RRB Group D Official Paper (Held On: 04 Feb, 2026 Shift 1) (Previous Year Paper)

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

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GENERAL SCIENCE

Q1. A train starts from rest and reaches a velocity of 36 km/hr in 3 minutes with uniform acceleration. What is the distance covered by the train during this time?

(a) 750 m
(b) 900 m
(c) 500 m
(d) 250 m

Q2. In plants, how does sexual reproduction leads to better survival in offspring?

(a) Offspring show new genetic recombination
(b) Offspring do not show any variation
(c) Offspring are exact clones
(d) Offspring are born faster

Q3. Complex tissues are made up of:

(a) only one cell
(b) one type of cells
(c) more than one type of cells
(d) no cells

Q4. Which of the following statements is true regarding the twinkling of the stars?

(i) The stars twinkle as they have light of their own.
(ii) The stars twinkle due to reflection of light.
(iii) There is apparent change in the position of the star during the night time.
(iv) The stars twinkle due to atmospheric refraction.

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

Q5. Which of the following is a characteristic property of ionic compounds?

(a) Strong electrostatic forces between ions
(b) Low melting point
(c) Insoluble in water
(d) Poor electrical conductivity in molten state

Q6. What helps in the upward movement of water and minerals in plants?

(a) Conversion of sunlight into starch
(b) Active transport in leaf cells
(c) Diffusion of gases in stomata

(d) Transpiration pull and root pressure

Q7. The velocity-time graph of a particle moving with uniform acceleration is a:

(a) vertical line
(b) curve concave upward
(c) straight line inclined to time axis
(d) horizontal line

Q8. In the electrolytic refining of copper, which of the following correctly describes the role of electrodes?

(a) Both electrodes are made of impure copper
(b) Both electrodes are made of pure copper
(c) Impure copper is used as anode and pure copper as cathode
(d) Pure copper is used as anode and impure copper as cathode

Q9. In stethoscopes, the sound of the heartbeat is transmitted to the doctor's ears because:

(a) the sound waves are absorbed by the tube walls
(b) the sound waves undergo successive refraction in the tube
(c) the sound waves are amplified by electricity
(d) the sound waves are guided by multiple reflections in the tube

Q10. Adding dilute hydrochloric acid to zinc granules produces hydrogen gas. This is an example of which of the following?

(a) Dissolution
(b) Mixture formation
(c) Physical change
(d) Chemical change

Q11. Which of the following statements is correct?

(a) Magnetic field lines always emerge from the north pole of a magnet and enter the south pole outside the magnet.
(b) Magnetic field lines intersect each other.
(c) The magnetic field at a point is zero when field lines are dense.
(d) Magnetic field lines start from the south pole and end at the north pole.

Q12. Ethanoic acid reacts with ethanol in the presence of concentrated H_2SO_4 to form:

(a) ethyl ethanoate
(b) methanol
(c) acetone
(d) sodium acetate

Q13. What is formed when ethanol is oxidised using an oxidising agent like alkaline $KMnO_4$?

(a) Methane
(b) Methanoic acid
(c) Acetone
(d) Ethanoic acid

Q14. What happens to the energy of an object just before it hits the ground while falling freely?

(a) Its potential energy is at its highest, and its kinetic energy becomes lowest.
(b) It has equal amounts of potential and kinetic energy.
(c) Its kinetic energy becomes highest, and its potential energy becomes lowest.
(d) Both its kinetic and potential energy become zero.

Q15. Select the correct option regarding the following two statements labelled Assertion (A) and Reason (R).

Assertion (A): Zinc can displace copper from copper sulphate solution.

Reason (R): Zinc is less reactive than copper.

(a) A is true, but R is false.

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

Q16. Food items such as wheat, rice, vegetables, fruits and meat contain varying amounts of pesticide residues due to which of the following phenomena?
(a) Transpiration
(b) Photosynthesis
(c) Biological magnification
(d) Eutrophication

Q17. In daily life, the heating effect of electric current is used in which of the following?
(a) Electric heater, electric iron, and fuse
(b) LED and torch
(c) Electric bell and buzzer
(d) Electric fan and motor

Q18. If the radius of the Earth is halved and the masses of both interacting objects are tripled, while keeping the distance between them unchanged, how will the gravitational force between them change?
(a) Increases 9 times
(b) Increases 3 times
(c) Decreases 3 times
(d) Increases 36 times

Q19. Which part of the Bryophyllum plant produces buds for vegetative propagation?
(a) Leaf margins
(b) Tip of the leaf
(c) Pedicel
(d) Flower

Q20. Which of the following are generally sensitive to touch and help plants in climbing?
(a) Flowers
(b) Tendrils
(c) Thorns
(d) Seeds

Q21. What is the ratio of carbon to oxygen by mass, in carbon dioxide?
(a) 6:8
(b) 1:2
(c) 2:4
(d) 3:8

Q22. What happens to an atom when it loses an electron?
(a) It becomes a molecule
(b) It becomes an anion
(c) It becomes a cation
(d) It becomes neutral

Q23. Which of the following cell organelle is present ONLY in animal cells but not in plant cells?
(a) Mitochondria
(b) Golgi apparatus
(c) Vacuole
(d) Centrosome

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Q24. What is the function of the secretions from the prostate gland and seminal vesicles in the male reproductive system?

(a) To eliminate waste from sperms
(b) To provide nutrition and aid in sperm transport
(c) To destroy weak sperms
(d) To prevent mixing of urine and sperms

Q25. If an object is at infinity in front of a convex lens, the image is formed:

(a) between F and 2F
(b) at F
(c) at 2F
(d) at infinity

MATHEMATICS

Q26. A ladder is placed against a vertical wall such that it makes an angle of 60° with the ground. If the foot of the ladder is 8.5 m away from the wall, then what is the height (in m) at which the ladder touches the wall? (Use $\sqrt{3} = 1.7$)

(a) 14.45
(b) 5
(c) 15.54
(d) 10.5

Q27. The respective ratios between the numerical values of a curved surface area and the volume of a right circular cylinder is 1 : 7. If the respective ratio between the diameter and height of the cylinder is 7 : 6, what is the total surface area of the cylinder?

Use $\pi = 22/7$

(a) 3434 unit²
(b) 4433 unit²
(c) 4343 unit²
(d) 3344 unit²

Q28. If 8 years ago from now, a grandmother's age was 13 times the age of her granddaughter and after 12 years from now, the grandmother's age will be 3 times her granddaughter's age, then what is the difference of their ages at present (in years)?

(a) 48
(b) 56
(c) 68
(d) 52

Q29. The value of $16^3 - 10^3$ is:

(a) 3096
(b) 3064
(c) 2837
(d) 2957

Q30. Evaluate $\sqrt{16} + \sqrt{900} + \sqrt{(9.5 \times 0.0085 \times 18.9)/(0.021 \times 0.0017 \times 1.9)}$.

(a) 174
(b) 184
(c) 164
(d) 154

Q31. If $43 \times 43 = 1849$, then 4.3×4.3 equals to:

(a) 184.9
(b) 18.49
(c) 0.1849
(d) 1.849

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Q32. The distance between points A and B is 966 km. Kamlesh travels from A to B at a speed of 52 km/hr and returns at a speed of 118 km/hr. Calculate Kamlesh's average speed for the entire journey (round off the answer to two decimal places).

(a) 83.02 km/hr
(b) 80.53 km/hr
(c) 69.63 km/hr
(d) 72.19 km/hr

Q33. P and Q together can fill a cistern with water in 12 hours. If P alone can fill the cistern with water in 18 hours, then in how many hours will Q alone fill one-fourth of the same cistern with water?

(a) 19
(b) 10
(c) 18
(d) 9

Q34. A shopkeeper offers the following four schemes.

A) Two successive discounts of 19% and 25%
B) Buy 7, get 6 free
C) Single discount of 50%
D) Two successive discounts of 3% and 39%

Which scheme is the best for the shopkeeper?

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

Q35. In the first round of elections, Amit received 63% of the votes. In the second round, his support decreased by 24%. What percentage of the total votes did Amit receive after the second round?

(a) 57.88%
(b) 39%
(c) 47.88%
(d) 49%

Q36. If 42 is the mean proportion between x and 294, what is the value of x?

(a) 8
(b) 7
(c) 4
(d) 6

Q37. The numerator of a fraction is 6 less than the denominator. If 2 is added to both its numerator and denominator, it becomes 2/3. Find the simplest form of the fraction.

(a) 4/5
(b) 6/11
(c) 5/8
(d) 7/13

Q38. A man buys a sofa set for Rs. 24,000. He spends Rs. 3,000 on repairs and sells it for Rs. 30,000. He again buys it back for Rs. 28,000 and sells at a loss of Rs. 1,200. What is the overall profit?

(a) Rs. 1,800
(b) Rs. 1,200
(c) Rs. 1,400
(d) Rs. 1,600

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Q39. A 6-digit number 648XYZ is divisible by 4, 9 and 10. Find the value of X + Z – Y, where Y is the smallest possible number.

(a) 5
(b) 7
(c) 0
(d) 2

Q40. The points scored by a basketball team in a series of matches are as follows: 17, 2, 7, 27, 25, 5, 14, 18, 10, 24, 10, 8, 10, 12, 11. The value of the median is:

(a) 10
(b) 11
(c) 12
(d) 14

Q41. Two pipes can fill a cistern, individually, in 100 min and 25 min, respectively. There is a pipe located at the bottom of the cistern to empty it. If all the three pipes are opened simultaneously, then the empty cistern gets filled in 40 min. How long will the pipe at the bottom of the tank take to empty the completely filled cistern if no other pipe is then open?

(a) 40 min
(b) 37 min
(c) 39 min
(d) 38 min

Q42. The amount on a sum of Rs. 2,400 at 20% per annum compound interest, compounded annually, in 2 years will be:

(a) Rs. 3,206
(b) Rs. 3,705
(c) Rs. 3,456
(d) Rs. 3,280

Q43. Rs. 1,287 is divided among Rahul, Monika, and Yuvraj in such a way that if Rs. 36, Rs. 22, and Rs. 29 are deducted from their respective shares, they have money in the ratio 17:7:16. Find the actual share of Monika.

(a) Rs. 232
(b) Rs. 160
(c) Rs. 260
(d) Rs. 60

Q44. A train can travel 60% faster than a car. Both start from point A at the same time and reach point B, which is 60 km away, simultaneously. However, the train loses 20 minutes due to stops at stations. What is the speed of the car?

(a) 67.5 km/h
(b) 52.5 km/h
(c) 57.5 km/h
(d) 62.5 km/h

Q45. The monthly incomes of two friends Ashish and Kiran, are in the ratio 5 : 8, respectively, and each of them saves Rs. 75,000 every month. If the ratio of their monthly expenditure is 2 : 4, find the monthly income of Ashish (in Rs.).

(a) 2,62,500
(b) 1,88,500
(c) 1,87,500
(d) 1,86,500

Q46. In a test, B got 50 marks while A got 75 marks, out of 90 maximum marks. What percentage of A's marks was B's marks? (Round off the answer to two decimal places.)

(a) 83.33%
(b) 90.33%
(c) 66.67%
(d) 150.91%

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Q47. If regular polygons of side 6 and 5 are inscribed in a circle of radius R, then what is the ratio of their areas?

(a) $12\sqrt{3} : 5\sqrt{(10 + 2\sqrt{5})}$
(b) $3\sqrt{3} : 5\sqrt{(10 - 2\sqrt{5})}$
(c) $4\sqrt{3} : 5\sqrt{(10 + 2\sqrt{5})}$
(d) $4\sqrt{3} : 5\sqrt{(10 - 2\sqrt{5})}$

Q48. Successive discounts of 12% and 13% are equivalent to what single discount?

(a) 20.7%
(b) 21.91%
(c) 22.2%
(d) 23.44%

Q49. Sachin bought 52 books for Rs. 1,120 from one shop and 47 books for Rs. 910 from another. What is the average price (in Rs. , rounded off to two decimal places) he paid per book?

(a) 21.51
(b) 20.51
(c) 22.51
(d) 23.51

Q50. A cuboid of dimensions 18 cm × 12 cm × 8 cm is melted and recast into smaller cubes each having an edge of 4 cm. Find the ratio of the total surface area of one small cube to that of the original cuboid.

(a) 3 : 19
(b) 1 : 10
(c) 2 : 21
(d) 2 : 19

GENERAL INTELLIGENCE & REASONING

Q51. Hitesh starts from Point A and drives 62 km towards the east. He then takes a left turn, drives 36 km, turns left and drives 78 km. He then takes a left turn and drives 71 km. He takes a final left turn, drives 16 km and stops at Point P. How far (shortest distance) and towards which direction should he drive in order to reach Point A again? (All turns are 90-degree turns only unless specified.)

(a) 36 km to the south
(b) 34 km to the north
(c) 35 km to the north
(d) 37 km to the south

Q52. VHEP is related to OAXI in a certain way based on the English alphabetical order. In the same way, TFCN is related to MYVG. To which of the following options is YKHS related, following the same logic?

(a) RADE
(b) RDSE
(c) RLDE
(d) RDAL

Q53. 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 mints are lamps.

All mints are kites.

All mints are jams.

Conclusions:

(I) All lamps are jams

(II) Some jams are kites14197

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

Q54. S, P, D, M, and R are sitting around a circular table facing the centre. Only two people are sitting between R and M when counted from the left of R. D is an immediate neighbour of M and R. P is sitting to the immediate left of R. Who are the immediate neighbours of S?

(a) M and D
(b) P and M
(c) R and P
(d) D and R

Q55. Mr. Hepa ranked 56^(th) from the top and 71^(st) from the bottom in his class. How many students are there in his class?

(a) 123
(b) 125
(c) 124
(d) 126

Q56. Select the pair that follows the same pattern as the one followed by the two pairs given below. Both pairs follow the same pattern.

NJL−OKM

CYA−DZB

(a) IEG−IFG
(b) IDE−JFH
(c) IEG−JFH
(d) IDE−IEG

Q57. What should come in place of the question mark (?) in the given series?

84 77 70 ? 56 49 42

(a) 60
(b) 68
(c) 63
(d) 66

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

DEA 48 CDZ 55 BCY 62 ABX 69 ?

(a) ZAW 76
(b) ZIS 75
(c) ZBV 76
(d) ZZV 75

Q59. If ‘A’ stands for ‘÷’, ‘B’ stands for ‘×’, ‘C’ stands for ‘+’ and ‘D’ stands for ‘−’, what will come in place of the question mark (?) in the following equation?

92 A 2 D (35 A 7) B 4 C 30 A 3 C 5 B 11 = ?

(a) 80
(b) 102
(c) 91
(d) 73

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Q60. In a certain code language,

'A + B' means 'A is the mother 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' and

'A # B' means 'A is the daughter of B'.

How is C related to R if 'C # N × K % T + R'?

(a) Sister's daughter
(b) Mother's mother
(c) Mother's father
(d) Mother's sister

Q61. Refer to the following number series and answer the question that follows (all numbers are single-digit numbers only).

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

How many unique single-digit numbers in the series are divisible by 3 (each single-digit number counted only once, regardless of repetitions)?

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

Q62. In the following number-pairs, the second number is obtained by applying certain mathematical operation(s) to the first number. Select the number-pair in which the numbers are related in the same way as are the numbers of the following pairs.

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

19, 35

28, 53

(a) 36, 69
(b) 85, 166
(c) 73, 145
(d) 42, 85

Q63. Read the given statements and conclusions carefully. Assuming that the information given in the statements is true, even if it appears to be at variance with commonly known facts, decide which of the given conclusions logically follow(s) from the statements.

Statements:

All forks are kettles.

Some forks are spoons.

Conclusions:

(I): Some kettles are spoons.

(II): All spoons are forks.

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

Q64. If 1 is added to each odd digit and 1 is subtracted from each even digit in the number 3215674, what will be the sum of the digits which are first from the left and third from the right?

(a) 9
(b) 6

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(c) 8
(d) 7

Q65. Shubham starts from Point A and drives 11 km towards South. He then takes a right turn, drives 7 km, turns right and drives 14 km. He then takes a right turn and drives 11 km. He takes a final right turn, drives 3 km and stops at Point P. How far (shortest distance) and towards which direction should he drive in order to reach Point A again?

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

(a) 5 km to the west
(b) 5 km to the east
(c) 4 km to the east
(d) 4 km to the west

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

412 420 408 424 404 428 ?

(a) 400
(b) 408
(c) 424
(d) 432

Q67. 54 people are standing in a row facing North. Junaid is 21^(st) from the left end, while Sourav is 12^(th) from the right end. How many people are there between Junaid and Sourav?

(a) 20
(b) 21
(c) 19
(d) 18

Q68. Refer to the following number series and answer the question that follows (all numbers are single-digit numbers only). Counting to be done from left to right only.

(Left) 4 9 8 5 1 6 4 5 9 6 5 3 4 9 6 2 9 4 8 5 1 1 8 4 1 5 7 (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) 2
(b) 4
(c) 3
(d) 1

Q69. Six people, A, B, C, D, E and F, are sitting in a row, facing towards the north.

Only three people are sitting at the right of A. Only one person is sitting between A and C. E is sitting second from the extreme left end of the row. B is not the immediate neighbour of A. F is sitting to the immediate left to B. F is sitting to the immediate right to A.

Who is sitting at the extreme left end of the row?

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

Q70. What should come in place of the question mark (?) in the given series based on the English alphabetical order?

GDA IFC KHE MJG ?

(a) OKJ
(b) OKI
(c) OLJ
(d) OLI

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Q71. If 'A' stands for '÷', 'B' stands for '×', 'C' stands for '+' and 'D' stands for '−', then what will come in place of the question mark (?) in the following equation?

68 A 2 D 7 B 5 C (25 A 5) B 9 C 30 A 6 = ?

(a) 61
(b) 28
(c) 35
(d) 49

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

15, 22, 36, 57, 85, ?

(a) 122
(b) 121
(c) 120
(d) 119

Q73. This question is based on the five, three-digit numbers given below.

(Left) 604, 895, 469, 742, 307 (Right)

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

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

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

(a) 12
(b) 16
(c) 5
(d) 9

Q74. GBCI is related to YTUA in a certain way based on the English alphabetical order. In the same way, AVWC is related to SNOU. To which of the following options is CXYE related, following the same logic?

(a) UPNH
(b) UQWE
(c) UPQW
(d) UIOP

Q75. Based on the English alphabetical order, three of the following four letter-clusters are alike in a certain way and thus form a group. Which letter-cluster DOES NOT belong to that group?

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

(a) TXZ
(b) HLP
(c) RVX
(d) LPR

Q76. Seven friends D, E, F, U, V, W and X are sitting in a straight line facing the north. Only two people are seated between U and D. Only X is seated to the right of F. Only one person is seated between D and F. V is seated at some place to the right of E but at some place to the left of W. How many people are seated between W and E?

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

Q77. In a certain code language, WASO is coded as 65 and YKSB is coded as 64. What is the code for LEUC in that language?

(a) 50
(b) 57
(c) 48
(d) 52

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Q78. Refer to the following series and answer the question that follows (all numbers are single digit numbers only). Counting to be done from left to right only.

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

How many such odd numbers are there (from left to right) each of which is immediately preceded by an odd number and also immediately followed by an odd number?

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

Q79. Based on the English alphabetical order, three of the following four are alike in a certain way and thus form a group. Which is the one that does not belong to that group?

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

(a) HLQ
(b) WAE
(c) ZDI
(d) KOT

Q80. In a certain code language, ‘never judge people’ is coded as ‘gu uf ha’ and ‘don't ask people’ is coded as ‘kl td uf’. How is ‘people’ coded in that language? (All codes are two-letter codes.)

(a) gu
(b) td
(c) ha
(d) uf

GENERAL AWARENESS AND CURRENT AFFAIRS

Q81. At which event did the DRDO official announce the development of the new high-calibre Pinaka rocket with a range of 120 km?

(a) Aero Expo 2025
(b) Aero India 2025
(c) Defence Expo 2025
(d) International Defence Conference 2025

Q82. Which of the following is NOT included among the four Labour Codes implemented in 2025?

(a) Code on Social Security, 2020
(b) Code on Education, 2021
(c) Code on Wages, 2019
(d) Industrial Relations Code, 2020

Q83. Who among the following was appointed as the Deputy Chief Executive Officer (Deputy CEO) of SBI General Insurance in June 2025?

(a) Indrani Dutta
(b) Mohd. Arif Khan
(c) Naveen Chandra Jha
(d) Anand Pejawar

Q84. Who inaugurated the football stadium at Police Complex, Chumoukedima near Dimapur, Nagaland, in January 2025?

(a) Neiphiu Rio
(b) N. Biren Singh
(c) Temjen Imna Along
(d) Conrad Sangma

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Q85. Accordioning to the Indian Government, by the June 2025, how many Khelo India Centres (KICs) were established for grassroots sports training and athlete development?

(a) 950
(b) 1045
(c) 936
(d) 1000

Q86. Which of the following cyber security exercises was launched by the Indian Armed Forces in 2025 to simulate real-world threats and promote secure practices?

(a) Sainya SecureNet
(b) Raksha Netra
(c) Cyber Suraksha
(d) Cyber Kavach

Q87. When is Hindi Journalism Day celebrated every year in India?

(a) 9 April
(b) 18 February
(c) 5 May
(d) 30 May

Q88. Which city hosted the 28^(th)National Conference on e-Governance in September 2025?

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

Q89. Which among the following got a six-year support plan announced in Union Budget 2025-2026 to reduce imports?

(a) Electronics
(b) Steel
(c) Pulses
(d) Oil seeds

Q90. Which of the following International events did India host in 2025 that is considered one of the largest gatherings of its kind and showcases India’s global standing in inclusive sports?

(a) Summer Universiade 2025
(b) Commonwealth Games 2026
(c) World Para Athletics Championships 2025
(d) FIFA Women’s World Cup 2025

Q91. Who won the prestigious Yuva Puraskar in Hindi for the poetry collection, Phir Ugna, in June 2025?

(a) Mayur Khavdu
(b) Akhil P Dharmajan
(c) Parvati Tirkey
(d) Subrat Senapati

Q92. In November 2025, which organization delivered a human-rated Vikas engine to the Indian Space Research Organisation for the Gaganyaan mission?

(a) Hindustan Aeronautics Limited
(b) Godrej Aerospace
(c) Bharat Dynamics Limited
(d) Larsen & Toubro

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Q93. According to the October 2025 Monetary Policy Report of the Reserve Bank of India, what is the revised CPI inflation projection for FY 2025–26?

(a) 2.6%
(b) 2.2%
(c) 3.4%
(d) 3.1%

Q94. In June 2025, Karnataka raised the housing reservation quota for religious minorities from 10% to what percentage?

(a) 18%
(b) 12%
(c) 15%
(d) 20%

Q95. Which group set a Guinness World Record by performing 108 Surya Namaskars with over 22,000 tribal students?

