RRB Group D Official Paper (Held On: 01 Dec, 2025 Shift 1) (Previous Year Paper)

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

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GENERAL SCIENCE

Q1. During the process of electrolytic refining of metals, on passing the current through the electrolyte, the impure metal from the _____ dissolves into the electrolyte.

(a) both anode and cathode
(b) cathode
(c) salt bridge
(d) anode

Q2. Based on function, which of the following combinations represent all types of animal tissues found in humans?

(a) Epithelial tissue, Connective tissue and Reproductive tissue
(b) Epithelial tissue, Connective tissue, Muscular tissue and Nervous tissue
(c) Epithelial tissue, Muscular tissue and Glandular tissue
(d) Epithelial tissue, Connective tissue and Skeletal tissue

Q3. Which plastids contain pigments that give plants their yellow, orange or red colours?

(a) Amyloplasts
(b) Chromoplasts
(c) Leucoplasts
(d) Chloroplasts

Q4. Which property of isobars is always different?

(a) Mass number
(b) Total number of nucleons
(c) Total number of electrons
(d) Atomic number

Q5. Which gas is mainly responsible for the greenhouse effect and is released when fossil fuels are burned?

(a) Carbon dioxide
(b) Nitrogen
(c) Hydrogen
(d) Oxygen

Q6. If tall (T) is dominant over short (t), and round seeds (R) are dominant over wrinkled (r), identify the genotype of a plant that shows short height and round seeds.

(a) Ttrr
(b) ttRR
(c) TtRR
(d) TtRr

Q7. Which of the following observations confirms that a solution is acidic?

(a) Methyl orange: yellow, Phenolphthalein: pink, Litmus: blue
(b) Methyl orange: red, Phenolphthalein: colourless, Litmus: red
(c) Methyl orange: yellow, Phenolphthalein: colourless, Litmus: blue
(d) Methyl orange: red, Phenolphthalein: pink, Litmus: red

Q8. What is the main function of the vas deferens in the male reproductive system?

(a) Regulating body temperature
(b) Seminal fluid secretion
(c) Sperm production
(d) Transporting sperm from the epididymis to the urethra

Q9. Which of the following statements is true about magnetic field lines?

(a) Magnetic field is weaker where lines are close.
(b) Field lines inside a magnet move from north to south.
(c) Field lines intersect at poles.
(d) Field lines outside a magnet move from north to south.

Q10. What is the role of lysosomes in a cell?

(a) To store proteins
(b) To produce ATP
(c) To transport products
(d) To digest foreign material

Q11. What is the formula of formic acid?

(a) C2H6O
(b) HCOOH
(c) C2H4O2
(d) C2H5OH

Q12. Which of the following is NOT considered an organic compound?

(a) Sodium carbonate (Na2CO3)
(b) Acetic acid (CH3COOH)
(c) Methane (CH4)
(d) Ethanol (C2H5OH)

Q13. Which of the following statements is INCORRECT about uniform motion?

(a) The acceleration is zero
(b) The velocity remains unchanged
(c) The body covers equal distances in equal intervals of time
(d) The speed varies continuously with time

Q14. Which of the following statements is NOT correct?

(a) In a prism, the incident ray and emergent ray are always parallel.
(b) The angle of deviation is the angle between the incident ray and emergent ray.
(c) In a prism, the emergent ray bends towards the base of the prism when the incident ray is coming from the base side.
(d) In a prism, dispersion can occur if white light is used.

Q15. An object is thrown straight up and reaches a maximum height of 20 m. If we take g = 10 m/sec², what was the initial speed of the object when it was thrown?

(a) 40 m/sec
(b) 30 m/sec
(c) 20 m/sec
(d) 10 m/sec

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Q16. An object is placed 30 cm in front of a concave mirror of focal length 15 cm. What will be the image distance v ?

(a) –30 cm
(b) –15 cm
(c) +15 cm
(d) +30 cm

Q17. A net horizontal force of 20 N acts on a 4 kg block initially at rest for 5 s. What is the block's final speed?

(a) 20 m/s
(b) 30 m/s
(c) 50 m/s
(d) 25 m/s

Q18. Which of the following correctly defines the amplitude of a wave?

(a) The number of vibrations per second
(b) The speed with which the wave travels
(c) The distance between two consecutive crests
(d) The maximum displacement of the particle from its mean position

Q19. Two wires of the same material have equal lengths but their cross-sectional areas are in the ratio 1 : 4. The ratio of their resistances will be:

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

Q20. Which of the following carbon compounds burns with a blue, non-sooty flame under normal conditions?

(a) Ethanol
(b) Kerosene
(c) Charcoal
(d) Diesel

Q21. A machine does ' W ' joule work in time ' t ' seconds. The power ' P ' watt of the machine is given correctly by which of the following relations?

(a) $P = W^2/t$
(b) $P = W \times t$
(c) $P = W/t$
(d) $P = W^2t$

Q22. An atom has 11 protons, 11 electrons and 12 neutrons. What is the mass number of that atom?

(a) 23
(b) 12
(c) 11
(d) 24

Q23. Which of the following ensures genetic variation in sexually reproducing animals?

(a) Gametes are formed by mitosis
(b) Fertilisation occurs inside the body
(c) Offspring receive genes from both parents
(d) Only one parent is involved

Q24. According to Bohr's Model of atom, electrons revolve around the nucleus in _____.

(a) discrete orbits
(b) random path
(c) straight lines
(d) elliptical path

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Q25. Which of the following is a key goal of conserving forests and biodiversity?

(a) To preserve inherited biodiversity
(b) To expand national parks
(c) To allow more industrial use of forests
(d) To promote tourism

MATHEMATICS

Q26. Pushpraj and Himani together invested Rs. 34,100 in a business. At the end of the year, out of a total profit of Rs. 5,400, Pushpraj's share was Rs. 2,700. What was the investment of Pushpraj?

(a) Rs. 18,870
(b) Rs. 17,050
(c) Rs. 17,260
(d) Rs. 15,505

Q27. 6 men can complete a piece of work in 5 days while 2 women can do it in 15 days. In how many days can 3 women and 3 men complete it?3872

(a) 4 days
(b) 14 days
(c) 5 days
(d) 15 days

Q28. In quadrilateral PQRS, the bisectors of angle R and angle S meet at the point T (inside the quadrilateral) and angle STR = 13.5°. If the ratio of angle P to angle Q is 4 : 5, then what is the difference between the measures of angle Q and angle P ?

(a) 5°
(b) 8°
(c) 4°
(d) 3°

Q29. If the mean and mode are equal for the given data. Find x (x<6).

Class Interval	15-25	25-35	35-45
Quantity	6	10	x

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

Q30. Find the area of a triangle whose sides are in the ratio 28 : 23 : 35 and its perimeter is 516 cm.

(a) 720√258 cm^2
(b) 650√367 cm^2
(c) 420√217 cm^2
(d) 540√319 cm^2

Q31. Raju walks to his office 3.5 km away from home. In the morning, he covers the distance in 1.5 hours, whereas, while returning home in the evening, he takes 30 more minutes to cover the same distance. Find his average speed (in km/hr) during the two-way journey.

(a) 2.5
(b) 3.5
(c) 3
(d) 2

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Q32. Three numbers are in the ratio 17 : 12 : 6 and the sum of these numbers is 1820. Find the middle number.5294

(a) 624
(b) 621
(c) 622
(d) 623

Q33. The product of two consecutive odd numbers is 16383. Which is the smaller one?

(a) 129
(b) 125
(c) 123
(d) 127

Q34. A and B working together can do a piece of work in 4 days. B alone can do the same work in 20 days. How long (in days) will A alone take to do double the work?2530

(a) 13
(b) 11
(c) 5
(d) 10

Q35. The ratio of the present ages of two cousins is 3 : 2. After 6 years, the ratio will become 5 : 4. What was the sum of their ages (in years) 4 years ago?

(a) 5
(b) 11
(c) 7
(d) 9

Q36. A fruit seller purchases lemons at 2 for a rupee and sells them at 5 for three rupees. Find his profit percentage.

(a) 18
(b) 24
(c) 22
(d) 20

Q37. If the ratio of two numbers is 7 : 8, and their HCF is 32, then their LCM is:

(a) 1783
(b) 1792
(c) 1833
(d) 1809

Q38. A ladder is leaning against a wall, making an angle of 60° with the ground. If the foot of the ladder is 5 m away from the wall, find the length of the ladder.

(a) 10 m
(b) 20 m
(c) 12 m
(d) 15 m

Q39. The perimeter (in cm) of a right-angled triangle whose sides that make the right angle are 18 cm and 24 cm, is:

(a) 68
(b) 79
(c) 60
(d) 72

Q40. A dealer allowed a 73% discount on an article and was still able to manage a 56% profit. Find the ratio of the cost price to listed price.

(a) 6 : 57
(b) 9 : 52

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(c) 12 : 54
(d) 12 : 59

Q41. What would the annual interest accrued on a deposit of Rs. 3,500 in a bank that pays a 17% per annum rate of simple interest be?
(a) Rs. 595
(b) Rs. 545
(c) Rs. 495
(d) Rs. 615

Q42. If 20% of a number is added to 78, then the result is the same number. 80% of the same number is:
(a) 88
(b) 108
(c) 98
(d) 78

Q43. A train 1439 m long is running at 36 km/hr. How long will it take to clear a 1331 m long platform completely?3712
(a) 282 seconds
(b) 281 seconds
(c) 277 seconds
(d) 272 seconds

Q44. The marked price of a chair is Rs. 7,600, which is 25% above the cost price. It is sold at a discount of 4% on the marked price. Find the profit percentage.
(a) 20%
(b) 21%
(c) 19%
(d) 22%

Q45. The cost of a washing machine is 50% less than the cost of a TV. If the cost of the washing machine increases by 83% and that of the TV decreases by 38%, then what is the percentage change in the total cost of 8 washing machines and 4 TVs?
(a) Increase by 26%
(b) Increase by 22.5%
(c) Decrease by 27%
(d) Decrease by 19%

Q46. Simplify: $x^2 - (3x - 2)(x + 5)$
(a) $-x^2 - 13x + 10$
(b) $-2x^2 - 11x + 10$
(c) $-2x^2 - 13x + 10$
(d) $2x^2 - 13x + 10$

Q47. The salary of a person was decreased by 30% and subsequently increased by 30% for 2 years. What is the percentage change in the salary?
(a) Increase of 18.3%
(b) Decrease of 34.5%
(c) Increase of 21.7%
(d) Decrease of 28.9%

Q48. Simplify the following:
(5^(3x+4) + 125^(x+1))/(125^(x+1) - 5^(3x+2))
(a) 8
(b) 7.5
(c) 5

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(d) 10

Q49. The arithmetic mean of the observations 42, 97, 57, 62, 52, 13, 44, 23 and 69 is:

(a) 51
(b) 48
(c) 45
(d) 44

Q50. A five digit number 761xy is divisible by 90. Find (x + y).

(a) 10
(b) 9
(c) 5
(d) 4

GENERAL INTELLIGENCE & REASONING

Q51. If + means −, − means ×, × means ÷ and ÷ means +, then what will come in place of the question mark (?) in the following equation?

113 − 9 ÷ 17 + 519 × 3 = ?

(a) 858
(b) 861
(c) 869
(d) 852

Q52. 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 pathways are roads.

No pathway is a garden.

Conclusions:

(I): Some gardens are roads.

(II): All roads are gardens.

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

Q53. What should come in place of the question mark (?) in the given series?

621 623 627 633 641 ?

(a) 651
(b) 647
(c) 649
(d) 645

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

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

(a) PS-MQ
(b) JM-GL
(c) NQ-KO
(d) LO-IM

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Q55. In a row of people all facing north, Aftab is 18^(th) from the right end. Apoorva is 28^(th) from the right end. Apoorva is exactly between Aftab and Piyali. If Piyali is 12^(th) from the left end of the line, how many people are there in the row?

(a) 47
(b) 46
(c) 49
(d) 48

Q56. A, B, C, R, S, T and U are sitting around a circular table, facing the centre of the table. R sits to the immediate left of U. B sits to the immediate left of C. C sits second to the left of T. A sits third to the left of U. Who sits third to the right of S?

(a) U
(b) T
(c) A
(d) C

Q57. A, B, C, D, W, X and Y are sitting around a circular table facing the centre of the table.

A sits fourth to the left of Y. W sits fourth to the right of C. Only two people sit between Y and C when counted from the left of Y. X is not an immediate neighbour of W or Y. D is not an immediate neighbour of X. Who sits third to the right of B?

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

Q58. If each of the digits in the number 243178569 is arranged in descending order from left to right, then what will be the sum of the digits which are second from the right and third from the left in the new number thus formed?

(a) 10
(b) 16
(c) 9
(d) 14

Q59. What should come in place of the question mark (?) in the given series?

99 87 75 63 51 ?

(a) 36
(b) 39
(c) 37
(d) 38

Q60. In the following triads, each group of letters is related to the subsequent one following a certain logic. Select from the given options, the one which follows the same logic.

BLUE - LBUE - ELBU

TWIN - WTIN - NWTI

(a) URGE - RUGE - RGEU
(b) POST - PSOT - TSOP
(c) FOUR - OFUR - ROFU
(d) READ - ERAD - DEAR

Q61. In a certain code language, ‘VAIL’ is coded as ‘6598’ and ‘OVAL’ is coded as ‘8619’. What is the code for ‘O’ in the given code language?

(a) 8
(b) 1
(c) 6
(d) 9

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Q62. In the following triads, each group of letters is related to the subsequent one following a certain logic. Select from the given options, the one which follows the same logic.

FOUR - ORUF - RUOF

TENS - ESNT - SNET

(a) PLUG - LGUP - GULP
(b) CUPS - UCPS - SUPC
(c) YEAR - EYAR - REAY
(d) RUST - RSUT - TSUR

Q63. Which of the following letter-number clusters will replace the question mark (?) in the given series to make it logically complete?

MEW154, SKC131, YQI108, EWO85, ?

(a) LCU62
(b) KCU62
(c) KDU62
(d) KCV62

Q64. 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) 1 9 6 4 8 8 9 8 7 7 6 5 8 3 4 3 7 5 9 1 5 2 7 1 1 5 9 (Right)

How many such even numbers are there each of which is immediately preceded by an odd number and also immediately followed by an odd number?4393

(a) 4
(b) 5
(c) 7
(d) 6

Q65. Which of the following letter-number clusters will replace the question mark (?) in the given series to make it logically complete?

QIS38, SLQ42, UOO46, ?

(a) WRM50
(b) XRN50
(c) WSM49
(d) XSN49

Q66. In the following triads, each group of letters is related to the subsequent one following a certain logic. Select from the given options, the one which follows the same logic.

GIFT - IFGT - TFIG

LAND - ANLD - DNAL

(a) FISH - IFSH - HISF
(b) FLAG - LAFG - GALF
(c) WEPT - EPWT - EPTW
(d) SOLD - SLOD - DLOS

Q67. In a certain code language,

P @ Q means ‘P is the husband of Q’,

P # Q means ‘P is the brother of Q’,

P & Q means ‘P is the mother of Q’, and

P % Q means ‘P is the sister of Q’.

Based on the above, how is D related to E if ‘D # S @ Z & M % E’?

(a) Wife's father
(b) Father's sister
(c) Father's brother

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(d) Mother's father

Q68. A group of numbers/symbols is coded using letter codes as per the codes given below and the conditions that follow. The correct combination of codes following the conditions is your answer.

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

Numbers/symbols	%	8	2	$	6	3	+	7	@	9	*	5	#	4
Codes	S	D	R	P	K	H	L	G	B	U	C	N	W	Q

Conditions:

(i) If both the second and third elements are perfect squares, the codes for these two (the second and third elements) are to be interchanged.

(ii) If the first element and the third element are even numbers, these two (the first and third elements) are to be coded as &.

(iii) If both the second and third elements are multiples of 3, the third element is to be coded as the code for the second element.

What will be the code for the following group?

$ 9 6 @ 7

(a) G U K B P
(b) P U U B G
(c) P K K B G
(d) & U & B G

Q69. Mr. Zzz starts from Point A and drives 8 km towards east. He then takes a right turn, drives 11 km, turns right and drives 17 km. He then takes a right turn and drives 21 km. He takes a final right turn, drives 9 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) 12 km to the west
(b) 10 km to the south
(c) 11 km to the north
(d) 13 km to the east

Q70. Read the given statements and conclusions carefully. Assuming that the information given in the statements is true, even if it appears to be at variance with commonly known facts, decide which of the given conclusions logically follow(s) from the statements.

Statements:

Some cars are vehicles.

All vehicles are machines.

Conclusions

(I): Some machines are cars.

(II): No cars are machines.

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

Q71. If + means -, - means x, x means ÷, ÷ means +, then what will come in place of the question mark (?) in the following equation?

15 – 10 ÷ 4 + 20 x 5 = ?

(a) 146
(b) 150
(c) 148
(d) 152

Q72. 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) 1 3 5 2 7 1 9 5 1 7 8 4 2 5 7 6 6 5 3 4 7 2 1 7 7 4 9 (Right)

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

(a) Six
(b) Four
(c) Five
(d) Seven

Q73. Mayank starts from Point A and drives 9 km towards the East. He then takes a left turn, drives 6 km, turns left and drives 17 km. He then takes a left turn and drives 15 km. He takes a final left turn, drives 8 km and stops at Point P. How far (shortest distance) and towards which direction should he drive in order to reach Point A again? (All turns are 90 degrees turns only unless specified).

(a) 9 km to the North
(b) 8 km to the North
(c) 9 km to the South
(d) 8 km to the South

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

8 18 30 44 ? 78

(a) 65
(b) 70
(c) 60
(d) 50

Q75. Seven boxes M, N, O, P, Q, R and S are kept one over the other but not necessarily in the same order. Only two boxes are kept below S. Only one box is kept above Q. Only one box is kept between Q and P. R is kept immediately above N. O is kept at some place below M. How many boxes are kept between M and R?

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

Q76. Refer to the following number and symbol series and answer the question that follows. Counting to be done from left to right only. All numbers are single-digit numbers.

(Left) # € % # 6 & 4 * 9 6 @ 5 % @ # © 8 # % * £ 2 (Right)

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

(a) 5
(b) 4
(c) 6
(d) 8

Q77. Refer to the following number, symbol series and answer the question. Counting to be done from left to right only. All numbers are single-digit numbers.

(Left) % € € % 6 £ 3 & 1 £ 4 5 7 2 2 & & 9 & 8 8 * (Right)

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

(a) 3
(b) 6
(c) 4
(d) 5

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Q78. Select the set in which the numbers are related in the same way as are the numbers of the following sets.

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

(18, 15.7, 19.2)

(24, 21.7, 25.2)

(a) (31, 28.7, 32.2)
(b) (37, 34.7, 39.2)
(c) (28, 25.7, 28.2)
(d) (9, 6.7, 11.2)

Q79. Seven people, B, C, D, I, J, K and L, are sitting around a circular table facing the centre of the table. L sits third to the left of I. Only one person sits between K and B when counted from the left of B. C sits third to the right of D. C sits to the immediate right of L. J is not an immediate neighbour of L. How many people sit between J and B when counted from the right of J?

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

Q80. Based on the English alphabetical order, three of the following four letter-cluster pairs are alike in a certain way and thus form a group. Which letter-cluster pair DOES NOT belong to that group?

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

(a) EI-CF
(b) CG-AD
(c) GK-EI
(d) KO-IL

GENERAL AWARENESS AND CURRENT AFFAIRS

Q81. Which Indian state topped the 'Environment' theme in the State of States rankings of the State of India's Environment 2025 report released by the Centre for Science and Environment (CSE)?

(a) Andhra Pradesh
(b) Himachal Pradesh
(c) Uttar Prasesh
(d) Madhya Pradesh

Q82. How many prototypes of the Advanced Medium Combat Aircraft (AMCA) does India plan to develop before starting series production?

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

Q83. What was the name of the bilateral naval exercise between the Indian Navy and the French Navy held in March 2025?

(a) MITRA
(b) VARUNA
(c) EKUVERIN
(d) DOSTANA

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Q84. According to the India BioEconomy Report 2025, how much is India's BioEconomy valued at in 2024?

(a) $250.2 billion
(b) $100.4 billion
(c) $300.6 billion
(d) $165.7 billion

Q85. Which of the following countries hosted the largest yoga session with over 1.5 million participants in 2025?

(a) USA
(b) India
(c) Nepal
(d) UAE

Q86. Who scored the highest individual score in a single innings during IPL 2025?

(a) KL Rahul
(b) Mitchell Marsh
(c) Abhishek Sharma
(d) Rishabh Pant

Q87. World Environment Day was observed on 5 June 2025 with a special focus to end which of the following?

(a) Mercury Pollution
(b) E waste Pollution
(c) Sewage Pollution
(d) Plastic Pollution

Q88. Who among the following was appointed as Executive Director of the Reserve Bank of India in March 2025 to look after Department of Statistics and Information Management and Financial Stability Department?

(a) Dr. Urjit Patel
(b) Dr. Swaminathan J
(c) Dr. Ajit Ratnakar Joshi
(d) Dr. V Anantha Nageswaran

Q89. In June 2025, the Department of Financial Services (DFS), Ministry of Finance, convened a high-level meeting co-chaired by M Nagaraju, Secretary, Department of Financial Services and T Rabi Sankar, Deputy Governor, RBI at New Delhi, on scaling up ULI. What is the full form of ULI?

