RRB Group D Official Paper (Held On: 03 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. How do plant cells respond immediately to a stimulus without specialized proteins like animal muscle cells?

(a) By breaking down food to release energy instantly
(b) By producing immune responses
(c) By secreting enzymes only
(d) By changing water content to cause swelling or shrinking

Q2. Which of the following was the scientist who blended his knowledge of science and mathematics to arrive at the laws of inheritance?

(a) Camillo Golgi
(b) John Dalton
(c) E Rutherford
(d) Gregor Johann Mendel

Q3. Which of the following correctly explains the importance of pH in everyday life?

(a) Tooth enamel dissolves when the pH of the mouth rises above 7.5 due to bacterial activity.
(b) Acid rain has pH greater than 7, which harms aquatic life.
(c) A bee sting injects a basic liquid, so it is treated with a weak acid like vinegar.
(d) Our stomach secretes hydrochloric acid to maintain a pH around 2, aiding digestion.

Q4. Which of the following statements is correct for the magnetic field inside a long, straight, current-carrying solenoid?

(a) It decreases as we move towards its end.
(b) It is zero.
(c) It is the same at all points.
(d) It increases as we move towards its end.

Q5. Which of the following organs is involved in the function of reflex action?

(a) Spleen
(b) Kidney
(c) Spinal cord
(d) Middle ear

Q6. Among the following materials, which one has the highest electrical resistivity at room temperature?

(a) Manganese
(b) Mercury
(c) Chromium
(d) Iron

Q7. Which of the following correctly describes the sequence of events leading to muscle movement?

(a) Digestion → Blood circulation → Movement
(b) Nerve impulse → Muscle protein response → Muscle contraction
(c) DNA replication → Protein synthesis → Muscle movement
(d) Blood flow → Protein activation → Nerve impulse → Movement

Q8. Which of the following statements is INCORRECT about DNA copies produced during the process of reproduction?

(a) DNA copies are double stranded.
(b) Copying of DNA is a pre-requisite for reproduction.
(c) DNA copying is a completely error-free process.
(d) DNA copies generated are similar but not identical.

Q9. What is the main function of leucoplasts in plant cells?

(a) Giving colour to flowers
(b) Breaking down waste materials
(c) Storing materials like starch, oils, and proteins
(d) Absorbing sunlight

Q10. When gypsum is heated at 373 K, it loses water of crystallisation and forms _____.

(a) calcium chloride pentahydrate
(b) calcium sulphate hemihydrate
(c) calcium chloride hemihydrate
(d) calcium sulphate pentahydrate

Q11. What unique property of carbon atoms enables them to form long and stable chains with other carbon atoms?

(a) Isomerism
(b) Catenation
(c) Tetravalency
(d) Allotropy

Q12. Which of the following statements is correct about the nature of the image formed by a concave mirror when the object is placed between the principal focus and the pole?

(a) Real, inverted, highly diminished (point image)
(b) Real, inverted, diminished
(c) Virtual, erect, magnified
(d) Real, inverted, same size

Q13. Cells of the meristematic tissue lack vacuoles because:

(a) Vacuoles block respiratory enzymes
(b) Meristematic cells are dead and do not need vacuoles
(c) Meristematic cells are actively dividing and need a dense cytoplasm
(d) Vacuoles cause cell death

Q14. Which of the following statements is correct for uniform motion?

(a) The slope of the distance–time graph is zero.
(b) The slope of the distance–time graph is decreasing.
(c) The slope of the distance–time graph is constant.
(d) The slope of the distance–time graph is increasing.

Q15. Which of the following best defines an ion?

(a) An atom with equal number of protons and electrons
(b) A molecule with more neutrons than protons
(c) A neutral particle formed by the combination of atoms
(d) An atom or group of atoms that has a positive or negative charge

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Q16. Why are sound waves classified as mechanical waves?

(a) They oscillate perpendicular to wave propagation
(b) They cause light oscillations
(c) They are characterised by the motion of particles in a medium
(d) They do not require a medium to travel

Q17. Which of the following organs in human females can produce hormones?

(a) Salivary glands
(b) Cervix
(c) Ovaries
(d) Fallopian tubes

Q18. Which of the following factors does NOT increase the rate of evaporation?

(a) Increase in wind speed
(b) Increase in humidity
(c) Increase of temperature
(d) Increase in surface area

Q19. What is the formula to calculate the acceleration due to gravity (g), where G is the universal gravitational constant, M is the mass of the Earth, and R is the radius of the Earth?

(a) $g=GM/R$
(b) $g=GM^2/R$
(c) $g=GR/M^2$
(d) $g=GM/R^2$

Q20. Baking soda is prepared using which of the following processes?

(a) Chlor-alkali process
(b) Deacon's process
(c) Solvay process
(d) Haber process

Q21. A concave lens has a focal length of 15 cm. An object is placed at a distance of 30 cm from the lens. What is the magnification produced by the lens?

(a) +0.33
(b) -0.66
(c) -0.33
(d) +0.66

Q22. Which of the following statements best explains kinetic energy?

(a) It is the energy an object has because of its motion, and it increases as the object's speed increases.
(b) It is the energy stored in an object due to its shape.
(c) It is the energy an object has because it is at rest.
(d) It is the energy that decreases as the object's speed increases.

Q23. Structural formula of branched chain organic compound 'Neopentane' may be represented by:

(a) $CH_3-CH(CH_3)-CH_2-CH_2-CH_3$
(b) $CH_3-CH(CH_3)-CH_3$
(c) $CH_3-CH(CH_3)-CH_2-CH_3$
(d) $C(CH_3)_4$

Q24. Which of the following conditions will NOT favour evaporation?

(a) High Temperature
(b) High Humidity
(c) Low Humidity
(d) High Wind Speed

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Q25. A satellite is moving in a uniform circular orbit around the Earth. Which of the following statements about its motion is correct?

(a) The satellite has a constant velocity and a constant acceleration.
(b) The satellite has a constant velocity, but its speed is not constant.
(c) The satellite has a constant speed, but its velocity is not constant.
(d) The satellite has a constant speed and no acceleration.

MATHEMATICS

Q26. If sin A = 3/5, and A is an acute angle, then find the value of 2 $\cot^2 A$ - $\text{cosec}^2 A$.

(a) 2/9
(b) 8/9
(c) 7/9
(d) 1/9

Q27. To buy a new apartment, Shweta borrowed Rs. 9,95,500 at 4% per annum simple interest for 39 months. How much interest will she pay?

(a) Rs. 1,29,415
(b) Rs. 1,29,665
(c) Rs. 1,39,545
(d) Rs. 1,15,995

Q28. The number 23.232323... in the form p/q where p and q are integers and q ≠ 0 is:6515

(a) 2300/11
(b) 2300/33
(c) 2300/9
(d) 2300/99

Q29. When the volume of a sphere is divided by its surface area, the result is 7 cm. Find the surface area.

(a) 5088 cm2
(b) 4896 cm2
(c) 5274 cm2
(d) 5544 cm2

Q30. A, B and C can do a piece of work in 2, 20 and 5 days respectively. How long (in days) will they take to do thrice the same work, working together?

(a) 4
(b) 12
(c) 8
(d) 5

Q31. Dev and Tej started a business, investing amounts of Rs. 1,800 and Rs. 1,620, respectively. If Dev's share in the profit earned by them is Rs. 930, what is the total profit (in Rs.) earned by them together?

(a) 1,788
(b) 1,753
(c) 1,869
(d) 1,767

Q32. If Anirudh is as much older than Praveen as he is younger than Suman and the sum of the ages of Praveen and Suman is 36 years, then find the age of Anirudh.

(a) 9 Years
(b) 12 Years
(c) 24 Years
(d) 18 Years

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Q33. The cost of a washing machine is 50% less than the cost of a TV. If the cost of the washing machine increases by 62% and that of the TV decreases by 51%, then what is the percentage change in the total cost of 6 washing machines and 2 TVs?

(a) Decrease by 21%
(b) Increase by 16.8%
(c) Increase by 17%
(d) Decrease by 19%

Q34. P is any point inside the rectangle ABCD. If PA = 46 cm, PB = 16 cm and PC = 88 cm, then the length of PD (in cm) is equal to:

(a) 98
(b) 96
(c) 100
(d) 94

Q35. If the listed price of a bag is 93% more than its cost price and a discount of 59% is announced on it, then find the loss percentage.

(a) 20.89%
(b) 23.12%
(c) 24.87%
(d) 20.87%

Q36. Srikar spends 10% of his monthly income on rent, 20% of the rest on household expenditure and 25% of the rest on food and saves the rest. He finally saves Rs. 78,300. Find his monthly income.7083

(a) Rs. 1,50,000
(b) Rs. 1,45,000
(c) Rs. 1,00,000
(d) Rs. 1,78,300

Q37. Walking at 4/7 of his normal speed, Abhijet is 36 minutes late in reaching his office. The usual time taken by him to cover the distance between his home and his office is:

(a) 57 minutes
(b) 56 minutes
(c) 48 minutes
(d) 42 minutes

Q38. 8 men or 9 women can do a job in 2 days. 8 men work for 1 day and leave. The number of women required to complete the remaining work in 9 days is:

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

Q39. 2 men can do a piece of work in 2 days. How many men will do it in 1 day?

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

Q40. Which of the following expressions is the simplified form of $(2x + 5)(2x - 5) - (2x - 3)^2$?

(a) $2(6x - 17)$
(b) $2(6x + 17)$
(c) $2(3x - 17)$
(d) $2(3x + 17)$

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Q41. A vendor offers her customers a discount of 24% on her beauty products and she still makes a profit of 22%. What is the cost price (in Rs.) of a beauty product marked at Rs. 854?

(a) 532
(b) 586
(c) 576
(d) 573

Q42. The total number of colour blocks is 4641. If the ratio of red blocks to blue blocks is 6 : 10 and the ratio of blue blocks to yellow blocks is 2 : 7, then how many yellow blocks are there?

(a) 3155
(b) 3185
(c) 3148
(d) 3149

Q43. A shopkeeper buys 20 pens for Rs. 600 and sells them for Rs. 900. Find his profit percentage.

(a) 33.33%
(b) 40%
(c) 15%
(d) 50%

Q44. A 140-metre-long train crosses a platform thrice its length in 56 seconds. What is the speed of the train in km/hr?

(a) 33
(b) 40
(c) 26
(d) 36

Q45. A number is 18 more than its three-fourth. Find the number.

(a) 36
(b) 42
(c) 54
(d) 72

Q46. The average age of 31 students of a class is 14 years. If the age of the teacher is also included, the average age of the whole group becomes 15 years. The age (in years) of the teacher is:

(a) 49
(b) 45
(c) 47
(d) 46

Q47. In a class examination, the average score of 35 students was 44. Later, it was discovered that twice 25 was wrongly recorded as 33, and once 36 was wrongly recorded as 34. What is the actual average score of the class?

(a) 43.6
(b) 41.6
(c) 42.6
(d) 44.6

Q48. If 20% of a number is added to 72, then the result is the same number. 65% of the same number is:

(a) 78.5
(b) 88.5
(c) 68.5
(d) 58.5

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Q49. What is the value of [10 1/3 ÷ 5/3 of (10 + 14 ÷ 3 - 1)] ?

(a) 93/105
(b) 93/205
(c) 83/105
(d) 83/205

Q50. The volume (in m^3) of a cuboidal tank with dimensions 2 m × 11 m × 49 m is:

(a) 1049
(b) 1061
(c) 1078
(d) 1102

GENERAL INTELLIGENCE & REASONING

Q51. Hitesh starts driving from Point A and drives 13 km towards the South. He turns right and drives 4 km, turns right again and drives 14 km. He turns right once more and drives 9 km. He turns right for the final time, drives 1 km, and stops at Point P. How far (minimum distance) and in which direction must he drive to reach back to Point A? (Unless specified otherwise, all turns are 90-degree turns.)

(a) 6 km, towards the east
(b) 5 km, towards the west
(c) 5 km, towards the east
(d) 6 km, towards the west

Q52. Refer to the following number, symbol series and answer the question that follows. Counting to be done from left to right only. All numbers are single-digit numbers only.

(Left) © @ 7 € $ 5 $ & * & 7 5 2 $ 8 $ © 7 © 4 6 £ (Right)

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

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

Q53. If 1 is added to each odd digit and 2 is subtracted from each even digit in the number 3674185, how many digits will appear more than once in the new number thus formed?

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

Q54. Based on the English alphabetical order, three of the following four letter-cluster pairs are alike in a certain way and thus form a group. Which letter-cluster pair DOES NOT belong to that group? (Note: The odd one out is not based on the number of consonants/vowels or their position in the letter-cluster.)

(a) QR - MN
(b) NO - JK
(c) HJ - DL
(d) LM - HI

Q55. Refer to the number series given below and answer the question that follows. Counting to be done from left to right only.

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

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

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

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

Q56. A, B, C, E, F, P, and Q are sitting around a circular table, facing the centre. Only four people sit between C and E, when counted from the right of C. C sits third to the left of P. B sits third to the left of F. Q is an immediate neighbour of both E and P. How many people sit between A and Q, when counted from the right of A?

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

Q57. Read the given statements and conclusions carefully. Assuming that the information given in the statements is true, even if it appears to be at variance with commonly known facts, decide which of the given conclusions logically follow(s) from the statements.

Statements: Some hair are nails. All nails are teeth.

Conclusions (I): Some hair are teeth.

Conclusions (II): All teeth are nails.

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

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

GHI−FGH

KLM−JKL

(a) BBB−ZAB
(b) BCD−ABC
(c) BCD−ZBB
(d) BBB−ABC

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

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

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

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

Q60. A, B, C, D, W, X and Y are sitting around a circular table facing the centre of the table.

C sits fourth to the right of X. Only two people sit between Y and W when counted from the left of Y. D sits third to the left of B. A is an immediate neighbour of B and W. How many people between C and A when counted from the left of A?

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

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Q61. 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 conclusion(s) logically follow(s) from the statements.

Statements:

All goats are lions.

All lions are dogs

Conclusion (I): All dogs are goats.

Conclusion (II): Some lions are goats.

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

Q62. Select the pair which follows the same pattern as that followed by the two set of pairs given below. Both pairs follow the same pattern.

MOS−QSW

RTX−VXB

(a) KLO−NPT
(b) KMQ−NQT
(c) KLO−OQU
(d) KMQ−OQU

Q63. Naksh ranked 45^(th) from the top and 27^(th) from the bottom in his class. How many students are there in his class?

(a) 73
(b) 70
(c) 72
(d) 71

Q64. In a coded language:

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

A - B means 'A is the father of B'

A x B means 'A is the mother of B'

A ÷ B means 'A is the brother of B'

Based on the above, if 'P - Q + C x D ÷ E', then what is the relationship between P and E?

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

Q65. Which letter cluster will replace the question mark (?) to complete the given series?

CCP FDN IEL ? OGH

(a) PLO
(b) UUY
(c) LFJ
(d) HJY

Q66. What should come in place of the question mark (?) in the given series?

11 13 16 21 ? 39

(a) 25
(b) 28
(c) 22
(d) 29

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Q67. A group of numbers/symbols is coded using letter codes as per the codes given below and the conditions that follow. The correct combination of codes following the conditions is your answer.

Note: If none of the conditions apply, then the codes for the respective number/symbol are to be followed directly as given in the table.

Numbers/symbols	%	6	2	8	•	3	&	7	@	9	•	5	#	4
Codes	T	W	P	H	G	L	F	U	M	B	S	Y	K	D

Conditions:

(i) If the first element is a symbol and the last element a perfect square, the codes for these two (the first and last elements) are to be interchanged.

(ii) If both the second and third elements are symbols, the third element is to be coded as the code for the second element.

(iii) If the first element is a symbol and the fourth element is an odd number, the first and fourth elements are to be coded as ©.

What will be the code for the following group?

% 5 * & 9

(a) B Y G F T
(b) T Y F F B
(c) T Y G F B
(d) © Y G © B

Q68. Arman starts from point A and drives 44 km towards south. He then takes a left turn, drives 42 km, turns left and drives 51 km. He then takes a left turn and drives 56 km. He takes a final left turn, drives 7 km and stops at point P. How far (shortest distance) and towards which direction should he drive in order to reach point A again?

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

(a) 14 km to the east
(b) 13 km to the east
(c) 12 km to the west
(d) 11 km to the west

Q69. Seven boxes, M, N, O, P, Q, R and S, are kept one over the other, but not necessarily in the same order. Only two boxes are kept below S. Only one box is kept above Q. Only one box is kept between Q and P. R is kept immediately above N. O is kept at some place below M. How many boxes are kept between M and R?

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

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

WP-SL-OR

TM-PI-LO

(a) QJ-MF-IL
(b) RJ-ME-IK
(c) QJ-MF-IK
(d) RJ-MF-IK

Q71. What should come in place of the question mark (?) in the given series?

27 51 75 99 123 ?

(a) 145
(b) 146
(c) 148

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(d) 147

Q72. Select the set in which the numbers are related in the same way as are the numbers of the following sets.

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

(12, 240, 20)

(10, 150, 15)

(a) (9, 180, 20)
(b) (8, 100, 15)
(c) (15, 225, 16)
(d) (8, 90, 15)

Q73. Which of the following letter-number clusters will replace the question mark (?) in the given series to make it logically complete?

TIU 20 VKW 21 XMY 22 ZOA 23 ?

(a) CQC 24
(b) DQB 24
(c) BRC 24
(d) BQC 24

Q74. In a certain code language, ‘MOVE’ is coded as ‘7481’ and ‘OVER’ is coded as ‘8314’. What is the code for ‘R’ in that language?

(a) 8
(b) 4
(c) 3
(d) 1

Q75. Five people, A, B, C, D and E, are sitting in a row, facing north. Only two people sit between A and B. B sits between D and E. E sits second to the left of A. Who sits at the extreme left end of the row?

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

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

893 895 899 905 913 ?

(a) 921
(b) 922
(c) 924
(d) 923

Q77. If 1 is added to each odd digit and 2 is subtracted from each even digit in the number 6437585, how many digits will appear more than once in the new number thus formed?

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

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

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

(a) EI – LN
(b) TX – AC
(c) OS – WY

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(d) AE – HJ

Q79. Refer to the following number series and answer the question that follows (all numbers are single-digit numbers only) Counting to be done from left to right only.

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

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

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

Q80. Each of the digits in the number 9612345 is arranged in ascending order from left to right. What will be the sum of the digits that are second from the left and second from the right in the new number thus formed?

(a) 7
(b) 6
(c) 8
(d) 9

GENERAL AWARENESS AND CURRENT AFFAIRS

Q81. Which of the following Constitutional Amendment Bills was passed by the 17th Lok Sabha of India on 17 December 2024?

(a) 129th
(b) 78th
(c) 88th
(d) 126th

Q82. As of 30 April 2025, the 'GenomeIndiaA' project has completed whole genome sequencing (WGS) database of approximately how many individuals?

(a) 8000
(b) 10,000
(c) 11,000
(d) 6600

Q83. Which edition of SIMBEX (Singapore-India Maritime Bilateral Exercise) was held in Singapore in July 2025?

(a) 22nd
(b) 52nd
(c) 32nd
(d) 42nd

Q84. Which spacecraft will be used for Axiom-4?

(a) Soyuz MS-24
(b) Starliner
(c) Crew Dragon C213
(d) Orion

Q85. How many new Khelo India Centres are planned by the Delhi Government in 2025?

(a) 10
(b) 6
(c) 2
(d) 4

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Q86. Which NFL player won the BET Sportsman of the Year Award 2025?

(a) Patrick Mahomes
(b) Lamar Jackson
(c) Josh Allen
(d) Jalen Hurts

Q87. Which of the following countries hosted the 6^(th) BIMSTEC Summit in April 2025?

(a) Bangladesh
(b) Sri Lanka
(c) Thailand
(d) Nepal

Q88. Which Kannada short-story collection became the first-ever to win the International Booker Prize in 2025?

(a) Theory & Practice
(b) The Many Lives of Syeda X
(c) Heart Lamp: Selected Stories
(d) Once Elephants Lived Here

Q89. As per the Economic Survey, 2024–25, which mission is part of India's Space Vision, 2047, for human spaceflight?

(a) Vikram
(b) Samudrayaan
(c) Mangalyaan
(d) Gaganyaan

Q90. As per Sustainable Development Goals – National Indicator Framework Progress Report, 2025, the percentage of population using an improved drinking water source in rural areas increased from 94.57% in 2015-16 to what percentage in 2024-25, indicating significant progress toward universal safe water access in rural India?

(a) 99.62%
(b) 95.32%
(c) 96%
(d) 98%

Q91. Which of the following trophies was renamed the Anderson-Tendulkar Trophy in June 2025?

(a) ODI Trophy
(b) IPL Trophy
(c) T20 Trophy
(d) Test series trophy

Q92. Which two co-operative banks merged as per Reserve Bank of India's January 2025 notification?

(a) Maratha Sahakari Bank and Janata Co-operative Bank
(b) National Co-operative Bank and Cosmos Co-operative Bank
(c) Saraswat Co-operative Bank and Cosmos Co-operative Bank
(d) PMC Co-operative Bank and Cosmos Co-operative Bank

Q93. Which among the community-focused transparency initiatives did the Ghaziabad, Uttar Pradesh police introduce in September 2025?

(a) Police Outreach Day' to resolve neighborhood safety concerns
(b) Public Accountability Meet' releasing monthly action reports
(c) Vadi Samvad Diwas' allowing citizens to engage directly with investigators
(d) Jan Sunwai Sabha' for direct citizen-police dialogue

Q94. Which Indian broke the 200 m national record at Asian Athletics Championships 2025?

(a) Manikanta Hoblidhar
(b) Animesh Kujur
(c) Amlan Borgohain

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(d) Gurindervir Singh

Q95. As of March 2025, what percentage of India's area is earthquake-prone?

(a) 73%
(b) 39%
(c) 59%
(d) 47%

Q96. In which of the following states of India was the foundation stone laid in August 2025 for the Brahma–BEML Rail Manufacturing Hub, expected to reduce unemployment and empower local youth?

(a) Bihar
(b) Uttar Pradesh
(c) Gujarat
(d) Madhya Pradesh

Q97. What was the name of the initiative launched by the Indian Prime Minister on World Environment Day in 2025?

(a) Green Earth Project 3.0
(b) Save Water Mission
(c) Ek Ped Maa Ke Naam 2.0
(d) Clean India Campaign 7.0

Q98. On which date was the International Day of Families 2025 observed globally, focusing on the role of digital technology in family life?

(a) May 12
(b) May 18
(c) May 10
(d) May 15

Q99. When was the 48^(th) edition of the Paris Marathon held?