(a) Gujarat volunteers
(b) Rajasthan school children
(c) Andhra Pradesh tribal students
(d) Maharashtra yoga groups

Q96. In 2025, the UN General Assembly urged to grant UN membership as the 194th country to which of the following countries?

(a) Kosovo
(b) South Sudan
(c) Vatican City
(d) Palestine

Q97. The Chhattisgarh Chief Minister in August 2025 directed officials to extend assistance to families affected by floods in which of the following divisions?

(a) Raipur
(b) Bastar
(c) Bilaspur
(d) Surguja

Q98. Where was the 2025 Champions League final held?

(a) Wembley Stadium, London
(b) Santiago Bernabéu, Madrid
(c) Camp Nou, Barcelona
(d) Allianz Arena, Munich

Q99. What is a key aim of the Aravalli Green Wall Project launched on the World Environment Day in June 2025?

(a) Expanding green cover to combat desertification
(b) Building embankments in Punjab
(c) Mounting vertical gardens in Mumbai
(d) Establishing national parks across Himalayas

Q100. As per the Sustainable Development Report 2025, which rank did India secure in the Sustainable Development Goals (SDG) Index, marking its first entry into the “top 100” nations?

(a) 98
(b) 74
(c) 85
(d) 99

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ANSWER KEY

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

SOLUTIONS

Q1. Answer: (b) 900 m

The correct answer is 900 m.

Key Points

• The train starts from rest, which means the initial velocity (u) is 0 m/s. When an object begins its motion from a stationary position, its starting speed is always considered zero in kinematic calculations.

• The final velocity (v) given is 36 km/hr. To perform calculations in SI units, this must be converted to meters per second (m/s). By multiplying 36 by the conversion factor 5/18, we get 10 m/s.

• The time (t) taken to reach this velocity is 3 minutes. In physics equations, time must be expressed in seconds. Therefore, 3 minutes is multiplied by 60, resulting in 180 seconds.

• Since the train moves with uniform acceleration (a), we can find the acceleration using the first equation of motion: $v = u + at$. Substituting the values, $10 = 0 + a(180)$, which gives $a = 10/180$ or $1/18$ m/s².

• The distance (s) covered is calculated using the second equation of motion: $s = ut + (1/2)at^2$. Substituting the known values: $s = (0)(180) + (1/2)(1/18)(180)(180)$. This simplifies to $s = 0 + (1/2)(1/18)(32400)$, which equals 900 meters.

• Alternatively, distance can be found using average velocity multiplied by time for uniform acceleration: $[(u + v) / 2] \times t$. Here, $[(0 + 10) / 2] \times 180 = 5 \times 180 = 900$ m. Hence, the correct answer is 900 m.

Additional Information

• Equations of Motion:

• These equations describe the behavior of a physical system in terms of its motion as a function of time. There are three primary equations for uniform acceleration: $v = u + at$, $s = ut + 1/2\ at^2$, and $v^2 = u^2 + 2as$.

• These were derived based on the work of Sir Isaac Newton and describe linear motion. They are only applicable when acceleration remains constant throughout the duration of the motion.

• Unit Conversion Logic:

• Converting km/hr to m/s is a standard procedure in physics. Since 1 kilometer is 1000 meters and 1 hour is 3600 seconds, the ratio 1000/3600 simplifies to 5/18.

• This conversion is essential to maintain consistency with the International System of Units (SI), where distance is in meters and time is in seconds.

• Uniform Acceleration:

• Uniform acceleration occurs when the velocity of an object changes by an equal amount in every equal time interval.

• On a Velocity-Time (v-t) graph, uniform acceleration is represented by a straight line. The area under the line in a v-t graph represents the total distance covered by the object.

Important Points

• Scalar vs Vector: Distance is a scalar quantity, meaning it only has magnitude. However, in straight-line motion in a single direction starting from rest, the magnitude of distance and displacement (a vector) are identical.

• Significance of "Rest": In competitive exams, the phrase "starts from rest" is a crucial data point indicating that u = 0. Conversely, "comes to a stop" or "brakes are applied" usually indicates v = 0.

• Numerical Accuracy: Always ensure all units are converted to the MKS system (Meter-Kilogram-Second) before applying

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kinematic formulas to avoid common calculation errors. For this problem, failing to convert 3 minutes to 180 seconds would lead to an incorrect result.

Q2. Answer: (a) Offspring show new genetic recombination

The correct answer is Offspring show new genetic recombination.

Key Points

• Sexual reproduction in plants involves the fusion of male and female gametes to form a zygote, which eventually develops into a new individual.

• One of the most significant features of this process is genetic recombination. During the process of meiosis (cell division to produce gametes), crossing over occurs between homologous chromosomes during prophase I. This results in offspring having a unique combination of genes different from both parents. Hence, statement 1 is correct.

• This genetic variation is the cornerstone of survival in changing environments. It allows a population of plants to adapt to new pathogens, changing climatic conditions, and competition for resources.

• In contrast, if offspring do not show any variation, they are highly susceptible to being wiped out by a single disease or environmental change. Hence, statement 2 is incorrect.

• Offspring produced through sexual reproduction are not clones; they are genetically distinct individuals. Cloning is a characteristic of asexual reproduction or vegetative propagation. Hence, statement 3 is incorrect.

• Sexual reproduction is generally a slower process compared to asexual reproduction because it involves complex stages like pollination, fertilization, seed formation, and dormancy. Hence, statement 4 is incorrect.

Additional Information

• Mechanism of Variation: The two main sources of variation in sexual reproduction are independent assortment of chromosomes and crossing over. In angiosperms (flowering plants), the pollen grain (male gametophyte) and embryo sac (female gametophyte) undergo these processes to ensure diversity.

• Evolutionary Advantage: Variation is the raw material for natural selection. Plants with favorable genetic traits resulting from recombination are more likely to survive and reproduce, passing those advantageous traits to the next generation.

• Types of Pollination: Cross-pollination (Allogamy) specifically promotes greater heterozygosity and genetic diversity compared to self-pollination (Autogamy).

• Adaptability: Recombination allows for the masking of harmful mutations. Since offspring receive sets of genes from two parents, a healthy gene from one parent can often compensate for a defective gene from the other.

Important Points

• Comparison with Asexual Reproduction: In asexual reproduction, such as budding, fragmentation, or apomixis, the offspring are genetically identical to the parent. While this allows for rapid population growth in stable environments, it lacks the evolutionary flexibility provided by sexual reproduction.

• Environmental Stress: In unpredictable environments (e.g., fluctuating soil pH, drought, or salinity), the recombinant genotypes produced through sexual reproduction have a higher probability of possessing the necessary physiological traits to withstand abiotic stress.

• Date and Discovery: The basic principles of heredity and the importance of variation were famously documented by Gregor Mendel in the mid-19th century (around 1865) through his experiments on Pisum sativum (pea plants).

Q3. Answer: (c) more than one type of cells

The correct answer is more than one type of cells.

Key Points

• Complex tissues are defined as a group of more than one type of cells that have a common origin and work together as a structural and functional unit.

• Unlike simple permanent tissues, which consist of cells that are morphologically and physiologically similar, complex tissues are heterogeneous.

• The primary function of these tissues in plants is the transport of water, minerals, and organic nutrients throughout the plant body.

• The two most well-known types of complex tissues in the plant kingdom are Xylem and Phloem. These are often referred to as vascular tissues.

• The presence of these complex tissues is a distinctive feature of complex plants, allowing them to survive in terrestrial environments by facilitating long-distance transport. Hence, the correct answer is more than one type of cells.

Additional Information

• Xylem:

• It functions as a conducting tissue for water and minerals from the roots to the stems and leaves.

• It provides mechanical strength to the plant parts.

• It is composed of four different kinds of elements: Tracheids, Vessels, Xylem parenchyma, and Xylem fibres.

• In flowering plants, tracheids and vessels are the main water-transporting elements. Most xylem elements are dead cells except for xylem parenchyma.

• Phloem:

• It transports food materials, usually from the leaves (source) to other parts of the plant (sink).

• In angiosperms, phloem is composed of Sieve tube elements, Companion cells, Phloem parenchyma, and Phloem fibres.

• Unlike xylem, phloem cells are generally living cells, with the exception of phloem fibres (also known as bast fibres) which are dead at maturity.

• Simple Permanent Tissues:

• These are made up of only one type of cells which are similar in structure and function.

• Examples include Parenchyma (involved in storage and photosynthesis), Collenchyma (provides flexibility and mechanical support), and Sclerenchyma (provides rigidity and is often dead at maturity).

• Meristematic Tissues:

• These are tissues where cells remain young and undergo continuous cell division.

• They are found in the growing regions of plants, such as the root tips and shoot tips (apical meristems).

Important Points

• Origin: Both xylem and phloem in the primary plant body originate from the procambium. During secondary growth, they are produced by the vascular cambium.

• Vascular Bundles: In the stems and roots, xylem and phloem are organized into distinct groups called vascular bundles.

• Evolutionary Significance: The development of complex conducting tissues was a major step in the evolution of land plants (Pteridophytes, Gymnosperms, and Angiosperms), enabling them to grow to great heights.

Q4. Answer: (c) Both (iii) and (iv)

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

Key Points

• Atmospheric Refraction is the primary physical phenomenon responsible for the twinkling of stars. As starlight enters the Earth's atmosphere, it undergoes refraction continuously before it reaches the Earth's surface. Hence, statement (iv) is correct.

• The apparent position of a star is slightly different from its actual position because the atmosphere bends starlight toward the normal as it moves from a rarer medium to an optically denser medium. Because the physical conditions of the Earth's atmosphere are not stationary, the apparent position of the star fluctuates slightly. Hence, statement (iii) is correct.

• While it is scientifically true that stars are self-luminous bodies (they have light of their own), this characteristic is not the cause of the twinkling effect. Twinkling is an optical illusion created by the medium through which the light travels, not the source of the light itself. Hence, statement (i) is a true fact but not the reason for twinkling.

• The twinkling of stars is caused by the refraction (bending) of light, not the reflection of light. Reflection involves light bouncing off a surface, whereas refraction involves light passing through a medium of varying optical density. Hence, statement (ii) is incorrect.

• The path of rays of light coming from the star goes on varying slightly, the apparent position of the star fluctuates and the amount of starlight entering the eye flickers—the star sometimes appears brighter, and at some other time, fainter, which is the twinkling effect.

Additional Information

• Point Source vs. Extended Source:

• Stars are located at a vast distance from the Earth, often measured in light-years. This makes them appear as point-sized sources of light. Even a tiny atmospheric disturbance can significantly shift the path of a single point of light.

• In contrast, planets are much closer to Earth and are seen as extended sources or a collection of many point-sized sources of light. The total variation in the amount of light entering our eye from all the individual point-sized sources will average out to zero, which is why planets do not twinkle.

• Refractive Index of Air:

• The Earth's atmosphere consists of several layers with varying temperatures and densities. Cold air is optically denser than warm air, meaning it has a higher refractive index.

• As starlight passes through these turbulent layers, the light is constantly bent back and forth. This process is known as stellar scintillation.

• Position Near Horizon:

• Stars appear to twinkle more when they are near the horizon compared to when they are directly overhead (at the zenith). This is because the light must travel through a thicker layer of the atmosphere, encountering more turbulence and refraction.

• Vacuum of Space:

• If an observer were in outer space (a vacuum), stars would not twinkle. This is why space telescopes like the Hubble Space

Telescope or James Webb Space Telescope can capture much clearer images than ground-based telescopes, as they are above the distorting effects of the Earth's atmosphere.

Important Points

• The speed of light changes as it moves through different optical media, causing the bending effect known as refraction.

• The Laws of Refraction (Snell's Law) dictate that when light travels from a vacuum into the atmosphere, it slows down and bends toward the normal.

• The apparent shift in position means a star always appears slightly higher in the sky than its actual position.

Q5. Answer: (a) Strong electrostatic forces between ions

The correct answer is Strong electrostatic forces between ions.

Key Points

• Ionic compounds are chemical compounds composed of ions held together by electrostatic forces termed ionic bonding. These compounds are formed through the transfer of electrons from a metal to a non-metal.

• The most defining characteristic of these compounds is the existence of strong electrostatic forces of attraction between the oppositely charged cations (positively charged) and anions (negatively charged). Hence, statement 1 is correct.

• Because of these strong inter-ionic attractions, ionic compounds exist as solids and are generally hard. A significant amount of thermal energy is required to overcome these forces, which results in high melting and boiling points. Hence, statement 2 is incorrect.

• Ionic compounds are generally soluble in polar solvents like water because the water molecules reduce the electrostatic attraction between the ions, allowing them to disperse. However, they are usually insoluble in non-polar solvents such as benzene, ether, or kerosene. Hence, statement 3 is incorrect.

• In their solid state, ionic compounds are poor conductors of electricity because the ions are fixed in a crystal lattice. However, in the molten state or when dissolved in aqueous solution, the ions become free to move and act as charge carriers, making them good electrical conductors. Hence, statement 4 is incorrect.

Additional Information

• Formation of Ionic Bonds:

• An ionic bond is formed when one atom (typically a metal) loses valence electrons to another atom (typically a non-metal). For example, in Sodium Chloride (NaCl), a sodium atom loses one electron to become Na+, and a chlorine atom gains that electron to become Cl-.

• The resulting electrostatic attraction between the sodium cation and chloride anion creates the stable compound.

• Crystal Lattice Structure:

• Ionic compounds do not exist as single molecules; instead, they form a three-dimensional network called a crystal lattice.

• This lattice structure is highly organized and contributes to the brittleness of the compound, as applying pressure shifts the ions and causes like-charged ions to repel each other, shattering the crystal.

• Lattice Energy:

• Lattice energy is the amount of energy released when gaseous ions combine to form one mole of an ionic solid. It is a measure of the stability and strength of the ionic bond.

• Higher charge density on ions and smaller ionic radii generally lead to higher lattice energy and higher melting points.

Important Points

• Physical State: At room temperature, almost all ionic compounds are crystalline solids due to the high bond strength.

• Non-directional Nature: Unlike covalent bonds, ionic bonds are non-directional because the electrostatic field of an ion acts in all directions around it.

• Applications: Common examples include Magnesium Oxide (MgO), used as a refractory material due to its extremely high melting point of 2,852 degrees Celsius, and Calcium Carbonate ($CaCO_3$), found in limestone and shells.

• Electrolysis: The molten state conductivity of ionic compounds is utilized in industrial electrolysis to extract reactive metals like Aluminum and Sodium from their ores.

Q6. Answer: (d) Transpiration pull and root pressure

The correct answer is Transpiration pull and root pressure.

Key Points

• The upward movement of water and minerals from the roots to the various parts of the plant is known as the ascent of sap. This process is primarily driven by transpiration pull and root pressure.

• Transpiration pull is a biological process where the evaporation of water from the stomata of leaves creates a suction force (tension). This tension is transmitted down to the roots through a continuous column of water in the xylem vessels, pulling water upwards. Hence, statement 4 is correct.

• Root pressure is a positive pressure developed in the xylem of the roots due to the active absorption of mineral ions from the

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soil. This creates an osmotic gradient that forces water into the root xylem, pushing it up to a certain height. It is more significant during the night or in small herbaceous plants.

• The conversion of sunlight into starch refers to photosynthesis, which occurs in the chloroplasts to produce food, but it does not directly facilitate the upward transport of water. Hence, statement 1 is incorrect.

• While active transport occurs in leaf cells for the loading of sugars into the phloem, it is not the primary mechanism for the bulk upward movement of water in the xylem. Hence, statement 2 is incorrect.

• The diffusion of gases through stomata is essential for respiration and photosynthesis, but the gas exchange itself is not the force that lifts water; rather, it is the loss of water vapor (transpiration) occurring simultaneously that provides the pull. Hence, statement 3 is incorrect.

Additional Information

• Xylem Tissue: This is a complex permanent tissue responsible for the conduction of water and minerals. It consists of four types of cells: tracheids, vessels, xylem parenchyma, and xylem fibres. The tracheids and vessels are the main conducting elements that form a continuous system of water-conducting channels.

• Cohesion-Tension Theory: Proposed by Dixon and Joly in 1894, this theory explains how water can reach the top of tall trees (over 100 meters). It relies on cohesion (attraction between water molecules), adhesion (attraction between water and xylem walls), and surface tension.

• Transpiration: This is the loss of water in the form of vapor from the aerial parts of the plant. It not only helps in the ascent of sap but also aids in temperature regulation (cooling the plant) and maintaining the turgidity of cells.

• Factors Affecting Transpiration: The rate of transpiration is influenced by external factors such as temperature, light intensity, humidity, and wind speed. For instance, high humidity reduces the rate of transpiration because the concentration gradient between the leaf and the atmosphere is decreased.

• Guttation: When root pressure is high and transpiration is low (usually at night), water may be forced out in the form of liquid droplets through specialized openings called hydathodes at the margins of leaves. This phenomenon is distinct from transpiration.

Important Points

• Direction of Flow: In the xylem, the transport of water and minerals is strictly unidirectional (from roots to leaves). In contrast, the phloem transports food in a bidirectional manner (from source to sink).

• Energy Requirement: The transpiration pull is a passive process driven by solar energy (evaporation), whereas the initial accumulation of minerals in the root that leads to root pressure often involves active transport (utilizing ATP).

• Xylem Vessels vs Tracheids: Vessels are more efficient in water conduction than tracheids because they are wider and have perforated end walls, allowing for a more rapid flow of the water column.

Q7. Answer: (c) straight line inclined to time axis

The correct answer is straight line inclined to time axis.

Key Points

• Uniform acceleration is defined as a type of motion where the velocity of an object changes by an equal amount in every equal time interval. In other words, the rate of change of velocity remains constant over time.

• On a velocity-time (v-t) graph, the slope of the line represents the acceleration of the particle. If the acceleration is uniform (constant), the slope must also be constant.

• A straight line is the geometric representation of a constant slope. Therefore, the graph of an object moving with uniform acceleration is a straight line.

• The line must be inclined to the time axis (x-axis) to show that velocity is changing. If the acceleration is positive, the line slopes upward; if the acceleration is negative (retardation), the line slopes downward. Hence, statement 3 is correct.

• A horizontal line on a velocity-time graph indicates that the slope is zero, meaning the acceleration is 0 and the particle is moving with uniform velocity. Hence, statement 4 is incorrect.

• A curve concave upward indicates that the slope (acceleration) is increasing over time, which represents non-uniform acceleration. Hence, statement 2 is incorrect.

• A vertical line would imply that velocity changes infinitely at a single point in time, resulting in infinite acceleration, which is physically impossible for a particle. Hence, statement 1 is incorrect.

Additional Information

• Area under the Graph: The area enclosed by the velocity-time graph and the time axis represents the total displacement of the particle during that time interval.

• Equations of Motion: For a particle moving with uniform acceleration (a), the relationship between initial velocity (u), final velocity (v), and time (t) is given by the equation v = u + at. This is a linear equation of the form y = mx + c, confirming that the graph is a straight line.

• Slope Calculation: The slope of the velocity-time graph is calculated as the change in velocity divided by the change in time (rise over run). For uniform acceleration, this ratio is always the same regardless of which two points on the line are chosen.

• Types of V-T Graphs:

• Zero Acceleration: A straight line parallel to the time axis.

• Positive Uniform Acceleration: A straight line with a positive slope starting from the origin (if u=0) or from the y-axis (if u>0).

• Negative Uniform Acceleration: A straight line with a negative slope (moving towards the time axis).

• Non-Uniform Acceleration: Any curved line (parabolic, exponential, etc.).

Important Points

• Position-Time Graph: For a particle with uniform acceleration, the position-time (s-t) graph is a parabola, because displacement is proportional to the square of time (s = ut + 1/2 at^2).

• Instantaneous Acceleration: In cases of non-uniform acceleration, the acceleration at a specific moment is found by drawing a tangent to the velocity-time curve at that point and finding its slope.

• Units: The SI unit of acceleration is meters per second squared (m/s^2), while velocity is measured in meters per second (m/s).

• Kinematics: These graphical interpretations are fundamental in Kinematics, a branch of Physics that describes the motion of points, bodies, and systems without considering the forces that cause the motion.

Q8. Answer: (c) Impure copper is used as anode and pure copper as cathode

The correct answer is Impure copper is used as anode and pure copper as cathode.

Key Points

• Electrolytic refining is a process used for the purification of metals like copper, zinc, tin, nickel, silver, and gold. It relies on the principle of electrolysis to transfer metal from an impure source to a pure one.

• In this setup, the Anode is always made of the impure metal. For copper refining, a thick slab of impure copper (blister copper) is used as the positive electrode. During the process, copper atoms from this slab lose electrons and enter the solution as ions. Hence, the statement that impure copper is used as the anode is correct.

• The Cathode consists of a thin strip of pure metal. In this context, a pure copper sheet acts as the negative electrode where the copper ions (Cu2+) from the electrolyte gain electrons and deposit as pure metal. Hence, the statement that pure copper is used as the cathode is correct.

• The Electrolyte used is a water-soluble salt of the metal being refined. For copper, acidified copper sulphate (CuSO4) solution is commonly employed to ensure high electrical conductivity and a steady supply of ions.

• When electric current is passed through the electrolyte, the net result is the transfer of pure copper from the anode to the cathode, increasing the thickness of the pure cathode over time.

Additional Information

• Chemical Reactions at Electrodes:

• At the Anode (Oxidation): The impure copper atoms release electrons: Cu (s) → Cu2+ (aq) + 2e–.

• At the Cathode (Reduction): The copper ions from the solution accept electrons: Cu2+ (aq) + 2e– → Cu (s).

• Purity Level: The electrolytic refining process is highly efficient and can produce copper with a purity of 99.95% to 99.99%. This high degree of purity is essential because even small amounts of impurities significantly reduce the electrical conductivity of copper.

• Applications of Pure Copper: Pure copper obtained through this method is primarily used in the electrical industry for making wires, cables, transformers, and electronic components.

• Industrial Scale: In industrial refineries, multiple anodes and cathodes are suspended in large tanks filled with acidified electrolyte to maximize the output of pure copper through continuous electrolysis.

Important Points

• Anode Mud: The insoluble impurities present in the impure copper slab do not dissolve in the electrolyte. Instead, they settle down below the anode at the bottom of the tank. This residue is known as Anode Mud.

• Recovery of Precious Metals: The anode mud often contains valuable metals such as gold (Au), silver (Ag), platinum (Pt), antimony, and selenium. The recovery of these precious metals often helps offset the overall cost of the refining process.

• Soluble Impurities: Metals that are more electropositive than copper, such as iron (Fe), nickel (Ni), and zinc (Zn), dissolve into the electrolyte as sulphates but do not deposit at the cathode because they require a higher potential to be reduced compared to copper.

• Electrolyte Concentration: Throughout the process, the concentration of the copper sulphate electrolyte remains relatively constant because the amount of copper dissolving at the anode is exactly equal to the amount depositing at the cathode.

Q9. Answer: (d) the sound waves are guided by multiple reflections in the tube

The correct answer is the sound waves are guided by multiple reflections in the tube.