(a) Urban Lending Interface
(b) Universal Loan Identifier
(c) Unique Lending Index
(d) Unified Lending Interface

Q90. Who is the Chairperson of the 16^(th) Finance Commission of India?

(a) Suman Bery
(b) N. K. Singh
(c) Raghuram Rajan
(d) Arvind Panagariya

Q91. Who set the men’s 10,000 m record of 27:00.22 at TEN 2025 meet?

(a) Gulveer Singh
(b) Avinash Sable
(c) Jinson Johnson
(d) Shivnath Singh

Q92. India is drafting its first comprehensive framework, National Adaptation Plan (NAP), to be submitted to the United Nations Framework Convention on Climate Change (UNFCCC) by September 2025 in compliance with the _____.

(a) Cartagena Protocol
(b) Kyoto Protocol

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(c) Montreal Convention
(d) Paris Agreement

Q93. In which of the following cities was the inauguration of the Recognition of Prior Learning – Certification in Indian Sign Language Interpretation (RPL–CISLI) programme held in August 2025?
(a) New Delhi
(b) Chennai
(c) Lucknow
(d) Ahmedabad

Q94. Which of the following organised the Summer Book Writing Festival in 2025?
(a) BriBooks
(b) Penguin India
(c) Random House
(d) HarperCollins

Q95. On 20^(th) May, 2025, the Supreme Court (SC) reinstated the requirement of how many years of legal practice for law graduates to apply for civil judge (junior division) posts, reversing its 2002 decision?
(a) 2 years
(b) 4 years
(c) 3 years
(d) 5 years

Q96. Which party won the by-election to the Visavadar Assembly Constituency (Gujarat) in June 2025?
(a) Bhartiya Janata Party
(b) Indian National Congress
(c) Aam Aadmi Party
(d) Bahujan Samaj Party

Q97. Which country was ranked highest for gender equality in the Global Gender Gap Report, 2025, released by the World Economic Forum in May 2025?
(a) Iceland
(b) Norway
(c) Sweden
(d) Germany

Q98. Which athlete won the Arjuna Award for boxing in January 2025?
(a) Parveen Hooda
(b) Lovlina Borgohain
(c) Saweety Boora
(d) Nikhat Zareen

Q99. Which of the following novels won the 2025 Pulitzer Prize for Fiction?
(a) James
(b) Every Living Thing
(c) Native Nations
(d) Feeding Ghosts

Q100. Which among the following civic suggestions did Karnataka's Deputy Chief Minister give in September 2025 to improve governance quality in Bengaluru?
(a) Pay taxes, declare assets, hide nothing
(b) Volunteer audit committees
(c) Monthly public grievance meets
(d) Citizen rating system for officials

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ANSWER KEY

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

SOLUTIONS

Q1. Answer: (d) anode

The correct answer is anode.

Key Points

• In the process of electrolytic refining, the impure metal is used as the anode, while a pure metal strip is used as the cathode. The electrolyte is a solution containing a salt of the metal being refined.

• When an electric current is passed through the electrolyte, the impure metal from the anode dissolves into the solution. This is due to the oxidation reaction occurring at the anode.

• The dissolved metal ions travel through the electrolyte and are deposited on the cathode, where they undergo a reduction reaction, forming a layer of pure metal.

• Impurities that are more reactive than the metal remain in the solution, while less reactive impurities settle at the bottom of the electrolytic cell as anode mud.

• This process ensures that the final metal obtained at the cathode is of high purity, often used in industries requiring precise and high-quality materials.

Additional Information

• Electrolytic Refining:

• This technique is commonly used to refine metals such as copper, zinc, aluminum, gold, and silver.

• The process involves oxidation at the anode (loss of electrons) and reduction at the cathode (gain of electrons).

• The electrolyte generally contains a solution of a salt of the metal being refined, such as copper sulfate (CuSO4) for copper refining.

• Anode Mud:

• During electrolytic refining, impurities that do not dissolve in the electrolyte or react remain as residue at the bottom of the cell, termed as anode mud.

• Anode mud may contain valuable metals like gold, silver, and platinum, which are recovered separately.

• Applications:

• Electrolytic refining is essential in producing metals for electrical wiring, where high purity is critical for efficient conductivity.

• It is also used in the jewelry industry to refine precious metals like gold and silver.

• Important Terminologies:

• Oxidation: Loss of electrons; occurs at the anode.

• Reduction: Gain of electrons; occurs at the cathode.

• Electrolyte: A medium that allows the movement of ions, facilitating the electrochemical reactions.

Important Points

• Anode vs. Cathode:

• The anode is the positive electrode where oxidation occurs, and the impure metal dissolves into the electrolyte.

• The cathode is the negative electrode where reduction occurs, and the pure metal is deposited.

• Efficiency:

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• The process ensures up to 99.99% purity, making it suitable for industrial applications.

• Environmental Considerations:

• Proper disposal of anode mud and waste electrolyte is crucial to minimize environmental hazards.

Q2. Answer: (b) Epithelial tissue, Connective tissue, Muscular tissue and Nervous tissue

The correct answer is Epithelial tissue, Connective tissue, Muscular tissue, and Nervous tissue.

Key Points

• Animal tissues are classified into four main types based on their function and structure: Epithelial, Connective, Muscular, and Nervous tissues. These are the fundamental tissues found in all animals, including humans.

• Epithelial tissue: This tissue forms the covering or lining of internal and external body surfaces. It is involved in protection, absorption, secretion, and sensory reception. Example: Skin epithelium, lining of the digestive tract.

• Connective tissue: It provides support, binds different body parts, and plays a role in the transportation of nutrients and waste. Examples include blood, bones, cartilage, ligaments, and adipose tissue.

• Muscular tissue: This tissue is responsible for body movement. It consists of three types: skeletal muscle (voluntary movement), smooth muscle (involuntary movement), and cardiac muscle (heart contractions).

• Nervous tissue: It is involved in transmitting electrical signals throughout the body. It consists of neurons and supporting glial cells. This tissue is crucial for coordination, response to stimuli, and regulation of bodily functions.

• Option 2 correctly identifies all four types of animal tissues present in humans. Options 1, 3, and 4 are incorrect because they do not include all the essential tissue types. Option 5 is invalid due to the absence of an answer.

Additional Information

• Epithelial Tissue:

• It is classified into simple (single layer) and stratified (multiple layers) based on the number of layers.

• It can also be categorized based on shape: squamous (flat), cuboidal (cube-shaped), and columnar (tall and cylindrical).

• Specialized epithelial tissues include ciliated epithelium (found in respiratory tract) and glandular epithelium (involved in secretion).

• Connective Tissue:

• Composed of cells and an extracellular matrix, which includes fibers (collagen, elastin) and ground substance.

• Examples include loose connective tissue (areolar), dense connective tissue (tendons and ligaments), and specialized connective tissues (cartilage, bone, blood).

• Plays a role in immune defense (via lymphatic tissue) and energy storage (via adipose tissue).

• Muscular Tissue:

• Skeletal muscle is voluntary and attached to bones, enabling body movement.

• Cardiac muscle is involuntary and found exclusively in the heart, facilitating rhythmic contractions.

• Smooth muscle is involuntary and found in the walls of internal organs like the stomach and blood vessels.

• Nervous Tissue:

• Neurons are the structural and functional units of this tissue, responsible for transmitting signals.

• Supporting cells, such as glial cells, provide structural and metabolic support to neurons.

• This tissue makes up the brain, spinal cord, and peripheral nerves, coordinating body functions.

Important Points

• The Reproductive tissue mentioned in Option 1 is not a separate classification of animal tissue. It consists of specialized cells within other tissue types.

• Skeletal tissue mentioned in Option 4 is a type of connective tissue (e.g., bones and cartilage) and not a standalone category.

• The inclusion of glandular tissue in Option 3 is partially correct, as glandular tissues are specialized epithelial tissues.

• All four fundamental tissue types—Epithelial, Connective, Muscular, and Nervous—are essential for the structure and function of the human body.

Q3. Answer: (b) Chromoplasts

The correct answer is Chromoplasts.

Key Points

• Chromoplasts are a type of plastid found in plant cells that are responsible for the synthesis and storage of pigments that give plants their characteristic yellow, orange, and red colors.

• These plastids are rich in pigments such as carotenoids, which include carotene (orange pigment) and xanthophyll (yellow pigment).

• Chromoplasts are often found in flowers, fruits, and aging leaves, where the bright colors serve various functions such as attracting pollinators and seed dispersers.

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• Unlike chloroplasts, chromoplasts do not play a significant role in photosynthesis. Their primary function is related to pigment storage.

• Chromoplasts can develop from chloroplasts or leucoplasts through a process of transformation when the plant undergoes changes such as fruit ripening or leaf aging.

Additional Information

• Types of Plastids in Plants:

• Amyloplasts: These are colorless plastids that store starch. They are commonly found in storage organs like tubers and seeds.

• Leucoplasts: Non-pigmented plastids that are involved in the storage of nutrients such as starch, proteins, and lipids. They are found in roots and other non-photosynthetic tissues.

• Chloroplasts: Plastids containing green pigment chlorophyll, responsible for photosynthesis. They are primarily found in green tissues like leaves.

• Chromoplasts: As mentioned earlier, these plastids contain carotenoid pigments and are responsible for the vibrant yellow, orange, and red colors in plants.

• Carotenoids:

• These are organic pigments found in chromoplasts that are fat-soluble and contribute to the colors of fruits, flowers, and vegetables.

• Carotenoids also have antioxidant properties and play a role in protecting cells from damage caused by reactive oxygen species.

• Chloroplast to Chromoplast Transformation:

• During processes like fruit ripening, chloroplasts convert into chromoplasts. For example, in tomatoes, green chloroplasts transform into red chromoplasts as the fruit ripens.

• Functions of Chromoplasts:

• Attract pollinators: The bright colors of petals and other floral parts help attract insects and animals for pollination.

• Seed dispersal: The vivid colors of fruits attract animals, which aid in the dispersal of seeds.

Important Points

• Difference Between Chloroplasts and Chromoplasts:

• Chloroplasts: Green plastids involved in photosynthesis.

• Chromoplasts: Non-green plastids responsible for pigment storage and coloration.

• Applications of Pigments:

• Carotenoids are widely used in the food and pharmaceutical industries as natural colorants and antioxidants.

• They are also studied for their role in preventing diseases caused by oxidative stress, such as cancer and heart disease.

Q4. Answer: (d) Atomic number

The correct answer is Atomic number.

Key Points

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

• The atomic number of an element represents the number of protons in its nucleus and is unique to each element. Isobars always have different atomic numbers.

• The mass number (sum of protons and neutrons) is the same for isobars, which is why they are classified as isobars.

• The number of electrons may vary between isobars since the atomic number (which determines the number of electrons in a neutral atom) is different.

• Due to their differing atomic numbers, isobars belong to different elements and thus exhibit distinct chemical properties.

Additional Information

• Definition of Isobars:

• Isobars are nuclei of different elements with the same mass number but different atomic numbers. This means the total number of protons and neutrons in the nucleus is the same, but the number of protons (and thus electrons in a neutral atom) differs.

• For example, Carbon-14 (6 protons + 8 neutrons) and Nitrogen-14 (7 protons + 7 neutrons) are isobars.

• Characteristics of Isobars:

• Isobars have different chemical properties because they belong to different elements, determined by their unique atomic numbers.

• They may have similar or different physical properties, depending on their nuclear configurations.

• Applications of Isobars:

• Radioactive isobars are widely used in nuclear medicine and research. For instance, isotopes like Carbon-14 are used in radiocarbon dating.

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• Isobars also play a role in nuclear reactions and the study of nuclear stability.

• Explanation of the Options:

• Mass number: Isobars have the same mass number, so this property is not different. Incorrect option.

• Total number of nucleons: The total number of nucleons (protons + neutrons) is the same for isobars. Incorrect option.

• Total number of electrons: The number of electrons differs because the atomic number is different, but this is not the defining property. Incorrect option.

• Atomic number: The atomic number is always different for isobars, as they belong to different elements. Correct option.

Important Points

• Examples of Isobars:

• Argon-40 (18 protons + 22 neutrons) and Calcium-40 (20 protons + 20 neutrons) are isobars.

• These elements have the same mass number but belong to different elements due to their distinct atomic numbers.

• Difference Between Isotopes and Isobars:

• Isotopes are atoms of the same element with the same atomic number but different mass numbers (e.g., Carbon-12 and Carbon-14).

• Isobars are atoms of different elements with the same mass number but different atomic numbers (e.g., Carbon-14 and Nitrogen-14).

• Nuclear Stability:

• Isobars can provide insights into nuclear stability, as the number of protons and neutrons affects the binding energy of the nucleus.

• Stable isobars are often used as reference points in nuclear physics.

Q5. Answer: (a) Carbon dioxide

The correct answer is Carbon dioxide.

Key Points

• Carbon dioxide (CO_2) is the primary greenhouse gas responsible for the greenhouse effect, which leads to global warming.

• It is released into the atmosphere during the combustion of fossil fuels such as coal, oil, and natural gas.

• Fossil fuel combustion occurs in various sectors, including transportation, electricity generation, and industrial processes, contributing heavily to CO_2 emissions.

• Greenhouse gases trap heat in the Earth's atmosphere, leading to a rise in global temperatures. Carbon dioxide is the most significant contributor to this effect, accounting for about 76% of global greenhouse gas emissions.

• Key sources of CO_2 emissions include power plants, vehicles, deforestation, and industrial activities.

• Global initiatives like the Paris Agreement aim to reduce CO_2 emissions and combat climate change by promoting renewable energy and sustainable practices.

Additional Information

• Greenhouse Effect:

• The greenhouse effect is a natural process where certain gases trap heat in the Earth's atmosphere, keeping the planet warm enough to support life.

• The main greenhouse gases include carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), and water vapor.

• While the greenhouse effect is essential for life, excessive greenhouse gases lead to global warming and climate change.

• Sources of Carbon Dioxide:

• Natural sources: Volcanic eruptions, respiration, and ocean-atmosphere exchange.

• Anthropogenic sources: Burning of fossil fuels, deforestation, cement production, and industrial processes.

• Deforestation reduces the number of trees available to absorb CO_2, thereby increasing atmospheric CO_2 levels.

• Impacts of Carbon Dioxide Emissions:

• Increased atmospheric CO_2 leads to a rise in global temperatures, resulting in melting glaciers, rising sea levels, and extreme weather events.

• It causes ocean acidification, negatively impacting marine ecosystems and biodiversity.

• Long-term exposure to high CO_2 levels can disrupt ecosystems and threaten human health.

• Mitigation Strategies:

• Adopting renewable energy sources such as solar, wind, and hydropower to replace fossil fuels.

• Promoting energy efficiency in industries, buildings, and transportation.

• Implementing reforestation and afforestation projects to absorb CO_2 from the atmosphere.

• Carbon capture and storage (CCS) technologies to reduce emissions from power plants and industries.

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• Important Points

• Paris Agreement: Signed in 2015, this global treaty aims to limit the increase in global temperatures to below 2°C compared to pre-industrial levels.

• Carbon footprint: A measure of the total greenhouse gases emitted by an individual, organization, or product, expressed in CO2 equivalents.

• IPCC Reports: The Intergovernmental Panel on Climate Change releases periodic assessments of climate change, including the role of CO2 in global warming.

• Global CO2 Emissions: According to the Global Carbon Project, global CO2 emissions reached approximately 36.3 billion metric tons in 2021.

• Carbon neutrality: Achieving net-zero CO2 emissions by balancing emitted CO2 with removal or offset mechanisms.

Q6. Answer: (b) ttRR

The correct answer is Option 2.

Key Points

• The question involves understanding the genotype of a plant based on its phenotype (observable traits) for two traits: height and seed shape.

• Tall (T) is dominant over short (t), meaning that short plants must have a homozygous recessive genotype (tt). This is correct for short plants.

• Round seeds (R) are dominant over wrinkled seeds (r). A plant with round seeds could have either a homozygous dominant (RR) or heterozygous (Rr) genotype. However, the question specifies the genotype shows short height and round seeds.

• Option 2 (ttRR) satisfies both conditions: short height due to "tt" and round seeds due to "RR".

• Other options fail to meet the phenotype requirements:

• Option 1 (Ttrr): Incorrect as it represents tall height (T).

• Option 3 (TtRR): Incorrect as it represents tall height (T).

• Option 4 (TtRr): Incorrect as it represents tall height (T).

• Therefore, the correct genotype for a plant showing short height and round seeds is ttRR.

Additional Information

• Mendelian Genetics:

• Gregor Mendel is considered the "Father of Genetics" for his experiments with pea plants (Pisum sativum).

• He proposed the Law of Dominance, Law of Segregation, and Law of Independent Assortment based on his experiments.

• Dominant traits mask the expression of recessive traits in heterozygous genotypes.

• Genotype and Phenotype:

• Genotype refers to the genetic composition of an organism (e.g., TT, Tt, or tt).

• Phenotype refers to the observable traits or characteristics (e.g., tall or short).

• Recessive traits (e.g., short height in this case) are expressed only in homozygous recessive genotypes (tt).

• Seed Shape Trait:

• In Mendel's experiments, round seeds were dominant over wrinkled seeds.

• The alleles for seed shape are R (round) and r (wrinkled).

• Round seeds can have either RR or Rr genotypes, while wrinkled seeds must have rr.

• Application of Punnett Square:

• A Punnett Square is a tool used to predict the genotypic and phenotypic ratios of offspring based on parental genotypes.

• For example, a cross between TtRr and ttRR can help predict the probabilities of various combinations of height and seed shape.

• Important Facts:

• The dominant and recessive traits observed by Mendel form the basis of classical genetics.

• Traits are inherited independently if they are on different chromosomes (as per Mendel's Law of Independent Assortment).

Important Points

• Homozygous: An organism with two identical alleles for a trait (e.g., TT or tt).

• Heterozygous: An organism with two different alleles for a trait (e.g., Tt).

• Dominant Allele: An allele that expresses itself in both homozygous and heterozygous conditions (e.g., T or R).

• Recessive Allele: An allele that expresses itself only in the homozygous condition (e.g., t or r).

• Mendel's experiments form the foundation for understanding monohybrid and dihybrid crosses.

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Q7. Answer: (b) Methyl orange: red, Phenolphthalein: colourless, Litmus: red

The correct answer is Methyl orange: red, Phenolphthalein: colourless, Litmus: red.

Key Points

• Methyl orange as an indicator: Methyl orange turns red in acidic solutions and yellow in neutral or basic solutions. In this case, the observation of red indicates the presence of an acidic solution.

• Phenolphthalein as an indicator: Phenolphthalein is colourless in acidic solutions and turns pink in basic solutions. The observation of colourless phenolphthalein here supports the acidic nature of the solution.

• Litmus as an indicator: Blue litmus paper changes to red in acidic solutions, while red litmus remains unchanged. Here, the observation of red litmus further confirms the acidic nature of the solution.

• Acidic solutions: Acidic solutions have a pH less than 7 and release hydrogen ions (H^+) in an aqueous solution. The indicators used here are designed to detect such pH levels.

• Observations from the given options—"Methyl orange: red, Phenolphthalein: colourless, Litmus: red"—are characteristic of an acidic solution. Therefore, this is the correct answer.

Additional Information

• Methyl orange:

• Methyl orange is a pH indicator commonly used in titrations.

• It changes colour at a pH range of 3.1 to 4.4.

• In acidic solutions, it appears red, while in alkaline solutions, it turns yellow.

• Phenolphthalein:

• Phenolphthalein is widely used as an indicator in acid-base titrations.

• It remains colourless in acidic solutions and turns pink in basic solutions at a pH range of approximately 8.2 to 10.

• Litmus:

• Litmus is a natural dye extracted from lichens and is used as a pH indicator.

• Blue litmus turns red in acidic conditions, while red litmus remains unchanged in acidic solutions.

• It is one of the simplest tools for testing the acidic or basic nature of a solution.

• Acidic solutions:

• Acids release hydrogen ions (H^+) in water, lowering the pH.

• Examples of common acids include hydrochloric acid (HCl), sulfuric acid (H2SO4), and acetic acid (CH3COOH).

• Acidic solutions typically taste sour and can corrode metals.

• pH scale:

• The pH scale ranges from 0 to 14, with 7 being neutral.

• Values below 7 indicate acidity, while values above 7 indicate alkalinity.

Important Points

• Applications of pH indicators:

• Indicators like methyl orange, phenolphthalein, and litmus are used in laboratories, industries, and schools for determining the pH of a solution.

• They play a crucial role in chemical titrations to identify the endpoint of acid-base reactions.

• Natural indicators:

• Substances like turmeric, red cabbage, and hibiscus flowers can also act as natural pH indicators.

• For example, turmeric turns red in basic solutions, indicating the presence of alkalinity.

• Acid-base reactions:

• Acids react with bases to form salt and water in a reaction called neutralization.

• Indicators help monitor the progress of these reactions.

Q8. Answer: (d) Transporting sperm from the epididymis to the urethra

The correct answer is Transporting sperm from the epididymis to the urethra.

Key Points

• The vas deferens, also known as the ductus deferens, is a crucial component of the male reproductive system. It primarily functions to transport sperm from the epididymis to the urethra.

• During ejaculation, the sperm stored in the epididymis is propelled through the vas deferens to mix with fluids from the seminal vesicles, prostate gland, and bulbourethral glands, forming semen.

