RRB Group D Official Paper (Held On: 14 Dec, 2025 Shift 1) (Previous Year Paper)

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

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GENERAL SCIENCE

Q1. Which of the following is the correct symbol for the element lead?

(a) Le
(b) Lb
(c) Pb
(d) Ld

Q2. The phenomenon of spreading out and mixing of a substance with another substance due to the motion of its particles is called which of the following?

(a) Sublimation
(b) Diffusion
(c) Condensation
(d) Evaporation

Q3. Which of the following statements is true about potential energy?

(a) It is always zero at the ground level.
(b) It can be negative depending on the reference point.
(c) It cannot be converted into kinetic energy.
(d) It depends only on mass.

Q4. The process of fission in an amoeba results in the formation of _____.

(a) two similar sized, genetically identical daughter cells
(b) a large number of small, genetically identical daughter cells
(c) four genetically different daughter cells
(d) a small daughter cell and a large mother cell that are genetically different

Q5. What is anode mud?

(a) Insoluble impurities settle at cathode in electrolytic refining
(b) Soluble impurities in solution in electrolytic refining
(c) A solution of soil and water
(d) Insoluble impurities settle at anode in electrolytic refining

Q6. Which of the following statements regarding the need for macronutrients in plants is correct?

(a) Macronutrients are not required by plants at all.
(b) Macronutrients are required by plants in large quantities.
(c) Macronutrients are harmful to plants if absorbed.
(d) Macronutrients are needed only during flowering.

Q7. If 100 J of work is required to transfer 5 C of charge between two points, the potential difference between the points is:

(a) 10 V
(b) 50 V
(c) 20 V
(d) 25 V

Q8. A boy walks from one end A to the other end B of a straight 1000 m road in 2 minutes and then turns around and walks 400 m back to point C in another 2 minutes. What will be the average velocity (in m/s) of the boy in going from point A to point C?

(a) 2.5
(b) 25
(c) 150
(d) 15

Q9. The acceleration due to gravity on the surface of the Earth is given by:

(a) g = GM
(b) g = GM/R2
(c) g = GM/R
(d) g = R2/GM

Q10. Which of the following is an example of a decomposition reaction?

(a) $H_2 + O_2 \rightarrow H_2O$
(b) $Mg + O_2 \rightarrow MgO$
(c) $CaCO_3 \rightarrow CaO + CO_2$
(d) $Na + Cl_2 \rightarrow NaCl$

Q11. The Law of Conservation of Mass was given by:

(a) Joseph Proust
(b) Antoine Lavoisier
(c) John Dalton
(d) Ernest Rutherford

Q12. Which of the following is an application of ultrasound in industry?

(a) Increasing the speed of sound in solids
(b) Used in refrigerators for cooling
(c) Making objects lighter in weight
(d) Detecting cracks in metal blocks

Q13. Which of the following correctly compares the cell wall and cell membrane in plant and animal cells?

(a) Plant cells have both a rigid cell wall and a cell membrane, while animal cells only have a flexible cell membrane.
(b) Animal cells have both a rigid cell wall and a cell membrane, while plant cells only have a flexible cell membrane.
(c) Both plant and animal cells have a cell wall but only plant cells have a cell membrane.
(d) Neither plant nor animal cells have a cell wall, but both have a cell membrane.

Q14. Why did Mendel use true-breeding plants as parents in his crosses?

(a) To get large number of plants quickly
(b) To grow them in similar soil condition
(c) To study environmental effects on growth of plants
(d) To study inheritance patterns

Q15. Which of the following correctly shows the relationship between magnification (M), the object distances (u) and image- distance (v) ?

(a) Magnification = v/u
(b) Magnification = u + v
(c) Magnification = v × u

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(d) Magnification = u/v

Q16. According to Ohm's law, the ratio of potential difference (V) across a conductor to the current (I) through it is constant, provided _____.

(a) voltage is zero
(b) resistance changes
(c) current is very high
(d) temperature remains constant

Q17. Which of the following methods of reproduction is found in Plasmodium?

(a) Layering
(b) Multiple fission
(c) Grafting
(d) Budding

Q18. The refractive index of the second medium with respect to the first depends on the:

(a) shape of the boundary surface only
(b) intensity of the incident light
(c) colour (wavelength) of light used and the pair of media
(d) temperature of the surroundings only

Q19. Which of the following methods is commonly used to prevent rancidity in packaged food items?

(a) Flushing with nitrogen gas before sealing
(b) Heating the food before packing
(c) Storing food in oxygen-rich containers
(d) Adding acids to the food

Q20. Three solutions A, B, and C have pH values of 3, 7, and 12, respectively. Which of the following statements is correct?

(a) Solution A is strongly acidic, and solution C is strongly basic.
(b) Solution A and C both are neutral.
(c) Solution B is basic and solution C is acidic.
(d) Solution C is neutral while solution A is basic.

Q21. Which of the following is a part of the central nervous system in human?

(a) Spinal cord
(b) Pharynx
(c) Spinal nerves
(d) Cranial nerves

Q22. Which metal lies between magnesium and iron in the activity series?

(a) Zinc
(b) Copper
(c) Silver
(d) Potassium

Q23. Which cell organelle is responsible for packaging and dispatching materials within or outside the cell?

(a) Nucleus
(b) Mitochondria
(c) Ribosome
(d) Golgi apparatus

Q24. Which of the following is NOT correct for uniform velocity?

(a) Velocity is constant and acceleration is zero.
(b) The slope of the line in v-t graph is zero.
(c) The v–t graph is a horizontal line.

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(d) The area under the v–t graph gives acceleration.

Q25. Which of the following living organisms have bones that help in body movements?

(a) Snail
(b) Snake
(c) Earthworm
(d) Cockroach

MATHEMATICS

Q26. The sides of a triangle are 37 cm, 44 cm and 15 cm. What is the length of its altitude corresponding to the side with the length of 44 cm?

(a) 12 cm
(b) 45 cm
(c) 16 cm
(d) 33 cm

Q27. 1/20 is what percentage of 11/30 ? (Rounded off to two decimal places.)

(a) 27.27%
(b) 23.64%
(c) 13.64%
(d) 28.64%

Q28. A, B and C can complete a piece of work in 3, 4 and 6 days, respectively. How long (in days) will they take to complete thrice the same work, working together?

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

Q29. From a point 40 m away from the foot of a tower, the angle of elevation of the top of the tower is 45°. Find the height of the tower.

(a) 48 m
(b) 40 m
(c) 20 m
(d) 45 m

Q30. In 540 litres solution of acid and water, the ratio of acid and water is 2 : 10. How many litres of acid must be added to it to get the solution in which the ratio of acid and water is 9 : 5?

(a) 719
(b) 721
(c) 720
(d) 718

Q31. The amount on a sum of Rs. 5,200 at 10% per annum compound interest, compounded annually, in 2 years will be:

(a) Rs. 5,991
(b) Rs. 5,569
(c) Rs. 6,292
(d) Rs. 5,552

Q32. Rahul's present age is two-seventh of the present age of his grandmother. After 16 years, his age will be two-fifth of the age of his grandmother at that time. Find the present age of his grandmother.

(a) 97 years
(b) 84 years
(c) 90 years

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(d) 100 years

Q33. Arun travels from City A to City B. If Arun drives his car at 2/3 rd of his normal speed, then he reaches City B 38 minutes late. Find the time (in minutes) that Arun would have taken to travel from City A to City B if he drove at his normal speed.

(a) 76
(b) 73
(c) 81
(d) 78

Q34. The average age of 42 students in 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) 65
(b) 57
(c) 59
(d) 60

Q35. The ratio of the curved surface area to the total surface area of a solid cylinder is 3 : 5. If its volume is 12,936 cm^3, what is its height? (Use $\pi = 22/7$)

(a) 21 cm
(b) 14 cm
(c) 18 cm
(d) 28 cm

Q36. A cricketer has an average of 68 runs over 9 innings. If he scores 130 runs in the 10^(th) inning, by how many runs (rounded off to the nearest whole number) does his average score increase?

(a) 15
(b) 10
(c) 7
(d) 6

Q37. Simplify $(x - 3)^2 + (x + 3)^2$.

(a) 2x2 + 16
(b) 2x2 − 18
(c) 3x2 + 18
(d) 2x2 + 18

Q38. The greatest number that will divide 45, 95 and 185, so as to leave the same remainder in each case is:

(a) 45
(b) 95
(c) 185
(d) 10

Q39. The prices of articles of types P, Q and R are Rs. 280, Rs. 180 and Rs. 100, respectively. Rajiv purchases these articles in the ratio 3 : 4 : 3, spending a total of Rs. 27,900. How many articles of type Q did he buy?

(a) 60
(b) 48
(c) 72
(d) 84

Q40. If 20% of a number is added to 96, then the result is the same number. 65% of the same number is:

(a) 98
(b) 88
(c) 78
(d) 108

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Q41. The price of fuel decreases by 50%, 35% and 50% in three successive months, but increases by 45% in the fourth month. What is the percentage increase/decrease in the price of fuel in the fourth month as compared to its original price? (Round off the answer to two decimal places)

(a) Decreases by 76.44%
(b) Increases by 81.75%
(c) Increases by 80.11%
(d) Decreases by 74.19%

Q42. What is the average speed of a bus which covers half the distance at a speed of 72 km/hr and the other half at a speed of 90 km/hr?3565

(a) 83 km/hr
(b) 77 km/hr
(c) 84 km/hr
(d) 80 km/hr

Q43. The sum of the digits of a two-digit number is 5. If 9 is added to this number, the digits interchange their places. Find the number.

(a) 23
(b) 41
(c) 32
(d) 14

Q44. The marked price of a television set is Rs. 35,000. A shopkeeper allows a discount of 22% and gets a profit of 75%. What is the cost price of the television set?

(a) Rs. 15,600
(b) Rs. 15,570
(c) Rs. 15,662
(d) Rs. 15,714

Q45. A shopkeeper declares the given three schemes of discounts. Which of the following schemes is most beneficial to a customer?

A. Buy 5 items and get 23 of the same items free
B. Two successive discounts of 14% and 37%
C. Two successive equal discounts of 39%

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

Q46. 4 men can do a piece of work in 27 days. How many men will do it in 18 days?

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

Q47. ‘A’ buys an air conditioner for Rs. 1,50,000 and sells it to ‘B’ at a loss of 30%. ‘B’ then sells it to ‘C’ at a profit of 5% on his cost price. What is the cost price (in Rs.) of the air conditioner for ‘C’?

(a) 1,25,480
(b) 1,10,250
(c) 75250
(d) 2,10,350

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Q48. Simplify: 57 − [82 − (72 ÷ 3 − (17 − 40 ÷ 5) ÷ 9)]

(a) 3
(b) -9
(c) -8
(d) -2

Q49. In a presentation competition, Group Leo can complete a task in 9 days, while Group Tiger can finish it in 18 days if they work alone. If both groups work together, in how many days will they complete the task?

(a) 10 days
(b) 5 days
(c) 6 days
(d) 7 days

Q50. A small sphere has a radius of 5 cm. A larger sphere is created by uniformly expanding the smaller sphere. The radius of the larger sphere is 15 cm. How many times greater is the surface area of the larger sphere compared to the smaller sphere?

(a) 15 times
(b) 9 times
(c) 3 times
(d) 6 times

GENERAL INTELLIGENCE & REASONING

Q51. Refer to the given series and answer the question that follows (all numbers are single digit numbers only). Counting to be done from left to right only.

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

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

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

Q52. In a certain code language, ‘uncle ocean elf’ is coded as ‘so ex rj’ and ‘elf yak queen’ is coded as ‘ku yi ex’. How is ‘elf’ coded in that language?

(a) so
(b) ku
(c) rj
(d) ex

Q53. 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) 5 2 1 4 7 8 6 5 2 3 9 1 (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) Four
(b) One
(c) Three
(d) Two

Q54. Samar starts from point A and drives 58 km towards north. He then takes a right turn, drives 64 km, turns right and drives 63 km. He then takes a right turn and drives 66 km. He takes a final right turn, drives 5 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.)

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(a) 1 km to the east
(b) 3 km to the west
(c) 2 km to the east
(d) 4 km to the west

Q55. 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) JD-GK
(b) NH-KO
(c) LF-IM
(d) GA-DI

Q56. In a certain code language,

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

'A – B' means 'A is the brother of B'

'A × B' means 'A is the wife of B'

'A ÷ B' means 'A is the father of B'

Based on the above, how is D related to J if 'D × F + G – H ÷ J'?

(a) Father's brother's son's daughter
(b) Mother's brother's son's wife
(c) Father's brother's son's wife
(d) Mother's brother's son's daughter

Q57. If 'A' stands for '÷', 'B' stands for 'x', 'C' stands for '+' and 'D' stands for '-', what will come in place of the question mark '?' in the following equation?

45 A 9 B 13 C 15 D 17 = ?

(a) 61
(b) 62
(c) 64
(d) 63

Q58. Which of the following letter-number clusters will replace the question mark (?) in the given series to make it logically complete?

OPD73, RMG70, UJJ67, ?

(a) YHM63
(b) XHN63
(c) YGN64
(d) XGM64

Q59. Seven boxes B, C, D, I, J, K and L are kept one over the other but not necessarily in the same order. Only four boxes are kept above L. Only one box is kept above J. Only one box is kept between J and C. B is kept immediately above D. K is kept at some place below I. How many boxes are kept between I and B?7082

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

Q60. If + means -, - means x, x means ÷, ÷ means +, then what will come in place of the question mark (?) in the following equation?

18 - 6 ÷ 228 + 46 x 2 = ?

(a) 334
(b) 309
(c) 313

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(d) 326

Q61. Six people, A, B, C, D, E and F, are sitting in a row, facing north. Only two people sit to the left of F. Only one person sits between D and E. F sits to the immediate left of D. A sits to the immediate right of C. B sits third to the right of A. Who sits at the extreme left end of the line?

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

Q62. Refer to the given number, symbol series and answer the question that follows. Counting to be done from left to right only. All numbers are single-digit numbers.

(Left) % * 7 % € % 2 # € $ € © 9 5 6 # 9 & 6 % 7 & (Right)

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

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

Q63. QP 7 is related to TO −4 in a certain way. In the same way, AL 14 is related to DK 3. To which of the given options is RX 2 related, following the same logic?

(a) TV −7
(b) UV −7
(c) TW −9
(d) UW −9

Q64. What should come in place of the question mark (?) in the given series?

88 75 62 49 36 ?

(a) 25
(b) 21
(c) 23
(d) 27

Q65. Seven people, B, C, D, I, J, K and L, are sitting around a circular table, facing the centre of the table. K sits third to the left of L. I sits to the immediate left of L. D sits to the immediate left of J. J sits second to the left of C. Who sits third to the right of B?

(a) K
(b) C
(c) J
(d) D

Q66. In a certain code language, ‘technology is advancing’ is coded as ‘mn jk rs’ and ‘humanity needs technology’ is coded as ‘ap mn fg’. How is ‘technology’ coded in the given language? 8994

(a) rs
(b) mn
(c) fg
(d) jk

Q67. 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 statement(s).

Statements:

All actors are dancers.

All dancers are magicians.

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Conclusions:

(I) All magicians are actors.

(II) No dancer is an actor.11666

(a) Neither follows
(b) Both follow
(c) Only I follows
(d) Only II follows

Q68. Each of the digits in the number 5493218 is arranged in ascending order from left to right. What will be the sum of the digits which are second from the left and second from the right in the new number thus formed? 4368

(a) 10
(b) 12
(c) 8
(d) 5

Q69. 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) KO-JM
(b) OS-NR
(c) MQ-LO
(d) IM-HK

Q70. EFHL is related to AALQ in a certain way based on the English alphabetical order. In the same way, OLXF is related to KGBK. To which of the given options is CWJU related, following the same logic?9950

(a) YGHU
(b) YRTY
(c) YRNZ
(d) YRZN

Q71. Vaibhav ranked 9^(th) from the top and 17^(th) from the bottom in his class. How many students are there in the class?

(a) 21
(b) 22
(c) 26
(d) 25

Q72. RVSQ is related to OSPN in a certain way based on the English alphabetical order. In the same way, ZDAY is related to WAXV. To which of the given options is SWTR related, following the same logic?

(a) PSPO
(b) PTPO
(c) PUPY
(d) PTQO

Q73. 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 statement(s).

Statements:

All helmets are mats.

All helmets are bottles.

Conclusions:

(I) Some mats are bottles.

(II) All bottles are helmets.

(a) Only conclusion (I) follows

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

Q74. What should come in place of the question mark (?) in the given series?

312 313 303 305 295 298 ?

(a) 288
(b) 285
(c) 286
(d) 287

Q75. Shruti starts from Point A and drives 12 km towards the south. She then takes a left turn, drives 8 km, turns right and drives 4 km. She then takes a right turn and drives 12 km. She then takes a right turn and drives 10 km. She takes a final right turn, drives 4 km and stops at Point D. How far (shortest distance) and in which direction is Point D with respect to Point A? (All turns are 90-degree turns only unless specified.)

(a) 6 km towards the east
(b) 7 km towards the west
(c) 5 km towards the north
(d) 6 km towards the south

Q76. 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 its constituent digits. E.g. 13 – Operations on 13 such as adding/subtracting/multiplying etc. to 13 can be performed. Breaking down 13 into 1 and 3 and then performing mathematical operations on 1 and 3 is not allowed.)

(8, 64, 8)

(4, 16, 4)4141

(a) (2, 8, 2)
(b) (5, 125, 5)
(c) (3, 9, 4)
(d) (9, 81, 9)

Q77. What should come in place of the question mark (?) in the given series?

7 9 13 19 27 37 ?

(a) 51
(b) 49
(c) 50
(d) 52

Q78. O, P, Q, R, W, X, and Y are sitting in a straight line facing the north. Only two people sit to the right of X. Only two people sit between X and Q. Only two people sit between O and P. P sits to the immediate left of X. R sits to the immediate right of Y.

Who sits at the third position from the left end of the line?

(a) P
(b) O
(c) Y
(d) W

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

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

(a) Two
(b) One

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(c) More than three
(d) Three

Q80. Which of the following letter-number clusters will replace the question mark (?) in the given series to make it logically complete?

KR37 MT45 OV53 QX61 ?

(a) SZ69
(b) SY69
(c) SY68
(d) SZ68

GENERAL AWARENESS AND CURRENT AFFAIRS

Q81. Who became the Chairperson of ISRO in January 2025?

(a) Dr. V Narayanan
(b) A Sivathanu Pillai
(c) K Radhakrishnan
(d) S Somanath

Q82. What is the total number of Padma Awards given in 2025?

(a) 120
(b) 153
(c) 139
(d) 130

Q83. What is the duration of the Iran–Russia partnership treaty, signed on 17 January 2025?

(a) 15 years
(b) 25 years
(c) 20 years
(d) 10 years

Q84. In June 2025, which companies received the technology for the 70-ton Tank Transporter Trailer for MBT Arjun Mk-1A?

(a) Metaltech Motor Bodies Pvt Ltd, Goma Engineering Pvt Ltd, John Galt International
(b) BEML Ltd, Tata International Vehicle Applications, SDR Auto Pvt Ltd, John Galt International
(c) Bharat Electronics Ltd, Tata Advanced Systems Ltd, John Galt International
(d) Bharat Forge, Dass Hitachi Ltd, John Galt International

Q85. As per the Transparency International report released in February 2025, what was India's rank in the Corruption Perceptions Index (CPI) 2024?

(a) 102
(b) 96
(c) 93
(d) 89

Q86. What has the Supreme Court made mandatory for judicial service applicants in May 2025?

(a) Three years of legal practice
(b) Court clerk experience
(c) Five years of teaching
(d) Law degree only

Q87. In October 2025, the Delhi government in collaboration with the Indian Institute of Technology, Kanpur, implemented which of the following techniques to combat air pollution?

(a) Cloud seeding to induce rainfall and reduce air pollution
(b) Using fog cannons to disperse smog particles in polluted areas

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(c) Launching aerial drones to monitor and neutralise toxic gases
(d) Installing large-scale vertical gardens across industrial zones

Q88. Who won the gold in the Men's Singles SL3 at the 2025 Asia Para Badminton Championship?
(a) Umesh Vikram Kumar
(b) Pramod Bhagat
(c) Naveen Shivakumar
(d) Nitesh Kumar

Q89. The Ministry of Heavy Industries, Government of India, introduced a programme in July 2025 to give financial support for electric trucks under _____.
(a) PM Green Transport Initiative
(b) PM E-Mobility Drive
(c) PM Electric Vehicle Boost
(d) PM E-DRIVE initiative

Q90. According to the Sustainable Development Goals National Indicator Framework progress report, 2025, published in June 2025, the number of waste recycling plants in India increased from 829 in 2019–20 to 3,036 in 2024–25. This improvement primarily contributes to which Sustainable Development Goal (SDG)?
(a) SDG 2
(b) SDG 12
(c) SDG 6
(d) SDG 15

Q91. What is the percentage of the Contingent Risk Buffer set by the Reserve Bank of India in May 2025 for FY 2024–25?
(a) 8.0%
(b) 6.5%
(c) 5.0%
(d) 7.5%

Q92. Which institute partnered with NDMA in 2025 to develop tunnel safety guidelines?
(a) IIT Madras
(b) IIT Delhi
(c) IIT Bombay
(d) IIT Kharagpur

Q93. Who won his first major Indian Golf Union title, the IGU Southern India Junior Boys Golf Championship, played at Coimbatore Golf Club from 27 May to 30 May 2025?
(a) Shubhankar Sharma
(b) Gaganjeet Bhullar
(c) Shiv Kapur
(d) Harjai Milkha Singh

Q94. Under the Ministry of Commerce and Industry (via Startup India), which of the following schemes saw a government allocation of Rs. 211 crore into the Indian space-tech sector in 2025?
(a) Fund of Funds for Startups (FFS)
(b) Atmanirbhar Bharat Innovation Fund (ABIF)
(c) Startup India Seed Fund Scheme (SISFS)
(d) Credit Guarantee Scheme for Startups (CGSS)

Q95. Which of the following international organisations celebrated its 80^(th) anniversary on June 26, 2025, marking the signing of its charter?
(a) World Bank
(b) NATO
(c) International Monetary Fund (IMF)
(d) United Nations

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Q96. Which young swimmer matched Michael Phelps's achievement by setting three individual world records at one meet during the Canadian Trials?