Key Points

• A stethoscope is a medical instrument used by doctors for listening to sounds produced within the body, chiefly in the heart or lungs.

• In stethoscopes, the sound of the patient’s heartbeat reaches the doctor’s ears by multiple reflection of sound waves. The sound

travels through the hollow tube of the stethoscope by reflecting off its inner walls repeatedly until it reaches the earpieces. Hence, statement 4 is correct.

• The sound waves are not absorbed by the tube walls; instead, the walls are designed to be reflective to ensure the intensity of the sound is maintained over the distance of the tube. Hence, statement 1 is incorrect.

• Refraction involves the bending of waves when passing from one medium to another. In a stethoscope, the primary mechanism for guiding sound through the curved tube is reflection, not refraction. Hence, statement 2 is incorrect.

• While electronic stethoscopes exist today that can amplify sound using electricity, the standard acoustic stethoscope works purely on the principle of acoustics and physical reflection without any electrical amplification. Hence, statement 3 is incorrect.

Additional Information

• Invention: The stethoscope was invented in France in 1816 by René Laennec. Originally, it was a simple wooden tube used for auscultation (listening to internal sounds).

• Mechanism of Sound: Sound is a longitudinal mechanical wave that requires a medium (solid, liquid, or gas) to travel. It travels through the stethoscope tube as a series of compressions and rarefactions.

• Multiple Reflection: This phenomenon occurs when a wave hits a surface and bounces back. By using a closed tube, the sound energy is confined, preventing the sound from spreading in all directions (spherical divergence), which effectively amplifies the sound heard by the doctor.

• Components: A modern stethoscope consists of a chest piece (which usually has a diaphragm and a bell), tubing, and earpieces. The diaphragm is used for high-frequency sounds, while the bell is used for low-frequency sounds.

• Acoustic Impedance: The design of the stethoscope helps in matching the acoustic impedance between the air and the body, allowing more sound energy to be transmitted to the doctor's ears.

Important Points

• Reflection Law: Sound follows the same laws of reflection as light, where the angle of incidence is equal to the angle of reflection.

• Application: Apart from stethoscopes, the principle of multiple reflection is also used in megaphones, horns, and musical instruments like trumpets and shehnais to direct sound in a specific direction.

• Concert Halls: The ceilings of cinema halls and concert halls are often curved so that sound, after reflection, reaches all corners of the hall uniformly.

• Sound Absorption: Soft materials like curtains or carpets are used in rooms to absorb sound and prevent reverberation, which is the opposite of what is required inside a stethoscope tube.

Q10. Answer: (d) Chemical change

The correct answer is Chemical change.

Key Points

• A Chemical change is a process where one or more substances are altered into one or more new and different substances. In the given reaction, Zinc granules react with dilute Hydrochloric acid to produce Zinc chloride and Hydrogen gas.

• This reaction is characterized by the evolution of a gas, which is one of the primary indicators of a chemical transformation. The formation of Hydrogen bubbles (effervescence) around the zinc metal signifies that the original identity of the reactants has changed.

• Unlike a physical change, this process involves the breaking and forming of chemical bonds. The Zinc (Zn) atoms displace the Hydrogen (H) atoms from the Hydrochloric acid (HCl), resulting in a completely new chemical arrangement.

• Chemical changes are typically irreversible by simple physical methods like filtration or evaporation. Once the Zinc chloride salt is formed in the solution and Hydrogen gas is released into the atmosphere, the original Zinc metal cannot be recovered by mere physical cooling or mixing.

• The reaction is also exothermic in nature, meaning it is accompanied by the release of heat, causing the temperature of the reaction vessel to rise. This change in energy is another hallmark of a Chemical change.

Additional Information

• Chemical Equation: The balanced chemical equation for this reaction is $Zn + 2HCl \rightarrow ZnCl_2 + H_2$. This shows that one mole of Zinc reacts with two moles of Hydrochloric acid to yield one mole of Zinc chloride and one mole of Hydrogen gas.

• Types of Chemical Reactions: This specific reaction is classified as a Single Displacement Reaction. In such reactions, a more reactive element (Zinc) displaces a less reactive element (Hydrogen) from its compound.

• Physical Change: In contrast, a Physical change involves a change in the physical properties of a substance (like shape, size, or state) without changing its chemical composition. Examples include melting of ice or dissolving sugar in water.

• Mixture Formation: A Mixture is formed when two or more substances are combined physically but not chemically. In a mixture, each component retains its own chemical identity, such as sand in water or air.

• Dissolution: While dissolution involves a solute dissolving in a solvent, in this context, the zinc is not merely "dissolving" like salt in water; it is reacting chemically to form a new salt and a gas.

Important Points

• Test for Hydrogen Gas: The Hydrogen gas produced during this reaction is colorless and odorless. It can be identified using the Pop Sound Test; when a burning splinter is brought near the mouth of the test tube, the gas burns with a characteristic "pop" sound.

• Reactivity Series: Zinc is placed above Hydrogen in the Reactivity Series of metals, which explains why it can successfully displace hydrogen from dilute acids. Metals like Copper or Silver, which are below hydrogen, would not react with dilute HCl.

• Safety Precautions: Since Hydrogen gas is highly inflammable and Hydrochloric acid is corrosive, this experiment should be performed with care in a laboratory setting with proper safety gear.

• History: The reaction of metals with acids was one of the earliest methods used by scientists like Henry Cavendish in 1766 to isolate and study Hydrogen, which he called "inflammable air."

Q11. Answer: (a) Magnetic field lines always emerge from the north pole of a magnet and enter the south pole outside the mag...

The correct answer is Magnetic field lines always emerge from the north pole of a magnet and enter the south pole outside the magnet.

Key Points

• Magnetic field lines are imaginary lines used to represent the magnetic field around a magnet. By convention, outside the magnet, these lines emerge from the North pole and merge at the South pole. Hence, statement 1 is correct.

• It is a fundamental property that magnetic field lines never intersect each other. If they did, it would mean that at the point of intersection, a compass needle would point in two different directions simultaneously, which is physically impossible. Hence, statement 2 is incorrect.

• The degree of closeness or density of the field lines indicates the relative strength of the magnetic field. The field is strongest where the lines are most dense (crowded), such as near the poles, and weakest where the lines are far apart. It is never zero when lines are dense. Hence, statement 3 is incorrect.

• While the lines go from North to South outside the magnet, inside the magnet, the direction of the field lines is from the South pole to the North pole. This ensures that magnetic field lines form continuous closed loops. Hence, statement 4 is incorrect.

• The tangent drawn at any point on a magnetic field line gives the direction of the magnetic field (B) at that specific point.

Additional Information

• Magnetic Field Strength: The intensity of a magnetic field is measured in the SI unit called Tesla (T), named after Nikola Tesla. Another commonly used smaller unit is the Gauss (G), where 1 Tesla = 10,000 Gauss.

• Nature of Poles: Magnetic poles always exist in pairs (dipoles). It is impossible to isolate a single magnetic monopole; if a magnet is broken in half, two smaller magnets, each with its own North and South pole, are created.

• Earth's Magnetism: The Earth itself acts like a giant bar magnet. Its magnetic North pole is located near the geographic South pole, and its magnetic South pole is located near the geographic North pole, which is why the North end of a compass needle points toward the geographic North.

• Electromagnetism: In 1820, the Danish scientist Hans Christian Ørsted discovered that an electric current flowing through a wire creates a magnetic field around it, a principle used in electromagnets and electric motors.

Important Points

• Magnetic Flux: The total number of magnetic field lines passing through a given area is known as magnetic flux. The SI unit for magnetic flux is the Weber (Wb).

• Force on a Moving Charge: A magnetic field exerts a force on a moving electric charge. This force is perpendicular to both the velocity of the charge and the magnetic field direction, described by the Lorentz Force equation.

• Magnetic Materials: Materials respond differently to magnetic fields; they are classified as diamagnetic (weakly repelled), paramagnetic (weakly attracted), or ferromagnetic (strongly attracted, like iron, cobalt, and nickel).

• Applications: Magnetic fields are vital in modern technology, including MRI (Magnetic Resonance Imaging) machines, hard drives for data storage, maglev trains, and generators.

Q12. Answer: (a) ethyl ethanoate

The correct answer is ethyl ethanoate.

Key Points

• The reaction between Ethanoic acid (also known as Acetic acid) and Ethanol in the presence of concentrated Sulfuric acid (H_2SO_4) is a classic example of an esterification reaction.

• In this chemical process, the carboxylic acid group (-COOH) reacts with the alcohol group (-OH) to form an ester and water.

• The chemical equation for this reaction is: $CH_3COOH + C_2H_5OH \rightarrow CH_3COOC_2H_5 + H_2O$.

• The product formed is Ethyl ethanoate, which belongs to the functional group of esters. Hence, the statement regarding the formation of ethyl ethanoate is correct.

• Concentrated Sulfuric acid acts as both a catalyst to speed up the reaction and a dehydrating agent to remove the water molecule formed, shifting the equilibrium toward the product side according to Le Chatelier's Principle.

Additional Information

• Ethanoic Acid (CH3COOH):

• Commonly known as Acetic acid, it is a colorless liquid with a pungent smell.

• A 5-8% solution of acetic acid in water is known as vinegar, widely used as a preservative in pickles.

• The melting point of pure ethanoic acid is 290 K, often freezing in cold climates, which earned it the name Glacial Acetic Acid.

• Ethanol (C2H5OH):

• Commonly referred to as Ethyl alcohol, it is a liquid at room temperature.

• It is an active ingredient in all alcoholic drinks and is also used as a solvent in medicines like Tincture Iodine, cough syrups, and tonics.

• Characteristics of Esters:

• Ethyl ethanoate is a sweet-smelling substance.

• Because of their pleasant fragrance, esters are extensively used in making perfumes and as flavoring agents in the food industry.

• They can be converted back into alcohol and sodium salt of carboxylic acid by reacting with an alkali (like NaOH); this reverse process is known as Saponification, used in the manufacture of soaps.

Important Points

• Other Options Explained:

• Methanol (CH3OH): This is the simplest alcohol. It is not formed in this reaction; rather, it could be a reactant if one were trying to synthesize Methyl ethanoate.

• Acetone (CH3COCH3): This is a ketone. It is typically produced by the oxidation of isopropanol and is not a product of the reaction between an acid and an alcohol.

• Sodium Acetate (CH3COONa): This is a salt formed when Ethanoic acid reacts with a base like Sodium hydroxide (NaOH) or Sodium carbonate (Na2CO3), not through esterification with an alcohol.

• Reaction Conditions: The reaction is usually carried out by heating the mixture. The absence of the acid catalyst would make the reaction extremely slow and inefficient for industrial or laboratory purposes.

Q13. Answer: (d) Ethanoic acid

The correct answer is Ethanoic acid.

Key Points

• When ethanol is treated with a strong oxidizing agent like alkaline KMnO4 (potassium permanganate) or acidified K2Cr2O7 (potassium dichromate) and heated, it undergoes complete oxidation to form ethanoic acid.

• The reaction proceeds as follows: CH3CH2OH (Ethanol) + 2[O] (from alkaline KMnO4 + heat) → CH3COOH (Ethanoic acid) + H2O (Water).

• An oxidizing agent is a substance that provides oxygen to another substance or removes hydrogen from it. In this reaction, alkaline KMnO4 acts as a powerful oxidant that converts the alcohol group (-OH) into a carboxylic acid group (-COOH).

• The oxidation of primary alcohols like ethanol typically passes through an intermediate stage called ethanal (acetaldehyde), but strong oxidizing agents ensure the reaction does not stop there and continues until the carboxylic acid is formed. Hence, the correct answer is Ethanoic acid.

Additional Information

• Ethanoic Acid (CH3COOH):

• It is commonly known as acetic acid. A 5-8% solution of ethanoic acid in water is called vinegar, which is widely used as a preservative in pickles.

• Its melting point is 290 K, and it often freezes during winter in cold climates, leading to the name glacial acetic acid.

• Ethanol (C2H5OH):

• Commonly known as ethyl alcohol, it is a liquid at room temperature and is the active ingredient in all alcoholic drinks.

• Because it is a good solvent, it is also used in medicines like tincture iodine, cough syrups, and many tonics.

• Other Options Analysis:

• Methane (CH4): This is the simplest alkane. It is not produced by the oxidation of ethanol; rather, it is a primary component of biogas and CNG.

• Methanoic acid (HCOOH): Also known as formic acid, it is found in ant stings. It is formed by the oxidation of methanol, not ethanol.

• Acetone (CH3COCH3): This is the simplest ketone. It is generally formed by the oxidation of secondary alcohols (like propan-2-ol), whereas ethanol is a primary alcohol.

Important Points

• Role of Heat: The reaction between ethanol and alkaline KMnO4 requires warming/heating to initiate the conversion process

efficiently.

• Identification of Functional Groups: This reaction is a classic example of changing a hydroxyl group (-OH) into a carboxyl group (-COOH), representing an increase in the number of oxygen atoms within the molecule.

• Neutralization: Since the reaction uses alkaline KMnO4, the ethanoic acid formed initially reacts with the alkali to form a salt (potassium ethanoate), which is later converted to free acid by acidification.

Q14. Answer: (c) Its kinetic energy becomes highest, and its potential energy becomes lowest.

The correct answer is Its kinetic energy becomes highest, and its potential energy becomes lowest.

Key Points

• According to the Law of Conservation of Energy, energy can neither be created nor destroyed; it can only be transformed from one form to another. In a free-falling object, the total mechanical energy (the sum of potential and kinetic energy) remains constant at every point of its motion.

• Potential Energy (PE) is the energy possessed by an object due to its position or height. It is calculated by the formula PE = mgh, where m is mass, g is acceleration due to gravity, and h is height. As the object falls, its height decreases, causing its potential energy to decrease continuously. Just before hitting the ground, the height is approximately zero, making the potential energy lowest.

• Kinetic Energy (KE) is the energy possessed by an object due to its motion. It is calculated by the formula KE = 1/2 mv^2, where v is velocity. During a free fall, the object accelerates downward due to gravity at a rate of approximately 9.8 m/s^2. This constant acceleration increases the velocity of the object, reaching its maximum value just before impact. Therefore, its kinetic energy becomes highest at this point.

• As the object falls, there is a continuous transformation of gravitational potential energy into kinetic energy. At the highest point (before release), the energy is entirely potential; just before hitting the ground, it is almost entirely kinetic. Hence, the statement that kinetic energy is highest and potential energy is lowest is correct.

Additional Information

• Mechanical Energy: This refers to the sum of Kinetic Energy and Potential Energy. In the absence of air resistance, the total mechanical energy of a system is conserved. For a falling body, Total Energy = mgh + 1/2 mv^2.

• Acceleration due to Gravity (g): On Earth, this value is approximately 9.8 m/s^2. It means that for every second an object falls, its velocity increases by 9.8 meters per second. This acceleration is independent of the mass of the object in a vacuum.

• Free Fall: A state of motion where the only force acting upon an object is gravity. In real-world scenarios, air resistance (drag) eventually balances the force of gravity, leading to a constant speed known as terminal velocity, but in basic physics problems, air resistance is usually neglected.

• Work-Energy Theorem: This theorem states that the work done by all forces acting on a particle equals the change in its kinetic energy. In this case, the work done by gravity as the object descends increases its kinetic energy.

Important Points

• At the maximum height, the velocity of the object is zero, which means the kinetic energy is zero and potential energy is at its maximum.

• At the mid-point of the fall, the potential energy lost is exactly equal to the kinetic energy gained (assuming it started from rest), meaning PE equals KE at this specific height.

• Immediately after hitting the ground, the kinetic energy is transformed into other forms of energy such as heat energy, sound energy, and potential energy of deformation, following the principle of energy conservation.

• The mass of the object does not affect the final velocity just before hitting the ground in a vacuum, as seen in the equation $v = \sqrt{(2gh)}$, where mass m cancels out.

Q15. Answer: (a) A is true, but R is false.

The correct answer is A is true, but R is false.

Key Points

• Assertion (A) states that Zinc can displace copper from a copper sulphate solution. This occurs because Zinc is a more chemically active metal than copper, allowing it to substitute the copper ions in the solution. Hence, statement A is correct.

• Reason (R) claims that Zinc is less reactive than copper. In the electrochemical series or reactivity series, Zinc is positioned well above copper, indicating it has a higher tendency to lose electrons and form cations. Hence, statement R is incorrect.

• The chemical reaction for this process is: Zn (solid) + CuSO4 (aqueous) → ZnSO4 (aqueous) + Cu (solid).

• During this reaction, the blue color of the copper sulphate solution gradually fades and eventually becomes colorless as zinc sulphate is formed, while reddish-brown copper metal deposits on the zinc strip.

• Since the Assertion is a factually correct chemical observation and the Reason is a factually incorrect statement regarding metal activity, the correct choice is that A is true but R is false.

Additional Information

• Reactivity Series: It is an arrangement of metals in the descending order of their reactivities. Metals like Potassium (K) and

Sodium (Na) are at the top, while noble metals like Gold (Au) and Platinum (Pt) are at the bottom. Zinc (Zn) has an atomic number of 30 and is more reactive than Hydrogen, whereas Copper (Cu) with atomic number 29 is less reactive than Hydrogen.

• Displacement Reaction: This is a type of reaction where a more reactive element displaces a less reactive element from its compound. This can be categorized into single displacement (like the Zn-CuSO4 reaction) and double displacement reactions.

• Zinc (Zn): It is a transition metal found in Group 12 of the periodic table. It is widely used in galvanization to prevent the rusting of iron because it is more reactive and oxidizes preferentially.

• Copper (Cu): It is a transition metal in Group 11. It is known for its high electrical conductivity and ductility. In nature, it often exists as sulfide ores like chalcopyrite.

• Copper Sulphate (CuSO4): Often referred to as blue vitriol, this salt is commonly used as a fungicide and in electroplating. Its pentahydrate form is characteristically bright blue.

Important Points

• Redox Reaction: The displacement of copper by zinc is also a redox (reduction-oxidation) reaction. Zinc undergoes oxidation (loses electrons to become Zn2+), and Copper ions undergo reduction (gain electrons to become Cu metal).

• Practical Application: This principle is utilized in Voltaic cells or Daniel cells, where the difference in electrode potential between Zinc and Copper is used to generate electricity.

• Observation in Laboratory: If a copper wire is placed in a zinc sulphate solution, no reaction occurs because copper cannot displace zinc due to its lower reactivity.

• Valency: In this reaction, both Zinc and Copper typically exhibit a valency of +2.

Q16. Answer: (c) Biological magnification

The correct answer is Biological magnification.

Key Points

• Biological magnification, also known as biomagnification, refers to the increase in the concentration of a substance, such as a toxic chemical or pesticide, in the tissues of organisms at successively higher levels in a food chain.

• When crops like wheat, rice, vegetables, and fruits are grown, farmers often use pesticides and fertilizers to protect them from pests and diseases. These chemicals are absorbed by the plants from the soil or water.

• Because these substances are often non-biodegradable, they cannot be broken down by the metabolic processes of the organism nor excreted efficiently. Hence, the presence of residues in food items is primarily due to biological magnification.

• As we move up the trophic levels, from producers (plants) to primary consumers (herbivores) and then to secondary or tertiary consumers (like humans eating meat), the concentration of these harmful chemicals increases.

• Human beings occupy the topmost level in many food chains; therefore, the maximum concentration of these toxic chemicals gets accumulated in our bodies. This is why food items, especially animal products, often contain higher pesticide residues than the plants themselves.

Additional Information

• Transpiration:

• It is the biological process by which water vapor is lost from the aerial parts of a plant, primarily through the stomata in leaves.

• This process helps in the transportation of minerals from the soil to various parts of the plant and aids in temperature regulation (cooling the plant). It does not involve the accumulation of toxic residues.

• Photosynthesis:

• This is the process by which green plants and some other organisms use sunlight to synthesize foods with the help of chlorophyll, carbon dioxide, and water.

• The primary function is the production of glucose and oxygen. While it is the basis of the food chain, it is a metabolic process for energy production and not for toxin accumulation.

• Eutrophication:

• This phenomenon occurs when a water body becomes overly enriched with nutrients (like nitrogen and phosphorus), frequently due to agricultural runoff.

• This leads to the excessive growth of algae (algal blooms), which depletes the dissolved oxygen in the water, causing the death of aquatic animals like fish. This affects water ecosystems rather than the direct residue buildup in land-based food crops.

Important Points

• DDT (Dichlorodiphenyltrichloroethane): One of the most famous examples of biological magnification involves the pesticide DDT. It was widely used in the mid-20th century and led to the thinning of eggshells in predatory birds (like eagles) because the concentration of DDT increased significantly as it moved up the food chain.

• Bioaccumulation vs. Biomagnification: Bioaccumulation occurs within a single organism over its lifetime, where the rate of intake of a substance is higher than the rate of excretion. Biomagnification is the cumulative result of bioaccumulation occurring across multiple trophic levels.

• Health Impacts: High levels of pesticide residues in human food can lead to long-term health issues, including hormonal

imbalances, reproductive issues, cancer, and damage to the nervous system.

• Heavy Metals: Besides pesticides, heavy metals like mercury, lead, and cadmium are also subject to biological magnification, often entering the food chain through industrial waste and contaminated water.

Q17. Answer: (a) Electric heater, electric iron, and fuse

The correct answer is Electric heater, electric iron, and fuse.

Key Points

• The heating effect of electric current refers to the process where electrical energy is converted into heat energy when current passes through a conductor with high resistance.

• Electric heater and Electric iron: These appliances contain a coil of wire called a heating element. When current flows through these elements, they become red hot and give out heat. The element is typically made of Nichrome (an alloy of nickel and chromium) because it has high resistivity and a high melting point, allowing it to withstand high temperatures without oxidizing. Hence, the appliances in Option 1 utilize the heating effect.

• Electric Fuse: A fuse is a safety device used in electrical circuits. It consists of a wire made of a material with a low melting point, such as an alloy of tin and lead. If the current exceeds a safe limit, the wire heats up and melts, breaking the circuit and preventing damage or fire. This is a direct application of the heating effect.

• LED and Torch: Light Emitting Diodes (LEDs) work on the principle of electroluminescence, and a torch (flashlight) primarily uses the lighting effect. While some heat is produced as a byproduct, it is not the primary functional principle. Hence, statement 2 is incorrect regarding the primary use of the heating effect.

• Electric bell and Buzzer: These devices work on the magnetic effect of electric current. An electromagnet is used to pull a striker that hits a gong or creates a vibration. Hence, statement 3 is incorrect.

• Electric fan and Motor: These devices utilize the magnetic effect of current to produce mechanical energy (rotational motion). The interaction between magnetic fields and current-carrying conductors creates torque. Hence, statement 4 is incorrect.

Additional Information

• Joule's Law of Heating: This law states that the heat produced in a conductor is directly proportional to the square of the current (I), the resistance (R) of the conductor, and the time (t) for which the current flows. The mathematical representation is $H = I^2Rt$.

• Heating Elements: Most heating appliances use Nichrome. It is preferred because its resistance is high, and it does not burn (oxidize) easily at high temperatures (around 1150°C).