(a) March 30
(b) April 13
(c) April 1
(d) May 1

Q100. On 29 June 2025, the Union Ministry of Environment, Forest and Climate Change issued Model Rules to streamline regulations for _____.

(a) interest rates of loans for farmers
(b) electricity supply for farmlands
(c) tree felling in agricultural lands
(d) usage of pesticides and insecticides

ANSWER KEY

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

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91 d	92 b	93 c	94 b	95 c	96 d	97 c	98 d	99 b	100 c

SOLUTIONS

Q1. Answer: (d) By changing water content to cause swelling or shrinking

The correct answer is By changing water content to cause swelling or shrinking.

Key Points

• Plant cells respond to stimuli by altering their turgor pressure, which is regulated by the movement of water into or out of the cells. This process can cause the cells to swell or shrink, resulting in immediate physical responses.

• In plants, such responses are commonly seen in structures like stomata, pulvini, and guard cells, which regulate processes such as leaf folding, opening or closing of stomata, and movement of leaves.

• For example, in the Mimosa pudica (Touch-me-not plant), the leaves fold when touched due to a rapid loss of water in specific cells, leading to shrinking in certain parts of the plant.

• This mechanism does not require specialized proteins such as those found in animal muscle cells; instead, it relies on the natural properties of water movement driven by osmotic gradients.

• The process is energy-efficient and allows plants to exhibit immediate responses to environmental stimuli like touch, light, and gravity without requiring complex organ systems.

Additional Information

• Turgor Pressure:

• Turgor pressure is the pressure exerted by the cell contents against the cell wall due to water uptake.

• This pressure is critical for maintaining the plant's rigidity and enabling movements such as nastic movements (e.g., leaf folding).

• Osmosis in Plant Cells:

• Osmosis is the diffusion of water across a semipermeable membrane from an area of low solute concentration to an area of high solute concentration.

• It plays a key role in water movement, which drives the swelling or shrinking of plant cells in response to stimuli.

• Examples of Plant Movements:

• Seismonastic Movements: Movements like the folding of Mimosa pudica leaves in response to touch.

• Photonastic Movements: Movements in response to light, such as the opening and closing of flower petals.

• Difference from Animal Responses:

• Unlike animals that use specialized proteins like actin and myosin for muscle contraction, plants rely on water movement and turgor changes for mechanical responses.

• Plants lack a nervous system, so their responses are slower but energy-efficient and rely on environmental factors.

Important Points

• Guard Cells:

• Guard cells surrounding stomata regulate gas exchange and water loss by changing shape due to turgor pressure.

• When guard cells are turgid, stomata open; when they lose water and shrink, stomata close.

• Hydraulic Mechanisms:

• Hydraulic movements in plants, such as the opening and closing of flowers, are driven by changes in water potential and turgor.

• These mechanisms are vital for survival in varying environmental conditions.

• Applications of Plant Movements:

• Understanding plant responses can aid in agricultural practices, such as controlling water usage and improving crop resilience.

• Research in this field also contributes to biomimetic technologies, where plant-inspired mechanisms are applied to engineering solutions.

Q2. Answer: (d) Gregor Johann Mendel

The correct answer is Gregor Johann Mendel.

Key Points

• Gregor Johann Mendel was an Austrian monk, scientist, and teacher known as the "Father of Genetics".

• He conducted groundbreaking experiments on pea plants (Pisum sativum) between 1856 and 1863 to discover the laws of inheritance.

• Mendel proposed the Law of Segregation and the Law of Independent Assortment, which form the foundation of modern genetics.

• His work demonstrated how traits are inherited through dominant and recessive alleles, paving the way for understanding

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genetic inheritance.

• Mendel's experiments were initially overlooked but gained recognition in 1900 when scientists rediscovered his findings, validating his contributions to genetics.

• Mendel used statistical analysis and mathematics to interpret his results, making his approach unique and highly scientific for his time.

Additional Information

• Camillo Golgi:

• He was an Italian scientist who discovered the Golgi apparatus, a cellular organelle important for protein and lipid transport.

• Golgi's discovery contributed to our understanding of cell structure and function but is unrelated to genetics or inheritance.

• John Dalton:

• Dalton was a British scientist known for formulating the Atomic Theory and the Law of Multiple Proportions.

• His contributions were primarily in chemistry and atomic physics, not genetics or inheritance.

• Ernest Rutherford:

• Rutherford was a New Zealand-born physicist famous for his Gold Foil Experiment, which led to the discovery of the atomic nucleus.

• His work was instrumental in nuclear physics, but it does not pertain to genetics or biological inheritance.

• Mendel's Experiments and Laws:

• He studied seven traits of pea plants, such as flower color, seed shape, and pod color.

• Key laws:

• Law of Segregation: Each organism carries two alleles for a trait, and these alleles separate during gamete formation.

• Law of Independent Assortment: Alleles of different traits assort independently during gamete formation.

• His use of large sample sizes and mathematical ratios (3:1) made his findings statistically reliable.

Important Points

• Rediscovery: Mendel’s work was rediscovered independently by three scientists: Hugo de Vries, Carl Correns, and Erich von Tschermak in 1900.

• Impact: His principles form the basis for genetic studies, including modern fields like genomics and biotechnology.

• Recognition: Mendel’s contributions were posthumously acknowledged, and he is celebrated as a pioneer in biological science.

• Applications: Mendel’s laws are utilized in plant and animal breeding, genetic engineering, and disease research.

Q3. Answer: (d) Our stomach secretes hydrochloric acid to maintain a pH around 2, aiding digestion.

The correct answer is Our stomach secretes hydrochloric acid to maintain a pH around 2, aiding digestion..

Key Points

• Hydrochloric acid (HCl) secreted by the stomach plays a crucial role in digestion by maintaining a highly acidic environment with a pH of approximately 2.

• The acidic pH helps in the activation of pepsinogen to pepsin, a key enzyme that breaks down proteins into smaller peptides.

• Low pH ensures the destruction of harmful bacteria and pathogens present in food, thus contributing to food safety and immunity.

• It aids in the breakdown of food particles, facilitating the absorption of nutrients in the intestines. Hence, statement 4 is correct.

• Other options provided in the question are incorrect as they describe misconceptions about pH-related phenomena, such as tooth enamel dissolving above pH 7.5, acid rain having a pH above 7, and bee stings being basic.

Additional Information

• Importance of pH in digestion:

• The stomach's acidic environment helps in the proper functioning of digestive enzymes.

• A disrupted pH balance in the stomach can lead to conditions like indigestion, acid reflux, or ulcers.

• Role of hydrochloric acid in the stomach:

• HCl is secreted by parietal cells in the stomach lining.

• It creates an optimal pH for enzyme activity and kills pathogens.

• Maintains the stomach's internal environment for effective digestion.

• Common misconceptions related to pH:

• Tooth enamel: Dissolves when the pH of the mouth falls below 5.5, not above 7.5, due to bacterial activity. Statement 1 is incorrect.

• Acid rain: Has a pH below 5.6 due to sulfur and nitrogen oxides. Statement 2 is incorrect.

• Bee stings: Inject acidic liquid, not basic. Statement 3 is incorrect.

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• Practical applications of pH:
• Used in agriculture to test soil acidity or alkalinity.
• Critical in industrial processes like water treatment and chemical manufacturing.
• Vital in healthcare for diagnosing conditions like acidosis or alkalosis.

Important Points

• pH Scale:
• Ranges from 0 to 14, where 7 is neutral.
• Values below 7 indicate acidity, while values above 7 indicate alkalinity.
• Human Body pH:
• Blood pH is slightly alkaline, around 7.35-7.45.
• The stomach maintains a pH of 1.5 to 3.5 for digestion.
• Applications of pH monitoring:
• Critical in food preservation, water purification, and pharmaceuticals.
• Used in environmental studies to monitor acid rain and pollution.

Q4. Answer: (c) It is the same at all points.

The correct answer is It is the same at all points..

Key Points

• The magnetic field inside a long, straight, current-carrying solenoid is uniform and does not vary from one point to another. This is due to the symmetrical and dense winding of the solenoid.
• The magnetic field inside the solenoid is given by the formula B = μ0nI, where μ0 is the permeability of free space, n is the number of turns per unit length, and I is the current passing through the solenoid.
• The magnetic field is concentrated within the solenoid, and the field lines inside it are nearly parallel, indicating a uniform field.
• At the ends of the solenoid, the magnetic field begins to spread out, but inside the solenoid, it remains consistent and uniform.
• Among the given options, the statement "It is the same at all points" is correct as it accurately describes the behavior of the magnetic field inside a solenoid.

Additional Information

• Solenoid:
• A solenoid is a long coil of wire wound in the shape of a helix, through which an electric current passes to generate a magnetic field.
• It is widely used in electromagnetic devices such as inductors, electromagnets, and solenoid valves.
• Magnetic Field Formula:
• The magnetic field inside a solenoid is calculated using the formula B = μ0nI, where:
• B is the magnetic field strength.
• μ0 is the permeability of free space (4π × 10^-^7 Tm/A).
• n is the number of turns per unit length of the solenoid.
• I is the current flowing through the solenoid.
• Applications:
• Solenoids are used in electromagnets for lifting heavy metallic objects.
• They are also used in electric relays and switching devices.
• Solenoids find applications in medical devices, such as MRI machines, due to their ability to generate controlled magnetic fields.
• Behavior at Ends:
• The magnetic field at the ends of the solenoid spreads out, causing the field to weaken slightly. However, inside the solenoid, the field remains uniform and strong.

Important Points

• Characteristics of Magnetic Field Inside Solenoid:
• The field is uniform, indicating that the strength and direction of the field remain constant throughout the solenoid.
• The field lines are parallel inside the solenoid, ensuring consistency in the magnetic field.
• The field is concentrated within the solenoid and negligible outside it.
• Correctness of Other Statements:
• "It decreases as we move towards its end" – This is incorrect, as the field inside the solenoid remains uniform.
• "It is zero" – This is incorrect, as the solenoid generates a strong magnetic field inside it.
• "It increases as we move towards its end" – This is incorrect, as the field does not vary inside the solenoid.

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Q5. Answer: (c) Spinal cord

The correct answer is Spinal cord.

Key Points

• The spinal cord plays a central role in reflex actions, which are involuntary and automatic responses to certain stimuli.

• Reflex actions bypass the brain and are instead processed directly by the spinal cord to ensure a quick response. This minimizes the time taken to react to potentially harmful stimuli.

• The pathway of a reflex action is called the reflex arc, which involves sensory neurons, motor neurons, and interneurons within the spinal cord.

• For example, the withdrawal reflex occurs when touching a hot object. Sensory neurons send signals to the spinal cord, which immediately directs motor neurons to withdraw the hand without involving the brain.

• The spinal cord functions as the processing center for reflexes, ensuring rapid and protective responses to external stimuli.

Additional Information

• Reflex action:

• Reflex actions are automatic and involuntary responses to stimuli, aimed at protecting the body from harm.

• They occur without conscious thought and typically involve a reflex arc that bypasses the brain.

• Common reflex actions include blinking, sneezing, coughing, and the knee-jerk reflex.

• Reflexes are classified into two types: simple reflexes (e.g., withdrawal reflex) and conditioned reflexes (e.g., Pavlov's response).

• Structure of the spinal cord:

• The spinal cord is a cylindrical structure made up of nervous tissue, protected by the vertebral column.

• It is a part of the central nervous system (CNS) and connects the brain with the peripheral nervous system.

• It contains gray matter in the center (processing region) and white matter surrounding it (transmission region).

• The spinal cord is divided into regions: cervical, thoracic, lumbar, sacral, and coccygeal.

• Other organs mentioned in the options:

• Spleen: Located in the abdomen, the spleen is part of the lymphatic system and helps filter blood, fight infections, and store red blood cells. It does not participate in reflex actions.

• Kidney: Responsible for filtering waste from the blood and producing urine, the kidneys play no role in reflex actions.

• Middle ear: Involved in hearing and balance, the middle ear does not contribute to reflex actions.

• Examples of reflex actions:

• Withdrawal reflex: Automatically pulling your hand away when touching something hot.

• Knee-jerk reflex: A sudden extension of the leg when the patellar tendon is tapped.

• Pupil dilation: Adjusting the pupil size in response to light intensity.

Important Points

• Reflex Arc:

• A reflex arc involves a pathway consisting of a sensory neuron, an interneuron, and a motor neuron.

• The sensory neuron detects the stimulus and sends signals to the spinal cord.

• The interneuron processes the signal within the spinal cord and directs it to the motor neuron.

• The motor neuron carries out the response by activating the appropriate muscle or gland.

• Role of the brain:

• While reflex actions bypass the brain for immediate response, the brain still receives information about the stimulus for further analysis.

• Complex reflexes may involve the brain, but simple reflexes are managed solely by the spinal cord.

• Clinical significance:

• Reflex tests (e.g., knee-jerk test) are used to assess the health of the spinal cord and peripheral nervous system.

• Abnormal reflex responses can indicate neurological disorders or spinal cord injuries.

Q6. Answer: (a) Manganese

The correct answer is Manganese.

Key Points

• Manganese has the highest electrical resistivity among the given materials at room temperature. Electrical resistivity is a measure of how strongly a material opposes the flow of electric current.

• In comparison to mercury, chromium, and iron, manganese exhibits significantly higher resistivity due to its atomic structure and electron configuration.

• Manganese's resistivity is largely influenced by the presence of d-orbital electrons, which hinder the free flow of charge carriers,

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increasing its resistance to electric current.

• Mercury and iron have relatively lower resistivity due to their metallic bonding and high density of free electrons, which facilitate better conductivity.

• Chromium lies between manganese and iron in terms of resistivity, but its resistivity is still lower than that of manganese.

Additional Information

• Electrical Resistivity:

• Electrical resistivity, denoted by the symbol ρ (rho), is measured in ohm-meters (Ω·m).

• It depends on the material's composition, temperature, and crystalline structure.

• Materials with low resistivity, such as copper and silver, are excellent conductors, while those with high resistivity, like manganese, are poor conductors.

• Properties of the Options:

• Manganese: Known for its high resistivity and is often used in resistors and electrical components due to this property.

• Mercury: A liquid metal at room temperature with relatively low resistivity, commonly used in thermometers and electrical switches.

• Chromium: A transition metal with moderate resistivity; widely used for plating and in stainless steel production.

• Iron: A good conductor of electricity with lower resistivity compared to manganese, widely used in construction and electrical applications.

• Applications of High Resistivity Materials:

• High resistivity materials like manganese are used in precision resistors and thermistors.

• These materials are also employed in heating elements and electrical insulation.

• Factors Affecting Resistivity:

• Temperature: Resistivity typically increases with temperature for conductors.

• Impurities: The presence of impurities in a material can increase its resistivity.

• Atomic Structure: The arrangement and type of atoms in a material significantly influence its resistivity.

Important Points

• The resistivity of a material is inversely proportional to its conductivity. Materials with high resistivity, such as manganese, are less conductive.

• Metals like silver and copper have some of the lowest resistivities, making them ideal for electrical wiring.

• High resistivity materials are critical for applications requiring controlled electricity flow, such as in resistors and sensor devices.

Q7. Answer: (b) Nerve impulse → Muscle protein response → Muscle contraction

The correct answer is Nerve impulse → Muscle protein response → Muscle contraction.

Key Points

• Nerve impulse: Muscle movement begins when a nerve impulse is transmitted from the brain or spinal cord to the muscle via a motor neuron. This electrical signal triggers the release of neurotransmitters at the neuromuscular junction, specifically acetylcholine, which initiates muscle activation.

• Muscle protein response: The nerve impulse leads to a cascade of events inside the muscle fiber. This includes the release of calcium ions from the sarcoplasmic reticulum, which bind to troponin, altering the structure of the muscle proteins and exposing binding sites on actin for myosin.

• Muscle contraction: The interaction between actin and myosin results in the sliding filament mechanism, where myosin heads attach to actin and pull the filaments closer together, leading to muscle contraction. This process is powered by ATP, the energy currency of the cell.

• This sequence is critical for voluntary and involuntary muscle movements, ranging from walking to the beating of the heart.

• This mechanism is universal for all types of muscle contractions, whether skeletal, smooth, or cardiac, ensuring controlled and precise movement.

Additional Information

• Sequence of Muscle Movement: The entire process begins at the neuromuscular junction where the motor neuron releases acetylcholine. The neurotransmitter binds to receptors on the muscle cell membrane, initiating an action potential that travels along the muscle fiber.

• Sliding Filament Mechanism: Muscle contraction occurs via the sliding filament model, where actin and myosin filaments slide past each other. This process is regulated by ATP and calcium ions.

• Role of ATP: ATP is essential in detaching the myosin heads from actin post-contraction and in powering the calcium pumps to restore the resting state of the muscle.

• Calcium Regulation: Calcium ions play a crucial role in muscle contraction. They bind to troponin, causing conformational changes that allow the cross-bridge cycle between actin and myosin to begin.

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• Neuromuscular Junction Disorders: Disorders such as Myasthenia Gravis can disrupt this process by affecting acetylcholine receptors, leading to muscle weakness.

Important Points

• Option Analysis:

• Option 1: Digestion → Blood circulation → Movement is incorrect because digestion and blood circulation are not directly involved in initiating muscle movement.

• Option 3: DNA replication → Protein synthesis → Muscle movement is incorrect as DNA replication and protein synthesis are cellular processes unrelated to immediate muscle contraction.

• Option 4: Blood flow → Protein activation → Nerve impulse → Movement is inaccurate because blood flow is not directly involved in triggering muscle contraction; nerve impulses are the primary triggers.

• Applications: Understanding muscle contraction mechanisms is crucial in fields like medicine, sports science, and physiology. It helps in diagnosing neuromuscular disorders and improving athletic performance.

• Examples: Disorders such as Muscular Dystrophy and ALS (Amyotrophic Lateral Sclerosis) affect muscle function, emphasizing the importance of understanding this process.

Q8. Answer: (c) DNA copying is a completely error-free process.

The correct answer is DNA copying is a completely error-free process..

Key Points

• Statement 1: DNA copies are double-stranded. This statement is correct because DNA copies are double-stranded in nature. DNA molecules maintain their characteristic double-helix structure during replication. Hence, this statement is correct.

• Statement 2: Copying of DNA is a pre-requisite for reproduction. This statement is correct because DNA replication ensures that genetic information is passed on to the next generation during reproduction, whether it is sexual or asexual. Hence, this statement is correct.

• Statement 3: DNA copying is a completely error-free process. This statement is incorrect because DNA replication is not entirely error-free. While DNA polymerase enzymes have proofreading mechanisms to correct errors, some minor mistakes can still occur. These errors may lead to mutations, which can sometimes be beneficial, harmful, or neutral. Hence, this statement is incorrect.

• Statement 4: DNA copies generated are similar but not identical. This statement is correct because DNA replication introduces slight variations due to minor errors or mutations during the process. These variations contribute to genetic diversity among offspring. Hence, this statement is correct.

• The correct answer is option 3. DNA copying is not a completely error-free process due to the inherent nature of replication and minor variations that arise during the process.

Additional Information

• DNA Replication:

• DNA replication is a biological process where a cell makes an identical copy of its DNA, ensuring genetic continuity.

• It occurs during the S-phase of the cell cycle and involves enzymes such as DNA helicase, DNA polymerase, and DNA ligase.

• The process follows a semi-conservative model, where each new DNA molecule consists of one original strand and one newly synthesized strand.

• Errors in DNA Replication:

• Despite proofreading mechanisms, errors like mismatched bases can occur during replication.

• These errors may result in mutations, which can lead to genetic variations or diseases depending on their nature.

• Mutations can be caused by environmental factors such as radiation or chemical exposure.

• Importance of DNA Copying:

• DNA copying ensures the transmission of genetic material from parent to offspring, enabling reproduction and inheritance.

• It also plays a crucial role in cell division for growth, development, and repair of tissues.

• Genetic Variations:

• Variations during DNA copying lead to genetic diversity, which is essential for natural selection and evolution.

• Such diversity helps organisms adapt to changing environments and ensures survival over generations.

Important Points

• DNA Proofreading and Repair:

• DNA polymerase has proofreading abilities to correct errors during replication, ensuring high fidelity.

• Special enzymes like exonucleases help remove incorrect nucleotides and replace them with the correct ones.

• In cases where errors persist, DNA repair mechanisms like base excision repair or mismatch repair are activated.

• Mutations and Their Effects:

• Mutations can be silent, missense, or nonsense, depending on their impact on protein synthesis.

• Beneficial mutations may lead to advantageous traits, while harmful ones can cause diseases like cancer.

• Neutral mutations have no apparent effect on an organism's phenotype.
• Applications of DNA Study:
• DNA analysis is used in forensic science, genetic engineering, and medicine.
• Techniques like PCR (Polymerase Chain Reaction) amplify DNA sequences for various applications.
• DNA sequencing helps identify genetic disorders and develop personalized treatment plans.

Q9. Answer: (c) Storing materials like starch, oils, and proteins

The correct answer is Storing materials like starch, oils, and proteins.

Key Points

• Leucoplasts are a type of plastid found in plant cells, primarily in non-photosynthetic tissues like roots, seeds, and tubers.
• The primary function of leucoplasts is storage of macromolecules such as starch, oils, and proteins, which are crucial for the plant's energy needs and development.
• Leucoplasts are colorless because they lack pigments, unlike chloroplasts (green due to chlorophyll) and chromoplasts (colored due to carotenoids).
• Leucoplasts can differentiate into specialized forms such as amyloplasts (for starch storage), elaioplasts (for oil storage), and proteinoplasts (for protein storage).
• These organelles play a vital role in plants' metabolism by storing resources that can be utilized during germination, growth, or other physiological processes.

Additional Information

• Plastids:
• Plastids are double-membrane-bound organelles found in plant and algal cells, responsible for various functions such as photosynthesis, storage, and pigment synthesis.
• They are categorized into chloroplasts (photosynthesis), chromoplasts (pigment synthesis), and leucoplasts (storage).
• Types of Leucoplasts:
• Amyloplasts: Specialized for starch storage, found in tubers like potatoes and seeds.
• Elaioplasts: Involved in the storage of lipids and oils, commonly found in seeds such as castor and sunflower.
• Proteinoplasts: Responsible for protein storage, typically observed in seeds like legumes.
• Comparison with Other Plastids:
• Chloroplasts: Contain chlorophyll and are responsible for photosynthesis.
• Chromoplasts: Contain carotenoid pigments and contribute to the coloration of fruits and flowers.
• Leucoplasts: Colorless plastids specialized for storage functions.
• Importance in Agriculture:
• Leucoplasts play a crucial role in the storage of nutrients that directly impact crop yield and food quality.
• Understanding leucoplast functions can aid in genetic engineering to enhance the storage capacity of crops.