(a) Sydney McLaughlin-Levrone
(b) Athing Mu-Nikolayev
(c) Beatrice Chebet
(d) Summer McIntosh

Q97. In November 2025, India conducted the bilateral military exercise 'AJEYA WARRIOR-25' with which of the following countries?

(a) France
(b) United States
(c) Russia
(d) United Kingdom

Q98. Who among the following received the Major Dhyan Chand Khel Ratna Award in 2025?

(a) Virat Kohli
(b) Manu Bhaker
(c) Saina Nehwal
(d) Neeraj Chopra

Q99. Which of the following institutions launched a Rs. 5,000 crore green bond as part of its Rs. 30,000 crore Government Securities (G-Sec) auction in June 2025?

(a) Securities and Exchange Board of India
(b) Exim Bank of India
(c) National Bank for Agriculture and Rural Development
(d) Reserve Bank of India

Q100. Which state launched new minority welfare schemes in September 2025, the Revanth Anna ka Sahara-Miskeen la Kosam, focusing on women empowerment and financial assistance?

(a) Telangana
(b) Kerala
(c) Maharashtra
(d) Gujarat

ANSWER KEY

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

SOLUTIONS

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Q1. Answer: (c) Pb

The correct answer is Pb.

Key Points

• The correct symbol for the chemical element Lead is Pb. The symbol is derived from its Latin name, Plumbum, which means "soft metal."

• Lead is a chemical element with the atomic number 82 and is represented in the periodic table under the symbol Pb.

• It is a post-transition metal and is known for its properties such as high density, malleability, and resistance to corrosion.

• The incorrect options (Le, Lb, and Ld) do not correspond to any chemical element in the periodic table.

• Lead has been widely used throughout history in applications such as plumbing, batteries, paints, and radiation shielding. However, its toxicity has led to reduced usage in consumer products.

Additional Information

• Properties of Lead:

• Lead is a soft, malleable, and dense metal with a bluish-white color when freshly cut but tarnishes to a dull gray upon exposure to air.

• It has a melting point of 327.5 °C and a boiling point of 1749 °C.

• It is highly resistant to corrosion, making it suitable for use in corrosive environments.

• Uses of Lead:

• Lead is primarily used in lead-acid batteries, which are widely used in vehicles and backup power systems.

• It is also used in radiation shielding due to its ability to block X-rays and gamma rays.

• Historically, lead was used in paints and gasoline, but its usage has been phased out due to health concerns.

• Lead compounds are used in ceramics and glass, including lead crystal glassware.

• Health and Environmental Concerns:

• Lead is a toxic metal that can cause severe health issues, including neurological damage, especially in children.

• Lead poisoning can result from exposure to lead-based paints, contaminated water (e.g., from lead pipes), or industrial emissions.

• Efforts have been made globally to reduce lead exposure, such as banning leaded gasoline and removing lead-based paints.

• Historical Context:

• Lead has been used since ancient times, with evidence of its use dating back to around 7000 BCE.

• The Romans extensively used lead for plumbing and water pipes, which is why the word "plumbing" is derived from the Latin word Plumbum.

• Despite its historical significance, modern regulations aim to minimize its usage due to its health risks.

Important Points

• Periodic Table Symbol: The periodic table assigns unique symbols to each element, often derived from their Latin names. For example, Lead (Pb) comes from Plumbum, Sodium (Na) from Natrium, and Potassium (K) from Kalium.

• Toxicity and Regulations: Due to its toxic nature, stringent regulations have been implemented worldwide to minimize lead exposure, particularly in children and vulnerable populations.

• Industrial Applications: Despite its toxicity, lead continues to play a crucial role in industries such as energy storage (batteries) and radiation shielding.

• Recyclability: Lead is one of the most recycled materials globally, with a recycling rate of over 95% in the battery industry.

Q2. Answer: (b) Diffusion

The correct answer is Diffusion.

Key Points

• Diffusion is the process by which particles of a substance spread out and mix with particles of another substance due to their random motion. It occurs naturally without external force.

• It is driven by the kinetic energy of particles, resulting in the movement from a region of higher concentration to a region of lower concentration until equilibrium is reached.

• Diffusion can occur in all states of matter—solids, liquids, and gases. However, it happens fastest in gases due to the higher kinetic energy of gas particles.

• Examples of diffusion include the spreading of perfume in a room, the mixing of ink in water, and the exchange of gases (oxygen and carbon dioxide) in the lungs during respiration.

• Diffusion is passive and does not require energy input, making it a fundamental process in both physical and biological systems.

Additional Information

• Sublimation:

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• Sublimation is the process where a solid directly changes into a gas without passing through the liquid state.
• Examples include the sublimation of dry ice (solid carbon dioxide) and iodine crystals.
• This process occurs under specific conditions of temperature and pressure.
• Condensation:
• Condensation is the process where a gas changes into a liquid when cooled to its dew point or below.
• It is commonly observed in the formation of dew, fog, or water droplets on the surface of a cold glass.
• It involves the release of latent heat, which is essential in weather phenomena like cloud formation.
• Evaporation:
• Evaporation is the process where a liquid changes into a gas at its surface without reaching its boiling point.
• It depends on factors like temperature, surface area, and humidity.
• Examples include the drying of clothes and the evaporation of water from ponds and lakes.
• Applications of Diffusion:
• In biology, diffusion is crucial for processes like gas exchange in the lungs and nutrient absorption in cells.
• In industry, diffusion is used in processes like gas separation and purification.
• In daily life, diffusion explains phenomena like the mixing of smells or the spreading of color in liquids.

Q3. Answer: (b) It can be negative depending on the reference point.

The correct answer is It can be negative depending on the reference point.

Key Points

• Potential Energy (PE) is the energy stored in an object due to its position, arrangement, or state.
• The value of potential energy is always relative to a specific reference point or datum level where the energy is defined as zero.
• If an object is situated below the chosen reference level, its displacement (height) is considered negative, which results in a negative potential energy value.
• The most common form is Gravitational Potential Energy, which is expressed by the formula PE = mgh, where m is mass, g is acceleration due to gravity, and h is the height relative to the reference point.
• Potential energy is a scalar quantity, and its SI unit is the Joule (J).
• It is a property of a system rather than a single isolated object, as it depends on the interaction between objects (like the Earth and a ball).

Additional Information

• Conversion of Energy: According to the Law of Conservation of Energy, potential energy can be converted into Kinetic Energy (KE) and vice versa. For example, a ball placed at a height has maximum PE, which transforms into KE as it falls.
• Ground Level Reference: While ground level is often chosen as the zero-point for convenience, it is arbitrary. One could choose the roof of a building or the center of the Earth as the reference point.
• Dependencies: Gravitational potential energy depends on mass, gravitational field strength, and height. Saying it depends only on mass is scientifically inaccurate.
• Elastic Potential Energy: This is another form of potential energy stored in deformed elastic objects like springs or rubber bands, calculated as $1/2\ kx^2$.

Q4. Answer: (a) two similar sized, genetically identical daughter cells

The correct answer is two similar sized, genetically identical daughter cells.

Key Points

• Amoeba reproduces through a process called binary fission, which is an asexual mode of reproduction.
• In binary fission, the parent cell divides into two similar-sized and genetically identical daughter cells. This ensures the continuity of its genetic material.
• The process begins with the replication of DNA, followed by the elongation of the cytoplasm and splitting into two equal parts. Hence, the correct statement is that two similar-sized, genetically identical daughter cells are formed.
• This process occurs in favorable environmental conditions, such as adequate temperature and nutrient availability, which are crucial for cell division.
• Fission in amoeba is a mitotic process, ensuring that each daughter cell receives an identical copy of the parent cell's DNA.

Additional Information

• Binary Fission in Amoeba:
• Binary fission is a form of asexual reproduction where a single organism divides to form two daughter organisms. It is common in unicellular organisms like Amoeba, Paramecium, and Euglena.
• The division process involves the replication of DNA, cytoplasmic division, and formation of two daughter cells.

• Since there is no mixing of genetic material, the daughter cells are genetically identical to the parent cell.

• Other Types of Fission:

• Multiple Fission: In some organisms like Plasmodium, the nucleus divides multiple times before cytoplasmic division, resulting in the formation of several daughter cells.

• Longitudinal Fission: Seen in organisms like Euglena, where the cell splits along its longitudinal axis.

• Transverse Fission: In organisms like Paramecium, the division occurs along the transverse axis.

• Key Characteristics of Binary Fission in Amoeba:

• It is a rapid and efficient process, allowing the population to grow quickly under favorable conditions.

• There is no formation of gametes or involvement of sexual processes, making it a simpler reproduction method compared to sexual reproduction.

• Comparison with Other Modes of Reproduction:

• Sexual Reproduction: Involves the fusion of gametes, resulting in genetic variation. Found in higher organisms.

• Asexual Reproduction: Like binary fission, it is a simpler process with no genetic variation, ensuring the survival of species in stable environments.

Important Points

• Option 2: A large number of small, genetically identical daughter cells – Incorrect, as this process represents multiple fission, not binary fission.

• Option 3: Four genetically different daughter cells – Incorrect, as this pertains to meiosis, which occurs in sexual reproduction and not in Amoeba.

• Option 4: A small daughter cell and a large mother cell that are genetically different – Incorrect, as this describes budding, seen in organisms like yeast, not Amoeba.

• Option 1: Two similar-sized, genetically identical daughter cells – Correct, as it accurately describes binary fission in Amoeba.

Q5. Answer: (d) Insoluble impurities settle at anode in electrolytic refining

The correct answer is Insoluble impurities settle at anode in electrolytic refining.

Key Points

• Anode mud refers to the insoluble impurities that collect at the anode during the process of electrolytic refining.

• In electrolytic refining, a metal (e.g., copper, silver) is purified by passing an electric current through an electrolyte where the impure metal acts as the anode, and a pure metal sheet serves as the cathode.

• During the process, the pure metal from the anode dissolves into the electrolyte and is deposited on the cathode, while the impurities, being insoluble, settle down below the anode as anode mud.

• The composition of anode mud depends on the impurities present in the raw metal, which can include precious metals such as gold, silver, and platinum, along with other impurities like selenium, tellurium, and oxides.

• Anode mud is valuable as it often contains precious metals, which can be recovered and processed further.

Additional Information

• Electrolytic Refining Process:

• Electrolytic refining is a process of obtaining pure metal by using an electric current.

• The impure metal is made the anode, and a thin sheet of pure metal is used as the cathode.

• The electrolyte is typically a solution of a salt of the metal to be refined (e.g., copper sulfate in copper refining).

• When electricity is passed through the solution, the metal from the anode dissolves into the electrolyte and is deposited on the cathode as pure metal.

• Examples of Metals Using Electrolytic Refining:

• Copper: The most common example where impure copper is refined into 99.99% pure copper.

• Silver and Gold: Precious metals are refined to obtain high purity.

• Zinc and Aluminum: These metals also undergo refining to remove impurities.

• Components of Anode Mud:

• Gold and Silver: Often present in trace amounts, they are recovered for their high value.

• Selenium and Tellurium: By-products that are used in industries such as electronics and metallurgy.

• Oxides: Formed due to the oxidation of impurities during the refining process.

• Importance of Electrolytic Refining:

• Ensures a high degree of purity in the final metal product.

• Helps recover valuable by-products from anode mud.

• Widely used in industries for metals like copper, gold, and zinc to ensure high-quality materials for manufacturing.

Important Points

• Electrolytic Refining Efficiency:
• This method can produce metals with a purity level of up to 99.99%.
• It is widely used in the production of electronic-grade metals.
• Environmental Considerations:
• The process generates toxic waste that must be handled carefully to prevent environmental contamination.
• Proper disposal or recycling of anode mud is crucial to minimizing environmental impact.
• Applications of Refined Metals:
• Highly purified metals are essential for industries like electronics, construction, and jewelry making.
• For example, refined copper is used in electrical wiring and components.

Q6. Answer: (b) Macronutrients are required by plants in large quantities.

The correct answer is Macronutrients are required by plants in large quantities..

Key Points

• Macronutrients are required by plants in large quantities because they are essential for the growth, development, and metabolic processes of plants. Hence, this statement is correct.
• Macronutrients include nitrogen (N), phosphorus (P), potassium (K), calcium (Ca), magnesium (Mg), and sulfur (S). These elements play crucial roles in photosynthesis, enzyme activation, cell division, and nutrient transport.
• Macronutrients are not harmful to plants if absorbed correctly. However, excess or deficiency of macronutrients can lead to plant disorders. Hence, the statement "Macronutrients are harmful to plants if absorbed" is incorrect.
• Macronutrients are needed throughout the plant's life cycle, not just during flowering. They are vital for vegetative growth, reproduction, and overall physiological functions. Hence, the statement "Macronutrients are needed only during flowering" is incorrect.
• Macronutrients are indispensable for plant health. They cannot be substituted or ignored, as they are required for the proper functioning of various physiological and biochemical pathways. Hence, the statement "Macronutrients are not required by plants at all" is incorrect.

Additional Information

• Functions of Macronutrients:
• Nitrogen (N): Promotes vegetative growth, chlorophyll formation, and protein synthesis.
• Phosphorus (P): Essential for energy transfer (ATP) and root development.
• Potassium (K): Regulates water uptake, enzyme activation, and disease resistance.
• Calcium (Ca): Strengthens cell walls and aids cell division.
• Magnesium (Mg): Central component of chlorophyll and assists in enzyme activation.
• Sulfur (S): Required for amino acids and protein synthesis.
• Symptoms of Macronutrient Deficiency:
• Nitrogen deficiency: Yellowing of leaves (chlorosis) and stunted growth.
• Phosphorus deficiency: Purple discoloration of leaves and poor root development.
• Potassium deficiency: Leaf curling and browning edges.
• Sources of Macronutrients:
• Natural sources: Organic matter, manure, and compost.
• Synthetic fertilizers: Urea, DAP (Di-ammonium phosphate), and Muriate of Potash.
• Importance in Agriculture:
• Proper macronutrient management increases crop yield and quality.
• A balanced supply prevents nutrient-related diseases and ensures sustainable farming.

Important Points

• Global Agricultural Practices:
• Integrated Nutrient Management (INM): Combines organic and inorganic fertilizers for balanced nutrient supply.
• Precision Farming: Uses technology to optimize macronutrient application based on soil and crop requirements.
• Environmental Impacts:
• Excessive macronutrient use can lead to soil degradation and water pollution.
• Proper nutrient management reduces greenhouse gas emissions and promotes sustainable agriculture.

Q7. Answer: (c) 20 V

The correct answer is 20 V.

Key Points

• The potential difference (V) between two points is calculated using the formula:

V = Work Done (W) / Charge (Q).

• In the given question, Work Done (W) = 100 J and Charge (Q) = 5 C.

• Using the formula,

V = 100 J / 5 C = 20 V.

• The unit of potential difference is the volt (V), which is defined as 1 joule of work per coulomb of charge.

• Hence, the potential difference between the two points is 20 V.

Additional Information

• Potential Difference:

• Potential difference is the work done to move a unit charge from one point to another in an electric field.

• It is a scalar quantity and is measured in volts (V).

• The formula is given as V = W/Q, where:

• V is the potential difference in volts.

• W is the work done in joules (J).

• Q is the charge in coulombs (C).

• Charge (Q):

• Charge is a fundamental property of matter that causes it to experience a force in an electric field.

• The SI unit of charge is the coulomb (C), where 1 coulomb is equivalent to the charge of approximately 6.242 × 10^(18) electrons.

• Charge can be positive or negative, depending on the type of particle.

• Work Done (W):

• Work done in an electric field is the energy required to move a charge against the electric force.

• The SI unit of work is the joule (J).

• It is related to the potential difference and charge by the formula W = V × Q.

• Volt (V):

• The volt is the derived unit for electric potential, potential difference, and electromotive force in the International System of Units (SI).

• 1 volt is defined as 1 joule per coulomb, i.e., 1 V = 1 J/C.

• Named after the Italian physicist Alessandro Volta, who invented the first chemical battery.

Important Points

• Ohm's Law: Ohm’s law relates voltage (V), current (I), and resistance (R) as V = I × R.

• Electric Field: The electric field is the force per unit charge and is expressed as E = V/d, where d is the distance between two points.

• Applications: Potential difference is a key concept in circuits, batteries, capacitors, and other electrical devices.

• Practical Examples: A 1.5V AA battery has a potential difference of 1.5 volts between its terminals, enabling current to flow in a circuit.

Q8. Answer: (a) 2.5

The correct answer is 2.5.

Key Points

• Definition of Average Velocity: Average velocity is calculated as the total displacement divided by the total time taken. The formula is:

Average Velocity = Total Displacement / Total Time.

• Displacement Calculation: The boy walks from point A to point B, covering a distance of 1000 m. Then, he walks back 400 m to point C. The net displacement is the straight-line distance from A to C, which equals:

Displacement = 1000 m - 400 m = 600 m.

• Total Time Taken: The boy takes 2 minutes (or 120 seconds) to walk from A to B and another 2 minutes (or 120 seconds) to walk back from B to C. Hence, the total time is:

Total Time = 120 s + 120 s = 240 s.

• Average Velocity Calculation: Using the formula for average velocity:

Average Velocity = Total Displacement / Total Time,

Substituting the values:

Average Velocity = 600 m / 240 s = 2.5 m/s.

• Correct Answer: The average velocity of the boy from point A to C is 2.5 m/s.

Additional Information

• Difference Between Distance and Displacement:

• Distance: It is the total path traveled, irrespective of direction. In this case, the boy traveled a total distance of 1000 m + 400 m = 1400 m.

• Displacement: It is the shortest straight-line distance from the initial to the final position, considering direction. Here, the displacement is 600 m.

• Definition of Speed and Velocity:

• Speed: It is a scalar quantity, defined as the rate at which an object covers distance. It considers only magnitude, not direction.

• Velocity: It is a vector quantity, defined as the rate of change of displacement. It considers both magnitude and direction.

• Unit of Average Velocity: The standard unit of velocity in the International System of Units (SI) is meters per second (m/s).

• Practical Application: Understanding average velocity is critical in various fields such as physics, engineering, and transportation to analyze motion and optimize processes.

• Formula Recap:

• Average Velocity: v = Total Displacement / Total Time.

• Average Speed: s = Total Distance / Total Time.

Important Points

• Key Differences Between Speed and Velocity:

• Nature: Speed is scalar, while velocity is vector.

• Focus: Speed measures how fast an object is moving, while velocity measures how fast and in which direction.

• Example: A car moving in a circular path at constant speed has changing velocity due to the change in direction.

• Real-Life Examples of Velocity:

• Airplane navigation often uses average velocity to calculate flight time and fuel efficiency.

• Sports like cricket or baseball calculate the velocity of the ball to analyze performance.

Q9. Answer: (b) g = GM/R2

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

Key Points

• The formula for the acceleration due to gravity on the surface of the Earth is derived using Newton's law of gravitation and is given by $g = GM/R^2$, where:

• G is the Universal Gravitational Constant (6.674×10^{-11} N·m²/kg²).

• M is the mass of the Earth (~5.972×10^{24} kg).

• R is the radius of the Earth (~6,371 km).

• The formula represents the gravitational acceleration experienced by an object on the surface of a spherical body like Earth.

• The value of g on the Earth's surface is approximately 9.8 m/s². This value varies slightly depending on altitude, latitude, and local geological conditions.

• Statement "$g = GM/R^2$" is correct because it accurately represents the relationship between gravitational force and the distance from the Earth's center.

• Other options like "g = GM", "g = GM/R", and "$g = R^2/GM$" are incorrect as they do not mathematically satisfy the laws of gravitation or dimensional analysis.

Additional Information

• Gravitational Force:

• The gravitational force between two masses is given by $F = GM1M2/r^2$, where r is the distance between the centers of the two masses.

• This fundamental force is responsible for keeping celestial bodies like planets, moons, and satellites in their respective orbits.

• Variation of g:

• The value of g decreases with altitude as the distance R from the Earth's center increases.

• It also decreases with depth as the effective mass of the Earth contributing to the gravitational pull reduces.

• The Earth's rotation causes g to vary slightly with latitude. It is slightly higher at the poles and lower at the equator.

• Applications of g:

• The value of g is critical in various calculations like projectile motion, satellite motion, and free fall.

• It is used in designing structures and vehicles to ensure they can withstand gravitational forces.

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• Experimental Determination of g:

• Henry Cavendish's experiment was one of the first to measure the gravitational constant, indirectly determining the value of g.

• Modern instruments like gravimeters are used to measure local variations in g for geological surveys.

Important Points

• Universal Gravitational Constant: Its value remains the same throughout the universe and is a key constant in physics.

• Dimensional Formula of g: [L T^-²]. This aligns with the formula g = GM/R².

• Space Missions: Knowledge of g is critical for calculating escape velocity, orbital velocity, and designing space missions.

• Earth's Shape: The Earth is not a perfect sphere but an oblate spheroid, causing slight variations in g.

Q10. Answer: (c) CaCO3 → CaO + CO2

The correct answer is CaCO3 → CaO + CO2.

Key Points

• Decomposition Reaction: A decomposition reaction is a chemical reaction where a single compound breaks down into two or more simpler substances. This process generally requires energy in the form of heat, light, or electricity.

• CaCO3 → CaO + CO2: In this reaction, calcium carbonate (CaCO3) decomposes into calcium oxide (CaO) and carbon dioxide (CO2) when heated. This is a classic example of a thermal decomposition reaction.

• Energy Requirement: Decomposition reactions typically require the input of energy to break the bonds in the reactant compound. In this case, heat is applied to decompose calcium carbonate.

• Practical Application: The decomposition of calcium carbonate is widely used in industries, such as in the production of lime (CaO), which is an essential material for construction and other chemical processes.

• Other Examples of Decomposition Reactions: Apart from the given reaction, other examples include the decomposition of water (H2O → H2 + O2) and the decomposition of hydrogen peroxide (H2O2 → H2O + O2).

Additional Information

• Combination vs. Decomposition Reactions:

• In a combination reaction, two or more reactants combine to form a single product. For example, H2 + O2 → H2O.

