W

Now find the box fourth from the top:

The 4^(th) box from the top is: S

Hence, the correct answer is "Option 3".

Q74. Answer: (c) Q

Given:

Six people L, M, N, P, Q and R are sitting around a circular table facing the centre.

There are exactly two people between P and N.

M sits second to the right of N.

R sits second to the right of M.

L sits to the immediate left of N.

The possible circular seating arrangement is given below:

Now find the immediate neighbour of both N and M:

Neighbours of N: L and Q

Neighbours of M: Q and P

Common neighbour: Q

Hence, the correct answer is "Option 3".

Q75. Answer: (d) North-east

Given:

Tommy walks north for 30 metres.

Then he turns right and walks 10 metres.

After that, he turns left and walks 25 metres to reach his school.

The possible direct diagram is given below:

Final Direction:

From the starting point, the school is towards:

• North direction

• East direction

Therefore, the school is in the North-east direction.

Hence, the correct answer is "Option 4".

Q76. Answer: (c) rp

Given:

“stop disturbing people” → “ls ck rp”

“people need peace” → “cd ok rp”

Find the common word:

The common word in both sentences is: people

Find the common code:

Codes in first sentence: ls, ck, rp

Codes in second sentence: cd, ok, rp

The common code is: rp

Therefore, ‘people’ is coded as ‘rp’.

Hence, the correct answer is "Option 3".

Q77. Answer: (d) 7

Given series:

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

Step 1:

Drop all the even numbers from the series.

Remaining series:

7 1 9 5 3 1 5 7 3 9 5 3 9 1

Step 2:

Now count from the right end:

1st → 1

2nd → 9

3rd → 3

4th → 5

5th → 9

6th → 3

7th → 7

Therefore, the 7th number from the right is 7.

Hence, the correct answer is "Option 4".

Q78. Answer: (a) Only conclusion (II) follows

Given Statements:

All watches are shirts.

All watches are pants.

Some pants are belts.

Venn Diagram Representation:

Conclusions:

(I) Some belts are watches: Does not follows (Because only “Some pants are belts” is given. There is no definite relation between belts and watches.)

(II) Some pants are shirts: Follows (Because all watches are shirts and all watches are pants. Therefore, watches form a common part of shirts and pants, so some pants are shirts.)

Therefore Only conclusion (II) follows.

Hence, the correct answer is "Option 1".

Q79. Answer: (d) 9 km to the south

Given:

Ritwik starts from Point A and drives 46 km towards East.

Then:

Takes a right turn and drives 54 km

Takes a right turn and drives 56 km

Takes a right turn and drives 63 km

Takes a final right turn and drives 10 km to reach Point P

Now find shortest distance from Point P to Point A:

Point A = (0,0)

Point P = (0,9)

So, Ritwik is 9 km North of Point A.

To reach Point A again, he must travel:

9 km towards South

Hence, the correct answer is "Option 4".

Q80. Answer: (a) (560, 263, 297)

Logic followed here is: The first number is the sum of the second and third numbers in the set.

For (424, 212, 212) →

2nd No.	3rd No.
212	212

Sum = 212 + 212 = 424 (1st Number)

For (508, 302, 206) →

2nd No.	3rd No.
302	206

Sum = 302 + 206 = 508 (1st Number)

The pattern observed is: 1st Number = (2nd Number + 3rd Number).

Similarly, let's find the set for (560, 263, 297):

2nd No.	3rd No.
263	297

Sum = 263 + 297 = 560 (1st Number)

Therefore, the set '(560, 263, 297)' follows the same pattern.

Hence, the correct answer is "Option 1".

Q81. Answer: (a) 4.86%

The correct answer is 4.86%.

Key Points

• According to the SBI Research report titled "Poverty Reduction in India: A Perspective" released in January 2025, India has witnessed a significant decline in its poverty rates.

• The report highlights that India's rural poverty rate for FY24 (Financial Year 2023-24) dropped to 4.86%. This represents a substantial improvement in the living standards of the rural population. Hence, the correct option is 4.86%.

• The urban poverty rate for the same period (FY24) was recorded at a much lower level of 1.57%, indicating that urban centers have also seen drastic reductions in extreme deprivation.

• Combining these figures, the national average poverty rate (Headcount Ratio) for India in FY24 stands at 3.86%.

• This data is primarily based on the Household Consumption Expenditure Survey (HCES) 2022-23, which was extrapolated and analyzed to provide insights into the FY24 scenario.

• The report suggests that the reduction in poverty is a result of sustained economic growth and targeted government social welfare programs.

Additional Information

• Historical Comparison:

• To understand the magnitude of this shift, one must look at the 2011-12 data. During that period, India's rural poverty was as high as 25.7%, while urban poverty stood at 13.7%.

• The total combined national poverty rate in 2011-12 was 21.9%. The fall to 3.86% by FY24 marks a historic milestone in India's developmental journey.

• Role of Government Schemes:

• The SBI report attributes this decline to several Direct Benefit Transfer (DBT) schemes and initiatives like the Pradhan Mantri Garib Kalyan Anna Yojana (PMGKAY), which provides free food grains.

• Other impactful schemes mentioned include PM-Awas Yojana for housing, Swachh Bharat Mission for sanitation, and Jal Jeevan Mission for piped water supply.

• Consumption Expenditure:

• The HCES 2022-23 revealed that the Monthly Per Capita Consumption Expenditure (MPCE) has more than doubled since 2011-12.

• In rural areas, the MPCE rose to Rs 3,773, while in urban areas, it increased to Rs 6,459.

• Economic Significance:

• The report indicates a narrowing gap between rural and urban consumption, suggesting that inequality is gradually decreasing in the country.

• The Gini Coefficient, a measure of inequality, has also reportedly improved, showing a decline in both rural and urban sectors.

Important Points

• State-wise Trends: The report notes that states which were previously considered part of the "BIMARU" category have shown the most significant improvements in lifting people out of poverty.

• NITI Aayog Perspective: The SBI findings align closely with NITI Aayog's Multidimensional Poverty Index (MPI) reports, which stated that nearly 24.8 crore people moved out of multidimensional poverty between 2013-14 and 2022-23.

• New Poverty Line: There is ongoing discussion among economists to redefine the Poverty Line in India based on these updated consumption patterns, as the old Tendulkar or Rangarajan methodologies may now be outdated given the current economic landscape.

Q82. Answer: (d) Sudipto Sen — The Kerala Story

p>The correct answer is Sudipto Sen — The Kerala Story.

Key Points

• The 71st National Film Awards, which were organized in 2025, specifically aimed to honor and recognize cinematic excellence for films released or certified during the year 2023.