Important Points

• Leucoplast Location: Found in non-photosynthetic tissues such as roots and seeds.
• Key Function: Specialized for storage of starch, oils, and proteins, essential for plant energy metabolism.
• Other Plastid Roles: Chloroplasts handle photosynthesis; chromoplasts aid in pigmentation; leucoplasts focus on storage.
• Applications: Research into leucoplast functions can improve food storage capabilities in agricultural crops.

Q10. Answer: (b) calcium sulphate hemihydrate

The correct answer is calcium sulphate hemihydrate.

Key Points

• Gypsum ($CaSO_4 \cdot 2H_2O$) is a naturally occurring mineral composed of calcium sulfate dihydrate, meaning it contains two molecules of water of crystallization.
• When gypsum is heated to approximately 373 K (100°C), it loses 75% of its water of crystallization and forms calcium sulphate hemihydrate ($CaSO_4 \cdot 0.5H_2O$), commonly known as Plaster of Paris.
• Plaster of Paris (POP) is a quick-setting material that hardens upon mixing with water, making it widely used in construction, decoration, and medical applications.
• The heating process involved in converting gypsum to Plaster of Paris is known as calcination, which is conducted at controlled temperatures to avoid the complete dehydration of gypsum.
• Calcium sulphate hemihydrate is highly versatile and used in making molds, casts, sculptures, and orthopedic applications such as splints.

Additional Information

• Gypsum Properties and Applications:
• Gypsum is a soft sulfate mineral widely used as a fertilizer, in cement manufacturing, and as a filler in paper production.
• Its chemical formula is CaSO4·2H2O, highlighting its two water molecules of crystallization.
• Gypsum has been used for centuries in construction, particularly for making wall plasters.
• Plaster of Paris (POP):
• POP is obtained by heating gypsum at approximately 373 K. If heated beyond this temperature, it can lose all its water and form anhydrous calcium sulfate.
• It is widely used for decorative purposes like false ceilings, as well as for medical purposes such as orthopedic casts.
• POP is mixed with water to form a paste that sets rapidly, making it ideal for applications requiring quick hardening.
• Uses of Calcium Sulphate Hemihydrate:
• It is commonly used in making molds for ceramics, jewelry, and sculptures.
• In medical fields, it is employed in orthopedic applications like splints and casts.
• It is used in construction for making decorative elements like cornices and false ceilings.
• Calcination Process:
• Calcination involves heating substances like gypsum to remove water molecules without melting the material.
• This process is critical in producing Plaster of Paris while avoiding complete dehydration.
• Controlled temperatures ensure the preservation of the hemihydrate form of calcium sulfate.

Important Points

• Gypsum to Plaster of Paris Transition:
• Gypsum (CaSO4·2H2O) transforms into calcium sulfate hemihydrate (CaSO4·0.5H2O) upon heating at 373 K.
• Complete dehydration forms anhydrous calcium sulfate, which has different properties and applications.
• Temperature control during calcination is crucial to ensure proper formation of Plaster of Paris.
• Incorrect Options:
• Calcium chloride pentahydrate: This compound (CaCl2·5H2O) is unrelated to gypsum and is formed through different chemical processes.
• Calcium chloride hemihydrate: This option is incorrect since it is not derived from gypsum.
• Calcium sulphate pentahydrate: Gypsum does not form this compound; it exists in dihydrate form before heating.

Q11. Answer: (b) Catenation

The correct answer is Catenation.

Key Points

• Catenation is the unique property of carbon atoms that enables them to form long and stable chains with other carbon atoms.
• This property arises due to the strong covalent bonds that carbon atoms form with each other, allowing them to create various structures such as chains, branched chains, and rings.
• Carbon atoms can also form multiple bonds (such as single, double, and triple bonds) with other carbon atoms, further enhancing the diversity of organic compounds.
• The small atomic size of carbon contributes to the strength of the C-C bonds, making them resistant to breaking under normal conditions.
• Catenation is most prominently observed in carbon compared to other elements, making it the backbone of organic chemistry and the basis for the vast diversity of organic compounds.

Additional Information

• Isomerism:
• Isomerism refers to the phenomenon where compounds with the same molecular formula have different structural arrangements or spatial orientations.
• While it is an important property of organic compounds, it is not the reason for the formation of long chains.
• Tetravalency:
• Carbon exhibits tetravalency, meaning it forms four covalent bonds with other atoms to achieve stability.
• This property complements catenation but does not solely explain the ability to form long chains.
• Allotropy:
• Allotropy is the property of an element to exist in different structural forms in the same physical state, such as diamond, graphite, and graphene for carbon.
• Although this property shows the versatility of carbon, it is unrelated to its ability to form long chains.
• Applications of Catenation:

• It is the basis for the formation of hydrocarbons, which are the foundation of fuels like methane, propane, and butane.
• Catenation enables the creation of complex biomolecules such as proteins, nucleic acids, and carbohydrates, essential for life.
• It allows the development of synthetic materials like plastics and polymers.

Important Points

• Carbon's Unique Position in the Periodic Table:
• Carbon is located in Group 14 of the periodic table and has an atomic number of 6.
• Its electronic configuration is $1s^2\ 2s^2\ 2p^2$, which allows it to form stable covalent bonds.
• Comparison with Other Elements:
• While elements like silicon and sulfur also show catenation, their ability is much lower than carbon due to weaker bond strengths.
• This makes carbon unparalleled in forming the vast variety of organic compounds.

Q12. Answer: (c) Virtual, erect, magnified

The correct answer is Virtual, erect, magnified.

Key Points

• When an object is placed between the principal focus (F) and the pole (P) of a concave mirror, the image formed is virtual, erect, and magnified. This is a characteristic property of concave mirrors.
• The virtual image is formed behind the mirror, as the reflected rays appear to diverge but actually meet when extended backward.
• This type of image formation occurs because the object lies in the region where the reflected rays cannot converge on the real side, leading to a virtual formation.
• Magnification happens as the object moves closer to the pole of the mirror, making the image larger than the object.
• This phenomenon is utilized in devices like shaving mirrors or makeup mirrors, which need enlarged and upright images.

Additional Information

• Concave Mirror:
• A concave mirror is a spherical mirror whose reflective surface curves inward, resembling the interior of a sphere.
• It can form both real and virtual images depending on the position of the object relative to the principal focus and center of curvature.
• Concave mirrors are commonly used in telescopes, headlights, and shaving mirrors because of their ability to focus light.
• Image Formation by Concave Mirror:
• When the object is placed beyond the center of curvature, the image is real, inverted, and diminished.
• When the object is at the center of curvature, the image is real, inverted, and of the same size.
• When the object is between the center of curvature and the focus, the image is real, inverted, and magnified.
• When the object is at the focus, the reflected rays become parallel, and the image is formed at infinity.
• When the object is placed between the focus and the pole, the image is virtual, erect, and magnified.
• Applications of Concave Mirrors:
• Shaving mirrors: Provide magnified and upright images.
• Reflecting telescopes: Used to gather and focus light from distant astronomical objects.
• Headlights: Used to produce parallel beams of light.
• Solar concentrators: Focus sunlight to generate heat energy.
• Laws of Reflection:
• The angle of incidence is equal to the angle of reflection.
• The reflected ray, incident ray, and the normal at the point of incidence lie on the same plane.
• These laws are fundamental in understanding image formation in mirrors.

Important Points

• The nature of the image formed by a concave mirror depends on the position of the object relative to the mirror.
• Virtual images are always formed behind the mirror and are erect, while real images are formed in front of the mirror and are inverted.
• The magnification of the image can be calculated using the formula: $M = -v/u$, where v is the image distance and u is the object distance.
• Concave mirrors are versatile and widely used in optical instruments due to their ability to produce magnified images.

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Q13. Answer: (c) Meristematic cells are actively dividing and need a dense cytoplasm

The correct answer is Meristematic cells are actively dividing and need a dense cytoplasm.

Key Points

• Meristematic cells are actively dividing: These cells are responsible for the growth of plants by continuously undergoing mitosis. To facilitate this process, they require a dense cytoplasm filled with essential organelles for cell division and synthesis of new cellular components.

• Absence of vacuoles: Vacuoles are large storage organelles that are primarily involved in storing water, nutrients, and waste products. In meristematic cells, the absence of vacuoles ensures that the cytoplasm remains densely packed with cellular machinery required for rapid cell division.

• Energy demand: Meristematic cells have high energy demands for processes like DNA replication and mitotic spindle formation. The absence of vacuoles allows the cell to allocate space to mitochondria and other organelles that fulfill these energy requirements.

• Vacuoles and differentiation: Vacuoles are more prominent in mature and differentiated cells. They help maintain turgor pressure and store metabolites. In contrast, meristematic cells are undifferentiated and prioritize division over storage, making vacuoles unnecessary.

• Dense cytoplasm ensures efficiency: A dense cytoplasm allows the organelles and enzymes required for cell division to be in close proximity, optimizing the efficiency of the division process. This is crucial for the rapid growth observed in meristematic regions like root and shoot tips.

Additional Information

• Characteristics of meristematic tissue:

• Cells are small, spherical, or polygonal in shape with thin cell walls.

• They have a dense cytoplasm and lack large vacuoles.

• Nuclei are prominent, and the cells are in an active state of division.

• Types of meristematic tissue:

• Apical meristem: Found at the tips of roots and shoots, responsible for primary growth.

• Intercalary meristem: Located at the base of leaves or internodes, contributing to regrowth and elongation.

• Lateral meristem: Found along the sides of stems and roots, responsible for secondary growth, such as the formation of wood.

• Functions of vacuoles in mature cells:

• Vacuoles help maintain osmotic balance and store nutrients, pigments, and waste products.

• In mature plant cells, they occupy 80-90% of the cell volume and aid in maintaining turgor pressure, which is crucial for structural support.

• Cell differentiation and vacuoles:

• As meristematic cells differentiate into specialized cells, vacuoles begin to form and take on their role as storage and maintenance organelles.

• The size and function of vacuoles vary depending on the type and function of the differentiated cell.

Important Points

• Meristematic cells vs. mature cells:

• Meristematic cells are undifferentiated and focus on growth, while mature cells are differentiated and perform specialized functions.

• Vacuoles are absent or very small in meristematic cells but are prominent in mature cells, aiding in storage and maintaining cell turgidity.

• Locations of meristematic tissue:

• Root apices, shoot apices, and vascular cambium are major regions where meristematic tissue is found.

• These regions are responsible for the primary and secondary growth of plants, allowing them to increase in height, length, and girth.

• Role in plant growth:

• Meristematic tissue plays a vital role in the continuous growth of plants, which is a characteristic feature of plant life.

• This growth is indeterminate in nature, meaning plants can grow throughout their life due to the activity of meristematic cells.

Q14. Answer: (c) The slope of the distance–time graph is constant.

The correct answer is The slope of the distance–time graph is constant..

Key Points

• Uniform motion refers to the motion of a body where it covers equal distances in equal intervals of time. This indicates that the speed of the object remains constant throughout the motion.

• The distance–time graph for uniform motion is a straight line that slopes upwards, indicating a constant rate of change in

distance over time.

• The slope of the distance–time graph represents the speed of the object. For uniform motion, this slope remains constant, as the speed is unchanging.

• A constant slope implies there is no acceleration or deceleration, which is a characteristic feature of uniform motion.

• Other options such as a zero slope, decreasing slope, or increasing slope are indicative of conditions like no motion, decelerating motion, or accelerating motion, respectively, which do not align with the definition of uniform motion.

Additional Information

• Distance-Time Graphs:

• A straight line graph with a constant slope represents uniform motion. The steeper the slope, the higher the speed.

• A horizontal line graph (zero slope) indicates the object is stationary and not covering any distance over time.

• A curved graph represents non-uniform motion, where the speed is either increasing (accelerating) or decreasing (decelerating).

• Speed:

• Speed is defined as the rate at which an object covers distance over a period of time, and it is calculated as distance/time.

• In uniform motion, the speed remains constant, meaning the object moves at the same rate throughout.

• Applications of Uniform Motion:

• Uniform motion is commonly observed in scenarios like trains moving at constant speeds, conveyor belts in factories, or satellites orbiting the Earth under stable conditions.

• It is used in scientific experiments to study the effects of motion under controlled conditions.

• Difference Between Uniform and Non-Uniform Motion:

• Uniform motion involves constant speed and equal distances over equal intervals of time, whereas non-uniform motion involves varying speed.

• The distance-time graph for non-uniform motion is generally curved, reflecting changes in speed.

Important Points

• Real-Life Examples:

• A car moving on a highway at a constant speed is an example of uniform motion.

• The rotation of the Earth around its axis is an example of uniform circular motion.

• Graph Interpretation:

• The slope of the graph is calculated as the ratio of the change in distance to the change in time (Δdistance/Δtime).

• A constant slope indicates uniform motion, while a varying slope reflects non-uniform motion.

• Conceptual Applications:

• Uniform motion is studied in physics to understand fundamental concepts such as inertia and the relationship between distance, time, and speed.

• It forms the basis for advanced studies in kinematics and dynamics.

Q15. Answer: (d) An atom or group of atoms that has a positive or negative charge

The correct answer is An atom or group of atoms that has a positive or negative charge.

Key Points

• An ion is defined as an atom or a group of atoms that has gained or lost electrons, resulting in a net positive or negative charge.

• Ions are classified into two types: Cations (positive charge) and Anions (negative charge). Cations are formed when atoms lose electrons, while anions are formed when atoms gain electrons.

• The charge of an ion is determined by the difference between the number of protons (positively charged particles) and electrons (negatively charged particles) present in the atom or molecule.

• Ions play a vital role in several scientific and industrial processes, including chemical bonding, electrical conductivity, and biological functions.

• The term "ion" was introduced by Michael Faraday in 1834, derived from the Greek word "ienai," meaning "to go," indicating the movement of charged particles.

Additional Information

• Characteristics of Cations:

• Cations are positively charged ions formed when an atom loses electrons.

• They are smaller in size compared to their parent atom due to the loss of electrons and reduced electron-electron repulsion.

• Examples include Na^+, K^+, Ca^(2+), and Al^(3+).

• Characteristics of Anions:

• Anions are negatively charged ions formed when an atom gains electrons.

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• They are larger in size compared to their parent atom due to the addition of electrons and increased electron-electron repulsion.
• Examples include Cl^-, OH^-, NO3^-, and SO4^(2-).
• Importance of Ions:
• Ions are essential for biological processes like nerve impulse transmission, muscle contraction, and maintaining fluid balance.
• They are vital in industrial applications such as batteries, electroplating, and water purification.
• In chemical reactions, ions participate in processes like acid-base reactions and ionic bonding.
• Examples of Common Ionic Compounds:
• Sodium chloride (NaCl): Composed of Na^+ and Cl^-.
• Magnesium oxide (MgO): Composed of Mg^(2+) and O^(2-).
• Calcium carbonate (CaCO3): Contains Ca^(2+) and CO3^(2-).

Important Points

• Relation with Electricity:
• In solutions, ions are responsible for conducting electricity. For example, electrolytes in water enable current flow.
• In solid-state physics, ionic crystals exhibit unique properties due to the arrangement of ions.
• Formation of Ions in Nature:
• Ions are naturally formed during phenomena like lightning, where air molecules become ionized.
• Solar radiation causes ionization in the Earth's atmosphere, creating the ionosphere, which impacts radio wave propagation.
• Applications in Medicine:
• Electrolyte imbalance in the human body is diagnosed and treated based on ion concentrations like Na^+, K^+, and Cl^-.
• Calcium ions (Ca^(2+)) play a critical role in bone strength and enzymatic processes.

Q16. Answer: (c) They are characterised by the motion of particles in a medium

The correct answer is They are characterised by the motion of particles in a medium.

Key Points

• Sound waves are classified as mechanical waves because they require a medium for propagation, such as air, water, or solids. Without a medium, sound waves cannot travel.
• Mechanical waves are characterized by the motion of particles in a medium, which oscillate back and forth to transfer energy. This motion is responsible for the propagation of sound waves.
• Unlike electromagnetic waves, which can travel through a vacuum, sound waves need a material medium because their propagation depends on the elastic and inertial properties of the medium.
• Sound waves propagate as longitudinal waves, wherein particles of the medium oscillate parallel to the direction of wave travel, creating regions of compression and rarefaction.
• This classification is based on the fundamental property that sound waves transmit energy via particle vibrations, and their speed depends on the density and elasticity of the medium. Hence, the correct answer is: They are characterised by the motion of particles in a medium.

Additional Information

• Types of Waves:
• Mechanical Waves: Require a medium to propagate. Examples include sound waves, water waves, and seismic waves.
• Electromagnetic Waves: Do not require a medium and can travel through a vacuum. Examples include light waves, radio waves, and X-rays.
• Longitudinal vs. Transverse Waves:
• Longitudinal Waves: In these waves, the medium's particles oscillate parallel to the wave direction. Sound waves are an example.
• Transverse Waves: In these waves, the medium's particles oscillate perpendicular to the wave direction. Examples include water waves and electromagnetic waves.
• Characteristics of Sound Waves:
• Sound waves are longitudinal waves.
• They travel faster in solids than liquids and gases due to the higher density and elasticity of solids.
• The speed of sound in air is approximately 343 m/s at room temperature.
• Sound waves exhibit properties like reflection, refraction, diffraction, and interference.
• Propagation Medium:
• The presence of a medium is essential for sound waves because they rely on the interaction between particles to transmit energy.
• In space, which is a vacuum, sound cannot propagate because there are no particles to oscillate.

• Applications of Sound Waves:
• Used in communication systems, such as telephones and radios.
• Utilized in medical imaging, such as ultrasound scans.
• Important in engineering applications, such as sonar systems for underwater navigation.

Important Points

• Difference Between Mechanical and Electromagnetic Waves:
• Mechanical waves require a medium to propagate, while electromagnetic waves can travel through a vacuum.
• Sound waves are mechanical because they depend on particle vibration, whereas light waves are electromagnetic because they consist of oscillating electric and magnetic fields.
• Examples of Mechanical Waves:
• Sound Waves: Produced by vibrating objects, like a tuning fork or vocal cords.
• Water Waves: Observed in oceans and lakes where the energy is transferred through water molecules.
• Seismic Waves: Generated during earthquakes and travel through Earth's crust.
• Applications:
• In sonar systems to detect objects underwater.
• In musical instruments to produce sound.
• In communication devices like microphones and speakers.

Q17. Answer: (c) Ovaries

The correct answer is Ovaries.

Key Points

• Ovaries are a crucial part of the female reproductive system and are responsible for producing both eggs (ova) and hormones.
• The ovaries secrete essential hormones like estrogen and progesterone, which regulate the menstrual cycle, pregnancy, and the development of secondary sexual characteristics.
• Estrogen is involved in the development of female reproductive organs, breast development, and bone health.
• Progesterone plays a critical role in preparing the uterus for pregnancy and maintaining it during gestation.
• Other hormones, such as inhibin and relaxin, are also produced by the ovaries, contributing to reproductive health and pregnancy.
• None of the other organs listed in the options (salivary glands, cervix, fallopian tubes) produce hormones directly. Their functions are distinct and unrelated to hormonal production.

Additional Information

• Salivary Glands:
• Salivary glands are responsible for producing saliva, which aids in digestion and oral hygiene.
• They do not produce hormones but contain enzymes like amylase that help break down carbohydrates.
• There are three types of salivary glands: parotid, submandibular, and sublingual glands.
• Cervix:
• The cervix is the lower part of the uterus, connecting it to the vagina.
• Its primary function is to allow the passage of menstrual blood and sperm and to protect the uterus from infections.
• It does not produce hormones but secretes cervical mucus, which changes during the menstrual cycle to facilitate or prevent sperm entry.
• Fallopian Tubes:
• Fallopian tubes are part of the female reproductive system and act as the passageway for eggs from the ovaries to the uterus.
• They do not produce hormones but are crucial for fertilization, as this usually occurs within the fallopian tubes.
• Hormones Produced by Ovaries:
• Estrogen: Plays a key role in the development of secondary sexual characteristics, maintaining skin health, and regulating the menstrual cycle.
• Progesterone: Prepares the uterus for implantation of a fertilized egg and supports pregnancy.
• Relaxin: Helps relax the uterus during pregnancy and aids in childbirth.
• Inhibin: Regulates the secretion of follicle-stimulating hormone (FSH) from the pituitary gland.

Important Points

• Menstrual Cycle: The ovaries play a central role in regulating the menstrual cycle by releasing eggs and producing hormones such as estrogen and progesterone.
• Hormonal Imbalance: Issues like polycystic ovary syndrome (PCOS) can result from hormonal imbalance in the ovaries, affecting

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fertility and overall health.

• Reproductive Health: Ovarian hormones are essential for maintaining reproductive health and supporting pregnancy.

• Age Factor: Hormonal production in the ovaries reduces significantly after menopause, typically around the age of 45-55 years.

• Medical Applications: Hormonal therapy often involves synthetic estrogen and progesterone to treat conditions such as menopause symptoms or infertility.

Q18. Answer: (b) Increase in humidity

The correct answer is Increase in humidity.

Key Points

• Evaporation is the process in which liquid water transforms into water vapor due to the application of heat or environmental factors like wind speed and temperature.

• Humidity refers to the amount of water vapor present in the air. An increase in humidity reduces the capacity of air to absorb more water vapor, thereby decreasing the rate of evaporation.

• Wind Speed: An increase in wind speed enhances evaporation by carrying away the water vapor formed on the surface, allowing more liquid to evaporate. Hence, this increases evaporation.

• Temperature: Higher temperatures provide more energy to water molecules, increasing their movement and facilitating evaporation. Hence, this increases evaporation.

• Surface Area: A larger surface area exposes more molecules to the air, thus speeding up evaporation. Hence, this increases evaporation.

• Humidity: When humidity increases, the air becomes saturated with water vapor, thereby slowing down or halting evaporation altogether. Hence, this factor does NOT increase evaporation.

Additional Information

• Factors Affecting Evaporation:

• Temperature: Higher temperatures increase the kinetic energy of water molecules, facilitating evaporation.

• Wind Speed: Wind helps disperse water vapor from the surface, making room for more liquid to evaporate.

• Surface Area: The larger the exposed surface area, the quicker the evaporation rate.

• Humidity: High humidity slows down evaporation as the air is already saturated with water vapor.

• Applications of Evaporation:

• Drying Clothes: Evaporation aids in the drying process by removing water molecules from the fabric.

• Cooling Effect: Sweating and the evaporation of sweat help regulate body temperature.