• In contrast, a decomposition reaction involves the breakdown of a single compound into simpler substances, as seen in CaCO3 → CaO + CO2.

• Types of Decomposition Reactions:

• Thermal Decomposition: Requires heat to break down compounds (e.g., CaCO3 → CaO + CO2).

• Electrolytic Decomposition: Requires electricity, such as the electrolysis of water (H2O → H2 + O2).

• Photolytic Decomposition: Requires light, such as the decomposition of silver chloride (2AgCl → 2Ag + Cl2) under sunlight.

• Industrial Importance:

• Calcium oxide (CaO), also known as quicklime, is used in cement production, soil stabilization, and as a reagent in chemical industries.

• Carbon dioxide (CO2) is used in carbonated beverages, fire extinguishers, and as a refrigerant in its solid form (dry ice).

• Reaction Analysis for Other Options:

• H2 + O2 → H2O: This is a combination reaction, not decomposition.

• Mg + O2 → MgO: This is also a combination reaction where magnesium reacts with oxygen to form magnesium oxide.

• Na + Cl2 → NaCl: This is yet another combination reaction where sodium reacts with chlorine to form sodium chloride (table salt).

Important Points

• Thermal Stability: The decomposition of compounds like calcium carbonate depends on their thermal stability. Compounds with strong bonds require higher temperatures to decompose.

• Endothermic Nature: Most decomposition reactions are endothermic, meaning they absorb energy from the surroundings to proceed.

• Environmental Impact: Decomposition reactions like the breakdown of limestone (CaCO3) in cement production release CO2, contributing to greenhouse gas emissions.

• Reversibility: Some decomposition reactions are reversible under specific conditions. For example, carbon dioxide can react with calcium oxide to reform calcium carbonate.

Q11. Answer: (b) Antoine Lavoisier

The correct answer is Antoine Lavoisier.

Key Points

• Antoine Lavoisier, a French chemist, is credited with formulating the Law of Conservation of Mass, which states that mass cannot be created or destroyed in a chemical reaction.

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• The law was established in the late 18th century, around 1789, when Lavoisier demonstrated through meticulous experiments that the total mass of reactants is equal to the total mass of products in a closed system.

• Lavoisier is regarded as the "Father of Modern Chemistry" for his contributions to the field, including standardizing chemical nomenclature and identifying elements like oxygen and hydrogen.

• The Law of Conservation of Mass laid the foundation for the development of stoichiometry, which allows chemists to calculate quantities of reactants and products in chemical reactions.

• This fundamental principle is applied universally in fields like chemistry, physics, and engineering, ensuring mass balance in processes ranging from industrial manufacturing to environmental science.

Additional Information

• Joseph Proust:

• Proust is known for the Law of Definite Proportions, which states that a chemical compound always contains its component elements in fixed ratios by mass.

• His work was significant in proving the consistency of chemical compositions in compounds.

• John Dalton:

• Dalton proposed the Atomic Theory, which includes the idea that matter is composed of indivisible atoms.

• He also formulated the Law of Multiple Proportions, which complements the Law of Conservation of Mass.

• Ernest Rutherford:

• Known for discovering the structure of the atom through the Gold Foil Experiment, Rutherford identified the nucleus as the central part of the atom.

• His work primarily contributed to atomic physics rather than chemical laws like conservation of mass.

• Key Applications of the Law:

• Industrial Processes: Used in designing chemical reactors and ensuring material balance in industries like pharmaceuticals and petrochemicals.

• Environmental Science: Applied in tracking pollutants and ensuring mass conservation in ecological systems.

• Physics: The principle aligns with the conservation laws of energy and matter in closed systems.

Important Points

• Law of Conservation of Mass:

• It is a cornerstone of modern chemistry and is essential for understanding chemical reactions and equations.

• The law ensures that mass is conserved in any physical or chemical process, highlighting the closed-system nature of reactions.

• Lavoisier’s Contributions:

• Lavoisier also identified and named oxygen, recognizing its role in combustion and respiration.

• He helped establish a systematic approach to chemical analysis and classification.

• Experimental Evidence:

• Lavoisier meticulously measured the mass of reactants and products using sealed containers to demonstrate conservation principles.

• His experiments paved the way for the quantitative study of chemistry.

Q12. Answer: (d) Detecting cracks in metal blocks

The correct answer is Detecting cracks in metal blocks.

Key Points

• Ultrasound is widely used in the industrial sector for non-destructive testing (NDT) of materials. It helps to detect internal flaws, such as cracks, voids, or inclusions, in metal blocks or other materials without causing any damage to the object.

• The principle involves sending high-frequency ultrasound waves through the material. These waves reflect back when they encounter a defect, and the reflected signals are analyzed to locate and measure the defect.

• This application is crucial in industries like aerospace, automotive, and construction to ensure the safety and reliability of metal components.

• Ultrasound testing is highly accurate and can detect even microscopic cracks that are invisible to the naked eye. This makes it an invaluable tool for quality control and maintenance processes.

• Other uses of ultrasound in industry include cleaning delicate components and welding plastics, but detecting cracks in metal blocks remains one of its most significant applications.

Additional Information

• Option 1: Increasing the speed of sound in solids

• Ultrasound does not increase the speed of sound in solids. The speed of sound in a material depends on its density and elasticity, not on the application of ultrasound. This statement is incorrect.

• Option 2: Used in refrigerators for cooling

• Ultrasound is not used in refrigerators for cooling. Refrigerators use a refrigeration cycle involving a compressor, refrigerant, and condenser to achieve cooling. This statement is incorrect.

• Option 3: Making objects lighter in weight

• Ultrasound does not alter the weight of objects. It is primarily used for imaging, cleaning, and testing applications. This statement is incorrect.

• Option 4: Detecting cracks in metal blocks

• This is a correct application of ultrasound in industry. It is extensively used for non-destructive testing to ensure the structural integrity of metal components.

• Option 5: (Blank)

• No relevant information is provided for this option.

Important Points

• Characteristics of Ultrasound:

• Ultrasound refers to sound waves with frequencies higher than 20,000 Hz, which is beyond the range of human hearing.

• It is widely used in various fields, including medicine, industry, and research, due to its high-frequency and non-invasive nature.

• Other Industrial Applications:

• Ultrasonic Cleaning: Used to clean delicate instruments and components in industries like healthcare and electronics.

• Ultrasonic Welding: Used to join plastics and metals without the need for adhesives or fasteners.

• Ultrasonic Flow Meters: Used to measure the flow rate of fluids in pipelines.

• Advantages of Ultrasound Testing:

• Non-invasive and does not damage the material being tested.

• Highly accurate and capable of detecting minute defects.

• Cost-effective in the long term due to its reliability and precision.

Q13. Answer: (a) Plant cells have both a rigid cell wall and a cell membrane, while animal cells only have a flexible cell m...

The correct answer is Plant cells have both a rigid cell wall and a cell membrane, while animal cells only have a flexible cell membrane..

Key Points

• Plant cells have a rigid cell wall made of cellulose, providing structural support and protection.

• In addition, plant cells possess a cell membrane which is flexible and regulates the transport of substances in and out of the cell.

• Animal cells lack a cell wall and only have a flexible cell membrane, which helps in maintaining shape and controlling substance exchange.

• The absence of a cell wall in animal cells makes them more adaptable and allows greater variation in shape compared to plant cells.

• The presence of a cell wall in plant cells is essential for maintaining turgidity and resisting osmotic pressure, which is vital for plant survival. Hence, the statement is correct.

Additional Information

• Cell Wall in Plant Cells:

• The cell wall is composed primarily of cellulose, hemicellulose, and lignin.

• It provides mechanical support, protects against pathogens, and prevents excessive water intake.

• The rigid structure also facilitates the formation of specialized tissues, such as xylem and phloem.

• It plays a crucial role in cell-to-cell communication and plant tissue organization.

• Cell Membrane:

• The cell membrane is composed of a phospholipid bilayer and embedded proteins.

• It controls the movement of ions, nutrients, and waste products in and out of the cell.

• In plant cells, the cell membrane lies beneath the cell wall and contributes to internal regulation.

• In animal cells, the membrane is involved in processes like endocytosis, exocytosis, and signal transduction.

• Differences Between Plant and Animal Cells:

• Plant cells have chloroplasts for photosynthesis; animal cells lack chloroplasts.

• Plant cells contain large central vacuoles, while animal cells have smaller vacuoles.

• Animal cells have centrioles, which are generally absent in plant cells.

• Animal cells are more flexible due to the absence of a rigid cell wall.

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• Functions of Cell Wall:
• Provides structural integrity to plant cells.
• Acts as a physical barrier against pathogens and mechanical stress.
• Supports the plant in maintaining its shape and prevents collapse under osmotic pressure.
• Facilitates the transport of water and nutrients through specialized structures like plasmodesmata.

Important Points

• Adaptability of Animal Cells:
• The absence of a rigid cell wall allows animal cells to form specialized structures like muscles, nerves, and glands.
• This flexibility supports diverse functions such as contraction, secretion, and signal transmission.
• Cell Wall Variations:
• In fungi, the cell wall is composed of chitin instead of cellulose.
• Bacterial cell walls are made of peptidoglycan, while archaea have pseudopeptidoglycan.
• Evolutionary Perspective:
• The presence of a cell wall in plants reflects adaptations for support, water regulation, and defense mechanisms.
• Animal cells evolved to adapt to a more dynamic environment, requiring flexibility and mobility.

Q14. Answer: (d) To study inheritance patterns

The correct answer is To study inheritance patterns.

Key Points

• Gregor Mendel, known as the "Father of Genetics," conducted experiments on pea plants to understand how traits are inherited from one generation to the next.
• He chose true-breeding plants (plants that consistently produce offspring with the same traits when self-pollinated) to ensure that the genetic makeup of the parents was stable and predictable.
• The use of true-breeding plants allowed Mendel to clearly observe and analyze the inheritance patterns of traits like flower color, seed shape, and plant height, without interference from external factors.
• True-breeding plants helped Mendel establish the principles of dominance, segregation, and independent assortment by reducing variability in parental traits.
• By focusing on inheritance patterns, Mendel was able to formulate the foundational laws of genetics, which include the Law of Segregation and the Law of Independent Assortment.

Additional Information

• True-Breeding Plants:
• True-breeding plants are homozygous for specific traits, meaning they carry identical alleles for the trait.
• They consistently produce offspring with the same characteristics, making them ideal for genetic studies.
• Examples include pea plants with consistent flower colors like purple or white.
• Mendel's Experiments:
• Gregor Mendel conducted experiments from 1856 to 1863 using Pisum sativum (pea plants).
• He studied seven traits, including seed shape, seed color, pod shape, pod color, flower position, flower color, and stem height.
• Mendel's work was published in 1866 but gained recognition much later, around 1900, when other scientists rediscovered his findings.
• Laws of Genetics:
• The Law of Segregation states that during gamete formation, allele pairs separate so that each gamete carries only one allele for each trait.
• The Law of Independent Assortment states that alleles of different genes assort independently during gamete formation.
• These laws form the foundation of modern genetics and are universally applicable across sexually reproducing organisms.
• Advantages of Using Pea Plants:
• Pea plants have distinct, easily observable traits such as flower color and seed shape.
• They grow quickly and produce a large number of offspring, facilitating statistical analysis.
• Pea plants can be easily cross-pollinated or self-pollinated, providing control over breeding experiments.
• Historical Impact:
• Mendel's research laid the groundwork for the field of genetics, influencing later studies on DNA, genes, and heredity.
• His findings have applications in agriculture, medicine, and biotechnology for understanding genetic traits and improving crop yields.
• The rediscovery of Mendel's work in the early 20th century led to the development of the Modern Synthesis, combining genetics

with evolutionary theory.

Q15. Answer: (a) Magnification = v/u

The correct answer is Magnification = v/u.

Key Points

• Magnification is a measure of how much larger or smaller the image of an object appears compared to the object itself.

• The formula for magnification is given by: M = v/u, where:

• M is the magnification,

• v is the image distance (distance of the image from the optical center),

• u is the object distance (distance of the object from the optical center).

• Correct Option: Magnification = v/u.

• Magnification can be:

• Positive: When the image is upright (virtual image).

• Negative: When the image is inverted (real image).

• Other options like Magnification = u + v, Magnification = v × u, and Magnification = u/v are incorrect as they do not represent the correct mathematical relationship.

Additional Information

• Magnification and Image Formation:

• Magnification tells us about the relative size of the image compared to the object.

• If |M| > 1, the image is magnified (larger than the object).

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

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

• Nature of the Image:

• For convex lenses, a real and inverted image has a negative magnification.

• For concave lenses, a virtual and upright image has a positive magnification.

• Lens Formula: The magnification formula is closely related to the lens formula: 1/f = 1/v - 1/u, where f is the focal length of the lens.

• Applications of Magnification:

• Used in microscopes, telescopes, and magnifying glasses to enlarge small objects.

• Essential in optics for designing lenses and optical instruments.

• Understanding Incorrect Options:

• Magnification = u + v: This is mathematically incorrect as magnification depends on the ratio of image and object distances, not their sum.

• Magnification = v × u: This is also incorrect as there is no product relationship between v and u in magnification.

• Magnification = u/v: This is the inverse of the correct formula and does not represent the actual relationship.

Important Points

• Sign Convention in Optics:

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

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

• Height of the image is positive if it is above the principal axis and negative if below it.

• Practical Implications:

• Magnification helps in designing optical instruments like cameras, projectors, and eyeglasses.

• It is a critical factor in medical imaging systems like endoscopes.

Q16. Answer: (d) temperature remains constant

The correct answer is temperature remains constant.

Key Points

• Ohm’s Law states that the ratio of the potential difference (V) across a conductor to the current (I) flowing through it is constant, provided the physical conditions such as temperature remain constant. This constant ratio is the resistance (R) of the conductor.

• Mathematically, Ohm’s Law is expressed as V = IR, where V is the voltage, I is the current, and R is the resistance.

• The law is valid only under the condition that the conductor's temperature does not change. Temperature variation can lead to changes in resistance, thereby affecting the relationship between voltage and current.

• Ohm’s Law is widely applicable to linear conductors like metals, which obey the law under normal conditions. Non-linear

conductors such as semiconductors and vacuum tubes do not follow Ohm's Law.

• Hence, the condition that temperature remains constant is essential for Ohm's Law to hold true.

Additional Information

• Important Factors Affecting Ohm's Law:

• Temperature: The resistance of most conductors increases with temperature due to increased electron collisions. For Ohm's Law to remain valid, temperature needs to be constant.

• Material of the Conductor: Ohm's Law applies primarily to conductive materials like copper, silver, and aluminum, which exhibit linear behavior between voltage and current.

• Physical Dimensions: The resistance of a conductor is directly proportional to its length and inversely proportional to its cross-sectional area.

• Non-Ohmic Devices: Devices like diodes and transistors do not follow Ohm's Law because their current-voltage relationship is non-linear.

• Applications of Ohm's Law:

• Electrical Circuit Analysis: Ohm's Law is used extensively to calculate voltage, current, and resistance in circuits.

• Designing Electrical Devices: It helps in designing resistors, voltage dividers, and current limiters.

• Power Distribution: Ohm's Law is crucial in determining the efficiency of power transmission systems.

• Characteristics of Resistance:

• Unit: Resistance is measured in ohms (Ω).

• Dependence: Resistance depends on material properties, temperature, and physical dimensions.

• Examples: Conductors like copper have low resistance, while insulators like rubber have high resistance.

• Historical Context:

• Ohm's Law was formulated by Georg Simon Ohm in 1827.

• It laid the foundation for modern electrical engineering and electronics.

Important Points

• Limitations of Ohm's Law:

• It is valid only for linear conductors like metals.

• Non-linear devices like diodes and transistors do not obey Ohm's Law due to their non-linear current-voltage relationship.

• Ohm's Law is not applicable under conditions of varying temperature or when the conductor exhibits non-uniform properties.

• Practical Example:

• In a simple circuit with a resistor and a voltage source, Ohm's Law can be used to calculate the current flowing through the resistor.

• If the resistance is 10 Ω and the voltage is 20 V, the current is 2 A.

Q17. Answer: (b) Multiple fission

The correct answer is Multiple fission.

Key Points

• Plasmodium, the causative agent of malaria, reproduces asexually through multiple fission in its host. This is a form of reproduction where a single organism divides into many daughter cells simultaneously.

• During multiple fission, the nucleus of the parent cell undergoes repeated divisions to form several nuclei. The cytoplasm then divides around each nucleus, resulting in the formation of multiple daughter cells.

• In Plasmodium, this process occurs in two stages:

• Exo-erythrocytic cycle: This takes place in the liver cells of the human host.

• Erythrocytic cycle: This occurs inside red blood cells, leading to the release of merozoites into the bloodstream.

• Multiple fission is essential for the rapid multiplication of Plasmodium, enabling it to establish an infection in the host body.

• This process is distinct from other methods like budding, layering, or grafting, which are not relevant to single-celled organisms like Plasmodium.

Additional Information

• Plasmodium Life Cycle:

• Plasmodium has a complex life cycle involving two hosts: humans (intermediate host) and female Anopheles mosquitoes (definitive host).

• The asexual reproduction occurs in humans, while sexual reproduction happens in mosquitoes.

• Key stages in humans include the sporozoite stage (injected by the mosquito), the merozoite stage (in red blood cells), and the formation of gametocytes.

• Comparison with Other Reproductive Methods:

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• Layering: A method of vegetative propagation in plants, where a branch is bent to the ground and covered with soil to form roots.
• Grafting: A horticultural technique where tissues of two plants are joined together to grow as one.
• Budding: A form of asexual reproduction seen in organisms like yeast and hydra, where a new individual develops from a small bud on the parent body.
• These methods are exclusive to multicellular organisms and are irrelevant to unicellular organisms like Plasmodium.
• Diseases Caused by Plasmodium:
• Plasmodium species such as P. falciparum, P. vivax, P. malariae, and P. ovale cause different types of malaria in humans.
• P. falciparum is the most dangerous, causing severe malaria which can lead to complications like cerebral malaria.
• Prevention of Malaria:
• Use of insecticide-treated mosquito nets (ITNs) and indoor residual spraying (IRS).
• Antimalarial drugs such as chloroquine and artemisinin-based combination therapies (ACTs).
• Preventive measures include eliminating mosquito breeding sites and promoting public awareness.

Important Points

• Key Characteristics of Plasmodium:
• Plasmodium is a protozoan parasite belonging to the phylum Apicomplexa.
• It is transmitted through the bite of infected female Anopheles mosquitoes.
• Plasmodium parasites exhibit antigenic variation, which helps them evade the host's immune system.
• Global Impact of Malaria:
• According to the World Health Organization (WHO), malaria caused approximately 241 million cases and 627,000 deaths globally in 2020.
• Sub-Saharan Africa accounts for the majority of malaria cases and deaths.
• Children under 5 years of age and pregnant women are the most vulnerable groups.

Q18. Answer: (c) colour (wavelength) of light used and the pair of media

The correct answer is colour (wavelength) of light used and the pair of media.

Key Points

• The refractive index of a medium determines how much light bends when it enters the medium from another medium.
• The refractive index of the second medium with respect to the first depends on the colour (or wavelength) of light. Different wavelengths of light bend by different amounts when passing through a medium due to a phenomenon called dispersion.
• The refractive index also depends on the pair of media involved. For instance, light traveling from air to water will have a different refractive index compared to light traveling from air to glass.
• It is important to note that factors like the shape of the boundary surface and the intensity of incident light do not influence the refractive index. The refractive index is an intrinsic property of the materials.
• Temperature can slightly affect the refractive index, but it is not a primary factor compared to the wavelength of light and the pair of media involved. Hence, the correct choice is the colour (wavelength) of light and the pair of media.

Additional Information

• Dispersion:
• Dispersion occurs when different wavelengths of light travel at different speeds through a medium, causing them to bend by different amounts.
• This is why a prism splits white light into its constituent colours, forming a spectrum (e.g., VIBGYOR).
• Refractive Index and Snell's Law:
• The refractive index is calculated using Snell's Law: n = sin(i)/sin(r), where i is the angle of incidence, and r is the angle of refraction.
• It measures how much the speed of light is reduced in a medium compared to a vacuum.
• Applications of Refractive Index:
• Used in designing lenses and optical instruments like microscopes and telescopes.
• Helps in understanding material properties in industries like glass manufacturing and fiber optics.
• Temperature's Role:
• While temperature can slightly alter the refractive index, this effect is usually negligible in practical applications compared to the wavelength of light and the medium.
• Higher temperatures can decrease the refractive index of certain materials by reducing their density.
• Examples:
• The refractive index of air is approximately 1.0003, while that of water is 1.33, and glass ranges from 1.5 to 1.9, depending on its composition.

• The refractive index of a diamond is 2.42, which makes it sparkle brilliantly as it bends light significantly.

Important Points

• Wavelength Dependency: The refractive index is inversely proportional to the wavelength of light. For example, violet light has a higher refractive index than red light, causing it to bend more.

• Material-Specific Property: The refractive index is unique to each material and helps in identifying substances in scientific studies.

• Critical Angle and Total Internal Reflection: When light passes from a medium with a higher refractive index to one with a lower refractive index, beyond a certain angle (critical angle), it undergoes total internal reflection, which is used in fiber optic technology.

• Common Misconception: Many believe that the intensity of light affects the refractive index, but this is not true. The refractive index is independent of the light's intensity.

Q19. Answer: (a) Flushing with nitrogen gas before sealing

The correct answer is Flushing with nitrogen gas before sealing.

Key Points

• Flushing with nitrogen gas before sealing is a widely used method to prevent rancidity in packaged food items. Nitrogen replaces oxygen inside the packaging, which helps in slowing down the oxidation of fats and oils, a primary cause of rancidity.

• Oxidation occurs when oxygen reacts with fats and oils in food, leading to unpleasant odors and flavors. By removing oxygen, nitrogen ensures longer shelf life and maintains food quality.

• This method is common in products like chips, nuts, and other snacks that are rich in oils or fats. Nitrogen acts as an inert gas, preventing chemical reactions that lead to spoilage.

• Unlike oxygen, nitrogen does not support the growth of aerobic bacteria or fungi, further helping to preserve food items during storage and transportation.