• Sudipto Sen was adjudged the winner of the Best Director award for his work on the film The Kerala Story. This award is one of

the highest individual honors presented in the Indian film industry.

• The film The Kerala Story gained national attention for its depiction of sensitive socio-political issues, and the directorial award highlights the technical and narrative execution led by Sudipto Sen.

• The ceremony continued the tradition of the National Film Awards in providing a platform where mainstream cinema and regional art films are evaluated on a common standard of excellence.

• The selection for this category was made by a National Jury comprising distinguished filmmakers and artists from across the country, ensuring a rigorous evaluation of directorial craft including storytelling, character development, and technical proficiency.

Additional Information

• National Film Awards Overview:

• Established in 1954, the National Film Awards are the most prestigious film awards in India. They are considered equivalent to the state honors given to individual excellence in the arts.

• The awards are administered by the Directorate of Film Festivals, which functions under the Ministry of Information and Broadcasting of the Government of India.

• Unlike commercial film awards (such as Filmfare or IIFA), these awards are focused on the aesthetic, technical, and social relevance of the films rather than their box office performance.

• Award Categories:

• The awards are divided into several sections, primarily Feature Films, Non-Feature Films, and Best Writing on Cinema.

• The Best Director award falls under the Feature Film section and is traditionally rewarded with the Swarna Kamal (Golden Lotus) trophy and a cash prize.

• Other major categories include Best Feature Film, Best Actor, and Best Actress, which recognize the comprehensive effort of the cast and crew.

Important Points

• Eligibility Criteria:

• To be eligible for the 71st National Film Awards, a film must have been certified by the Central Board of Film Certification (CBFC) between January 1, 2023, and December 31, 2023.

• The awards are open to films made in any Indian language, promoting linguistic diversity and regional cinema on a national stage.

• Significance of the Director's Role:

• The Best Director honor recognizes the person responsible for the creative vision and the overall management of the film's production, from screenplay execution to cinematographic style.

• Winners of this award are often cited for their ability to balance artistic integrity with audience engagement, contributing significantly to the cultural fabric of Indian Cinema.

Q83. Answer: (b) Bhashini Project

The correct answer is Bhashini Project.

Key Points

• The Bhashini Project, also known as the National Language Translation Mission, is a flagship initiative of the Ministry of Electronics and Information Technology (MeitY) designed to provide Artificial Intelligence (AI)-led language translation services.

• It was honored with the Gold Award at the National Awards for e-Governance under the category of "Application of Emerging Technologies for Providing Citizen Centric Services" for its revolutionary impact on digital accessibility.

• The project aims to empower Indian citizens by enabling them to access the internet and digital government services in their own native languages, thereby bridging the digital divide.

• It leverages advanced technologies such as Natural Language Processing (NLP), Machine Learning (ML), and Artificial Intelligence to provide real-time translation and voice-to-text services for the 22 scheduled languages of India.

• The Digital India Bhashini Division (DIC) operates as an independent business division to nurture a startup ecosystem that develops local language-based solutions for the masses.

Additional Information

• Bhasha Daan Initiative:

• This is a crowdsourcing component of the Bhashini project that invites citizens to contribute to the creation of huge datasets.

• Users can participate in Suno India (typing what they hear), Bolo India (donating their voice), Likho India (translating text), and Dekho India (labeling images) to train AI models.

• Universal Language Contribution API (ULCA):

• It is the standard platform used by the Bhashini ecosystem to manage and share Indian language datasets, models, and benchmarks.

• This open-source architecture ensures that the technology developed is scalable and accessible to developers and researchers

across India.

• Digital India Week:

• The Bhashini portal was officially launched by Prime Minister Narendra Modi in July 2022 during the Digital India Week in Gandhinagar, Gujarat.

• The mission aligns with the broader goals of Digital India to make government information and services available electronically to everyone.

• Impact on Governance:

• By providing multi-lingual support, the project enhances the reach of schemes like PM-Kisan and Ayushman Bharat, allowing non-English speaking citizens in rural areas to interact with digital platforms seamlessly.

Important Points

• National Awards for e-Governance:

• These awards are presented annually by the Department of Administrative Reforms and Public Grievances (DARPG) to recognize excellence in the implementation of e-governance solutions.

• The Gold Award represents the highest level of recognition for innovation and efficiency in public service delivery.

• Voice-based UPI Payments:

• One of the most significant applications of Bhashini technology is its integration with Unified Payments Interface (UPI), enabling users to perform financial transactions through voice commands in their local dialects.

• Target Languages:

• The project focuses on the 22 official languages listed in the Eighth Schedule of the Constitution of India, ensuring wide geographical and cultural coverage.

Q84. Answer: (d) Jakob Ingebrigtsen

The correct answer is Jakob Ingebrigtsen.

Key Points

• Jakob Ingebrigtsen, the prolific Norwegian middle-distance runner, achieved a historic double world record on February 13, 2025.

• During the Meeting Hauts-de-France Pas-de-Calais held in Liévin, France, he shattered two world indoor records in a single race.

• He clocked a sensational 3:45.14 for the mile, significantly lowering the previous world indoor record of 3:47.01 held by Yomif Kejelcha since 2019.

• As he completed the 1500-meter portion of the race, he was timed at 3:29.63 (en route), which also established a new world indoor record for that distance, breaking his own previous mark of 3:30.60.

• This performance cemented his status as one of the greatest distance athletes in history, holding multiple indoor and outdoor records simultaneously.

Additional Information

• Jakob Ingebrigtsen Profile: Born on September 19, 2000, in Sandnes, Norway, he is an Olympic Gold Medalist in the 1500m (Tokyo 2020) and 5000m (Paris 2024). He has been coached primarily by his family and is known for his high-volume training threshold method.

• World Indoor Records: Indoor records are set on 200-meter banked tracks, which are generally slower than the standard 400-meter outdoor tracks. Ingebrigtsen's mile time of 3:45.14 is remarkably close to the outdoor world record of 3:43.13 set by Hicham El Guerrouj in 1999.

• Meeting Hauts-de-France Pas-de-Calais: This meeting is part of the World Athletics Indoor Tour Gold series. The track in Liévin is legendary for middle-distance running, having hosted numerous world records in the 1500m, 2000m, and 3000m.

• Competing Athletes: Other athletes mentioned in the options, such as Yared Nuguse (USA) and Cole Hocker (USA), are his primary rivals. Nuguse previously held the North American indoor mile record, and Hocker is the Paris 2024 Olympic 1500m champion.

Important Points

• En Route Timing: In World Athletics sanctioned events, an athlete can set a world record for a shorter distance (like the 1500m) during a longer race (like the mile), provided the timing is recorded electronically at the specific mark.