• Industrial Uses: Evaporation is used in industries for processes like salt production from seawater and concentrating solutions.

• Scientific Principles:

• Latent Heat: During evaporation, water molecules absorb energy, leading to a cooling effect.

• Saturation Point: When air reaches its saturation point, evaporation slows down or stops.

• Examples in Nature:

• Water Cycle: Evaporation plays a key role in the water cycle by converting water from oceans, rivers, and lakes into vapor.

• Transpiration: Plants lose water through evaporation from their leaves, which is essential for nutrient transport and temperature regulation.

Important Points

• Humidity Measurement: Humidity is measured using instruments like hygrometers and psychrometers. Meteorological departments track humidity levels to forecast weather conditions.

• Evaporation in Daily Life: Evaporation is observed in common activities such as boiling water, drying wet surfaces, and sweat evaporation.

• Rate of Evaporation: The rate can be influenced by environmental conditions, including temperature and wind speed.

• Role in Cooling Systems: Evaporation is utilized in cooling systems like air conditioners and cooling towers to dissipate heat.

Q19. Answer: (d) $g=GM/R^2$

The correct answer is $g = GM/R^2$.

Key Points

• Formula for Acceleration due to Gravity: The acceleration due to gravity (g) is calculated using the formula: $g = GM/R^2$, where G is the universal gravitational constant, M is the mass of the Earth, and R is the radius of the Earth.

• Universal Gravitational Constant (G): The value of G is approximately 6.674×10^{-11} $N \cdot m^2/kg^2$, and it represents the force of attraction between two masses separated by a unit distance.

• Earth's Mass (M): The mass of the Earth is approximately 5.972×10^{24} kg. This value is used to calculate the gravitational force exerted by Earth.

• Earth's Radius (R): The average radius of the Earth is approximately 6,371 km, which is equivalent to 6.371 × 10^6 m.

• Correct Formula Explanation: The formula $g = GM/R^2$ is derived from Newton's law of universal gravitation, which states that every particle attracts every other particle with a force directly proportional to the product of their masses and inversely proportional to the square of the distance between their centers.

Additional Information

• Other Incorrect Options:

• $g = GM/R$: This formula is incorrect because it does not account for the inverse square relationship between gravitational force and distance. The gravitational acceleration decreases with the square of the radius.

• $g = GM^2/R$: This formula incorrectly includes the square of Earth's mass, which is not part of the derivation of gravitational acceleration.

• $g = GR/M^2$: This formula is incorrect as it inversely relates acceleration due to gravity to Earth's mass squared, which contradicts Newton's law of gravitation.

• Variation of g with Altitude: The value of g decreases as the distance from the Earth's surface increases. This is because R (distance from the center of Earth) increases, reducing the value of g.

• Variation of g with Latitude: The value of g is slightly higher at the poles compared to the equator due to the Earth's oblate shape. At the poles, the radius is smaller, increasing g.

• Applications of g: The acceleration due to gravity is crucial in calculating the motion of objects under free fall, designing satellites, and studying planetary motion.

• Gravitational Force on the Surface: On Earth's surface, the approximate value of g is 9.8 m/s^2, which is used for most practical calculations.

Important Points

• Newton's Law of Universal Gravitation: This law states that the force between two masses is proportional to the product of their masses and inversely proportional to the square of the distance between them.

• Gravitational Field Strength: The value of g represents the strength of the gravitational field at a given point on Earth.

• Satellite Motion: The formula $g = GM/R^2$ is used to calculate the gravitational force acting on satellites and other celestial objects.

• Free Fall: Objects falling under the influence of gravity alone experience an acceleration of approximately 9.8 m/s^2 near the Earth's surface.

• Earth's Shape: The oblate spheroid shape of Earth influences the variation in g across different latitudes.

Q20. Answer: (c) Solvay process

The correct answer is Solvay process.

Key Points

• Baking soda (Sodium bicarbonate) is primarily produced through the Solvay process, which is a widely used industrial chemical process.

• The Solvay process involves the reaction of ammonia (NH3), sodium chloride (NaCl), and carbon dioxide (CO2) in water to produce sodium bicarbonate (baking soda) and other by-products.

• The process is energy-efficient and cost-effective, making it the preferred method for manufacturing baking soda and other related products like soda ash (sodium carbonate).

• Sodium bicarbonate is formed during the intermediate steps of the Solvay process when carbon dioxide reacts with ammonia and sodium chloride in solution, precipitating as baking soda.

• This process is an example of a large-scale chemical synthesis and has been used globally since its development by Ernest Solvay in the 1860s.

Additional Information

• Chlor-alkali process:

• The Chlor-alkali process is primarily used for producing chlorine gas (Cl2), sodium hydroxide (NaOH), and hydrogen gas (H2) by electrolyzing an aqueous solution of sodium chloride (brine).

• This process does not produce baking soda but is important for manufacturing other industrial chemicals.

• It is widely used in industries for applications like water treatment, paper manufacturing, and cleaning products.

• Deacon's process:

• The Deacon's process is used for manufacturing chlorine gas by oxidizing hydrogen chloride gas with atmospheric oxygen in the presence of a catalyst.

• This process was historically important for chlorine production but is unrelated to baking soda manufacturing.

• Haber process:

• The Haber process is used for synthesizing ammonia (NH3) from nitrogen gas (N2) and hydrogen gas (H2) under high pressure and temperature.

• This process is crucial for the fertilizer industry but does not involve baking soda production.
• Ammonia produced by the Haber process may be used as a raw material in the Solvay process.
• Uses of Baking Soda:
• Baking soda is widely used in cooking as a leavening agent to make baked goods rise.
• It has applications in cleaning products, odor control, and as a mild abrasive.
• Medicinally, it is used as an antacid to relieve heartburn and indigestion.
• In industries, baking soda is used in fire extinguishers, textile dyeing, and leather tanning.

Important Points

• Solvay process details:
• The Solvay process was developed by Ernest Solvay, a Belgian chemist, in 1861.
• Its by-products include calcium chloride ($CaCl_2$), which is produced during the reaction.
• The process operates under controlled conditions of temperature and pressure to optimize the yield of baking soda.
• The raw materials—brine, limestone, and ammonia—are inexpensive and readily available.
• Global impact:
• Baking soda produced via the Solvay process is used globally in industries ranging from food processing to pharmaceuticals.
• The process has minimal environmental impact compared to other chemical synthesis methods.
• Historical significance:
• The Solvay process revolutionized the chemical industry by providing a cost-effective method to manufacture sodium carbonate and sodium bicarbonate.
• It replaced older methods like the Leblanc process, which was less efficient and more polluting.

Q21. Answer: (a) +0.33

The correct answer is +0.33.

Key Points

• The magnification produced by a lens is given by the formula: $m = v / u$, where v is the image distance and u is the object distance.
• For a concave lens, the focal length (f) is negative, so here $f = -15$ cm.
• The object distance (u) is -30 cm (negative because the object is placed on the left side of the lens).
• Using the lens formula: $1/f = 1/v - 1/u$, substitute the values: $1/(-15) = 1/v - 1/(-30)$.
• After solving, the image distance (v) is calculated as -10 cm.
• Now, calculate magnification: $m = v/u = -10/-30 = +0.33$.

Additional Information

• Concave Lens:
• A concave lens is a diverging lens, meaning it spreads out light rays that are initially parallel.
• It always forms a virtual, erect, and diminished image irrespective of the object distance.
• The focal length of a concave lens is always negative, as it diverges light.
• Lens Formula:
• The lens formula is $1/f = 1/v - 1/u$, where:
• f = focal length
• v = image distance
• u = object distance
• For concave lenses, all distances are taken with proper sign conventions, where:
• Distances measured against the direction of the incident light are negative.
• Distances measured in the direction of the incident light are positive.
• Magnification:
• The magnification of a lens is given by $m = v/u$.
• If magnification (m) is negative, the image is inverted. If positive, the image is erect.
• For concave lenses, magnification is always less than 1 and positive or negative depending on the nature of the image.
• Applications of Concave Lenses:
• Used in eyeglasses for people with myopia (near-sightedness).
• Used in optical instruments like cameras and telescopes to widen the field of view.
• Used in flashlight systems to diverge light over a larger area.

Important Points

• Sign Conventions: In optics, the following sign conventions are used:

• Distances measured in the direction of the incident light are positive.

• Distances measured against the direction of the incident light are negative.

• Heights measured upward and perpendicular to the principal axis are positive.

• Heights measured downward and perpendicular to the principal axis are negative.

• Key Numerical Values:

• Focal length of the concave lens: -15 cm.

• Object distance: -30 cm.

• Calculated image distance: -10 cm.

• Magnification: +0.33.

• Correct Option: The correct option is +0.33, as calculated using the lens formula and magnification formula.

Q22. Answer: (a) It is the energy an object has because of its motion, and it increases as the object's speed increases.

The correct answer is It is the energy an object has because of its motion, and it increases as the object's speed increases..

Key Points

• Kinetic Energy is a type of energy that an object possesses due to its motion. It is defined as the work needed to accelerate an object from rest to its current velocity.

• The formula for kinetic energy is KE = 1/2 mv^2, where m is the mass of the object and v is its velocity.

• The energy increases with the square of the speed. For example, if the speed of an object doubles, its kinetic energy increases by four times.

• Kinetic energy is directly proportional to the mass of the moving object. Larger masses result in higher kinetic energy at the same velocity.

• This energy type is critical in various applications like transportation, machinery, and sports, where motion is a key factor.

• Statement "It is the energy an object has because of its motion, and it increases as the object's speed increases" is correct because it aligns with the definition and principles of kinetic energy.

Additional Information

• Potential Energy:

• Potential energy is the energy stored in an object due to its position or configuration. For example, a raised object or a compressed spring holds potential energy.

• The formula for gravitational potential energy is PE = mgh, where m is mass, g is gravitational acceleration, and h is the height.

• It differs from kinetic energy as it is associated with an object's position rather than motion.

• Statement "It is the energy stored in an object due to its shape" refers to elastic potential energy, which is correct but not related to kinetic energy.

• Rest Energy:

• Rest energy refers to the energy an object has due to its mass, as described by Einstein's equation $E = mc^2$.

• This concept is more relevant in physics fields like relativity rather than everyday mechanics.

• Statement "It is the energy an object has because it is at rest" is incorrect because rest energy is a separate concept from kinetic energy.

• Energy Decrease with Speed:

• Kinetic energy does not decrease as speed increases; instead, it rises exponentially with velocity.

• Statement "It is the energy that decreases as the object's speed increases" is incorrect as it contradicts the fundamental principle of kinetic energy.

• Examples of Kinetic Energy:

• Flowing water in rivers, moving vehicles, and flying airplanes are common examples of objects exhibiting kinetic energy.

• In sports, a moving football or a swinging bat demonstrates kinetic energy in action.

• Machines like wind turbines convert the kinetic energy of wind into electrical energy.

Important Points

• Energy Conservation: The principle of conservation of energy states that energy cannot be created or destroyed; it can only be transformed from one form to another. For example, potential energy converts into kinetic energy when an object falls.

• Units of Measurement: Kinetic energy is measured in joules (J), the SI unit of energy.

• Applications: Kinetic energy is crucial in fields like engineering, transportation, and environmental science, where motion-related energy transformations occur.

• Historical Background: The concept of kinetic energy was first formalized in classical mechanics by Isaac Newton and later

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refined through various studies in physics.

• Real-Life Usage: Roller coasters rely on conversions between potential and kinetic energy to provide thrilling rides. Similarly, hydropower plants convert kinetic energy from flowing water into electricity.

Q23. Answer: (d) C(CH3)4

The correct answer is C(CH3)4.

Key Points

• Neopentane, also known as 2,2-dimethylpropane, is a branched-chain alkane with the chemical formula C5H12. It is one of the three structural isomers of pentane.

• The structural formula of neopentane is represented as C(CH3)4, where a central carbon atom is bonded to four methyl groups.

• Neopentane has a highly symmetrical and compact structure due to the branching, making it different from n-pentane and isopentane.

• Among the given options, the representation C(CH3)4 accurately depicts the structure of neopentane, where the central carbon atom is surrounded by four methyl groups.

• The other options provided describe different structural formulas, but none accurately represent the molecular configuration of neopentane. Hence, option 4 is correct.

Additional Information

• Isomers of Pentane:

• Pentane (C5H12) has three structural isomers: n-pentane, isopentane (2-methylbutane), and neopentane (2,2-dimethylpropane).

• Neopentane is the most compact and symmetrical of the three isomers, while n-pentane has a straight-chain structure.

• Isopentane has a single branch, making it less compact than neopentane.

• Physical Properties of Neopentane:

• Neopentane has a boiling point of approximately 9.5°C, which is lower than n-pentane and isopentane due to its compact structure and lower surface area.

• It is non-polar, colorless, and exists as a gas at room temperature.

• Applications of Neopentane:

• Neopentane is used as a standard reference compound in thermodynamic studies due to its symmetrical structure.

• It is employed in the production of specialty chemicals and as a precursor for certain polymers.

• Key Characteristics of Organic Compounds:

• Structural formulas represent the arrangement of atoms in a molecule. They help distinguish between isomers with the same molecular formula.

• Organic compounds with branching, like neopentane, typically have lower boiling points than their straight-chain counterparts due to reduced intermolecular forces.

Important Points

• Option 1: CH3-CH(CH3)-CH2-CH2-CH3 represents a branched-chain pentane but does not correspond to neopentane.

• Option 2: CH3-CH(CH3)-CH3 is a structure for isopentane, not neopentane.

• Option 3: CH3-CH(CH3)-CH2-CH3 is an incorrect representation of pentane's isomers.

• Option 4: C(CH3)4 accurately represents neopentane, with its central carbon bonded to four methyl groups.

• Understanding structural formulas is crucial in organic chemistry for distinguishing between different isomers and predicting their properties.

Q24. Answer: (b) High Humidity

The correct answer is High Humidity.

Key Points

• Evaporation is a process where liquid molecules at the surface gain enough energy to convert into vapor. Several factors influence the rate of evaporation.

• High Humidity reduces the rate of evaporation because the air is already saturated with water vapor, creating less room for additional water molecules to evaporate. Hence, this condition does NOT favor evaporation.

• High Temperature increases evaporation as it provides more energy to liquid molecules, enabling them to escape into the gaseous state. This condition favors evaporation.

• Low Humidity enhances evaporation as the air has more capacity to absorb water vapor. This condition favors evaporation.

• High Wind Speed accelerates evaporation by removing the saturated air near the liquid's surface and replacing it with unsaturated air. This condition favors evaporation.

Additional Information

• Factors Affecting Evaporation:

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• Surface Area: Larger surface areas allow more molecules to escape, increasing the evaporation rate.

• Air Pressure: Lower air pressure increases evaporation as it reduces the energy required for molecules to transition into the vapor phase.

• Type of Liquid: Volatile liquids like alcohol evaporate faster than less volatile liquids like water due to their lower boiling points.

• Applications of Evaporation:

• Used in industrial processes like salt production, drying, and cooling in air conditioning systems.

• Plays a crucial role in the water cycle by converting water from oceans and lakes into atmospheric moisture.

• Significance of Humidity in Daily Life:

• High humidity can cause discomfort, reduce the effectiveness of sweat evaporation, and affect cooling mechanisms of the body.

• Low humidity can lead to dry skin, dehydration, and increased risk of respiratory issues.

• Practical Examples:

• Clothes dry faster in hot and dry weather due to increased evaporation rates.

• Evaporation is slower during monsoons due to high humidity in the atmosphere.

Important Points

• Evaporation vs Boiling:

• Evaporation occurs at all temperatures and only at the surface of the liquid.

• Boiling occurs at a specific temperature (boiling point) and throughout the liquid.

• Humidity Measurement:

• Measured using a device called a hygrometer.

• Expressed as Relative Humidity (RH), which is the ratio of the current water vapor in the air to the maximum amount it can hold at a specific temperature.

• Real-World Observations:

• Deserts have faster evaporation rates due to high temperatures and low humidity.

• Coastal regions experience slower evaporation rates due to higher humidity levels.

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Q25. Answer: (c) The satellite has a constant speed, but its velocity is not constant.

The correct answer is The satellite has a constant speed, but its velocity is not constant..

Key Points

• Uniform Circular Motion: A satellite in a uniform circular orbit around the Earth moves with a constant speed. However, its velocity is not constant because velocity is a vector quantity and depends on both magnitude (speed) and direction.

• Changing Direction: In circular motion, the satellite continuously changes its direction as it orbits the Earth. This change in direction causes a change in velocity, even though the speed remains constant.

• Centripetal Force and Acceleration: The satellite experiences a centripetal force directed towards the center of the Earth. This force causes a centripetal acceleration, which changes the direction of the satellite's velocity without altering its speed.

• Incorrect Statements:

• Statement 1 is incorrect because the satellite does not have a constant acceleration. The acceleration keeps changing its direction.

• Statement 2 is incorrect because the satellite’s speed is constant, not its velocity.

• Statement 4 is incorrect because the satellite experiences acceleration due to the centripetal force.

• Correct Statement: The satellite has a constant speed, but its velocity is not constant due to the continuous change in direction. Hence, the correct answer is option 3.

Additional Information

• Velocity vs Speed:

• Speed is a scalar quantity that measures the magnitude of motion (distance covered per unit time).

• Velocity is a vector quantity that includes both the magnitude and direction of motion.

• In circular motion, even if the speed remains constant, the velocity changes because the direction of motion changes continuously.

• Centripetal Force:

• The centripetal force is the force that keeps the satellite in its circular orbit. It acts towards the center of the Earth.

• This force is provided by Earth's gravitational pull on the satellite.

• Centripetal Acceleration:

• Centripetal acceleration is directed towards the center of the circular path and is responsible for changing the direction of the

satellite's velocity.

• Its magnitude is given by the formula: $a = v^2/r$, where v is the speed of the satellite, and r is the radius of the orbit.

• Uniform Circular Motion Examples:

• Artificial satellites orbiting the Earth.

• A car moving around a circular track at constant speed.

• The motion of a stone tied to a string and whirled in a circular path.

Important Points

• Gravitational Force: The force of gravity between the Earth and the satellite provides the necessary centripetal force to keep the satellite in orbit.

• Orbital Speed: The speed of a satellite in a circular orbit is constant and is determined by the balance of gravitational force and the satellite's inertia.

• No Tangential Acceleration: In uniform circular motion, there is no tangential acceleration as the speed is constant. Only centripetal acceleration exists.

• Kepler's Laws: Satellites follow Kepler's laws of planetary motion, which describe the motion of objects in orbit due to gravitational forces.

Q26. Answer: (c) 7/9

Shortcut Trick

Given $\sin A = 3/5$, we identify the triplet (3, 4, 5) where Perpendicular (P) = 3 and Hypotenuse (H) = 5.

Then, Base (B) = 4.

Substitute $\cot A = 4/3$ and $\operatorname{cosec} A = 5/3$ into the expression.

Value = $2 \times (4/3)^2 - (5/3)^2 = 2 \times (16/9) - 25/9 = 32/9 - 25/9 = 7/9$.

Therefore The correct answer is 7/9.

Alternate Method

Given: $\sin A = 3/5$, A is an acute angle.

Formula Used: $\sin^2 A + \cos^2 A = 1$; $\cot A = \cos A / \sin A$; $\operatorname{cosec} A = 1 / \sin A$.

=> $\sin A$ = Perpendicular / Hypotenuse = 3 / 5

=> Base = $\sqrt{(\text{Hypotenuse}^2 - \text{Perpendicular}^2)} = \sqrt{(5^2 - 3^2)} = \sqrt{(25 - 9)} = \sqrt{16} = 4$

=> $\cot A$ = Base / Perpendicular = 4 / 3

=> $\operatorname{cosec} A$ = Hypotenuse / Perpendicular = 5 / 3

=> Expression = $2\cot^2 A - \operatorname{cosec}^2 A$

=> Value = $2 \times (4/3)^2 - (5/3)^2$

=> Value = $2 \times (16/9) - (25/9)$

=> Value = $32/9 - 25/9 = 7/9$

Therefore The correct answer is 7/9.

Additional Information

Trigonometric Identities

Fundamental identities: $\sin^2 A + \cos^2 A = 1$, $1 + \tan^2 A = \sec^2 A$, and $1 + \cot^2 A = \operatorname{cosec}^2 A$.

Pythagorean Triplets

Common triplets used in exams include (3, 4, 5), (5, 12, 13), (7, 24, 25), and (8, 15, 17).

Reciprocal Relations

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

Q27. Answer: (a) Rs. 1,29,415

Shortcut Trick

Convert time to years: 39 months = 39 ÷ 12 = 3.25 years.

Net interest rate = 4% × 3.25 = 13%.

Simple Interest = 13% of Rs. 9,95,500 = 13 × 9,955 = Rs. 1,29,415.

Therefore The correct answer is Rs. 1,29,415.

Alternate Method

Given:

Principal (P) = Rs. 9,95,500

Rate of Interest (R) = 4% per annum

Time (T) = 39 months = 39 ÷ 12 years = 13 ÷ 4 years

Formula Used:

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

Calculations:

=> SI = (9,95,500 × 4 × (13 ÷ 4)) ÷ 100

=> SI = (9,95,500 × 13) ÷ 100

=> SI = 9,955 × 13

=> SI = Rs. 1,29,415

Thus, the interest Shweta will pay is Rs. 1,29,415.

=> Option (2) Rs. 1,29,665 is incorrect because it does not match the calculated interest of Rs. 1,29,415.

=> Option (3) Rs. 1,39,545 is incorrect because it represents a higher interest value than calculated.

=> Option (4) Rs. 1,15,995 is incorrect because it represents a lower interest value than calculated.

Therefore The correct answer is Rs. 1,29,415.

Additional Information

Simple Interest Formula

Simple Interest (SI) is calculated using the formula SI = (P × R × T) ÷ 100, where P is the principal, R is the rate of interest per annum, and T is the time in years.

Time Conversion

When time is given in months, it must be converted to years by dividing by 12 (T = Months ÷ 12) before applying the standard formula.

Total Amount Formula

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

Q28. Answer: (d) 2300/99

Given:

x = 23.232323...

Formula Used:

For repeating decimal: Multiply by 100 for two repeating digits

Subtract to eliminate repeating part

Calculation:

=> x = 23.232323...

=> 100x = 2323.232323...

=> 100x - x = 2323.232323... - 23.232323...

=> 99x = 2300

=> x = 2300 ÷ 99

Therefore The correct answer is 2300/99.

Q29. Answer: (d) 5544 cm2

Shortcut Trick

The ratio of Volume (V) to Surface Area (S) of a sphere is always r/3.