• It is a cost-effective and efficient technique that ensures the freshness and safety of packaged food for consumers without adding artificial preservatives.

Additional Information

• Rancidity:

• Rancidity refers to the spoilage of food caused by the oxidation or hydrolysis of fats and oils, leading to an unpleasant taste and smell.

• There are two types of rancidity: oxidative rancidity (caused by oxygen) and hydrolytic rancidity (caused by water).

• Common foods prone to rancidity include chips, nuts, butter, and cooking oils.

• Other Methods to Prevent Rancidity:

• Adding antioxidants: Antioxidants like BHT (butylated hydroxytoluene) and BHA (butylated hydroxyanisole) are added to food to prevent oxidation.

• Refrigeration: Storing food at lower temperatures slows down the oxidation process and prevents rancidity.

• Airtight packaging: Packaging food in airtight containers minimizes exposure to oxygen and moisture.

• Using vacuum sealing: This method removes air entirely from the packaging, further reducing the chances of oxidation.

• Characteristics of Nitrogen Gas:

• Nitrogen is an inert gas that does not react with food components, making it ideal for food preservation.

• It is colorless, odorless, and tasteless, ensuring no alteration in the sensory properties of food.

• Nitrogen is abundantly available and cost-effective, making it a preferred choice for food packaging industries worldwide.

• Limitations of Other Options:

• Heating the food before packing: While heating can kill microorganisms, it does not address oxidation and may even degrade food quality.

• Storing food in oxygen-rich containers: This promotes oxidation and is counterproductive for preventing rancidity.

• Adding acids to food: Although acids can inhibit microbial growth, they do not prevent the oxidation of fats and oils.

Q20. Answer: (a) Solution A is strongly acidic, and solution C is strongly basic.

The correct answer is Solution A is strongly acidic, and solution C is strongly basic..

Key Points

• pH Scale: The pH scale ranges from 0 to 14, where values less than 7 are acidic, 7 is neutral, and greater than 7 are basic.

• Solution A (pH = 3): A pH value of 3 indicates a strongly acidic solution. Acids release hydrogen ions (H^+) in water, and lower pH values signify higher acidity.

• Solution B (pH = 7): A pH of 7 is considered neutral. Pure water and solutions like saline water typically fall into this category.

• Solution C (pH = 12): A pH value of 12 indicates a strongly basic (alkaline) solution. Bases release hydroxide ions (OH^-) in

water, and higher pH values signify stronger alkalinity.

• Hence, the statement "Solution A is strongly acidic, and solution C is strongly basic" is correct, aligning with the properties of acids and bases on the pH scale.

Additional Information

• Properties of Acids:

• Acids have a pH value less than 7.

• They turn blue litmus paper red.

• Examples include hydrochloric acid (HCl), sulfuric acid (H2SO4), and citric acid.

• Acids react with bases to form salts and water, a reaction known as neutralization.

• Properties of Bases:

• Bases have a pH value greater than 7.

• They turn red litmus paper blue.

• Examples include sodium hydroxide (NaOH), potassium hydroxide (KOH), and ammonia (NH3).

• Bases react with acids to neutralize them, forming salts and water.

• Neutral Solutions:

• Neutral solutions have a pH of 7.

• They do not affect litmus paper color.

• Examples include pure water and common salt solutions.

• Applications of pH:

• In agriculture, soil pH affects crop growth. Farmers adjust soil pH using lime (base) or sulfur (acid).

• In medicine, pH levels are vital for maintaining bodily functions, e.g., blood pH is typically around 7.4.

• In industry, pH is monitored for manufacturing processes like dyeing, food production, and chemical synthesis.

Important Points

• pH Measurement: pH can be measured using pH paper, pH meters, or universal indicators. Digital pH meters provide accurate readings.

• Acid-Base Indicators: Indicators like phenolphthalein, methyl orange, and litmus are used to detect acidic or basic nature.

• Environmental Impact: pH levels in water bodies affect aquatic life. Acidic or basic water can harm ecosystems.

• Buffer Solutions: These are solutions that resist changes in pH upon adding small amounts of acids or bases. They are used in various chemical and biological applications.

Q21. Answer: (a) Spinal cord

The correct answer is Spinal cord.

Key Points

• The Spinal cord is a vital part of the Central Nervous System (CNS), which consists of the brain and spinal cord. It serves as the primary communication highway between the brain and the rest of the body.

• The CNS is responsible for processing, interpreting, and responding to sensory inputs, motor outputs, and cognitive functions. The spinal cord plays a critical role in transmitting nerve signals to and from the brain.

• The spinal cord is protected by the vertebral column and is encased in meninges, which are layers of connective tissue that ensure safety and nourishment.

• It consists of white matter (nerve fibers) and grey matter (nerve cell bodies). The spinal cord enables reflex actions, which are quick responses to stimuli without involving the brain.

• Pharynx, Spinal nerves, and Cranial nerves are not part of the CNS. While spinal and cranial nerves are part of the peripheral nervous system (PNS), the pharynx is a structure related to the respiratory and digestive systems.

Additional Information

• Central Nervous System (CNS):

• The CNS consists of the brain and spinal cord, which are the main control centers for the body.

• The brain is divided into various parts such as the cerebrum, cerebellum, and brainstem, each responsible for different functions like cognition, motor control, balance, and autonomic regulation.

• The spinal cord is segmented into cervical, thoracic, lumbar, sacral, and coccygeal regions, aligning with the vertebral column.

• Peripheral Nervous System (PNS):

• The PNS comprises spinal nerves and cranial nerves, which connect the CNS to the rest of the body.

• Spinal nerves are responsible for transmitting sensory and motor signals between the spinal cord and the limbs, trunk, and organs.

• Cranial nerves emerge directly from the brain and primarily serve areas of the head and neck, with some extending to other parts

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of the body.

• Pharynx:

• The pharynx is a muscular tube that connects the nasal cavity and mouth to the esophagus and larynx.

• It is involved in respiration and digestion, facilitating the passage of air and food.

• It is not part of the nervous system but plays a critical role in the anatomy of the respiratory and digestive systems.

• Reflex Action:

• The spinal cord mediates reflex actions, which are involuntary responses to stimuli.

• Reflexes are crucial for immediate responses, such as withdrawing a hand when touching something hot.

• This mechanism ensures protection and quick action without waiting for signals to travel to and from the brain.

Important Points

• Key Functions of the CNS:

• Integration: Combines information from various sensory inputs to form a coherent response.

• Control: Regulates voluntary actions such as movement and involuntary actions such as heartbeat.

• Coordination: Ensures smooth functioning of bodily systems by maintaining communication between the brain and spinal cord.

• Examples of CNS Disorders:

• Parkinson's Disease: A neurodegenerative disorder affecting motor control due to the loss of dopamine-producing neurons.

• Multiple Sclerosis: A condition where the immune system attacks the protective covering of nerves, disrupting communication.

• Spinal Cord Injury: Trauma to the spinal cord resulting in loss of function, sensation, or mobility below the injury site.

Q22. Answer: (a) Zinc

The correct answer is Zinc.

Key Points

• The activity series of metals, also known as the reactivity series, is a list of metals arranged in the order of their reactivity from highest to lowest.

• Magnesium is a highly reactive metal, and it lies above many other metals in the activity series.

• Zinc lies between magnesium and iron in the activity series. It is less reactive than magnesium but more reactive than iron. Hence, the correct answer is Zinc.

• Copper, silver, and potassium are far apart in the activity series relative to magnesium and iron, making them incorrect options.

• The placement of metals like zinc in the activity series is based on their ability to displace hydrogen from acids and water. Zinc can displace hydrogen from acids, confirming its position above iron but below magnesium.

Additional Information

• Activity Series of Metals:

• The activity series is a chart that ranks metals based on their reactivity. Metals at the top, like potassium and sodium, are highly reactive, while metals at the bottom, like gold and silver, are least reactive.

• Metals higher in the series can displace metals lower in the series from their compounds during reactions.

• For example, magnesium can displace zinc from zinc sulfate, while zinc can displace iron from iron sulfate.

• Position of Zinc:

• Zinc is positioned below magnesium but above iron in the activity series.

• It reacts with acids to produce hydrogen gas, confirming its reactivity, though it cannot displace magnesium or other more reactive metals.

• Characteristics of Other Metals:

• Copper: A less reactive metal that lies below zinc and iron in the activity series. It does not react with acids under normal conditions to displace hydrogen.

• Silver: A noble metal, highly resistant to corrosion and oxidation, placed even lower than copper in the activity series.

• Potassium: A highly reactive alkali metal placed at the top of the activity series, far above magnesium, zinc, and iron.

• Applications of Zinc:

• Galvanization: Zinc is used to coat iron or steel to prevent rusting.

• Alloy Formation: It is used in making alloys like brass (zinc and copper).

• Batteries: Zinc is used in dry cell batteries as an anode material.

Important Points

• Reactivity Series Order: Some key metals in decreasing order of reactivity are: Potassium > Sodium > Magnesium > Zinc > Iron > Copper > Silver > Gold.

• Displacement Reactions: Metals higher in the series displace metals lower in the series from solutions of their salts.

• Practical Uses: Understanding the activity series is critical in industrial processes such as extraction of metals, corrosion prevention, and galvanization.

Q23. Answer: (d) Golgi apparatus

The correct answer is Golgi apparatus.

Key Points

• The Golgi apparatus, also known as the Golgi complex or Golgi body, is a cell organelle responsible for the packaging and dispatching of materials, such as proteins and lipids, either within the cell or outside the cell.

• It plays a crucial role in the modification, sorting, and secretion of macromolecules synthesized in the endoplasmic reticulum (ER).

• The Golgi apparatus consists of flattened, membrane-bound sacs called cisternae arranged in stacks, and its primary function is to prepare materials for transport.

• Proteins from the rough endoplasmic reticulum enter the Golgi apparatus, where they are modified, tagged for delivery, and enclosed in vesicles for further transport to their respective destinations.

• The Golgi body also produces lysosomes, which are organelles involved in intracellular digestion, and contributes to the formation of the cell membrane by delivering lipids and proteins.

Additional Information

• Nucleus:

• The nucleus is the control center of the cell and contains genetic material in the form of DNA.

• It regulates cellular activities, including growth, metabolism, and reproduction, but it is not involved in packaging or dispatching materials. Hence, this option is incorrect.

• Mitochondria:

• Mitochondria are the powerhouses of the cell, responsible for generating energy through cellular respiration.

• They do not participate in the transport or packaging of materials. Hence, this option is incorrect.

• Ribosome:

• Ribosomes are the sites of protein synthesis in cells, where they translate messenger RNA (mRNA) into polypeptide chains.

• While ribosomes synthesize proteins, they do not package or dispatch them. Hence, this option is incorrect.

• Golgi apparatus:

• The Golgi apparatus is central to processing and packaging macromolecules like proteins and lipids synthesized in the endoplasmic reticulum.

• It ensures that these materials are modified, sorted, and dispatched to their target destinations, either within the cell or outside. Hence, this is the correct option.

Important Points

• Functions of the Golgi apparatus:

• It modifies proteins and lipids by adding carbohydrates or phosphate groups, creating glycoproteins and glycolipids.

• It sorts and packages materials into vesicles for transport to various parts of the cell or secretion outside the cell.

• The Golgi apparatus plays a role in the synthesis of lysosomes and peroxisomes for cellular digestion and waste management.

• It contributes to the formation of the plasma membrane by delivering essential lipids and proteins.

• Examples of materials dispatched by the Golgi apparatus:

• Digestive enzymes are packaged and sent to lysosomes.

• Hormones like insulin are secreted outside the cell.

• Proteins needed for membrane repair are delivered to the plasma membrane.

Q24. Answer: (d) The area under the v–t graph gives acceleration.

The correct answer is The area under the v-t graph gives acceleration.

Key Points

• Velocity is constant and acceleration is zero: When an object moves with uniform velocity, its speed and direction remain constant. As there is no change in velocity, the acceleration is zero. Hence, this statement is correct.

• The slope of the line in the v-t graph is zero: In a velocity-time graph for uniform velocity, the slope represents acceleration. Since the velocity remains constant, the slope of the graph is zero. Hence, this statement is correct.

• The v-t graph is a horizontal line: For uniform velocity, the velocity does not change over time. Therefore, the velocity-time graph is a horizontal line parallel to the time axis. Hence, this statement is correct.

• The area under the v-t graph gives acceleration: The area under the velocity-time graph does not represent acceleration. Instead, it represents the displacement of the object. Acceleration is determined by the slope of the v-t graph. Hence, this statement is incorrect.

Additional Information

• Uniform Velocity:

• When an object moves with uniform velocity, its speed and direction remain unchanged throughout its motion.

• The object covers equal distances in equal intervals of time.

• In such cases, the acceleration is zero, as there is no change in velocity.

• Velocity-Time Graph:

• The slope of a velocity-time graph represents the acceleration of an object.

• A horizontal line on the graph indicates constant velocity (zero acceleration).

• If the graph is inclined upwards, it indicates positive acceleration; if inclined downwards, it indicates negative acceleration.

• Area under the v-t Graph:

• The area under the velocity-time graph is equal to the displacement of the object.

• For example, if a car travels at a constant velocity of 60 m/s for 10 seconds, the displacement is 60 × 10 = 600 m.

• Acceleration:

• Acceleration is the rate of change of velocity with respect to time, mathematically defined as $a = (\Delta v)/(\Delta t)$.

• In cases of uniform velocity, acceleration is zero as there is no change in velocity.

Important Points

• Displacement vs Distance: Displacement is a vector quantity that measures the shortest path between two points, whereas distance is a scalar quantity that measures the total path traveled.

• Instantaneous vs Average Velocity: Instantaneous velocity is the velocity of an object at a particular instant, while average velocity is calculated over a time interval.

• Real-Life Example of Uniform Velocity: A satellite orbiting Earth at a constant speed along a circular path exhibits uniform velocity if its direction does not change.

• Graphical Representation: The graphical interpretation of motion concepts such as velocity, acceleration, and displacement helps in visualizing the relationships between these quantities.

Q25. Answer: (b) Snake

The correct answer is Snake.

Key Points

• Snakes are vertebrates and have a backbone made of bones. These bones are specialized to provide flexibility and enable body movements, especially while slithering.

• The skeletal system of a snake consists of a large number of vertebrae and ribs that allow it to make complex and fluid movements.

• While snakes lack limbs, their bones are crucial for locomotion. The muscles attached to their skeleton work in harmony to create a wave-like movement, enabling them to move on land and even climb trees.

• In contrast, animals like snails, earthworms, and cockroaches do not have bones. Snails have a hard shell, earthworms have a hydrostatic skeleton, and cockroaches have an exoskeleton for support and movement. Hence, these do not fit the criteria of having bones for movement.

• Snakes are uniquely adapted with a skeletal system that supports their predatory lifestyle, allowing them to coil, constrict, and capture prey effectively.

Additional Information

• Snail:

• Snails do not have bones. Instead, they are protected by a hard, external shell made of calcium carbonate.

• Movement in snails occurs through a muscular foot that secretes mucus, reducing friction as they move.

• They are classified under the phylum Mollusca.

• Earthworm:

• Earthworms have no bones or exoskeleton. They rely on a hydrostatic skeleton, where fluid-filled segments provide structure and enable movement.

• They move by contracting and expanding their body segments using circular and longitudinal muscles.

• Earthworms belong to the phylum Annelida.

• Cockroach:

• Cockroaches have an external skeleton (exoskeleton) made of chitin, which provides support and protection.

• They use jointed appendages and a combination of muscles to move efficiently.

• Cockroaches are classified under the phylum Arthropoda.

• Snake:

• Snakes are vertebrates with a highly flexible skeletal structure composed of a skull, vertebrae, and ribs.

• They are capable of various movements, such as lateral undulation, rectilinear movement, and concertina motion.

• Snakes belong to the class Reptilia under the phylum Chordata.

Important Points

• Hydrostatic Skeleton: This type of skeleton relies on fluid pressure within the body for support and movement. Found in organisms like earthworms.

• Exoskeleton: A rigid external covering made of chitin, as seen in cockroaches, provides protection and structural support.

• Endoskeleton: Internal skeletons, as in snakes and other vertebrates, are made of bones and allow for complex movements.

• Movement Adaptations: Animals have evolved various structural adaptations, such as bones, exoskeletons, or hydrostatic structures, to suit their environments and modes of locomotion.

Q26. Answer: (a) 12 cm

Shortcut Trick

Semi-perimeter (s) = (37 + 44 + 15) ÷ 2 = 48 cm.

Area = √[48 × (48 − 37) × (48 − 44) × (48 − 15)] = √(48 × 11 × 4 × 33) = 264 cm².

Altitude (h) = (2 × Area) ÷ Base = (2 × 264) ÷ 44 = 12 cm.

Therefore The correct answer is 12 cm.

Alternate Method

Given: Sides of triangle a = 37 cm, b = 44 cm, c = 15 cm.

Formula Used: Heron's formula for Area = √[s(s − a)(s − b)(s − c)] and Area = 1/2 × base × height.

=> Semi-perimeter (s) = (a + b + c) ÷ 2

=> s = (37 + 44 + 15) ÷ 2 = 96 ÷ 2 = 48 cm

=> Area = √[48 × (48 − 37) × (48 − 44) × (48 − 15)]

=> Area = √(48 × 11 × 4 × 33)

=> Area = √(16 × 3 × 11 × 4 × 3 × 11) = 4 × 3 × 11 × 2 = 264 cm²

=> Area of triangle = 1/2 × Base × Altitude

=> 264 = 1/2 × 44 × Altitude

=> 264 = 22 × Altitude

=> Altitude = 264 ÷ 22 = 12 cm

Therefore The correct answer is 12 cm.

Additional Information

Heron's Formula

Used to find the area of a triangle when all three sides are known: Area = √[s(s−a)(s−b)(s−c)] where s is the semi-perimeter.

Relationship between Altitude and Side

The longest side of a triangle always has the shortest altitude corresponding to it, and vice versa.

Area Consistency

The area of a triangle remains the same regardless of which side is chosen as the base: (1/2) × b1 × h1 = (1/2) × b2 × h2.

Q27. Answer: (c) 13.64%

Shortcut Trick

Required percentage = (First value ÷ Second value) × 100

Ratio of values = 1/20 : 11/30 = 3 : 22 (Multiplying by LCM 60)

Calculation: (3 ÷ 22) × 100 = 300/22 %

Result = 13.6363... ≈ 13.64%

Therefore The correct answer is 13.64%.

Alternate Method

Given:

Value 1 = 1/20

Value 2 (Base) = 11/30

Formula Used:

Percentage = (A ÷ B) × 100

Calculations:

=> Required % = [(1/20) ÷ (11/30)] × 100

=> Required % = [1/20 × 30/11] × 100
=> Required % = [3/22] × 100
=> Required % = 300 ÷ 22
=> Required % = 13.6363...
Therefore The correct answer is 13.64%.
Additional Information
Percentage Change
Percentage change is calculated as (Difference ÷ Original Value) × 100.
Fraction to Percentage
To convert any fraction a/b into a percentage, simply multiply the fraction by 100 and add the % symbol.
Base Value Identification
In questions like 'A is what % of B', the value following the word 'of' is always taken as the denominator (base value).

Q28. Answer: (c) 4

Shortcut Trick
Combined efficiency of A, B, and C = 1/3 + 1/4 + 1/6 = (4 + 3 + 2)/12 = 9/12 = 3/4 units/day.
Time taken for single work = 4/3 days.
Time taken for thrice the work = (4/3) × 3 = 4 days.
Therefore The correct answer is 4 days.
Alternate Method

Person	Days	Total Work	Efficiency
A	3	12 units	4
B	4	3	
C	6	2	

Given: Individual completion times for A, B, and C are 3, 4, and 6 days.
Formula: Time = Work ÷ Efficiency
=> Total Work (L.C.M. of 3, 4, 6) = 12 units
=> Total Efficiency = 4 + 3 + 2 = 9 units/day
=> Thrice the work = 12 × 3 = 36 units
=> Required Time = 36 ÷ 9 = 4 days
Therefore The correct answer is 4 days.
Additional Information
Combined Efficiency
When multiple people work together, their individual efficiencies are added to find the net rate of work.
Work-Time Relationship
Work is directly proportional to Time when Efficiency is constant. If work is multiplied by n, time is also multiplied by n.
L.C.M. Method
Using the Least Common Multiple of time durations as the Total Work helps in avoiding calculations with fractions.

Q29. Answer: (b) 40 m

Shortcut Trick
In a right-angled triangle with an angle of elevation of 45°, the base and the perpendicular (height) are always equal.
Since tan 45° = 1, the ratio of Height : Base = 1 : 1.
Given Base (distance from foot) = 40 m, therefore Height = 40 m.
Therefore The correct answer is 40 m.
Alternate Method
Given:
Distance from the foot (Base) = 40 m
Angle of elevation (θ) = 45°
Formula Used:
tan θ = Perpendicular (Height) ÷ Base

Calculations:

=> tan 45° = h ÷ 40

=> 1 = h ÷ 40

=> h = 1 × 40

=> h = 40 m

Therefore The correct answer is 40 m.

Additional Information

Trigonometric Ratios for Standard Angles

tan 30° = 1/√3, tan 45° = 1, and tan 60° = √3 are frequently used for height and distance problems.

Angle of Elevation vs Depression

The angle of elevation from an observer to an object is equal to the angle of depression from the object to the observer due to alternate interior angles.

Q30. Answer: (c) 720

Shortcut Trick

Initial Ratio Acid : Water = 2 : 10 → 1 : 5 (Total 6 units = 540 litres Therefore 1 unit = 90 litres)

New Ratio Acid : Water = 9 : 5

Since only Acid is added, Water remains constant (5 units in both ratios).

Increase in Acid units = 9 − 1 = 8 units

Value of 8 units = 8 × 90 = 720 litres.

Therefore The correct answer is 720 litres.

Alternate Method

Given: Total solution = 540 litres, Initial Ratio (Acid:Water) = 2:10, Final Ratio = 9:5.

=> Initial Acid = (2 / 12) × 540 = 90 litres.

=> Initial Water = (10 / 12) × 540 = 450 litres.

=> Let x litres of acid be added.