• Wavelight Technology: The race in Liévin utilized Wavelight technology, a visual pacing system using LED lights along the inside rail of the track, which helped Ingebrigtsen maintain the precise world-record pace required to beat Kejelcha's 2019 time.

• Impact on Athletics: This performance marked the first time an athlete had broken the 3:30 barrier for 1500m and the 3:46 barrier for the mile indoors, showcasing the rapid advancement in middle-distance running speeds.

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Q85. Answer: (d) New Delhi

The correct answer is New Delhi.

Key Points

• The 'Save The Earth Conclave: Bamboo for a Resilient Future' was held in New Delhi on April 24, 2023.

• The event took place at the prestigious Vigyan Bhawan, serving as a platform for experts, researchers, and policymakers to discuss the ecological and economic benefits of bamboo.

• The conclave was organized with a focus on promoting sustainable development and finding eco-friendly alternatives to single-use plastics through bamboo-based products.

• Participants emphasized that bamboo, often referred to as "Green Gold," is a critical resource for achieving Net Zero carbon emissions and enhancing the rural economy in India.

• The conclave aimed to create a roadmap for the bamboo industry to contribute significantly to the country's resilient infrastructure and environmental conservation efforts.

Additional Information

• National Bamboo Mission (NBM):

• The mission was restructured in 2018-19 to promote holistic growth of the bamboo sector by connecting farmers to markets.

• It falls under the Ministry of Agriculture and Farmers Welfare and aims to increase the area under bamboo cultivation in non-forest government and private lands.

• Environmental Significance of Bamboo:

• Bamboo is one of the fastest-growing plants in the world and can sequester up to 35% more carbon than equivalent stands of trees.

• It plays a vital role in soil conservation and preventing erosion due to its extensive root system.

• Economic and Industrial Uses:

• Bamboo has over 1,500 documented uses, ranging from construction and furniture to textiles and bio-ethanol production.

• India is the second-largest producer of bamboo in the world, following China, possessing a vast diversity of species.

• Regulatory Changes:

• The Indian Forest (Amendment) Act, 2017, significantly omitted bamboo grown in non-forest areas from the definition of "trees."

• This amendment removed the requirement of a felling or transit permit for bamboo grown outside forests, encouraging farmers to cultivate it as a cash crop.

Important Points

• Global Bamboo Day: Celebrated every year on September 18 to raise awareness about the potential of bamboo as a sustainable resource.

• Species Diversity: India is home to about 136 species of bamboo across 23 genera, with a major concentration in the North-Eastern states.

• Bamboo as Plastic Alternative: With the ban on various single-use plastic items in India effective from July 1, 2022, bamboo has emerged as a primary substitute for manufacturing cutlery, straws, and packaging materials.

Q86. Answer: (c) Uttarakhand Revenue Secretary, Surendra Pandey

The correct answer is Uttarakhand Revenue Secretary, Surendra Pandey.

Key Points

• In August 2025, the Uttarakhand Government constituted a specialized three-member committee to conduct a thorough assessment of the damages resulting from the Dharali disaster in the Uttarkashi district.

• The committee was led by the Uttarakhand Revenue Secretary, Surendra Pandey, who was tasked with overseeing the technical and administrative evaluation of the affected regions.

• The primary objective of this committee was to quantify the loss of public infrastructure, private property, and agricultural land to ensure the timely disbursement of compensation and relief funds.

• The formation of this high-level committee followed reports of significant cloudburst-induced damage in the Bhagirathi valley, specifically affecting the Dharali and Harsil sectors.

• The committee's findings were designated to serve as the basis for the state's request for additional financial assistance from the National Disaster Response Fund (NDRF).

• Hence, the correct answer is Uttarakhand Revenue Secretary, Surendra Pandey.

Additional Information

• Geography of Dharali:

• Dharali is a picturesque village located at an altitude of approximately 2,680 meters in the Uttarkashi district of Uttarakhand.

• It is situated on the banks of the Bhagirathi River (a headstream of the Ganges) and is renowned for its apple orchards and proximity to the Gangotri National Park.

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• Role of the Revenue Secretary:

• In the administrative hierarchy of Uttarakhand, the Revenue Secretary serves as a pivotal figure in disaster management, as the department is responsible for land records and the assessment of natural calamity losses.

• The secretary coordinates with the District Magistrates (DM) to implement the State Disaster Response Fund (SDRF) guidelines and ensure administrative transparency during crisis recovery.

• Disaster Management Framework:

• Assessment committees typically operate under the Disaster Management Act, 2005, which provides the legal framework for the preparation, mitigation, and response to disasters in India.

• In Uttarakhand, the State Disaster Management Authority (SDMA), chaired by the Chief Minister, works in tandem with the Revenue Department to handle such crises.

• Vulnerability of the Region:

• The Uttarkashi region is highly susceptible to flash floods, cloudbursts, and landslides due to its fragile Himalayan topography and high-intensity rainfall during the monsoon months.

• The 2025 disaster in Dharali underscored the need for continuous monitoring of glacial streams and the implementation of Early Warning Systems (EWS) along the Char Dham pilgrimage route.

Important Points

• The three-member committee included technical experts from the Public Works Department (PWD) and the Irrigation Department to evaluate structural integrity.

• Surendra Pandey, an IAS officer, emphasized the use of drone surveys and satellite imagery for precise mapping of the disaster-affected zones in August 2025.

• The Dharali area is a significant stop for pilgrims traveling to Gangotri, making its rapid restoration a priority for the state's tourism and pilgrimage economy.

Q87. Answer: (a) Sheopur

The correct answer is Sheopur.

Key Points

• Kuno National Park is located in the Sheopur and Morena districts of Madhya Pradesh in India.

• It was initially established as a Wildlife Sanctuary in the year 1981 with an area of about 344.68 sq. km.

• The government of Madhya Pradesh upgraded the status of the sanctuary to a National Park in December 2018, increasing its area to 748.76 sq. km.

• This park is famous for being the site of Project Cheetah, the world's first intercontinental large wild carnivore translocation project.

• In September 2022, eight African Cheetahs were brought from Namibia and released into the park by Prime Minister Narendra Modi.

• The park is part of the Khathiar-Gir dry deciduous forests ecoregion and is nestled in the Vindhyan Hills.

Additional Information

• Geography and Flora:

• The park is named after the Kuno River, which flows through the center of the park from South to North.

• The forest type is primarily Northern Tropical Dry Deciduous Forest, dominated by trees like Kardhai (Anogeissus pendula), Khair (Acacia catechu), and Salai (Boswellia serrata).

• The terrain is a mix of sprawling grasslands and dense woodlands, which provides an ideal habitat for herbivores and predators alike.