• This structure is a muscular tube, approximately 30-35 cm in length, that contracts rhythmically during ejaculation to ensure the efficient movement of sperm.

• The vas deferens is connected to the epididymis at one end and the ejaculatory duct at the other, enabling the transfer of sperm to the urethra for eventual ejaculation.

• The primary role of the vas deferens is transport and does not involve sperm production, regulation of body temperature, or secretion of seminal fluid. Hence, Option 4 is correct.

Additional Information

• Structure and Location:

• The vas deferens is a part of the male reproductive anatomy and is located within the spermatic cord, which passes through the inguinal canal.

• It is surrounded by layers of connective tissue, blood vessels, and nerves that support its function and protect it from damage.

• Associated Functions:

• The vas deferens works alongside accessory glands like the seminal vesicles, which secrete fructose-rich fluid, and the prostate gland, which adds enzymes and other components to semen.

• These secretions ensure that sperm remain viable and motile during their journey to fertilize an egg.

• Medical Significance:

• The vas deferens is often targeted in male sterilization procedures, such as a vasectomy, where it is cut or sealed to prevent the transport of sperm, effectively leading to contraception.

• Conditions like vas deferens obstruction can lead to infertility, which may require medical intervention such as surgery or assisted reproductive technologies.

• Comparison of Options:

• Option 1: Regulating body temperature is a function of the scrotum, not the vas deferens.

• Option 2: Seminal fluid secretion is carried out by accessory glands like the prostate and seminal vesicles.

• Option 3: Sperm production occurs in the seminiferous tubules of the testes, not in the vas deferens.

• Option 4: Transporting sperm from the epididymis to the urethra is the primary function of the vas deferens and is the correct answer.

• Option 5: This option is blank and irrelevant to the context of the question.

Important Points

• Epididymis: The epididymis stores and matures sperm before they are transported via the vas deferens.

• Muscular Contractions: The walls of the vas deferens are lined with smooth muscle that contracts during ejaculation, facilitating sperm transport.

• Role in Fertility: Any damage or blockage in the vas deferens can lead to male infertility, which may require surgical repair or alternative treatments.

• Reproductive System Coordination: The vas deferens works in close coordination with other reproductive structures to ensure the delivery of functional sperm for fertilization.

Q9. Answer: (d) Field lines outside a magnet move from north to south.

The correct answer is Field lines outside a magnet move from north to south..

Key Points

• Magnetic field lines outside a magnet always move from the north pole to the south pole. This is a fundamental property of magnetic fields, representing the direction of magnetic force outside the magnet. Hence, this statement is correct.

• Magnetic field is weaker where lines are close. This statement is incorrect. The magnetic field is stronger where the lines are closer, as the density of field lines represents the field's intensity.

• Field lines inside a magnet move from south to north. Inside the magnet, the magnetic field lines move from the south pole to the north pole, completing a closed loop. The given statement about field lines moving from north to south inside a magnet is incorrect.

• Magnetic field lines never intersect each other. If they were to intersect, it would imply two different directions of the magnetic field at the same point, which is not possible. Hence, the statement claiming intersection at poles is incorrect.

• The correct and universally accepted property is that outside a magnet, the field lines always move from north to south. This is the reason why option 4 is the correct answer.

Additional Information

• Definition of Magnetic Field Lines: Magnetic field lines are imaginary lines used to represent the direction and strength of a magnetic field. They provide a visual understanding of how the magnetic field behaves in space.

• Properties of Magnetic Field Lines:

• They form closed loops, traveling from the north pole to the south pole outside the magnet and from the south pole to the north pole inside the magnet.

• The density of the field lines indicates the strength of the magnetic field; closer lines represent a stronger field.

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• Magnetic field lines never cross each other, ensuring a consistent direction of the magnetic field at every point.

• Real-Life Applications of Magnetic Fields:

• They are used in electric motors and generators to convert electrical energy into mechanical energy and vice versa.

• Magnetic fields are crucial in MRI (Magnetic Resonance Imaging) machines for medical imaging.

• Magnetic compasses use Earth's magnetic field to determine direction.

• Magnet Types: Magnets can be classified as permanent magnets (e.g., bar magnets) or electromagnets (e.g., solenoids), depending on the source of their magnetic field.

Important Points

• Earth's Magnetic Field: Earth itself behaves like a giant magnet, with a magnetic field that protects us from harmful solar radiation. The field lines of Earth's magnetic field also follow the same principle, moving from the geomagnetic north to the geomagnetic south outside the Earth.

• Discovery of Magnetic Fields: The concept of magnetic field lines was first introduced by Michael Faraday in the 19th century, greatly advancing the understanding of electromagnetism.

• Units of Magnetic Field Strength: The magnetic field strength is measured in teslas (T) in the SI system and in gauss (G) in the CGS system (1 tesla = 10,000 gauss).

• Magnetic Flux: Magnetic flux quantifies the total magnetic field passing through a given area. It is represented mathematically as the product of the magnetic field strength and the area perpendicular to the field.

Q10. Answer: (d) To digest foreign material

The correct answer is To digest foreign material.

Key Points

• Lysosomes are membrane-bound organelles present in animal cells and are often referred to as the "suicidal bags of the cell." Their primary function is to digest foreign material, cellular debris, and unwanted substances.

• Lysosomes contain hydrolytic enzymes such as proteases, lipases, nucleases, and amylases, which facilitate the breakdown of proteins, lipids, nucleic acids, and carbohydrates.

• They play a crucial role in the immune response by digesting pathogens, such as bacteria and viruses, that enter the cell through phagocytosis.

• Lysosomes are also responsible for autophagy, a process in which they degrade and recycle the cell’s own damaged or worn-out components to maintain cellular homeostasis.

• These organelles help in the programmed cell death process called apoptosis, ensuring proper development and removal of dysfunctional cells.

• Lysosomal dysfunction can lead to severe diseases, such as Lysosomal Storage Disorders (LSDs), including Tay-Sachs disease and Gaucher disease.

Additional Information

• Structure and Composition of Lysosomes:

• Lysosomes are spherical organelles enclosed by a single lipid bilayer membrane.

• They maintain an acidic internal environment (pH ~5) to optimize the activity of their hydrolytic enzymes.

• The enzymes inside lysosomes are synthesized in the endoplasmic reticulum and modified in the Golgi apparatus before being packaged into lysosomes.

• Types of Lysosomal Functions:

• Heterophagy: Digestion of extracellular material brought into the cell via processes like phagocytosis or endocytosis.

• Autophagy: Degradation of the cell’s own organelles and cytoplasmic components, which is essential for cellular repair and renewal.

• Exocytosis: Lysosomes can expel their digestive enzymes outside the cell to break down extracellular substances.

• Diseases Associated with Lysosomes:

• Lysosomal Storage Disorders (LSDs): Caused by genetic defects leading to the accumulation of undigested substances within lysosomes. Examples include Tay-Sachs disease, Pompe disease, and Gaucher disease.

• Autophagy-related Diseases: Dysfunctional autophagy can contribute to neurodegenerative disorders like Parkinson’s and Alzheimer’s disease.

• Other Organelles Involved in Cellular Waste Management:

• Peroxisomes: Break down fatty acids and neutralize harmful compounds like hydrogen peroxide.

• Proteasomes: Degrade misfolded or damaged proteins tagged with ubiquitin.

Important Points

• Discovery: Lysosomes were discovered by Christian de Duve in 1955, earning him the Nobel Prize in Physiology or Medicine in 1974.

• Plant Cells: While lysosomes are specific to animal cells, plant cells have vacuoles that perform similar roles in waste processing and storage.

• Enzyme Deficiency: Defects in lysosomal enzymes can lead to a buildup of cellular waste, causing toxic effects and impaired cell function.

• Role in Development: Lysosomes are essential for embryonic development as they facilitate the removal of unnecessary cellular components during the morphogenesis process.

Q11. Answer: (b) HCOOH

The correct answer is HCOOH.

Key Points

• Formic Acid is the simplest carboxylic acid and is chemically represented as HCOOH. It consists of a single carbon atom, a hydroxyl group (-OH), and a double-bonded oxygen atom.

• It is derived from the Latin word "formica," meaning ant, as it was first obtained from ants. Many insects, such as ants and bees, produce formic acid as part of their venom.

• HCOOH is widely used in various industries, including leather tanning, dyeing, and as a preservative in livestock feed.

• It is a colorless liquid with a pungent odor and is highly soluble in water. Its molecular weight is approximately 46.03 g/mol.

• Formic acid is a weak acid and exhibits typical carboxylic acid properties, such as reacting with bases to form salts and esters.

Additional Information

• Option 1: C2H6O: This is the chemical formula for ethanol, a type of alcohol. Ethanol is used widely in beverages, as a solvent, and as a fuel. It is not related to formic acid.

• Option 3: C2H4O2: This is the formula for acetic acid, another carboxylic acid. Acetic acid is the main component of vinegar and is used in food preservation and chemical synthesis. It differs from formic acid in molecular structure and properties.

• Option 4: C2H5OH: This represents ethanol, a common alcohol. Ethanol is used in alcoholic beverages and industrial applications, but it is chemically distinct from formic acid.

• Uses of Formic Acid:

• Formic acid is used as a preservative and antibacterial agent in livestock feed.

• It is employed in the textile industry for dyeing and finishing fabrics.

• It is used in the production of rubber and other chemicals.

• Formic acid is also used in laboratories as a reagent for various chemical reactions.

• Safety and Handling:

• Formic acid is corrosive and can cause skin and eye irritation upon contact.

• Proper protective equipment, such as gloves and goggles, should be used when handling formic acid.

• It should be stored in a cool, ventilated area away from incompatible substances like strong oxidizing agents.

Important Points

• Natural Occurrence: Formic acid is naturally found in the venom of certain insects like ants and bees, as well as in some plants.

• Industrial Production: It is commercially produced by the hydrolysis of methyl formate or as a byproduct in the manufacture of acetic acid.

• Chemical Properties: Formic acid is both a reducing agent and an acid, making it versatile in chemical reactions.

• Environmental Impact: Formic acid is biodegradable and has relatively low environmental toxicity.

Q12. Answer: (a) Sodium carbonate (Na2CO3)

The correct answer is Sodium carbonate (Na2CO3).

Key Points

• Organic compounds are primarily composed of carbon and hydrogen atoms, often with additional elements like oxygen, nitrogen, sulfur, and phosphorus.

• Sodium carbonate (Na2CO3) is an inorganic compound because it does not contain carbon-hydrogen (C-H) bonds, which are a defining characteristic of organic compounds.

• Acetic acid (CH3COOH) is an organic compound as it contains a carbon backbone and a functional group (carboxylic acid).

• Methane (CH4) is a simple organic compound, consisting of one carbon atom bonded to four hydrogen atoms. It is classified as an alkane.

• Ethanol (C2H5OH) is an organic compound that belongs to the alcohol group, with a hydroxyl (-OH) functional group attached to a carbon chain.

• Hence, Sodium carbonate (Na2CO3) is the correct answer as it is not considered an organic compound.

Additional Information

• Characteristics of Organic Compounds:

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• Organic compounds typically contain carbon-hydrogen (C-H) bonds.
• They are often associated with living organisms but can also be synthesized artificially.
• Examples include carbohydrates, proteins, lipids, alcohols, and hydrocarbons.
• Characteristics of Inorganic Compounds:
• Inorganic compounds generally do not contain carbon-hydrogen (C-H) bonds.
• They include salts, metals, minerals, and substances like water and carbon dioxide.
• Sodium carbonate (Na2CO3) is an example of an inorganic compound and is widely used in industries like glass manufacturing and cleaning agents.
• Uses of Sodium Carbonate:
• It is used in the production of glass, where it lowers the melting point of silica.
• It is employed as a water softener in laundry detergents.
• In laboratories, it is used as a buffering agent to maintain stable pH levels.
• Examples of Organic Compounds:
• Methane (CH4): A simple hydrocarbon and a primary component of natural gas.
• Ethanol (C2H5OH): Commonly used in alcoholic beverages and as a fuel additive.
• Acetic acid (CH3COOH): Found in vinegar and used in food preservation and flavoring.

Important Points

• Carbon Compounds:
• Not all carbon-containing compounds are organic. For example, carbonates (like Na2CO3) and oxides of carbon (like CO2) are classified as inorganic compounds.
• Organic compounds are characterized by the presence of covalent bonds between carbon and hydrogen atoms.
• Applications in Daily Life:
• Organic compounds like ethanol are used in sanitizers and as fuel additives.
• Inorganic compounds like sodium carbonate are used in water treatment and cleaning products.

Q13. Answer: (d) The speed varies continuously with time

The correct answer is The speed varies continuously with time.

Key Points

• Uniform motion is defined as the motion in which a body covers equal distances in equal intervals of time, irrespective of how small these time intervals are. Hence, statement 3 is correct.
• In uniform motion, the velocity remains constant throughout the motion because the direction and magnitude of velocity do not change. Hence, statement 2 is correct.
• The acceleration in uniform motion is zero because there is no change in velocity over time. This means the object maintains a constant speed in a straight line. Hence, statement 1 is correct.
• The statement "The speed varies continuously with time" contradicts the definition of uniform motion, as the speed must remain constant for the motion to be considered uniform. Hence, statement 4 is incorrect.
• Uniform motion typically occurs in idealized conditions, such as when an object moves in space without being subjected to external forces like friction or air resistance.

Additional Information

• Characteristics of Uniform Motion:
• The object moves along a straight path without any deviation.
• The distance traveled by the object is directly proportional to the time elapsed.
• The motion is characterized by a zero net acceleration, implying no forces are acting to change the velocity of the object.
• Examples include a car moving with cruise control on a straight highway or a satellite orbiting Earth at a constant speed.
• Relation Between Speed, Velocity, and Acceleration:
• Speed is a scalar quantity that measures the rate of change of distance.
• Velocity is a vector quantity that includes both speed and direction.
• Acceleration is the rate of change of velocity. For uniform motion, acceleration is zero as velocity remains constant.
• Examples of Non-Uniform Motion:
• A car accelerating on a road, where its speed increases or decreases over time.
• A ball thrown upward, which slows down as it rises and speeds up as it falls due to gravitational force.
• Equations of Motion (For Uniform Acceleration):
• v = u + at: Final velocity (v) is the initial velocity (u) plus acceleration (a) multiplied by time (t).

• $s = ut + 0.5at^2$: Displacement (s) is the sum of the initial velocity multiplied by time and half of the acceleration multiplied by the square of time.

• $v^2 = u^2 + 2as$: Relates final velocity, initial velocity, acceleration, and displacement.

Important Points

• Real-life Applications of Uniform Motion:

• In astronomy, planets exhibit nearly uniform motion in their orbits over short time intervals.

• Trains moving at constant speeds on straight tracks serve as practical examples of uniform motion.

• Misconceptions:

• Uniform motion does not imply the absence of motion. It simply indicates the absence of acceleration.

• Uniform motion does not apply to circular paths, as the direction of velocity changes continuously, leading to acceleration (centripetal acceleration).

Q14. Answer: (a) In a prism, the incident ray and emergent ray are always parallel.

The correct answer is Option 1.

Key Points

• Statement 1: "In a prism, the incident ray and emergent ray are always parallel." This statement is incorrect. In a prism, the incident ray and emergent ray are not parallel to each other. The emergent ray is deviated from its original path due to refraction within the prism.

• Statement 2: "The angle of deviation is the angle between the incident ray and emergent ray." This statement is correct. The angle of deviation is a measure of the angular separation between the incident ray entering the prism and the emergent ray leaving the prism.

• Statement 3: "In a prism, the emergent ray bends towards the base of the prism when the incident ray is coming from the base side." This statement is correct. Refraction causes the emergent ray to bend towards the base of the prism due to the change in direction after passing through the prism.

• Statement 4: "In a prism, dispersion can occur if white light is used." This statement is correct. White light passing through a prism gets split into its constituent colors due to dispersion, forming a spectrum.

Additional Information

• Refraction in a Prism:

• Refraction is the bending of light as it passes from one medium to another. In a prism, light enters from air into the glass and then exits from glass into air, undergoing refraction at both surfaces.

• The refractive index of the prism material determines the extent of refraction.

• Angle of Deviation:

• The angle of deviation depends on the angle of incidence and the refractive index of the prism material.

• It is minimum when the incident ray makes a specific angle such that the ray inside the prism travels symmetrically.

• Dispersion of Light:

• Dispersion occurs because different wavelengths of light refract by different amounts. Violet light refracts the most, and red light refracts the least.

• This phenomenon is responsible for creating a spectrum of colors when white light passes through the prism.

• Applications of Prisms:

• Prisms are used in optical instruments, such as spectrometers, to analyze light.

• They are utilized in periscopes and binoculars for reflecting and redirecting light paths.

Important Points

• Snell's Law: Snell's law governs refraction and states that the ratio of the sine of the angle of incidence to the sine of the angle of refraction is constant for a given pair of media.

• Critical Angle: When light travels from a denser to a rarer medium, the critical angle is the angle of incidence above which total internal reflection occurs.

• Spectrum Formation: A prism disperses white light into its constituent colors, forming a spectrum due to varying refractive indices for different wavelengths of light.

• Refractive Index: This is a dimensionless number that describes how light propagates through a medium. Higher refractive indices result in greater bending of light.

Q15. Answer: (c) 20 m/sec

The correct answer is Option 3.

Key Points

• To determine the initial speed of the object, we use the equation of motion derived from kinematics: $v^2 = u^2 - 2gh$, where:

• v = final velocity (0 m/s at maximum height).
• u = initial velocity (to be calculated).
• g = acceleration due to gravity (10 m/s²).
• h = maximum height (20 m).
• Since the object comes to rest momentarily at maximum height, v = 0 m/s.
• Substituting values into the equation:
• $0^2 = u^2 - 2 \times 10 \times 20$.
• $0 = u^2 - 400$.
• $u^2 = 400 \rightarrow u = \sqrt{400} = 20$ m/s.
• Thus, the initial speed of the object when thrown is 20 m/s.
• Option 3 is correct as it matches the calculated value.

Additional Information

• Kinematic Equations of Motion:
• These equations relate the initial velocity, final velocity, acceleration, time, and displacement of an object.
• The three primary equations are:
• $v = u + at$ (Velocity-Time relation).
• $s = ut + 0.5at^2$ (Displacement-Time relation).
• $v^2 = u^2 + 2as$ (Velocity-Displacement relation).
• Acceleration Due to Gravity (g):
• The standard value of g near the Earth's surface is 9.8 m/s², approximated as 10 m/s² in calculations for simplicity.
• It signifies the rate at which objects accelerate towards the Earth when in free fall.
• Maximum Height Concept:
• At maximum height, the object's velocity becomes zero momentarily before it starts descending.
• The total energy of the object (kinetic + potential) remains conserved in the absence of air resistance.
• Practical Applications:
• Kinematic equations are widely used in projectile motion problems.
• They help analyze the motion of objects in sports, engineering, and space exploration.

Important Points

• Energy Conservation: At the moment of release, the object has maximum kinetic energy and zero potential energy. At maximum height, the kinetic energy becomes zero, and the potential energy becomes maximum.
• Real-world examples: The principles of kinematics are applicable in analyzing the trajectory of rockets, sports balls, and amusement park rides.

Q16. Answer: (a) –30 cm

The correct answer is –30 cm.

Key Points

• The question is about determining the image distance (v) when an object is placed in front of a concave mirror. The given parameters are:
• Object distance (u) = –30 cm. (The object distance is negative as per the sign convention because the object is placed in front of the mirror.)
• Focal length (f) = –15 cm. (The focal length of a concave mirror is negative as it lies on the same side as the object.)
• The mirror formula is given by: $1/f = 1/v + 1/u$
• Substitute the values of f and u:
• $1/–15 = 1/v + 1/–30$
• Simplify: $1/v = 1/–15 – 1/–30$
• Take the LCM of –15 and –30: $1/v = –2/30 + 1/30$
• Further simplify: $1/v = –1/30$
• So, v = –30 cm.
• The negative sign of v indicates that the image is formed on the same side as the object, which means the image is real and inverted.
• Hence, the correct image distance is –30 cm.

Additional Information

• Sign Convention for Mirrors:

• All distances are measured from the pole of the mirror.
• Distances measured in the direction of the incident light (towards the mirror) are taken as negative.
• Distances measured in the direction opposite to the incident light (away from the mirror) are taken as positive.
• The focal length of a concave mirror is always negative, while that of a convex mirror is positive.
• Nature of Image Formed by a Concave Mirror:
• If the object is beyond the focal point (f), the image formed is real, inverted, and on the same side as the object.
• If the object is at the focal point, the image is formed at infinity.
• If the object is between the focal point and the pole, the image is virtual, upright, and magnified.
• Mirror Formula:
• The mirror formula relates the focal length (f), object distance (u), and image distance (v): 1/f = 1/v + 1/u.
• It is valid for both concave and convex mirrors, provided the correct sign convention is followed.
• Magnification:
• The magnification (M) of a mirror is given by: M = –v/u.
• A positive magnification indicates an upright image, while a negative magnification indicates an inverted image.

Important Points

• Real Image: A real image is formed when the rays of light converge after reflection or refraction. It can be projected onto a screen.
• Virtual Image: A virtual image is formed when the rays of light appear to diverge from a point but do not actually meet. It cannot be projected onto a screen.
• Applications of Concave Mirrors:
• Used in torches and vehicle headlights to produce a strong, focused beam of light.
• Used by dentists for magnified and focused views of teeth.
• Used in solar concentrators to focus sunlight on a single point.
• Convex Mirrors: Used as rear-view mirrors in vehicles because they provide a wider field of view.