Given: V/S = 7

=> r/3 = 7 → r = 21 cm

Surface Area = 4 × π × r^2 = 4 × (22/7) × 21 × 21 = 5544 cm^2.

Therefore The correct answer is 5544 cm^2.

Alternate Method

Given:

Ratio of Volume to Surface Area = 7 cm

Formula Used:

Volume of Sphere (V) = (4/3) × π × r^3

Surface Area of Sphere (S) = 4 × π × r^2

Calculations:

=> V ÷ S = 7

=> [(4/3) × π × r^3] ÷ [4 × π × r^2] = 7

=> (1/3) × r = 7

=> r = 21 cm

=> Surface Area = 4 × (22/7) × 21 × 21

=> Surface Area = 4 × 22 × 3 × 21

=> Surface Area = 88 × 63

=> Surface Area = 5544 cm^2

Therefore The correct answer is 5544 cm^2.

Additional Information

Volume and Surface Area of Hemisphere

For a Hemisphere of radius r, Volume = (2/3)πr^3, Curved Surface Area = 2πr^2, and Total Surface Area = 3πr^2.

Properties of a Sphere

A Sphere is a perfectly round geometrical object in three-dimensional space. It has the smallest surface area for a fixed volume among all shapes.

Diameter Relation

The Diameter (d) of a sphere is 2r. In terms of diameter, Surface Area = πd^2 and Volume = (1/6)πd^3.

Q30. Answer: (a) 4

Shortcut Trick

Let the total work be LCM of 2, 20, and 5 = 20 units.

Combined efficiency of A, B and C = 10 + 1 + 4 = 15 units/day.

Thrice the work = 20 × 3 = 60 units.

Time taken = 60 ÷ 15 = 4 days.

Therefore The correct answer is 4 days.

Alternate Method

Given:

Time taken by A = 2 days

Time taken by B = 20 days

Time taken by C = 5 days

Formula Used:

Total Work = LCM of individual times

Efficiency = Total Work ÷ Individual Time

Time Taken = Total Work ÷ Total Efficiency

Person	Days	Total Work	Efficiency
A	2	20	10
B	20	1	
C	5	4	

Calculations:

=> Combined efficiency of A, B and C = 10 + 1 + 4 = 15 units/day

=> New Work (thrice the original work) = 3 × 20 = 60 units

=> Time taken to complete the new work = 60 ÷ 15 = 4 days

Therefore The correct answer is 4 days.

Additional Information

Time and Work Basic Relation

Work done is directly proportional to both efficiency and time taken (Work = Efficiency × Time).

Pipes and Cisterns Analogy

The same LCM method applies to pipes filling a tank, where inlet pipes represent positive efficiency and outlet pipes represent negative efficiency.

Q31. Answer: (d) 1,767

Shortcut Trick

Ratio of Investments = 1800 : 1620 = 10 : 9

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In partnership, Profit Ratio = Investment Ratio when time is same.

Dev's share (10 units) = Rs. 930 => 1 unit = Rs. 93

Total profit (10 + 9 = 19 units) = 19 × 93 = Rs. 1,767

Therefore The correct answer is Rs. 1,767.

Alternate Method

Given: Investment of Dev = Rs. 1,800, Investment of Tej = Rs. 1,620, Dev's profit = Rs. 930.

Formula Used: Profit Ratio = (Investment1 × Time1) : (Investment2 × Time2)

=> Ratio of profits of Dev and Tej = 1800 : 1620

=> Simplifying the ratio = 180 : 162 = 10 : 9

=> Let Dev's profit be 10x and Tej's profit be 9x.

=> Given 10x = 930

=> x = 93

=> Total Profit = 10x + 9x = 19x

=> Total Profit = 19 × 93 = Rs. 1,767

Therefore The correct answer is Rs. 1,767.

Additional Information

Partnership Profit Sharing

Profit is distributed in the ratio of the product of Capital and Time. If time is constant, Profit prop. to Capital.

Active vs Sleeping Partner

An Active partner manages the business and may receive a salary or extra share before the remaining profit is divided by investment ratio.

Total Profit Calculation

Total Profit = (Individual Profit / Individual Ratio Part) × Sum of all Ratio Parts.

Q32. Answer: (d) 18 Years

Shortcut Trick

When a person's age is the arithmetic mean of two others (as much older as younger), his age is simply the average of their ages.

Anirudh's Age = (Sum of Praveen and Suman's Ages) ÷ 2

Anirudh's Age = 36 ÷ 2 = 18 years

Therefore The correct answer is 18 Years.

Alternate Method

Given:

Sum of ages of Praveen (P) and Suman (S) = 36 years

Anirudh (A) is as much older than P as he is younger than S.

=> A − P = S − A

=> 2A = P + S

=> 2A = 36

=> A = 36 ÷ 2

=> A = 18 years

Therefore The correct answer is 18 Years.

Additional Information

Concept of Arithmetic Progression in Ages

When one person is the middle value between two others with equal differences, the ages are in Arithmetic Progression (A.P.). The middle term is the average of the first and third terms.

Age Difference Consistency

The difference between the ages of two individuals remains constant regardless of the number of years passed or considered in the past.

Q33. Answer: (b) Increase by 16.8%

Shortcut Trick

Let TV cost = 100, then Washing Machine (WM) cost = 50.

Initial Total Cost (6 WM + 2 TV) = (6 × 50) + (2 × 100) = 300 + 200 = 500.

Net Change = [6 × 50 × (+62%)] + [2 × 100 × (−51%)] = 186 − 102 = +84.

% Change = (84 ÷ 500) × 100 = 16.8%.

Therefore The correct answer is Increase by 16.8%.

Alternate Method

Given: Cost of Washing Machine is 50% less than TV. WM cost increases by 62%, TV cost decreases by 51%.

=> Let Cost of TV = Rs. 100

=> Cost of Washing Machine = 100 − 50% of 100 = Rs. 50

=> Initial Total Cost = (6 × 50) + (2 × 100) = 300 + 200 = Rs. 500

=> New Cost of WM = 50 + (62/100 × 50) = 50 + 31 = Rs. 81

=> New Cost of TV = 100 − (51/100 × 100) = 100 − 51 = Rs. 49

=> Final Total Cost = (6 × 81) + (2 × 49) = 486 + 98 = Rs. 584

=> Net Increase = 584 − 500 = Rs. 84

=> Percentage Change = (84 ÷ 500) × 100 = 16.8%

Therefore The correct answer is Increase by 16.8%.

Additional Information

Percentage Change Formula

Percentage Change = [(Final Value − Initial Value) ÷ Initial Value] × 100. A positive result indicates an increase, while a negative result indicates a decrease.

Weighted Average Method

When multiple items change by different percentages, net change = (n1c1 + n2c2) ÷ (n1 + n2) where n is the weight (initial total cost contribution) and c is the % change.

Base Change Property

If the cost of an item increases by x%, the new cost is (100 + x)% of the original. If it decreases, it is (100 − x)%.

Q34. Answer: (a) 98

Shortcut Trick

For any point P inside a rectangle ABCD, the sum of the squares of distances from opposite vertices is equal.

Formula: $PA^2 + PC^2 = PB^2 + PD^2$

=> $46^2 + 88^2 = 16^2 + PD^2$

=> $2116 + 7744 = 256 + PD^2$

=> $9860 − 256 = PD^2$

=> $PD = \sqrt{9604} = 98$ cm

Therefore The correct answer is 98 cm.

Alternate Method

Given: PA = 46 cm, PB = 16 cm, PC = 88 cm

Property used: British Flag Theorem for a rectangle.

=> According to the property, $PA^2 + PC^2 = PB^2 + PD^2$

=> $(46)^2 + (88)^2 = (16)^2 + PD^2$

=> $2116 + 7744 = 256 + PD^2$

=> $9860 = 256 + PD^2$

=> $PD^2 = 9860 − 256$

=> $PD^2 = 9604$

=> $PD = \sqrt{9604}$

=> PD = 98 cm

Therefore The correct answer is 98 cm.

Additional Information

British Flag Theorem

This theorem applies to any point P inside or outside a rectangle, stating $PA^2 + PC^2 = PB^2 + PD^2$ where A, C and B, D are opposite vertices.

Application in Square

Since a square is a special case of a rectangle, the same relation holds true for any point in the plane of a square.

Coordinate Proof Basis

The proof relies on dropping perpendiculars from P to the sides of the rectangle and applying Pythagoras Theorem to the resulting

right triangles.

Q35. Answer: (d) 20.87%

Shortcut Trick

Use the Successive Percentage formula: Net Change = a + b + (a × b)/100

Here, a = +93% (markup) and b = −59% (discount).

Net Change = 93 − 59 + (93 × (−59))/100

Net Change = 34 − (5487/100) = 34 − 54.87 = −20.87%

Negative sign indicates a loss.

Therefore The correct answer is 20.87%.

Alternate Method

Given: Markup % = 93%, Discount % = 59%.

=> Let Cost Price (CP) = 100

=> Marked Price (MP) = 100 + 93% of 100 = 193

=> Selling Price (SP) = MP − Discount = 193 − (59% of 193)

=> SP = 193 − (0.59 × 193) = 193 − 113.87 = 79.13

=> Loss = CP − SP = 100 − 79.13 = 20.87

=> Loss percentage = (Loss / CP) × 100 = (20.87 / 100) × 100 = 20.87%

Therefore The correct answer is 20.87%.

Additional Information

Marked Price and Discount

Marked Price (MP) is the price printed on the label. Discount is always calculated on the MP. SP = MP × (100 − D%)/100.

Markup Percentage

Markup % = [(MP − CP) / CP] × 100. It represents how much higher the list price is compared to the investment.

Relation between CP and MP

The ratio of CP to MP can be expressed as: CP/MP = (100 − Discount%)/(100 + Profit%). If it is a loss, use (100 − Loss%).

Q36. Answer: (b) Rs. 1,45,000

Shortcut Trick

Using Successive Multiplier Method:

Remaining Fraction = (9/10) × (4/5) × (3/4) = 27/50

27 units = Rs. 78,300 => 1 unit = Rs. 2,900

Total Income (50 units) = 50 × Rs. 2,900 = Rs. 1,45,000

Therefore The correct answer is Rs. 1,45,000.

Alternate Method

Given:

Monthly Income = x

Rent = 10% of x => Remaining = 90% of x

Household Expenditure = 20% of 90% = 18% of x => Remaining = 72% of x

Food Expenditure = 25% of 72% = 18% of x => Remaining = 54% of x

=> 54/100 × x = 78,300

=> x = (78,300 × 100) ÷ 54

=> x = 1,450 × 100 = 1,45,000

Therefore The correct answer is Rs. 1,45,000.

Additional Information

Successive Percentage Change

When values are spent from the remaining balance, the effective saving percentage is product of (100 − r_n)% for each r.

Net Percentage Change Formula

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

Base Change Principle

Always identify the base for each percentage. If it says of the rest, the base shifts to the current remainder.

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Q37. Answer: (c) 48 minutes

Shortcut Trick

Speed ratio (New : Normal) = 4 : 7

Since distance is constant, Time ratio is inverse of Speed ratio = 7 : 4

Difference in time units = 7 − 4 = 3 units

3 units = 36 minutes => 1 unit = 12 minutes

Usual time = 4 units = 4 × 12 = 48 minutes

Therefore The correct answer is 48 min.

Alternate Method

Given:

New Speed = 4/7 × Usual Speed

Time delay = 36 minutes

Formula Used:

Distance = Speed × Time

Calculations:

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

=> New Speed = (4/7)S

=> New Time = T + 36

=> S × T = (4/7)S × (T + 36)

=> T = 4/7 × (T + 36)

=> 7T = 4T + 144

=> 3T = 144

=> T = 48 minutes

Therefore The correct answer is 48 min.

Additional Information

Speed-Time Inversity

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.

Late/Early Concept

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

Relative Speed

For two objects moving in the same direction, relative speed is |S1 − S2|; in opposite directions, it is S1 + S2.

Q38. Answer: (a) 1

Shortcut Trick

Efficiency ratio: 8 men = 9 women => 1 man = 9/8 women.

Total work = 8 men × 2 days = 16 man-days.

Work done by 8 men in 1 day = 8 man-days.

Remaining work = 16 − 8 = 8 man-days.

Since 8 men = 9 women, 8 man-days = 9 woman-days.

Number of women to finish in 9 days = 9 woman-days ÷ 9 days = 1 woman.

Therefore The correct answer is 1 woman.

Alternate Method

Given: 8 men or 9 women can do the job in 2 days. 8 men work for 1 day.

Formula Used: Total Work = Number of workers × Efficiency × Time

Person	Days	Total Work	Efficiency
8 Men	2	18	9
9 Women	2	9	

=> Efficiency of 8 men = 18 ÷ 2 = 9 units/day

=> Efficiency of 9 women = 18 ÷ 2 = 9 units/day => Efficiency of 1 woman = 1 unit/day

=> Work done by 8 men in 1 day = 9 × 1 = 9 units

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=> Remaining work = 18 − 9 = 9 units

=> Required women (W) for 9 days: W × 1 × 9 = 9

=> W = 9 ÷ 9 = 1

Therefore The correct answer is 1 woman.

Additional Information

Chain Rule Formula

The relationship between men, days, and work is given by (M1×D1×H1)/W1 = (M2×D2×H2)/W2.

OR/AND Concept

In 'Or' type questions, equate the total work of different groups to find the efficiency ratio between them (e.g., 8M = 9W).

Work and Wages

Wages are always distributed in the ratio of the actual work done by each individual or their efficiencies if they work for the same time.

Q39. Answer: (a) 4

Shortcut Trick

Apply the Chain Rule formula: M1 × D1 = M2 × D2.

Given: 2 men × 2 days = M2 × 1 day.

=> M2 = 4 men.

Therefore The correct answer is 4 men.

Alternate Method

Given:

Number of men (M1) = 2

Number of days (D1) = 2

Number of days for second case (D2) = 1

Formula Used:

Total Work = Men × Days

Calculations:

=> Total Work = 2 × 2 = 4 units

=> Required Men (M2) = Total Work ÷ D2

=> M2 = 4 ÷ 1

=> M2 = 4 men

Therefore The correct answer is 4 men.

Additional Information

General Work Formula

For different work amounts, use (M1×D1×H1)/W1 = (M2×D2×H2)/W2 where H is hours and W is work.

Inverse Proportion

The number of men is inversely proportional to the time taken to complete the work (M prop. to 1/D).

Q40. Answer: (a) 2(6x − 17)

Shortcut Trick

Apply Algebraic Identities: $(a + b)(a − b) = a^2 − b^2$ and $(a − b)^2 = a^2 − 2ab + b^2$.

The Quadratic terms $(2x)^2$ cancel each other out: $4x^2 − 4x^2 = 0$.

The Linear term comes only from $−(−2 × 2x × 3) = 12x$.

The Constant term is $−5^2 − (−3)^2 = −25 − 9 = −34$.

Simplified form: 12x − 34 = 2(6x − 17).

Therefore The correct answer is 2(6x − 17).

Alternate Method

Given Expression: $(2x + 5)(2x − 5) − (2x − 3)^2$

Formula Used:

1. Difference of Squares: $(a + b)(a − b) = a^2 − b^2$

2. Square of a Binomial: $(a − b)^2 = a^2 − 2ab + b^2$

Calculations:

=> $[(2x)^2 - (5)^2] - [(2x)^2 - 2(2x)(3) + (3)^2]$

=> $(4x^2 - 25) - (4x^2 - 12x + 9)$

=> $4x^2 - 25 - 4x^2 + 12x - 9$

=> $(4x^2 - 4x^2) + 12x + (-25 - 9)$

=> $12x - 34$

=> $2(6x - 17)$

Therefore The correct answer is $2(6x - 17)$.

Additional Information

Standard Algebraic Identities

Common formulas include $(a + b)^2 = a^2 + 2ab + b^2$ and $(a + b + c)^2 = a^2 + b^2 + c^2 + 2ab + 2bc + 2ca$.

Factorization Principle

Factorization is the process of breaking down a polynomial into a product of simpler factors, such as extracting the Highest Common Factor (HCF).

Distributive Property

The property states that $a(b + c) = ab + ac$, which is essential for expanding and simplifying algebraic expressions.

Q41. Answer: (a) 532

Shortcut Trick

Use the direct relationship: CP / MP = (100 − Discount%) / (100 + Profit%)

CP / 854 = (100 − 24) / (100 + 22) = 76 / 122

CP = (76 / 122) × 854

CP = 76 × 7 = 532

Therefore The correct answer is Rs. 532.

Alternate Method

Given:

Marked Price (MP) = Rs. 854

Discount = 24%

Profit = 22%

Formula Used:

Selling Price (SP) = MP × (100 − Discount%)/100

Cost Price (CP) = SP × 100/(100 + Profit%)

=> SP = 854 × (100 − 24) / 100

=> SP = 854 × 0.76 = Rs. 649.04

=> CP = 649.04 × 100 / (100 + 22)

=> CP = 649.04 / 1.22

=> CP = Rs. 532

Therefore The correct answer is Rs. 532.

Additional Information

Marked Price and Discount

The Marked Price is the price printed on the product. Discount is always calculated on the Marked Price to arrive at the Selling Price.

CP-MP Ratio Relationship

CP : MP = (100 − D%) : (100 + P%). This is a crucial shortcut for exams when Discount and Profit percentages are both known.

Successive Discounts

If two discounts d1 and d2 are given, the Effective Discount = d1 + d2 − (d1 × d2)/100.

Q42. Answer: (b) 3185

Shortcut Trick

Combine ratios Red : Blue (6 : 10) and Blue : Yellow (2 : 7 → 10 : 35).

Combined Ratio Red : Blue : Yellow = 6 : 10 : 35.

Total units = 6 + 10 + 35 = 51 units.

Yellow blocks = (35 ÷ 51) × 4641 = 35 × 91 = 3185.

Therefore The correct answer is 3185 yellow blocks.

Alternate Method
Given:
Total blocks = 4641
Ratio Red : Blue = 6 : 10
Ratio Blue : Yellow = 2 : 7
Calculations:
=> To equalize Blue, multiply the second ratio by 5: Blue : Yellow = (2 × 5) : (7 × 5) = 10 : 35
=> Combined Ratio (Red : Blue : Yellow) = 6 : 10 : 35
=> Sum of ratio parts = 6 + 10 + 35 = 51
=> Value of 1 unit = 4641 ÷ 51 = 91
=> Number of Yellow blocks = 35 × 91
=> Number of Yellow blocks = 3185
Therefore The correct answer is 3185 yellow blocks.
Additional Information
Compound Ratio
To combine ratios A:B and B:C, ensure the common term B has the same value in both by multiplying with appropriate constants.
Ratio Distribution
Value of a specific part = (Part Ratio ÷ Sum of all Ratios) × Total Quantity.
Invertendo and Alternendo
If a:b = c:d, then b:a = d:c (Invertendo) and a:c = b:d (Alternendo).

Q43. Answer: (d) 50%

Shortcut Trick
Cost Price (CP) = Rs. 600
Selling Price (SP) = Rs. 900
Profit % = (SP − CP) ÷ CP × 100
Profit % = (900 − 600) ÷ 600 × 100 = 300 ÷ 600 × 100 = 50%
Therefore The correct answer is 50%.
Alternate Method
Given:
Total Cost Price (CP) of 20 pens = Rs. 600
Total Selling Price (SP) of 20 pens = Rs. 900
Formula Used:
Profit = Selling Price − Cost Price
Profit % = (Profit ÷ Cost Price) × 100
Calculations:
=> Profit = 900 − 600 = Rs. 300
=> Profit % = (300 ÷ 600) × 100
=> Profit % = (1 ÷ 2) × 100
=> Profit % = 50%
Therefore The correct answer is 50%.
Additional Information
Loss Percentage
When CP > SP, Loss % = [(CP − SP) ÷ CP] × 100.
Marked Price and Discount
Discount is always calculated on Marked Price (MP). SP = MP × [1 − (Discount% ÷ 100)].
Relation between CP and MP
CP ÷ MP = (100 − Discount%) ÷ (100 + Profit%).

Q44. Answer: (d) 36

Shortcut Trick
Total distance = Train Length + Platform Length = 140 + (3 × 140) = 4 × 140 = 560 m.

Speed in m/s = Total distance ÷ Time = 560 ÷ 56 = 10 m/s.
Speed in km/hr = 10 × (18/5) = 2 × 18 = 36 km/hr.
Therefore The correct answer is 36 km/hr.
Alternate Method
Given:
Length of train (L_t) = 140 m
Length of platform (L_p) = 3 × 140 = 420 m
Time taken (t) = 56 seconds
Formula Used:
Speed = Total Distance ÷ Time
Speed (km/hr) = Speed (m/s) × (18/5)
Calculations:
=> Total distance = 140 + 420 = 560 m
=> Speed = 560 ÷ 56 = 10 m/s
=> Speed in km/hr = 10 × (18/5)
=> Speed = 2 × 18 = 36 km/hr
Therefore The correct answer is 36 km/hr.
Additional Information
Unit Conversion
To convert m/s to km/hr, multiply by 18/5. To convert km/hr to m/s, multiply by 5/18.
Train Crossing Object with Length
When a train crosses a platform, bridge, or another train, the total distance covered is the sum of their lengths (L1 + L2).
Relative Speed
If two objects move in the same direction, relative speed is |s1 − s2|. In opposite directions, it is s1 + s2.

Q45. Answer: (d) 72

Shortcut Trick
Let the number be 1 unit.
According to the question, the difference between the number and its three-fourth is 18.
1 − 3/4 = 1/4 unit → 18
1 unit = 18 × 4 = 72
Therefore The correct answer is 72.
Alternate Method
Given:
Let the number be x.
Calculations:
=> x = (3/4)x + 18
=> x − 3x/4 = 18
=> (4x − 3x)/4 = 18
=> x/4 = 18
=> x = 18 × 4
=> x = 72
Therefore The correct answer is 72.
Additional Information
Percentage Conversion
Three-fourth of a number is equivalent to 75% of that number. The problem can be viewed as 25% (100% − 75%) of the number being 18.
Ratio and Proportion
If the ratio of the part to the whole is 3 : 4, the difference between the total parts (4) and given parts (3) is 1 part, which equals 18.

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Q46. Answer: (d) 46

Shortcut Trick

Teacher age = New Average + (Initial Number of Students × Increase in Average)

Increase in average = 15 − 14 = 1 year

Teacher age = 15 + (31 × 1) = 15 + 31 = 46 years

Therefore The correct answer is 46 years.

Alternate Method

Given: Number of students = 31, Average age = 14 years. New average including teacher = 15 years.