• Fauna:

• Apart from cheetahs, the park is home to a variety of animals including Leopards, Chital (spotted deer), Sambar, Nilgai, Chinkara, and Wild Boar.

• It was originally identified as a secondary home for the Asiatic Lion to prevent the species from extinction due to potential epidemics in the Gir National Park.

• Madhya Pradesh Wildlife:

• Madhya Pradesh is known as the "Tiger State of India" because it consistently records the highest tiger population in the All India Tiger Estimation reports.

• The state hosts several other famous national parks such as Kanha, Bandhavgarh, Pench, Satpura, and Panna.

Important Points

• Project Cheetah Milestones:

• Following the first batch from Namibia, a second batch of 12 cheetahs was introduced from South Africa in February 2023.

• The reintroduction marks the return of the cheetah to India after it was declared extinct in the country in 1952.

• District Context:

• Sheopur district, where the park is primarily situated, is located in the Chambal Division of Madhya Pradesh.

• The Chambal River flows nearby, forming the boundary between Madhya Pradesh and Rajasthan.

• The local tribal community, the Sahariya tribe, lived within the forest area before being relocated during the expansion of the sanctuary.

Q88. Answer: (b) Phenome India Project

The correct answer is Phenome India Project.

Key Points

• The Phenome India Project, a large-scale health cohort study, led to the formal establishment of the National Biobank at the CSIR–Institute of Genomics and Integrative Biology (IGIB) in New Delhi in July 2025.

• Launched by the Council of Scientific and Industrial Research (CSIR), the Phenome India-CSIR Health Cohort Study is a first-of-its-kind pan-India initiative designed to collect comprehensive phenotypic and genetic data.

• The mission aims to identify specific risk factors for cardio-metabolic diseases, such as diabetes, cardiovascular ailments, and hypertension, which are increasingly common in the Indian population.

• The National Biobank serves as a centralized, high-tech repository for the cryopreservation of biological samples like blood, plasma, and serum, ensuring they are available for long-term medical research.

• The project involved a massive data collection drive from thousands of participants across India, primarily focusing on CSIR employees and their families to build a robust longitudinal dataset for precision medicine.

Additional Information

• CSIR–IGIB: The Institute of Genomics and Integrative Biology, located in New Delhi, is a premier research institute under CSIR that specializes in genomics, molecular medicine, and bioinformatics. It plays a pivotal role in genomic sequencing and public health diagnostics.

• Phenomics vs. Genomics: While Genomics focuses on the DNA sequence of an organism, Phenomics is the systematic study of phenotypes—the observable physical and biochemical traits—resulting from the interaction between genetics and the environment.

• Importance of Biobanks: A Biobank is critical for epidemiological studies as it allows scientists to correlate lifestyle factors and biomarkers with disease outcomes over several years or decades.

• Precision Medicine: The data generated by the Phenome India Project will help in developing personalized treatments and diagnostic tools specifically tailored for Indian ethnicities, rather than relying on Western clinical models.

• Comparison with Genome India: The Genome India Mission, another significant project, aimed to sequence 10,000 Indian genomes to create a reference genome for India, which was successfully completed in early 2024.

Important Points

• Longitudinal Study: The project is characterized as a longitudinal study, meaning it monitors the same group of individuals over a long period to observe how health conditions evolve.

• Data Integration: The National Biobank integrates biochemical parameters, clinical history, lifestyle data, and genetic information into a single database to provide a holistic view of Indian health.

• Scientific Impact: This mission is expected to significantly reduce the burden of non-communicable diseases (NCDs) in India by enabling early intervention and identifying novel biomarkers for disease susceptibility.

Q89. Answer: (a) 24 October

The correct answer is 24 October.

Key Points

• United Nations Day is celebrated on 24 October every year to mark the anniversary of the entry into force of the UN Charter in 1945.

• With the ratification of this founding document by the majority of its signatories, including the five permanent members of the Security Council, the United Nations officially came into being.

• The United Nations General Assembly declared this day in 1947, and it has been celebrated since 1948 to make known to the people of the world the aims and achievements of the United Nations.

• In 1971, the General Assembly adopted a resolution (Resolution 2782) recommending that United Nations Day should be a public holiday in all Member States.

• The UN Charter was signed on 26 June 1945 in San Francisco, at the conclusion of the United Nations Conference on International Organization, and came into force on 24 October 1945.

Additional Information

• 10 December (Human Rights Day):

• This day commemorates the United Nations General Assembly's adoption and proclamation of the Universal Declaration of

Human Rights (UDHR) on 10 December 1948.

• The UDHR is a milestone document that set out, for the first time, fundamental human rights to be universally protected.

• 7 April (World Health Day):

• Observed every year on 7 April, this date marks the anniversary of the founding of the World Health Organization (WHO) in 1948.

• Each year, a specific health theme is chosen to highlight a priority area of concern for the WHO, such as mental health, maternal care, or climate change.

• 5 June (World Environment Day):

• This is the United Nations' principal vehicle for encouraging awareness and action for the protection of the environment.

• It was established by the UN General Assembly in 1972 on the first day of the Stockholm Conference on the Human Environment and was first celebrated in 1973.

Important Points

• The name "United Nations" was devised by United States President Franklin D. Roosevelt and was first used in the Declaration by United Nations of 1 January 1942.

• The United Nations is headquartered in New York City, but it also has significant offices in Geneva, Nairobi, and Vienna.

• The UN currently consists of 193 Member States and 2 Observer States (Holy See and Palestine).

• The main organs of the UN are the General Assembly, the Security Council, the Economic and Social Council, the Trusteeship Council, the International Court of Justice, and the UN Secretariat.

• The International Court of Justice (ICJ) is the only principal organ not located in New York; it is located in The Hague, Netherlands.

Q90. Answer: (c) Maharashtra

The correct answer is Maharashtra.

Key Points

• In June 2025, the state government of Maharashtra officially announced the withdrawal of the existing three-language policy in schools to pave the way for a more flexible and modernized linguistic curriculum.

• To determine the new educational framework, the state formed a specialized committee led by the prominent educationist and economist Narendra Jadhav.

• The Narendra Jadhav committee is tasked with evaluating the impact of the previous policy and suggesting a way forward that aligns with the evolving needs of students in a globalized environment while preserving the importance of the regional language.

• This move follows growing discussions regarding the administrative and academic burden on students and the need to emphasize Marathi as the primary medium of instruction and cultural identity in the state.

• The committee includes various experts from the field of education who will submit a comprehensive report detailing the language requirements for primary and secondary education levels in Maharashtra.

Additional Information

• The Three-Language Formula:

• The formula was first formulated by the Union Ministry of Education in 1968 as part of the National Policy on Education.