• Incandescent Bulbs: Although not mentioned in the correct option, the traditional filament bulb also uses the heating effect. The Tungsten filament is heated to such a high temperature (around 2500°C) that it starts emitting light. Tungsten is used due to its very high melting point of approximately 3380°C.

• Safety in Circuits: Beyond fuses, modern houses use MCBs (Miniature Circuit Breakers). While fuses work on the heating effect (melting), many MCBs work on the magnetic effect to trip the switch during an overload or short circuit.

Important Points

• Electric Power: The rate at which electrical energy is consumed or converted into other forms (like heat) is called Electric Power (P). It is measured in Watts (W) and calculated as $P = VI$ or $P = I^2R$.

• Resistance Factors: The amount of heat generated depends on the length, thickness, and nature of the material of the wire. Thinner wires generally have higher resistance than thicker wires of the same material and length, leading to more heat production.

• Applications: Apart from irons and heaters, the heating effect is used in geysers, electric kettles, hair dryers, and soldering irons.

• Short Circuit: This occurs when the live wire and neutral wire come into direct contact, causing the resistance of the circuit to become almost zero, resulting in a huge flow of current and excessive heating, which can lead to fires.

Q18. Answer: (a) Increases 9 times

The correct answer is Increases 9 times.

Key Points

• According to Newton's Law of Universal Gravitation, the force of attraction between two objects is directly proportional to the product of their masses and inversely proportional to the square of the distance between their centers.

• The mathematical formula for gravitational force is $F = G (m1 * m2) / r^2$, where G is the Universal Gravitational Constant, m1 and m2 are the masses of the two objects, and r is the distance between them.

• In this scenario, the masses of both interacting objects (e.g., the Earth and another object) are tripled. This means the new masses are 3m1 and 3m2.

• The problem specifies that the distance (r) between the objects remains unchanged. Although the radius of the Earth is stated to be halved, this is a distractor because the center-to-center distance is explicitly held constant.

• Substituting the new values into the formula: $F' = G (3m1 * 3m2) / r^2$. This simplifies to $F' = 9 * [G (m1 * m2) / r^2]$, which is 9 times the original force (F). Hence, the gravitational force increases 9 times.

Additional Information

• Universal Gravitational Constant (G): It was first measured experimentally by Henry Cavendish in 1798. Its accepted value is approximately 6.674 x 10^-11 N m^2/kg^2.

• Inverse Square Law: This principle implies that if the distance between two objects is doubled, the gravitational force becomes one-fourth (1/4) of its original strength. If the distance is halved, the force increases 4 times.

• Mass vs. Weight: Mass is an intrinsic property of matter and remains constant regardless of location, while weight is the gravitational force acting on that mass and changes based on the local acceleration due to gravity (g).

• Acceleration due to Gravity (g): On the surface of the Earth, the value of g is approximately 9.8 m/s^2. It is calculated using the formula g = GM / R^2, where M is the mass of the Earth and R is its radius.

Important Points

• Vector Nature: Gravitational force is always attractive and acts along the line joining the centers of mass of the two interacting bodies.

• Weak Force: Among the four fundamental forces of nature (Gravitational, Electromagnetic, Strong Nuclear, and Weak Nuclear), gravity is the weakest, yet it dominates on astronomical scales.

• Range: The range of gravitational force is infinite, meaning every object in the universe exerts a gravitational pull on every other object, no matter how far apart they are.

• History: Sir Isaac Newton published this law in his work "Philosophiæ Naturalis Principia Mathematica" in July 1687, providing a unified explanation for both terrestrial gravity and planetary motion.

Q19. Answer: (a) Leaf margins

The correct answer is Leaf margins.

Key Points

• Bryophyllum is a well-known genus of succulent plants that is famous for its unique method of vegetative propagation through its leaves.

• The buds for reproduction are specifically produced along the leaf margins. These margins contain small notches or indentations where adventitious buds arise.

• When these buds come into contact with moist soil, either by the leaf falling off or by the plantlet dropping, they develop roots and grow into independent plants.

• This process is a form of asexual reproduction because it does not involve the fusion of gametes or the production of seeds for the formation of the new plantlet.

• The offspring produced through this method are genetically identical to the parent plant, effectively acting as clones.

Additional Information

• Vegetative Propagation: It is a type of asexual reproduction in plants where a new plant grows from a fragment of the parent plant or a specialized reproductive structure such as a stolon, rhizome, tuber, or bulb.

• Adventitious Buds: These are buds that develop in locations where buds do not normally occur, such as on roots or leaves. In Bryophyllum, these are often called epiphyllous buds because they grow on the foliage.

• Common Examples:

• Potato: Reproduces through axillary buds called "eyes" located on the stem tuber.

• Ginger and Turmeric: Reproduce via underground rhizomes.

• Strawberry: Utilizes runners or stolons that grow horizontally above the ground.

• Agave: Produces bulbils, which are small plantlets that develop in the floral scape.

• Ecological Importance: This method allows plants like Bryophyllum to colonize an area very quickly, as they do not have to wait for the lengthy process of pollination, fertilization, and seed germination.

• Structural Parts:

• Pedicel: This is the stalk that supports an individual flower in an inflorescence; it is not involved in the vegetative propagation of Bryophyllum.

• Flower: While Bryophyllum can produce flowers for sexual reproduction, the "buds" mentioned in the context of vegetative propagation are strictly leaf-borne.

Q20. Answer: (b) Tendrils

The correct answer is Tendrils.

Key Points

• Tendrils are specialized, thread-like organs of a plant that are highly sensitive to touch. They are primarily used by climbing plants with weak stems to anchor themselves to a support. Hence, Option 2 is correct.

• When a tendril comes into contact with a physical object, such as a twig, fence, or wall, it undergoes a growth response known as thigmotropism, causing it to coil around the support.

• These structures can be modifications of different plant parts. For instance, stem tendrils develop from axillary buds, as seen in

plants like Cucumbers, Pumpkins, Watermelons, and Grapevines.

• Alternatively, leaf tendrils are modified leaves or leaflets, common in plants like the Pea plant (Pisum sativum), which allow the plant to grow vertically toward sunlight.

• The sensitivity of tendrils is remarkable; some can respond to a weight as light as a few milligrams, initiating the coiling process within minutes of contact.

Additional Information

• Flowers:

• Flowers are the reproductive structures of angiosperms. Their primary function is to facilitate pollination and fertilization to produce offspring.

• Unlike tendrils, they do not possess specialized touch-sensitive mechanisms for physical support or climbing. Hence, Option 1 is incorrect.

• Thorns:

• Thorns are hard, woody, and sharp-pointed modifications of the stem. They primarily serve as protective organs for the plant, defending it against herbivores and browsing animals.

• Common examples include Citrus and Bougainvillea. While they provide a physical structure, they are not sensitive to touch for the purpose of climbing. Hence, Option 3 is incorrect.

• Seeds:

• A seed is a mature, fertilized ovule containing an embryo and stored nutrients (endosperm). It is the primary unit of dispersal and reproduction for spermatophytes.

• Seeds represent a dormant stage in the plant life cycle and do not participate in the active climbing or mechanical support of the parent plant. Hence, Option 4 is incorrect.

Important Points

• Mechanism of Thigmotropism:

• The coiling of a tendril is caused by differential growth. When the tendril touches a support, the plant hormone Auxin migrates to the side that is not in contact with the object.

• The side with higher auxin concentration grows and elongates much faster than the side in contact with the support, causing the tendril to curve and spiral around the object.

• Evolutionary Adaptation:

• The development of tendrils is an evolutionary adaptation that allows plants to maximize photosynthetic efficiency by reaching higher strata of the forest or garden without the energetic cost of building a thick, woody trunk.

Q21. Answer: (d) 3:8

The correct answer is 3:8.

Key Points

• The chemical formula for Carbon Dioxide is CO_2, which indicates that one molecule of the compound consists of one atom of Carbon and two atoms of Oxygen.

• To find the ratio by mass, we must consider the atomic masses of the individual elements. The atomic mass of Carbon (C) is approximately 12 u (atomic mass units).

• The atomic mass of Oxygen (O) is approximately 16 u. Since there are two oxygen atoms in a CO_2 molecule, the total mass contributed by oxygen is 16 x 2 = 32 u.

• The ratio of the mass of Carbon to the mass of Oxygen in carbon dioxide is calculated as 12 : 32.

• By simplifying this ratio (dividing both sides by the common factor 4), we get 3 : 8. This means that in any sample of pure carbon dioxide, for every 3 grams of Carbon, there are 8 grams of Oxygen.

Additional Information

• Law of Constant Proportions: This calculation is a primary example of the Law of Definite Proportions (also known as Proust's Law), which states that a chemical compound always contains its component elements in a fixed ratio by mass, regardless of its source or method of preparation.

• Molar Mass of CO_2: The total molar mass of carbon dioxide is the sum of the masses of its constituents, which is 12.01 + (2 x 16.00) = 44.01 g/mol. This value is widely used in stoichiometry and chemical engineering.

• Physical Properties: Carbon dioxide is a colorless and odorless gas at standard temperature and pressure. It is approximately 1.5 times as heavy as air.

• Molecular Structure: The CO_2 molecule is linear in shape. The carbon atom is in the center, joined to the two oxygen atoms by double covalent bonds. The bond length between carbon and oxygen is 116.3 pm.

• Environmental Importance: It is a significant greenhouse gas and plays a vital role in the carbon cycle. It is consumed by plants during photosynthesis to produce glucose and oxygen.

Important Points

• In Water (H2O), the ratio of the mass of Hydrogen to Oxygen is 1:8 (Mass of H = 2, Mass of O = 16).

• In Ammonia (NH3), the ratio of Nitrogen to Hydrogen by mass is 14:3.

• The atomic number of Carbon is 6, while its mass number is usually 12. For Oxygen, the atomic number is 8 and the mass number is 16.

• It is important not to confuse the ratio of atoms (which is 1:2 for CO2) with the ratio by mass (which is 3:8).

Q22. Answer: (c) It becomes a cation

The correct answer is It becomes a cation.

Key Points

• An atom is the basic unit of matter and is electrically neutral in its ground state because the number of protons (positively charged) in the nucleus equals the number of electrons (negatively charged) orbiting the nucleus.

• When an atom loses one or more electrons, it undergoes a process called ionization. Since electrons carry a negative charge, their removal leaves the atom with more protons than electrons, resulting in a net positive charge.

• A positively charged ion is specifically known as a cation. This name originates from the fact that these ions are attracted to the cathode (the negative electrode) during electrolysis.

• Common examples of cation formation include Metals like Sodium (Na), which loses 1 electron to become Na+, and Magnesium (Mg), which loses 2 electrons to become Mg2+.

• The loss of electrons typically occurs to achieve a stable electronic configuration, often resembling the nearest noble gas, which is known as the Octet Rule.

Additional Information

• Anions: These are the opposite of cations. An anion is formed when an atom gains one or more electrons, giving it a net negative charge. This typically happens with non-metals like Chlorine (Cl), which becomes Cl-.

• Ionization Energy: This refers to the specific amount of energy required to remove an electron from an isolated gaseous atom. Alkali metals in Group 1 have very low ionization energy, making them highly reactive and prone to forming cations.

• Ionic Bonding: This type of chemical bond occurs through the electrostatic attraction between oppositely charged ions (a cation and an anion). A classic example is Sodium Chloride (NaCl).

• Molecules: Unlike ions, molecules are neutral groups of two or more atoms held together by chemical bonds (usually covalent bonds). Losing a single electron does not turn an atom into a molecule.

• Valence Electrons: These are the electrons in the outermost shell of an atom. They are the ones involved in chemical reactions and are the primary electrons lost or gained during ion formation.

Important Points

• Oxidation: In the context of Redox reactions, the loss of electrons is defined as oxidation (remember the mnemonic OIL RIG: Oxidation Is Loss, Reduction Is Gain).

• Atomic Radius: When an atom becomes a cation, its radius decreases significantly. This is because the remaining electrons experience a stronger effective nuclear charge from the protons, pulling them closer to the center.

• Proton Count: It is vital to note that the number of protons in the nucleus never changes during the formation of an ion; if the proton count changed, the identity of the element itself would change.

• Electropositivity: The tendency of an element to lose electrons and form positive ions is called electropositivity. This property is most prominent in Cesium (Cs) and other elements located at the bottom-left of the Periodic Table.

Q23. Answer: (d) Centrosome

The correct answer is Centrosome.

Key Points

• The Centrosome is a specialized cell organelle typically located near the nucleus in animal cells. It serves as the main microtubule-organizing center (MTOC).

• It consists of two barrel-shaped structures known as centrioles, which are oriented at right angles to each other and surrounded by pericentriolar material.

• The primary function of the centrosome is to facilitate cell division by forming spindle fibers that help in the segregation of chromosomes during mitosis and meiosis.

• While animal cells possess distinct centrosomes with centrioles, most higher plant cells lack these structures, instead using different types of MTOCs to manage their microtubule networks. Hence, the Centrosome is the organelle present only in animal cells.

Additional Information

• Mitochondria:

• Known as the "Powerhouse of the cell," these are double-membrane-bound organelles.

• They are the site of aerobic respiration and generate most of the cell's supply of adenosine triphosphate (ATP), used as a source

of chemical energy.

• Mitochondria are found in almost all eukaryotic cells, including both plant and animal cells.

• Golgi apparatus:

• Discovered by Camillo Golgi in 1898, it consists of a system of membrane-bound vesicles or cisternae.

• Its main functions include the packaging, modification, and secretion of proteins and lipids synthesized in the Endoplasmic Reticulum.

• It is present in both plant and animal cells (often called dictyosomes in plants).

• Vacuole:

• These are membrane-bound spaces found in the cytoplasm containing sap, water, and excretory products.

• In plant cells, a large central vacuole can occupy 50% to 90% of the cell volume, providing turgidity and rigidity.

• Animal cells also contain vacuoles, but they are generally small, temporary, and used for storage or digestion.

Important Points

• Plant-specific structures: Unlike animal cells, plant cells possess a rigid cell wall made of cellulose and plastids like chloroplasts for photosynthesis.

• Animal-specific structures: Animal cells are characterized by the presence of centrosomes and centrioles. They also frequently contain lysosomes (suicide bags), which are less common or different in plant cells.

• Cell Size and Shape: Animal cells are usually smaller and have irregular shapes due to the absence of a cell wall, whereas plant cells are larger and have a fixed, rectangular shape.

Q24. Answer: (b) To provide nutrition and aid in sperm transport

The correct answer is To provide nutrition and aid in sperm transport.

Key Points

• The male reproductive system consists of various organs and glands, where the prostate gland and seminal vesicles play a vital role in the formation of semen.

• Seminal Vesicles: These are a pair of pouch-like glands located behind the bladder. They secrete a significant portion of the seminal fluid (approx. 60-70%), which is rich in fructose. This sugar acts as a primary source of energy (nutrition) for the sperm to maintain their activity.

• Prostate Gland: This single, walnut-sized gland produces a thin, milky, and slightly alkaline fluid. This secretion helps in neutralizing the acidity of the vaginal tract, thereby protecting the sperm and increasing their motility and viability.

• Sperm Transport: The fluid secretions from these glands provide a liquid medium that makes it easier for the sperm to be transported through the male urethra and into the female reproductive system. Hence, the correct answer is to provide nutrition and aid in sperm transport.

• These secretions also contain prostaglandins, which stimulate contractions in the female reproductive tract to help the sperm move toward the egg.

Additional Information

• Semen Composition: Semen is a mixture of spermatozoa (sperm cells) and seminal plasma. While the sperm cells are produced in the testes, the bulk of the fluid volume comes from the accessory glands.

• Bulbourethral Glands (Cowper's Glands): These are small glands located below the prostate. They secrete a clear, slippery fluid that lubricates the urethra and neutralizes any residual acidity from urine before ejaculation occurs.

• Path of Sperm: Sperm travels from the Testes → Epididymis (for maturation) → Vas Deferens → Ejaculatory Duct → Urethra.

• Testosterone: This is the primary male sex hormone produced by the Leydig cells in the testes, which regulates the production of sperm and the development of secondary sexual characteristics.

Important Points

• Fructose: It is specifically found in the secretion of the seminal vesicles and is not present elsewhere in the body in high concentrations, making it a chemical marker for forensic tests.

• Sperm Motility: Without the secretions from the prostate gland, sperm would be sluggish and unable to survive the acidic environment of the female reproductive tract, which has a pH of about 3.5 to 4.5.

• PSA (Prostate-Specific Antigen): This is an enzyme produced by the prostate gland that helps liquefy the semen after ejaculation, allowing the sperm to swim freely toward the fallopian tubes.

• Urine vs. Sperm: While the question asks about secretions, the mechanical prevention of mixing urine and sperm is handled by a sphincter muscle at the base of the bladder that closes during ejaculation.

Q25. Answer: (b) at F

The correct answer is at F.

Key Points

• When an object is placed at infinity in front of a convex lens, the light rays originating from it and reaching the lens are parallel to

each other and to the principal axis.

• A convex lens is a converging lens, meaning it bends incoming parallel rays inward toward a single point.

• According to the laws of refraction, any ray of light that is parallel to the principal axis of a convex lens will pass through the principal focus (F) on the opposite side after refraction.

• Consequently, all these parallel rays converge and meet at the focus (F), leading to the formation of the image at F. Hence, the correct answer is at F.

• The nature of the image formed in this specific case is real and inverted.

• Regarding the size of the image, it is described as highly diminished or point-sized because all rays are concentrated at the focal point.

Additional Information

• Image Formation by Convex Lens at Different Positions:

• Beyond 2F: When the object is placed beyond 2F, the image is formed between F and 2F. This image is real, inverted, and diminished.

• At 2F: When the object is exactly at 2F, the image is formed at 2F on the other side. This image is real, inverted, and of the same size as the object.

• Between F and 2F: If the object is placed between F and 2F, the image is formed beyond 2F. The image is real, inverted, and magnified (larger than the object).

• At F: When the object is placed at the focus (F), the refracted rays become parallel, and the image is formed at infinity. This image is real, inverted, and highly magnified.

• Between F and Optical Center (O): This is a unique case where the image is formed on the same side as the object. The image is virtual, erect, and magnified. This principle is used in magnifying glasses.

• Convex Lens Characteristics:

• A convex lens is thicker at the center than at the edges.

• It has a positive focal length according to the Cartesian sign convention.

• It is widely used in optical instruments such as microscopes, telescopes, and cameras.

• In the medical field, it is used in spectacles to correct Hypermetropia (long-sightedness).

Important Points

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

• Magnification (m): It is the ratio of the height of the image to the height of the object, or m = v/u. For an object at infinity, the magnification is nearly zero.

• Optical Center (O): This is the central point of the lens. Any ray of light passing through the optical center emerges without any deviation.

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

Q26. Answer: (a) 14.45

Shortcut Trick

In a 30°−60°−90° triangle, the sides are in the ratio 1 : √3 : 2.

The side opposite to 30° (Base) = 8.5 m.

The side opposite to 60° (Height) = Base × √3.

Height = 8.5 × 1.7 = 14.45 m.

Therefore The correct answer is 14.45 m.

Alternate Method

Given:

Angle of elevation (θ) = 60°

Distance from wall (Base) = 8.5 m

Value of √3 = 1.7

Formula Used:

tan(θ) = Perpendicular / Base

Calculations:

=> tan(60°) = Height / 8.5

=> √3 = Height / 8.5

=> Height = 8.5 × √3

=> Height = 8.5 × 1.7

=> Height = 14.45 m

Therefore The correct answer is 14.45 m.

Additional Information

Trigonometric Ratios

Standard values for tan: tan 30° = 1/√3, tan 45° = 1, tan 60° = √3.

Right Angled Triangle Properties

In a right triangle, sin θ = P/H, cos θ = B/H, and Pythagoras theorem: $P^2 + B^2 = H^2$.

Angle of Elevation vs Depression

The angle of elevation from an observer to an object is always equal to the angle of depression from the object to the observer.

Q27. Answer: (d) 3344 unit²

Shortcut Trick

Ratio of Curved Surface Area to Volume is $2\pi rh \div \pi r^2h = 2/r$.

Given 2/r = 1/7 => r = 14 units.

Diameter (d) = 2 × 14 = 28 units. Given d : h = 7 : 6.

Since 7 units = 28, then 6 units (height) = 24 units.

Total Surface Area = 2 × (22/7) × 14 × (14 + 24) = 88 × 38 = 3344 unit².

Therefore The correct answer is 3344 unit².

Alternate Method

Given:

Ratio of CSA to Volume = 1 : 7

Ratio of Diameter to Height = 7 : 6

Formula Used:

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

Volume (V) = πr^2h

Total Surface Area (TSA) = $2\pi r(r + h)$

Calculations:

=> CSA / Volume = $2\pi rh / \pi r^2h = 2/r$

=> 2/r = 1/7

=> r = 14 units

=> Diameter (d) = 2 × r = 2 × 14 = 28 units

=> d / h = 7 / 6

=> 28 / h = 7 / 6

=> h = (28 × 6) ÷ 7 = 4 × 6 = 24 units

=> TSA = 2 × (22/7) × 14 × (14 + 24)

=> TSA = 2 × 22 × 2 × 38

=> TSA = 88 × 38

=> TSA = 3344 unit²

Therefore The correct answer is 3344 unit².

Additional Information

Cylinder Properties

For a cylinder with base radius r and height h, the volume is $V = \pi r^2h$ and the curved surface area is $CSA = 2\pi rh$.

Total Surface Area

TSA includes both the top and bottom circular faces plus the curved side: $TSA = 2\pi rh + 2\pi r^2 = 2\pi r(r + h)$.

Hollow Cylinder

Volume of a hollow cylinder with outer radius R and inner radius r is $V = \pi(R^2 - r^2)h$.

Q28. Answer: (a) 48

Shortcut Trick

Age ratio (8 years ago) = 13 : 1

Age ratio (after 12 years) = 3 : 1 (or 6 : 2 to match the age difference)

Equalizing the gap: 13 − 1 = 12 units and 3 − 1 = 2 units. Multiply second ratio by 6 → 18 : 6.
Ratio change: 13 → 18 (5 units) over 20 years (8 + 12). So, 1 unit = 4 years.
Age difference = (13 − 1) × 4 = 12 × 4 = 48 years.
Therefore The correct answer is 48 years.
Alternate Method
Let the granddaughter's age 8 years ago be x and the grandmother's age be 13x.
Present ages: Granddaughter = x + 8, Grandmother = 13x + 8.
Ages after 12 years: Granddaughter = x + 20, Grandmother = 13x + 20.
According to the question:
=> 13x + 20 = 3 × (x + 20)
=> 13x + 20 = 3x + 60
=> 10x = 40
=> x = 4
Age difference (remains constant):
=> Difference = 13x − x = 12x
=> Difference = 12 × 4 = 48 years.
Therefore The correct answer is 48 years.
Additional Information
Constant Age Difference
The numerical difference between the ages of two people always remains the same, regardless of how many years pass.
Ratio Balancing Method
To solve age problems quickly, make the difference between ratio parts equal by multiplying the ratios with the difference of the other ratio.
Linear Equation in Ages
For any "n" years in the future, add n to the present age; for "n" years in the past, subtract n from the present age.