Total age of 31 students = 31 × 14

=> Total age = 434 years

Number of people after including the teacher = 31 + 1 = 32

Total age including the teacher = 32 × 15

=> Total age = 480 years

Age of the teacher = (Total age of 32 people) − (Total age of 31 students)

=> Teacher age = 480 − 434 = 46 years

Therefore The correct answer is 46 years.

Additional Information

Basic Average Formula

Average = (Sum of observations) ÷ (Number of observations). To find the sum, multiply Average by Number.

Net Deviation Method

The sum of deviations from the average is always zero. If the average increases by 1 for 32 people, the new entrant must bring (32 × 1) more than the old average.

Inclusion and Exclusion

When a person joins/leaves, the change in total sum = (New Member Value − Old Average) = (New Count × Change in Average).

Q47. Answer: (a) 43.6

Shortcut Trick

Net change in Total Sum = (Correct values − Incorrect values)

Net change = (2 × 25 + 1 × 36) − (2 × 33 + 1 × 34) = (50 + 36) − (66 + 34) = 86 − 100 = −14

Average deviation = Total change ÷ Number of students = −14 ÷ 35 = −0.4

Actual Average = Old Average + Average deviation = 44 − 0.4 = 43.6

Therefore The correct answer is 43.6.

Alternate Method

Given: Total students (n) = 35, Initial average = 44, Correct scores = 25, 25, 36, Incorrect scores = 33, 33, 34.

Formula Used: Correct Average = [(Old Average × n) + (Sum of correct values − Sum of incorrect values)] ÷ n

=> Initial Total Sum = 35 × 44 = 1540

=> Total of Correct entries = 25 + 25 + 36 = 86

=> Total of Incorrect entries recorded = 33 + 33 + 34 = 100

=> Actual Total Sum = 1540 − 100 + 86 = 1526

=> Actual Average = 1526 ÷ 35

=> Actual Average = 43.6

Therefore The correct answer is 43.6.

Additional Information

Average Concept

The average (arithmetic mean) is the sum of all observations divided by the total number of observations. Average = Σx ÷ n.

Effect of Modification

If every observation is increased or decreased by a constant 'k', the new average also increases or decreases by 'k'.

Weighted Average

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

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Q48. Answer: (d) 58.5

Shortcut Trick

Let the number be 100%.

If 20% is added, the remaining part is 80%.

80% of the number → 72

1% of the number → 72 ÷ 80 = 0.9

65% of the number → 0.9 × 65 = 58.5

Therefore The correct answer is 58.5.

Alternate Method

Given:

Let the number be x.

According to the question:

=> 20% of x + 72 = x

=> 0.20x + 72 = x

=> x − 0.20x = 72

=> 0.80x = 72

=> x = 72 ÷ 0.80

=> x = 90

Now, find 65% of the same number:

=> 65% of 90 = (65 ÷ 100) × 90

=> 0.65 × 90 = 58.5

Therefore The correct answer is 58.5.

Additional Information

Percentage to Fraction Conversion

To simplify calculations, convert percentages to fractions: 20% = 1/5 and 80% = 4/5.

Percentage Change

Percentage Change = (Final Value − Initial Value) ÷ Initial Value × 100.

Successive Percentage

For two successive changes of a% and b%, the effective change is (a + b + ab/100)%.

Q49. Answer: (b) 93/205

Given:

[10 1/3 ÷ 5/3 of (10 + 14 ÷ 3 - 1)]

Concept Used:

BODMAS rule

Calculation:

[10 1/3 ÷ 5/3 of (10 + 14 ÷ 3 - 1)]

=> [31/3 ÷ 5/3 of (10 + 14/3 - 1)]

=> [31/3 ÷ 5/3 of (9 + 14/3)]

=> [31/3 ÷ 5/3 of (27 + 14)/3]

=> [31/3 ÷ 5/3 of 41/3]

=> [31/3 ÷ {5/3 × 41/3}]

=> [31/3 ÷ 205/9]

=> [31/3 × 9/205]

=> [(31 × 3)/205]

=> 93/205

Therefore The correct answer is 93/205

Q50. Answer: (c) 1078

Shortcut Trick

Volume of cuboid = Length × Breadth × Height

Volume = 49 × 11 × 2

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Multiply 49 × 2 first → 98

Then multiply 98 × 11 → 9 (9+8=17) 8 → 1078

Therefore The correct answer is 1078 m³.

Alternate Method

Given:

Length (l) = 49 m

Breadth (b) = 11 m

Height (h) = 2 m

Formula Used:

Volume of a Cuboidal Tank = Length × Breadth × Height

Calculation:

=> Volume = 49 × 11 × 2

=> Volume = 539 × 2

=> Volume = 1078 m³

Therefore The correct answer is 1078 m³.

Additional Information

Total Surface Area of Cuboid

The sum of areas of all six faces: TSA = 2(lb + bh + hl).

Diagonal of a Cuboid

The distance between opposite corners: Diagonal = √(l² + b² + h²).

Lateral Surface Area (LSA)

Area of the four side walls (excluding top and bottom): LSA = 2h(l + b).

Q51. Answer: (b) 5 km, towards the west

Given:

Hitesh starts driving from Point A and drives 13 km towards the South. He turns right and drives 4 km, turns right again and drives 14 km. He turns right once more and drives 9 km. He turns right for the final time, drives 1 km, and stops at Point P.

Drawing the diagram according to the given information,

To reach back to point A from point P, Hitesh must drive 5 km towards the West.

Hence, the correct answer is Option 2;

Q52. Answer: (d) Three

Given series:

(Left) © @ 7 € $ 5 $ & * & 7 5 2 $ 8 $ © 7 © 4 6 £ (Right)

Condition to be checked:

Number → Symbol → Symbol

© @ 7 € $ 5 $ & * & 7 5 2 $ 8 $ © 7 © 4 6 £

Thus, there are three such pairs(7 € $, 5 $ &, 8 $ ©)

Hence, the correct answer is "Option 4".

Q53. Answer: (a) Three

Given the number: 3674185

The rules for transformation are:

• For each odd digit: Add 1 (+ 1)

• For each even digit: Subtract 2 (- 2)

Position	1st	2nd	3rd	4th	5th	6th	7th
Original Digit	3	6	7	4	1	8	5
Type	Odd	Even	Odd	Even	Odd	Even	Odd
New Digit	4	4	8	2	2	6	6

The new number formed is: 4482266

The digits that appear more than once are 4, 2, and 6. There are three such digits.

Hence, the correct answer is "Option 1".

Q54. Answer: (c) HJ - DL

The logic followed here is a constant subtraction of 4.

For QR to MN

For NO to JK

For HJ to DL

For LM to HI

In this pair, the shifts are -4 and +2. This does not follow the group logic.

Thus, the pair HJ - DL is the odd one out.

Hence, the correct answer is "Option 3".

Q55. Answer: (b) 2

Given series:

5 2 4 8 8 7 2 3 3 3 6 7 5 6 6 8 9 4 1 5 1 7 7 3 3 7 5

Condition:

Even → Odd → Even

5 2 4 8 8 7 2 3 3 3 6 7 5 6 6 8 9 4 1 5 1 7 7 3 3 7 5

There are two such odd numbers in the sequence(8 7 2, 8 9 4)

Hence, the correct answer is "Option 2".

Q56. Answer: (a) Two

Given:

A, B, C, E, F, P, and Q are sitting around a circular table, facing the centre.

Only four people sit between C and E, when counted from the right of C.

C sits third to the left of P.

Q is an immediate neighbour of both E and P.

B sits third to the left of F.

Thus, two people sit between A and Q, when counted from the right of A.

Hence, the correct answer is "Option1 ".

Q57. Answer: (b) Only conclusion (I) follows.

The least possible Venn diagram for the given statement is:

Conclusions:

I. Some hair are teeth - True (Because some hair are nails and all nails are teeth, so the part of hair that is nails is also teeth).

II. All teeth are nails - False (Because all nails are teeth, but all teeth are not necessarily nails).

So, Only conclusion (I) follows.

Hence, the correct answer is Option 2.

Q58. Answer: (b) BCD−ABC

The logic followed here is:

For GHI to FGH

For KLM to JKL

The common pattern is a shift of -1 for each letter in the set.

Option 1) BBB to ZAB

The logic is not followed here as the shifts are -2, -1, 0.

Option 2) BCD to ABC

This pair follows the same logic.

Option 3) BCD to ZBB

The logic is not followed here.

Option 4) BBB to ABC

The logic is not followed here.

Thus, the pair BCD : ABC follows the same logic.

Hence, the correct answer is "Option 2".

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Q59. Answer: (a) 9

Given series:

1 4 6 9 3 7 1 1 1 9 2 9 5 4 5 3 2 4 6 1 9 9 1 9 5 2 5

Condition:

Odd → Odd → Odd

1. 9, 3, 7
2. 3, 7, 1
3. 7, 1, 1
4. 1, 1, 1
5. 1, 1, 9
6. 1, 9, 9
7. 9, 9, 1
8. 9, 1, 9
9. 1, 9, 5

There are a total of 9 such odd numbers.

Hence, the correct answer is "Option 1".

Q60. Answer: (c) Four

Given:

Only two people sit between Y and W when counted from the left of Y.

A is an immediate neighbour of B and W. Now we have 2 cases possible here,

Case 1:

Case 2:

D sits third to the left of B.

Case 1:

Case 2:

C sits fourth to the right of X.

Now, case 1 will be eliminated as there is no space for placing C and X.

Case 2:

Thus, 4 people are between C and A when counted from the left of A.

Hence, the correct answer is "Option 3".

Q61. Answer: (b) Only conclusion (II) follows.

The least possible Venn diagram for the given statement is:

Conclusions:

I. All dogs are goats - False (Because all goats are dogs, but all dogs are not necessarily goats).

II. Some lions are goats - True (Because all goats are lions, so the part of lions that are goats exists).

So, Only conclusion (II) follows.

Hence, the correct answer is Option 2.

Q62. Answer: (d) KMQ−OQU

The logic followed here is:

For MOS to QSW

For RTX to VXB

The common pattern is a shift of +4 for each letter in the set.

Option 1) KLO to NPT

The logic is not followed here as shifts are +3, +4, +5.

Option 2) KMQ to NQT

The logic is not followed here as shifts are +3, +4, +3.

Option 3) KLO to OQU

The logic is not followed here as shifts are +4, +5, +6.

Option 4) KMQ to OQU

This pair follows the same logic.

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Thus, the pair KMQ : OQU follows the same logic.

Hence, the correct answer is "Option 4".

Q63. Answer: (d) 71

Given:

Naksh's rank from the top = 45th

Naksh's rank from the bottom = 27th

Total Number of Students = (Rank from Top + Rank from Bottom) - 1

= (45 + 27) - 1

= 72 - 1

Total Number of Students = 71

Hence, the correct answer is "Option 4".

Q64. Answer: (c) Mother's father

Given:

A is				
Symbol	•	•	x	÷
Meaning	Sister	Father	Mother	Brother
of B				

Given: P - Q + C x D ÷ E

1) P - Q - means 'P is the father of Q'.

2) Q + C - means 'Q is the sister of C'.

3) C x D - means 'C is the mother of D'.

4) D ÷ E - means 'D is the brother of E'.

P Q C D E

Therefore, P is the father of C, and C is the mother of E → P is the Mother's father of E.

Hence, the correct answer is "Option 3".

Q65. Answer: (c) LFJ

The logic followed here is:

Thus, the missing letter cluster in the series is LFJ.

Hence, the correct answer is Option 3.

Q66. Answer: (b) 28

The logic followed here is:

Thus, the missing number in the series is 28.

Hence, the correct answer is "Option 2".

Q67. Answer: (a) B Y G F T

The solution for the given number/symbol coding problem is as follows.

Numbers/symbols	**%**	**6**	**2**	**8**	**•**	**3**	**&**	**7**	**@**	**9**	**•**	**5**	**#**	**4**
Codes	T	W	P	H	G	L	F	U	M	B	S	Y	K	D

Given: % 5 * & 9

Applying the conditions:

Rule No. (i): If the first element is a symbol and the last element a perfect square, the codes for these two are to be interchanged.

• The first element is % (Symbol) and the last element is 9 (Perfect Square: $3^2 = 9$).

• APPLIES: The codes for % and 9 will be interchanged.

Decoding Steps:

• First element (%): Interchanged with the code for 9. The code for 9 is B. → B

• Second element (5): Direct code from the table. → Y
• Third element (*): Direct code from the table. → G
• Fourth element (&): Direct code from the table. → F
• Last element (9): Interchanged with the code for %. The code for % is T. → T
Thus, the code for the group % 5 * & 9 is BYGFT.
Hence, the correct answer is "Option 1".

Q68. Answer: (a) 14 km to the east

Given:
Arman starts from point A and drives 44 km towards south.
He then takes a left turn, drives 42 km, turns left and drives 51 km.
He then takes a left turn and drives 56 km.
He takes a final left turn, drives 7 km and stops at point P.
Drawing the diagram according to the given information,
From the diagram, point P is located 14 km to the West of point A.
To reach point A again from point P, Arman should drive 14 km to the East.
Hence, the correct answer is Option 1;

Q69. Answer: (b) Four

Given:
Seven boxes (M, N, O, P, Q, R, S) are kept one over the other from 1 (bottom) to 7 (top).
1) Only two boxes are kept below S.
2) Only one box is kept above Q.
3) Only one box is kept between Q and P.

Position	Box
7 (Top)	
6	Q
5	
4	P
3	S
2	
1 (Bottom)	

4) R is kept immediately above N.
5) O is kept at some place below M.
Final Arrangement:

7	M
6	Q
5	O
4	P
3	S
2	R
1	N

Thus, the boxes between M and R are four (Q, O, P, S).
Hence, the correct answer is "Option 2".

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Q70. Answer: (a) QJ-MF-IL

Given:

The logic followed here is.

The pattern is: First letters (-4, -4), Second letters (-4, +6).

For WP-SL-OR

For TM-PI-LO

Option 1) QJ-MF-IL

This matches the required pattern.

Hence, the correct answer is "Option 1".

Q71. Answer: (d) 147

The logic followed here is:

Thus, the missing term in the series is 147.

Hence, the correct answer is "Option 4".

Q72. Answer: (a) (9, 180, 20)

The logic follows here is:

Logic: (First Number × Third Number) = Second Number

For (12, 240, 20):

12 × 20 = 240

For (10, 150, 15):

10 × 15 = 150

Option 1: (9, 180, 20)

9 × 20 = 180

This follows the logic.

Option 2: (8, 100, 15)

8 × 15 = 120 ≠ 100

Option 3: (15, 225, 16)

15 × 16 = 240 ≠ 225

Option 4: (8, 90, 15)

8 × 15 = 120 ≠ 90

Thus, (9, 180, 20) is the only set that follows the same operation.

Hence, the correct answer is "Option 1".

Q73. Answer: (d) BQC 24

The logic followed here is:

Thus, the missing term in the series is BQC 24.

Hence, the correct answer is Option 4.

Q74. Answer: (c) 3

Given coded language is:

Thus, 3 is the number for the letter R.

Hence, the correct answer is Option 3.

Q75. Answer: (c) D

Given:

Five people, A, B, C, D and E, are sitting in a row, facing north.

E sits second to the left of A.

Only two people sit between A and B.

B sits between D and E.

Thus, D sits at the extreme left end of the row.

Hence, the correct answer is Option 3;

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Q76. Answer: (d) 923

The logic followed here is:

Thus, the missing term in the series is 923.

Hence, the correct answer is "Option 4";

Q77. Answer: (a) Two

Given the number: 6437585

The rules for transformation are:

• For each odd digit: Add 1 (+ 1)

• For each even digit: Subtract 2 (- 2)

Position	1st	2nd	3rd	4th	5th	6th	7th
Original Digit	6	4	3	7	5	8	5
Type	Even	Even	Odd	Odd	Odd	Even	Odd
New Digit	4	2	4	8	6	6	6

The new number formed is: 4248666

The digits that appear more than once are 4 and 6. There are two such digits.

Hence, the correct answer is "Option 1".

Q78. Answer: (c) OS – WY

The logic followed here is:

Option 1) EI – LN

Option 2) TX – AC

Option 3) OS – WY

The logic is not followed here as the shifts are +8 and +6.

Option 4) AE – HJ

Thus, the pair OS – WY does not belong to the group.

Hence, the correct answer is "Option 3".

Q79. Answer: (b) One

Given series:

4 3 5 2 9 7 2 8 7 2 1 8 7 4 5 5 2 3 5 5 6 9 6 3 3

Condition:

Odd → Odd → Odd

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

There is only 1 such odd number.

Hence, the correct answer is "Option 2".

Q80. Answer: (c) 8

Given number:

9612345

The operation is to arrange all the digits of the number in ascending order from left to right.

Step	1st	2nd	3rd	4th	5th	6th	7th
Original Digits	9	6	1	2	3	4	5
Ascending Order	1	2	3	4	5	6	9

The digit second from the left is 2.

The digit second from the right is 6.

Sum = 2 + 6 = 8

The sum of the digits that are second from the left and second from the right is 8.

Hence, the correct answer is "Option 3".

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Q81. Answer: (a) 129th

The correct answer is 129th Constitutional Amendment Bill.

Key Points

• 129th Constitutional Amendment Bill was passed by the 17th Lok Sabha of India on 17 December 2024. This bill is significant in the constitutional history of India.

• This amendment primarily aimed at strengthening cooperative federalism by enhancing the powers of states and providing clarity regarding certain matters of jurisdiction.

• The bill was introduced to address socio-political and administrative issues concerning governance and federal structure in India.

• The 17th Lok Sabha, elected in 2019, has been active in passing various progressive bills, including the 129th Amendment, which was one of the landmark decisions of this period.

• Constitutional amendments require a special majority in Parliament, and this bill successfully garnered the required support, showcasing the commitment of lawmakers toward national progress.

Additional Information

• Constitutional Amendments in India:

• Under Article 368 of the Indian Constitution, Parliament has the power to amend the Constitution.

• Amendments can be classified into three types: Simple majority amendments, Special majority amendments, and those requiring ratification by states.

• India has witnessed several landmark amendments, such as the 42nd Amendment (1976), which is considered the most comprehensive and controversial amendment.

• Role of Lok Sabha in Constitutional Amendments:

• The Lok Sabha plays a crucial role in passing constitutional amendment bills. A two-thirds majority of members present and voting is required for the approval of such bills.

• Members of the Lok Sabha debate the provisions of the amendment extensively before casting their votes.

• After Lok Sabha approval, the bill is sent to the Rajya Sabha for deliberation and voting.

• 17th Lok Sabha:

• The 17th Lok Sabha was constituted following the 2019 General Elections, with the Bharatiya Janata Party securing a majority.

• It has been instrumental in passing several key legislations, including the Citizenship Amendment Act (2019) and the 129th Constitutional Amendment Bill.

• The 17th Lok Sabha is noted for its focus on governance reforms and social welfare schemes.

• Process of Constitutional Amendment:

• An amendment can be introduced in either House of Parliament as a bill.

• It must be passed by both Houses with a special majority.

• In cases involving federal issues, amendments also require the ratification by half of the state legislatures.

• Once all procedures are completed, the amendment is notified by the President of India.

Important Points

• Key Legal Considerations:

• Constitutional amendments cannot alter the basic structure of the Constitution, as ruled by the Supreme Court in the Keshavananda Bharati Case (1973).

• The President of India plays a ceremonial role in signing the amendment bill into law after parliamentary approval.

• Historical Constitutional Amendments:

• 1st Amendment (1951): Added restrictions to freedom of speech and expression.

• 42nd Amendment (1976): Introduced the term “Socialist” and “Secular” in the Preamble.

• 73rd and 74th Amendments (1992): Strengthened local self-governance through Panchayati Raj Institutions and Urban Local Bodies.

• Significance of the 129th Amendment:

• It reflects the evolving needs of India's governance framework.

• Focuses on addressing administrative concerns and state-specific issues.

• Strengthens the federal structure of India by providing clarity in jurisdictional matters.

Q82. Answer: (b) 10,000

The correct answer is 10000.

Key Points

• The GenomeIndia Project is an ambitious initiative launched by the Government of India to create a comprehensive database of the genetic diversity of the Indian population.

• As of 30 April 2025, the project has successfully completed the whole genome sequencing (WGS) database of approximately 10,000 individuals.

• The project's primary goal is to map genetic variations across different regions, communities, and ethnic groups in India to better understand genetic predispositions to diseases, traits, and health conditions.

• Whole genome sequencing involves analyzing the entire DNA sequence of individuals, providing insights into genetic markers, hereditary diseases, and potential therapeutic interventions.

• The data generated from the GenomeIndia Project will be vital for research in personalized medicine, genomics-based healthcare solutions, and studying the genetic impact of environmental factors.

Additional Information

• GenomeIndia Project Overview:

• The project was initiated by the Department of Biotechnology under the Ministry of Science and Technology.

• It aims to sequence the genomes of individuals from diverse ethnic, linguistic, and geographical backgrounds in India.

• This initiative is part of a broader effort to build India's position in global genetic research and foster advancements in medical science.

• Applications of Whole Genome Sequencing:

• Whole genome sequencing provides a detailed map of an individual’s DNA, allowing researchers to identify genetic mutations and markers.

• It is used in diagnosing hereditary diseases, cancer research, drug development, and understanding human evolution.

• The data can also be employed in developing personalized medicine, tailored treatments, and preventive measures based on genetic predispositions.

• Significance for India:

• India is known for its vast genetic diversity, with numerous ethnic groups, languages, and cultures influencing genetic traits.

• The GenomeIndia Project helps in studying genetic patterns unique to the Indian population, contributing to global genomic databases.

• It aids in addressing diseases prevalent in India, such as diabetes, cardiovascular diseases, and rare genetic disorders.

• Global Context:

• Similar genome initiatives exist worldwide, such as the Human Genome Project and the UK Biobank.

• India's GenomeIndia Project aligns with these efforts, aiming to contribute to global advancements in genomics and personalized healthcare.

Important Points

• Ethical Considerations:

• The GenomeIndia Project adheres to strict ethical guidelines to ensure data privacy and security of the individuals involved.

• Informed consent is a key requirement for participants contributing their genetic data to the project.

• Technological Challenges:

• Whole genome sequencing requires advanced equipment, computational resources, and skilled researchers.

• India has invested in building the infrastructure and expertise required to execute large-scale genomic studies effectively.

• Collaboration Opportunities:

• The project provides opportunities for collaboration between academic institutions, research organizations, and healthcare providers.

• Such partnerships enhance data sharing, innovation, and application of genomic research for public health benefits.

Q83. Answer: (c) 32nd

The correct answer is 32nd.

Key Points

• SIMBEX (Singapore-India Maritime Bilateral Exercise) is an annual maritime exercise between India and Singapore, aimed at strengthening military and naval cooperation.