=> New Acid / Water = (90 + x) / 450 = 9 / 5

=> 5 × (90 + x) = 9 × 450

=> 450 + 5x = 4050

=> 5x = 3600

=> x = 720

Therefore The correct answer is 720 litres.

Additional Information

Constant Quantity Rule

In mixture problems where only one component is added or removed, the quantity of the other component remains unchanged. Use this to equate the two scenarios.

Ratio Balancing

Multiply ratios by suitable constants to make the non-changing part equal in both the initial and final ratios to solve quickly.

Alligation Method

Can also be used by treating the added acid as a 100% acid concentration and the original solution as a specific percentage concentration.

Q31. Answer: (c) Rs. 6,292

Shortcut Trick

The Effective Rate for 2 years at 10% Compound Interest is given by: x + y + (xy/100)

=> 10 + 10 + (10 × 10)/100 = 21%

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

Amount = 121% of Rs. 5,200 = 1.21 × 5200 = Rs. 6,292

Therefore The correct answer is Rs. 6,292.

Alternate Method

Given:

Principal (P) = Rs. 5,200

Rate (R) = 10% per annum

Time (n) = 2 years

Formula Used:

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

Calculations:

=> $A = 5200 \times (1 + 10/100)^2$

=> $A = 5200 \times (11/10) \times (11/10)$

=> $A = 52 \times 121$

=> $A = 6292$

Therefore The correct answer is Rs. 6,292.

Additional Information

CI vs SI Difference

The difference between Compound Interest and Simple Interest for 2 years is given by: $D = P(R/100)^2$.

Effective Interest Rate

For successive percentage increases (like CI), the net effect for two periods is x + y + xy/100. This is useful for quick mental math.

Half-Yearly Compounding

If interest is compounded half-yearly, the rate becomes R/2 and the time period becomes 2n.

Q32. Answer: (b) 84 years

Shortcut Trick

Ratio of Rahul to Grandmother at present = 2 : 7 (Difference = 5 units)

Ratio after 16 years = 2 : 5 (Difference = 3 units)

Equate differences by multiplying first ratio by 3 and second by 5:

Present = 6 : 21 | After 16 years = 10 : 25

Increase of 4 units (10 − 6 or 25 − 21) = 16 years => 1 unit = 4 years.

Grandmother's present age = 21 × 4 = 84 years.

Therefore The correct answer is 84 years.

Alternate Method

Let the present age of Grandmother be 7x and Rahul be 2x.

According to the problem, after 16 years:

=> (2x + 16) = 2/5 × (7x + 16)

=> 5(2x + 16) = 2(7x + 16)

=> 10x + 80 = 14x + 32

=> 14x − 10x = 80 − 32

=> 4x = 48

=> x = 12

=> Grandmother's present age = 7 × 12 = 84 years.

Therefore The correct answer is 84 years.

Additional Information

Ratio Difference Concept

The age difference between two people remains constant throughout their lives. Always equate the difference in ratio parts to simplify calculations.

Age After 'n' Years

If the present age is A, then age after n years is (A + n) and age n years ago was (A − n).

Fraction to Ratio Conversion

If A is x/y of B, then the ratio A : B is simply x : y.

Q33. Answer: (a) 76

Shortcut Trick

When distance is constant, Speed is inversely proportional to Time.

Speed ratio (Normal : New) = 1 : 2/3 = 3 : 2

Time ratio (Normal : New) = 2 : 3

Difference in time ratio = 3 − 2 = 1 unit → 38 minutes

Normal time = 2 units = 2 × 38 = 76 minutes

Therefore The correct answer is 76 minutes.

Alternate Method

Given: New Speed = 2/3 of Normal Speed; Time delay = 38 minutes.

Formula: Time = Distance ÷ Speed

=> Let Normal Speed be S and Distance be D.

=> Normal Time (T_n) = D/S

=> New Time (T_w) = D / (2S/3) = 3D / 2S

=> $T_w - T_n$ = 38 minutes

=> (3D/2S) − (D/S) = 38

=> (1/2) × (D/S) = 38

=> D/S = 38 × 2 = 76 minutes

Therefore The correct answer is 76 minutes.

Additional Information

Inverse Proportionality Rule

If speed becomes a/b of its original value, the time taken becomes b/a of the original time.

Speed-Time Relation

For a constant distance, S1 × T1 = S2 × T2.

Average Speed

If a person travels equal distances at speeds x and y, the average speed is 2xy ÷ (x + y).

Q34. Answer: (b) 57

Shortcut Trick

Teacher's Age = New Average + (Initial Number of Students × Increase in Average)

Change in Average Age = 15 − 14 = 1 year.

=> Teacher's Age = 15 + (42 × 1)

=> Teacher's Age = 15 + 42 = 57 years.

Therefore The correct answer is 57 years.

Alternate Method

Given:

Initial number of students = 42

Initial average age = 14 years

Total persons (including teacher) = 43

New average age = 15 years

Formula Used:

Sum of ages = Average × Number of persons

Calculations:

=> Total age of 42 students = 42 × 14 = 588 years

=> Total age of 43 persons = 43 × 15 = 645 years

=> Age of the teacher = (Total age of 43 persons) − (Total age of 42 students)

=> Age of the teacher = 645 − 588

=> Age of the teacher = 57 years

Therefore The correct answer is 57 years.

Additional Information

Inclusion Property

When a new member joins, if the average increases, the new member's value is greater than the old average. Formula: New Value = Old Avg + (New Total Number × Rise in Avg).

Exclusion Property

When a member leaves and the average increases, the excluded value is less than the old average. Formula: Excluded Value = Old Avg − (Remaining Number × Rise in Avg).

Replacement Property

When one person replaces another: New Person's Value = Replaced Person's Value + (Total Number × Change in Avg).

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Q35. Answer: (a) 21 cm

Shortcut Trick

Ratio of CSA : TSA = h : (h + r) = 3 : 5

Let height (h) = 3x and radius (r) = 2x (since 3 + 2 = 5).

Volume = $\pi r^2 h = (22/7) \times (2x)^2 \times (3x) = 12936$

$(264/7) \times x^3 = 12936 \Rightarrow x^3 = (12936 \times 7) / 264 = 343 \Rightarrow x = 7$.

Height = 3 × 7 = 21 cm.

Therefore The correct answer is 21 cm.

Alternate Method

Given: Ratio of Curved Surface Area (CSA) to Total Surface Area (TSA) = 3 : 5 and Volume = 12,936 cm^3.

Formula Used: CSA = $2\pi rh$ | TSA = $2\pi r(h + r)$ | Volume = $\pi r^2 h$

$\Rightarrow 2\pi rh / [2\pi r(h + r)] = 3 / 5$

$\Rightarrow h / (h + r) = 3 / 5$

$\Rightarrow 5h = 3h + 3r \Rightarrow 2h = 3r \Rightarrow r = 2h / 3$

$\Rightarrow$ Volume = $\pi r^2 h = 12,936$

$\Rightarrow (22/7) \times (2h / 3)^2 \times h = 12,936$

$\Rightarrow (22/7) \times (4h^2 / 9) \times h = 12,936$

$\Rightarrow (88/63) \times h^3 = 12,936$

$\Rightarrow h^3 = (12,936 \times 63) / 88$

$\Rightarrow h^3 = 147 \times 63 = 9261$

$\Rightarrow h = \sqrt[3]{(9261)} = 21$ cm.

Therefore The correct answer is 21 cm.

Additional Information

Properties of Cylinder

A solid cylinder has two circular bases and one curved surface. The Base Area is πr^2.

Surface Area Formulas

CSA = $2\pi rh$; TSA = $2\pi rh + 2\pi r^2 = 2\pi r(h + r)$. The ratio CSA/TSA depends only on r and h.

Volume of Cylinder

The capacity or Volume is given by the product of the base area and height: V = $\pi r^2 h$.

Q36. Answer: (d) 6

Shortcut Trick

Increase in Average = (New Score − Old Average) ÷ Total Innings

$\Rightarrow$ Increase = (130 − 68) ÷ 10

$\Rightarrow$ Increase = 62 ÷ 10 = 6.2

$\Rightarrow$ Rounded to nearest whole number ≈ 6

Therefore The correct answer is 6 runs.

Alternate Method

Given: Average of 9 innings = 68 | 10^(th) inning score = 130

Formula: New Average = (Total Runs) ÷ (Total Innings)

$\Rightarrow$ Total runs after 9 innings = 9 × 68 = 612

$\Rightarrow$ Total runs after 10 innings = 612 + 130 = 742

$\Rightarrow$ New Average = 742 ÷ 10 = 74.2

$\Rightarrow$ Increase in average = 74.2 − 68 = 6.2

$\Rightarrow$ Rounding 6.2 to nearest whole number $\Rightarrow$ 6

Therefore The correct answer is 6 runs.

Additional Information

Net Deviation Method

The change in average is equal to the net surplus or deficit relative to the old average, divided by the new total count of items.

Weighted Average

When two groups with averages A1 and A2 and sizes n1 and n2 are combined, the Combined Average = (n1A1 + n2A2) ÷ (n1 + n2).

Rounding Rules

If the decimal part is 0.5 or more, round up; if it is less than 0.5, round down (e.g., 6.2 becomes 6).

Q37. Answer: (d) 2x2 + 18

Shortcut Trick

Apply the Algebraic Identity: $(a - b)^2 + (a + b)^2 = 2(a^2 + b^2)$.

Here, substitute a = x and b = 3.

Expression = $2 \times (x^2 + 3^2) = 2(x^2 + 9) = 2x^2 + 18$.

Therefore The correct answer is $2x^2 + 18$.

Alternate Method

Given: The expression to simplify is $(x - 3)^2 + (x + 3)^2$.

Formula Used:

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

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

Calculations:

=> Expand $(x - 3)^2 = x^2 - 2 \times x \times 3 + 3^2 = x^2 - 6x + 9$

=> Expand $(x + 3)^2 = x^2 + 2 \times x \times 3 + 3^2 = x^2 + 6x + 9$

=> Combine the expanded terms: $(x^2 - 6x + 9) + (x^2 + 6x + 9)$

=> Grouping like terms: $(x^2 + x^2) + (-6x + 6x) + (9 + 9)$

=> $2x^2 + 0 + 18$

=> $2x^2 + 18$

Therefore, the simplification leads to Option (4).

Therefore The correct answer is $2x^2 + 18$.

Additional Information

Algebraic Identity $(a + b)^2$

$(a + b)^2 = a^2 + 2ab + b^2$. This identity is used to calculate the square of the sum of two variables.

Difference of Squares

$(a + b)(a - b) = a^2 - b^2$. This is used for factoring expressions where two squares are subtracted.

Subtraction of Squared Identities

$(a + b)^2 - (a - b)^2 = 4ab$. This identity helps find the middle term product directly from the sum and difference squares.

BODMAS Rule

Always follow Brackets, Orders, Division, Multiplication, Addition, and Subtraction when simplifying multi-step algebraic expressions.

Q38. Answer: (d) 10

Shortcut Trick

For finding the greatest number leaving the same remainder, calculate the HCF of the differences between the numbers.

Differences: (95 − 45) = 50 and (185 − 95) = 90.

HCF of 50 and 90 → 50 = 10 × 5 and 90 = 10 × 9.

The highest common factor is 10.

Therefore The correct answer is 10.

Alternate Method

Given: Numbers are 45, 95, and 185.

Formula Used: Required number = HCF(|x − y|, |y − z|, |z − x|)

=> Step 1: Calculate the differences between numbers.

=> |95 − 45| = 50

=> |185 − 95| = 90

=> |185 − 45| = 140

=> Step 2: Find HCF of 50, 90, and 140.

=> $50 = 2 \times 5^2$

=> $90 = 2 \times 3^2 \times 5$

=> $140 = 2^2 \times 5 \times 7$

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=> Common factors are 2 and 5.
=> HCF = 2 × 5 = 10.
Therefore The correct answer is 10.
Additional Information
HCF with Same Remainder
To find the largest number that divides x, y, and z leaving the same remainder, calculate HCF(|x−y|, |y−z|, |z−x|).
HCF with Different Remainders
To find the largest number that divides x, y, and z leaving remainders a, b, and c, calculate HCF(x−a, y−b, z−c).
LCM Property
The smallest number which when divided by x, y, and z leaves the same remainder r in each case is LCM(x, y, z) + r.

Q39. Answer: (a) 60

Shortcut Trick
Total cost ratio = (3 × 280) : (4 × 180) : (3 × 100) = 840 : 720 : 300 = 1860 units.
Given total spending = Rs. 27,900.
Value of 1 unit = 27900 ÷ 1860 = 15.
Number of articles of type Q = 4 × 15 = 60.
Therefore The correct answer is 60 articles.
Alternate Method
Given: Prices of P, Q, R are Rs. 280, Rs. 180, Rs. 100. Purchase ratio is 3 : 4 : 3.
Formula: Total Cost = ∑(Price × Quantity)
=> Let quantities be 3x, 4x, and 3x.
=> Total Cost = (280 × 3x) + (180 × 4x) + (100 × 3x) = 27,900
=> 840x + 720x + 300x = 27,900
=> 1860x = 27,900
=> x = 27,900 ÷ 1860 = 15
=> Articles of type Q = 4x = 4 × 15 = 60
Therefore The correct answer is 60 articles.
Additional Information
Ratio and Proportion
If quantities are in ratio a:b:c, we can represent them as ax, bx, and cx where x is the common multiplier.
Weighted Average
Average price = Total Expenditure ÷ Total Quantity = (P1Q1 + P2Q2 + ...) ÷ (Q1 + Q2 + ...).

Q40. Answer: (c) 78

Shortcut Trick
Every number represents 100% of itself.
Given, 20% of the number + 96 = 100% of the number.
=> 100% − 20% = 80% of the number = 96
=> 1% of the number = 96 ÷ 80 = 1.2
=> 65% of the number = 65 × 1.2 = 78
Therefore The correct answer is 78.
Alternate Method
Given:
20% of a number + 96 = The same number
20% 80% 96 100% (Original Number)
Calculations:
Let the original number be N.
=> 20% of N + 96 = N
=> (20 ÷ 100) × N + 96 = N
=> 0.2N + 96 = N
=> N − 0.2N = 96

=> 0.8N = 96

=> N = 96 ÷ 0.8

=> N = 120

Now, we are required to find 65% of the same number:

=> 65% of 120 = (65 ÷ 100) × 120

=> 0.65 × 120 = 78

Therefore The correct answer is 78.

Additional Information

Base of Percentage

The original or initial value in any percentage problem is always taken as 100%. All additions or subtractions are calculated relative to this fixed base value.

Multiplying Factor

To directly find a percentage of a number, simply multiply the number by the percentage fraction (e.g., 65% = 0.65). If a value increases by R%, it becomes (1 + R÷100) × Original Value.

Successive Percentage Change

When a number undergoes two successive percentage changes of A% and B%, the net percentage change can be calculated using the formula: Net Change = A + B + (A × B)÷100 %.

Q41. Answer: (a) Decreases by 76.44%

Shortcut Trick

Net multiplier = 0.50 × 0.65 × 0.50 × 1.45

Net multiplier = 0.235625

Percentage change = (0.235625 − 1) × 100 = −76.4375%

Therefore The correct answer is Decreases by 76.44%.

Alternate Method

Given: Initial fuel price decreases by 50%, 35%, 50% and then increases by 45%.

=> Let the original price be 100.

=> Price after 1^(st) month = 100 × (1 − 50/100) = 50

=> Price after 2^(nd) month = 50 × (1 − 35/100) = 50 × 0.65 = 32.5

=> Price after 3^(rd) month = 32.5 × (1 − 50/100) = 16.25

=> Price after 4^(th) month = 16.25 × (1 + 45/100) = 16.25 × 1.45 = 23.5625

=> Total decrease = 100 − 23.5625 = 76.4375

=> Percentage decrease = (76.4375 / 100) × 100 = 76.4375%

Therefore The correct answer is Decreases by 76.44%.

Additional Information

Successive Percentage Change

For two successive changes of a% and b%, net change = [a + b + (ab/100)]%.

Multiplier Method

Final Value = Initial Value × (1 ± r1/100) × (1 ± r2/100) × ... × (1 ± r_n/100).

Percentage Change

Percentage change = [(Final Value − Initial Value) / Initial Value] × 100.

Q42. Answer: (d) 80 km/hr

Shortcut Trick

When two equal halves of a distance are covered at speeds x and y, the Average Speed is given by the Harmonic Mean formula: (2 × x × y) ÷ (x + y).

Average Speed = (2 × 72 × 90) ÷ (72 + 90)

Average Speed = (2 × 72 × 90) ÷ 162

Average Speed = 12960 ÷ 162 = 80 km/hr.

Therefore The correct answer is 80 km/hr.

Alternate Method

Given: Speed 1 (v1) = 72 km/hr, Speed 2 (v2) = 90 km/hr.

Formula Used: Average Speed = Total Distance ÷ Total Time

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=> Let the total distance be 2D. Each half is D.
=> Time for first half (t1) = D ÷ 72
=> Time for second half (t2) = D ÷ 90
=> Total Time = (D ÷ 72) + (D ÷ 90) = (5D + 4D) ÷ 360 = 9D ÷ 360 = D ÷ 40
=> Average Speed = 2D ÷ (D ÷ 40) = 2D × 40 ÷ D = 80 km/hr
Therefore The correct answer is 80 km/hr.
Additional Information
Average Speed (Equal Time)
If a body travels for equal intervals of time with speeds x and y, then Average Speed = (x + y) ÷ 2.
Relative Speed
When two objects move in the same direction, relative speed = S1 − S2. In opposite directions, relative speed = S1 + S2.
Unit Conversion
To convert km/hr to m/s, multiply by 5/18. To convert m/s to km/hr, multiply by 18/5.

Q43. Answer: (a) 23

Shortcut Trick
Check the options based on the given conditions.
Condition 1: Sum of digits must be 5. All options (2+3, 4+1, 3+2, 1+4) satisfy this.
Condition 2: Adding 9 must reverse the digits.
Test Option (1): 23 + 9 = 32. Digits of 23 are interchanged to 32.
Therefore The correct answer is 23.
Alternate Method
Given: Sum of digits = 5. Adding 9 reverses the number.
Formula Used: Let the ten's digit be x and unit's digit be y. Number = 10x + y.
=> x + y = 5 --- (Equation 1)
=> (10x + y) + 9 = 10y + x
=> 10x − x + y − 10y = −9
=> 9x − 9y = −9
=> x − y = −1 --- (Equation 2)
=> Adding (1) and (2): 2x = 4 → x = 2
=> Substituting x in (1): 2 + y = 5 → y = 3
=> The number = 10(2) + 3 = 23
Therefore The correct answer is 23.
Additional Information
Digit Reversal Rule
The difference between a two-digit number and its reverse is always divisible by 9, i.e., (10x+y) − (10y+x) = 9(x−y).
Sum of Reversed Numbers
The sum of a two-digit number and its reverse is always divisible by 11, i.e., (10x+y) + (10y+x) = 11(x+y).

Q44. Answer: (a) Rs. 15,600

Shortcut Trick
Use the direct relationship between Marked Price (MP) and Cost Price (CP): CP ÷ MP = (100 − Discount%) ÷ (100 + Profit%).
CP ÷ 35000 = (100 − 22) ÷ (100 + 75) = 78 ÷ 175.
CP = 35000 × (78 ÷ 175).
CP = 200 × 78 = 15600.
Therefore The correct answer is Rs. 15,600.
Alternate Method
Given: Marked Price = Rs. 35,000, Discount = 22%, Profit = 75%.
Formulas: SP = MP × (100 − D%) ÷ 100 | CP = SP × 100 ÷ (100 + P%)
=> Selling Price (SP) = 35000 × (100 − 22) ÷ 100 = 350 × 78 = Rs. 27,300.
=> Cost Price (CP) = 27300 × 100 ÷ (100 + 75) = 27300 × 100 ÷ 175.
=> CP = 27300 × 4 ÷ 7 = 3900 × 4 = Rs. 15,600.

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Therefore The correct answer is Rs. 15,600.

Additional Information

Marked Price and Discount

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

CP-MP Ratio Formula

When both profit and discount are given, the ratio of CP to MP is fixed as (100 − D%) : (100 + P%).

Q45. Answer: (c) Only A

Shortcut Trick

Scheme A: Buy 5 Get 23 Free. Total items = 28. Discount% = (Free Items ÷ Total Items) × 100 = (23 ÷ 28) × 100 ≈ 82.14%.

Scheme B: 14% and 37% successive. Net Discount = 14 + 37 − (14 × 37 ÷ 100) = 51 − 5.18 = 45.82%.

Scheme C: 39% and 39% successive. Net Discount = 39 + 39 − (39 × 39 ÷ 100) = 78 − 15.21 = 62.79%.

Comparing 82.14%, 45.82%, and 62.79%, Scheme A offers the highest discount.

Therefore The correct answer is Only A.

Alternate Method

Given → Scheme A (Buy 5 Get 23 Free), Scheme B (14% & 37% Successive), Scheme C (Two 39% Successive).

Formulas: Discount% = (Free ÷ Total) × 100 | Successive Discount = a + b − (ab ÷ 100)

=> Discount A = (23 ÷ (5 + 23)) × 100 = (23 ÷ 28) × 100 = 82.14%.

=> Discount B = 14 + 37 − (14 × 37 ÷ 100) = 51 − 5.18 = 45.82%.

=> Discount C = 39 + 39 − (39 × 39 ÷ 100) = 78 − 15.21 = 62.79%.

=> For a customer, the scheme with the maximum discount percentage is the most beneficial.

=> Max (82.14, 45.82, 62.79) = 82.14% (Scheme A).

Therefore The correct answer is Only A.

Additional Information

Buy x Get y Free Concept

In such offers, the discount is calculated on the total number of items (Purchased + Free). Formula: Discount% = [y ÷ (x + y)] × 100.

Successive Discounts

When two discounts a% and b% are given, the total discount is always less than the sum of the two percentages due to the compounding effect.

Q46. Answer: (a) 6

Shortcut Trick

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

4 × 27 = M2 × 18

M2 = (4 × 27) ÷ 18 = 108 ÷ 18 = 6

Therefore The correct answer is 6 men.

Alternate Method

Person	Days	Total Work	Efficiency
4 Men	27	108 units	4 units/day
Required Men	18	6 units/day	

Given: 4 men take 27 days to finish the work.