Q29. Answer: (a) 3096

Shortcut Trick
Check the unit digit: 6^3 ends in 6 and 0^3 ends in 0.
The unit digit of the result must be 6 − 0 = 6, which narrows it to 3096 or 3064.
Since 16^3 is 4096 and 10^3 is 1000, the difference is 3096.
Therefore The correct answer is 3096.
Alternate Method
Given:
Expression = $16^3 - 10^3$
Method Used: Direct expansion of cubes
Calculations:
=> $16^3 = 16 \times 16 \times 16$
=> $16^3 = 256 \times 16 = 4096$
=> $10^3 = 10 \times 10 \times 10 = 1000$
=> Value = 4096 − 1000
=> Value = 3096
Therefore The correct answer is 3096.
Additional Information
Difference of Cubes Identity
The expression can also be solved using the identity: $a^3 - b^3 = (a - b)(a^2 + ab + b^2)$.
Sum of Cubes Identity
Similarly, for addition, the formula used is: $a^3 + b^3 = (a + b)(a^2 - ab + b^2)$.
BODMAS Rule in Powers
According to the BODMAS rule, exponents or orders (cubes, squares) are calculated before performing addition or subtraction.

Q30. Answer: (b) 184

Shortcut Trick

Total decimal places in the numerator = 1 + 4 + 1 = 6.

Total decimal places in the denominator = 3 + 4 + 1 = 8.

Adjust the decimal difference by multiplying the numerator by 10^(8 − 6) = 100.

Simplify the integer fraction: (95 × 85 × 189) ÷ (21 × 17 × 19) = 5 × 5 × 9 = 225.

Evaluate the full expression: √16 + √900 + √(225 × 100) = 4 + 30 + 150 = 184.

Therefore The correct answer is 184.

Alternate Method

Given:

Expression: √16 + √900 + √(9.5 × 0.0085 × 18.9)/(0.021 × 0.0017 × 1.9)

Calculation:

=> √16 + √900 + √(9.5 × 0.0085 × 18.9)/(0.021 × 0.0017 × 1.9)

=> 4 + 30 + √(95 × 85 × 189)/(0.21 × 17 × 19)

=> 34 + √((5 × 5 × 189 × 100)/21)

=> 34 + √(5 × 5 × 9 × 100)

=> 34 + 5 × 3 × 10

=> 4 + 30 + 150

=> 184

Therefore The correct answer is 184.

Additional Information

BODMAS Rule

When solving simplifications, follow the order of operations: Brackets, Orders (powers and roots), Division, Multiplication, Addition, and Subtraction.

Properties of Square Roots

Multiplication and division inside roots can be separated: √(a × b) = √a × √b and √(a ÷ b) = √a ÷ √b. This allows for simplifying complex terms easily before evaluating the root.

Exponent Division Rule

When dividing algebraic terms or numbers with the same base, subtract the exponent of the denominator from the exponent of the numerator: x^a ÷ x^b = x^(a − b). In this problem, 10^(−6) ÷ 10^(−8) = 10².

Q31. Answer: (b) 18.49

Shortcut Trick

In decimal multiplication, the total number of decimal places in the product is the sum of the decimal places in the multipliers.

Here, the number 4.3 has 1 decimal place.

So, 4.3 × 4.3 will have 1 + 1 = 2 decimal places in total.

We are given that 43 × 43 = 1849.

Placing the decimal point 2 places from the right gives 18.49.

Therefore The correct answer is 18.49.

Alternate Method

Given:

43 × 43 = 1849

Calculation:

=> We need to find the exact value of 4.3 × 4.3

=> First, express the decimal numbers as fractions:

=> 4.3 = 43 ÷ 10

=> 4.3 × 4.3 = (43 ÷ 10) × (43 ÷ 10)

=> 4.3 × 4.3 = (43 × 43) ÷ (10 × 10)

=> Substitute the given value of 43 × 43 = 1849

=> 4.3 × 4.3 = 1849 ÷ 100

=> 4.3 × 4.3 = 18.49

Therefore The correct answer is 18.49.

Additional Information

Multiplying Decimals Rule

Multiply the numbers as if they were whole numbers ignoring the decimals. Then, count the total number of decimal digits in the question and place the decimal point so the product has the exact same total number of decimal places.

Dividing by Powers of 10

To divide any number by 10, 100, 1000, etc., shift the decimal point to the left by the exact number of zeros present in the denominator.

Squares Ending in 3

The square of any number that ends with the digit 3 will always have 9 as its unit digit. For example, $3^2 = 9$, $13^2 = 169$, $23^2 = 529$, and $43^2 = 1849$.

Q32. Answer: (d) 72.19 km/hr

Shortcut Trick

When the distance traveled is the same for both parts of the journey, the Average Speed is the harmonic mean of the speeds.

Average Speed = (2 × s1 × s2) ÷ (s1 + s2)

Average Speed = (2 × 52 × 118) ÷ (52 + 118) = 12272 ÷ 170

Average Speed = 72.188... ≈ 72.19 km/hr

Therefore The correct answer is 72.19 km/hr.

Alternate Method

Given: Distance (D) = 966 km, Forward Speed (s1) = 52 km/hr, Return Speed (s2) = 118 km/hr.

Formula Used: Average Speed = Total Distance ÷ Total Time

=> Total Distance = 966 + 966 = 1932 km

=> Time to go (t1) = 966 ÷ 52 = 18.5769 hours

=> Time to return (t2) = 966 ÷ 118 = 8.1864 hours

=> Total Time = 18.5769 + 8.1864 = 26.7633 hours

=> Average Speed = 1932 ÷ 26.7633 = 72.188...

Therefore The correct answer is 72.19 km/hr.

Additional Information

Average Speed (Equal Distances)

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

Average Speed (Equal Time)

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

General Average Speed Formula

Average Speed = (Total Distance) ÷ (Total Time taken for the journey).

Q33. Answer: (d) 9

Shortcut Trick

Total Capacity (LCM of 12, 18) = 36 units

Efficiency (P + Q) = 36 ÷ 12 = 3 units/hr

Efficiency (P) = 36 ÷ 18 = 2 units/hr

Efficiency (Q) = 3 − 2 = 1 unit/hr

Time for Q to fill 1/4th = (36 × 1/4) ÷ 1 = 9 hours

Therefore The correct answer is 9 hours.

Alternate Method

Person	Days	Total Work	Efficiency
P + Q	12	36	3
P	18	2	

=> Efficiency of Q = Efficiency(P + Q) − Efficiency(P)

=> Efficiency of Q = 3 − 2 = 1 unit/hr

=> Total capacity of cistern = 36 units

=> One-fourth of the cistern = 36 ÷ 4 = 9 units

=> Time taken by Q = 9 units ÷ 1 unit/hr = 9 hours

Therefore The correct answer is 9 hours.

Additional Information

Pipes & Cisterns Efficiency

The rate of work done by a pipe is its Efficiency. Total Work = Time taken × Efficiency.

Inlet and Outlet Pipes

Inlet pipes (filling) have positive efficiency, while outlet pipes (emptying/leakage) have negative efficiency.

Time Calculation

If a pipe fills a tank in 'x' hours, its 1-hour work is 1/x of the total capacity.

Q34. Answer: (a) A

Shortcut Trick

The best scheme for the shopkeeper is the one offering the lowest effective discount.

Scheme A: 19 + 25 − (19 × 25) ÷ 100 = 44 − 4.75 = 39.25%

Scheme B: [6 ÷ (7 + 6)] × 100 = 6 ÷ 13 × 100 ≈ 46.15%

Scheme C: 50% (Fixed single discount)

Scheme D: 3 + 39 − (3 × 39) ÷ 100 = 42 − 1.17 = 40.83%

Comparing discounts: 39.25% < 40.83% < 46.15% < 50%.

Therefore The correct answer is A.

Alternate Method

Given → Four different discount schemes A, B, C, and D.

Formulas: Successive Discount = a + b − (ab ÷ 100) | Buy X Get Y Free Discount% = [Y ÷ (X + Y)] × 100.

=> Calculate effective discount for Scheme A: 19 + 25 − 4.75 = 39.25%.

=> Calculate effective discount for Scheme B (Buy 7 Get 6 Free): (6/13) × 100 = 46.15%.

=> Calculate effective discount for Scheme D: 3 + 39 − 1.17 = 40.83%.

=> Scheme C is given as a flat 50% discount.

=> For a shopkeeper, the minimum discount results in the maximum profit.

=> Minimum value among {39.25, 46.15, 50, 40.83} is 39.25%.

Therefore The correct answer is A.

Additional Information

Perspective of Best Scheme

The Best Scheme for Customer is the one with the highest discount, whereas the Best Scheme for Shopkeeper is the one with the lowest discount.

Buy X Get Y Free

Discount% = [Number of free items ÷ Total number of items (Paid + Free)] × 100.

Q35. Answer: (c) 47.88%

Shortcut Trick

Initial votes share = 63%

Decrease in support = 24%

Remaining support = 100% − 24% = 76%

Final percentage = 63 × 0.76 = 47.88%

Therefore The correct answer is 47.88%.

Alternate Method

Given:

Votes in first round = 63% of total

Decrease in second round = 24% of his current share

Calculations:

=> Amount of decrease = 24% of 63%

=> Decrease = (24 ÷ 100) × 63 = 0.24 × 63 = 15.12%

=> Final votes = 63% − 15.12%

=> Final votes = 47.88%

Therefore The correct answer is 47.88%.

Additional Information

Percentage Decrease

To calculate a percentage decrease on a base value, multiply the base by (100 − decrease %)/100.

Successive Percentage

When a value changes successively, the final value is A × (1 ± x/100) × (1 ± y/100).

Base Value Concept

Always identify if the percentage change is applied to the original total or the intermediate value.

Q36. Answer: (d) 6

Shortcut Trick

For Mean Proportion b between a and c: $b^2 = a \times c$

Given b = 42 and c = 294, find x (where x is a).

x = (42 × 42) ÷ 294

x = 1764 ÷ 294 = 6

Therefore The correct answer is 6.

Alternate Method

Given:

Mean Proportion (b) = 42

First term (a) = x

Third term (c) = 294

Formula Used:

If b is the mean proportion between a and c, then a : b = b : c => $b^2 = ac$

Calculations:

=> $42^2 = x \times 294$

=> 1764 = x × 294

=> x = 1764 ÷ 294

=> x = 6

Therefore The correct answer is 6.

Additional Information

Mean Proportion

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

Third Proportion

If a : b = b : c, then c is called the third proportion to a and b, calculated as $c = b^2 \div a$.

Fourth Proportion

If a : b = c : d, then d is the fourth proportion, calculated as d = (b × c) ÷ a.

Q37. Answer: (c) 5/8

Shortcut Trick

Check options for numerator = denominator − 6.

(1) 5 − 4 = 1 | (2) 11 − 6 = 5 | (3) 8 − 5 = 3 | (4) 13 − 7 = 6.

Only 7/13 has a difference of 6. Let us verify the condition: (7+2)/(13+2) = 9/15 = 3/5.

Wait, if the condition becomes 2/3, let us check (x − 6 + 2) / (x + 2) = 2/3 => (x − 4) / (x + 2) = 2/3 => 3x − 12 = 2x + 4 => x = 16.
Fraction = 10/16 = 5/8.

Therefore The correct answer is 5/8.

Alternate Method

Let the denominator be x.

Then, the numerator = x − 6.

Original Fraction = (x − 6) / x

According to the question, if 2 is added to both:

=> ((x − 6) + 2) / (x + 2) = 2/3

=> (x − 4) / (x + 2) = 2/3

=> 3 × (x − 4) = 2 × (x + 2)

=> 3x − 12 = 2x + 4

=> 3x − 2x = 4 + 12

=> x = 16

=> Numerator = 16 − 6 = 10

=> Fraction = 10 / 16

=> Simplest form = 5 / 8

Therefore The correct answer is 5/8.

Additional Information

Simplest Form of a Fraction

A fraction is in its simplest form when the Highest Common Factor (HCF) of the numerator and denominator is 1.

Proper vs Improper Fractions

A proper fraction has a numerator less than the denominator (e.g., 5/8), while an improper fraction has a numerator greater than or equal to the denominator.

Ratio and Proportion

Fractional equality a/b = c/d can be solved using cross-multiplication: a × d = b × c.

Q38. Answer: (a) Rs. 1,800

Shortcut Trick

Total Profit = (Profit in Transaction 1) + (Profit or Loss in Transaction 2)

Transaction 1: CP1 = 24,000 + 3,000 = 27,000; SP1 = 30,000 => Profit1 = 3,000

Transaction 2: Loss2 = 1,200

Net Profit = 3,000 − 1,200 = 1,800

Therefore The correct answer is Rs. 1,800.

Alternate Method

Given: Initial purchase price = Rs. 24,000, Repair cost = Rs. 3,000, First selling price = Rs. 30,000, Buy back price = Rs. 28,000, Loss on second sale = Rs. 1,200.

Formulas: Total CP = Purchase Price + Overheads | Profit = SP − CP | Loss = CP − SP | Net Profit = Total SP − Total CP

=> Total Cost Price for Transaction 1 = 24,000 + 3,000 = 27,000

=> Profit from Transaction 1 = 30,000 − 27,000 = 3,000

=> Cost Price for Transaction 2 = 28,000

=> Selling Price for Transaction 2 = CP − Loss = 28,000 − 1,200 = 26,800

=> Total CP = 27,000 + 28,000 = 55,000

=> Total SP = 30,000 + 26,800 = 56,800

=> Overall Profit = 56,800 − 55,000 = 1,800

Therefore The correct answer is Rs. 1,800.

Additional Information

Treatment of Overhead Expenses

Any money spent on repairs, transportation, or labor after buying an item is added to the purchase price to calculate the Effective Cost Price.

Net Profit/Loss in Multiple Transactions

The Overall Profit or Loss is the algebraic sum of results from each individual transaction. Profit is taken as positive (+), and Loss is taken as negative (−).

Q39. Answer: (c) 0

Shortcut Trick

Number 648XYZ is divisible by 10 => Z = 0.

Divisible by 4 => YZ must be divisible by 4. Since Z = 0, smallest Y = 0 (00 is divisible by 4).

Divisible by 9 => 6 + 4 + 8 + X + 0 + 0 = 18 + X must be divisible by 9 => X = 0 or 9.

Using X = 0, Y = 0, Z = 0: X + Z − Y = 0 + 0 − 0 = 0.

Therefore The correct answer is 0.

Alternate Method

Given: Number 648XYZ is divisible by 4, 9, and 10. Y is the smallest possible digit.

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Calculations:
=> Divisibility by 10: The last digit must be 0. Therefore Z = 0.
=> Divisibility by 4: The last two digits (YZ) must be divisible by 4. Since Z = 0, Y can be 0, 2, 4, 6, 8.
=> Smallest Y: The question states Y is the smallest possible number. Therefore Y = 0.
=> Divisibility by 9: Sum of digits (6 + 4 + 8 + X + Y + Z) must be divisible by 9.
=> 18 + X + 0 + 0 = 18 + X.
=> For 18 + X to be divisible by 9, X can be 0 or 9.
=> If X = 0, then X + Z − Y = 0 + 0 − 0 = 0.
=> If X = 9, then X + Z − Y = 9 + 0 − 0 = 9 (Not in options).
Therefore The correct answer is 0.
Additional Information
Divisibility by 9
A number is divisible by 9 if the sum of its digits is a multiple of 9.
Divisibility by 4
A number is divisible by 4 if the last two digits of the number are divisible by 4 or are 00.
Divisibility by 10
A number is divisible by 10 if its unit digit is strictly 0.

Q40. Answer: (b) 11

Shortcut Trick
Arrange the Basketball scores in ascending order: 2, 5, 7, 8, 10, 10, 10, 11, 12, 14, 17, 18, 24, 25, 27.
Total number of match scores (n) = 15 (Odd).
For odd n, Median = ((n + 1) ÷ 2)^(th) term.
Median = ((15 + 1) ÷ 2)^(th) term = 8^(th) term.
The 8^(th) value in the sorted list is 11.
Therefore The correct answer is 11 points.
Alternate Method
Given Data: 17, 2, 7, 27, 25, 5, 14, 18, 10, 24, 10, 8, 10, 12, 11.
Formula Used: Median = ((n + 1) ÷ 2)^(th) term (where n is odd).
=> Total observations (n) = 15
=> Sorted Data in ascending order: 2, 5, 7, 8, 10, 10, 10, 11, 12, 14, 17, 18, 24, 25, 27
=> Median index = (15 + 1) ÷ 2 = 8^(th) term
=> Median value = Value of 8^(th) term
=> Median = 11
Therefore The correct answer is 11 points.
Additional Information
Median for Even n
If the number of observations (n) is even, the median is the average of the (n ÷ 2)^(th) and ((n ÷ 2) + 1)^(th) terms.
Mode of Data
The mode is the most frequently occurring value. In this set, 10 occurs three times, so Mode = 10.
Arithmetic Mean
Mean = (Sum of all values) ÷ (Total number of values). It represents the central balance point of the data.

Q41. Answer: (a) 40 min

Shortcut Trick
Let the pipes be A, B, and C (waste pipe).
Total Capacity (LCM of 100, 25, 40) = 200 units.
Efficiency of A = 2, B = 8, and A+B−C = 5.
Efficiency of C = (2 + 8) − 5 = 5 units/min.
Time taken by pipe C = 200 ÷ 5 = 40 min.
Therefore The correct answer is 40 min.
Alternate Method

Pipe	Time (min)	Total Work (units)	Efficiency
Pipe A (Inlet)	100	200	2
Pipe B (Inlet)	25	8	
A + B + C (Resultant)	40	5	

Calculations:
=> Let the efficiency of the waste pipe (C) be x.
=> Total efficiency = Efficiency of A + Efficiency of B − Efficiency of C
=> 5 = 2 + 8 − x
=> 5 = 10 − x
=> x = 10 − 5 = 5 units/min
=> Time taken by waste pipe to empty the tank = Total capacity ÷ Efficiency of C
=> Time = 200 ÷ 5 = 40 min
Therefore The correct answer is 40 min.
Additional Information
Pipes and Cisterns Logic
Inlet pipes have positive efficiency, while outlet (leak/waste) pipes have negative efficiency.
Total Work Formula
Total Work = Efficiency × Time. Using the LCM method is the fastest way to solve multiple pipe problems.
Fractional Method
If a pipe fills a tank in 'x' minutes, its work in 1 minute is 1/x of the total tank volume.

Q42. Answer: (c) Rs. 3,456

Shortcut Trick
Net compound interest rate for 2 years at 20% = 20 + 20 + (20 × 20) ÷ 100 = 44%.
Total Amount = 100% (Principal) + 44% (Interest) = 144% of Principal.
Amount = 144% × 2400 = 1.44 × 2400 = Rs. 3456.
Therefore The correct answer is Rs. 3456.
Alternate Method
Given: Principal (P) = Rs. 2,400, Rate (R) = 20% per annum, Time (n) = 2 years.
Formula Used: Amount (A) = $P(1 + R/100)^n$
=> Amount (A) = $2400 \times (1 + 20 \div 100)^2$
=> Amount (A) = $2400 \times (1 + 1 \div 5)^2$
=> Amount (A) = $2400 \times (6 \div 5) \times (6 \div 5)$
=> Amount (A) = $2400 \times 36 \div 25$
=> Amount (A) = 96×36
=> Amount (A) = 3456
Therefore The correct answer is Rs. 3456.
Additional Information
Compound Interest (CI)
It is the interest calculated on the initial principal, which also includes all of the accumulated interest from previous periods.
Difference between CI and SI
For 2 years, the difference between Compound Interest and Simple Interest is given by the formula: $D = P \times (R \div 100)^2$.
Effective Rate for Half-Yearly Compounding
When interest is compounded half-yearly, the annual rate (R) is divided by 2, and the time period (n) is multiplied by 2.

Q43. Answer: (a) Rs. 232

Shortcut Trick
Total Amount = Rs. 1,287
Total Deductions = 36 + 22 + 29 = Rs. 87
Remaining Amount = 1,287 − 87 = Rs. 1,200

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Remaining share ratio = 17 : 7 : 16 (Total parts = 40)
Monika's remaining share = (7 ÷ 40) × 1,200 = Rs. 210
Actual share = 210 + 22 = Rs. 232
Therefore The correct answer is Rs. 232.
Alternate Method
Given:
Total amount = Rs. 1,287
Individual deductions: Rahul = Rs. 36, Monika = Rs. 22, Yuvraj = Rs. 29
Ratio after deduction = 17 : 7 : 16
Calculations:
=> Let the shares after deduction be 17x, 7x, and 16x.
=> (17x + 36) + (7x + 22) + (16x + 29) = 1287
=> 40x + 87 = 1287
=> 40x = 1287 − 87
=> 40x = 1200
=> x = 1200 ÷ 40 = 30
=> Monika's share after deduction = 7 × 30 = Rs. 210
=> Monika's actual share = 210 + 22 = Rs. 232
Therefore The correct answer is Rs. 232.
Additional Information
Ratio and Proportion
If a total sum S is divided into a ratio a : b : c, then the share of b is calculated as (b ÷ (a + b + c)) × S.
Deduction Concept
When fixed amounts are deducted from shares to obtain a new ratio, subtract the total deduction from the original sum before applying the ratio parts.

Q44. Answer: (a) 67.5 km/h

Shortcut Trick
Speed ratio (Train : Car) = 160 : 100 = 8 : 5.
Time ratio (Train : Car) = 5 : 8 (since distance is constant).
Difference in time units = 8 − 5 = 3 units.
Given 3 units = 20 minutes => 8 units (Car's time) = (20 ÷ 3) × 8 = 160/3 minutes = 8/9 hours.
Speed of car = Distance ÷ Time = 60 ÷ (8/9) = 540 ÷ 8 = 67.5 km/h.
Therefore The correct answer is 67.5 km/h.
Alternate Method
Given: Distance = 60 km, Train speed is 60% more than Car, Time delay = 20 mins.
Formula: Time = Distance ÷ Speed
=> Let Speed of car = x km/h.
=> Speed of train = 1.6x km/h.
=> Time taken by car − Time taken by train = 20/60 hours.
=> 60/x − 60/1.6x = 1/3
=> 60/x × (1 − 1/1.6) = 1/3
=> 60/x × (0.6/1.6) = 1/3
=> 60/x × (3/8) = 1/3
=> 22.5/x = 1/3
=> x = 22.5 × 3 = 67.5 km/h.
Therefore The correct answer is 67.5 km/h.
Additional Information
Inverse Proportion of Speed and Time
When distance is constant, speed is inversely proportional to time (S1/S2 = T2/T1).
Relative Speed
In same direction, relative speed = S1 − S2. In opposite direction, relative speed = S1 + S2.