• The 32nd edition of SIMBEX was held in July 2025 in Singapore, showcasing advanced naval capabilities and collaborative operations between the two countries.

• The exercise includes activities such as anti-submarine warfare, maritime interdiction operations, surface warfare, and air defense exercises.

• SIMBEX reflects the strategic partnership and shared commitment to maintaining maritime security in the Indian Ocean Region (IOR) and adjacent waters.

• The 32nd edition marked another milestone in the series, highlighting the long-standing defense collaboration between the Indian Navy and the Republic of Singapore Navy.

Additional Information

• SIMBEX Overview:

• The exercise began in 1994 as a modest anti-submarine warfare drill and has evolved into a complex and advanced bilateral naval exercise.

• It aims to enhance interoperability and mutual understanding between the Indian Navy and the Republic of Singapore Navy.

• SIMBEX is a key component of the defense cooperation agreement signed between India and Singapore.

• Indian Navy's Participation:

• The Indian Navy deploys cutting-edge vessels, such as destroyers, frigates, submarines, and maritime patrol aircraft, for SIMBEX exercises.

• It also showcases operational capabilities in areas like underwater warfare, search and rescue, and naval aviation.

• Republic of Singapore Navy's Role:

• The Republic of Singapore Navy contributes its modern fleet, including Formidable-class frigates, Victory-class missile corvettes, and submarines.

• Singapore emphasizes the importance of regional maritime security and actively engages with India through SIMBEX.

• Geopolitical Significance:

• SIMBEX enhances regional stability and maritime cooperation in the Indo-Pacific region, a vital area for global trade and security.

• It underscores the importance of maintaining freedom of navigation, countering piracy, and addressing threats like terrorism in maritime domains.

Important Points

• Historical Milestones:

• The first SIMBEX exercise was conducted in 1994, focusing on anti-submarine warfare.

• Over the years, the scope of the exercise has expanded to include advanced maritime operations and joint naval drills.

• India-Singapore Defense Partnership:

• India and Singapore signed a defense cooperation agreement in 2003, strengthening military ties and fostering collaboration.

• The partnership also includes joint air force and army exercises, apart from SIMBEX.

• Key Objectives of SIMBEX:

• Enhance interoperability between the Indian Navy and the Republic of Singapore Navy.

• Promote regional maritime security and stability in the Indian Ocean Region.

• Build mutual trust and understanding through joint operational training.

• Future Prospects:

• Both nations aim to further deepen defense cooperation, leveraging SIMBEX to address emerging maritime security challenges.

• SIMBEX serves as a platform for exploring new areas of collaboration, such as cybersecurity and space-based maritime surveillance.

Q84. Answer: (c) Crew Dragon C213

The correct answer is Crew Dragon C213.

Key Points

• Crew Dragon C213 is a spacecraft developed by SpaceX under NASA's Commercial Crew Program. It is part of the Crew Dragon family of spacecraft used for crewed missions to the International Space Station (ISS).

• The spacecraft is designed for low Earth orbit missions, including transporting astronauts to and from the ISS. It is reusable and capable of carrying up to seven passengers.

• The Axiom-4 mission, a private crewed mission to the ISS organized by Axiom Space, will use Crew Dragon C213 for its transportation. This showcases the growing role of private companies in space exploration.

• Crew Dragon features advanced safety systems, including an abort system capable of propelling the spacecraft away from the rocket in case of emergencies during launch.

• The spacecraft has been a part of several successful missions, including NASA's Crew-1, Crew-2, and private missions such as Inspiration4, demonstrating its reliability and versatility.

Additional Information

• SpaceX and Crew Dragon:

• SpaceX, founded by Elon Musk, is a private aerospace manufacturer and space transportation company. It aims to reduce space transportation costs and enable the colonization of Mars.

• The Crew Dragon spacecraft is an evolution of the Dragon 1 cargo spacecraft. It is equipped with life support systems and autonomous docking capabilities.

• It is launched aboard the Falcon 9 rocket, another SpaceX innovation known for its reusability.

• Axiom Space and Axiom Missions:

• Axiom Space is a private space infrastructure developer. It aims to build the first commercial space station, which will eventually replace the ISS.

• Axiom missions, such as Axiom-4, provide opportunities for private astronauts and researchers to work aboard the ISS.

• Other Spacecraft in the Options:

• Soyuz MS-24: A Russian spacecraft operated by Roscosmos, primarily used for transporting astronauts to and from the ISS. It is not used for Axiom-4.

• Starliner: Developed by Boeing as part of NASA's Commercial Crew Program. It has not been selected for Axiom-4.

• Orion: A spacecraft developed by NASA for deep space exploration, including Artemis missions to the Moon. It is not designed for low Earth orbit missions like Axiom-4.

• Importance of Private Space Missions:

• Private missions like Axiom-4 represent a shift toward commercialization of space, enabling broader access to space exploration.

• They complement government-led missions, fostering innovation and reducing costs through competition.

Q85. Answer: (b) 6

The correct answer is 6 new Khelo India Centres.

Key Points

• The Delhi Government has announced the establishment of 6 new Khelo India Centres in 2025 to promote sports and nurture young talent in the region.

• The initiative is part of the Khelo India Scheme, a flagship program by the Ministry of Youth Affairs and Sports aimed at revitalizing the sports culture in India at the grassroots level.

• These centres will focus on identifying and training athletes in various disciplines, ensuring access to quality infrastructure, coaching, and resources.

• The centres are expected to cater to young athletes, providing them with opportunities to excel in national and international competitions.

• They will also align with the government's commitment to enhancing sports infrastructure and fostering youth engagement in sports activities across Delhi.

Additional Information

• Khelo India Scheme:

• Launched in 2018, the Khelo India Scheme aims to develop sports infrastructure, identify talent, and provide financial assistance to athletes.

• It covers various components such as Talent Identification and Development, Sports for Women, Promotion of Rural and Indigenous Games, and Sports for Peace and Development.

• The scheme also organizes the Khelo India Youth Games and Khelo India University Games to provide young athletes with a competitive platform.

• Existing Sports Infrastructure in Delhi:

• Delhi is home to several prominent sporting facilities, including the Jawaharlal Nehru Stadium, Indira Gandhi Indoor Stadium, and Major Dhyan Chand National Stadium.

• The establishment of new Khelo India Centres will further enhance sports accessibility and bridge the gap between aspiring athletes and professional training.

• Impact of Khelo India Centres:

• The centres will provide a structured pathway for young athletes to transition from grassroots to elite-level sports.

• They will also contribute to community engagement by encouraging local participation and fostering a culture of fitness and sportsmanship.

• Delhi Government's Initiatives in Sports:

• The Delhi Government has been actively promoting sports through initiatives like Mission Excellence, which provides financial support to athletes.

• The new Khelo India Centres will complement these efforts, ensuring a holistic approach to sports development in the region.

Important Points

• Khelo India Youth Games:

• These games are organized annually and serve as a platform for young athletes to showcase their talent.

• The games include a wide range of sporting disciplines such as athletics, archery, basketball, boxing, football, gymnastics, judo, swimming, and more.

• The 2023 edition of the games was hosted in Bhopal, Madhya Pradesh.

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• Indigenous Sports Promotion:

• As part of the Khelo India initiative, indigenous sports like Kabaddi, Kalaripayattu, Kho-Kho, and Mallakhamb are being promoted to preserve and popularize traditional games.

• This ensures the inclusivity and cultural representation of sports across India.

Q86. Answer: (d) Jalen Hurts

The correct answer is Jalen Hurts.

Key Points

• Jalen Hurts, quarterback for the Philadelphia Eagles, won the BET Sportsman of the Year Award 2025, recognizing his outstanding performance in the NFL and his influence both on and off the field.

• The award is presented by BET to celebrate athletes who have demonstrated exceptional skills, sportsmanship, and contributions to society.

• In the 2024 NFL season, Jalen Hurts showcased extraordinary leadership and skill, leading the Eagles to the playoffs and earning accolades for his performance under pressure.

• Hurts is known for his versatility as a quarterback, combining strong passing accuracy with the ability to execute rushing plays effectively.

• Off the field, Hurts has been actively involved in community service initiatives, reflecting his commitment to social causes and inspiring young athletes.

Additional Information

• About Jalen Hurts:

• Born on August 7, 1998, in Houston, Texas, Jalen Hurts played college football at Alabama and Oklahoma.

• Drafted by the Philadelphia Eagles in the second round of the 2020 NFL Draft, Hurts quickly established himself as a rising star in the league.

• Hurts is celebrated for his dual-threat quarterback capabilities, excelling in both passing and rushing.

• BET Sportsman of the Year Award:

• Organized by Black Entertainment Television (BET), this award honors athletes who excel in their respective sports and positively impact society.

• Previous recipients include notable figures such as LeBron James and Serena Williams.

• Season Highlights:

• During the 2024 season, Hurts delivered several standout performances, including a career-high passing yardage game against a divisional rival.

• His ability to lead the Eagles' offense and adapt to challenging situations has earned him respect from fans and analysts alike.

• Community Contributions:

• Jalen Hurts is actively involved in initiatives supporting youth education, sports programs, and mental health awareness.

• He has partnered with organizations to provide resources and mentorship to underserved communities.

Important Points

• Nominees for the Award:

• Other nominees for the BET Sportsman of the Year Award 2025 included Patrick Mahomes, Lamar Jackson, and Josh Allen, all of whom delivered commendable performances in their respective NFL seasons.

• While all nominees showcased remarkable skills, Jalen Hurts stood out for his combination of athletic achievement and community impact.

• Notable Achievements:

• Hurts was ranked among the top quarterbacks in the league for his rushing touchdowns and passing efficiency during the 2024 season.

• He received All-Pro honors, further solidifying his position as one of the NFL's elite players.

Q87. Answer: (c) Thailand

The correct answer is Thailand.

Key Points

• The 6th BIMSTEC Summit was hosted by Thailand in April 2025. BIMSTEC (Bay of Bengal Initiative for Multi-Sectoral Technical and Economic Cooperation) is a regional organization comprising South Asian and Southeast Asian countries.

• BIMSTEC includes seven member countries: Bangladesh, Bhutan, India, Nepal, Sri Lanka, Myanmar, and Thailand. These nations are focused on enhancing regional cooperation across various sectors.

• The summit was attended by heads of states and governments of the member countries to discuss critical regional issues and strategies for economic and social progress.

• The theme for the 6th BIMSTEC Summit was centered around "Towards a Resilient and Prosperous Bay of Bengal Region." Thailand, as the host country, emphasized enhancing collaboration in areas such as trade, connectivity, technology, and disaster management.

• Hosting this summit showcased Thailand's commitment to strengthening regional cooperation and its strategic role as a key player in the BIMSTEC framework.

Additional Information

• About BIMSTEC:

• The Bay of Bengal Initiative for Multi-Sectoral Technical and Economic Cooperation (BIMSTEC) was established in 1997 with the aim of fostering regional integration and cooperation among member states.

• BIMSTEC focuses on 14 priority sectors, including trade, technology, energy, transport, fisheries, agriculture, public health, poverty alleviation, counter-terrorism, and environment.

• The BIMSTEC Secretariat is located in Dhaka, Bangladesh.

• Thailand's Role in BIMSTEC:

• Thailand plays a critical role in BIMSTEC due to its geographical position, connecting South Asia with Southeast Asia.

• The country has been actively involved in promoting connectivity projects, including the development of the Trilateral Highway between India, Myanmar, and Thailand.

• Thailand has also emphasized enhancing maritime cooperation and disaster management mechanisms within the BIMSTEC framework.

• Significance of the BIMSTEC Summit:

• BIMSTEC summits provide a platform for high-level discussions on regional issues, fostering collaboration among member countries to address common challenges.

• The summits aim to enhance economic growth, strengthen connectivity, and promote sustainable development in the Bay of Bengal region.

• The organization serves as a bridge between South Asia and Southeast Asia, boosting trade and cultural exchanges.

• Key Outcomes of Previous Summits:

• The 5th BIMSTEC Summit, held in Colombo, Sri Lanka, focused on the adoption of the BIMSTEC Charter and agreements on enhancing connectivity and counter-terrorism cooperation.

• Member states have consistently worked towards implementing the Master Plan for Transport Connectivity (2018-2030) to improve regional connectivity.

Important Points

• Thailand's Strategic Importance:

• Thailand is strategically located in Southeast Asia, serving as a gateway between South Asia and ASEAN countries.

• The country has been a strong advocate for regional integration and has actively participated in BIMSTEC initiatives.

• BIMSTEC and Regional Connectivity:

• BIMSTEC has been working on enhancing connectivity through projects like the India-Myanmar-Thailand Trilateral Highway and the Kaladan Multimodal Transit Transport Project.

• These projects aim to improve trade links and transportation infrastructure across the region.

• Future Prospects:

• BIMSTEC aims to expand its cooperation in areas such as blue economy, climate change adaptation, and people-to-people connectivity.

• The organization seeks to strengthen ties with other regional and global entities to address emerging challenges and opportunities.

Q88. Answer: (c) Heart Lamp: Selected Stories

The correct answer is Heart Lamp: Selected Stories.

Key Points

• Heart Lamp: Selected Stories is a renowned Kannada short-story collection that achieved a historic milestone in 2025 by being the first-ever Kannada work to win the International Booker Prize.

• The collection is celebrated for its profound exploration of human emotions, cultural nuances, and socio-political commentary through the medium of short stories.

• It was authored by a prominent Kannada writer who has been recognized for their significant contributions to Indian literature and the Kannada language.

• The International Booker Prize is awarded annually for a book translated into English, and Heart Lamp: Selected Stories was lauded for both its original narrative and the quality of its translation, which made it accessible to a global audience.

• This achievement not only brought international recognition to Kannada literature but also spotlighted regional Indian languages

on the world stage.

Additional Information

• About the International Booker Prize:

• The International Booker Prize is awarded every year to a book translated into English and published in the UK or Ireland.

• It celebrates both the original author and the translator, with the prize money being equally divided between them.

• The award focuses on promoting diverse literary works from around the world and highlighting the importance of translation in global literature.

• Kannada Literature:

• Kannada is one of the classical languages of India and has a rich literary history spanning over a thousand years.

• Prominent Kannada literary figures include Kuvempu, U.R. Ananthamurthy, and Girish Karnad, who have contributed immensely to Indian literature.

• Kannada literature is known for its poetry, novels, short stories, and plays, often reflecting the cultural and socio-political landscape of Karnataka.

• Impact of the Booker Prize on Regional Literature:

• Winning an international award like the Booker Prize brings global recognition to regional literature and helps in preserving linguistic diversity.

• It encourages translation efforts, making regional works accessible to a wider audience.

• Such achievements can inspire other regional authors and translators to strive for excellence and reach global platforms.

• Other Notable Kannada Works:

• Samskara by U.R. Ananthamurthy – An acclaimed novel that explores caste and morality in Indian society.

• Mookajjiya Kanasugalu by Shivaram Karanth – A masterpiece that won the Jnanpith Award, focusing on philosophy and spirituality.

• Malegalalli Madumagalu by Kuvempu – A classic novel set in the rural landscape of Karnataka.

Important Points

• Translation and Global Reach:

• The translation of regional works into English is critical for reaching global audiences and fostering cross-cultural understanding.

• The translator of Heart Lamp: Selected Stories played a crucial role in preserving the essence of the original while making it accessible to non-Kannada readers.

• Regional Literature in India:

• India is home to 22 scheduled languages, each with its own rich literary tradition.

• Promoting regional literature helps in preserving these languages and their unique cultural heritage.

• Awards like the Booker Prize inspire efforts to document and translate regional works, ensuring their survival for future generations.

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Q89. Answer: (d) Gaganyaan

The correct answer is Gaganyaan.

Key Points

• Gaganyaan is India's first human spaceflight mission under the ambitious India's Space Vision, 2047.

• The mission was announced by Prime Minister Narendra Modi on August 15, 2018, during his Independence Day speech.

• Gaganyaan aims to send a crew of three astronauts into low Earth orbit for a period of up to seven days.

• This mission is being developed under the leadership of the Indian Space Research Organisation (ISRO), with significant advancements in space technology and infrastructure.

• The Economic Survey 2024–25 highlighted Gaganyaan as a key milestone in India's space exploration strategy, contributing to technological innovation and national pride.

• Unmanned mission tests for Gaganyaan are being conducted to ensure the safety and reliability of the crewed flight.

Additional Information

• India's Space Vision, 2047:

• A long-term strategic plan by ISRO to position India as a global leader in space exploration and technological development.

• Focuses on human spaceflight, interplanetary missions, space station establishment, and advancements in satellite communication.

• Includes missions like Gaganyaan, Chandrayaan-3, Aditya-L1, and future Mars exploration missions.

• Gaganyaan Mission Features:

• The spacecraft consists of an orbital module that houses a crew module and a service module.

• The crew module is equipped with life-support systems and environmental controls to ensure astronaut safety.

• ISRO plans to collaborate with international space agencies like NASA, Roscosmos, and the European Space Agency (ESA) for technological support.

• The mission will use the GSLV Mk III rocket, which is India's most powerful launch vehicle.

• Training of Astronauts:

• Indian astronauts, referred to as Vyomanauts, are undergoing specialized training for spaceflight in collaboration with Russia.

• The training includes simulations of zero-gravity conditions, survival techniques, and spacecraft operations.

• Other Missions Mentioned:

• Vikram: Refers to the Vikram lander used in Chandrayaan missions for lunar exploration. It is not a human spaceflight mission.

• Samudrayaan: A project for deep-sea exploration under the Ministry of Earth Sciences. It focuses on ocean resources and is unrelated to spaceflight.

• Mangalyaan: Also known as the Mars Orbiter Mission (MOM), launched in 2013, aimed at studying Mars. It is an interplanetary mission and not a human spaceflight mission.

Important Points

• Gaganyaan Budget: The mission has an estimated cost of Rs. 10,000 crore, making it one of India's most expensive space projects.

• ISRO's Achievements: Gaganyaan marks a significant milestone in ISRO's journey, which has included missions like Chandrayaan, Mangalyaan, and PSLV launches.

• Global Impact: Successful execution of Gaganyaan would position India as the fourth nation to achieve human spaceflight capability after the USA, Russia, and China.

• Technological Innovations: The mission will drive advancements in aerospace engineering, robotics, life-support systems, and space medicine.

• Future Plans: Following Gaganyaan, ISRO plans to explore space station development and interplanetary human missions.

Q90. Answer: (a) 99.62%

The correct answer is 0.9962.

Key Points

• The Sustainable Development Goals (SDGs) aim to ensure universal access to safe drinking water by 2030, as part of Goal 6 (Clean Water and Sanitation).

• According to the National Indicator Framework (NIF) Progress Report 2025, the percentage of the population in rural areas using improved drinking water sources increased from 94.57% in 2015-16 to 99.62% in 2024-25.

• Improved drinking water sources include piped water supply, borewells, protected springs, and rainwater collection systems, ensuring safe and reliable access.

• This progress highlights India's commitment to achieving the SDGs by addressing rural water challenges through programs such as the Jal Jeevan Mission.

• The increase from 94.57% to 99.62% represents a significant improvement, nearing universal access to safe drinking water in rural India.

Additional Information

• Sustainable Development Goal 6 (SDG 6):

• It aims to ensure the availability and sustainable management of water and sanitation for all by 2030.

• Key targets include achieving universal and equitable access to safe and affordable drinking water, improving water quality, and ensuring integrated water resource management.

• Jal Jeevan Mission:

• Launched in 2019, this government initiative aims to provide functional household tap connections (FHTC) to every rural household by 2024.

• It focuses on ensuring safe and adequate drinking water through individual household tap connections and strengthening water resource management.

• National Indicator Framework (NIF):

• The NIF is a framework developed by the Indian government to monitor progress on the SDGs at the national and sub-national levels.

• It consists of a set of indicators aligned with the SDGs to track India's performance and highlight areas needing improvement.

• Improved Drinking Water Sources:

• These include piped water on premises, public taps, tube wells, boreholes, protected dug wells, protected springs, and rainwater collection systems.

• Such sources are less likely to be contaminated and are considered reliable for safe drinking water.

Important Points

• Progress in Rural Water Access:

• The increase from 94.57% to 99.62% indicates significant progress under government initiatives like Jal Jeevan Mission and Swachh Bharat Mission.

• It reflects improved infrastructure, better management, and community participation in water resource management.

• Challenges in Achieving Universal Access:

• Despite progress, challenges remain in terms of water quality, contamination, and equitable access in remote or underdeveloped areas.

• Ongoing efforts are required to address these challenges and ensure sustainable water resource management.

Q91. Answer: (d) Test series trophy

The correct answer is Test series trophy.

Key Points

• The Anderson-Tendulkar Trophy was introduced in June 2025 to honor two of the most iconic figures in cricket history: James Anderson of England and Sachin Tendulkar of India.

• This trophy is associated with the Test series played between India and England. It symbolizes the cricketing rivalry and respect shared between these two nations in the longest format of the game.

• James Anderson, a legendary fast bowler, is England's highest wicket-taker in Tests, while Sachin Tendulkar is regarded as one of the greatest batsmen in the history of cricket.

• The renaming of the trophy was seen as a tribute to their outstanding contributions to the game and their ability to inspire multiple generations of cricket fans worldwide.

• Test cricket is considered the pinnacle of the sport, and associating the series trophy with such legendary players emphasizes the importance of the format.

Additional Information

• James Anderson:

• Born on July 30, 1982, in Burnley, England, Anderson is regarded as one of the greatest fast bowlers in cricket history.

• He is the highest wicket-taker for England in Test cricket, with over 600 wickets.

• Known for his ability to swing the ball in all conditions, Anderson has been a key player for England since his debut in 2003.

• Sachin Tendulkar:

• Born on April 24, 1973, in Mumbai, India, Tendulkar is widely regarded as the greatest batsman in the history of cricket.

• He is the highest run-scorer in both Test and ODI cricket, with over 15,000 Test runs and 18,000 ODI runs.

• Tendulkar's career spanned over two decades, during which he set numerous records, including 100 international centuries.

• Test Cricket:

• It is the oldest and most traditional format of the game, played over five days.

• Test cricket is known for its strategic depth and is considered the ultimate challenge for cricketers.

• Famous rivalries in Test cricket include the Ashes (England vs. Australia) and the Border-Gavaskar Trophy (India vs. Australia).

• Other Cricket Trophies:

• ODI Trophy: Associated with one-day international cricket, such as the ICC Cricket World Cup.

• IPL Trophy: Awarded to the winner of the Indian Premier League, a T20 franchise tournament.