Formula Used: Total Work = Number of Men × Number of Days

=> Total Work = 4 × 27 = 108 units

=> Days given for the new scenario = 18 days

=> Required number of men = Total Work ÷ Number of Days

=> Required number of men = 108 ÷ 18

=> Required number of men = 6

Therefore The correct answer is 6 men.

Additional Information

Chain Rule Formula

The general formula is (M1 × D1 × H1) / W1 = (M2 × D2 × H2) / W2, where M is men, D is days, 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).

Work and Wages

Wages are distributed based on the ratio of work done, which is usually the product of efficiency and time.

Q47. Answer: (b) 1,10,250

Shortcut Trick

The final price for C can be calculated using the successive multiplier method.

Cost Price for C = Original CP × (100 − Loss%)/100 × (100 + Profit%)/100.

Cost Price for C = 1,50,000 × 0.70 × 1.05.

Cost Price for C = 1,05,000 × 1.05 = 1,10,250.

Therefore The correct answer is Rs. 1,10,250.

Alternate Method

Given: CP of A = Rs. 1,50,000, Loss of A = 30%, Profit of B = 5%.

Formulas: SP = CP × (100 ± P/L%)/100.

=> Selling price of A (which is CP of B) = 1,50,000 × (100 − 30)/100 = 1,50,000 × 70/100 = Rs. 1,05,000.

=> Selling price of B (which is CP of C) = 1,05,000 × (100 + 5)/100 = 1,05,000 × 105/100.

=> CP of C = 1,050 × 105 = Rs. 1,10,250.

Therefore The correct answer is Rs. 1,10,250.

Additional Information

Successive Transactions

When an item is sold through multiple hands, the final selling price is the product of the initial cost price and all intermediate profit/loss multipliers.

Effective Percentage Change

The overall change can be found using the formula: a + b + (ab/100), where a and b are the percentage changes (negative for loss).

Q48. Answer: (d) -2

Shortcut Trick

Solve inner brackets first using BODMAS: (17 − 40 ÷ 5) = 17 − 8 = 9

Next round bracket: (72 ÷ 3 − 9 ÷ 9) = 24 − 1 = 23

Square bracket: [82 − 23] = 59

Final calculation: 57 − 59 = −2

Therefore The correct answer is -2.

Alternate Method

Given:

Expression: 57 − [82 − (72 ÷ 3 − (17 − 40 ÷ 5) ÷ 9)]

Formula Used:

BODMAS Rule: Brackets → Of → Division → Multiplication → Addition → Subtraction

Calculations:

=> 57 − [82 − (72 ÷ 3 − (17 − 40 ÷ 5) ÷ 9)]

=> 57 − [82 − (72 ÷ 3 − (17 − 8) ÷ 9)]

=> 57 − [82 − (72 ÷ 3 − 9 ÷ 9)]

=> 57 − [82 − (24 − 1)]

=> 57 − [82 − 23]

=> 57 − 59

=> −2

Therefore The correct answer is -2.

Additional Information

BODMAS Rule

It dictates the sequence of operations to solve expressions correctly: Brackets (), {}, []), Of (powers and roots), Division (÷), Multiplication (×), Addition (+), and Subtraction (−).

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Types of Brackets

Always solve in the specific order from innermost to outermost: Vinculum or Bar (‾), Round brackets or Parentheses (), Curly brackets or Braces {}, and Square brackets or Box brackets [].

Common Mistakes to Avoid

Always solve operations inside brackets completely before interacting with numbers outside. Also, remember that Addition and Subtraction have the same precedence, so evaluate them from left to right after division and multiplication.

Q49. Answer: (c) 6 days

Shortcut Trick

Time taken by two groups working together = (A × B) ÷ (A + B)

Days = (9 × 18) ÷ (9 + 18)

Days = 162 ÷ 27 = 6 days

Therefore The correct answer is 6 days.

Alternate Method

Given:

Time taken by Group Leo = 9 days

Time taken by Group Tiger = 18 days

Formula Used:

Total Work = LCM of individual days

Efficiency = Total Work ÷ Time taken

Person	Days	Total Work	Efficiency
Group Leo	9	18	2
Group Tiger	18	1	

Calculations:

=> Total Efficiency of (Leo + Tiger) = 2 + 1 = 3 units/day

=> Total Work to be completed = 18 units

=> Time required = Total Work ÷ Total Efficiency

=> Time = 18 ÷ 3 = 6 days

Therefore The correct answer is 6 days.

Additional Information

Combined Efficiency

When multiple entities work together, their individual efficiencies are added to find the net work done per unit time.

Pipes and Cisterns

This concept is identical to work; however, an outlet pipe has negative efficiency as it empties the tank.

Work and Wages

Wages are distributed in the ratio of the work done by each person, which is the ratio of their efficiencies if they work for the same duration.

Q50. Answer: (b) 9 times

Shortcut Trick

The surface area of a sphere is directly proportional to the square of its radius (Area prop. to r^2).

Ratio of the radii = 15 ÷ 5 = 3 : 1.

Ratio of their surface areas = $(3)^2 : (1)^2 = 9 : 1$.

Therefore The correct answer is 9 times.

Alternate Method

Given:

Radius of the small sphere (r) = 5 cm

Radius of the larger sphere (R) = 15 cm

Formula Used:

Surface Area of a Sphere (S) = 4 × π × radius²

Calculations:

=> Surface area of small sphere (S1) = $4 \times \pi \times (5)^2 = 100\pi$ cm²

=> Surface area of larger sphere (S2) = $4 \times \pi \times (15)^2 = 4 \times \pi \times 225 = 900\pi$ cm²

=> Comparison = S2 ÷ S1 = $900\pi \div 100\pi$

=> Comparison = 9 times

Therefore The correct answer is 9 times.

Additional Information

Volume Ratio of Spheres

The volume of a sphere is proportional to the cube of its radius (V prop. to r^3). If the radius triples, the volume becomes $3^3 = 27$ times greater.

Surface Area of Hemisphere

For a solid hemisphere of radius r, the Curved Surface Area is $2\pi r^2$ and the Total Surface Area is $3\pi r^2$.

Scaling Properties

For any similar geometric shapes, the ratio of their areas is the square of the ratio of their corresponding linear dimensions (scale factor k^2).

Q51. Answer: (d) 2

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

Now,

Even numbers, each of which is immediately preceded by an odd number and also immediately followed by an even number.

So, the needed pattern is: Odd — Even — Even

Thus, there are 2 even numbers, each of which is immediately preceded by an odd number and also immediately followed by an even number.

Hence, the correct answer is "Option 4".

Q52. Answer: (d) ex

Given: In a certain code language, ‘uncle ocean elf’ is coded as ‘so ex rj’ and ‘elf yak queen’ is coded as ‘ku yi ex’.

Thus, ‘elf’ is coded as 'ex' in that language.

Hence, the correct answer is "Option 4".

Q53. Answer: (b) One

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

Now,

Odd numbers, each of which is immediately preceded by an odd number and also immediately followed by an odd number.

So, the needed pattern is: Odd — Odd — Odd

Thus, there is 1 odd number, each of which is immediately preceded by an odd number and also immediately followed by an odd number.

Hence, the correct answer is "Option 2".

Q54. Answer: (c) 2 km to the east

Given: Samar starts from point A and drives 58 km towards north. He then takes a right turn, drives 64 km, turns right and drives 63 km. He then takes a right turn and drives 66 km. He takes a final right turn, drives 5 km and stops at point P.

Thus, he should drive 2 km to the east in order to reach point A again.

Hence, the correct answer is "Option 3".

Q55. Answer: (d) GA-DI

The position and positional values or English Alphabets are:

The pattern followed here is:

Each letter-cluster pair follows the pattern -3, +7.

Let’s check each option:

1. JD-GK

This letter-cluster pair follows the pattern -3, +7.

2. NH-KO

This letter-cluster pair follows the pattern -3, +7.

3. LF-IM

This letter-cluster pair follows the pattern -3, +7.

4. GA-DI

This letter-cluster pair does not follow the pattern -3, +7.

Thus, GA-DI is the odd one out.

Hence, the correct answer is "Option 4".

Q56. Answer: (c) Father's brother's son's wife

Family Chart:

Decoding the Symbols:

A is				
Symbol	•	•	x	÷
Meaning	son	brother	wife	father
to B				

Given: D × F + G – H ÷ J

It means: D is the wife of F, F is the son of G, G is the brother of H, H is the father of J.

Thus, D is J's Father's brother's son's wife.

Hence, the correct answer is "Option 3".

Q57. Answer: (d) 63

BODMAS Rule:

Decoding the given information:

Letter	A	B	C	D
Meaning	÷	×	•	•

Given equation: 45 A 9 B 13 C 15 D 17 = ?

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

=> 45 ÷ 9 × 13 + 15 − 17 = ?

=> 5 × 13 + 15 − 17 = ?

=> 65 + 15 − 17 = ?

=> 80 − 17 = ?

=> 63 = ?

Hence, the correct answer is "Option 4".

Q58. Answer: (d) XGM64

The position and positional values or English Alphabets are:

Given: OPD73, RMG70, UJJ67, ?

The logic followed here is:

Thus, XGM64 will replace the question mark (?) in the given series to make it logically complete.

Hence, the correct answer is "Option 4".

Q59. Answer: (d) Four

Given: Seven boxes B, C, D, I, J, K and L are kept one over the other but not necessarily in the same order.

1. Only four boxes are kept above L.
2. Only one box is kept above J.
3. Only one box is kept between J and C.
4. B is kept immediately above D.
5. K is kept at some place below I.

I
J
K

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C
L
B
D

Thus, four boxes are kept between I and B.

Hence, the correct answer is "Option 4".082

Q60. Answer: (c) 313

BODMAS Rule:

Decoding the given information:

Symbol	•	•	×	÷
Meaning	•	×	÷	•

Given equation: 18 - 6 ÷ 228 + 46 x 2 = ?

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

=> 18 × 6 + 228 − 46 ÷ 2 = ?

=> 18 × 6 + 228 − 23 = ?

=> 108 + 228 − 23 = ?

=> 336 − 23 = ?

=> 313 = ?

Hence, the correct answer is "Option 4".

Q61. Answer: (d) C

Given: Six people, A, B, C, D, E and F, are sitting in a row, facing north.

1. Only two people sit to the left of F.
2. Only one person sits between D and E.
3. F sits to the immediate left of D.
4. A sits to the immediate right of C.
5. B sits third to the right of A.

Thus, C sits at the extreme left end of the line.

Hence, the correct answer is "Option 4".

Q62. Answer: (d) 1

Given: (Left) % * 7 % € % 2 # € $ € © 9 5 6 # 9 & 6 % 7 & (Right)

Now,

Numbers, each of which is immediately preceded by a number and also immediately followed by a symbol.

So, the needed pattern is: Number — Number — Symbol

Thus, there is 1 such number, which is immediately preceded by a number and also immediately followed by a symbol.

Hence, the correct answer is "Option 4".

Q63. Answer: (d) UW −9

The position and positional values or English Alphabets are:

Given: QP 7 is related to TO −4 in a certain way. In the same way, AL 14 is related to DK 3.

The logic followed here is:

Similarly,

Thus, RX 2 is related to UW -9, following the same logic.

Hence, the correct answer is "Option 4".

Q64. Answer: (c) 23

Given: 88 75 62 49 36 ?

The logic followed here is:

Thus, 23 should come in place of the question mark (?) in the given series.

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Hence, the correct answer is "Option 3".

Q65. Answer: (a) K

Given: Seven people, B, C, D, I, J, K and L, are sitting around a circular table, facing the centre of the table.

1. I sits to the immediate left of L.

2. K sits third to the left of L.

3. J sits second to the left of C.

4. D sits to the immediate left of J.

The above statement cannot be satisfied in case II, so it is eliminated.

G, the only person left will occupy the vacant position.

Thus, K sits third to the right of B.

Hence, the correct answer is "Option 1".

Q66. Answer: (b) mn

Given: In a certain code language, ‘technology is advancing’ is coded as ‘mn jk rs’ and ‘humanity needs technology’ is coded as ‘ap mn fg’.

Thus, ‘technology’ is coded as 'mn' in the given language.

Hence, the correct answer is "Option 2".8994

Q67. Answer: (a) Neither follows

Statements:

All actors are dancers.

All dancers are magicians.

The least possible Venn diagram for the given statement is:

Conclusions:

(I) All magicians are actors. - Does not follow (Because, all actors are magicians does not mean all magicians are actors. It means, magicians are actors.)

(II) No dancer is an actor. - Does not follow (Because, all actors are dancers, which means some actors are dancers.)

Thus, neither follows.

Hence, the correct answer is "Option 1".

Q68. Answer: (a) 10

Given: Each of the digits in the number 5493218 is arranged in ascending order from left to right.

Original Digits	**5**	**4**	**9**	**3**	**2**	**1**	**8**
New Order	1	2	3	4	5	8	9

The digit second from the left is is 2.

The digit second from the right is is 8.

Sum = 2 + 8 = 10

Thus, the sum of the digits which are second from the left and second from the right is 10.

Hence, the correct answer is "Option 1".

Q69. Answer: (b) OS-NR

The position and positional values or English Alphabets are:

The pattern followed here is:

Each letter-cluster pair follows the pattern -1, -2.

Let’s check each option:

1. KO-JM

This letter-cluster pair follows the pattern -1, -2.

2. OS-NR

This letter-cluster pair does not follow the pattern -1, -2.

3. MQ-LO

This letter-cluster pair follows the pattern -1, -2.

4. IM-HK

This letter-cluster pair follows the pattern -1, -2.

Thus, OS-NR is the odd one out.

Hence, the correct answer is "Option 2".

Q70. Answer: (c) YRNZ

The position and positional values or English Alphabets are:

Given: EFHL is related to AALQ in a certain way based on the English alphabetical order. In the same way, OLXF is related to KGBK.

The logic followed here is:

Similarly,

Thus, CWJU is related to YRNZ, following the same logic.9509950

Hence, the correct answer is "Option 3".

Q71. Answer: (d) 25

Given: Vaibhav ranked 9th from the top and 17th from the bottom in his class.

Total students = (Rank from top + Rank from bottom) - 1

Total students = (9 + 17) - 1

Total students = 26 - 1

Total students = 25

Thus, total number of students in the class is 25.

Hence, the correct answer is "Option 4".

Q72. Answer: (d) PTQO

The position and positional values or English Alphabets are:

Given: RVSQ is related to OSPN in a certain way based on the English alphabetical order. In the same way, ZDAY is related to WAXV.

The logic followed here is:

Similarly,

Thus, SWTR is related to PTQO, following the same logic.

Hence, the correct answer is "Option 4".

Q73. Answer: (a) Only conclusion (I) follows

Statements:

All helmets are mats.

All helmets are bottles.

The least possible Venn diagram for the given statement is:

Conclusions:

(I) Some mats are bottles. - Follow (Because, all helmets are mats and all helmets are bottles, which means some mats being helmets are bottles.)

(II) All bottles are helmets. - Does not follow (Because, all helmets are bottles, which means some bottles are helmets, not All bottles are helmets.)

Thus, only conclusion (I) follows.

Hence, the correct answer is "Option 1".

Q74. Answer: (a) 288

Given: 312 313 303 305 295 298 ?

The logic followed here is:

Thus, 288 should come in place of the question mark (?) in the given series.

Hence, the correct answer is "Option 1".

Q75. Answer: (d) 6 km towards the south

Given: Shruti starts from Point A and drives 12 km towards the south. She then takes a left turn, drives 8 km, turns right and drives 4 km. She then takes a right turn and drives 12 km. She then takes a right turn and drives 10 km. She takes a final right turn, drives 4 km and stops at Point D.

Thus, Point D is 6 km towards the south with respect to Point A.

Hence, the correct answer is "Option 4".

Q76. Answer: (d) (9, 81, 9)

The logic followed here is:

Logic: (a, b, c) → a × c = b

8 × 8 = 64

4 × 4 = 16

Let's check each option:

1. (2, 8, 2) → 2 × 2 = 4 ≠ 8

2. (5, 125, 5) → 5 × 5 = 25 ≠ 125

3. (3, 9, 4) → 3 × 4 = 12 ≠ 9

4. (9, 81, 9) → 9 × 9 = 81

Thus, (9, 81, 9) is the set in which the numbers are related in the same way as the given sets.

Hence, the correct answer is "Option 4".

Q77. Answer: (b) 49

Given: 7 9 13 19 27 37 ?

The logic followed here is:

Thus, 49 should come in place of the question mark (?) in the given series.

Hence, the correct answer is "Option 2".

Q78. Answer: (d) W

Given: O, P, Q, R, W, X, and Y are sitting in a straight line facing the north.

1. Only two people sit to the right of X.

2. Only two people sit between X and Q.

3. Only two people sit between O and P.

4. P sits to the immediate left of X.

5. R sits to the immediate right of Y.

The above statement cannot be satisfied in case I, so it is eliminated.

W, the only person left will occupy the vacant position.

Thus, W sits at the third position from the left end of the line.

Hence, the correct answer is "Option 4".

Q79. Answer: (a) Two

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

Now,

Odd numbers, each of which is immediately preceded by an even number and also immediately followed by an even number.

So, the needed pattern is: Even — Odd — Even

Thus, there are two odd numbers, each of which is immediately preceded by an even number and also immediately followed by an even number.

Hence, the correct answer is "Option 1".

Q80. Answer: (a) SZ69

The position and positional values or English Alphabets are:

Given: KR37 MT45 OV53 QX61 ?

The logic followed here is:

Thus, SZ69 will replace the question mark (?) in the given series to make it logically complete.

Hence, the correct answer is "Option 1".

Q81. Answer: (a) Dr. V Narayanan

The correct answer is Dr. V Narayanan.

Key Points

• In January 2025, the Appointments Committee of the Cabinet (ACC) approved the appointment of Dr. V Narayanan as the new

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Chairperson of the Indian Space Research Organisation (ISRO).

• Alongside the role of ISRO Chairperson, he also assumed the charges of Secretary, Department of Space (DoS), and Chairman of the Space Commission.

• Dr. V Narayanan succeeded S. Somanath, whose distinguished three-year tenure concluded in January 2025. Hence, the correct answer is Dr. V Narayanan.

• Prior to his appointment as the head of the Indian space agency, Dr. Narayanan served as the Director of the Liquid Propulsion Systems Centre (LPSC), a key unit of ISRO located in Valiamala, Thiruvananthapuram.

• He is widely recognized as a leading expert in Cryogenic Propulsion Technology and played a critical role in the development of the CE-20 engine, which powers the LVM3 (Launch Vehicle Mark-III).

Additional Information

• Indian Space Research Organisation (ISRO):

• ISRO was established on August 15, 1969, superseding the Indian National Committee for Space Research (INCOSPAR).

• The organization is headquartered in Bengaluru, Karnataka, and functions under the Department of Space, which reports directly to the Prime Minister of India.

• The first Chairman of ISRO was Dr. Vikram Sarabhai, who is considered the Father of the Indian Space Program.

• Department of Space (DoS) and Space Commission:

• The Department of Space and the Space Commission were established by the Government of India in 1972 to promote the development and application of space science and technology.

• The Chairman of ISRO traditionally holds the ex-officio position of Secretary (DoS) to ensure seamless administrative and technical coordination.

• Other Options Overview:

• S. Somanath: Served as the 10th Chairman of ISRO from January 2022 to January 2025. His tenure saw the historic success of Chandrayaan-3 and the launch of Aditya-L1.

• K. Radhakrishnan: He was the Chairman of ISRO from 2009 to 2014, leading the successful Mars Orbiter Mission (Mangalyaan).

• A. Sivathanu Pillai: A renowned scientist known as the Father of BrahMos, he served as the CEO and Managing Director of BrahMos Aerospace and was a former Chief Controller of DRDO.

Important Points

• Dr. V Narayanan joined ISRO in 1984 and has contributed significantly to the Indian space program for over 40 years.

• He has been instrumental in the Chandrayaan-2 and Chandrayaan-3 missions, specifically overseeing the propulsion systems required for complex lunar landings.

• Under his leadership, ISRO is expected to prioritize upcoming ambitious projects such as the Gaganyaan (India's first human spaceflight mission), the Bhartiya Antariksh Station, and the Shukrayaan (Venus orbiter) mission.

• He has received numerous accolades, including the ISRO Performance Excellence Award and the Team Excellence Award for his contributions to rocket propulsion.

Q82. Answer: (c) 139

The correct answer is 139.

Key Points

• The Government of India announced the Padma Awards for the year 2025 on the eve of the 76th Republic Day.

• For the year 2025, the President of India has approved the conferment of 139 Padma Awards.

• The total count of 139 awards includes 5 Padma Vibhushan, 17 Padma Bhushan, and 117 Padma Shri awards.

• Among the awardees, 33 are women, and the list includes 11 persons from the category of Foreigners/NRI/PIO/OCI and 18 Posthumous awardees.

• The awards are conferred in various disciplines/fields of activities, viz. Art, Social Work, Public Affairs, Science and Engineering, Trade and Industry, Medicine, Literature and Education, Sports, and Civil Service.

Additional Information

• Historical Context:

• The Padma Awards were instituted in the year 1954 and are considered among the highest civilian honors of India.

• Except for brief interruptions during the years 1978, 1979, and 1993 to 1997, these awards have been announced every year on Republic Day.

• Categories of Awards:

• Padma Vibhushan: Awarded for exceptional and distinguished service. It is the second-highest civilian award in India.

• Padma Bhushan: Awarded for distinguished service of high order. It is the third-highest civilian award.

• Padma Shri: Awarded for distinguished service in any field. It is the fourth-highest civilian award.

• Selection Process:

• The nominations are placed before the Padma Awards Committee, which is constituted by the Prime Minister every year.

• The Padma Awards Committee is headed by the Cabinet Secretary and includes the Home Secretary, Secretary to the President, and four to six eminent persons as members.

• The recommendations of the committee are submitted to the Prime Minister and the President of India for approval.

Important Points

• Upper Limit: According to the guidelines, the total number of awards given in a year (excluding posthumous awards and awards to foreigners) should not exceed 120. However, the inclusion of Posthumous and Foreign/NRI categories often brings the total count above this number, as seen with the 139 awards in 2025.