Average Speed

For constant distance segments, Average Speed = 2S1S2 ÷ (S1 + S2).

Q45. Answer: (c) 1,87,500

Shortcut Trick

Ratio of Income (Ashish : Kiran) = 5 : 8

Ratio of Expenditure (Ashish : Kiran) = 2 : 4 = 1 : 2

Since Savings (Income − Expenditure) are same (Rs. 75,000), make the ratio difference equal: (5−1) ≠ (8−2). Adjust expenditure ratio by ×3 → 3 : 6. Now (5−3) = (8−6) = 2 units.

2 units = Rs. 75,000 => 1 unit = Rs. 37,500.

Income of Ashish = 5 units = 5 × Rs. 37,500 = Rs. 1,87,500.

Therefore The correct answer is Rs. 1,87,500.

Alternate Method

Given: Ratio of incomes = 5 : 8, Ratio of expenditures = 2 : 4, Constant savings = Rs. 75,000.

Formula Used: Income − Savings = Expenditure

=> (5x − 75000) / (8x − 75000) = 2 / 4

=> (5x − 75000) / (8x − 75000) = 1 / 2

=> 2 × (5x − 75000) = 1 × (8x − 75000)

=> 10x − 1,50,000 = 8x − 75,000

=> 2x = 1,50,000 − 75,000

=> 2x = 75,000

=> x = 37,500

=> Monthly Income of Ashish = 5x = 5 × 37,500 = Rs. 1,87,500

Therefore The correct answer is Rs. 1,87,500.

Additional Information

Income, Expenditure, and Savings Relationship

The fundamental equation for these problems is Income = Expenditure + Savings.

Ratio Balancing Method

When the difference (Savings) is constant, you can solve by making the vertical difference between the ratio parts equal for both individuals.

Cross-Multiplication Method

For different savings amounts, use the formula (I1 × E2 − I2 × E1) units = (S1 × E2 − S2 × E1).

Q46. Answer: (c) 66.67%

Shortcut Trick

Identify the base value (A's marks) and the comparing value (B's marks).

Required percentage = (B ÷ A) × 100

Required percentage = (50 ÷ 75) × 100 = 2/3 × 100 = 66.666...

Rounding to two decimal places, we get 66.67%.

Therefore The correct answer is 66.67%.

Alternate Method

Given:

Marks obtained by A = 75

Marks obtained by B = 50

Maximum Marks = 90 (Not required for this specific ratio calculation)

Formula Used:

Percentage = (Value / Base Value) × 100

Calculations:

=> Required Percentage = (Marks of B / Marks of A) × 100

=> Percentage = (50 / 75) × 100

=> Percentage = (2 / 3) × 100

=> Percentage = 200 / 3

=> Percentage = 66.6666...

=> Rounded Percentage ≈ 66.67%

Therefore The correct answer is 66.67%.

Additional Information

Percentage Change

To find the percentage by which A is more than B: [(A − B) / B] × 100. Always divide by the 'than' value.

Fraction to Percentage Conversion

Common fractions: 1/2 = 50%, 1/3 = 33.33%, 2/3 = 66.67%, 1/4 = 25%, 1/5 = 20%.

Base Value Identification

The value following the word 'of' or 'than' is typically treated as the denominator (base value) in percentage problems.

Q47. Answer: (a) 12√3 : 5√(10 + 2√5)

Shortcut Trick

Area of a regular polygon with n sides inscribed in a circle of radius R is given by: Area = (n/2) × R² × sin(360°/n).

For Hexagon (n = 6): Area6 = (6/2) × R² × sin(60°) = 3 × R² × (√3/2) = (3√3/2)R².

For Pentagon (n = 5): Area5 = (5/2) × R² × sin(72°) = (5/2) × R² × (√(10 + 2√5)/4) = (5√(10 + 2√5)/8)R².

Ratio = (3√3/2) : (5√(10 + 2√5)/8) => Multiply by 8 => 12√3 : 5√(10 + 2√5).

Therefore The correct answer is 12√3 : 5√(10 + 2√5).

Alternate Method

Given:

Radius of the circumcircle = R

Number of sides of first polygon (Hexagon) = 6

Number of sides of second polygon (Pentagon) = 5

Formula Used:

Area of regular n-gon = (n/2) × R² × sin(360°/n)

Calculations:

=> Area of Hexagon (A1) = (6/2) × R² × sin(360°/6)

Q48. Answer: (d) 23.44%

Shortcut Trick

For two successive discounts a% and b%, use the successive discount formula.

Equivalent Discount = a + b − (a × b) ÷ 100

Equivalent Discount = 12 + 13 − (12 × 13) ÷ 100

Equivalent Discount = 25 − 156 ÷ 100 = 25 − 1.56

Equivalent Discount = 23.44%

Therefore The correct answer is 23.44%.

Alternate Method

Given: First discount (d1) = 12%, Second discount (d2) = 13%.

Formulas: Final SP = MP × (100 − d1)% × (100 − d2)% | Equivalent Discount% = (MP − SP) ÷ MP × 100

=> Let the Marked Price (MP) be 100.

=> Price after 1st discount = 100 × (100 − 12) ÷ 100 = 88.

=> Price after 2nd discount (Final SP) = 88 × (100 − 13) ÷ 100 = 88 × 0.87 = 76.56.

=> Single Equivalent Discount = MP − Final SP = 100 − 76.56 = 23.44%.

Therefore The correct answer is 23.44%.

Additional Information

Successive Discount Concept

When a series of discounts are applied on the Marked Price, each subsequent discount is calculated on the reduced value obtained after the previous discount.

Net Discount for 3 values

For three successive discounts a, b, and c, calculate the equivalent of 'a' and 'b' first, then use that result with 'c'.

Q49. Answer: (b) 20.51

Shortcut Trick

Total Expenditure = 1120 + 910 = Rs. 2030

Total Books purchased = 52 + 47 = 99
Average Price = Total Cost ÷ Total Books = 2030 ÷ 99
Average Price ≈ Rs. 20.51
Therefore The correct answer is Rs. 20.51.
Alternate Method
Given:
Number of books from Shop 1 = 52 | Cost = Rs. 1,120
Number of books from Shop 2 = 47 | Cost = Rs. 910
Formula Used:
Average = (Total Sum of Observations) ÷ (Total Number of Observations)
Calculations:
=> Total Cost Price = 1120 + 910 = Rs. 2030
=> Total Quantity (Books) = 52 + 47 = 99
=> Average price per book = 2030 ÷ 99
=> Average price per book = 20.50505...
=> Rounding off to two decimal places, we get Rs. 20.51
Therefore The correct answer is Rs. 20.51.
Additional Information
Weighted Average
When items have different frequencies or counts, the average is calculated as (n1x1 + n2x2) ÷ (n1 + n2).
Rounding Off Rules
If the third decimal digit is 5 or more, the second decimal digit is increased by 1 (e.g., 20.505 → 20.51).
Arithmetic Mean
It represents the central value of a data set, calculated by dividing the sum of all values by the total count of values.

Q50. Answer: (d) 2 : 19

Shortcut Trick
Directly calculate the Total Surface Area (TSA) ratio.
TSA of one small cube = $6 \times 4^2 = 6 \times 16 = 96$ cm².
TSA of original cuboid = $2 \times (18\times12 + 12\times8 + 18\times8) = 2 \times (216 + 96 + 144) = 912$ cm².
Required Ratio = 96 : 912 = 1 : 9.5 = 2 : 19.
Therefore The correct answer is 2 : 19.
Alternate Method
Given:
Dimensions of cuboid: Length (L) = 18 cm, Width (B) = 12 cm, Height (H) = 8 cm.
Edge of small cube (a) = 4 cm.
Formula Used:
TSA of cuboid = 2(LB + BH + LH)
TSA of cube = $6a^2$
Calculations:
=> Total Surface Area of the cuboid = 2 × (18 × 12 + 12 × 8 + 8 × 18)
=> TSA of cuboid = 2 × (216 + 96 + 144) = 2 × (456) = 912 cm²
=> Total Surface Area of one small cube = 6 × $(4)^2$
=> TSA of cube = 6 × 16 = 96 cm²
=> Required Ratio = TSA of cube : TSA of cuboid
=> Ratio = 96 : 912
=> Dividing both by 48: 96 ÷ 48 = 2 and 912 ÷ 48 = 19
=> Ratio = 2 : 19
Therefore The correct answer is 2 : 19.
Additional Information
Volume of Solids
The volume of a cuboid is L × B × H and a cube is a^3. When melting and recasting, the total volume remains constant: n × a^3 = L ×

B × H.

Lateral Surface Area (LSA)

LSA of a cuboid = 2H(L + B), and LSA of a cube = $4a^2$. LSA only considers the area of the four side walls.

Diagonal of Solids

Diagonal of a cuboid = $\sqrt{(L^2 + B^2 + H^2)}$, and diagonal of a cube = $a\sqrt{3}$.

Q51. Answer: (c) 35 km to the north

Given:

Hitesh starts from Point A and drives 62 km East.

He turns left → 36 km North.

He turns left → 78 km West.

He turns left → 71 km South.

He takes a final left → 16 km East.

So,To reach Point A again, he must travel 35 km North.

Hence, the correct answer is Option 3.

Q52. Answer: (d) RDAL

The logic followed here is:

For, VHEP → OAXI

Now, TFCN → MYVG

Now, applying the same logic for YKHS:

So, YKHS → RDAL

Hence, the correct answer is Option 4.

Q53. Answer: (b) Only conclusion (II) follows

Given Statements:

All mints are lamps.

All mints are jams.

All mints are kites.

The least possible Venn diagram for the given statements is:

Conclusions:

I. All lamps are jams – Does not follow (Only mints are common to both lamps and jams; lamps may exist outside jams).

II. Some jams are kites – Follows (Since all mints are jams and all mints are kites, at least some jams are definitely kites).

So, only conclusion II follows.

Hence, the correct answer is Option 2.

Q54. Answer: (b) P and M

Given: S, P, D, M, and R are sitting around a circular table facing the centre.

Only two people sit between R and M when counted from the left of R.

D is an immediate neighbour of M and R.

P is sitting to the immediate left of R.

Therefore, the immediate neighbours of S are P and M.

Hence, the correct answer is Option 2.

Q55. Answer: (d) 126

Given:

Rank from top = 56

Rank from bottom = 71

Total number of students = (Rank from top + Rank from bottom) − 1

= (56 + 71) − 1

= 127 − 1

= 126

Here, there are 126 students in his class.

Hence, the correct answer is "Option 4".

Q56. Answer: (c) IEG−JFH

The logic followed here is:

For, NJL → OKM

Now, CYA → DZB

Now, checking the options:

Option 1) IEG → IFG

Option 2) IDE → JFH

Option 3) IEG → JFH

Option 4) IDE → IEG

Hence, the correct answer is Option 3.

Q57. Answer: (c) 63

The logic followed here is:

thus, "63" will replace the question mark in the given series.

Hence, the correct option is "Option 3"

Q58. Answer: (a) ZAW 76

The logic followed here is:

So, 'ZAW 76' will replace the question mark in the given series.

Hence, the correct answer is "Option 1".

Q59. Answer: (c) 91

BODMAS Table:

Given equation: 92 A 2 D (35 A 7) B 4 C 30 A 3 C 5 B 11 = ?

Now, replacing the symbols as:

Symbol	A	B	C	D
Replaced by	÷	×	•	−

=> 92 ÷ 2 − (35 ÷ 7) × 4 + 30 ÷ 3 + 5 × 11 = ?

=> 46 − 5 × 4 + 10 + 5 × 11 = ?

=> 46 − 20 + 10 + 55 = ?

=> 26 + 10 + 55 = ?

=> 36 + 55 = ?

=> 91

Hence, the correct answer is Option 3.

Q60. Answer: (d) Mother’s sister

Family Chart:

Symbol	•	−	×	%	#
Meaning	Mother	Brother	Wife	Father	Daughter

Given: C # N × K % T + R

It means: C is the daughter of N, N is the wife of K, K is the father of T, T is the mother of R.

Here, C is related to R as Mother’s sister

Hence, the correct answer is Option 4.

Q61. Answer: (c) Three

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

Now,

We need to identify the unique single-digit numbers present in the series and count those that are exactly divisible by 3.

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

Now, identifying unique digits: 1, 2, 3, 4, 5, 6, 7, 8, 9

Digit	Division	Result	Remainder	Status

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3	3 ÷ 3	1	0	Divisible
6	6 ÷ 3	2	0	Divisible
9	9 ÷ 3	3	0	Divisible

Now, only valid unique digits: {3, 6, 9}
Total unique single-digit numbers divisible by 3 = 3
Hence, the correct answer is "Option 3".

Q62. Answer: (a) 36, 69

The logic followed here is:
Logic: Second number = (First number × 2) − 3
19, 35
=> (19 × 2) − 3
=> 38 − 3 = 35
28, 53
=> (28 × 2) − 3
=> 56 − 3 = 53
Now, checking the options:
Option 1) 36, 69
=> (36 × 2) − 3
=> 72 − 3 = 69
Option 2) 85, 166
=> (85 × 2) − 3
=> 170 − 3 = 167 (not 166)
Option 3) 73, 145
=> (73 × 2) − 3
=> 146 − 3 = 143 (not 145)
Option 4) 42, 85
=> (42 × 2) − 3
=> 84 − 3 = 81 (not 85)
Hence, the correct answer is Option 1.

Q63. Answer: (a) Only conclusion (I) follows

Given Statements:
All forks are kettles.
Some forks are spoons.
The least possible Venn diagram for the given statement is:
Conclusions:
I. Some kettles are spoons - Follows (Since some forks are spoons and all forks are kettles, those spoons are also kettles).
II. All spoons are forks - Does not follow (Only some forks are spoons; it does not mean all spoons are forks).
So, only conclusion I follows.
Hence, the correct answer is Option 1.

Q64. Answer: (a) 9

Given: (Left) 3215674 (Right)
Now,
We need to modify each digit according to the given rule and then find the required positional sum.
So, the required logic is:
Odd digit → +1
Even digit → −1
(Left) 3 2 1 5 6 7 4 (Right)

Original Digit	Type	Operation	New Digit

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3	Odd	+1	4
2	Even	−1	1
1	Odd	+1	2
5	Odd	+1	6
6	Even	−1	5
7	Odd	+1	8
4	Even	−1	3

New number formed: 4 1 2 6 5 8 3
First digit from left = 4
Third digit from right = 5
Now, Sum = 4 + 5 = 9
Hence, the correct answer is "Option 1".

Q65. Answer: (d) 4 km to the west

Given:
Shubham starts from Point A and drives 11 km South.
He turns right → 7 km West.
He turns right → 14 km North.
He turns right → 11 km East.
He takes a final right → 3 km South.
So, To reach Point A again, he must travel 4 km West.
Hence, the correct answer is Option 4.

Q66. Answer: (a) 400

The logic followed here is:
thus, "400" will replace the question mark in the given series.
Hence, the correct option is "Option 1".

Q67. Answer: (b) 21

Given:
Total number of people = 54
Junaid's position from left = 21
Sourav's position from right = 12
Sum of positions from opposite ends = 21 + 12 = 33
Number of people between them = Total − (Sum of positions)
= 54 − (21 + 12)
= 54 − 33
= 21
Here, the number of people between Junaid and Sourav is 21.
Hence, the correct answer is "Option 2".

Q68. Answer: (a) 2

Given: (Left) 4, 9, 8, 5, 1, 6, 4, 5, 9, 6, 5, 3, 4, 9, 6, 2, 9, 4, 8, 5, 1, 1, 8, 4, 1, 5, 7 (Right)
Now,
We need to identify odd numbers that are both preceded and followed by an odd number.
So, the required condition is: Odd Number – Odd Number – Odd Number
(Left) 4, 9, 8, 5, 1, 6, 4, 5, 9, 6, 5, 3, 4, 9, 6, 2, 9, 4, 8, 5, 1, 1, 8, 4, 1, 5, 7 (Right)
Total odd numbers satisfying the condition = 2
Hence, the correct answer is "Option 1".

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Q69. Answer: (b) C

Given: A, B, C, D, E and F are sitting in a row facing north.

Only three people are sitting at the right of A.

Only one person is sitting between A and C.

E is sitting second from the extreme left end of the row.

B is not the immediate neighbour of A.

F is sitting to the immediate left of B.

F is sitting to the immediate right of A.

The extreme left end is position 1 → C

Hence, the correct answer is Option 2.

Q70. Answer: (d) OLI

The logic followed here is:

So, the next term = OLI

Hence, the correct answer is Option 4.

Q71. Answer: (d) 49

BODMAS Table:

Given equation: 68 A 2 D 7 B 5 C (25 A 5) B 9 C 30 A 6 = ?

Now, replacing the symbols as:

Symbol	A	B	C	D
Replaced by	÷	×	•	−

=> 68 ÷ 2 − 7 × 5 + (25 ÷ 5) × 9 + 30 ÷ 6 = ?

=> 34 − 7 × 5 + (25 ÷ 5) × 9 + 30 ÷ 6 = ?

=> 34 − 35 + 5 × 9 + 5 = ?

=> 34 − 35 + 45 + 5 = ?

=> −1 + 45 + 5 = ?

=> 44 + 5 = ?

=> 49

Hence, the correct answer is Option 4.

Q72. Answer: (c) 120

The logic followed here is:

thus, "120" will replace the question mark in the given series.

Hence, the correct option is "Option 3".

Q73. Answer: (c) 5

Given: (Left) 604, 895, 469, 742, 307 (Right)

Now,

We need to identify the highest and lowest numbers from the given set and then perform the required operation on the specified digits.

(Left) 604, 895, 469, 742, 307 (Right)

Highest number = 895

Lowest number = 307

Third digit of highest number = 5

Second digit of lowest number = 0

Now,

Value 1 = 5

Value 2 = 0

Sum = 5 + 0 = 5

Hence, the correct answer is "Option 3".

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Q74. Answer: (c) UPQW

The logic followed here is:
For, GBCI → YTUA
Now, AVWC → SNOU
Now, applying the same logic for CXYE:
So, CXYE → UPQW
Hence, the correct answer is Option 3.

Q75. Answer: (b) HLP

The logic followed here is:
Option 1) TXZ
Option 2) HLP
Option 3) RVX
Option 4) LPR
Here, HLP is odd from the given options because it follows (+4, +4) instead of (+4, +2).
Hence, the correct answer is "Option 2".

Q76. Answer: (b) Two

Given: D, E, F, U, V, W and X are sitting in a straight line facing north.
Only two people are seated between U and D.
Only X is seated to the right of F.
Only one person is seated between D and F.
V is seated at some place to the right of E but at some place to the left of W.
Between them are V (3) and D (4) → 2 people
Hence, the correct answer is Option 2.

Q77. Answer: (c) 48

The logic followed here is:
Logic: Code = Sum of letter positions + 7
Given:
WASO → 65
Sum = 23 + 1 + 19 + 15 = 58
Code = 58 + 7 = 65
Now, YKSB → 64
Sum = 25 + 11 + 19 + 2 = 57
Code = 57 + 7 = 64
Now, for LEUC:
Sum = 12 + 5 + 21 + 3 = 41
Now, 41 + 7 = 48
Hence, the correct answer is Option 3.

Q78. Answer: (b) 1

Given: (Left) 1, 7, 9, 4, 5, 3 (Right)
Now,
We need to identify odd numbers that are both preceded and followed by another odd number.
So, the required condition is: Odd Number – Odd Number – Odd Number
(Left) 1, 7, 9, 4, 5, 3 (Right)
Total odd numbers satisfying the condition = 1
Hence, the correct answer is "Option 2".

Q79. Answer: (b) WAE

The logic followed here is:
Option 1) HLQ

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Option 2) WAE

Option 3) ZDI

Option 4) KOT

Here, WAE is odd from the given options because it follows (+4, +4) instead of the common (+4, +5) pattern.

Hence, the correct answer is "Option 2".

Q80. Answer: (d) uf

The logic followed here is:

Given:

'never judge people' → gu uf ha

'don't ask people' → kl td uf

So, people → uf

Hence, the correct answer is Option 4.

Q81. Answer: (b) Aero India 2025

The correct answer is Aero India 2025.

Key Points

• The announcement regarding the development of a new high-calibre Pinaka rocket with an extended range of 120 km was made by DRDO (Defence Research and Development Organisation) officials during the Aero India 2025 event.

• Aero India 2025 is the 15th edition of Asia's largest aero show, held at the Yelahanka Air Force Station in Bengaluru, Karnataka.

• The new variant is designed to significantly enhance the Indian Army's long-range fire power, effectively doubling the range of the current Pinaka Mk-II system. Hence, the statement regarding the event is correct.

• This development is part of India's Aatmanirbhar Bharat initiative, focusing on reducing dependency on foreign weapon systems and promoting indigenous defence technology.

• The 120 km range version will likely feature advanced guidance systems to maintain precision at longer distances, transitioning the Pinaka from a saturation weapon to a precision-strike asset.

Additional Information

• Pinaka Multi-Barrel Rocket Launcher (MBRL):

• The system is named after the divine bow of Lord Shiva. It was developed by the Armament Research and Development Establishment (ARDE), a DRDO laboratory based in Pune.

• It was first battle-tested during the Kargil War in 1999, where it was successful in neutralizing enemy positions on high mountain ridges.

• Existing Variants:

• Pinaka Mk-I: The initial version with a range of approximately 37.5 km to 40 km.

• Pinaka Mk-II / ER (Extended Range): Offers an enhanced range of up to 60 km to 75 km.

• Guided Pinaka: Equipped with a Navigation, Guidance, and Control (NGC) kit, utilizing the Indian Regional Navigation Satellite System (NavIC) for high accuracy.

• System Capabilities: A single Pinaka battery consists of six launcher vehicles, each capable of firing 12 rockets in 44 seconds, neutralizing an area of 700m x 500m.

• Defence Exports: The Pinaka system has gained international recognition, with Armenia becoming the first international customer to sign a deal for the system in 2022, valued at approximately Rs. 2,000 crores.

Important Points

• Strategic Impact: The development of the 120 km range variant bridges the tactical gap between traditional tube artillery and short-range ballistic missiles like the Pralay.

• Manufacturing Partners: While DRDO is the lead designer, the production is carried out by private and public sector partners, including Tata Power SED, Larsen & Toubro (L&T), and Munitions India Limited (MIL).

• Technological Integration: The upcoming high-calibre rockets are expected to integrate advanced composite propellants and improved aerodynamic control surfaces to achieve the 120 km milestone while maintaining a low Circular Error Probable (CEP).

• Aero India 2025: The event serves as a global platform for Ministry of Defence to showcase indigenous achievements, attracting Defence Ministers and CEOs from over 100 countries.

Q82. Answer: (b) Code on Education, 2021

The correct answer is Code on Education, 2021.

Key Points

• The Government of India has consolidated 29 Central Labour Laws into four comprehensive Labour Codes to simplify and

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modernize the legal framework for the workforce.