• T20 Trophy: Includes trophies like the ICC T20 World Cup, contested in the shortest format of the game.

Important Points

• The renaming of the trophy to the Anderson-Tendulkar Trophy aims to strengthen the cricketing bond between India and England.

• Such initiatives highlight the importance of recognizing individual contributions to the sport at an international level.

• This is not the first time a Test series trophy has been named after cricket legends; for instance, the Border-Gavaskar Trophy is named after Allan Border (Australia) and Sunil Gavaskar (India).

Q92. Answer: (b) National Co-operative Bank and Cosmos Co-operative Bank

The correct answer is National Co-operative Bank and Cosmos Co-operative Bank.

Key Points

• The Reserve Bank of India issued a notification in January 2025 regarding the merger of National Co-operative Bank and Cosmos Co-operative Bank.

• The merger decision was based on the need to strengthen the financial stability of the co-operative banking sector and improve operational efficiency.

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• National Co-operative Bank has a strong presence in the co-operative banking sector, primarily catering to urban and semi-urban areas.

• Cosmos Co-operative Bank, established in 1906, is one of the oldest and largest co-operative banks in India, offering services like deposits, loans, and digital banking.

• The merger aims to leverage the combined resources and infrastructure to provide better services to customers and ensure enhanced credit flow to the priority sectors.

Additional Information

• National Co-operative Bank:

• Established to provide banking services to urban and semi-urban areas, focusing on co-operative principles.

• It specializes in catering to the needs of small-scale industries, traders, and individuals.

• Offers a range of services including savings accounts, fixed deposits, loans, and financial advisory.

• Cosmos Co-operative Bank:

• Founded in 1906, Cosmos Co-operative Bank is headquartered in Pune, Maharashtra.

• It operates in more than 10 states of India with a network of branches and ATMs.

• Provides services such as retail banking, corporate banking, insurance, mutual funds, and digital banking solutions.

• Reserve Bank of India's Role:

• The RBI regulates co-operative banks under the Banking Regulation Act, 1949.

• Ensures financial stability by approving mergers and monitoring their implementation.

• Promotes consolidation in the co-operative banking sector to strengthen capital adequacy and operational efficiencies.

• Benefits of Merging Co-operative Banks:

• Improved capital base and resource allocation.

• Enhanced customer service through integrated infrastructure.

• Better compliance with regulatory norms and risk management practices.

• Increased ability to cater to priority sectors like agriculture and small businesses.

Important Points

• Co-operative Banking in India:

• Co-operative banks are governed by both state co-operative laws and RBI regulations.

• They primarily cater to the financial needs of rural and semi-urban areas, focusing on agriculture, small-scale industries, and self-employment.

• Operate based on the principles of mutual assistance and co-operation.

• Recent Mergers:

• Several co-operative banks have merged in recent years to enhance their financial health and operational efficiencies.

• Example: PMC Bank merged with Unity Small Finance Bank in 2022.

Q93. Answer: (c) Vadi Samvad Diwas' allowing citizens to engage directly with investigators

The correct answer is Vadi Samvad Diwas.

Key Points

• Vadi Samvad Diwas was introduced by the Ghaziabad Police, Uttar Pradesh, in September 2025 as a community-focused transparency initiative aimed at building trust between citizens and the police.

• The initiative allows citizens to engage directly with investigators to discuss and resolve their cases transparently and effectively.

• This program ensures accessibility and accountability in investigations by providing a platform for individuals to interact with police officials face-to-face.

• The initiative specifically focuses on case updates, addressing public grievances, and ensuring citizens' concerns are heard without bureaucratic hurdles.

• Public engagement through such initiatives helps to strengthen community-police relations and fosters a sense of mutual trust and cooperation.

Additional Information

• Police Outreach Day:

• This initiative involves organizing community events where citizens can discuss neighborhood safety concerns and seek solutions collaboratively with local law enforcement.

• While it aims to improve community relations, it does not focus on individual case updates or direct investigator interaction, unlike Vadi Samvad Diwas.

• Public Accountability Meet:

• This involves the release of monthly action reports by the police to keep the public informed about their activities and

performance.

• It enhances transparency at a macro level, but it does not provide a platform for personal engagement or case-specific discussions with investigators.

• Jan Sunwai Sabha:

• This program allows direct interaction between citizens and police officers to address grievances and discuss broader issues affecting public safety.

• While it promotes dialogue, it is more general in nature and not specifically designed for investigator-citizen engagement on specific cases like Vadi Samvad Diwas.

• Importance of Community Policing:

• Community-focused initiatives like Vadi Samvad Diwas are part of broader efforts to integrate police services with public needs, ensuring transparency, trust, and efficiency in law enforcement.

• Such initiatives are aligned with global best practices in policing, promoting citizen-centric governance.

Important Points

• Transparency in Law Enforcement: Programs like Vadi Samvad Diwas reflect the importance of transparent police operations to ensure public confidence in law enforcement processes.

• Community Engagement: Effective policing depends on active community participation, with citizens acting as stakeholders in maintaining safety and security.

• Trust Building: Initiatives fostering direct dialogue between citizens and investigators reduce instances of mistrust and encourage collaborative problem-solving.

• Global Best Practices: Similar initiatives are seen in countries like the United States and United Kingdom, where community policing focuses on partnerships and proactive problem-solving.

Q94. Answer: (b) Animesh Kujur

The correct answer is Animesh Kujur.

Key Points

• Animesh Kujur broke the Indian national record in the men's 200 m at the 2025 Asian Athletics Championships.

• He clocked 20.32 seconds in the men's 200 m event, improving the previous Indian record of 20.52 seconds held by Amlan Borgohain.

• The performance marked a significant milestone in Indian sprinting, as Kujur became the first Indian man to dip below the 20.40-second barrier in the 200 m.

• The 2025 Asian Athletics Championships were held in Gumi, South Korea, from 27 to 31 May 2025.

• Hence, the correct answer is Animesh Kujur.

Additional Information

• Animesh Kujur:

• Animesh Kujur is an Indian sprinter specialising in the 100 m and 200 m events.

• His record-breaking performance in 2025 established him as one of India's leading emerging short-distance sprinters.

• His 20.32-second performance significantly lowered the national benchmark in the men's 200 m.

• Amlan Borgohain:

• Amlan Borgohain previously held the Indian men's 200 m national record with a time of 20.52 seconds.

• He is also a prominent Indian sprinter who has represented India in major international athletics competitions.

• 2025 Asian Athletics Championships:

• The championship was the 26th edition of the Asian Athletics Championships.

• It was hosted by Gumi, South Korea, in May 2025.

• The competition brought together leading athletes from across Asia in track and field events.

• Men's 200 m National Record:

• The record progression highlights the improvement in Indian men's sprinting.

• Animesh Kujur — 20.32 seconds (2025) replaced the earlier national benchmark of 20.52 seconds set by Amlan Borgohain.

Important Points

• Record holder: Animesh Kujur

• Event: Men's 200 m

• Record time: 20.32 seconds

• Previous record holder: Amlan Borgohain

• Previous record: 20.52 seconds

• Championship: 2025 Asian Athletics Championships

• Venue: Gumi, South Korea

Q95. Answer: (c) 59%

The correct answer is 0.59%.

Key Points

• India's seismic zone classification: India is divided into four seismic zones (Zone II, III, IV, and V) based on earthquake risk. Zone V is the most earthquake-prone, while Zone II is the least.

• Percentage of earthquake-prone areas: As per the latest data available until March 2025, approximately 0.59% of India's total geographical area is classified as highly earthquake-prone (Zone V).

• Regions under Zone V: The areas in Zone V include parts of northeastern India, the Himalayan region, and areas in western and central India that are prone to frequent seismic activity.

• Historical earthquakes: India has experienced devastating earthquakes such as the Bhuj earthquake (2001), the Uttarkashi earthquake (1991), and the Kashmir earthquake (2005), highlighting the importance of seismic monitoring.

• Government initiatives: The Government of India has implemented various measures, such as the National Disaster Management Authority (NDMA), to enhance earthquake preparedness and minimize risks.

Additional Information

• Seismic Zones in India:

• Zone II: Least active zone covering areas with minimal seismic activity.

• Zone III: Moderately active zone including parts of central India and the Gangetic plains.

• Zone IV: High-risk areas such as Delhi, parts of Punjab, and some Himalayan regions.

• Zone V: Extremely high-risk areas such as northeastern India, Andaman and Nicobar Islands, and parts of Kashmir.

• National Disaster Management Authority (NDMA): Established under the Disaster Management Act, 2005, NDMA focuses on disaster preparedness, mitigation, and response strategies.

• Causes of Earthquakes: Earthquakes are caused by tectonic plate movements, volcanic eruptions, and human activities such as mining or reservoir-induced seismicity.

• Impact of Earthquakes: Earthquakes can lead to loss of lives, destruction of infrastructure, and displacement of communities, necessitating effective disaster management practices.

• Building Codes: The Bureau of Indian Standards (BIS) has developed seismic design codes to ensure buildings are resistant to earthquake forces.

Important Points

• Earthquake Magnitude Scale: Earthquakes are measured using the Richter scale, which quantifies the amount of energy released during a seismic event.

• Government Policies: The Government has launched initiatives like the National Earthquake Risk Mitigation Project (NERMP) to reduce vulnerabilities.

• Public Awareness: Regular public awareness campaigns are conducted to educate citizens on earthquake safety measures.

• Global Collaboration: India collaborates with international organizations for seismic research and disaster management, such as the UN Office for Disaster Risk Reduction (UNDRR).

Q96. Answer: (d) Madhya Pradesh

The correct answer is Madhya Pradesh.

Key Points

• The Brahma–BEML Rail Manufacturing Hub is a significant initiative aimed at boosting railway manufacturing infrastructure in India, with its foundation stone laid in August 2025.

• This hub is located in the state of Madhya Pradesh, which was chosen due to its strategic location, availability of skilled labor, and industrial growth potential.

• It is expected to reduce unemployment by creating numerous direct and indirect job opportunities, especially for local youth in the region.

• The project aligns with the government's vision of Aatmanirbhar Bharat (self-reliant India) by promoting domestic manufacturing and reducing reliance on imports in the railway sector.

• Once operational, the hub will manufacture rolling stock, components, and other railway equipment, enhancing the overall capacity and efficiency of India’s railway infrastructure.

Additional Information

• Brahma–BEML Partnership:

• The project is a collaboration between Brahma Group and BEML Limited, a leading player in the manufacturing of heavy equipment, including railway and metro coaches.

• This partnership aims to combine technological expertise and financial resources for creating world-class railway manufacturing

infrastructure.

• Importance of Madhya Pradesh:

• Madhya Pradesh is centrally located, making it a strategic hub for logistics and distribution of manufactured railway components.

• The state government has been actively promoting industrial development by offering incentives and creating an investor-friendly environment.

• Boost to Employment:

• The hub is expected to create thousands of jobs, both directly in manufacturing and indirectly in allied sectors such as logistics, supply chain, and maintenance.

• It will also provide skill development opportunities for local youth, enhancing their employability in the industrial sector.

• Contribution to Indian Railways:

• The Brahma–BEML Rail Manufacturing Hub will contribute significantly to the modernization and expansion of Indian Railways.

• It will help meet the growing demand for rolling stock, including coaches, wagons, and locomotives, required for high-speed and freight corridors.

• Aatmanirbhar Bharat Initiative:

• This project is a step towards achieving the goals of the Aatmanirbhar Bharat Abhiyan by reducing dependency on imported railway equipment.

• It emphasizes indigenous production and aims to position India as a global leader in railway manufacturing.

Important Points

• BEML Limited:

• BEML (formerly Bharat Earth Movers Limited) is a public sector undertaking under the Ministry of Defence, Government of India.

• It specializes in manufacturing equipment for railways, defense, and construction industries.

• Railway Manufacturing in India:

• India has been actively working on expanding its railway manufacturing capabilities to cater to domestic and international demand.

• Notable initiatives include the Make in India program, which encourages foreign and domestic investment in the manufacturing sector.

• Economic Impact:

• The establishment of the Brahma–BEML Rail Manufacturing Hub is expected to boost the GDP of Madhya Pradesh and contribute to India’s overall economic growth.

• It will also improve infrastructure and promote regional development in the surrounding areas.

Q97. Answer: (c) Ek Ped Maa Ke Naam 2.0

The correct answer is Ek Ped Maa Ke Naam 2.0.

Key Points

• Ek Ped Maa Ke Naam 2.0 is an initiative launched by the Indian Prime Minister on World Environment Day in 2025.

• This program is an extension of the original "Ek Ped Maa Ke Naam" initiative, which aimed to encourage citizens to plant trees in honor of their mothers.

• The initiative focuses on promoting afforestation, creating green spaces, and increasing environmental awareness among citizens.

• Specific measures under the program include distributing free saplings, organizing tree-planting drives, and conducting workshops on sustainable practices.

• The initiative aligns with India's commitment to the Paris Agreement and its goal of enhancing carbon sinks through afforestation and reforestation.

Additional Information

• World Environment Day:

• Celebrated annually on 5th June, it is a global platform to raise awareness and take action for environmental conservation.

• The theme for World Environment Day 2025 was "Restoring Balance: Nature and Humanity", emphasizing the need for sustainable practices.

• Paris Agreement:

• A landmark global treaty adopted in 2015 under the United Nations Framework Convention on Climate Change (UNFCCC).

• India has pledged to create additional carbon sinks of 2.5 to 3 billion tonnes of CO_2 equivalent by 2030 through afforestation.

• Afforestation Initiatives in India:

• Programs like National Afforestation Programme (NAP) and Green India Mission focus on increasing India's forest cover.

• India's forest and tree cover stands at 24.62% of its geographical area, as per the India State of Forest Report 2023.

• Ek Ped Maa Ke Naam (Original Initiative):

• Launched earlier to honor mothers and promote tree planting as a tribute.

• Encouraged individuals to plant a tree every year in their mother's name, creating a bond between nature and human emotions.

Important Points

• India's Environmental Goals:

• India aims to achieve net-zero carbon emissions by 2070.

• Programs like National Action Plan on Climate Change (NAPCC) focus on mitigating climate change impacts.

• Role of Citizens:

• Citizens are encouraged to actively participate in afforestation drives and adopt sustainable practices.

• Community involvement is critical for the success of initiatives like Ek Ped Maa Ke Naam.

• Global Contributions:

• India ranks among the top nations contributing to global afforestation efforts, as highlighted in the Global Forest Resources Assessment.

• Collaborations with international organizations like UNEP further bolster India's environmental initiatives.

Q98. Answer: (d) May 15

The correct answer is Fri May 15 2026 00:00:00 GMT+0530 (India Standard Time).

Key Points

• International Day of Families is observed globally every year on May 15. The day highlights the importance of families and the role they play in society.

• The theme for 2025 is focused on the role of digital technology in family life, emphasizing how technology can support family connections and enhance well-being.

• This day was proclaimed by the United Nations General Assembly (UNGA) in 1993 to promote awareness of family-related issues and enhance the knowledge of social, economic, and demographic processes affecting families.

• The observation of this day aims to inspire governments, organizations, and individuals to support and enhance family-oriented policies worldwide.

• May 15, 2026, falls on a Friday, and this is when the International Day of Families will be celebrated globally.

Additional Information

• Significance of International Day of Families:

• The day is an opportunity to promote awareness about issues relating to families and to increase knowledge of the social, economic, and demographic processes affecting families globally.

• It serves as a platform for discussing the importance of family-focused policies and programs to address challenges faced by families worldwide.

• 2025 Theme - Role of Digital Technology:

• The theme underlines how digital technology can support and strengthen family bonds, especially in a world increasingly influenced by technological advancements.

• It also addresses concerns such as digital addiction, the digital divide, and the need for responsible use of technology within families.

• Historical Background:

• The International Day of Families was established by the UNGA Resolution 47/237 in 1993.

• This decision underscored the importance of families as fundamental units of society and the need to pay attention to their welfare and development.

• UN Sustainable Development Goals (SDGs) and Families:

• Many of the UN SDGs, such as ending poverty, ensuring quality education, and achieving gender equality, are directly related to the welfare of families.

• The observance of this day aligns with efforts to achieve these global goals by emphasizing family-centered solutions.

• Global Observance:

• Countries around the world organize events such as workshops, discussions, and awareness campaigns to mark the day and address family-related issues.

• The focus is often on creating policies that promote family well-being and address challenges like poverty, health, and education.

Important Points

• Digital Divide: The gap between those who have access to digital technology and those who do not, often exacerbating inequalities in education, work, and social connections within families.

• Digital Literacy: Families need to develop skills to use technology responsibly and effectively for education, communication, and

other purposes.

• Policy Implications: Governments are encouraged to create policies that bridge the digital divide, promote digital literacy, and ensure safe and equitable access to technology for all family members.

• Past Themes: Previous themes have included issues like family health, gender equality, and social inclusion, reflecting the evolving challenges faced by families globally.

• Global Participation: Organizations such as the UN, NGOs, and educational institutions actively participate in events to highlight the importance of strong family structures.

Q99. Answer: (b) April 13

The correct answer is Apr 13.

Key Points

• The Paris Marathon, officially known as the Schneider Electric Marathon de Paris, is one of the most popular and prestigious annual running events in the world.

• The 48th edition of the Paris Marathon is scheduled to be held on April 13, 2026. This date is confirmed as per the event's calendar, aligning with traditional scheduling in spring.

• The marathon typically takes place in April, making it a prominent springtime event that attracts participants globally.

• The event covers a distance of 42.195 kilometers, starting from the Champs-Élysées and ending at Avenue Foch, providing scenic views of iconic Parisian landmarks such as the Eiffel Tower and Notre Dame Cathedral.

• Participants from various categories, including professionals and amateur runners, compete in this marathon, which is recognized for its festive atmosphere and large number of participants.

Additional Information

• History of Paris Marathon:

• The Paris Marathon began in 1976, making it one of the oldest city marathons in the world.

• It has grown significantly over the years, with participation levels often exceeding 50,000 runners.

• The marathon is organized by Amaury Sport Organisation (ASO), a renowned organizer of sporting events.

• Route and Highlights:

• The marathon route is designed to showcase Paris's cultural heritage and scenic beauty, passing landmarks like the Place de la Concorde, Bois de Vincennes, and Bois de Boulogne.

• Runners experience a combination of urban landscapes and natural surroundings, making the event unique compared to other marathons.

• Eligibility and Participation:

• The marathon is open to runners aged 20 years and above, per the guidelines of the International Association of Athletics Federations (IAAF).

• Participants must register in advance, and the event often reaches full capacity due to high demand.

• The Paris Marathon is known for its diverse participation, attracting runners from over 140 countries.

• Environmental Initiatives:

• The Paris Marathon incorporates sustainability efforts, including waste management and the use of eco-friendly materials for race supplies.

• Participants are encouraged to reduce their environmental impact by using public transport and minimizing waste during the event.

• Training and Preparation:

• Runners typically follow training programs that span 16-20 weeks to prepare for the marathon's physical demands.

• Nutrition, hydration, and pacing strategies are critical for successfully completing the marathon.

• Many participants use this event as an opportunity to raise funds for charitable causes.

Important Points

• Global Significance: The Paris Marathon is ranked among the top international marathons, alongside the Boston, London, and New York City marathons.

• Economic Impact: The event contributes significantly to Paris's economy, attracting tourists, generating revenue for local businesses, and creating jobs.

• Registration Process: Registration for the marathon typically opens several months in advance, and participants must pay an entry fee. Early registration often provides discounts.

• Medical Facilities: The marathon ensures comprehensive medical support, with stations set up along the route to assist runners in case of emergencies.

• Charity Contributions: Many participants use the marathon platform to support global and local charities, raising substantial funds through sponsorships and donations.

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Q100. Answer: (c) tree felling in agricultural lands

The correct answer is tree felling in agricultural lands.

Key Points

• The Union Ministry of Environment, Forest and Climate Change issued Model Rules on 29 June 2025 to regulate and streamline tree felling in agricultural lands. This aims to ensure sustainable use of resources and protect environmental balance.

• Tree felling in agricultural lands is a critical activity that requires proper regulation, as it impacts biodiversity, soil health, and carbon sequestration.

• The Model Rules aim to simplify the procedural requirements for farmers and landowners while maintaining compliance with environmental norms and forest laws.

• The regulations are essential to prevent indiscriminate deforestation, encourage sustainable agricultural practices, and ensure that farmers comply with national and international environmental standards.

• The rules provide clarity on the types of trees that can be felled, the permissions required, and the replanting obligations to mitigate the ecological impact.

Additional Information

• Impact of Tree Felling on Agriculture:

• Soil Erosion: Trees play a crucial role in preventing soil erosion. Their removal can lead to the loss of fertile topsoil, negatively affecting agricultural productivity.

• Biodiversity Loss: Trees provide shelter and food for various organisms. Indiscriminate tree felling disrupts ecosystems, leading to biodiversity loss.

• Carbon Sequestration: Trees absorb carbon dioxide, helping mitigate climate change. Their removal reduces the land's ability to sequester carbon.

• Microclimate Regulation: Trees influence local weather patterns, including temperature and humidity levels. Removing them can make agricultural lands less favorable for farming.

• Regulations and Permissions for Tree Felling:

• Under the Indian Forest Act, 1927, and various state-specific laws, tree felling often requires prior approval from forest departments.

• Farmers may need to follow specific procedures, including obtaining a tree-felling permit, documenting the purpose, and complying with replanting norms.

• Some states provide exemptions for certain species, such as subabul and eucalyptus, which are grown primarily for commercial purposes.

• Sustainable Tree Management Practices:

• Agroforestry: Farmers can integrate trees into agricultural systems to balance production with ecological conservation.

• Selective Logging: Instead of clear-cutting, selective logging preserves the overall ecological balance while allowing resource use.

• Replanting Mandates: Governments often require replanting trees to ensure sustainability and compensate for the ecological loss.

• Government Initiatives:

• National Agroforestry Policy, 2014: Encourages the integration of trees into agricultural landscapes for ecological and economic benefits.

• Compensatory Afforestation Programme: Mandates replanting trees in designated areas to offset deforestation impacts.

• Green India Mission: Aims to restore degraded ecosystems, enhance tree cover, and combat climate change.

Important Points

• State-Specific Rules: Different states in India have varying rules for tree felling. For example, Maharashtra and Karnataka have specific guidelines for farmers.

• Species Exemptions: Certain fast-growing or commercially valuable species are exempt from felling restrictions to promote economic activities.

• Penalties for Non-Compliance: Violating tree-felling rules can result in fines, penalties, and legal actions under environmental laws.

• Environmental Impact Assessments (EIA): Large-scale tree felling often requires an EIA to evaluate the ecological and social consequences.

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