Q17. Answer: (d) 25 m/s

The correct answer is 25 m/s.

Key Points

• The problem involves calculating the final speed of a block subjected to a net force for a given period, which can be solved using the second law of motion and the formula for acceleration and velocity.
• Newton's second law states that Force = Mass × Acceleration. From this, acceleration can be calculated as Acceleration = Force ÷ Mass.
• Given values: Force = 20 N, Mass = 4 kg, and Time = 5 seconds. Substituting these values: Acceleration = 20 ÷ 4 = 5 m/s².
• The formula for calculating final velocity is: Final Velocity = Initial Velocity + (Acceleration × Time).
• Since the block is initially at rest, Initial Velocity = 0. Using the formula: Final Velocity = 0 + (5 × 5) = 25 m/s.
• Thus, the block's final speed is 25 m/s.

Additional Information

• Newton's Second Law of Motion:
• It states that the rate of change of momentum of an object is directly proportional to the net external force applied and occurs in the direction of the applied force.
• The mathematical expression is: F = ma, where F is the net force, m is the mass, and a is the acceleration.
• This law forms the basis for calculating forces and motion in physics.
• Equations of Motion:
• The equations of motion describe the relationship between velocity, acceleration, displacement, and time.
• The three key equations are:
• v = u + at: Final velocity (v) depends on initial velocity (u), acceleration (a), and time (t).
• s = ut + 1/2 at²: Displacement (s) depends on u, a, and t.
• v² = u² + 2as: Relates velocity and displacement.
• Force and Its Effects:
• Force is a vector quantity that causes an object to accelerate, decelerate, or change direction.
• Its SI unit is the Newton (N), where 1 N = 1 kg·m/s².
• In real-world scenarios, forces like friction, gravity, and applied forces interact to determine an object's motion.
• Practical Applications:

• The laws of motion are used in designing vehicles, predicting planetary orbits, and determining the forces in structures like bridges and buildings.

• Understanding acceleration and velocity is crucial in sports, engineering, and transportation systems.

Important Points

• Acceleration: It is the rate of change of velocity of an object. Its SI unit is m/s^2.

• Initial Velocity: The velocity at the start of motion; in this problem, it is 0 m/s.

• Final Velocity: The velocity at the end of the time period. Calculated using equations of motion.

• Time: It is the duration for which the force acts on the object, given as 5 seconds in this question.

• When forces act in a single direction on an object at rest, its motion is linear, and the velocity increases uniformly under constant acceleration.

Q18. Answer: (d) The maximum displacement of the particle from its mean position

The correct answer is The maximum displacement of the particle from its mean position.

Key Points

• Amplitude refers to the maximum displacement of a particle in a wave from its mean or equilibrium position. It is a measure of the wave's strength or intensity.

• The amplitude determines the energy carried by the wave. A larger amplitude indicates a wave with higher energy.

• Amplitude is always measured in units of distance, such as meters (m), centimeters (cm), or other relevant units, depending on the type of wave.

• In a graphical representation of a wave, the amplitude is the vertical distance from the mean position (baseline) to the crest (highest point) or trough (lowest point).

• It is important to note that amplitude is independent of other wave properties such as frequency, wavelength, or speed.

• Hence, the correct definition of amplitude is "The maximum displacement of the particle from its mean position."

Additional Information

• Wave Properties:

• Frequency: The number of vibrations or oscillations per second. It is measured in hertz (Hz). Frequency is not related to amplitude but determines the pitch of sound waves and the color of light waves.

• Wavelength: The distance between two consecutive crests or troughs in a wave. It is measured in meters (m). Wavelength and frequency are inversely proportional to each other.

• Wave Speed: The speed at which the wave propagates through a medium. It is calculated as the product of frequency and wavelength.

• Period: The time it takes for one complete oscillation or wave cycle. It is the reciprocal of frequency.

• Types of Waves:

• Mechanical Waves: Require a medium (e.g., air, water, solid) to propagate. Examples include sound waves and water waves.

• Electromagnetic Waves: Do not require a medium and can travel through a vacuum. Examples include light waves, radio waves, and X-rays.

• Importance of Amplitude:

• In sound waves, the amplitude determines the loudness. Higher amplitude results in louder sounds.

• In light waves, the amplitude is related to the intensity or brightness of the light.

• In seismic waves, the amplitude helps measure the energy release during an earthquake.

• Applications of Waves:

• Sound Waves: Used in communication, medical imaging (ultrasound), and musical instruments.

• Electromagnetic Waves: Used in technologies such as radio communication, microwaves (cooking and radar), and X-ray imaging.

• Water Waves: Studied for energy extraction (wave energy) and coastal engineering.

• Seismic Waves: Used to study Earth's interior and predict earthquakes.

Important Points

• Amplitude Formula: For simple harmonic motion (SHM), amplitude (A) can be expressed as the maximum displacement in the equation: $x = A \sin(\omega t + \varphi)$, where:

• x: Displacement

• A: Amplitude

• ω: Angular frequency

• t: Time

• φ: Phase constant

• Examples of Amplitude:

• The height of ocean waves from the calm water level to the crest represents the amplitude of the wave.

• In a pendulum, the maximum angular displacement from the vertical is the amplitude of its motion.

• In an electric circuit, the peak voltage of an alternating current (AC) wave is the amplitude.

Q19. Answer: (c) 4 : 1

The correct answer is 3 : 4 : 1.

Key Points

• Resistance and its formula: The electrical resistance of a conductor is given by the formula:

R = ρ × (L / A), where:

• R is the resistance,

• ρ (rho) is the resistivity of the material,

• L is the length of the conductor,

• A is the cross-sectional area.

• Given data in the question:

• The two wires are made of the same material, so their resistivity (ρ) is the same.

• The lengths of the wires are equal (L is constant).

• The ratio of cross-sectional areas of the wires is 1 : 4.

• Relation between resistance and area: Since R prop. to 1 / A (resistance is inversely proportional to the cross-sectional area for a given material and length), the ratio of resistances will be the inverse of the ratio of areas.

• Calculation:

• Let the cross-sectional areas of the wires be A1 and A2, where A1 : A2 = 1 : 4.

• The resistances R1 and R2 will be in the ratio R1 : R2 = A2 : A1.

• Therefore, the ratio of resistances is 4 : 1.

• Correct conclusion: The ratio of the resistances of the two wires is 4 : 1.

Additional Information

• Factors affecting resistance:

• Material: Different materials have different resistivities. Conductors like copper and silver have low resistivity, while insulators like rubber have high resistivity.

• Length: Resistance increases with an increase in the length of the conductor (R prop. to L).

• Cross-sectional area: Resistance decreases with an increase in the cross-sectional area of the conductor (R prop. to 1 / A).

• Temperature: For most conductors, resistance increases with an increase in temperature, while for semiconductors, resistance decreases with an increase in temperature.

• Applications of resistance:

• Heating devices: High resistance materials like nichrome are used in electric heaters, toasters, and irons.

• Electrical circuits: Resistors are used to control current and voltage in electronic circuits.

• Transmission lines: Low resistance materials like copper and aluminum are used in power transmission to minimize energy loss.

• Key characteristics of resistivity (ρ):

• Resistivity is a material property and is independent of the shape and size of the conductor.

• It is measured in ohm-meters (Ω·m).

• Good conductors like copper and silver have low resistivity, while insulators like rubber and glass have high resistivity.

• Practical example:

• If two wires of copper have the same length but different thicknesses, the thicker wire (larger cross-sectional area) will have lower resistance.

• This principle is used in designing electrical cables to ensure efficient power transmission.

Important Points

• Unit of resistance: The SI unit of resistance is the ohm (Ω).

• Conductance: The reciprocal of resistance is called conductance and is measured in siemens (S).

• Ohm's Law: It states that V = I × R, where V is the voltage, I is the current, and R is the resistance.

• Superconductors: Certain materials exhibit zero resistance below a critical temperature, known as superconductors. Examples include mercury and lead.

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Q20. Answer: (a) Ethanol

The correct answer is Ethanol.

Key Points

• Ethanol, a type of alcohol, burns with a blue, non-sooty flame due to its clean combustion process. This is a characteristic feature of carbon compounds with a simple molecular structure.

• When ethanol is burned in the presence of sufficient oxygen, it undergoes a complete combustion reaction, producing carbon dioxide (CO_2) and water (H_2O) as by-products.

• The absence of soot formation is attributed to the low carbon content of ethanol, which ensures that all the carbon atoms are completely oxidized during combustion.

• Other substances like kerosene, charcoal, and diesel often produce sooty or yellow flames due to incomplete combustion, especially when oxygen is limited.

• Ethanol is widely used as a biofuel and in applications where clean burning is essential, such as in indoor alcohol lamps and stoves.

Additional Information

• Ethanol:

• Ethanol (C_2H_5OH) is a volatile, flammable liquid that is a primary component of alcoholic beverages.

• It is also used as a renewable fuel source, often blended with gasoline to reduce harmful emissions.

• The combustion of ethanol produces a clean, blue flame, making it ideal for use in laboratories and clean energy applications.

• Ethanol is produced through the fermentation of sugars derived from crops like sugarcane, corn, and wheat.

• Kerosene:

• Kerosene is a hydrocarbon fuel commonly used for heating and lighting, but it tends to produce a yellow, sooty flame due to incomplete combustion.

• Its higher carbon content compared to ethanol leads to the formation of soot when burned.

• Charcoal:

• Charcoal is a solid form of carbon that burns with a yellow, sooty flame when oxygen is limited.

• It is primarily used for grilling, metallurgy, and heating purposes but does not produce a clean flame like ethanol.

• Diesel:

• Diesel is a petroleum-based fuel that burns with a yellow, sooty flame due to incomplete combustion, especially in engines or low-oxygen environments.

• It is commonly used in heavy machinery and vehicles but is not considered a clean-burning fuel like ethanol.

Important Points

• Complete vs. Incomplete Combustion:

• Complete combustion occurs when a fuel burns in the presence of adequate oxygen, producing carbon dioxide and water as by-products without soot.

• Incomplete combustion happens when oxygen is insufficient, leading to the production of carbon monoxide, soot, and other pollutants.

• Applications of Ethanol:

• Ethanol is extensively used as a biofuel in the transportation sector, often blended with petrol to create gasohol.

• It is also a key ingredient in hand sanitizers, cosmetics, and medicinal products due to its antiseptic properties.

• Environmental Impact:

• Ethanol is considered a cleaner alternative to fossil fuels as its combustion produces fewer greenhouse gases.

• However, large-scale ethanol production may lead to issues like deforestation and competition with food crops for agricultural land.

Q21. Answer: (c) P = W/t

The correct answer is P = W/t.

Key Points

• Power (P) is defined as the rate at which work is done or energy is transferred over time. The formula for power is given as: P = W/t, where:

• W represents the work done (in joules).

• t represents the time taken (in seconds).

• The SI unit of power is the watt (W), which is equivalent to one joule per second (1 W = 1 J/s).

• In the question, the machine performs W joules of work in t seconds. Using the formula P = W/t, the power of the machine can be calculated. Thus, Option 3 is correct.

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• Other options provided in the question are incorrect because:
• Option 1 ($P = W^2/t$): This is dimensionally inconsistent as power cannot involve a square of work.
• Option 2 ($P = W \times t$): This is incorrect because multiplying work by time does not yield power.
• Option 4 ($P = W^2t$): Again, this is dimensionally inconsistent and not based on the definition of power.

Additional Information

• Work (W):
• Work is defined as the product of force and displacement in the direction of the force. The formula is: $W = F \times d \times \cos(\theta)$, where:
• F is the force applied (in newtons).
• d is the displacement (in meters).
• θ is the angle between the force and displacement vectors.
• The SI unit of work is the joule (J), where 1 J = 1 N·m.
• Time (t):
• Time is a fundamental physical quantity and is measured in seconds (s) in the SI system.
• It is used to quantify the duration over which work is performed or energy is transferred.
• Power (P):
• Power is a scalar quantity, representing the rate of work done or energy transfer per unit time.
• In practical applications, power is often used to measure the performance of engines, machines, and electrical devices.
• For example, a 100 W lightbulb consumes energy at the rate of 100 joules per second.
• Practical Examples of Power:
• A person climbing stairs performs work against gravity. The power output depends on the rate of climbing (work done per second).
• In electrical circuits, power can be calculated using the formula $P = V \times I$, where V is voltage and I is current.

Important Points

• SI Units: Always ensure that quantities like work, time, and power are expressed in their respective SI units (joules, seconds, and watts) for consistent calculations.
• Dimensional Analysis: This is a useful tool for verifying the correctness of physical equations. For example, the dimensional formula of power is $[M^1L^2T^{-3}]$.
• Applications of Power: Power measurements are critical in fields like engineering, physics, and even sports science, as they help evaluate performance and efficiency.
• Real-World Examples: Devices like turbines, engines, and electric motors are rated based on their power output, which determines their capability to perform work efficiently over time.

Q22. Answer: (a) 23

The correct answer is 23.

Key Points

• The mass number of an atom is the total number of protons and neutrons in its nucleus. It is calculated using the formula:

Mass Number = Number of Protons + Number of Neutrons.

• In the given question, the atom has 11 protons and 12 neutrons. Substituting these values into the formula:

Mass Number = 11 + 12 = 23.

• Electrons are not included in the calculation of the mass number because their mass is negligible compared to protons and neutrons.
• The given atom has 11 electrons, which balances the 11 protons, ensuring the atom is electrically neutral. However, this does not affect the mass number.
• Hence, the correct mass number of the atom is 23.

Additional Information

• Protons:
• Protons are positively charged particles found in the nucleus of an atom.
• The number of protons determines the atomic number of the element.
• For example, an atom with 11 protons corresponds to the element Sodium (Na).
• Neutrons:
• Neutrons are neutral particles found in the nucleus alongside protons.
• The number of neutrons varies among isotopes of the same element, affecting the mass number but not the chemical properties.
• In this case, the atom has 12 neutrons.

• Electrons:

• Electrons are negatively charged particles that orbit the nucleus in energy levels or shells.

• The number of electrons is equal to the number of protons in a neutral atom.

• Electrons have negligible mass compared to protons and neutrons, so they do not contribute to the mass number.

• Mass Number vs Atomic Number:

• Mass Number: The total number of protons and neutrons in an atom's nucleus.

• Atomic Number: The number of protons in the nucleus, which defines the element.

• For example, Sodium (Na) has an atomic number of 11 and a mass number of 23 (11 protons + 12 neutrons).

Important Points

• The term "mass number" is different from "atomic mass." The mass number is a whole number, while the atomic mass is a weighted average of all isotopes of an element.

• Isotopes of an element have the same atomic number (number of protons) but different mass numbers due to varying numbers of neutrons. For example, Carbon-12 and Carbon-14 are isotopes of Carbon.

• The mass number is critical in identifying isotopes and calculating molecular masses in chemistry.

• Elements in the periodic table are arranged by their atomic numbers, not their mass numbers.

Q23. Answer: (c) Offspring receive genes from both parents

The correct answer is Offspring receive genes from both parents.

Key Points

• is ensured in sexually reproducing animals as offspring inherit genes from both parents, resulting in unique genetic combinations.

• During sexual reproduction, the fusion of male and female gametes (sperm and egg) combines genetic material from both parents, leading to diversity.

• This process of genetic mixing is facilitated by meiosis, which creates gametes with half the genetic material of the parent and ensures recombination of genetic traits.

• The genetic variation helps species adapt to changing environments and provides a survival advantage by introducing new traits into the population.

• Other factors like mutations, genetic recombination during meiosis, and random fertilization further contribute to the diversity of offspring.

Additional Information

• Meiosis and Genetic Variation:

• is the process by which gametes are formed, reducing the chromosome number by half and introducing genetic recombination through processes like crossing over.

• During meiosis, homologous chromosomes exchange genetic material, resulting in new combinations of genes.

• Fertilization:

• is the fusion of male and female gametes, combining genetic material from two different individuals to create a genetically unique zygote.

• Random fertilization, where any sperm can fuse with any egg, increases the diversity of offspring.

• - Genetic variation is crucial for and adaptation to environmental changes.

• It helps populations withstand diseases, environmental stress, and other challenges, enhancing their chances of survival.

• - Option 1 (): Gametes are formed by meiosis, not mitosis. Mitosis produces identical cells, whereas meiosis creates genetic variation.

• Option 2 (): While internal fertilization is common in some species, genetic variation is primarily due to recombination and inheritance, not the location of fertilization.

• Option 4 (): Sexual reproduction involves two parents, contributing to genetic diversity. A single parent reproduction (asexual reproduction) results in identical offspring.

Important Points

• Genetic variation is the cornerstone of, enabling natural selection to act upon populations.

• Diverse genetic traits allow populations to adapt to, emerging diseases, and ecological shifts.

• Traits like eye color, height, and susceptibility to certain diseases are influenced by genetic variation inherited from parents.

• Preserving genetic diversity is a priority for to ensure species survival in changing ecosystems.

Q24. Answer: (a) discrete orbits

The correct answer is discrete orbits.

Key Points

• The Bohr Model of the atom, proposed by Niels Bohr in 1913, describes the behavior of electrons in an atom.

• According to this model, electrons revolve around the nucleus in discrete orbits, which are also known as energy levels or shells.

• The orbits are quantized, meaning that electrons can only occupy specific energy levels and not exist in between them.

• Each orbit is associated with a fixed amount of energy, and electrons can transition between these orbits by absorbing or emitting energy in the form of photons.

• The model explains the stability of atoms and the emission spectra of elements, particularly the hydrogen atom.

Additional Information

• Bohr's Postulates:

• Quantized Orbits: Electrons revolve in specific, quantized orbits without radiating energy.

• Energy Absorption and Emission: Electrons absorb or emit energy when they transition between orbits.

• Angular Momentum Quantization: The angular momentum of an electron in orbit is quantized and given by the formula $mvr = n(h/2\pi)$, where n is the principal quantum number.

• Energy Levels: The energy of each orbit is defined by the equation $E = -13.6/n^2$ eV for hydrogen-like atoms, where n is the principal quantum number.

• Emission Spectra: The Bohr model successfully explains the discrete spectral lines of hydrogen, such as those in the Balmer series.

• Limitations of Bohr's Model:

• It is applicable only to single-electron systems like hydrogen and fails to explain multi-electron atoms.

• It does not account for the wave nature of electrons, as described by quantum mechanics.

• Modern Advancements: The Bohr model was later refined with the development of quantum mechanics, particularly the Schrödinger equation, which provides a more accurate description of electron behavior.

Important Points

• Discrete Orbits: These are fixed paths where electrons are stable and do not lose energy, as proposed by Bohr.

• Random Path: Incorrect, as electrons do not follow random paths in Bohr's model but specific orbits.

• Straight Lines: Incorrect, as electrons revolve in circular orbits around the nucleus, not in straight lines.

• Elliptical Path: Incorrect, as the Bohr model specifies circular orbits. Elliptical paths were proposed later in Sommerfeld's model.

Q25. Answer: (a) To preserve inherited biodiversity

The correct answer is To preserve inherited biodiversity.

Key Points

• Preserving inherited biodiversity ensures the continuation of ecological balance. Biodiversity is essential for the survival of all species, including humans, as it provides ecosystem services like pollination, oxygen production, and water purification.

• Conservation of forests plays a vital role in maintaining biodiversity. Forests are home to over 80% of terrestrial species, including plants, animals, fungi, and microorganisms.

• Conserving biodiversity helps in protecting the genetic diversity of species, which is crucial for adaptation and evolution. This genetic pool is essential for agricultural development, medicinal research, and resilience to climate change.

• It also contributes to the cultural and economic well-being of people by preserving resources used for food, medicine, and livelihood. Many indigenous communities depend on forests and biodiversity for their survival.

• In contrast, promoting industrial use of forests or prioritizing tourism over conservation can lead to habitat destruction, deforestation, and the extinction of species, which undermines the ecological balance.

Additional Information

• Biodiversity Hotspots:

• India is home to four biodiversity hotspots: the Himalayas, the Western Ghats, the Indo-Burma region, and the Sundaland (Nicobar Islands). These regions are rich in endemic species.

• The Western Ghats, for example, are recognized by UNESCO as a World Heritage Site due to their ecological significance.

• Threats to Biodiversity:

• Deforestation, habitat destruction, over-exploitation of resources, pollution, and climate change are major threats to biodiversity.

• Illegal wildlife trade also poses a significant challenge by endangering species and disrupting ecosystems.

• Important Initiatives for Biodiversity Conservation:

• Convention on Biological Diversity (CBD): An international treaty adopted at the Earth Summit in 1992 to promote sustainable development and biodiversity conservation.

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• National Biodiversity Authority (NBA): Established under the Biological Diversity Act, 2002, the NBA regulates the use of biological resources and promotes their sustainable use.

• Project Tiger: Launched in 1973, it aims to conserve tigers and their habitats.

• Eco-Sensitive Zones: Buffer zones around protected areas to minimize the impact of human activities on biodiversity.

• Functions of Forests:

• Forests act as carbon sinks, absorbing carbon dioxide and mitigating climate change.

• They regulate the hydrological cycle, prevent soil erosion, and support diverse flora and fauna.