• The four codes are: the Code on Wages, 2019; the Industrial Relations Code, 2020; the Code on Social Security, 2020; and the Occupational Safety, Health and Working Conditions Code, 2020.

• Code on Education, 2021 is not a part of these labour reforms; education-related regulations fall under different ministries and the National Education Policy 2020. Hence, option 2 is the correct answer.

• The Code on Wages, 2019 was the first to be passed by Parliament in August 2019, while the remaining three codes received Presidential assent in September 2020. Hence, statement 1, 3, and 4 are included in the codes.

• These reforms aim to cover over 50 crore workers in both organized and unorganized sectors, providing them with minimum wages and social security.

Additional Information

• Code on Wages, 2019:

• This code replaces four laws: the Minimum Wages Act, 1948, the Payment of Wages Act, 1936, the Payment of Bonus Act, 1965, and the Equal Remuneration Act, 1976.

• It universalizes the provisions of minimum wages and timely payment of wages to all employees regardless of the sector or wage ceiling.

• Industrial Relations Code, 2020:

• It amalgamates the Trade Unions Act, 1926, the Industrial Employment (Standing Orders) Act, 1946, and the Industrial Disputes Act, 1947.

• The code introduces the concept of a "Fixed Term Employment" and aims to improve Ease of Doing Business by streamlining dispute resolution.

• Code on Social Security, 2020:

• This code subsumes nine central labour laws including the Employees' Provident Fund Act and the Maternity Benefit Act.

• It is significant for extending social security benefits to gig workers and platform workers for the first time in India.

• Occupational Safety, Health and Working Conditions Code, 2020:

• It merges 13 central labour laws regulating the health and safety of workers in factories, mines, and plantations.

• It creates a National Occupational Safety and Health Advisory Board to recommend standards for different sectors.

Important Points

• The implementation of these codes has been a major focus of the Ministry of Labour and Employment, with a transition target set towards 2025 to ensure all states frame their respective rules.

• By consolidating the laws, the government aims to reduce multiplicity of definitions and compliance burdens for businesses.

• The codes empower the Central Government to fix a "Floor Wage", taking into account the living standards of workers across different geographical areas.

• One of the primary features is the digitization of compliance, where registers and returns can be maintained and filed electronically.

Q83. Answer: (b) Mohd. Arif Khan

The correct answer is Mohd. Arif Khan.

Key Points

• Mohd. Arif Khan has been appointed as the Deputy Chief Executive Officer (Deputy CEO) of SBI General Insurance, effective from June 2024 (noted as 2025 in the context of specific organizational cycles).

• With a career spanning over 30 years in the banking and financial services sector, he brings extensive experience from his long-standing tenure at the State Bank of India (SBI).

• In his role as Deputy CEO, he is responsible for overseeing strategic business operations, enhancing operational efficiency, and driving the company's growth in the competitive non-life insurance market.

• His expertise encompasses various domains including retail banking, human resources, and strategic planning, which are critical for the expansion of SBI General Insurance across urban and rural India.

• The appointment is part of a broader leadership reshuffle at SBI General Insurance aimed at strengthening its management team to achieve a higher market share and improve customer service delivery.

Additional Information

• SBI General Insurance: Established in 2009, it is a leading general insurance company in India. It was initially a joint venture between the State Bank of India and Insurance Australia Group (IAG), though SBI currently holds the majority stake.

• Naveen Chandra Jha: He was appointed as the Managing Director (MD) and Chief Executive Officer (CEO) of SBI General Insurance in June 2024, succeeding Kishore Kumar Poludasu.

• Anand Pejawar: He serves as the Whole-time Director at SBI General Insurance and was previously the Deputy Managing Director. He has been instrumental in expanding the company's distribution channels and bancassurance partnerships.

• Regulatory Oversight: All operations and appointments in the company are governed by the Insurance Regulatory and Development Authority of India (IRDAI), ensuring compliance with national insurance laws.

• Product Portfolio: The company offers a diverse range of products including Health Insurance, Motor Insurance, Travel Insurance, and Home Insurance, catering to both individual and corporate clients.

Important Points

• Strategic Location: The headquarters of SBI General Insurance is located in Mumbai, Maharashtra.

• Bancassurance Strength: The company leverages SBI's massive network of over 22,000 branches to distribute its insurance products to the unbanked and under-penetrated sections of society.

• Recent Growth: SBI General Insurance has consistently reported a high Gross Written Premium (GWP), making it one of the fastest-growing players in the private general insurance space in India.

• Digital Transformation: Under the new leadership of Mohd. Arif Khan and Naveen Chandra Jha, the company is focusing heavily on digitization and AI-driven claim processing to improve the settlement ratio.

Q84. Answer: (a) Neiphiu Rio

The correct answer is Neiphiu Rio.

Key Points

• The Chief Minister of Nagaland, Neiphiu Rio, officially inaugurated a state-of-the-art football stadium at the Police Complex in Chumoukedima, located near Dimapur, in January 2025.

• This infrastructure project was specifically developed to enhance the training facilities for the Nagaland Police personnel and to provide a platform for local sports talent to flourish in the region. Hence, the correct answer is Neiphiu Rio.

• The inauguration ceremony was attended by various dignitaries, including the Director General of Police (DGP) of Nagaland and other senior government officials, marking a significant milestone for the Chumoukedima district.

• The stadium is equipped with modern amenities, including high-quality turf and a spectator gallery, aimed at hosting local and state-level football tournaments to promote a culture of sports and physical fitness.

• During his address, Neiphiu Rio emphasized the role of sports in fostering discipline and unity, particularly within the police force and among the youth of Nagaland.

Additional Information

• Neiphiu Rio:

• He is currently serving as the 5th Chief Minister of Nagaland and is a leader of the Nationalist Democratic Progressive Party (NDPP).

• Neiphiu Rio has been a dominant figure in Nagaland politics, holding the office of Chief Minister for multiple terms, starting from his first appointment in 2003.

• He has been a strong advocate for the Naga Peace Process and has focused heavily on infrastructure development and sports promotion across the state.

• Other Options in Context:

• N. Biren Singh: He is the current Chief Minister of the neighboring state of Manipur, known for his focus on the "Go to Hills" and "Go to Village" missions.

• Temjen Imna Along: He is a prominent Minister in the Nagaland government, holding portfolios such as Tourism and Higher Education, and is widely popular on social media for promoting Naga culture.

• Conrad Sangma: He is the Chief Minister of Meghalaya and the President of the National People's Party (NPP).

• Location - Chumoukedima:

• Chumoukedima was officially established as a separate district in December 2021, having been carved out of the Dimapur district.

• It serves as a vital administrative and educational hub, housing the Nagaland Police Training School and several major educational institutions.

Important Points

• Sports Heritage of Nagaland: The state has a rich history in football, notably producing Dr. T. Ao, who was the first captain of the Indian National Football Team during the 1948 London Olympics.

• Infrastructure Goals: The Government of Nagaland has been working under the "Catch Them Young" policy to identify and nurture athletes at a young age, with the Chumoukedima stadium being a part of this broader vision.

• Police Modernization: The construction of the stadium within the Police Complex is part of the Police Modernization Scheme, which aims to improve the welfare and physical standards of the state's security forces.

Q85. Answer: (b) 1045

The correct answer is 1045.

Key Points

• The Ministry of Youth Affairs and Sports has established 1045 Khelo India Centres (KICs) across the country to strengthen the sports ecosystem at the grassroots level.

• These centres are spread across 36 States and Union Territories, covering a vast majority of districts in India.

• The primary objective of these centres is to provide low-cost, high-quality sports training to young athletes and to identify talent at an early age.

• A unique feature of the KIC scheme is the involvement of former champion athletes, who are engaged as coaches and mentors to run these centres and earn a livelihood.

• Each centre is provided with financial assistance for recurring expenses such as coaching salaries, sports equipment, and consumable kits. Hence, the correct answer is 1045.

Additional Information

• The Khelo India Programme:

• Launched in 2017-18, this central sector scheme aims at reviving the sports culture in India at the grassroots level by building a strong framework for all sports played in the country.

• It consists of 12 verticals, including "State Level Khelo India Centres" and "Talent Search and Development", which focus on different aspects of athlete progression.

• Selection of Athletes:

• Under the Talent Identification vertical, talented players are identified in priority sports disciplines at various levels by the High-Powered Committee.

• Selected athletes receive an annual financial assistance of Rs. 5 lakh per annum for 8 years to support their training and development.

• Employment Opportunities:

• The KIC initiative specifically targets the welfare of retired athletes. By appointing them as mentors, the government ensures their expertise is utilized while providing them with employment.

Important Points

• Infrastructure and Funding:

• The Government of India provides a one-time grant for the upgradation of sports infrastructure and the purchase of equipment at these centres.

• In addition to the initial grant, an annual recurring grant of Rs. 5 lakh is provided for each sporting discipline at the centre for at least 4 years.

• Regional Impact:

• Special focus is given to rural and tribal areas, as well as Left Wing Extremism (LWE) affected districts, to ensure that sports training is inclusive and reaches every corner of India.

• The "One District One KIC" policy was envisioned to ensure that at least 1,000 centres were operational, a target that has been successfully surpassed by reaching the 1045 mark.

Q86. Answer: (c) Cyber Suraksha

The correct answer is Cyber Suraksha.

Key Points

• The Indian Armed Forces launched the major cyber security exercise Cyber Suraksha in 2025 to strengthen the nation's digital defenses and ensure the resilience of military communication networks.

• The primary objective of Cyber Suraksha 2025 is to simulate real-world cyber threats such as malware injections, distributed denial-of-service (DDoS) attacks, and sophisticated phishing campaigns to evaluate the readiness of the tri-services.

• This exercise is conducted under the aegis of the Defence Cyber Agency (DCyA), which serves as the premier body for handling cyber warfare and protecting Critical Information Infrastructure (CII) within the military domain.

• The exercise emphasizes jointness and interoperability among the Indian Army, Indian Navy, and Indian Air Force, promoting a unified response strategy against coordinated digital incursions.

• By creating a simulated high-stress environment, the exercise helps in identifying vulnerabilities in current systems and encourages the adoption of secure practices among personnel. Hence, the correct answer is Cyber Suraksha.

Additional Information

• Defence Cyber Agency (DCyA):

• Established in 2019, the DCyA is a tri-service command of the Indian Armed Forces headquartered in New Delhi.

• It is tasked with handling cyber security threats and is capable of conducting both offensive and defensive cyber operations.

• The agency works in close coordination with the National Security Council Secretariat (NSCS) and the National Cyber Security Coordinator.

• Cyber Security Landscape in India:

• The Indian Computer Emergency Response Team (CERT-In), functioning under the Ministry of Electronics and Information Technology (MeitY), is the national nodal agency for responding to computer security incidents.

• The National Cyber Security Policy (2013) and the upcoming National Cyber Security Strategy aim to build a secure and resilient cyberspace for citizens, businesses, and the government.

• India is increasingly focusing on Atmanirbhar Bharat in the tech sector to reduce dependence on foreign hardware and software that may contain supply chain vulnerabilities.

• Common Cyber Exercise Terminologies:

• Red Teaming: An ethical hacking approach where a group simulates an adversary to test the effectiveness of a security program.

• Blue Teaming: The defensive team responsible for maintaining internal network protections and responding to incidents.

• Zero Trust Architecture: A security model that requires strict identity verification for every person and device trying to access resources on a private network.

Important Points

• Evolution of Threats: In the current era of Hybrid Warfare, cyber attacks are often used in tandem with kinetic military actions to disable C4I (Command, Control, Communications, Computers, and Intelligence) systems.

• Data Sovereignty: Exercises like Cyber Suraksha highlight the importance of Data Localization and protecting sensitive military intelligence from State-sponsored actors and Advanced Persistent Threats (APTs).

• International Cooperation: While Cyber Suraksha is a domestic exercise, India also participates in multilateral exercises like Ex-Pitch Black or Malabar, where cyber security components are increasingly becoming a standard module.

• Skill Development: These exercises serve as a training ground for the cyber warriors of the Indian Armed Forces, ensuring they are well-versed in the latest encryption standards and threat-hunting techniques.

Q87. Answer: (d) 30 May

The correct answer is 30 May.

Key Points

• Hindi Journalism Day, also known as Hindi Patrakarita Diwas, is celebrated annually on 30 May across India to acknowledge the significance of the Hindi press.

• This specific date was chosen because it marks the first publication of the very first Hindi-language newspaper, Udant Martand, in the year 1826.

• The newspaper was established and edited by Pt. Jugal Kishore Shukla, who launched the venture from Calcutta (now Kolkata), which was the capital of British India at the time.

• The primary objective of celebrating this day is to honor the contributions of journalists who use Hindi as a medium to inform the public and preserve the cultural and social fabric of the nation.

• It serves as a reminder of the historical struggle and the pivotal role that the Hindi media played during the Indian Independence Movement by uniting the Hindi-speaking masses.

Additional Information

• Udant Martand:

• The name of the newspaper, Udant Martand, literally translates to "The Rising Sun."

• It was a weekly newspaper published every Tuesday.

• Pt. Jugal Kishore Shukla, its founder, was a lawyer originally from Kanpur, Uttar Pradesh, who moved to Calcutta to start this historic initiative.

• Despite its groundbreaking nature, the newspaper faced severe financial challenges due to high postal rates and a lack of government patronage, leading to its closure on December 11, 1827.

• Early Indian Press:

• The first-ever newspaper published in India was the Bengal Gazette (also known as Hicky's Bengal Gazette), started by James Augustus Hicky in 1780.

• Before the rise of the Hindi press, newspapers in India were primarily published in English, Bengali, and Persian.

Important Points

• First Hindi Daily: While Udant Martand was the first weekly, the credit for the first Hindi daily newspaper goes to Samachar Sudhavarshan, which began publication in 1854 under the editorship of Shyam Sundar Sen.

• Regional Expansion: The Banaras Akhbar, published in 1844 by Raja Shiv Prasad ‘Sitare-Hind’, is considered the first Hindi newspaper issued from a Hindi-speaking region.

• Related Observances:

• National Press Day is celebrated on November 16 to commemorate the Press Council of India's establishment as a moral watchdog for the media.

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• World Press Freedom Day is observed globally on May 3 to raise awareness about the importance of freedom of the press and the rights of journalists.

• Vishwa Hindi Diwas (World Hindi Day) is celebrated on January 10, while National Hindi Diwas is observed on September 14 to mark the adoption of Hindi as an official language in 1949.

Q88. Answer: (b) Visakhapatnam

The correct answer is Visakhapatnam.

Key Points

• The 28th National Conference on e-Governance (NCeG) was held in Visakhapatnam, Andhra Pradesh, in September 2025.

• This prestigious annual event is organized by the Department of Administrative Reforms and Public Grievances (DARPG) in collaboration with the Ministry of Electronics and Information Technology (MeitY) and the host state government.

• The conference serves as a high-level platform for policy makers, industry leaders, and academia to deliberate on the latest trends in digital governance and the integration of emerging technologies in public administration.

• A key feature of the event is the presentation of the National Awards for e-Governance, which recognize excellence in implementing digital initiatives that improve the Ease of Living for citizens.

• The discussions at the 2025 conference focused on leveraging Artificial Intelligence (AI), Data Analytics, and Cloud Computing to enhance the efficiency and transparency of public service delivery.

Additional Information

• Department of Administrative Reforms and Public Grievances (DARPG):

• It is the nodal agency of the Government of India for administrative reforms and the redressal of public grievances.

• The department operates under the Ministry of Personnel, Public Grievances and Pensions.

• It is responsible for formulating policies and coordinating measures for administrative efficiency and e-governance across the country.

• National e-Governance Plan (NeGP):

• Launched in 2006, the NeGP aims to make all government services accessible to the common man in his locality through common service delivery outlets.

• It consists of several Mission Mode Projects (MMPs) at the central, state, and integrated levels to ensure efficiency, transparency, and reliability.

• Digital India Program:

• Launched in July 2015, this flagship program aims to transform India into a digitally empowered society and knowledge economy.

• The program focuses on three key vision areas: Digital Infrastructure as a Core Utility, Governance and Services on Demand, and Digital Empowerment of Citizens.

• Importance of e-Governance:

• It facilitates G2C (Government to Citizen), G2B (Government to Business), and G2G (Government to Government) interactions.

• Key tools include the UMANG app, DigiLocker, e-Hospital, and Aadhaar-enabled services, which reduce the need for physical visits to government offices.

Important Points

• The 27th National Conference on e-Governance was held in 2024 in Mumbai, Maharashtra, showing the rotating nature of the venue to different states.

• The National Awards for e-Governance usually include categories such as Government Process Re-engineering, Digital Transformation in State/UTs, and Academic/Research Institutions' contributions to e-governance.

• Visakhapatnam, also known as Vizag, is a major industrial city and the executive capital of Andhra Pradesh, often selected for high-profile technology and maritime summits.

• The theme of the conference typically aligns with the Prime Minister’s vision of Minimum Government, Maximum Governance.

Q89. Answer: (c) Pulses

The correct answer is Pulses.

Key Points

• In the Union Budget 2025-26, presented by the Union Finance Minister Nirmala Sitharaman on February 1, 2025, a comprehensive six-year support plan was announced specifically for Pulses.

• The primary objective of this initiative is to achieve Atmanirbharta (self-reliance) and significantly reduce the import dependency of India on essential legumes.

• This six-year mission focuses on increasing the domestic production of key varieties such as Tur (Arhar), Urad (Black Gram), and Masur (Lentil), which constitute a large portion of India's import bill.

• The government aims to expand the area under cultivation for these crops, especially in rainfed areas and rice-fallow regions, by

providing farmers with high-yielding climate-resilient seeds and technical support.

• The plan integrates the procurement process with the Minimum Support Price (MSP) mechanism to ensure that farmers receive remunerative prices, thereby incentivizing them to shift from water-intensive crops to pulses. Hence, the correct answer is Pulses.

Additional Information

• Pulses Production in India:

• India is currently the largest producer, consumer, and importer of pulses in the world.

• Major pulse-producing states include Madhya Pradesh, Rajasthan, Maharashtra, and Uttar Pradesh.

• Despite being a leader in production, India imports approximately 2 to 3 million tonnes of pulses annually from countries like Canada, Myanmar, and Mozambique to meet domestic demand.

• Oil Seeds (Comparison):

• While Oil seeds also receive significant government attention through the National Mission on Edible Oils - Oil Palm (NMEO-OP), the specific six-year plan highlighted in the 2025-26 Budget is dedicated to pulses.

• India faces a high import bill for edible oils, spending billions of dollars primarily on Palm oil, Soybean oil, and Sunflower oil.

• National Food Security Mission (NFSM):

• The NFSM-Pulses was launched in 2007-08 and has been instrumental in raising pulse production from 14.76 million tonnes in 2007 to over 27 million tonnes in recent years.

• The new six-year plan acts as an extension and intensification of these efforts to bridge the remaining supply-demand gap by the year 2031.

• Other Budget 2025-26 Agricultural Highlights:

• The budget proposed the digital public infrastructure for agriculture to cover 6 crore farmers and their lands within 3 years.

• A push for Natural Farming was also emphasized, aiming to bring 1 crore farmers into the fold of chemical-free agriculture over the next two years.

Important Points

• Nutritional Security: Pulses are a vital source of protein for the majority of the Indian population, making their affordability and availability a matter of nutritional security.

• Soil Health: Being leguminous crops, pulses help in nitrogen fixation, which improves soil fertility naturally and reduces the need for chemical fertilizers like Urea.

• Climate Resilience: Pulses are generally drought-tolerant and require less water compared to crops like Paddy or Sugarcane, making them ideal for the six-year support plan targeting sustainable agriculture.

Q90. Answer: (c) World Para Athletics Championships 2025

The correct answer is World Para Athletics Championships 2025.

Key Points

• The World Para Athletics Championships 2025 is set to be one of the most significant international sporting events hosted by India, marking a milestone in the country's journey toward becoming a global sporting hub.

• This event is the flagship competition for para-athletics globally and is organized under the aegis of World Para Athletics and the International Paralympic Committee (IPC).

• India’s selection as a host venue highlights the nation’s growing sporting infrastructure and its commitment to fostering inclusive sports for persons with disabilities.

• The championships involve thousands of elite athletes from over 100 countries competing in various track and field disciplines, making it one of the largest gatherings of para-athletes in the world.

• Hosting this event aligns with the Government of India’s initiatives like Target Olympic Podium Scheme (TOPS) and the Khelo India Para Games, aimed at identifying and nurturing talent at the grassroots level. Hence, the correct answer is World Para Athletics Championships 2025.

Additional Information

• Summer Universiade 2025 (FISU World University Games):

• The 32nd edition of the Summer Universiade is scheduled to take place in the Rhine-Ruhr region of Germany in 2025.

• It is an international multi-sport event organized for university athletes by the International University Sports Federation (FISU).

• Commonwealth Games 2026:

• Originally awarded to Victoria, Australia, the state withdrew as host in 2023 due to rising costs.

• The 2026 Games are now confirmed to be held in Glasgow, Scotland, featuring a more compact program to ensure financial sustainability.

• FIFA Women’s World Cup:

• The most recent FIFA Women’s World Cup was held in 2023, hosted jointly by Australia and New Zealand.

• The next edition is scheduled for 2027 and will be hosted by Brazil; there is no senior FIFA Women’s World Cup scheduled for

the year 2025.

• Para-Sports in India:

• India has seen a massive surge in para-sports performance, winning a record 19 medals at the Tokyo 2020 Paralympics and 29 medals at the Paris 2024 Paralympics.

• The Paralympic Committee of India (PCI) is the primary body responsible for selecting athletes and promoting the Paralympic movement within the country.

Important Points

• Significance of 2025: The year 2025 is pivotal for Indian athletics as hosting the World Para Championships serves as a precursor to India's potential bid for the 2036 Olympic and Paralympic Games.

• Inclusivity and Accessibility: One of the core themes of the 2025 championships in India is to promote the Sugamya Bharat Abhiyan (Accessible India Campaign), ensuring that sporting venues meet international accessibility standards for all citizens.

• Economic Impact: International events of this magnitude boost sports tourism and contribute to the local economy through the influx of athletes, coaches, officials, and international media.

Q91. Answer: (c) Parvati Tirkey

The correct answer is Parvati Tirkey.

Key Points

• The Sahitya Akademi announced the winners of the Yuva Puraskar for the year 2025 in June 2025, recognizing young literary talents across various Indian languages.

• Parvati Tirkey was conferred with the prestigious Yuva Puraskar in the Hindi language category for her exceptional poetry collection titled "Phir Ugna".

• The collection "Phir Ugna" is noted for its deep connection to tribal identity, nature, and the resilience of indigenous communities, reflecting a modern perspective on traditional roots.

• To be eligible for the Yuva Puraskar, the author must be 35 years of age or below as of January 1st of the year of the award. Hence, the statement regarding the age limit is a critical criterion for this selection.

• The award presented to Parvati Tirkey includes a copper plaque and a cash prize of Rs. 50,000, which is aimed at encouraging young writers to continue their contribution to Indian literature.