• It typically involves the study of Hindi, English, and a regional language in non-Hindi speaking states, and Hindi, English, and a modern Indian language in Hindi-speaking states.

• The primary objective of this formula was to promote national integration and multilingualism among Indian students.

• Narendra Jadhav:

• Narendra Jadhav is a renowned Indian economist, educationist, and author who has served as a member of the Planning Commission of India.

• He also served as a nominated member of the Rajya Sabha from 2016 to 2022 and has held the position of Vice-Chancellor of Savitribai Phule Pune University.

• His expertise is frequently sought by both State and Central Governments for drafting policies related to social justice and educational reforms.

• Linguistic Policy in Maharashtra:

• Marathi was made a compulsory subject in all schools in Maharashtra, regardless of the board affiliation (SSC, CBSE, ICSE, or IB), through the Maharashtra Compulsory Teaching and Learning of Marathi Language Act, 2020.

• The withdrawal of the three-language policy in 2025 indicates a shift toward prioritizing regional proficiency and reducing the curriculum load in alignment with state-specific priorities.

Important Points

• National Education Policy (NEP) 2020 Connection:

• The NEP 2020 provides states with the flexibility to choose the three languages they wish to teach, provided at least two of the

three languages are native to India.

• The Maharashtra government's decision to review its policy through the Narendra Jadhav committee is seen as a localized implementation strategy of the broader NEP guidelines.

• Committee Objectives:

• The committee will focus on the cognitive development of children through mother-tongue-based instruction in the early years.

• It will also look into the implementation challenges faced by schools in rural versus urban areas regarding language faculty and resources.

• Date and Context:

• The decision made in June 2025 reflects a significant turning point in the educational history of Maharashtra, aiming to balance the Marathi language's heritage with English's global utility.

Q91. Answer: (b) The Constitution (One Hundred and Thirtieth Amendment) Bill, 2025

The correct answer is The Constitution (One Hundred and Thirtieth Amendment) Bill, 2025.

Key Points

• The Constitution (One Hundred and Thirtieth Amendment) Bill, 2025 was introduced in the Lok Sabha during the Budget Session of 2025 to address a significant legal vacuum regarding the eligibility of ministers to hold office while in judicial custody.

• The primary objective of this bill is to provide for the automatic removal of a Prime Minister, Chief Minister, or any Minister at the Union or State level if they remain in custody for a period of 30 consecutive days or more.

• The bill specifically targets situations where these high-ranking officials are arrested for a serious criminal offence, ensuring that the administrative machinery of the country or a state does not come to a standstill due to the incarceration of its executive head.

• Under the proposed amendment, the 30-day threshold is considered a definitive period after which the individual is deemed unable to perform their constitutional duties, thereby necessitating their removal from the Council of Ministers.

• The bill seeks to amend Article 75 (pertaining to the Union) and Article 164 (pertaining to the States) of the Constitution of India to include these specific disqualification criteria.

Additional Information

• Constitutional Provisions for Ministers:

• Article 75: States that the Prime Minister shall be appointed by the President and other ministers shall be appointed by the President on the advice of the Prime Minister. They hold office during the pleasure of the President.

• Article 164: Similar to Article 75, it mandates that the Chief Minister is appointed by the Governor, and ministers hold office during the pleasure of the Governor.

• Currently, the Constitution does not explicitly mention "custody" as a ground for removal, relying instead on the "pleasure" doctrine or voluntary resignation.

• Serious Criminal Offence:

• In the context of this bill, a serious criminal offence generally refers to crimes that carry a punishment of imprisonment for three years or more, or offences involving moral turpitude, corruption, or terrorism.

• The Representation of the People Act, 1951, already provides for the disqualification of legislators upon conviction for certain offences, but this amendment bill addresses the stage of prolonged custody prior to final conviction.

• Legislative Context:

• The bill was introduced amidst rising concerns over constitutional deadlocks where incumbent Chief Ministers in various Indian states continued to hold office while being in Tihar Jail or other judicial facilities, leading to difficulties in Cabinet meetings and policy implementation.

• By setting a 30-day limit, the legislature aims to balance the presumption of innocence with the necessity of effective governance.

Important Points

• Integrity of the Executive: The bill reinforces the principle that the executive branch must be headed by individuals who are physically and legally available to discharge their oath of office.

• Judicial Custody vs. Police Custody: The provision applies primarily to judicial custody, where the court determines there is enough evidence to keep the accused detained during the investigation or trial process for a prolonged period.

• Impact on Federalism: While the bill applies to both the Union and States, it has significant implications for state autonomy, as the Governor would be constitutionally empowered to recognize the vacancy after the 30-day period expires.

• Previous Precedents: Before this bill, the Supreme Court of India in various judgments, such as the Manoj Narula case, had expressed that it is the "constitutional expectation" that the Prime Minister and Chief Ministers do not appoint persons with criminal antecedents as ministers, though it left the actual removal to the discretion of the executive heads.

Q92. Answer: (a) Arundhati Roy

The correct answer is Arundhati Roy.

Key Points

• The memoir titled Mother Mary Comes to Me is authored by the acclaimed writer Arundhati Roy, marking her first foray into full-length memoir writing.

• The book is scheduled for a simultaneous global launch in September 2025. It will be published by Hamish Hamilton in India and the United Kingdom, and by Scribner in the United States.

• The narrative centers on the author's complex and "unnatural" relationship with her mother, Mary Roy, who was a famous educator and women's rights activist in Kerala. Hence, the statement regarding the author is correct.

• The memoir explores Arundhati Roy’s childhood in Kerala, her life as a young architecture student, and her journey toward becoming a world-renowned literary figure.

• It reflects on how the death of her mother in September 2022 influenced her to finally write about their shared history and the impact Mary Roy had on her life and politics.

Additional Information

• Arundhati Roy:

• Born in 1961 in Shillong, Meghalaya, she is one of India's most influential contemporary authors and activists.

• She won the Man Booker Prize in 1997 for her debut novel, The God of Small Things, which achieved international critical and commercial success.

• Her second novel, The Ministry of Utmost Happiness, was published in 2017, twenty years after her first, and was longlisted for the Man Booker Prize.

• In addition to fiction, she has published several non-fiction works such as The Algebra of Infinite Justice and Azadi: Freedom. Fascism. Fiction., focusing on human rights and environmentalism.

• Mary Roy:

• She was a pioneering educator who founded Pallikoodam school in Kottayam.

• She is famously known for winning a landmark Supreme Court case in 1986 that ensured equal inheritance rights for Syrian Christian women in Kerala.

Important Points

• The title Mother Mary Comes to Me is a reference to the opening lyrics of the Beatles' iconic 1970 song, "Let It Be".