• Forests also provide resources such as timber, fuelwood, and non-timber forest products like medicinal plants and fruits.

Important Points

• UN Decade on Ecosystem Restoration (2021–2030): This initiative aims to prevent, halt, and reverse ecosystem degradation globally to combat climate change and protect biodiversity.

• India's Forest Cover: As per the India State of Forest Report (ISFR) 2021, India's total forest and tree cover is 24.62% of its geographical area.

• Sacred Groves: These are community-protected forest areas, often dedicated to local deities, which play a key role in biodiversity conservation.

• Ramsar Sites: Wetlands of international importance under the Ramsar Convention, aiding in the conservation of migratory birds and aquatic biodiversity.

Q26. Answer: (b) Rs. 17,050

Shortcut Trick

Profit Ratio (Pushpraj : Himani) = 2700 : (5400 − 2700) = 2700 : 2700 = 1 : 1.

Since the Time Period is the same for both, the Investment Ratio is equal to the Profit Ratio.

Investment Ratio = 1 : 1.

Pushpraj's Investment = 1/2 × 34100 = Rs. 17,050.

Therefore The correct answer is Rs. 17,050.

Alternate Method

Given: Total Investment = Rs. 34,100, Total Profit = Rs. 5,400, Pushpraj's Profit Share = Rs. 2,700.

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

=> Himani's Profit Share = Total Profit − Pushpraj's Profit Share

=> Himani's Profit Share = 5400 − 2700 = Rs. 2,700

=> Profit Ratio (Pushpraj : Himani) = 2700 : 2700 = 1 : 1

=> Since Time is constant (1 year for both), Investment Ratio = Profit Ratio = 1 : 1

=> Let Pushpraj's Investment be x and Himani's Investment be x.

=> x + x = 34100

=> 2x = 34100

=> x = 34100 ÷ 2 = Rs. 17,050

Therefore The correct answer is Rs. 17,050.

Additional Information

Simple Partnership

In a Simple Partnership, all partners invest their capital for the same duration. The Profit is shared directly in the ratio of their Investments.

Compound Partnership

In a Compound Partnership, partners invest for different time periods. The Profit Ratio is calculated as (Investment1 × Time1) : (Investment2 × Time2).

Working vs Sleeping Partner

A Working Partner manages the business and may receive a fixed percentage of profit as a salary before the remaining profit is divided based on the investment ratio.

Q27. Answer: (c) 5 days

Shortcut Trick

Work Equivalence: 6 men × 5 days = 2 women × 15 days => 30 M = 30 W => 1 M = 1 W.

Total work in terms of men = 6 × 5 = 30 units.

Efficiency of 3 women + 3 men = 3 men + 3 men = 6 men.

Time taken = Total work ÷ Efficiency = 30 ÷ 6 = 5 days.

Therefore The correct answer is 5 days.

Alternate Method

Given:

Time for 6 men = 5 days

Time for 2 women = 15 days

Person	Days	Total Work	Efficiency
6 Men	5	30	6
2 Women	15	2	

Calculations:

=> Efficiency of 1 man = 6 ÷ 6 = 1 unit/day

=> Efficiency of 1 woman = 2 ÷ 2 = 1 unit/day

=> Efficiency of (3 men + 3 women) = (3 × 1) + (3 × 1) = 6 units/day

=> Time taken = Total Work ÷ Combined Efficiency = 30 ÷ 6 = 5 days

Therefore The correct answer is 5 days.

Additional Information

M-D-H Formula

Used for work comparison: (M1×D1×H1)/W1 = (M2×D2×H2)/W2.

Efficiency and Time

Efficiency is inversely proportional to the time taken to complete a work.

Work and Wages

Wages are distributed in the ratio of work done or the ratio of efficiencies when time is constant.

Q28. Answer: (d) 3°

Shortcut Trick

The angle formed by the bisectors of two adjacent angles in a quadrilateral is equal to half the sum of the other two angles.

angle STR = (angle P + angle Q) ÷ 2

=> 13.5° = (angle P + angle Q) ÷ 2 => angle P + angle Q = 27°

Ratio of angle P : angle Q = 4 : 5. Total parts = 9 units.

9 units = 27° => 1 unit = 3°.

Difference (angle Q − angle P) = 5 − 4 = 1 unit = 3°.

Therefore The correct answer is 3°.

Alternate Method

Given: angle STR = 13.5°, angle P : angle Q = 4 : 5.

Formula Used: Sum of interior angles of a quadrilateral = 360°. Sum of angles in a triangle = 180°.

In ΔSTR:

=> angle TSR + angle TRS + angle STR = 180°

=> (1/2)angle S + (1/2)angle R + 13.5° = 180°

=> (1/2)(angle S + angle R) = 166.5°

=> angle S + angle R = 333°

In quadrilateral PQRS:

=> angle P + angle Q + angle R + angle S = 360°

=> angle P + angle Q + 333° = 360°

=> angle P + angle Q = 27°

Let angle P = 4x and angle Q = 5x:

=> 4x + 5x = 27° => 9x = 27° => x = 3°

Difference = angle Q − angle P = 5x − 4x = x = 3°

Therefore The correct answer is 3°.

Additional Information

Quadrilateral Angle Bisector Theorem

The angle between the bisectors of any two adjacent angles is half the sum of the remaining two angles of the quadrilateral.

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Sum of Interior Angles

For any n-sided polygon, the sum of interior angles is (n − 2) × 180°. For a quadrilateral (n=4), it is 360°.

Opposite Angle Bisectors

The angle between the bisectors of two opposite angles in a quadrilateral is half the difference of the other two angles.

Q29. Answer: (c) 4

Shortcut Trick

For the Mean and Mode to be equal in this grouped data, the distribution should ideally be symmetric around the central class.

Identify the Modal Class as 25−35 (highest frequency = 10).

Check options for x < 6 to see which value makes Mean = Mode.

For x = 4: Mean = (120 + 300 + 160) ÷ 20 = 29. Mode = 25 + [(10 − 6) ÷ (20 − 6 − 4)] × 10 = 25 + 4 = 29.

Both values match perfectly at x = 4.

Therefore The correct answer is 4.

Alternate Method

Given: Class intervals and frequencies: (15−25, 6), (25−35, 10), (35−45, x). Also, Mean = Mode and x < 6.

1. Calculation of Mean:

=> Midpoints (m): 20, 30, 40

=> $\Sigma f_i = 6 + 10 + x = 16 + x$

=> $\Sigma f_i m_i = (6 \times 20) + (10 \times 30) + (x \times 40) = 120 + 300 + 40x = 420 + 40x$

=> Mean = (420 + 40x) ÷ (16 + x)

2. Calculation of Mode:

=> Modal Class = 25−35 (as 10 is the highest frequency since x < 6)

=> l = 25, h = 10, f1 = 10, f0 = 6, f2 = x

=> Mode = l + [(f1 − f0) ÷ (2f1 − f0 − f2)] × h

=> Mode = 25 + [(10 − 6) ÷ (20 − 6 − x)] × 10 = 25 + [4 ÷ (14 − x)] × 10 = 25 + 40 ÷ (14 − x)

3. Equating Mean and Mode:

=> (420 + 40x) ÷ (16 + x) = 25 + 40 ÷ (14 − x)

=> Try x = 4:

=> Mean = (420 + 160) ÷ 20 = 580 ÷ 20 = 29

=> Mode = 25 + 40 ÷ (14 − 4) = 25 + 40 ÷ 10 = 25 + 4 = 29

=> Since 29 = 29, the condition is satisfied.

Therefore The correct answer is 4.

Additional Information

Empirical Relationship

For moderately skewed distributions: Mode = 3 × Median − 2 × Mean.

Symmetric Distribution

In a perfectly symmetric distribution, the Mean, Median, and Mode are all equal.

Modal Class Property

The Modal Class is the interval with the highest frequency density. If frequencies are equal, the distribution is bimodal or multimodal.

Q30. Answer: (a) 720√258 cm²

Shortcut Trick

Sum of ratio parts = 28 + 23 + 35 = 86 units.

Value of 1 unit = 516 ÷ 86 = 6 cm.

Sides (a, b, c) = 168 cm, 138 cm, 210 cm; Semi-perimeter (s) = 258 cm.

Area = √(258 × 90 × 120 × 48) = √(258 × 518400) = 720√258 cm².

Therefore The correct answer is 720√258 cm².

Alternate Method

Given:

Ratio of sides of triangle = 28 : 23 : 35

Perimeter of the triangle = 516 cm

Formula Used:

Heron's Formula: Area = √[s(s − a)(s − b)(s − c)]

Where s is the semi-perimeter = (a + b + c) ÷ 2

Calculations:

=> Let the sides be 28x, 23x, and 35x.

=> 28x + 23x + 35x = 516

=> 86x = 516

=> x = 516 ÷ 86 = 6

=> Side a = 28 × 6 = 168 cm

=> Side b = 23 × 6 = 138 cm

=> Side c = 35 × 6 = 210 cm

=> Semi-perimeter (s) = 516 ÷ 2 = 258 cm

=> s − a = 258 − 168 = 90

=> s − b = 258 − 138 = 120

=> s − c = 258 − 210 = 48

=> Area = √(258 × 90 × 120 × 48)

=> Area = √(258 × 518400)

=> Area = √(258 × 720²)

=> Area = 720√258 cm²

Therefore The correct answer is 720√258 cm².

Additional Information

Heron's Formula

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

Semi-perimeter (s)

It is half the perimeter of the triangle: s = (a + b + c) ÷ 2.

Ratio Scaling

If sides are in ratio m:n:p, actual sides are mx, nx, px where x = Perimeter ÷ (m+n+p).

Q31. Answer: (d) 2

Shortcut Trick

Total distance covered during the two-way journey = 3.5 km × 2 = 7 km.

Total time taken = 1.5 hours + (1.5 hours + 0.5 hours) = 3.5 hours.

Average speed = Total distance ÷ Total time = 7 km ÷ 3.5 hours = 2 km/hr.

Therefore The correct answer is 2 km/hr.

Alternate Method

Given:

One-way distance = 3.5 km

Morning time (t1) = 1.5 hours

Evening time (t2) = 1.5 hours + 30 minutes = 2 hours

Formula Used:

Average Speed = Total Distance ÷ Total Time

Calculations:

=> Total distance covered = 3.5 km + 3.5 km = 7 km

=> Total time taken = 1.5 hours + 2 hours = 3.5 hours

=> Average speed = 7 ÷ 3.5 = 2 km/hr

Therefore The correct answer is 2 km/hr.

Additional Information

Average Speed with Equal Distances

When a person travels equal distances at speeds u and v, the average speed is given by the harmonic mean: Average Speed = (2 × u × v) ÷ (u + v).

General Average Speed Formula

For unequal distances and intervals, always use the fundamental formula: Average Speed = (Total Distance) ÷ (Total Time) = (d1

+ d2 + ...) ÷ (t1 + t2 + ...).

Unit Conversion

To convert speed from km/hr to m/s, multiply by 5/18. To convert from m/s to km/hr, multiply by 18/5.

Q32. Answer: (a) 624

Shortcut Trick

Ratio of numbers = 17 : 12 : 6

Sum of ratio parts = 17 + 12 + 6 = 35 units

Given 35 units = 1820

Middle number (12 units) = (1820 ÷ 35) × 12 = 52 × 12 = 624

Therefore The correct answer is 624.

Alternate Method

Given: Ratio = 17 : 12 : 6, Total Sum = 1820

=> Let the numbers be 17x, 12x, and 6x.

=> 17x + 12x + 6x = 1820

=> 35x = 1820

=> x = 1820 ÷ 35

=> x = 52

=> Middle number = 12x = 12 × 52

=> Middle number = 624

Therefore The correct answer is 624.

Additional Information

Ratio and Proportion

If a quantity A is divided into parts in the ratio a:b:c, then the value of the first part is [a / (a + b + c)] × A.

Compound Ratio

The compound ratio of a:b and c:d is (ac):(bd). It is found by multiplying the corresponding terms of the ratios.

Q33. Answer: (d) 127

Shortcut Trick

For two consecutive odd numbers, their product is always equal to (Middle Even Number)² − 1.

Given Product = 16383 => $x^2 - 1 = 16383$ => $x^2 = 16384$.

√16384 = 128 (since $120^2 = 14400$ and $130^2 = 16900$).

The numbers are (128 − 1) and (128 + 1), which are 127 and 129.

Therefore The correct answer is 127.

Alternate Method

Given: Product of two consecutive odd numbers = 16383.

Let the smaller odd number be n and the larger odd number be (n + 2).

=> n × (n + 2) = 16383

=> $n^2 + 2n - 16383 = 0$

=> $n^2 + 129n - 127n - 16383 = 0$

=> n(n + 129) − 127(n + 129) = 0

=> (n − 127)(n + 129) = 0

=> n = 127 (Ignoring negative value for natural odd numbers)

Therefore The correct answer is 127.

Additional Information

Consecutive Odd/Even Product

The product of any two consecutive odd or even numbers is always one less than the square of the even or odd number between them: $(x-1)(x+1) = x^2-1$.

Quadratic Roots Property

For a quadratic equation $ax^2 + bx + c = 0$, the sum of roots is −b/a and the product of roots is c/a.

Square Root Estimation

To find √16384, notice it ends in 4, so the square root must end in 2 or 8. Since $120^2 = 14400$ and $130^2 = 16900$, the value is 128.

Q34. Answer: (d) 10

Shortcut Trick

Combined efficiency of A + B = 1/4 and B = 1/20.

Efficiency of A = 1/4 − 1/20 = (5 − 1)/20 = 4/20 = 1/5.

Days for A to do single work = 5 days.

Days for A to do double the work = 5 × 2 = 10 days.

Therefore The correct answer is 10 days.

Alternate Method

Given: Time taken by (A + B) = 4 days, Time taken by B = 20 days.

Person	Days	Total Work	Efficiency
A + B	4	20	5
B	20	1	

=> Efficiency of A = Efficiency of (A + B) − Efficiency of B

=> Efficiency of A = 5 − 1 = 4 units/day

=> Double the work = 20 × 2 = 40 units

=> Time taken by A alone = Double Work ÷ Efficiency of A

=> Time taken by A = 40 ÷ 4 = 10 days

Therefore The correct answer is 10 days.

Additional Information

Efficiency Rule

Efficiency is inversely proportional to time taken. Efficiency = Total Work ÷ Time.

Work & Time Relationship

If work is doubled or tripled, the time taken by the same individual at a constant efficiency also doubles or triples accordingly.

Combined Work Formula

If A takes 'x' days and B takes 'y' days, together they take (xy)/(x+y) days to complete the work.

Q35. Answer: (c) 7

Shortcut Trick

Present ratio = 3 : 2 (Difference = 1 unit)

Ratio after 6 years = 5 : 4 (Difference = 1 unit)

Difference in ratio parts: (5 − 3) = 2 units → 6 years

Therefore 1 unit = 3 years

Present sum of ages = (3 + 2) × 3 = 15 years

Sum 4 years ago = 15 − (2 × 4) = 7 years

Therefore The correct answer is 7 years.

Alternate Method

Given: Present age ratio = 3 : 2. After 6 years ratio = 5 : 4.

Formula: Let ages be 3x and 2x.

=> (3x + 6) ÷ (2x + 6) = 5 ÷ 4

=> 4 × (3x + 6) = 5 × (2x + 6)

=> 12x + 24 = 10x + 30

=> 2x = 6

=> x = 3

=> Present ages are 3 × 3 = 9 and 2 × 3 = 6 years.

=> Present sum = 9 + 6 = 15 years.

=> Sum 4 years ago = (9 − 4) + (6 − 4) = 5 + 2 = 7 years.

Therefore The correct answer is 7 years.

Additional Information

Concept of Age Difference

The difference between the ages of two people remains constant regardless of the number of years passed or gone by.

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Sum of Ages Change

When calculating the sum of ages for 'n' people 't' years ago, subtract n × t from the current sum of their ages.

Ratio Balancing

To solve age ratios quickly, ensure the difference between the ratio parts is equal for both time periods by multiplying the ratios with appropriate factors.

Q36. Answer: (d) 20

Shortcut Trick

To find Profit %, equate the number of articles.

CP for 2 lemons = Rs. 1 → (Multiply by 5) → CP for 10 lemons = Rs. 5

SP for 5 lemons = Rs. 3 → (Multiply by 2) → SP for 10 lemons = Rs. 6

Profit % = (SP − CP) ÷ CP × 100 = (6 − 5) ÷ 5 × 100 = 1/5 × 100 = 20%

Therefore The correct answer is 20%.

Alternate Method

Given:

Cost Price (CP) of 2 lemons = Rs. 1

Selling Price (SP) of 5 lemons = Rs. 3

Formula Used:

Profit % = [(SP − CP) ÷ CP] × 100

=> CP of 1 lemon = 1 ÷ 2 = Rs. 0.50

=> SP of 1 lemon = 3 ÷ 5 = Rs. 0.60

=> Profit = SP − CP = 0.60 − 0.50 = Rs. 0.10

=> Profit % = (0.10 ÷ 0.50) × 100

=> Profit % = 1/5 × 100 = 20%

Therefore The correct answer is 20%.

Additional Information

Profit and Loss Basics

Profit occurs when Selling Price (SP) > Cost Price (CP). Profit = SP − CP. Loss occurs when CP > SP. Loss = CP − SP.

Cross-Multiplication Trick

For 'a' items at 'b' rupees and 'c' items at 'd' rupees, the profit/loss % can be found by comparing the products (b×c) and (a×d).

Percentage Calculation

Always calculate Profit % or Loss % on the Cost Price (CP) unless stated otherwise in the question.

Q37. Answer: (b) 1792

Shortcut Trick

For two numbers in ratio a : b, their LCM = a × b × HCF.

Given ratio = 7 : 8 and HCF = 32.

LCM = 7 × 8 × 32 = 56 × 32 = 1792.

Therefore The correct answer is 1792.

Alternate Method

Given:

Ratio of numbers = 7 : 8

HCF of numbers = 32

Formula Used:

Numbers = (Ratio 1 × HCF) and (Ratio 2 × HCF)

Product of numbers = HCF × LCM

Calculations:

=> First number = 7 × 32 = 224

=> Second number = 8 × 32 = 256

=> LCM × HCF = Product of numbers

=> LCM × 32 = 224 × 256

=> LCM = (224 × 256) ÷ 32

=> LCM = 224 × 8
=> LCM = 1792
Therefore The correct answer is 1792.
Additional Information
Product of Two Numbers
For any two positive integers a and b, LCM(a, b) × HCF(a, b) = a × b.
Co-prime Factors
If the ratio of two numbers is x : y (where x and y are co-prime), then LCM = HCF × x × y.
HCF property
The HCF of two or more numbers is always a factor of their LCM.

Q38. Answer: (a) 10 m

Shortcut Trick
In a 30°−60°−90° triangle, the ratio of sides is 1 : √3 : 2.
Side adjacent to 60° (Base) = 1 unit = 5 m.
Hypotenuse (Ladder length) = 2 units = 2 × 5 m = 10 m.
Therefore The correct answer is 10 m.
Alternate Method
Given:
Angle of elevation (θ) = 60°
Distance of foot from wall (Base) = 5 m
Formula Used:
cos θ = Base ÷ Hypotenuse
=> cos 60° = 5 ÷ L
=> 1/2 = 5 ÷ L
=> L = 5 × 2
=> L = 10 m
Therefore The correct answer is 10 m.
Additional Information
Trigonometric Ratios
For a right-angled triangle: sin θ = P/H, cos θ = B/H, and tan θ = P/B.
Special Angles
Value of cos 60° = 0.5, sin 60° = √3/2, and tan 60° = √3.
Pythagoras Theorem
In any right-angled triangle, $H^2 = P^2 + B^2$.

Q39. Answer: (d) 72

Shortcut Trick
The given sides of the right-angled triangle are 18 cm and 24 cm.
The ratio of these sides is 18 : 24 => 3 : 4.
According to the standard Pythagorean triplet (3, 4, 5), the third side (hypotenuse) will be proportional to 5.
Scaling factor = 18 ÷ 3 = 6 (or 24 ÷ 4 = 6).
Perimeter = (Sum of triplet parts) × Scaling factor => (3 + 4 + 5) × 6 = 12 × 6 = 72 cm.
Therefore The correct answer is 72 cm.
Alternate Method
Given:
Base (a) = 18 cm
Height (b) = 24 cm
Formula used:
Pythagoras Theorem: $\text{Hypotenuse}^2 = \text{Base}^2 + \text{Height}^2$
Perimeter = Base + Height + Hypotenuse
Calculations:

=> Hypotenuse (h) = √(18² + 24²)
=> h = √(324 + 576)
=> h = √900
=> h = 30 cm
=> Perimeter = 18 + 24 + 30
=> Perimeter = 72 cm
Therefore The correct answer is 72 cm.
Additional Information
Common Pythagorean Triplets
Triplets like (3, 4, 5), (5, 12, 13), (8, 15, 17), and (7, 24, 25) are frequently used in exams to find the hypotenuse quickly.
Area of a Right Triangle
The area is calculated as Area = 1/2 × Base × Height. For this triangle, Area = 1/2 × 18 × 24 = 216 cm².
Circumradius of a Right Triangle
The circumradius (R) is exactly half of the hypotenuse. Here, R = 30 ÷ 2 = 15 cm.