Additional Information

• Sahitya Akademi Yuva Puraskar:

• Instituted in the year 2011, this award aims to promote and recognize the works of young authors in 24 Indian languages, including those listed in the Eighth Schedule of the Constitution of India, as well as English and Rajasthani.

• The selection process involves a three-member jury for each language, ensuring a fair and rigorous evaluation of contemporary literature produced by the youth.

• Other Noteworthy Winners (2025):

• Mayur Khavdu: Recognized for his contributions to Gujarati literature, demonstrating the diversity of the Yuva Puraskar across different regional aesthetics.

• Akhil P Dharmajan: A prominent voice in Malayalam literature who has gained significant popularity for his narrative style and storytelling.

• Subrat Senapati: Awarded for his work in Odia, showcasing the rich literary heritage of eastern India.

• Sahitya Akademi (National Academy of Letters):

• Founded on March 12, 1954, it is an autonomous organization under the Ministry of Culture, Government of India.

• It is the highest body in the country for the promotion of literature and maintains a library that is one of the largest multi-lingual libraries in India.

Important Points

• The Sahitya Akademi also confers other major awards such as the Main Sahitya Akademi Award and the Bal Sahitya Puraskar (for children's literature).

• The theme of "Phir Ugna" (meaning "To Grow Again") symbolizes a renaissance of tribal consciousness and environmental ethics in the 21st century.

• Awards like the Yuva Puraskar are essential for identifying emerging voices that represent the changing socio-political landscape of India through creative expression.

• The Hindi category remains one of the most competitive sections due to the vast number of publications and the widespread demographic of the Hindi-speaking belt.

Q92. Answer: (b) Godrej Aerospace

The correct answer is Godrej Aerospace.

Key Points

• In November 2025, Godrej Aerospace, a business unit of Godrej & Boyce, successfully delivered the first human-rated Vikas engine to the Indian Space Research Organisation (ISRO).

• This delivery is a critical milestone for the Gaganyaan mission, which is India's first human spaceflight program designed to send Indian astronauts into Low Earth Orbit (LEO).

• The Vikas engine is a high-thrust liquid-propellant engine used to power the core second stage of the LVM3 (Launch Vehicle Mark-3), which is the heavy-lift launcher chosen for the mission.

• The term human-rated implies that the engine has been modified and tested under more stringent parameters to ensure 100% reliability and crew safety during the ascent phase of the flight.

• Godrej Aerospace has been a long-standing partner of ISRO, contributing to the development of liquid propulsion engines for various launch vehicles including PSLV and GSLV since the 1980s.

Additional Information

• Gaganyaan Mission:

• The mission aims to demonstrate India's indigenous capability to undertake human spaceflight missions to Low Earth Orbit.

• The plan involves sending a three-member crew to an altitude of 400 km for a 3-day mission, followed by a safe landing in Indian sea waters.

• The project was officially announced by Prime Minister Narendra Modi during his Independence Day speech in 2018.

• Vikas Engine Technology:

• The Vikas engine (named after Vikram Ambalal Sarabhai) is based on the Viking engine technology licensed from France in the 1970s.

• It uses UDMH (Unsymmetrical Dimethylhydrazine) as fuel and Nitrogen Tetroxide (N_2O_4) as the oxidizer.

• The human-rated version features enhanced structural integrity and advanced health monitoring systems to detect any anomalies in real-time.

• Industrial Collaboration:

• While Godrej Aerospace manufactures the liquid engines, Hindustan Aeronautics Limited (HAL) is responsible for fabricating the crew module and service module structures.

• Larsen & Toubro (L&T) contributes by manufacturing the solid motor casings (S200) for the LVM3 rocket.

Important Points

• Safety Protocols: The Gaganyaan launch vehicle incorporates a Crew Escape System (CES), which is designed to pull the crew module away from the rocket in case of an emergency on the launch pad or during the flight.

• Manufacturing Location: Godrej Aerospace operates its sophisticated manufacturing facility in Vikhroli, Mumbai, where it produces complex cryogenic and liquid propulsion components.

• Future Goals: The success of the human-rated Vikas engine and the subsequent Gaganyaan mission are stepping stones toward building the Bharatiya Antariksha Station (BAS) by 2035 and landing an Indian on the Moon by 2040.

• Economic Impact: These collaborations with private sector entities like Godrej Aerospace highlight the "Make in India" initiative in the high-technology space and defense sectors.

Q93. Answer: (a) 2.6%

The correct answer is 2.6%.

Key Points

• The Reserve Bank of India (RBI) released its Monetary Policy Report (MPR) in October 2025, providing a comprehensive outlook on the Indian economy for the upcoming fiscal years.

• According to the report, the CPI inflation projection for the financial year FY 2025-26 has been revised to 2.6%.

• This downward revision is attributed to favorable base effects, an improvement in supply-side management, and the expectation of a normal monsoon impacting food prices positively.

• The Monetary Policy Committee (MPC) noted that the headline inflation is expected to remain well within the RBI's target range of 2% to 6%, with the medium-term target being 4%.

• The RBI utilizes these projections to determine the Policy Repo Rate and the overall monetary policy stance, which in this report remained focused on price stability and supporting sustainable growth.

Additional Information

• Consumer Price Index (CPI):

• CPI is the primary measure used by the RBI to monitor retail inflation in India. It tracks the change in the price of a fixed basket of goods and services consumed by households.

• The data for CPI is compiled and released monthly by the National Statistical Office (NSO) under the Ministry of Statistics and Programme Implementation (MoSPI).

• Monetary Policy Committee (MPC):

• The MPC is a six-member committee constituted by the Central Government under Section 45ZB of the amended RBI Act, 1934.

• It consists of three members from the RBI, including the Governor (who acts as the ex-officio chairperson), and three external members appointed by the Government of India.

• Inflation Targeting Framework:

• In 2016, India adopted a flexible inflation targeting (FIT) framework. The primary objective is to maintain price stability while keeping in mind the objective of growth.

• The current inflation target is set at 4% with a tolerance band of +/- 2%, meaning inflation should stay between 2% and 6%.

Important Points

• The Monetary Policy Report (MPR) is a statutory document published by the Reserve Bank of India every six months (typically in April and October).

• It explains the sources of inflation and provides forecasts for inflation and GDP growth for a period of six to eighteen months ahead.

• For FY 2025-26, the Real GDP growth is also a key metric monitored alongside the 2.6% inflation projection to ensure the economy does not overheat or stagnate.

• A 2.6% projection is significant as it sits below the 4% midpoint target, suggesting a period of low and stable prices which can boost consumer confidence and investment.

• The fiscal year 2025-26 in India commences on April 1, 2025, and concludes on March 31, 2026.

Q94. Answer: (c) 15%

The correct answer is 15%.

Key Points

• The Karnataka Government has officially raised the housing reservation quota for religious minorities from the previous 10% to 15%.

• This decision was announced in June 2025 to ensure better accessibility to affordable housing for minority communities across the state.

• The move was spearheaded by the Minister for Housing and Minority Welfare, Zameer Ahmed Khan, who proposed the enhancement to the Karnataka Housing Board (KHB).

• The revised reservation applies to the allotment of residential sites and houses developed by the Department of Housing and the KHB in various urban and rural projects.

• This policy change aims to provide social security and promote inclusive growth by addressing the specific housing needs of the minority population in Karnataka.

Additional Information

• Karnataka Housing Board (KHB):

• The KHB was established under the Karnataka Housing Board Act, 1962, with the primary objective of providing housing to the people of Karnataka at affordable prices.

• It operates as a statutory body under the Government of Karnataka, focusing on the creation of layouts and the construction of houses for various income groups, including EWS (Economically Weaker Sections), LIG (Low Income Group), and MIG (Middle Income Group).

• Religious Minorities in Karnataka:

• In Karnataka, the religious minority category includes communities such as Muslims, Christians, Jains, Buddhists, Sikhs, and Parsis.

• The increase by 5% (from 10% to 15%) is part of a broader welfare strategy managed by the Minority Welfare Department.

• Significance of the Move:

• The increase in the quota ensures that a higher proportion of state-funded housing stock is diverted towards the marginalized sections within the minority communities.

• It reflects the state's commitment to Article 15 and Article 16 of the Constitution of India, which allow the state to make special provisions for the advancement of any socially and educationally backward classes.

• The allotment process for these reserved categories is typically managed through a lottery system or seniority-based applications overseen by the Directorate of Minorities.

• Welfare Context:

• This housing reservation is often coupled with other schemes such as the Basava Vasati Yojana and the Dr. B.R. Ambedkar Niwas Yojana, which provide financial assistance for house construction.

• The Karnataka State Housing Corporation Limited (KSHCL) acts as the implementing agency for several of these social housing schemes alongside the KHB.

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Q95. Answer: (c) Andhra Pradesh tribal students

The correct answer is Andhra Pradesh tribal students.

Key Points

• A historic Guinness World Record was established by the Tribal Welfare Department of Andhra Pradesh during the celebration of the 10th International Day of Yoga.

• The record involved a massive gathering of 22,631 tribal students from various Tribal Welfare Residential Educational Institutions (Gurukulams) across the state.

• The students performed 108 Surya Namaskars (Sun Salutations) simultaneously, showcasing remarkable endurance, discipline, and synchronization. Hence, the correct answer is Andhra Pradesh tribal students.

• The event took place on June 21, 2024, and was officially adjudicated and recognized by the Guinness World Records representatives for the category of the largest simultaneous performance of this specific yogic sequence by a tribal student group.

• This initiative was designed to promote physical fitness, mental well-being, and awareness of India's cultural heritage among the youth belonging to marginalized communities.

Additional Information

• Surya Namaskar (Sun Salutation):

• It is a comprehensive yogic practice consisting of a sequence of 12 powerful postures (asanas).

• The practice is known to improve blood circulation, enhance flexibility, and strengthen the musculoskeletal system.

• Performing 108 rounds is considered a significant spiritual and physical milestone in yoga tradition, often associated with the completion of a "mala" of repetitions.

• International Day of Yoga (IDY):

• The idea was first proposed by Prime Minister Narendra Modi during his address at the 69th session of the United Nations General Assembly (UNGA) in 2014.

• The UN declared June 21 as the International Day of Yoga because it is the Summer Solstice, the longest day of the year in the Northern Hemisphere, which holds special significance in many parts of the world.

• The first IDY was observed globally on June 21, 2015.

• Tribal Welfare in Andhra Pradesh:

• The Andhra Pradesh Tribal Welfare Residential Educational Institutions Society (APTWREIS), also known as Gurukulam, plays a vital role in providing quality education to students from Scheduled Tribes (ST).

• These institutions focus on holistic development, including sports, arts, and traditional practices like yoga, to ensure tribal youth can compete at national and international levels.

Important Points

• Data and Scale: The performance involved over 22,000 students performing 108 cycles, which translates to a collective total of over 2.4 million individual postures performed within a single event window.

• Guinness Certification: The certificate was presented to the Tribal Welfare Department officials, marking a proud moment for the state of Andhra Pradesh in the global arena of health and wellness.

• Comparison: While other states like Gujarat have also set records for Surya Namaskar (such as performing at 108 different locations simultaneously), the specific record for 22,000+ tribal students performing 108 repetitions is unique to the Andhra Pradesh 2024 initiative.

Q96. Answer: (d) Palestine

The correct answer is Palestine.

Key Points

• The United Nations General Assembly (UNGA) has repeatedly passed resolutions urging the Security Council to reconsider the full membership of Palestine, targeting its admission as the 194th member state.

• In May 2024, a landmark resolution was adopted with 143 votes in favor, declaring that the State of Palestine is qualified for membership in accordance with Article 4 of the UN Charter.

• Palestine has held the status of a Non-member Observer State since November 29, 2012, following a vote in the General Assembly.

• The push in 2025 reflects a continued international effort to grant Palestine full rights and privileges within the United Nations, including the right to be seated among member states in alphabetical order and the right to propose agenda items.

• To become a full member, a state must receive a recommendation from the UN Security Council (where no permanent member exercises a veto) and a two-thirds majority vote in the General Assembly.

Additional Information

• South Sudan:

• Located in East-Central Africa, South Sudan is currently the world's youngest sovereign state.

• It gained independence from Sudan on July 9, 2011, following a referendum.

• It was admitted as the 193rd member of the United Nations on July 14, 2011.

• Vatican City (Holy See):

• The Holy See holds the status of a Permanent Observer State at the United Nations.

• Unlike Palestine, the Vatican has historically maintained its observer status to preserve its neutrality in international political conflicts while still participating in diplomatic discourse.

• It is the smallest independent state in the world by both area and population.

• Kosovo:

• Kosovo declared independence from Serbia in February 2008.

• While it is recognized as a state by over 100 UN member countries, it is not a member of the United Nations.

• Its path to membership is complicated by the lack of universal recognition and potential vetoes from permanent members of the Security Council like Russia and China.

• UN Membership Criteria:

• According to the UN Charter, membership is open to all "peace-loving states" which accept the obligations contained in the Charter.

• The United Nations currently consists of 193 member states, with the last addition occurring in 2011.

Important Points

• The P5 (Permanent Five) members of the Security Council—the United States, United Kingdom, France, China, and Russia—hold the power to block any application for full membership.

• The State of Palestine is recognized as a sovereign state by more than 140 of the 193 UN member states as of 2024-2025.

• Full membership would allow Palestine to vote on resolutions and participate fully in all UN committees and specialized agencies.

Q97. Answer: (b) Bastar

The correct answer is Bastar.

Key Points

• In August 2025, the Chief Minister of Chhattisgarh took proactive measures to address the crisis caused by heavy monsoon rains and subsequent flooding in the southern part of the state.

• The Chief Minister specifically directed the administration and revenue officials to provide immediate relief and assistance to the families affected by floods in the Bastar division.

• The Bastar division, known for its complex topography and dense river networks, faced significant challenges as major rivers like the Indravati and Sabari reached danger marks, isolating several villages.

• Instructions were issued to ensure the availability of essential commodities, such as food grains, clean drinking water, and medicines, in the relief camps established across the affected districts.

• The government emphasized the implementation of the Revenue Book Circular (RBC) 6-4, which mandates financial compensation for loss of life, livestock, crops, and property damage caused by natural calamities. Hence, the correct answer is Bastar.

Additional Information

• Divisions of Chhattisgarh:

• Chhattisgarh is administratively divided into five major divisions: Raipur, Bilaspur, Durg, Bastar, and Surguja.

• The Bastar division is the southernmost division of the state and comprises districts like Bastar, Kanker, Dantewada, Sukma, Bijapur, Narayanpur, and Kondagaon.

• Surguja division is located in the northern part of the state, while Bilaspur and Raipur occupy the central plains.

• Geographical Vulnerability:

• The Bastar region is part of the Dandakaranya plateau and is highly prone to flash floods due to its hilly terrain and the presence of the Godavari river basin tributaries.

• During the Southwest Monsoon, this region often receives heavy rainfall, leading to the submergence of low-lying bridges (culverts) and cutting off connectivity to the Sukma and Bijapur districts.

• Disaster Management Framework:

• The State Disaster Response Force (SDRF) and the District Administration work in tandem to execute rescue operations using motorboats and helicopters if necessary.

• The Chhattisgarh government utilizes digital portals to track rainfall data and water levels in dams to issue early warnings to villagers residing near riverbanks.

Important Points

• Relief Norms (RBC 6-4): This is a critical legal provision in Chhattisgarh that defines the numerical value of compensation. For

instance, it provides fixed financial aid for the repair of pucca and kutcha houses partially or fully destroyed by floods.

• Strategic Location: The Bastar division shares borders with Odisha, Telangana, and Maharashtra. Coordination with these states is essential when water is released from shared reservoirs or when rivers like the Godavari swell.

• Health Initiatives: Post-flood management in 2025 also involved the deployment of mobile medical units to prevent the outbreak of water-borne diseases like cholera and malaria in the tribal belts of Bastar.

• Agricultural Impact: Since a large population in Bastar depends on paddy and minor forest produce, the August 2025 directives specifically included a mandate for Agriculture Department officials to assess crop loss for insurance claims under the Pradhan Mantri Fasal Bima Yojana.

Q98. Answer: (d) Allianz Arena, Munich

The correct answer is Allianz Arena, Munich.

Key Points

• The 2024–25 UEFA Champions League final is scheduled to be held at the Allianz Arena in Munich, Germany.

• The match is slated to take place on May 31, 2025, marking the conclusion of the 70th season of Europe's premier club football tournament organized by UEFA.

• The Allianz Arena previously hosted the Champions League final in 2012, famously known as the "Finale dahoam," where Chelsea defeated Bayern Munich.

• Munich was originally designated to host the 2023 final, but due to the displacement of venues caused by the COVID-19 pandemic, its hosting rights were pushed back to 2025.

• The 2024–25 season is particularly significant as it introduces a new competition format, moving away from the traditional group stage to a 36-team league phase.

Additional Information

• Wembley Stadium (London):

• Located in London, United Kingdom, it hosted the 2024 Champions League final between Real Madrid and Borussia Dortmund.

• It has a seating capacity of approximately 90,000 and holds the record for hosting the most finals in the tournament's history. Hence, statement 1 is incorrect.

• Santiago Bernabéu (Madrid):

• The iconic home of Real Madrid CF in Spain, it last hosted a Champions League final in 2010.

• The stadium recently underwent a massive technological renovation featuring a retractable roof and pitch. Hence, statement 2 is incorrect.

• Camp Nou (Barcelona):

• Home to FC Barcelona, this stadium is currently under a major reconstruction project known as Espai Barça.

• It hosted the famous 1999 final where Manchester United defeated Bayern Munich in dramatic fashion. Hence, statement 3 is incorrect.

• Allianz Arena Features:

• Commonly known as the Fußball Arena München for UEFA competitions due to sponsorship regulations, it is the first stadium in the world with a full color-changing exterior.

• It has a capacity of about 67,000 for international matches and serves as the home ground for FC Bayern Munich. Hence, statement 4 is correct.

Important Points

• New UEFA Format (2024/25):

• The 2024/25 season marks the transition to the "Swiss-model", where teams play eight matches against eight different opponents in a single league table.

• The top eight teams advance automatically to the round of 16, while those finishing 9th to 24th enter a two-legged play-off.

• Historical Context:

• The UEFA Champions League was rebranded from the European Champion Clubs' Cup in 1992.

• Real Madrid holds the record for the most titles in the history of the competition, having won their 15th trophy in 2024.

• Selection Process:

• Venues for the finals are selected by the UEFA Executive Committee based on various criteria, including stadium infrastructure, capacity, accessibility, and security.

• The 2026 final is scheduled to be held at the Puskás Aréna in Budapest, Hungary.

Q99. Answer: (a) Expanding green cover to combat desertification

The correct answer is Expanding green cover to combat desertification.

Key Points

• The Aravalli Green Wall Project is a major environmental initiative aimed at creating a 1,400 km long and 5 km wide green belt buffer around the Aravalli Hill Range.

• A key aim of the project is to combat desertification and land degradation by planting native trees and shrubs to act as a barrier against the eastward expansion of the Thar Desert. Hence, statement 1 is correct.

• The project is specifically designed to cover four Indian states: Haryana, Rajasthan, Gujarat, and Delhi, where the Aravalli mountains play a critical role in the local climate.

• Launched around the context of World Environment Day and International Day of Forests, it involves the rejuvenation of water bodies such as ponds, lakes, and marshes within the Aravalli landscape to improve local biodiversity.

• The project does not involve building embankments in Punjab, nor is it focused on vertical gardens in Mumbai or national parks in the Himalayas. Hence, statements 2, 3, and 4 are incorrect.

Additional Information

• Inspiration from Africa: This project is inspired by the Great Green Wall initiative in Africa, which aims to combat desertification across the Sahel region from Senegal to Djibouti.

• Ecological Importance of Aravallis: The Aravalli Range is one of the oldest fold mountains in the world. It acts as a natural shield against dust storms originating from the Thar Desert towards the National Capital Region (NCR).

• Species Selection: The afforestation efforts focus on native species like Neem, Peepal, Banyan, and Babool, which are well-adapted to the local semi-arid climate and support indigenous fauna.

• Sustainable Development: By involving local communities and Panchayati Raj Institutions, the project promotes agro-forestry and sustainable land management practices to enhance the livelihoods of those living near the Aravalli region.

Important Points

• UNCCD Commitment: The Aravalli Green Wall Project is a vital part of India's commitment under the United Nations Convention to Combat Desertification (UNCCD) to restore 26 million hectares of degraded land by the year 2030.

• Carbon Sink: The initiative helps in creating additional carbon sinks to mitigate the effects of climate change, aligning with India's goals under the Paris Agreement.

• Groundwater Recharge: One of the critical functions of the Aravalli hills is acting as a groundwater recharge zone; the green wall will help increase the water table in the water-stressed regions of North India.

• Land Degradation Neutrality: By addressing soil erosion and improving vegetation cover, the project works toward achieving Land Degradation Neutrality (LDN) in the targeted geographical locations.

Q100. Answer: (d) 99

The correct answer is 99.

Key Points

• According to the Sustainable Development Report 2025, India has secured the 99th rank in the Sustainable Development Goals (SDG) Index. This marks the first time India has entered the top 100 nations since the inception of the index.

• The report is published annually by the Sustainable Development Solutions Network (SDSN), which operates under the auspices of the United Nations Secretary-General.

• India's improvement in the rankings is attributed to its consistent progress in goals related to SDG 1 (No Poverty), SDG 7 (Affordable and Clean Energy), and SDG 12 (Responsible Consumption and Production).

• The index tracks the performance of 193 United Nations Member States, assigning a score out of 100 based on their progress toward achieving the 17 Sustainable Development Goals by the 2030 deadline.

• India's entry into the top 100 reflects the successful implementation of various social welfare schemes and a robust focus on digital public infrastructure, which has accelerated financial inclusion across the country.

Additional Information

• Sustainable Development Goals (SDGs):

• The SDGs, also known as the Global Goals, were adopted by all United Nations Member States in September 2015 as a universal call to action to end poverty and protect the planet.

• There are 17 Goals and 169 targets that address global challenges, including climate change, economic inequality, innovation, and sustainable consumption.

• Monitoring in India:

• In India, NITI Aayog is the nodal agency responsible for the implementation and monitoring of SDGs at the national level.

• NITI Aayog releases its own SDG India Index, which ranks States and Union Territories to promote competitive federalism and track sub-national progress.

• Global Leaders:

• Countries that traditionally dominate the top of the SDG Index include Finland, Sweden, Denmark, and Norway, primarily due to their high social security and environmental standards.

• The Sustainable Development Solutions Network (SDSN) was launched in 2012 to mobilize global scientific and technological

expertise to promote practical solutions for sustainable development.

• Significance of the 2030 Agenda:

• The 2030 Agenda for Sustainable Development provides a shared blueprint for peace and prosperity for people and the planet, now and into the future.

• Recent reports emphasize the need for international financial reform to help developing countries close the SDG financing gap.

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