• The memoir is expected to provide deep insights into the semi-autobiographical elements found in The God of Small Things, particularly the social landscape of Ayemenem.

• The release in September 2025 is highly anticipated in the literary world, as it bridges the gap between Arundhati Roy’s private life and her public persona as a fierce critic of institutional power.

• The author has often described her mother as a "character" she had been writing about her whole life, and this memoir serves as the definitive exploration of that maternal bond.

Q93. Answer: (c) 49

p>The correct answer is 49.

Key Points

• French President Emmanuel Macron announced on 9 June 2025, during the lead-up to the UN Ocean Conference in Nice, that 49 countries had ratified the High Seas Treaty.

• The treaty, formally known as the BBNJ Treaty (Biodiversity Beyond National Jurisdiction), requires 60 ratifications to officially enter into force.

• This announcement was a significant milestone in the global effort to protect international waters, which cover nearly two-thirds of the global ocean surface. Hence, the correct answer is 49.

• The High Seas Treaty was adopted by the United Nations on 19 June 2023, following nearly two decades of negotiations to establish a legal framework for the conservation of marine life in international waters.

• The treaty aims to establish Marine Protected Areas (MPAs) in the high seas, which are areas beyond the Exclusive Economic Zones (EEZ) of individual nations.

Additional Information

• The BBNJ Agreement:

• It is an international agreement under the United Nations Convention on the Law of the Sea (UNCLOS).

• It focuses on four main pillars: Marine Genetic Resources (MGRs), Area-based management tools including Marine Protected Areas, Environmental Impact Assessments (EIAs), and Capacity building and the transfer of marine technology.

• The treaty is vital for achieving the "30x30" goal, a target set under the Kunming-Montreal Global Biodiversity Framework to protect 30% of the world’s land and oceans by the year 2030.

• Ratification Process:

• For an international treaty to become legally binding, a country must first sign it and then ratify it through its domestic legislative process.

• The 60-country threshold is the designated number required to trigger the treaty's activation 120 days after the 60th instrument of ratification is deposited.

• President Emmanuel Macron has been a vocal advocate for the treaty, launching the High Ambition Coalition on BBNJ at the One Ocean Summit in Brest, France, in February 2022.

Important Points

• The High Seas:

• These are areas of the ocean that do not belong to any state's jurisdiction. They represent 95% of the Earth's habitat by volume but are among the least protected regions on the planet.

• Before this treaty, only about 1% of the high seas were under any form of management or protection.

• The 2025 UN Ocean Conference in Nice, France, co-hosted by France and Costa Rica, served as a major platform for accelerating the ratification count toward the 60-nation target.

• Marine Genetic Resources: One of the most debated aspects of the treaty involves the equitable sharing of benefits derived from genetic material of marine plants and animals found in the deep sea.

Q94. Answer: (a) Nalanda district

The correct answer is Nalanda district.

Key Points

• In May 2025, the Chief Minister of Bihar, Shri Nitish Kumar, inaugurated the state-of-the-art sports facilities and the administrative wing of the Bihar Sports University in Rajgir.

• Rajgir is a prominent historical and pilgrimage city located in the Nalanda district of Bihar.

• The new sports complex is spread over an area of approximately 90 acres and has been developed with a budget exceeding Rs. 740 crore to foster athletic talent in the state.

• The facility includes an International Cricket Stadium, built according to ICC standards, and a multi-purpose Indoor Stadium with a seating capacity for thousands of spectators.

• The Bihar Sports University is the first of its kind in the state and the sixth sports university established in India, aimed at professionalizing sports education and training.

Additional Information

• Nalanda District:

• It is part of the Magadh Division and is internationally famous for the Ancient Nalanda University, which is a UNESCO World Heritage Site.

• The district headquarters is located at Bihar Sharif.

• Nalanda is a major hub for tourism, encompassing Rajgir, Pawapuri (the place of Mahavira's Nirvana), and the ruins of the ancient university.

• Bihar Sports University Act:

• The Bihar Sports University Bill was passed by the state legislature in July 2021.

• Under the provisions of the Act, the Chief Minister of Bihar serves as the ex-officio Chancellor of the university.

• Development in Rajgir:

• Apart from the sports complex, Rajgir houses the Bihar Police Academy and the International Nalanda University.

• Recent ecological and tourism developments include the Nature Safari, Zoo Safari, and the Glass Skywalk.

Important Points

• Sports Infrastructure: The Rajgir Sports Complex features facilities for over 24 sports disciplines, including Athletics, Football, Hockey, Volleyball, and Swimming.

• Objective: The primary goal of the university is to provide scientific training, sports medicine facilities, and high-performance coaching to help athletes from Bihar compete at Olympic and International levels.

• Geographical Context: Rajgir is surrounded by seven hills—Vipulachal, Ratnagiri, Udaygiri, Swarnagiri, Vaibhagiri, Sontagiri, and Pandugiri—making it a natural choice for a sports and trekking destination.

Q95. Answer: (c) Ease of Doing Business

The correct answer is Ease of Doing Business.

Key Points

• The Environment (Audit) Rules, 2025, have been formulated by the Ministry of Environment, Forest and Climate Change (MoEFCC) to streamline the process of environmental compliance for industries in India.

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• These rules are a significant step toward the national reform agenda of Ease of Doing Business, as they aim to reduce the regulatory burden on project proponents by simplifying reporting mechanisms.

• The primary objective is to replace the traditional "command and control" inspection regime with a more transparent, self-regulatory, and third-party verification system.

• Under these rules, industries are required to conduct regular audits to ensure they are meeting the standards set during their Environmental Clearance (EC) process.

• The alignment with Ease of Doing Business is evident as the rules promote predictability, transparency, and efficiency in environmental governance, which are critical for attracting Foreign Direct Investment (FDI).

Additional Information

• Environment (Protection) Act, 1986:

• The Environment (Audit) Rules, 2025, are framed under the powers conferred by the Environment (Protection) Act, 1986, which was enacted following the Bhopal Gas Tragedy of 1984.

• This umbrella legislation provides the Central Government with the authority to protect and improve environmental quality and control pollution.

• Accreditation of Auditors:

• The rules mandate that environmental audits must be carried out by accredited environmental auditors or agencies recognized by the Quality Council of India (QCI) or the National Accreditation Board for Education and Training (NABET).

• This ensures that the data provided to the government is accurate, professional, and scientifically sound.

• PARIVESH Portal:

• The Environment Audit reports are integrated into the PARIVESH (Pro-Active and Responsive facilitation by Interactive, Virtuous and Environmental Single-window Hub) portal.

• This digital India initiative serves as a single-window system for all environmental, forest, wildlife, and CRZ clearances, further enhancing the Ease of Doing Business.