Q40. Answer: (b) 9 : 52

Shortcut Trick
Direct formula for Ratio of Cost Price (CP) to Marked Price (MP):
CP : MP = (100 − Discount%) : (100 + Profit%)
CP : MP = (100 − 73) : (100 + 56)
CP : MP = 27 : 156 = 9 : 52
Therefore The correct answer is 9 : 52.
Alternate Method
Given:
Discount = 73%
Profit = 56%
Let Listed Price (MP) = 100 units
=> Selling Price (SP) = MP − Discount = 100 − 73 = 27 units
=> Profit is 56%, so SP = CP × (156/100)
=> 27 = CP × 1.56
=> CP = 27 ÷ 1.56 = 2700 ÷ 156
=> Ratio CP : MP = (2700/156) : 100
=> Ratio = 2700 : 15600 = 27 : 156
=> Dividing by 3: 9 : 52
Therefore The correct answer is 9 : 52.
Additional Information
Marked Price and Selling Price
Selling Price (SP) = Marked Price (MP) × (100 − Discount%)/100.
Cost Price and Selling Price
Selling Price (SP) = Cost Price (CP) × (100 + Profit%)/100.
Successive Discounts
Total Discount for two successive discounts d1 and d2 = d1 + d2 − (d1 × d2)/100.

Q41. Answer: (a) Rs. 595

Shortcut Trick
Calculate 17% of Rs. 3,500 directly for one year.
Break down 17% into 10% + 5% + 2%.
10% of 3500 = 350
5% of 3500 = 175
2% of 3500 = 70
Total Interest = 350 + 175 + 70 = 595
Therefore The correct answer is Rs. 595.

Alternate Method

Given:

Principal (P) = Rs. 3,500

Rate of Interest (R) = 17% per annum

Time (T) = 1 year (Annual interest)

Formula Used:

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

Calculations:

=> SI = (3500 × 17 × 1) ÷ 100

=> SI = 35 × 17

=> SI = 35 × (10 + 7)

=> SI = 350 + 245

=> SI = 595

Therefore The correct answer is Rs. 595.

Additional Information

Simple Interest Components

Simple interest is calculated only on the Principal amount. The formula is SI = (P × R × T) / 100, where P is Principal, R is Rate, and T is Time in years.

Total Amount Formula

The total Amount (A) received after the time period is the sum of the Principal and the Interest: A = P + SI.

Rate and Time Relationship

If the time is given in months, divide by 12 to convert to years. If given in days, divide by 365. The Rate must always correspond to the time unit used.

Q42. Answer: (d) 78

Given:

20% of a number + 78 = Number

Formula used:

Number = 100%

Calculations:

=> 20% + 78 = 100%

=> 100% - 20% = 78

=> 80% = 78

Therefore The correct answer is option (4).

Q43. Answer: (c) 277 seconds

Shortcut Trick

Total Distance = Train Length + Platform Length = 1439 + 1331 = 2770 m.

Speed in m/s = 36 × (5/18) = 10 m/s.

Time Taken = 2770 ÷ 10 = 277 sec.

Therefore The correct answer is 277 sec.

Alternate Method

Given:

Length of Train (L1) = 1439 m

Length of Platform (L2) = 1331 m

Speed of Train (S) = 36 km/hr

Formula Used:

Time = Total Distance ÷ Speed

To convert km/hr to m/s, multiply by 5/18.

Calculations:

=> Total distance to cover = L1 + L2

=> Total distance = 1439 + 1331 = 2770 m

=> Speed in m/s = 36 × (5/18) = 2 × 5 = 10 m/s

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=> Time = 2770 ÷ 10

=> Time = 277 sec

Therefore The correct answer is 277 sec.

Additional Information

Unit Conversion

To convert km/hr to m/s, multiply by 5/18. To convert m/s to km/hr, multiply by 18/5.

Relative Speed

When two objects move in the opposite direction, relative speed is the sum of their speeds (S1 + S2). In the same direction, it is the difference (S1 − S2).

Crossing Stationary Objects

When a train crosses a pole or a man, distance = length of train. When it crosses a bridge or platform, distance = train length + platform length.

Q44. Answer: (a) 20%

Shortcut Trick

Net Profit % = Markup % − Discount % − [(Markup % × Discount %) ÷ 100]

Markup = 25%, Discount = 4%

Profit % = 25 − 4 − [(25 × 4) ÷ 100]

Profit % = 21 − [100 ÷ 100] = 21 − 1 = 20%

Therefore The correct answer is 20%.

Alternate Method

Given: Marked Price (MP) = Rs. 7,600, Markup = 25% above CP, Discount = 4%

Formula Used: CP = MP × [100 ÷ (100 + Markup %)]; SP = MP × [(100 − Discount %) ÷ 100]

=> Cost Price (CP) = 7600 × (100 ÷ 125) = 7600 × (4 ÷ 5) = Rs. 6,080

=> Selling Price (SP) = 7600 × (96 ÷ 100) = 76 × 96 = Rs. 7,296

=> Profit = SP − CP = 7296 − 6080 = Rs. 1,216

=> Profit % = (Profit ÷ CP) × 100 = (1216 ÷ 6080) × 100

=> Profit % = (1 ÷ 5) × 100 = 20%

Therefore The correct answer is 20%.

Additional Information

Relationship between CP and MP

The ratio of CP to MP is given by CP/MP = (100 − Discount %) ÷ (100 + Profit %).

Successive Percentage Change

Profit % is the resultant of markup (positive) and discount (negative) applied successively: a + b + (ab/100).

Marked Price (MP)

Also known as the List Price or MRP, it is the price printed on the product before any discounts.

Q45. Answer: (b) Increase by 22.5%

Shortcut Trick

Let TV cost = 100, then Washing Machine cost = 50.

Initial total cost (8 WM + 4 TV) = 8 × 50 + 4 × 100 = 400 + 400 = 800.

Change in WM cost = +83% of 400 = +332; Change in TV cost = −38% of 400 = −152.

Net Change = 332 − 152 = +180.

% Change = (180 ÷ 800) × 100 = 22.5%.

Therefore The correct answer is Increase by 22.5%.

Alternate Method

Given: WM cost is 50% less than TV cost. WM price increase = 83%, TV price decrease = 38%.

=> Let Cost of TV = Rs. 100 and Cost of Washing Machine (WM) = Rs. 50.

=> Initial total cost for 8 WM and 4 TV = (8 × 50) + (4 × 100) = 400 + 400 = Rs. 800.

=> New cost of WM = 50 + 83% of 50 = 50 + 41.5 = Rs. 91.5.

=> New cost of TV = 100 − 38% of 100 = 100 − 38 = Rs. 62.

=> New total cost = (8 × 91.5) + (4 × 62) = 732 + 248 = Rs. 980.

=> Percentage Change = [(980 − 800) ÷ 800] × 100 = (180 ÷ 800) × 100 = 22.5%.

Therefore The correct answer is Increase by 22.5%.

Additional Information

Percentage Change Formula

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

Weighted Average Method

When components change by different percentages, the net change is the weighted average: %Net = (w1c1 + w2c2) ÷ (w1 + w2).

Base Value Selection

Choosing 100 as the base for percentages simplifies calculation as the percentage value equals the absolute change.

Q46. Answer: (c) $-2x^2 - 13x + 10$

Shortcut Trick

Expand the product $(3x − 2)(x + 5)$ as $3x^2 + 15x − 2x − 10 = 3x^2 + 13x − 10$.

Subtract this from x^2: $x^2 − (3x^2 + 13x − 10)$.

Result: $−2x^2 − 13x + 10$.

Therefore The correct answer is $−2x^2 − 13x + 10$.

Alternate Method

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

Step 1: Multiply the binomials $(3x − 2)$ and $(x + 5)$ using the distributive property.

=> $(3x − 2)(x + 5) = 3x(x + 5) − 2(x + 5)$

=> $3x^2 + 15x − 2x − 10$

=> $3x^2 + 13x − 10$

Step 2: Substitute the result back into the original expression.

=> $x^2 − (3x^2 + 13x − 10)$

Step 3: Distribute the negative sign throughout the parenthesis.

=> $x^2 − 3x^2 − 13x + 10$

Step 4: Combine the like terms x^2 and $−3x^2$.

=> $−2x^2 − 13x + 10$

Therefore The correct answer is $−2x^2 − 13x + 10$.

Additional Information

Binomial Expansion (FOIL Method)

To multiply two binomials $(a + b)(c + d)$, use First, Outer, Inner, Last: $ac + ad + bc + bd$.

Distributive Property over Subtraction

When a negative sign is outside a parenthesis, like $−(a + b − c)$, it flips the sign of every term inside to $−a − b + c$.

Like Terms in Algebra

Only terms with the same variable and the same exponent (e.g., x^2) can be added or subtracted together.

Q47. Answer: (a) Increase of 18.3%

Shortcut Trick

Successive percentage changes: −30%, +30%, and +30%.

Net multiplier → $0.7 × 1.3 × 1.3 = 0.7 × 1.69 = 1.183$.

Percentage change → $(1.183 − 1) × 100 = +18.3\%$.

Therefore The correct answer is Increase of 18.3%.

Alternate Method

Given:

Decrease in 1^(st) year = 30%

Increase in 2^(nd) year = 30%

Increase in 3^(rd) year = 30%

Formula Used:

Final Value = Initial Value × (1 ± r1/100) × (1 ± r2/100) × (1 ± r3/100)

Calculations:

=> Let the initial salary be 100.

=> Salary after 30% decrease = 100 × (1 − 30/100) = 100 × 0.7 = 70.

=> Salary after 1^(st) subsequent 30% increase = 70 × (1 + 30/100) = 70 × 1.3 = 91.

=> Salary after 2^(nd) subsequent 30% increase = 91 × (1 + 30/100) = 91 × 1.3 = 118.3.

=> Percentage change = [(Final − Initial) ÷ Initial] × 100

=> Net change = (118.3 − 100) = 18.3%.

Therefore The correct answer is Increase of 18.3%.

Additional Information

Successive Percentage Formula

For two changes x% and y%, the net change is (x + y + xy/100)%. For more than two, apply the formula to the result of the first two.

Salary Decrease/Increase Rule

If a value is increased and then decreased by the same percentage r%, there is always a net decrease of (r^2/100)%.

Fraction Equivalent

30% increase means a multiplier of 13/10; 30% decrease means a multiplier of 7/10. Multiplying these fractions gives the final ratio directly.

Q48. Answer: (b) 7.5

Shortcut Trick

To solve such algebraic expressions quickly, substitute a convenient value for the variable, such as x = 0.

Numerator: 5^(3(0)+4) + 125^(0+1) = 5^4 + 125 = 625 + 125 = 750

Denominator: 125^(0+1) − 5^(3(0)+2) = 125 − 5^2 = 125 − 25 = 100

Result: 750 ÷ 100 = 7.5

Therefore The correct answer is 7.5.

Alternate Method

Given: (5^(3x+4) + 125^(x+1)) ÷ (125^(x+1) − 5^(3x+2))

Formula used: (a^m)^n = a^(mn) and a^(m+n) = a^m × a^n

=> Convert the base 125 into 5: 125^(x+1) = (5^3)^(x+1) = 5^(3x+3)

=> Substitute in expression: (5^(3x+4) + 5^(3x+3)) ÷ (5^(3x+3) − 5^(3x+2))

=> Factor out the smallest power 5^(3x+2) from both numerator and denominator:

=> [5^(3x+2) × (5^2 + 5^1)] ÷ [5^(3x+2) × (5^1 − 5^0)]

=> (5^2 + 5) ÷ (5 − 1)

=> (25 + 5) ÷ 4

=> 30 ÷ 4 = 7.5

Therefore The correct answer is 7.5.

Additional Information

Product and Quotient Rules

When multiplying bases, add exponents: a^m × a^n = a^(m+n). When dividing bases, subtract exponents: a^m ÷ a^n = a^(m−n).

Power of a Power Rule

For any base a, (a^m)^n = a^(m × n). This is essential for converting numbers like 125 to base 5.

Zero Exponent Rule

Any non-zero base raised to the power of zero is equal to 1: a^0 = 1.

Q49. Answer: (a) 51

Given:

Observations: 42, 97, 57, 62, 52, 13, 44, 23, 69

Number of observations (n) = 9

Formula used:

Mean = Sum / n

Calculations:

=> Sum = 42 + 97 + 57 + 62 + 52 + 13 + 44 + 23 + 69

=> Sum = 459

=> Mean = 459 / 9

=> Mean = 51

Therefore The correct answer is option (1).

Q50. Answer: (d) 4

Shortcut Trick

For a number to be divisible by 90, it must be divisible by both 9 and 10.

Divisibility by 10 => last digit y = 0.

Divisibility by 9 => sum of digits (7 + 6 + 1 + x + 0) must be a multiple of 9.

=> 14 + x = 18 => x = 4.

=> x + y = 4 + 0 = 4.

Therefore The correct answer is 4.

Alternate Method

Given: Five-digit number is 761xy and it is divisible by 90.

Formula Used: Divisibility rules for 9 and 10.

=> A number divisible by 90 is divisible by 9 × 10.

=> Rule for 10: The unit digit y must be 0.

=> The number becomes 761x0.

=> Rule for 9: The sum of digits 7 + 6 + 1 + x + 0 must be divisible by 9.

=> 14 + x must be a multiple of 9.

=> Since x is a single digit (0-9), the only possible value for 14 + x is 18.

=> x = 18 − 14 = 4.

=> Calculation for (x + y):

=> x + y = 4 + 0 = 4.

Therefore The correct answer is 4.

Additional Information

Divisibility Rule of 9

A number is divisible by 9 if the sum of its digits is divisible by 9.

Divisibility Rule of 10

A number is divisible by 10 if its unit digit is 0.

Composite Divisibility

To check divisibility by a composite number like 90, check divisibility by its co-prime factors (9 and 10 in this case).

Q51. Answer: (b) 861

Given:

• means −

− means ×

× means ÷

÷ means +

Calculation:

113 − 9 ÷ 17 + 519 × 3

= 113 × 9 + 17 − 519 ÷ 3

= 1017 + 17 − 173

= 1034 − 173

Hence, correct answer is 861

Q52. Answer: (a) Neither conclusion (I) nor (II) follows

All pathways are roads → Pathways are inside roads.

No pathway is a garden → Pathways and gardens do not overlap.

Conclusions:

(I) Some gardens are roads.

No definite relation is given between gardens and roads, so this cannot be concluded.

(II) All roads are gardens.

This is not possible because pathways are roads but no pathway is a garden.

Hence, the correct answer is: Neither conclusion I nor II follows.

Q53. Answer: (a) 651

621, 623, 627, 633, 641, ?

Differences:

+2, +4, +6, +8

Next difference = +10

641 + 10 = 651

Hence, the correct answer is 651.

Q54. Answer: (b) JM-GL

Check the alphabetical movement:

PS → MQ

P → M = −3

S → Q = −2

JM → GL

J → G = −3

M → L = −1

NQ → KO

N → K = −3

Q → O = −2

LO → IM

L → I = −3

O → M = −2

In three pairs, the pattern is (−3, −2).

But in JM – GL, the pattern is (−3, −1), which is different.

Hence, the correct answer is JM – GL.

Q55. Answer: (c) 49

Aftab is 18th from the right end.

Apoorva is 28th from the right end.

Apoorva is exactly between Aftab and Piyali, so Apoorva is the midpoint.

Distance between Aftab and Apoorva = 28 − 18 = 10

Therefore distance between Apoorva and Piyali is also 10.

So Piyali's position from the right end = 28 + 10 = 38

Piyali is 12th from the left end.

Total people in the row = 12 + 38 − 1 = 49

Hence, the correct answer is 49.

Q56. Answer: (c) A

Given:

R sits to the immediate left of U.

B sits to the immediate left of C.

C sits second to the left of T.

A sits third to the left of U.

Hence, the correct answer is A

Q57. Answer: (b) D

Given:

A sits fourth to the left of Y.

W sits fourth to the right of C.

Only two people sit between Y and C when counted from the left of Y.

X is not an immediate neighbour of W or Y.

D is not an immediate neighbour of X.

Hence, the correct answer is D

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Q58. Answer: (c) 9

Given: Number = 243178569

Arrange the digits in descending order:

987654321

Third digit from the left = 7

Second digit from the right = 2

Sum = 7 + 2 = 9

Hence, the correct answer is 9.

Q59. Answer: (b) 39

99, 87, 75, 63, 51, ?

Differences:

−12, −12, −12, −12

Next term = 51 − 12 = 39

Hence, the correct answer is 39.

Q60. Answer: (c) FOUR - OFUR - ROFU

Given:

BLUE → LBUE → ELBU

Pattern:

1 2 3 4 → 2 1 3 4 (first two letters interchange)

2 1 3 4 → 4 2 1 3 (last letter comes to the first position)

Apply to the given pair:

TWIN → WTIN (first two letters interchange)

WTIN → NWTI (last letter comes to the first position)

Now check the options.

URGE → RUGE → RGEU

URGE → RUGE (1 2 3 4 → 2 1 3 4 Yes)

RUGE → RGEU (1 2 3 4 → 1 3 4 2 No)

POST → PSOT → TSOP

POST → PSOT (1 2 3 4 → 1 3 2 4 No)

FOUR → OFUR → ROFU

FOUR → OFUR (1 2 3 4 → 2 1 3 4 Yes)

OFUR → ROFU (1 2 3 4 → 4 2 1 3 Yes)

READ → ERAD → DEAR

READ → ERAD (1 2 3 4 → 2 1 3 4 Yes)

ERAD → DEAR (1 2 3 4 → 4 2 3 1 No)

Hence, the correct answer is FOUR – OFUR – ROFU.

Q61. Answer: (b) 1

Given:

VAIL → 6598

OVAL → 8619

Common letters in both words: V, A, L

Common digits in both codes: 6, 9, 8

So these digits represent V, A, L.

Remaining digit in 8619 is 1, which corresponds to O.

Hence, the correct answer is 1.

Q62. Answer: (a) PLUG - LGUP - GULP

Given:

FOUR → ORUF → RUOF

TENS → ESNT → SNET

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Observe the pattern.
Step 1: Move the 1st letter to the last position.
FOUR → ORUF
TENS → ESNT
Step 2: Move the first two letters to the end in the same order.
ORUF → RUOF
ESNT → SNET
Now check the options.
PLUG → LGUP → GULP
PLUG → LGUP (1st letter to last Yes)
LGUP → GULP (first two letters move to the end Yes)
CUPS → UCPS → SUPC ?
YEAR → EYAR → REAY ?
RUST → RSUT → TSUR ?
Hence, the correct answer is PLUG – LGUP – GULP.

Q63. Answer: (b) KCU62

Numbers pattern:
154 − 23 = 131
131 − 23 = 108
108 − 23 = 85
Next number = 85 − 23 = 62
Letters pattern:
First letters:
M → S → Y → E (each +6)
Next: K
Second letters:
E → K → Q → W (each +6)
Next: C
Third letters:
W → C → I → O (each +6)
Next: U
So the next cluster = KCU62
Hence, the correct answer is KCU62.

Q64. Answer: (b) 5

Given series:
1 9 6 4 8 8 9 8 7 7 6 5 8 3 4 3 7 5 9 1 5 2 7 1 1 5 9
We need even numbers that are preceded by an odd number and followed by an odd number.
Check:
9 6 4 → next is even ?
9 8 7 → Yes
7 6 5 → Yes
5 8 3 → Yes
3 4 3 → Yes
5 2 7 → Yes
Total such numbers = 5
Hence, the correct answer is 5.

Q65. Answer: (a) WRM50

Numbers pattern:
38 → 42 → 46 (increase by +4)
Next number = 50

Letters pattern:
First letters:
Q → S → U (each +2)
Next = W
Second letters:
I → L → O (each +3)
Next = R
Third letters:
S → Q → O (each −2)
Next = M
So the next cluster = WRM50
Hence, the correct answer is WRM50.

Q66. Answer: (b) FLAG - LAFG - GALF

Given:
GIFT → IFGT → TFIG
LAND → ANLD → DNAL
GIFT → IFGT
Positions: 1 2 3 4 → 2 3 1 4
IFGT → TFIG
Positions: 1 2 3 4 → 4 2 1 3
Check with LAND:
LAND → ANLD
Positions: 1 2 3 4 → 2 3 1 4
ANLD → DNAL
Positions: 1 2 3 4 → 4 2 1 3
Now check options.
FLAG → LAFG
Positions: 1 2 3 4 → 2 3 1 4
LAFG → GALF
Positions: 1 2 3 4 → 4 2 1 3
The same pattern is followed.
Hence, the correct answer is FLAG – LAFG – GALF.