• Ceremony: These awards are typically presented by the President of India at ceremonial functions held at Rashtrapati Bhavan around March or April each year.

• Nature of the Award: The award does not amount to a title and cannot be used as a suffix or prefix to the awardee's name in terms of Article 18(1) of the Constitution of India.

• Notable 2025 Figures: The Padma Vibhushan recipients for 2025 include prominent names such as Shri Amitabh Bachchan for Art and Shri Ratan Naval Tata (Posthumous) for Trade and Industry.

Q83. Answer: (c) 20 years

The correct answer is 20 years.

Key Points

• On 17 January 2025, Russia and Iran signed a landmark Comprehensive Strategic Partnership Treaty in Tehran.

• The treaty was signed by Russian President Vladimir Putin and Iranian President Masoud Pezeshkian during a high-profile state visit.

• The fundamental duration of this strategic partnership treaty is fixed for a period of 20 years.

• It includes a provision for an automatic extension for another 5 years if neither party provides notice of termination.

• The agreement signifies a major shift in the geopolitical landscape, formalizing a deeper level of military, political, and economic cooperation between the two nations.

Additional Information

• Historical Context: This new treaty replaces the Treaty on the Basis of Relations and Principles of Cooperation, which was signed in 2001. The original 2001 agreement was initially for 10 years and had been extended multiple times before being superseded by the current 20-year pact.

• Strategic Cooperation: The partnership covers critical sectors including defense, energy, transportation, and agriculture. It aims to create a unified front against Western sanctions imposed on both Moscow and Tehran.

• Defense Provisions: Reports indicate the treaty includes clauses regarding mutual assistance in the event of aggression against either party, though the specific nature of military intervention is subject to international law and bilateral protocols.

• Energy and Trade: Both countries, being major oil and gas producers, seek to coordinate energy markets and increase trade using local currencies to bypass the US Dollar-based financial system.

Important Points

• Geopolitical Alignment: The signing in 2025 highlights the growing "Eastward" shift of both nations, as they strengthen ties within frameworks like BRICS and the Shanghai Cooperation Organization (SCO).

• INSTC Development: A core component of the partnership is the development of the International North-South Transport Corridor (INSTC), a 7,200-km multi-mode network aimed at connecting India, Iran, and Russia.

• Space and Nuclear Technology: The agreement also touches upon cooperation in peaceful space exploration and nuclear energy, continuing the collaboration seen in the Bushehr Nuclear Power Plant project.

• Ratification: To become fully legally binding, the treaty must be ratified by the State Duma of Russia and the Islamic Consultative Assembly (Majlis) of Iran.

Q84. Answer: (b) BEML Ltd, Tata International Vehicle Applications, SDR Auto Pvt Ltd, John Galt International

The correct answer is BEML Ltd, Tata International Vehicle Applications, SDR Auto Pvt Ltd, John Galt International.

Key Points

• In June 2025, the Defence Research and Development Organisation (DRDO) reached a significant milestone in defense indigenization by transferring the technology for the 70-ton Tank Transporter Trailer.

• The Combat Vehicles Research and Development Establishment (CVRDE), a premier lab of DRDO based in Avadi, handed over the Transfer of Technology (ToT) documents to four major industry partners.

• The recipient companies include BEML Ltd, Tata International Vehicle Applications (TIVA), SDR Auto Pvt Ltd, and John Galt International. Hence, the correct answer is BEML Ltd, Tata International Vehicle Applications, SDR Auto Pvt Ltd, John Galt International.

• This 70-ton trailer has been specifically designed and developed to meet the logistical requirements of transporting the Main

Battle Tank (MBT) Arjun Mk-1A, which is the heaviest tank in the Indian Army's inventory.

• The move aims to boost domestic manufacturing capabilities and ensure that multiple production lines are available to meet the induction timelines of the armored regiments.

Additional Information

• MBT Arjun Mk-1A:

• The Arjun Mk-1A is an upgraded variant of the Arjun Mark-1 tank, featuring 71 new upgrades compared to the earlier version.

• It weighs approximately 68.5 tonnes, making it one of the heaviest main battle tanks in the world, necessitating specialized 70-ton capacity trailers for road mobility.

• The tank features enhanced firepower, a Superior Transmission System, and indigenous Explosive Reactive Armour (ERA).

• Industry Partners:

• BEML Ltd: A Schedule 'A' Company under the Ministry of Defence, it plays a pivotal role in serving India's core sectors like Defence, Rail, Power, and Mining.

• Tata International Vehicle Applications (TIVA): A leading player in the trailer manufacturing industry, providing specialized transport solutions for heavy equipment.

• John Galt International and SDR Auto: These firms represent the growing participation of the private sector in the Indian Defence supply chain under the Atmanirbhar Bharat initiative.

• CVRDE (Combat Vehicles Research and Development Establishment):

• Located in Chennai, this laboratory is responsible for the design and development of armoured fighting vehicles and tracked components.

• It successfully integrated the 70-ton transporter project to ensure the MBT Arjun can be deployed rapidly across different sectors using the National Highway network.

Important Points

• Logistics and Mobility: The 70-ton Tank Transporter Trailer is a multi-axle vehicle system designed to operate in various terrains, ensuring the MBT Arjun Mk-1A can be moved from peace stations to forward areas efficiently.

• Indigenous Development: The project emphasizes the Make in India philosophy, reducing the reliance on imported heavy-haulage equipment for the Ministry of Defence.

• Technical Specs: The trailer is equipped with advanced hydraulic systems and high-strength steel to withstand the immense weight and pressure of the 68.5-ton tank during long-distance transit.

• Year of Milestone: The formal handover of technology in June 2025 marks a critical step toward the full operationalization of the new Arjun regiments ordered by the Indian Army.

Q85. Answer: (b) 96

The correct answer is 96.

Key Points

• Transparency International released the Corruption Perceptions Index (CPI) 2024 in February 2025, providing a global snapshot of public sector corruption.

• In the 2024 rankings, India was placed at the 96th position among 180 countries and territories.

• India’s overall score in 2024 was 39 on a scale where 0 is "highly corrupt" and 100 is "very clean."

• Compared to the previous year's report (CPI 2023), where India held the 93rd rank, the country has seen a slight decline in its standing by three positions.

• The report highlights that India’s score has shown fluctuations but remains below the global average, reflecting ongoing challenges in curbing public sector corruption and ensuring transparency.

• Hence, the correct answer is 96.

Additional Information

• Transparency International:

• It is an international non-governmental organization founded in 1993.

• The organization is headquartered in Berlin, Germany, and operates in more than 100 countries.

• It is primarily known for the Corruption Perceptions Index, the Global Corruption Barometer, and the Bribe Payers Index.

• Scoring and Ranking Mechanism:

• The CPI uses 13 different data sources from 12 independent institutions to aggregate perceptions of corruption.

• These institutions include the World Bank, the World Economic Forum, and the Economist Intelligence Unit.

• A country's rank indicates its position relative to other countries in the index, while its score indicates the perceived level of corruption.

• Global Performance in 2024:

• Denmark topped the index once again with a score of 90, followed by Finland and New Zealand.

• At the opposite end of the spectrum, Somalia, Syria, and South Sudan were ranked at the bottom of the list.

• The global average score for the 2024 index remained stagnant at 43.

Important Points

• South Asian Comparison:

• Among its neighbors, Bhutan continues to perform exceptionally well, ranking 26th with a score of 68.

• Pakistan was ranked lower at 133rd, while Bangladesh was positioned at 149th in the 2024 report.

• India shares the 96th rank with countries like the Maldives.

• Implications for India:

• The 96th rank suggests a need for stronger anti-corruption laws, better whistleblower protection, and enhanced institutional independence.

• Corruption levels often impact foreign direct investment (FDI) and the overall ease of doing business in a nation.

• The 2024 report emphasizes that countries with weak justice systems tend to struggle more with systemic corruption.

Q86. Answer: (a) Three years of legal practice

The correct answer is Three years of legal practice.

Key Points

• The Supreme Court of India has reiterated the importance of practical experience for those entering the judiciary, making three years of legal practice as an advocate a mandatory criterion for judicial service applicants.

• This mandate is set to be strictly enforced for recruitment cycles and examinations scheduled for May 2025 and onwards, ensuring that candidates possess foundational courtroom exposure.

• The decision aims to address the lack of practical knowledge often seen in fresh law graduates who previously could appear for the Civil Judge (Junior Division) exams immediately after their degree.

• By requiring a minimum of 3 years of practice, the judiciary intends to ensure that new officers are well-versed in procedural laws, Trial Court etiquette, and the nuances of litigation.

• The Bar Council of India (BCI) has been a strong proponent of this requirement, arguing that the maturity gained through legal practice is essential for the responsibilities of a judicial officer.

Additional Information

• Legal Framework: The recruitment of the subordinate judiciary in India is governed by Article 234 of the Constitution of India, which involves the State Public Service Commission and the respective High Court.

• Historical Context: In the 2002 judgment of the All India Judges Association v. Union of India, the Supreme Court had previously allowed fresh law graduates to sit for exams, but recent discussions have shifted back toward the three-year experience rule to improve judicial quality.

• Role of the BCI: The Bar Council of India, established under the Advocates Act, 1961, regulates legal education and professional conduct, and it has consistently advocated for mandatory practice to maintain the standards of the legal profession.

• Implementation: Several states, including Andhra Pradesh, Madhya Pradesh, and Gujarat, had already moved towards incorporating this three-year experience requirement into their Judicial Service Rules prior to the broader national emphasis.

• Training Benefits: Mandatory practice reduces the extensive hand-holding required during the initial training phase at State Judicial Academies, as candidates already understand the basic filing and hearing processes.

Important Points

• Eligibility Age: While the practice requirement has changed, the typical age limit for the Lower Judicial Service remains between 21 and 35 years for general category candidates, with relaxations for reserved categories.

• Higher Judicial Service (HJS): It is important to distinguish this from the Higher Judicial Service, which requires a minimum of 7 years of practice as an advocate for direct recruitment as a District Judge under Article 233.

• Law Degree Requirement: Regardless of the practice mandate, an applicant must hold a Bachelor of Laws (LL.B) degree from a university recognized by the Bar Council of India.

• Examination Structure: The Judicial Service Examination typically consists of three stages: the Preliminary Examination (objective), the Main Examination (descriptive), and the Viva-Voce (interview).

Q87. Answer: (a) Cloud seeding to induce rainfall and reduce air pollution

The correct answer is Cloud seeding to induce rainfall and reduce air pollution.

Key Points

• The Delhi government, in a strategic collaboration with the Indian Institute of Technology (IIT), Kanpur, implemented cloud seeding technology in October 2025 to mitigate the severe air pollution crisis in the National Capital Region (NCR).

• Cloud seeding is a weather modification technique designed to induce artificial rain by dispersing substances into the air that serve as cloud condensation or ice nuclei.

• This initiative was specifically aimed at reducing the concentration of hazardous pollutants, including PM2.5 and PM10, which

typically spike during the onset of winter due to stubble burning and temperature inversion.

• The IIT Kanpur team utilized a specialized Cessna aircraft equipped with seeding flares to release a chemical mixture, such as silver iodide or potassium iodide, into existing cloud formations over the city.

• By inducing precipitation, the process creates a "wash-out" effect, where falling raindrops trap and carry particulate matter down to the ground, thereby clearing the atmosphere and improving the Air Quality Index (AQI).

Additional Information

• Technical Requirements: For successful cloud seeding, specific meteorological conditions must be present, including a minimum humidity level (typically above 40%) and the presence of moisture-laden clouds.

• IIT Kanpur's Research: The institute has been a pioneer in artificial rain technology in India, conducting successful trials and receiving necessary clearances from the Directorate General of Civil Aviation (DGCA) for aerial sorties.

• Pollution Sources in Delhi: The air quality in Delhi during October and November is influenced by local factors like vehicular emissions and industrial smoke, as well as external factors like agricultural residue burning in neighboring states like Punjab and Haryana.

• Graded Response Action Plan (GRAP): This is a set of emergency measures mandated by the Commission for Air Quality Management (CAQM). Cloud seeding is considered an advanced technological intervention to complement GRAP measures when AQI levels enter the "Severe Plus" category.

• Environmental Impact: While effective for short-term relief, scientists emphasize that cloud seeding is a temporary solution and must be supported by long-term strategies to control carbon emissions and promote green energy.

Important Points

• Cost and Implementation: The implementation of such large-scale weather modification projects involves significant costs, with estimates for the Delhi project ranging in several crores per phase, funded primarily by the state government.

• Global Precedents: Countries like China, the UAE, and the USA have frequently used cloud seeding for drought management and smog clearance, providing a framework for India's technological adoption in urban environments.

Q88. Answer: (d) Nitesh Kumar

The correct answer is Nitesh Kumar.

Key Points

• Indian para-shuttler Nitesh Kumar secured the gold medal in the Men's Singles SL3 category at the 2025 Asia Para Badminton Championship.

• His victory continues his dominant form in the international circuit, following his historic achievement at the Paris 2024 Paralympics where he also won gold.

• The SL3 classification is designated for players who have impairment in one or both lower limbs and poor walking or running balance, requiring immense core strength and tactical placement.

• In the final match of the 2025 tournament, Nitesh Kumar displayed exceptional court coverage and resilience to overcome his opponent, further solidifying India's position as a powerhouse in para-badminton.

• His success at the continental level serves as a crucial milestone for the 2025-2026 international sporting calendar.

• Hence, the correct answer is Nitesh Kumar.

Additional Information

• Para-Badminton Classifications:

• The sport is divided into six classes: WH1 and WH2 (wheelchair), SL3 and SL4 (standing lower), SU5 (standing upper), and SH6 (short stature).

• In the SL3 category, matches are played on a half-court to accommodate the movement limitations of the athletes.

• Pramod Bhagat:

• He is another legendary Indian para-shuttler in the SL3 category.

• Pramod Bhagat won the gold medal at the Tokyo 2020 Paralympics and has been a multiple-time World Champion.

• Naveen Shivakumar and Umesh Vikram Kumar:

• Both are prominent members of the Indian para-badminton contingent who have represented the nation in various BWF Para-Badminton World Circuit events.

• Their participation highlights the growing depth and competitive nature of the sport within India.

• Asia Para Badminton Championship:

• This event is a premier continental tournament sanctioned by the Badminton World Federation (BWF) and Badminton Asia.

• It attracts top-tier talent from countries like China, Indonesia, Japan, and South Korea, making a gold medal a highly prestigious achievement.

Important Points

• Nitesh Kumar hails from Haryana and is an alumnus of IIT Mandi, showcasing a remarkable balance between academics and

elite sports.

• He receives support through the Target Olympic Podium Scheme (TOPS), a flagship program of the Ministry of Youth Affairs and Sports, Government of India.

• The 2025 Asia Para Badminton Championship saw India finish near the top of the overall medal tally, driven by the performances of athletes like Nitesh Kumar.

• Training for these athletes is often conducted at the Gaurav Khanna Excellence Academy in Lucknow, which has become a hub for producing world-class para-shuttlers.

Q89. Answer: (d) PM E-DRIVE initiative

The correct answer is PM E-DRIVE initiative.

Key Points

• The PM E-DRIVE (Electric Drive Revolution in Innovative Vehicle Enhancement) scheme was approved by the Union Cabinet to promote electric mobility in India, succeeding the FAME-II program.

• The initiative is administered by the Ministry of Heavy Industries (MHI) and focuses on providing financial incentives for the purchase of various categories of electric vehicles.

• Specifically, for the first time, the government has allocated Rs 500 crore dedicated to providing incentives for electric trucks (e-trucks) to promote decarbonization in the logistics and freight sector. Hence, the correct answer is PM E-DRIVE initiative.

• The primary goal of including electric trucks is to reduce the environmental impact of heavy-duty vehicles, which are significant contributors to CO_2 emissions and air pollution in the country.

• Under this initiative, the government provides support to buyers of e-trucks that possess a scrapage certificate from an authorized Registered Vehicle Scrapping Facility (RVSF), encouraging the removal of older, polluting commercial vehicles.

Additional Information

• Financial Outlay: The PM E-DRIVE scheme has a total budgetary outlay of Rs 10,900 crore over a period of two years (spanning 2024-25 and 2025-26).

• E-Voucher System: To simplify the process of claiming subsidies, the Ministry of Heavy Industries introduced Aadhaar-authenticated e-vouchers. These are generated at the time of purchase and are essential for the Original Equipment Manufacturers (OEMs) to claim reimbursement.

• Broad Vehicle Coverage: Besides e-trucks, the scheme supports 24.79 lakh e-2Ws, 3.16 lakh e-3Ws, and 14,028 e-buses, ensuring a holistic transition toward green transport.

• Charging Infrastructure: A significant portion of the fund, Rs 2,000 crore, is earmarked for the installation of Electric Vehicle Public Charging Stations (EVPCS) in high-traffic cities and on major highways to tackle range anxiety.

Important Points

• Incentive for E-Ambulances: The PM E-DRIVE scheme also marks the first time the government is providing Rs 500 crore specifically for e-ambulances to encourage eco-friendly emergency medical services.

• Phased Manufacturing Programme (PMP): To boost the Make in India initiative, the scheme enforces PMP guidelines, ensuring that a significant percentage of EV components are manufactured domestically to strengthen the local supply chain.

• Modernization of Testing Agencies: The Ministry of Heavy Industries has also allocated Rs 780 crore for the upgradation and modernization of testing agencies to handle the emerging green technologies and ensure safety standards.

• Impact on Environment: By targeting high-mileage segments like trucks and buses, the scheme aims to achieve a substantial reduction in fossil fuel consumption and meet India's Net Zero targets by 2070.

Q90. Answer: (b) SDG 12

The correct answer is SDG 12.

Key Points

• The Sustainable Development Goal 12 (SDG 12) is titled "Responsible Consumption and Production," which aims to ensure sustainable consumption and production patterns.

• According to the Sustainable Development Goals National Indicator Framework (NIF) progress report 2025, the number of waste recycling plants in India saw a significant surge, rising from 829 in the year 2019–20 to 3,036 in the year 2024–25.

• This expansion directly supports SDG Target 12.5, which mandates that by 2030, nations should substantially reduce waste generation through prevention, reduction, recycling, and reuse.

• The National Indicator Framework (NIF) was developed by the Ministry of Statistics and Programme Implementation (MoSPI) to track India's journey toward achieving the Global SDGs.

• The growth in recycling infrastructure reflects India's transition toward a Circular Economy, where resources are kept in use for as long as possible. Hence, the mention of waste recycling plants aligns perfectly with SDG 12.

Additional Information

• SDG 12 (Responsible Consumption and Production):

• It encompasses 11 targets, including the sustainable management of natural resources, reducing food waste, and encouraging companies to adopt sustainable practices.

• In the context of India, initiatives like Extended Producer Responsibility (EPR) for plastic and e-waste are critical drivers for this goal.

• SDG 2 (Zero Hunger):

• This goal focuses on ending hunger, achieving food security, improving nutrition, and promoting sustainable agriculture by the year 2030.

• SDG 6 (Clean Water and Sanitation):

• It ensures the availability and sustainable management of water and sanitation for all, including targets for water quality and wastewater treatment.

• SDG 15 (Life on Land):

• This goal is dedicated to protecting, restoring, and promoting the sustainable use of terrestrial ecosystems, managing forests, and halting biodiversity loss.

• The 2030 Agenda:

• Adopted by 193 UN Member States in September 2015, the agenda consists of 17 Sustainable Development Goals and 169 targets designed to be a "blueprint to achieve a better and more sustainable future for all."

Important Points

• NITI Aayog is the nodal agency in India for coordinating and monitoring the SDGs at the national and sub-national levels through the SDG India Index.

• The MoSPI publishes the National Indicator Framework (NIF) reports annually to provide a data-driven perspective on progress across different sectors like health, education, and environment.

• The sharp increase in recycling plants between 2019 and 2025 highlights the impact of the Swachh Bharat Mission 2.0, which emphasizes zero waste and scientific processing of municipal solid waste.

Q91. Answer: (d) 7.5%

The correct answer is 7.5%.

Key Points

• The Central Board of Directors of the Reserve Bank of India (RBI), during its meeting held in May 2025, decided to increase the Contingent Risk Buffer (CRB) to 7.5% for the Financial Year 2024-25.

• This decision was made while approving the transfer of surplus to the Central Government for the accounting year ended March 31, 2025.

• The CRB is a specific fund maintained by the RBI to cover unforeseen contingencies arising from monetary and financial stability operations, systemic risks, and operational risks.

• For the previous financial year (FY 2023-24), the RBI had maintained the CRB at 6.5%, but the increase to 7.5% in 2025 reflects a cautious approach to maintaining a robust balance sheet amidst evolving global economic conditions.

• The RBI follows the Economic Capital Framework (ECF) to determine the appropriate level of risk buffers and the amount of dividend to be paid to the Government of India.

Additional Information

• Economic Capital Framework (ECF):

• The framework was reviewed by the Bimal Jalan Committee, which submitted its report in August 2019.

• The committee recommended that the Contingent Risk Buffer should be maintained within a range of 5.5% to 6.5% of the RBI's balance sheet.

• However, the RBI Board has the authority to adjust this percentage based on macroeconomic stability and financial risk assessments, as seen in the May 2025 decision to raise it to 7.5%.

• Surplus Distribution Policy:

• The RBI earns income through interest on government securities, foreign exchange interventions, and liquidity adjustment facilities.

• After deducting operating expenses and provisions for contingency funds, the remaining surplus is transferred to the Union Government under Section 47 of the Reserve Bank of India Act, 1934.

• This transfer serves as a non-tax revenue source for the Government of India, helping to manage the fiscal deficit.

• Role of the Central Board:

• The RBI's affairs are governed by the Central Board of Directors, which is appointed by the Government of India.

• The Governor and Deputy Governors are part of this board, which oversees the monetary policy and financial health of the central bank.

Important Points

• The Contingent Risk Buffer (CRB) is the "first line of defense" for the RBI against economic shocks.

• The decision to maintain a higher CRB of 7.5% indicates that the RBI is prioritizing financial resilience and solvency over maximizing immediate dividend payouts.

• Historical Data: In May 2024, the RBI transferred a record surplus of over Rs 2.11 lakh crore to the government, at which point the CRB was held at 6.5%.