Important Points

• Categorization and Frequency:

• Industries are often categorized into Red, Orange, and Green categories based on their Pollution Index (PI). The 2025 Rules specify different audit frequencies based on these categories to optimize resources.

• High-pollution (Red) industries are subject to more frequent and rigorous environmental audits compared to less polluting ones.

• Compliance and Penalties:

• The rules emphasize compliance with the conditions stipulated in the Environmental Impact Assessment (EIA).

• Non-compliance or submission of fraudulent audit reports can lead to heavy penalties, cancellation of clearances, or legal action under Section 15 of the Environment (Protection) Act, which includes imprisonment for up to 5 years or a fine up to 1 lakh rupees, or both.

• Sustainable Development Goals (SDG):

• While focusing on Ease of Doing Business, the rules also align with India's commitment to Sustainable Development Goals, specifically SDG 12 (Responsible Consumption and Production) and SDG 13 (Climate Action).

Q96. Answer: (a) Indian Ports Act of 1908

The correct answer is Indian Ports Act of 1908.

Key Points

• The Indian Ports Bill, 2025, was passed by the Rajya Sabha (Upper House of Parliament) on 18 August 2025, marking a significant milestone in the modernization of India's maritime legal framework.

• This new legislation is designed to replace the Indian Ports Act of 1908, which had been the primary law regulating ports in India for over 117 years.

• The primary objective of the 2025 Bill is to repeal the archaic colonial-era 1908 Act and provide a contemporary regulatory framework that addresses the current needs of the maritime sector, including safety, security, and administrative efficiency.

• The bill focuses on the holistic development of non-major ports (also known as minor ports) and ensures that their management is aligned with international maritime standards and global best practices.

• It empowers the Maritime State Development Council (MSDC) to act as an apex advisory body to ensure integrated planning and development of the entire port sector across the country's vast coastline.

Additional Information

• The Indian Ports Act, 1908:

• Enacted during the British colonial period, this act provided for the administration of ports and the imposition of port-dues.

• It lacked comprehensive provisions for environmental protection, modern security protocols, and the structured development of private sector participation in port operations.

• Key Features of the Indian Ports Bill, 2025:

• Safety and Security: The bill incorporates the International Ship and Port Facility Security (ISPS) Code, ensuring that Indian ports meet global security requirements to prevent maritime terrorism and smuggling.

• Pollution Control: It introduces stringent measures for the prevention of marine pollution, mandating ports to have adequate facilities for the reception of ship-generated waste and oil residues.

• Digitalization: The legislation promotes the use of the National Logistics Portal-Marine to facilitate Ease of Doing Business by automating port clearances and documentation.

• Classification of Ports in India:

• Major Ports: Currently, India has 12 Major Ports that are governed by the Major Port Authorities Act, 2021, and fall under the jurisdiction of the Central Government.

• Non-Major Ports: There are over 200 Non-Major Ports distributed across the maritime states and Union Territories, which are generally managed by the State Governments or Maritime Boards.

Important Points

• Maritime State Development Council (MSDC): This council is a permanent body created to foster consultation between the Union Government and State Governments. It plays a critical role in preventing the duplication of port infrastructure and optimizing the use of India's 7,517 km coastline.

• Economic Significance: Approximately 95% by volume and 70% by value of India's external trade is handled through maritime transport, making the replacement of the 1908 Act vital for achieving the target of a 5 trillion-dollar economy.

• Adjudication: The 2025 Bill provides for an Adjudicatory Authority to resolve disputes between ports and users, ensuring a transparent and time-bound grievance redressal mechanism.

Q97. Answer: (c) Tuhin Kanta Pandey

The correct answer is Tuhin Kanta Pandey.

Key Points

• Tuhin Kanta Pandey, a 1987-batch IAS officer of the Odisha cadre, was appointed as the new Chairman of the Securities and Exchange Board of India (SEBI) in February 2025.

• He made history by becoming the first serving Finance Secretary to be appointed as the chief of the capital markets regulator.

• Before this prestigious appointment, he served as the Finance Secretary and Secretary of the Department of Investment and Public Asset Management (DIPAM) under the Ministry of Finance.

• He succeeded Madhabi Puri Buch, who was the first woman to lead SEBI and completed her tenure on February 28, 2025.

• The appointment was approved by the Appointments Committee of the Cabinet (ACC) for a period of three years or until further orders.

Additional Information

• Securities and Exchange Board of India (SEBI):

• SEBI was established on April 12, 1988, and was given statutory powers on January 30, 1992, through the SEBI Act, 1992.

• The headquarters of the board is located in the business district of Bandra Kurla Complex in Mumbai, Maharashtra.

• The main functions of SEBI include protecting the interests of investors in securities and promoting the development and regulation of the Indian securities market.

• It regulates the operations of stock exchanges, brokers, investment advisors, and mutual funds.

• DIPAM and Tuhin Kanta Pandey’s Legacy:

• As the Secretary of DIPAM, Tuhin Kanta Pandey was instrumental in managing the disinvestment process of Air India and the mega IPO of the Life Insurance Corporation (LIC) in 2022.

• His role as Finance Secretary involved coordinating between various departments of the Ministry of Finance to manage the country’s fiscal policy.

Important Points

• The Chairman of SEBI is typically appointed based on the recommendations of the Financial Sector Regulatory Appointments Search Committee (FSRASC), which is headed by the Cabinet Secretary.

• Madhabi Puri Buch (the predecessor) was the first non-IAS person and the first woman to lead the regulator since its inception, appointed in March 2022.

• Ajay Tyagi served as the SEBI Chairman for five years prior to Madhabi Puri Buch, from 2017 to 2022.

• The transition to Tuhin Kanta Pandey comes at a time when the Indian stock market is seeing unprecedented growth and retail participation, requiring strong regulatory oversight.

Q98. Answer: (a) Gout Gout

The correct answer is Gout Gout.

Key Points

• Gout Gout, a rising star in Australian athletics, shattered the long-standing national record in the 200m sprint.

• The feat was achieved at the Golden Spike meet held in Ostrava, Czech Republic, during the 2025 season.

• He recorded an extraordinary time of 20.02 seconds, which officially surpassed the previous Australian national mark. Hence, the statement regarding his record-breaking run is correct.

• This performance is significant as it broke the record previously held by the legendary Peter Norman, whose time of 20.06 seconds had stood since the 1968 Mexico City Olympics.

• At a very young age, Gout Gout has drawn comparisons to sprinting legends due to his upright running style and explosive speed in the final 100 meters of the race.

Additional Information

• Golden Spike Ostrava:

• This is one of the most prestigious track and field meetings in the world, held annually at the Mestsky Stadion in Ostrava.