Q67. Answer: (c) Father's brother

Given:
D # S → D is the brother of S
S @ Z → S is the husband of Z
Z & M → Z is the mother of M
M % E → M is the sister of E
Symbol:
| - Upper/Lower Generation (Father/mother/grand father, mother)
— - Siblings (brother, sister, same generation)
• - Male
• (minus) - Female
Hence, the correct answer is option3

Q68. Answer: (b) P U U B G

Group: $ 9 6 @ 7
Original codes: $ → P, 9 → U, 6 → K, @ → B, 7 → G → P U K B G
Check conditions:
Second = 9 (perfect square), third = 6 (not perfect square) → no change
First and third even? $ is not a number → no change

Second and third multiples of 3? 9 and 6 → yes → third element takes code of second
Final codes: $ → P, 9 → U, 6 → U, @ → B, 7 → G
Answer: P U U B G
Hence, the correct answer is PUUBG

Q69. Answer: (b) 10 km to the south

Given:
Start at A, drives 8 km East → Position: 8 km East, 0 km North.
Right turn (South) and drives 11 km → Position: 8 km East, 11 km South.
Right turn (West) and drives 17 km → Position: 9 km West, 11 km South.
Right turn (North) 21 km, then right turn (East) 9 km → Position P: 0 km East, 10 km North.
Shortest distance to A = 10 km South.
Hence, the correct answer is option 2

Q70. Answer: (d) Only conclusion (I) follows

Explanation:
From the statements, some cars are vehicles and all vehicles are machines.
Therefore, the cars that are vehicles must also be machines.
So some machines are cars is definitely true.
But the statement No cars are machines contradicts the given information.
Hence, only conclusion (I) follows.

Q71. Answer: (b) 150

Operator meanings:
• means −
− means ×
× means ÷
÷ means +
Replace the operators:
15 × 10 + 4 − 20 ÷ 5
Calculate:
15 × 10 = 150
20 ÷ 5 = 4
150 + 4 − 4 = 150
Hence, the correct answer is 150.

Q72. Answer: (c) Five

Given series:
1 3 5 2 7 1 9 5 1 7 8 4 2 5 7 6 6 5 3 4 7 2 1 7 7 4 9
We need odd numbers that are preceded by an odd number and followed by an even number.
Check:
3 5 2 Yes
1 7 8 Yes
5 7 6 Yes
5 3 4 Yes
7 7 4 Yes
Total such numbers = 5
Hence, the correct answer is 5.

Q73. Answer: (a) 9 km to the North

Given:
Mayank drives 9 km East → Position: 9 km East, 0 km North.
Left turn (North) and drives 6 km → Position: 9 km East, 6 km North.
Left turn (West) and drives 17 km → Position: 8 km West, 6 km North.

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Left turn (South) and drives 15 km, then left turn (East) and drives 8 km → Position P: 0 km East, 9 km South.
Shortest distance to A = 9 km North.
Hence, the correct answer is option 1

Q74. Answer: (c) 60

The logic followed here:
8 + 10 = 18
18 + 12 = 30
30 + 14 = 44
44 + 16 = 60 (?)
60 + 18 = 78
Thus, the missing term is 60.
Hence, the correct answer is option (3).

Q75. Answer: (b) Four

Given:
We are taking Top = 1, Bottom = 7.
“Two boxes below S” → S must be at position 5.
“Only one box above Q” → Q must be at position 2.
“Only one box between Q and P” → P = 4.
“R immediately above N” → R = 6, N = 7.
“O is below M” → M = 1, O = 3.
Final order (Top → Bottom):
1 M
2 Q
3 O
4 P
5 S
6 R
7 N
Boxes between M (1) and R (6) = positions 2, 3, 4, 5 → 4 boxes
Hence, the correct answer is 4

Q76. Answer: (b) 4

Given series:
€ % # 6 & 4 * 9 6 @ 5 % @ # © 8 # % * £ 2
We need numbers which are preceded by a symbol and followed by a symbol.
Check:
6 & Yes
& 4 * Yes
9 6 No
9 6 @ No
@ 5 % Yes
© 8 # Yes
£ 2 (no symbol after) No
Total such numbers = 4
Hence, the correct answer is 4.

Q77. Answer: (c) 4

Given series:
% € € % 6 £ 3 & 1 £ 4 5 7 2 2 & & 9 & 8 8 *
We need symbols that are immediately preceded by a number and followed by a number.
Go step by step:

6 £ 3 → £ is between numbers Yes

3 & 1 → & is between numbers Yes

1 £ 4 → £ is between numbers Yes

5 7 2 → numbers only, skip

2 & & 9 → first & is preceded by 2 (number), followed by & (symbol) No, second & is preceded by & (symbol), followed by 9 (number) No

9 & 8 → & is between numbers Yes

8 * → * is preceded by 8 (number), but no number after No

Symbols that satisfy the condition: £, &, £, &

Total = 4

Hence, the correct answer is 4.

Q78. Answer: (a) (31, 28.7, 32.2)

Given sets:

(18, 15.7, 19.2)

18 − 2.3 = 15.7

18 + 1.2 = 19.2

(24, 21.7, 25.2)

24 − 2.3 = 21.7

24 + 1.2 = 25.2

Pattern:

Second number = First − 2.3

Third number = First + 1.2

Check options:

(31, 28.7, 32.2)

31 − 2.3 = 28.7 Yes

31 + 1.2 = 32.2 Yes

Hence, the correct answer is Option 1 (31, 28.7, 32.2).

Q79. Answer: (c) Three

Given:

L third to the left of I → Left = clockwise → L is 3 seats clockwise from I.

C immediate right of L → Right = anticlockwise → C sits just anticlockwise of L.

C third to the right of D → From D, move 3 anticlockwise to reach C → fixes D.

One person between B and K from the left of B → Clockwise pattern: B → _ → K.

J not neighbour of L → J sits in the remaining seat.

From right of J (anticlockwise) to B, the people between them = 3.

Hence, the correct answer is 3

Q80. Answer: (c) GK-EI

Check alphabet positions.

1) EI → CF

E → C (−2)

I → F (−3)

2) CG → AD

C → A (−2)

G → D (−3)

3) GK → EI

G → E (−2)

K → I (−2) ?

4) KO → IL

K → I (−2)

O → L (−3)

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In three pairs the pattern is −2, −3, but in option 3 it is −2, −2.

Hence, the correct answer is Option 3 (GK – EI).

Q81. Answer: (a) Andhra Pradesh

The correct answer is Andhra Pradesh.

Key Points

• According to the State of India's Environment 2025 report released by the Centre for Science and Environment (CSE), Andhra Pradesh secured the top position in the 'Environment' theme among Indian states.

• The rankings evaluate states based on various environmental indicators, including forest and tree cover, air quality, water resource management, waste management, biodiversity conservation, and climate action.

• The report aims to assess the environmental performance of states and encourage sustainable development and effective environmental governance.

• The State of States rankings are a part of the annual State of India's Environment report published by the Centre for Science and Environment.

• Hence, the correct answer is Option 1 – Andhra Pradesh.

Additional Information

• Centre for Science and Environment (CSE):

• It is a New Delhi-based public interest research and advocacy organisation working on environmental issues.

• It was founded in 1980 by Anil Agarwal.

• Sunita Narain is the Director General of CSE.

• State of India's Environment Report:

• It is published annually by the Centre for Science and Environment (CSE).

• The report covers themes related to environment, agriculture, public health, forests, water, climate change, and sustainable development.

Important Points

• Report: State of India's Environment 2025.

• Released By: Centre for Science and Environment (CSE).

• Top State in 'Environment' Theme: Andhra Pradesh.

• CSE Headquarters: New Delhi.

• Founder of CSE: Anil Agarwal.

• Director General: Sunita Narain.

Q82. Answer: (c) Five

The correct answer is Five.

Key Points

• India plans to develop five prototypes of the Advanced Medium Combat Aircraft (AMCA) before initiating series production. This development strategy ensures thorough testing and validation of the aircraft's design and functionality.

• The AMCA is a fifth-generation fighter aircraft project undertaken by India. It aims to enhance the nation's air combat capabilities significantly.

• The development of prototypes is crucial to identifying and resolving design flaws, optimizing performance, and ensuring operational readiness for mass production.

• The AMCA is being developed under the aegis of the Aeronautical Development Agency (ADA) in collaboration with other key stakeholders, such as Hindustan Aeronautics Limited (HAL).

• Prototype development is an integral part of the aircraft manufacturing process. It allows engineers and scientists to test the aircraft under varying conditions, ensuring compliance with operational requirements and safety standards.

Additional Information

• Advanced Medium Combat Aircraft (AMCA):

• The AMCA is a stealth, multi-role fighter aircraft designed for superior aerial combat, precision strike missions, and ground attack capabilities.

• This indigenous project is part of India's efforts to reduce dependence on foreign defense equipment and achieve self-reliance in defense technology.

• The AMCA will feature advanced technologies such as stealth capabilities, supercruise, and advanced avionics systems.

• The aircraft will be powered by twin engines and is expected to have a maximum takeoff weight of approximately 25 tons.

• The AMCA will be equipped with state-of-the-art weaponry, including long-range missiles, smart munitions, and electronic warfare systems.

• Prototype Development Process:
• Prototype development involves creating a preliminary version of the aircraft to test its design and functionality.
• Through rigorous testing, engineers identify and rectify issues related to performance, safety, and reliability.
• The prototype phase is essential for ensuring the aircraft meets operational requirements and adheres to international standards.
• After successful testing, the design is finalized, and the aircraft progresses to series production for deployment.
• Key Features of Fifth-Generation Fighter Aircraft:
• Fifth-generation aircraft are characterized by stealth technology, making them less detectable by radar and infrared systems.
• They incorporate supercruise capability, enabling sustained supersonic flight without afterburners.
• These aircraft are equipped with advanced avionics and sensors for enhanced situational awareness.
• They possess superior maneuverability, which is crucial for air combat dominance.
• Examples of fifth-generation fighters include the F-22 Raptor and Su-57 Felon.
• India's Defense Initiatives:
• India has been actively pursuing indigenous defense projects under the 'Make in India' initiative.
• Other significant projects include the Tejas Light Combat Aircraft (LCA) and various missile systems.
• These efforts aim to reduce dependency on foreign defense imports and enhance India's strategic autonomy.
• India's defense sector also emphasizes collaboration with private industries and international partners for technology sharing and co-development.

Important Points

• Timeline of AMCA Development:
• The AMCA project was conceptualized to replace older aircraft like the MIG-21 and Jaguar.
• The first prototype is expected to be ready by 2024-2025, with series production likely to begin by 2030.
• Collaborations:
• The project is being jointly developed by the Aeronautical Development Agency (ADA) and Hindustan Aeronautics Limited (HAL).
• International partnerships for critical technologies, such as engine development, are also being explored.
• Strategic Importance:
• The AMCA will significantly boost India's air defense capabilities and reduce reliance on foreign fighter jets like the Rafale.
• It will also enhance India's position as a defense exporter, supporting allied nations with cutting-edge technology.

Q83. Answer: (b) VARUNA

The correct answer is VARUNA.

Key Points

• The bilateral naval exercise between the Indian Navy and the French Navy is called VARUNA.
• VARUNA is a long-standing naval exercise conducted to enhance operational cooperation, maritime security, and interoperability between the navies of India and France.
• The 2025 edition of the VARUNA exercise was held in March 2025, showcasing joint maneuvers, tactical operations, and maritime drills.
• This exercise includes activities such as surface and anti-submarine warfare, air defense operations, and joint naval maneuvers.
• Both countries aim to strengthen their strategic partnership and ensure maritime security in the Indo-Pacific region through this exercise.

Additional Information

• History of Exercise VARUNA:
• The VARUNA exercise was first initiated in the year 2001 as part of Indo-French defense cooperation.
• It has evolved over the years to include a wide range of maritime operations, reflecting the growing importance of naval ties between the two nations.
• Significance of VARUNA:
• It underscores the commitment of India and France to ensure freedom of navigation and adherence to international maritime laws.
• It provides a platform for both navies to share best practices and improve coordination in maritime operations.
• Other Naval Exercises of India:
• EKUVERIN: A joint military exercise between India and the Maldives.
• SIMBEX: A naval exercise between India and Singapore.
• SLINEX: A bilateral naval exercise between India and Sri Lanka.

• France-India Strategic Relations:

• France is one of India's key strategic partners in defense, space, and nuclear energy.

• Both countries collaborate extensively to ensure maritime security in the Indo-Pacific region.

Important Points

• Option 1: MITRA

• This is not related to any bilateral naval exercise between India and France.

• Option 2: VARUNA

• Correct answer: The name of the bilateral naval exercise between the Indian Navy and the French Navy.

• Option 3: EKUVERIN

• A joint military exercise between India and the Maldives.

• Option 4: DOSTANA

• Not associated with any known naval exercises.

Q84. Answer: (d) $165.7 billion

The correct answer is $165.7 billion.

Key Points

• The India BioEconomy Report 2025 estimates that India's BioEconomy will be valued at $165.7 billion in 2024. This sector covers industries like biotechnology, pharmaceuticals, bioenergy, and agricultural biotechnology.

• The growth in the BioEconomy is attributed to advancements in biotechnology and bio-manufacturing technologies, enabling the production of sustainable and eco-friendly products.

• India is among the top 12 destinations for biotechnology worldwide and is home to over 4,200 biotech startups, a number expected to grow significantly in the coming years.

• Government initiatives such as ‘Make in India’, Biotechnology Industry Research Assistance Council (BIRAC), and Startup India have played a major role in fostering innovation and entrepreneurship in the BioEconomy sector.

• The BioEconomy is vital for India's economy as it integrates science and technology with traditional industries, contributing to sustainable development and job creation.

Additional Information

• BioEconomy Overview:

• The term BioEconomy refers to an economy where the basic building blocks of materials, chemicals, and energy are derived from renewable biological resources.

• This includes biotechnology-based solutions in agriculture, healthcare, energy, and industrial processes.

• Government Initiatives:

• The Biotechnology Industry Research Assistance Council (BIRAC), a Government of India enterprise, was established to empower the biotech sector through funding, mentorship, and policy support.

• Programs like Biotechnology Ignition Grant (BIG) and BioNEST Incubators aim to facilitate the growth of startups and entrepreneurship in biotechnology.

• Global Context:

• The global BioEconomy is projected to grow significantly, driven by the demand for sustainable and eco-friendly solutions, with India playing a critical role due to its massive biological resources and skilled workforce.

• Countries like the USA, Germany, and China have also invested heavily in BioEconomy sectors, underscoring its global importance.

• Applications of BioEconomy:

• In healthcare, biotechnology innovations include vaccines, gene therapy, and precision medicine.

• In agriculture, innovations in bio-fertilizers and genetically modified crops are revolutionizing sustainable farming practices.

• In energy, biofuels and biomass-based energy sources offer cleaner alternatives to fossil fuels.

Important Points

• India's BioEconomy Vision: India aims to achieve a $300 billion BioEconomy by 2030, focusing on research, innovation, and sustainable development.

• Job Creation: The BioEconomy is expected to create millions of jobs across various sectors, including biotech startups, research organizations, and manufacturing units.

• R&D Investment: Increased investment in Research and Development (R&D) is critical for driving innovation and maintaining India's competitive edge in the global BioEconomy.

• Challenges: Despite its potential, challenges such as regulatory hurdles, funding limitations, and lack of awareness need to be addressed to unlock the full potential of India's BioEconomy.

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Q85. Answer: (b) India

The correct answer is India.

Key Points

• India hosted the largest yoga session in 2025, with over 1.5 million participants, marking it as a historical event in the promotion of yoga and wellness globally.

• The event was organized on a massive scale to commemorate International Yoga Day, which is celebrated annually on 21st June as declared by the United Nations in 2014.

• The location for the yoga session was a sprawling venue in India, specifically chosen to accommodate the large number of participants and to showcase the country's commitment to promoting yoga as a global practice.

• India has been at the forefront of promoting yoga worldwide, with efforts spearheaded by the Indian government, particularly under the leadership of Prime Minister Narendra Modi.

• The event set a new Guinness World Record for the largest yoga session, surpassing all previous records and drawing significant international attention.

Additional Information

• International Yoga Day:

• Declared by the United Nations General Assembly (UNGA) in 2014, International Yoga Day is celebrated annually on 21st June.

• The initiative for this day was proposed by Indian Prime Minister Narendra Modi during his speech at the UNGA in 2014.

• The day aims to raise awareness about the health benefits of yoga and its role in promoting mental and physical well-being.

• Global Recognition of Yoga:

• Yoga is a 5,000-year-old discipline originating in India that combines physical, mental, and spiritual practices to attain holistic well-being.

• The practice of yoga has been recognized globally, with millions of enthusiasts participating in yoga sessions worldwide on International Yoga Day.

• Government Initiatives to Promote Yoga:

• The Ministry of AYUSH (Ayurveda, Yoga & Naturopathy, Unani, Siddha, and Homeopathy) plays a pivotal role in promoting yoga in India and abroad.

• Various campaigns, workshops, and international collaborations have been launched to encourage the adoption of yoga practices globally.

• Guinness World Records Related to Yoga:

• The previous record for the largest yoga session was held in 2018 when 100,984 participants performed yoga in Kota, Rajasthan.

• The 2025 event in India shattered this record with over 1.5 million participants, marking a significant milestone in yoga's global history.

Important Points

• Impact of Yoga on Health:

• Yoga is known to improve flexibility, strength, balance, and mental clarity.

• It helps in reducing stress, anxiety, and chronic pain, contributing to a better quality of life.

• Global Yoga Awareness:

• The celebration of International Yoga Day has led to an increase in the number of yoga practitioners globally.

• Countries worldwide, including USA, UAE, and Nepal, have incorporated yoga into their healthcare and wellness programs.

• UNESCO Recognition:

• In 2016, yoga was inscribed in the UNESCO's Representative List of the Intangible Cultural Heritage of Humanity.

• This recognition underscores yoga's cultural and historical significance as an ancient Indian tradition.

Q86. Answer: (c) Abhishek Sharma

The correct answer is Abhishek Sharma.

Key Points

• Abhishek Sharma scored the highest individual score in a single innings during the IPL 2025, showcasing an exceptional batting performance.

• His innings included a combination of powerful shots and strategic gameplay, making him the standout player of the tournament.

• Abhishek Sharma's record-breaking score surpassed previous records held by other players in the Indian Premier League.

• He played for his franchise team with remarkable consistency throughout the tournament, contributing significantly to their success.

• The match where he achieved this milestone was highly celebrated, and it highlighted his ability to handle pressure in crucial

moments.

Additional Information

• Abhishek Sharma:

• Born on 4 September 2000, Abhishek Sharma is a talented Indian cricketer known for his all-round abilities.

• He hails from Amritsar, Punjab, and has been a part of various domestic and international cricket tournaments.

• He is primarily recognized for his aggressive batting style and ability to accelerate the game during middle overs.

• Abhishek has represented teams like Sunrisers Hyderabad in the IPL and played key roles in their campaigns.

• Indian Premier League (IPL):

• The IPL is one of the most popular T20 cricket leagues globally, featuring top players from around the world.

• It was established in 2008 and is governed by the Board of Control for Cricket in India (BCCI).

• The league is known for its competitive matches, entertainment value, and contribution to the growth of cricket.

• Highest Individual Scores in IPL History:

• Before Abhishek Sharma, players like Chris Gayle (175*), Rishabh Pant, and KL Rahul were among the record holders for high individual scores.

• Abhishek's record-breaking innings added his name to the list of legendary performances in IPL history.

• Impact on the Team:

• Abhishek Sharma's milestone innings had a significant impact on his team's morale and overall performance in the tournament.

• Such individual achievements often inspire younger players and contribute to the league's excitement.

Important Points

• Chris Gayle's record: He scored 175 not out in IPL 2013, which was considered the highest individual score until it was surpassed by Abhishek Sharma.

• Consistency in IPL: Players like KL Rahul and Rishabh Pant have showcased exceptional performances, but Abhishek's innings in IPL 2025 was unique in terms of magnitude and impact.

• Emerging Talent: Abhishek Sharma's performance highlights the importance of nurturing young talent in Indian cricket.

Q87. Answer: (d) Plastic Pollution

The correct answer is Plastic Pollution.

Key Points

• World Environment Day is celebrated every year on 5th June, and in 2025, the theme focused on addressing Plastic Pollution, a global environmental challenge.

• Plastic Pollution has devastating effects on ecosystems, marine life, terrestrial habitats, and human health due to its non-biodegradable nature and accumulation in the environment.

• As part of the 2025 observance, countries worldwide emphasized reducing single-use plastics and transitioning to sustainable alternatives.

• The initiative aligned with the United Nations Environment Programme (UNEP) campaign titled "Beat Plastic Pollution" to promote policies, awareness, and actions to curb the menace of plastic waste.

• Efforts were concentrated on enhancing recycling infrastructure, encouraging biodegradable materials, and implementing stringent regulations to minimize plastic usage.

Additional Information

• Plastic Pollution:

• Definition: The accumulation of plastic objects and particles (e.g., bottles, bags, microplastics) adversely affects the environment, wildlife, and human health.

• Sources: Major contributors include single-use plastics, packaging materials, and improperly disposed plastic waste.

• Statistics: According to UNEP, over 400 million tons of plastic are produced annually, of which only less than 10% is recycled.

• Impact: Plastics pollute oceans, leading to the death of marine species, disrupt soil fertility, and release toxic chemicals during degradation.

• Global Efforts to Combat Plastic Pollution:

• United Nations Initiatives: UNEP launched the "Beat Plastic Pollution" campaign to address the global crisis.

• Policy Actions: Nations have introduced bans on single-use plastics, imposed taxes on plastic products, and promoted circular economy models.

• Innovations: Research is being conducted into biodegradable plastics, and businesses are transitioning to eco-friendly materials.

• Alternatives to Plastic:

• Biodegradable Materials: Such as bamboo, jute, paper, and organic polymers.

• Reusable Products: Promotion of steel, glass, and cloth-based alternatives for packaging and storage.

• Recycling: Advanced technologies to recycle plastic waste efficiently.
• Role of Individuals:
• Adopting zero-waste lifestyles by minimizing plastic usage in daily activities.
• Participating in clean-up drives and supporting awareness campaigns.
• Opting for products made from sustainable materials.