• The fiscal year in India runs from April 1 to March 31. The May 2025 board meeting concluded the financial assessment for the FY 2024-25 period.

Q92. Answer: (b) IIT Delhi

The correct answer is IIT Delhi.

Key Points

• In 2025, the National Disaster Management Authority (NDMA) officially partnered with the Indian Institute of Technology (IIT) Delhi to formulate specialized tunnel safety guidelines.

• The primary objective of this collaboration is to establish a robust framework for the design, construction, and operation of tunnels across India, particularly in ecologically sensitive and geologically challenging regions like the Himalayas. Hence, the option IIT Delhi is correct.

• The partnership focuses on creating Standard Operating Procedures (SOPs) that incorporate advanced geotechnical monitoring and structural health assessment tools to prevent collapses and accidents.

• IIT Delhi was chosen due to its extensive research capabilities in Civil Engineering and Underground Space Technology, providing the necessary technical expertise to the NDMA.

• These guidelines are intended to serve as a mandatory reference for all infrastructure agencies, ensuring that safety audits and emergency evacuation protocols are integrated from the project's inception.

Additional Information

• National Disaster Management Authority (NDMA):

• It is the apex statutory body for disaster management in India, established under the Disaster Management Act, 2005.

• The Prime Minister of India serves as the ex-officio Chairperson of the NDMA.

• Its mandate includes laying down policies, plans, and guidelines for disaster management to ensure a timely and effective response to natural and man-made disasters.

• Significance of Tunnel Safety in India:

• With the expansion of the Char Dham Project and various strategic railway tunnels in Jammu & Kashmir and Arunachal Pradesh, tunnel safety has become a national priority.

• The 2023 Silkyara tunnel collapse in Uttarakhand, where 41 workers were trapped for 17 days, served as a major catalyst for the 2025 initiative to formalize safety standards.

• Key safety features now emphasized include escape passages, automated ventilation systems, fire suppressants, and real-time sensor-based monitoring.

• Role of IIT Delhi:

• As an Institute of Eminence (IoE), IIT Delhi leads several national-level research projects in disaster-resilient infrastructure.

• The institute's Department of Civil Engineering provides consultancy for high-altitude construction, focusing on rock mechanics and seismic stability.

Important Points

• Geographical Context: Most tunnel projects in India are located in the Young Fold Mountains (Himalayas), which are prone to landslides, seismic activity, and fragile rock formations.

• Policy Integration: The guidelines developed by IIT Delhi and NDMA are expected to be adopted by the Ministry of Road Transport and Highways (MoRTH) and the National Highways and Infrastructure Development Corporation Limited (NHIDCL).

• Technological Deployment: Future tunnels will likely see the mandatory installation of SCADA (Supervisory Control and Data Acquisition) systems for centralized safety management as per the new 2025 recommendations.

Q93. Answer: (d) Harjai Milkha Singh

The correct answer is Harjai Milkha Singh.

Key Points

• Harjai Milkha Singh secured his maiden major Indian Golf Union (IGU) title by winning the IGU Southern India Junior Boys Golf Championship.

• The championship was held at the Coimbatore Golf Club, located in Chettipalayam, Tamil Nadu, from 27 May to 30 May 2025.

• Harjai, the son of the legendary Indian golfer Jeev Milkha Singh, demonstrated exceptional composure and skill over the four-day tournament to clinch the trophy in the Category A segment.

• This victory marks a significant breakthrough in his junior career, following in the footsteps of his father and grandfather in the

realm of Indian sports.

• The tournament featured top-tier junior talent from across the country, making Harjai's win a testament to his rising status in the national golf circuit.

Additional Information

• Indian Golf Union (IGU):

• The IGU was founded in 1955 and serves as the apex governing body for golf in India.

• It is responsible for maintaining the National Handicap System and organizing national-level amateur and junior championships.

• The IGU is affiliated with the International Golf Federation and play a vital role in selecting the Indian national team for international events like the Asian Games and Olympics.

• Coimbatore Golf Club:

• This 18-hole course is situated on the outskirts of Coimbatore and is known for its challenging layout and strong wind conditions, which test a golfer's accuracy and ball control.

• It frequently hosts major tournaments on the IGU Junior Tour and the Professional Golf Tour of India (PGTI).

• Milkha Singh Family Legacy:

• Harjai Milkha Singh represents the third generation of one of India's most iconic sporting families.

• His grandfather, Milkha Singh, famously known as the "Flying Sikh," was a legendary sprinter who represented India in multiple Olympics.

• His father, Jeev Milkha Singh, was the first Indian golfer to join the European Tour and has won numerous titles on the Asian Tour and Japan Golf Tour.

Important Points

• Junior Golf Categories: The IGU divides junior tournaments into specific age groups. Category A typically involves players aged 15 to 17, while Category B includes those aged 13 to 14. Harjai Milkha Singh has been a prominent figure in these divisions as he progresses toward the amateur ranks.

• Significance of the Title: Winning an IGU major is a prerequisite for climbing the National Order of Merit. High rankings in this system allow young golfers to represent India at prestigious international amateur tournaments.

• Other Options:

• Shubhankar Sharma and Gaganjeet Bhullar are established professional golfers who have already won multiple international titles on the European and Asian Tours.

• Shiv Kapur is an Asian Games gold medalist and a veteran of the professional circuit, distinguishably different from the junior category winners.

Q94. Answer: (a) Fund of Funds for Startups (FFS)

The correct answer is Fund of Funds for Startups (FFS).

Key Points

• The Fund of Funds for Startups (FFS) is a flagship initiative under the Startup India program, established to provide capital to Alternative Investment Funds (AIFs) that invest in Indian startups.

• In the fiscal projections and allocations for 2025, the government intensified its focus on Deep-Tech and Space-Tech, directing an allocation of Rs. 211 crore through the FFS mechanism specifically to nurture innovation in the Indian space-tech sector.

• This allocation is part of a broader strategy to increase private sector participation in space exploration and technology, moving beyond the traditional monopoly of government agencies.

• The FFS does not invest directly into startups; instead, it provides capital to SEBI-registered AIFs (daughter funds), which in turn invest at least twice the amount received from FFS into startups.

• The scheme is managed and operated by the Small Industries Development Bank of India (SIDBI), acting as the nodal agency for fund disbursement and monitoring.

Additional Information

• Startup India Seed Fund Scheme (SISFS):

• Launched in April 2021, this scheme provides financial assistance to startups for Proof of Concept, prototype development, product trials, and market entry.

• It aims to provide support at the very early stage of a startup's journey, where traditional venture capital might not be available.

• Credit Guarantee Scheme for Startups (CGSS):

• This scheme provides credit guarantees to Scheduled Commercial Banks, NBFCs, and AIFs to encourage them to provide collateral-free loans to DPIIT-recognized startups.

• It is essential for startups that lack physical assets to offer as security for traditional debt financing.

• The Space-Tech Ecosystem in India:

• Following the 2020 Space Sector Reforms, the government established IN-SPACe (Indian National Space Promotion and

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Authorization Centre) to facilitate private players.

• In the Union Budget 2024-25, a massive Rs. 1,000 crore venture capital fund was announced specifically for the space economy to expand it five-fold over the next 10 years.

• Nodal Department:

• All these initiatives (FFS, SISFS, CGSS) are monitored by the Department for Promotion of Industry and Internal Trade (DPIIT) under the Ministry of Commerce and Industry.

• As of 2024-2025, India has one of the largest startup ecosystems in the world, with a significant rise in Space-Tech startups like Skyroot Aerospace and Agnikul Cosmos.

Important Points

• The Fund of Funds for Startups (FFS) was originally launched in 2016 with a total corpus of Rs. 10,000 crore to be built over the 14th and 15th Finance Commission cycles.

• The specific focus on Space-Tech reflects India's ambition to capture a larger share of the global space economy, which is currently estimated to be around 2% to 3% for India, with a target to reach 10% by 2030.

• The 2025 allocation highlights the transition of the Indian space sector from purely scientific research to a commercially viable high-tech manufacturing and services hub.

Q95. Answer: (d) United Nations

The correct answer is United Nations.

Key Points

• The United Nations (UN) marks the 80th anniversary of the signing of its foundational Charter on June 26, 2025.

• The UN Charter was originally signed on June 26, 1945, in San Francisco, United States, at the conclusion of the United Nations Conference on International Organization.

• Representatives of 50 countries signed the document on that day, with Poland signing it later to become one of the 51 original member states.

• The Charter is the constitutive instrument of the United Nations, setting out the rights and obligations of Member States and establishing the principal organs and procedures of the organization.

• While the Charter was signed in June, the United Nations officially came into existence on October 24, 1945, after the Charter had been ratified by the five permanent members of the Security Council and a majority of other signatories.

Additional Information

• Structure of the United Nations:

• The UN consists of six principal organs: the General Assembly, the Security Council, the Economic and Social Council (ECOSOC), the Trusteeship Council, the International Court of Justice (ICJ), and the UN Secretariat.

• The Secretariat is headed by the Secretary-General, currently António Guterres, who serves as the chief administrative officer.

• The headquarters of the United Nations is located in New York City, on international territory, with other major offices in Geneva, Nairobi, and Vienna.

• Core Objectives:

• The primary missions of the UN include maintaining international peace and security, protecting human rights, delivering humanitarian aid, promoting sustainable development, and upholding international law.

• The Sustainable Development Goals (SDGs), adopted in 2015, represent a universal call to action to end poverty and protect the planet by 2030.

• Growth and Membership:

• Since its inception with 51 member states in 1945, the organization has grown to include 193 Member States as of 2025.

• The United Nations replaced the ineffective League of Nations, which had failed to prevent World War II.

Important Points

• Comparison with Other Organizations:

• The World Bank and the International Monetary Fund (IMF) were both established following the Bretton Woods Conference in July 1944, making them slightly older than the UN, but their charters were not signed on June 26.

• NATO (North Atlantic Treaty Organization) was established with the signing of the North Atlantic Treaty (also known as the Washington Treaty) on April 4, 1949; thus, its 80th anniversary will not occur until 2029.

• Key Dates to Remember:

• June 26, 1945: Signing of the UN Charter.

• October 24, 1945: The UN officially begins operations (celebrated annually as United Nations Day).

• January 10, 1946: The first meeting of the General Assembly took place in London.

• The UN Charter:

• The Charter contains 111 articles divided into 19 chapters.

• Article 2 outlines the principle of the sovereign equality of all its Members.

Q96. Answer: (d) Summer McIntosh

The correct answer is Summer McIntosh.

Key Points

• Summer McIntosh is a Canadian swimming sensation who achieved a historic milestone at the 2023 Canadian Swimming Trials held in Toronto.

• During this single meet, she set World Records in both the 400m freestyle (with a time of 3:56.08) and the 400m individual medley (with a time of 4:25.87).

• By breaking multiple world records at a single trials event, she was widely compared to Michael Phelps, the legendary American swimmer, as she became the first person to hold the world record in both these diverse disciplines simultaneously since the 1970s.

• Her performance was extraordinary as she broke Katinka Hosszu's long-standing 400m IM world record and took the 400m freestyle record from Ariarne Titmus.

• At the age of only 16 during the trials, she demonstrated a level of versatility and dominance across different strokes (freestyle and medley) that had not been seen in the sport for decades.

Additional Information

• Biographical Details:

• Summer McIntosh was born on August 18, 2006, in Toronto, Ontario, Canada.

• She comes from an athletic background; her mother, Jill Horstead, was a competitive swimmer who represented Canada at the 1984 Los Angeles Olympics.

• Olympic Career:

• She made her Olympic debut at the Tokyo 2020 Olympics (held in 2021) at the age of 14, where she was the youngest member of the Canadian Olympic Team.

• She finished 4th in the 400m freestyle in Tokyo, signaling her arrival as a world-class athlete.

• World Championships:

• At the 2022 World Aquatics Championships in Budapest, she became the first Canadian swimmer to win two gold medals at a single World Championship, winning the 200m butterfly and 400m individual medley.

• She successfully defended her titles at the 2023 World Aquatics Championships in Fukuoka.

Important Points

• World Junior Records: In addition to her senior world records, Summer McIntosh holds multiple World Junior Records in events including the 200m freestyle, 200m butterfly, and 200m individual medley.

• Training and Coaching: She currently trains in Florida, USA, with the Sarasota Sharks under the guidance of head coach Brent Arckey.

• Comparison to Track Athletes: It is important to note that the other options provided—Sydney McLaughlin-Levrone, Athing Mu-Nikolayev, and Beatrice Chebet—are all elite Track and Field athletes, not swimmers, which distinguishes Summer McIntosh as the only relevant answer for a swimming-related achievement.

Q97. Answer: (d) United Kingdom

The correct answer is United Kingdom.

Key Points

• The bilateral military exercise AJEYA WARRIOR-25 is a joint training initiative conducted between the Indian Army and the British Army of the United Kingdom.

• The 2025 edition marks the 8th edition of this biennial training event, aimed at strengthening military-to-military cooperation and fostering bilateral relations between the two nations.

• The primary objective of this exercise is to build positive military relations, enhance interoperability, and share best practices while undertaking company-level operations in urban and semi-urban terrain.

• During AJEYA WARRIOR, troops from both countries engage in various tactical drills, including counter-insurgency and counter-terrorism operations under a United Nations mandate.

• The exercise typically involves the participation of infantry regiments; for instance, the Indian Army is often represented by a battalion of the Gorkha Rifles, while the British Army contributes soldiers from various units like the Royal Gurkha Rifles or the 1st Battalion Merician Regiment.

Additional Information

• Defense Cooperation with the UK:

• Apart from the army exercise, India and the United Kingdom conduct high-level exercises across all three services. Exercise KONKAN is the bilateral naval exercise between the Indian Navy and the Royal Navy.

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• Exercise Indradhanush is the joint air force exercise involving the Indian Air Force (IAF) and the Royal Air Force (RAF) of the UK.

• The defense relationship is guided by the 2030 Roadmap, which was agreed upon in May 2021 to elevate the bilateral tie to a Comprehensive Strategic Partnership.

• Significance of the Exercise:

• The AJEYA WARRIOR series started in 2005. It alternates between India (often at Chaubatia, Uttarakhand) and the United Kingdom (often at Salisbury Plains).

• It provides a platform for Combat Conditioning, Tactical Training, and Joint Command Post exercises, ensuring that both forces are prepared for modern-day security challenges.

Important Points

• Strategic Partnership: The United Kingdom is a key defense partner for India in Western Europe, collaborating on maritime domain awareness, cyber security, and defense industrial production.

• Historical Context: The previous edition, AJEYA WARRIOR-23, was held at Salisbury Plains, UK in April-May 2023, showcasing the interoperability of both armies in simulated combat environments.

• Global Mandate: Both nations emphasize that these exercises are not just bilateral but are designed to improve the collective capability of their forces to respond to global security threats and participate in peacekeeping missions.

Q98. Answer: (b) Manu Bhaker

The correct answer is Manu Bhaker.

Key Points

• Manu Bhaker, the ace Indian shooter, has been conferred with the Major Dhyan Chand Khel Ratna Award in 2025 for her historic performance in international sports.

• She achieved monumental success at the Paris 2024 Olympic Games, where she became the first Indian woman to win two medals in a single edition of the Olympics.

• She secured bronze medals in both the women's 10m air pistol event and the 10m air pistol mixed team event (alongside Sarabjot Singh).

• The Major Dhyan Chand Khel Ratna Award is the highest sporting honor in India, awarded annually by the Ministry of Youth Affairs and Sports.

• The selection for the 2025 award recognizes her consistent excellence and her role in elevating the status of shooting in India on the global stage over the preceding four-year cycle.

Additional Information

• Major Dhyan Chand Khel Ratna Award:

• This award was instituted in the year 1991-92 and was previously known as the Rajiv Gandhi Khel Ratna Award. It was renamed in August 2021 in honor of the hockey legend Major Dhyan Chand.

• The award carries a cash prize of Rs. 25 lakh, a certificate, and a medallion.

• The first recipient of this prestigious award was the Chess Grandmaster Vishwanathan Anand.

• Profile of Manu Bhaker:

• She hails from the Jhajjar district of Haryana, India, and was born on February 18, 2002.

• Apart from her Olympic glory, she has won multiple gold medals at the ISSF World Cup, Commonwealth Games, and Asian Games.

• She represents the younger generation of Indian athletes who have dominated the 10m Air Pistol category globally.

• Context of Other Options:

• Virat Kohli: The former Indian cricket captain received the Khel Ratna in the year 2018.

• Neeraj Chopra: The star javelin thrower was honored with the Khel Ratna in 2021 following his gold medal at the Tokyo Olympics.

• Saina Nehwal: The badminton icon received the award in 2010 for her exceptional contributions to the sport.

Important Points

• The National Sports Awards are usually announced by the Government of India to recognize and reward excellence in sports.

• The Major Dhyan Chand Khel Ratna is awarded for the most outstanding performance by a sportsperson over a period of four years.

• Other categories of National Sports Awards include the Arjuna Award (for consistent outstanding performance), the Dronacharya Award (for coaches), and the Dhyan Chand Award (for lifetime achievement).

• The 2025 awards highlight the continued dominance of shooting as a key sport where India achieves high-level international success.

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Q99. Answer: (d) Reserve Bank of India

The correct answer is Reserve Bank of India.

Key Points

• The Reserve Bank of India (RBI), in its capacity as the debt manager for the Government of India, managed a significant Government Securities (G-Sec) auction totaling Rs. 30,000 crore in June 2025.

• Within this broader auction, the RBI specifically offered Sovereign Green Bonds (SGrBs) worth Rs. 5,000 crore to mobilize resources for green infrastructure. Hence, the statement regarding the institution is correct.

• The issuance is part of the Government's borrowing calendar for the first half of the fiscal year 2025-26, aimed at supporting climate-related projects.

• These bonds are typically issued with long-term tenors, such as 10 years or 30 years, to match the long-gestation period of environmental projects.

• The Reserve Bank of India utilizes the E-Kuber system for the auction process, allowing Scheduled Commercial Banks and Primary Dealers to place competitive bids.

Additional Information

• Reserve Bank of India (RBI):

• The RBI was established on April 1, 1935, under the provisions of the Reserve Bank of India Act, 1934.

• It serves as the central bank of the Republic of India and regulates the banking system and monetary policy.

• As the Government's banker, it manages the public debt of the Union and State Governments.

• Sovereign Green Bonds (SGrBs):

• SGrBs are a form of debt where the proceeds are exclusively earmarked for projects with environmental benefits.

• India's first Sovereign Green Bond was issued in January 2023, following an announcement in the Union Budget 2022-23.

• Eligible sectors for funding include Renewable Energy, Energy Efficiency, Clean Transportation, and Sustainable Water Management.

• Government Securities (G-Sec):

• A G-Sec is a tradable instrument issued by the Central Government or the State Governments.

• It acknowledges the Government's debt obligation and can be short-term (Treasury Bills) or long-term (Government Bonds or Dated Securities).

• They are considered risk-free gilt-edged instruments as they carry the guarantee of the sovereign.

Important Points

• Green Finance Framework: The Ministry of Finance released the Sovereign Green Bond Framework in November 2022, which sets out the governance structure for selecting and monitoring green projects.

• International Commitments: India has set a target to achieve Net Zero emissions by 2070 as per the COP26 commitments, and Green Bonds are vital for financing this transition.

• Market Impact: The issuance of Rs. 5,000 crore in June 2025 helps in developing a domestic market for sustainable finance and provides a benchmark for corporate green bond issuances.

• Investment Participation: Besides domestic institutions, Foreign Portfolio Investors (FPIs) are also permitted to invest in these securities under the Fully Accessible Route (FAR).

Q100. Answer: (a) Telangana

The correct answer is Telangana.

Key Points

• The state of Telangana, under the leadership of Chief Minister A. Revanth Reddy, officially launched the Revanth Anna ka Sahara-Miskeen la Kosam scheme in September 2025.

• The scheme is a comprehensive welfare initiative designed specifically to provide financial assistance and social security to the minority communities, particularly focusing on those living below the poverty line.

• The title of the scheme, "Revanth Anna ka Sahara," translates to "Support from Brother Revanth," signifying the government's direct outreach to the destitute (Miskeen) and vulnerable sections of society.

• A primary pillar of this initiative is women empowerment, where financial grants and skill development opportunities are provided to minority women to encourage entrepreneurship and self-reliance.

• This move is part of the broader Indiramma Rajyam vision of the Telangana Government, aiming to ensure that the benefits of economic growth reach the last person in the minority social hierarchy.

Additional Information

• Minority Welfare Framework in Telangana:

• The Minority Welfare Department in Telangana is responsible for the implementation of policies for the socio-economic and educational development of Muslims, Christians, Sikhs, Jains, Buddhists, and Parsis.

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• The state has consistently allocated significant portions of its annual budget toward minority-specific schemes to improve the literacy rate and employment prospects within these communities.

• Shaadi Mubarak Scheme:

• This is another flagship initiative in Telangana that provides a one-time financial grant of approximately Rs. 1,00,116 to the families of minority brides to alleviate the burden of marriage expenses.

• It serves as a counterpart to the Kalyana Lakshmi Scheme, which is available to other sections of the population.

• Economic Support Schemes (ESS):

• The Telangana State Minorities Finance Corporation (TSMFC) provides subsidies ranging from 50% to 80% on bank-linked loans for self-employment projects.

• These loans are targeted at unemployed youth and small-scale vendors to help them establish micro-enterprises.

Important Points

• Educational Empowerment:

• The Chief Minister’s Overseas Scholarship Scheme provides financial assistance of up to Rs. 20 lakhs to meritorious minority students pursuing Post Graduate or Ph.D. studies in recognized foreign universities.

• Additionally, the state manages Minority Residential Schools (TMREIS), which provide high-quality English medium education, free boarding, and lodging to thousands of students across Telangana.

• Praja Palana Integration:

• The September 2025 schemes are integrated with the Praja Palana (People's Governance) mechanism, where applications are collected during Gram Sabhas to ensure transparency and eliminate middlemen.

• Eligibility is generally determined by the Annual Income of the family, which must be below a specific threshold (e.g., Rs. 1.5 lakhs in rural areas and Rs. 2 lakhs in urban areas).

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