• It is part of the World Athletics Continental Tour Gold series, often attracting world-record holders and Olympic champions.

• Athletes Mentioned:

• Aidan Murphy: A talented Australian sprinter who specializes in the 200m and has represented the country at the World Athletics Championships.

• Reynier Mena: A high-profile Cuban sprinter known for his personal bests under 20 seconds, frequently competing in elite European circuits.

• Armand Duplantis: While a world-renowned athlete, he is a Swedish-American pole vaulter and the current world record holder in that discipline, not a professional 200m sprinter.

• Significance of the 200m Sprint:

• The 200 meters is a classic sprint event that begins on a curve and ends on a straightaway, testing both the acceleration and speed endurance of an athlete.

• Gout Gout's time of 20.02 seconds places him among the global elite, nearing the sub-20 second barrier that defines world-class sprinting.

Important Points

• Peter Norman's Legacy: The previous record holder, Peter Norman, was famous not only for his 1968 silver medal and national record but also for his support of the Olympic Project for Human Rights. Breaking a 57-year-old record is considered a historic milestone in Australian sports history.

• Future Prospects: With his record-breaking performance in 2025, Gout Gout is positioned as a primary medal contender for Australia in upcoming international events, including the World Championships and the Olympic Games.

• Data and Facts: The time of 20.02 seconds was wind-legal, confirming its validity as a national record under World Athletics guidelines.

Q99. Answer: (d) Heightened geopolitical tensions near border regions

The correct answer is Heightened geopolitical tensions near border regions.

Key Points

• On May 9, 2025, Union Finance Minister Nirmala Sitharaman chaired a high-level review meeting with the Managing Directors and CEOs of Public Sector Banks (PSBs) in New Delhi.

• The meeting was specifically convened to discuss the banking sector's preparedness in the face of heightened geopolitical tensions particularly near border regions, which pose a unique set of challenges to financial infrastructure and national security.

• The Finance Minister directed banks to remain fully alert and develop robust contingency plans to ensure that banking operations, including ATM services and digital payments, remain uninterrupted in sensitive geographical zones. Hence, the situation related to border tensions is the primary reason for the directive.

• Banks were instructed to prioritize the financial needs of the Indian Armed Forces and the civilian population residing in strategic border areas to maintain economic morale and stability.

• A significant portion of the directive focused on Cybersecurity, as geopolitical friction often correlates with an increase in state-sponsored cyberattacks targeting critical financial infrastructure.

Additional Information

• Role of Public Sector Banks (PSBs):

• PSBs in India, such as the State Bank of India (SBI) and Punjab National Bank (PNB), play a crucial role in maintaining financial inclusion in remote areas through the Business Correspondent (BC) model.

• In times of geopolitical instability, these banks act as the backbone for distributing government subsidies and Direct Benefit Transfers (DBT) to vulnerable populations.

• Geopolitical Risk Management:

• The Ministry of Finance and the Reserve Bank of India (RBI) monitor Macro-prudential risks arising from global conflicts, which can affect exchange rates, inflation, and capital flows.

• The directive on May 9, 2025, aligns with the broader national strategy of securing the Vibrant Villages Programme, which aims to develop infrastructure in villages along India's northern border.

• Department of Financial Services (DFS):

• The DFS, under the Ministry of Finance, is responsible for overseeing the policy framework for Public Sector Banks and ensuring their operational readiness during national emergencies.

• It coordinates with the Ministry of Home Affairs to identify high-risk zones where banking security needs to be intensified.

Important Points

• Business Continuity Planning (BCP):

• Banks are required to maintain Disaster Recovery (DR) sites located in different seismic zones to ensure data integrity if a border region facility is compromised.

• The Finance Minister emphasized that liquidity management must be agile to prevent any panic withdrawals or financial distress in conflict-prone areas.

• Technological Safeguards:

• Under the guidance of CERT-In (Indian Computer Emergency Response Team), banks are enhancing their firewalls and encryption standards to defend against ransomware and phishing that often spike during geopolitical unrest.

• The 2025 directive also touched upon the Digital Rupee (e-Rupee) as a potential tool for offline transactions in areas with intermittent internet connectivity near the border.

Q100. Answer: (d) New Delhi

The correct answer is New Delhi.

Key Points

• The India Open 2025, officially sanctioned by the Badminton World Federation (BWF), was held in New Delhi.

• The tournament took place at the prestigious K. D. Jadhav Indoor Hall, located within the Indira Gandhi Sports Complex, which is a premier venue for international indoor sports in India.

• Scheduled from January 21 to January 26, 2025, the event is a part of the BWF World Tour circuit.

• It is classified as a Super 750 tournament, representing the second-highest level of the BWF World Tour, just below the Super 1000 and the World Tour Finals.

• The event attracts the world's elite badminton players across five categories: Men's Singles, Women's Singles, Men's Doubles, Women's Doubles, and Mixed Doubles.

• Hence, the correct answer is New Delhi.

Additional Information

• Tournament Status Upgrade:

• Historically, the India Open was a Super 500 event. However, starting from the year 2023, the BWF upgraded its status to Super 750 to reflect its growing importance and high organizational standards.

• As a Super 750 event, no qualifying rounds are held; only the top 32 players/pairs in the world rankings are permitted to compete in the main draw.

• Historical Context:

• The India Open was first inaugurated in 1973. Over the decades, it has become the flagship badminton event in the country, showcasing Indian talent on a global stage.

• The tournament is organized annually by the Badminton Association of India (BAI).

• Prize Money and Ranking:

• For the 2025 edition, the total prize pool was approximately USD 850,000.

• Winners of the Super 750 title earn 11,000 ranking points, which are vital for maintaining a high BWF World Ranking and securing seeds in major championships like the World Championships and Olympics.

Important Points

• Venue Significance:

• The K. D. Jadhav Indoor Hall in New Delhi is named after Khashaba Dadasaheb Jadhav, the first individual Olympic medalist of independent India. It has a seating capacity of approximately 15,000 spectators.

• Notable Indian Champions:

• Several Indian shuttlers have won titles at the India Open, including Saina Nehwal (2015), Kidambi Srikanth (2015), P.V. Sindhu (2017), and Lakshya Sen (2022).

• The pair of Satwiksairaj Rankireddy and Chirag Shetty famously won the Men's Doubles title in 2022, becoming the first Indian pair to do so.

• BWF Structure:

• The BWF World Tour is divided into six levels: World Tour Finals, Super 1000, Super 750, Super 500, Super 300, and the BWF

Tour Super 100 level.

• The India Open sits alongside prestigious events like the Japan Open, Denmark Open, and French Open in the Super 750 category.

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