Important Points

• United Nations Environment Programme (UNEP):
• The UNEP has been instrumental in leading global efforts against plastic pollution through initiatives and partnerships.
• Its campaigns focus on sustainable waste management, marine conservation, and promoting eco-friendly alternatives.
• Global Reports:
• The Global Plastic Pollution Report highlights that plastic waste contributes to 80% of marine debris, affecting over 700 marine species.
• Studies emphasize the need for global cooperation in combating plastic pollution, citing rapid increases in production and disposal rates.
• Government Regulations:
• Several countries, including India, Kenya, and the EU, have implemented bans on single-use plastics and set recycling targets.
• Policies promoting Extended Producer Responsibility (EPR) ensure manufacturers manage post-consumer waste.

Q88. Answer: (c) Dr. Ajit Ratnakar Joshi

The correct answer is Dr. Ajit Ratnakar Joshi.

Key Points

• Dr. Ajit Ratnakar Joshi was appointed as the Executive Director of the Reserve Bank of India (RBI) in March 2025.
• He is responsible for overseeing two critical departments of the RBI:
• The Department of Statistics and Information Management (DSIM), which handles statistical analysis, data collection, and information management to support RBI's policy decisions.
• The Financial Stability Department (FSD), which ensures the stability of India's financial system by identifying and mitigating systemic risks.
• Dr. Ajit Ratnakar Joshi is known for his extensive experience in economics, finance, and data analysis, making him well-suited for these vital roles in RBI.
• His appointment aligns with RBI's objective of strengthening its analytical and data-driven approach to policy formulation and maintaining financial stability in India.
• He has previously held important positions in various financial institutions and is recognized for his contributions to economic policymaking.

Additional Information

• Reserve Bank of India (RBI):
• The Reserve Bank of India (RBI) is the central banking institution of India, responsible for regulating the country's monetary policy and ensuring financial stability.
• It was established on 1 April 1935, under the Reserve Bank of India Act, 1934.
• The RBI performs functions such as issuing currency, managing foreign exchange reserves, regulating and supervising banks, and acting as the banker to the government.
• Department of Statistics and Information Management (DSIM):
• This department collects, compiles, and analyzes macroeconomic and financial statistics critical for policymaking.
• It also develops statistical methodologies and manages the digital infrastructure for data storage and dissemination.
• The DSIM is instrumental in conducting surveys, such as the Consumer Confidence Survey and Inflation Expectations Survey, which aid the RBI in decision-making.
• Financial Stability Department (FSD):
• Established in 2010, the FSD is tasked with monitoring the stability of India's financial system.
• It identifies systemic risks, conducts stress testing, and formulates measures to prevent financial crises.
• The department also publishes the Financial Stability Report, which provides a comprehensive assessment of the health of the financial sector.
• Executive Directors in RBI:
• Executive Directors (EDs) play a pivotal role in implementing RBI's policies and managing its various departments.
• They typically have extensive experience in banking, finance, economics, or related fields and are responsible for key operational areas of the central bank.

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• The appointment of EDs is crucial for ensuring effective governance and operational efficiency within the RBI.

Important Points

• The RBI is headquartered in Mumbai and has multiple regional offices across India.

• The Governor of RBI is the chief executive officer, supported by Deputy Governors and Executive Directors.

• In recent years, the RBI has emphasized the importance of data-driven decision-making to enhance policy effectiveness and transparency.

• The Financial Stability Report (FSR), published semi-annually by the FSD, provides key insights into the health of the banking and financial sectors.

• The DSIM has been at the forefront of modernizing statistical practices and adopting advanced data analytics to support the RBI's regulatory and supervisory functions.

Q89. Answer: (d) Unified Lending Interface

The correct answer is Unified Lending Interface.

Key Points

• The term Unified Lending Interface (ULI) refers to a unified platform that aims to streamline and simplify the lending processes by integrating different financial stakeholders, including banks, non-banking financial institutions, and regulatory bodies.

• The Department of Financial Services (DFS) under the Ministry of Finance, along with the Reserve Bank of India (RBI), convened a high-level meeting in June 2025 to discuss scaling up ULI.

• This initiative is expected to enhance transparency, improve credit accessibility, and increase efficiency in the lending ecosystem for borrowers and lenders alike.

• The meeting was co-chaired by M Nagaraju, Secretary, Department of Financial Services, and T Rabi Sankar, Deputy Governor of RBI, reflecting the collaboration between government departments and regulatory institutions.

• ULI may potentially utilize advanced technologies like blockchain, artificial intelligence (AI), and digital interfaces to ensure seamless integration across financial platforms.

Additional Information

• Department of Financial Services (DFS):

• The DFS operates under the Ministry of Finance, Government of India, and is responsible for overseeing various financial institutions including banks, insurance companies, and pension schemes.

• It plays a pivotal role in formulating policies to improve financial inclusion and strengthen India's financial ecosystem.

• Key initiatives under DFS include schemes like Pradhan Mantri Jan Dhan Yojana and Pradhan Mantri Mudra Yojana.

• Reserve Bank of India (RBI):

• The RBI is India's central banking institution, established on April 1, 1935, under the Reserve Bank of India Act, 1934.

• It regulates monetary policy, manages foreign exchange reserves, and ensures the stability of the financial system in India.

• Key functions include issuing currency, managing inflation, and supervising banks and non-banking financial institutions.

• Unified Lending Interface (ULI) Features:

• ULI aims to integrate various lending platforms for improved coordination and efficiency.

• It is expected to provide a centralized database for lenders, enabling easier credit assessments and reducing loan processing times.

• The interface could support digital KYC and real-time credit scoring, ensuring better transparency.

• It may also help reduce fraudulent activities by cross-verifying borrower details through unified digital frameworks.

• Future Implications of ULI:

• With enhanced integration, ULI could serve as a game-changer for small businesses and individuals seeking easier access to credit.

• The introduction of ULI aligns with India's broader goals of digital transformation and financial inclusion.

• It could provide opportunities for innovative lending solutions such as peer-to-peer lending and microcredit systems.

Important Points

• Technological Integration: The success of ULI will depend on the implementation of advanced technologies like blockchain for secure data sharing and AI for predictive credit scoring.

• Policy Alignment: ULI must align with existing financial policies and regulations to ensure smooth implementation and compliance.

• Stakeholder Collaboration: Effective collaboration among banks, NBFCs, and fintech companies is critical for the success of ULI.

• Impact on Financial Inclusion: ULI could significantly improve access to credit for underserved sectors, including rural and semi-urban areas.

• Monitoring and Evaluation: Regular performance assessments will be crucial to measure the effectiveness of ULI and make necessary improvements.

Q90. Answer: (d) Arvind Panagariya

The correct answer is Arvind Panagariya.

Key Points

• N. K. Singh was the Chairperson of the 15th Finance Commission and is a notable economist and policymaker in India.

• The 16th Finance Commission has been constituted as of the latest updates. The Chairperson of the 16th Finance Commission of India is Dr. Arvind Panagariya.

• The Chairperson of a Finance Commission is typically an expert in public finance, economics, or administration, ensuring that the recommendations align with national priorities.

• N. K. Singh, as the Chairperson of the 15th Finance Commission, played a significant role in addressing critical financial issues such as tax devolution, grants to local bodies, and disaster management funds.

• The Finance Commission is a constitutional body established under Article 280 of the Indian Constitution, which ensures a sound fiscal relationship between the Union and the States.

Additional Information

• About the Finance Commission:

• The Finance Commission is a constitutional body constituted by the President of India every five years under Article 280.

• Its primary function is to recommend the division of tax revenues between the Union and the States and among the states themselves.

• It also addresses issues related to grants-in-aid for local bodies and other financial matters as referred to it by the President.

• Key Responsibilities of the Chairperson:

• To lead discussions on fiscal policies and ensure equitable revenue sharing between the Union and States.

• To analyze and address economic challenges, such as fiscal deficits, state debts, and revenue mobilization.

• To guide the Commission in providing recommendations for financial governance and intergovernmental fiscal relations.

• About N. K. Singh:

• Nand Kishore Singh is a prominent Indian economist, policymaker, and former IAS officer.

• He has held key positions, including Revenue Secretary and Expenditure Secretary in the Government of India.

• As Chairperson of the 15th Finance Commission, he addressed vital issues such as vertical and horizontal tax devolution, local body finances, and disaster management funds.

• Article 280 of the Constitution:

• This Article mandates the formation of the Finance Commission by the President every five years or earlier, as required.

• The Commission consists of a Chairperson and four other members appointed by the President.

• Its recommendations are advisory, but they carry significant weight in shaping fiscal policies and governance.

• Historical Background:

• The first Finance Commission was constituted in 1951 under the Chairmanship of K.C. Neogy.

• Since then, 15 Finance Commissions have been constituted, addressing India's evolving fiscal needs and governance challenges.

Important Points

• 15th Finance Commission Recommendations:

• Vertical devolution of 41% of the divisible tax pool to states, a reduction from 42% due to Jammu & Kashmir's reorganization.

• Special grants and performance-based incentives for states to improve governance and fiscal management.

• Focus on health, education, and disaster risk management in fiscal transfers.

• Significance of Finance Commissions:

• They ensure a balanced fiscal relationship between different levels of government.

• They promote financial stability and equitable development across regions in India.

• They help address fiscal challenges like debt sustainability and resource mobilization in a growing economy.

Q91. Answer: (a) Gulveer Singh

The correct answer is Gulveer Singh.

Key Points

• Gulveer Singh set the men’s 10,000 m record of 27:00.22 at the TEN 2025 meet, showcasing exceptional athletic performance in long-distance running.

• The TEN 2025 meet is a prestigious event that attracts elite runners globally, and achieving such a record highlights his dedication and skill.

• With this achievement, Gulveer Singh has positioned himself among the top long-distance runners on both a national and international level.

• Breaking the 27-minute barrier in the 10,000 m is a rare feat and underscores his exceptional endurance, speed, and training regimen.

• This record contributes significantly to India's athletics history, inspiring future generations of runners and enhancing India's presence in long-distance running on the global stage.

Additional Information

• 10,000 m Race:

• The 10,000 m is a long-distance track event that covers 25 laps of a standard 400-meter track.

• This race demands a combination of endurance, speed, and tactical awareness, making it one of the most challenging track events.

• It is featured in major athletic championships, including the Olympics and World Athletics Championships.

• Gulveer Singh's Background:

• Gulveer Singh is an emerging talent in Indian athletics, known for his strong performances in middle and long-distance events.

• His achievement at the TEN 2025 meet adds to his growing reputation as one of India's top long-distance runners.

• Training and Preparation:

• To achieve such a record, athletes like Gulveer undergo rigorous training that includes interval training, tempo runs, and long runs to build endurance and speed.

• Nutrition and recovery also play a critical role in ensuring peak performance during competitions.

• Other Indian Athletes in Long-Distance Running:

• Avinash Sable: Known for his achievements in the steeplechase, he is one of India's prominent track athletes.

• Jinson Johnson: Specializes in middle-distance events like the 1500 m and has represented India in multiple international events.

• Shivnath Singh: A legendary figure in Indian athletics, he held the national marathon record for decades.

Important Points

• Global Context: The men's 10,000 m world record currently stands at 26:11.00, set by Joshua Cheptegei of Uganda in 2020, showcasing the global standard for this event.

• Historical Significance: Breaking records at events like the TEN 2025 meet brings attention to the athlete's country and promotes athletics development.

• Future Prospects: Achievements like Gulveer Singh's provide a platform for participation in international competitions such as the Olympics and World Championships.

Q92. Answer: (d) Paris Agreement

The correct answer is Paris Agreement.

Key Points

• India's National Adaptation Plan (NAP) is being drafted as the country's first comprehensive framework for climate adaptation to address challenges posed by climate change.

• The Paris Agreement, adopted in December 2015, mandates signatory countries to submit their National Adaptation Plans (NAPs) to the United Nations Framework Convention on Climate Change (UNFCCC).

• The Paris Agreement specifically aims to limit global temperature rise to below 2°C above pre-industrial levels and pursue efforts to limit the temperature increase to 1.5°C.

• Under the Paris Agreement, countries are expected to focus not only on mitigation (reducing greenhouse gas emissions) but also on adaptation strategies to build resilience against climate impacts.

• India's NAP is set to be submitted by September 2025, demonstrating India's compliance with its international climate commitments under the Paris Agreement.

Additional Information

• Paris Agreement:

• The Paris Agreement is a landmark international treaty adopted during the 21st Conference of Parties (COP21) in Paris, France.

• It involves commitments by 196 parties to combat climate change and adapt to its effects, with enhanced support to assist developing countries.

• The agreement includes provisions for Nationally Determined Contributions (NDCs), where countries outline their climate actions and targets.

• It emphasizes global financial support for adaptation initiatives, especially in developing countries.

• The agreement entered into force on 4 November 2016.

• Cartagena Protocol:

• Adopted in 2000 as a supplementary agreement to the Convention on Biological Diversity (CBD).

• Focuses on the safe handling, transport, and use of living modified organisms (LMOs) resulting from modern biotechnology.

• It does not address climate change but rather biodiversity and biosafety issues.
• Kyoto Protocol:
• Adopted in 1997, it aimed to reduce greenhouse gas emissions globally, primarily focusing on industrialized nations.
• It set binding emission reduction targets but was replaced by the Paris Agreement as it failed to engage all nations equally.
• Montreal Protocol:
• Adopted in 1987, this protocol focuses on protecting the ozone layer by phasing out ozone-depleting substances.
• It is not related to climate adaptation plans but is considered one of the most successful environmental treaties.

Important Points

• India's Climate Commitments:
• India submitted its NDCs under the Paris Agreement, pledging to reduce its emissions intensity of GDP by 33-35% by 2030 compared to 2005 levels.
• It also aims to achieve 40% of its electric power capacity from non-fossil fuel sources by 2030.
• National Adaptation Plan (NAP):
• The NAP process is critical for developing countries to enhance resilience against climate impacts.
• It involves comprehensive research, stakeholder consultations, and policy framing to mitigate vulnerabilities.
• UNFCCC:
• The UNFCCC was established in 1992 to combat climate change and its impacts globally.
• The Paris Agreement operates under the framework of the UNFCCC.

Q93. Answer: (a) New Delhi

The correct answer is New Delhi.

Key Points

• Recognition of Prior Learning – Certification in Indian Sign Language Interpretation (RPL–CISLI) programme was inaugurated in New Delhi in August 2025.
• The RPL-CISLI programme aims to provide certification to individuals proficient in Indian Sign Language (ISL) interpretation, enabling their skills to be formally recognized.
• This initiative is part of the broader framework to promote inclusivity and accessibility for the hearing and speech-impaired communities in India.
• The programme aligns with the government's commitment to the National Education Policy (NEP) 2020, which emphasizes skill development and inclusiveness.
• The event saw the participation of key stakeholders, including representatives from the Ministry of Skill Development and Entrepreneurship (MSDE), educational institutions, and non-governmental organizations.

Additional Information

• Indian Sign Language (ISL):
• Indian Sign Language is a standardized visual language used by the deaf and hard-of-hearing community in India.
• It comprises a unique set of gestures, facial expressions, and body movements to convey meaning.
• The Indian Sign Language Research and Training Centre (ISLRTC), under the Department of Empowerment of Persons with Disabilities, promotes and develops ISL.
• Recognition of Prior Learning (RPL):
• RPL is a process of certifying prior knowledge and skills gained through experience or informal training.
• It allows individuals to obtain formal recognition for their expertise, enhancing their employability and career progression.
• RPL is a key component of the Skill India Mission, which seeks to certify millions of workers in various industries.
• National Education Policy (NEP) 2020:
• The NEP 2020 emphasizes inclusive education and skill development to meet the needs of a diverse population, including persons with disabilities.
• It advocates for the use of Indian Sign Language in schools to provide equitable access to education for hearing-impaired students.
• Ministry of Skill Development and Entrepreneurship (MSDE):
• The MSDE oversees skill development initiatives in India and focuses on creating a skilled workforce for various sectors.
• It implements programmes such as the Pradhan Mantri Kaushal Vikas Yojana (PMKVY), which includes RPL as a key component.

Important Points

• Inclusion of Persons with Disabilities (PwDs):
• Government initiatives such as RPL-CISLI are part of efforts to integrate PwDs into mainstream society.

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• These initiatives align with the Rights of Persons with Disabilities Act, 2016, which emphasizes equal opportunities and accessibility for PwDs.

• Role of Certification:

• Certification under RPL helps individuals gain recognition in the job market, increasing their employability and earning potential.

• It also facilitates the creation of a skilled workforce in the field of sign language interpretation, addressing the communication needs of the hearing-impaired community.

Q94. Answer: (a) BriBooks

The correct answer is BriBooks.

Key Points

• BriBooks is a leading platform that encourages and promotes young authors and writers to create and publish their books in a simplified manner.

• In 2025, BriBooks organized the Summer Book Writing Festival, which aimed to nurture creativity among children and young adults.

• The festival provided participants with structured guidance, resources, and workshops to craft their stories and eventually publish them as books.

• This initiative was particularly focused on building the creative confidence of students and fostering a love for writing and storytelling.

• It is noteworthy that BriBooks stands out for its user-friendly platform that simplifies the process of writing, editing, and publishing, making it accessible to first-time authors.

Additional Information

• BriBooks:

• Founded as an innovative platform to empower young authors, BriBooks provides tools that make book writing an enjoyable and accessible process.

• The platform is designed for users of all ages, especially students, to create high-quality, professional-looking books within weeks.

• BriBooks focuses on promoting literacy and creativity by organizing events like book writing festivals, workshops, and competitions globally.

• Participants of the Summer Book Writing Festival often have the opportunity to see their work published and distributed, which can be a transformative experience for budding writers.

• Penguin India:

• Penguin India is one of the largest publishing houses in India, known for publishing books across various genres, including fiction, non-fiction, and children's literature.

• Although Penguin India actively organizes literary events and book launches, they were not involved in the Summer Book Writing Festival 2025.

• Random House:

• Random House is a global publishing company renowned for its wide range of publications in adult and children's literature.

• It primarily focuses on publishing and promoting established authors and does not typically organize book writing festivals like BriBooks.

• HarperCollins:

• HarperCollins is another major publishing house that specializes in books across genres, including fiction, non-fiction, and academic publications.

• While HarperCollins is involved in literary promotion, it was not associated with the Summer Book Writing Festival 2025.

Important Points

• Features of the Summer Book Writing Festival:

• Participants were given access to professional mentors and editors to guide them through the writing process.

• The program included workshops on creative writing, storytelling techniques, and the basics of self-publishing.

• Many participants had their books published as part of the festival, enhancing their confidence and skill as writers.

• Benefits of Initiatives like BriBooks Festivals:

• They encourage creativity and literacy among young individuals.

• Such programs offer a platform for students to showcase their talent on an international level.

• Participants gain firsthand experience in writing, editing, and publishing, which can pave the way for future opportunities in literature.

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Q95. Answer: (c) 3 years

The correct answer is 3 years.

Key Points

• On 20th May, 2025, the Supreme Court of India reinstated the requirement of 3 years of legal practice for law graduates to apply for the posts of Civil Judge (Junior Division).

• This decision reversed a previous ruling made by the Supreme Court in 2002, which had allowed fresh law graduates to directly apply for these judicial posts without any mandatory legal practice.

• The 3-year legal practice requirement ensures that candidates gain adequate exposure and experience in the field of law before assuming judicial responsibilities.

• The move aligns with the objective of enhancing the quality of judicial appointments and ensuring that candidates have substantial practical knowledge of legal proceedings.

• The Supreme Court emphasized the importance of practical experience in law to ensure candidates are well-prepared to handle judicial duties effectively. Hence, the correct answer is 3 years.

Additional Information

• Supreme Court's 2002 Decision:

• In 2002, the Supreme Court allowed law graduates to apply for Civil Judge posts without requiring prior legal practice.

• This decision was aimed at increasing the pool of candidates for judicial posts and fast-tracking appointments.

• Importance of Legal Practice:

• Legal practice enables candidates to gain hands-on experience in court proceedings, drafting, arguing cases, and understanding nuances of legal processes.

• It also helps candidates develop critical thinking, analytical skills, and familiarity with judicial ethics and responsibilities.

• Eligibility for Civil Judge (Junior Division):

• Eligibility criteria include a Bachelor’s degree in law (LLB) from a recognized institution.

• Post the Supreme Court’s 2025 ruling, candidates must have 3 years of legal practice as a prerequisite.

• Age limits and other criteria may vary across states in India.

• Significance of Judicial Appointments:

• Judicial appointments play a critical role in ensuring efficient administration of justice.

• Experienced and well-trained judges contribute to maintaining the quality, impartiality, and integrity of the judiciary.

Important Points

• Supreme Court's Role:

• The Supreme Court of India is the highest judicial authority in the country and has the power to interpret laws and review its previous decisions.

• It plays a pivotal role in ensuring justice and upholding the Constitution of India.

• Judicial Ethics and Experience:

• Judicial ethics demand fairness, impartiality, and adherence to legal principles.

• Practical legal experience equips candidates with skills to manage complex cases and deliver unbiased decisions.

• Impact of the Decision:

• The reinstatement of the 3-year legal practice requirement aims to enhance the competency of Civil Judges (Junior Division).

• It ensures that candidates have sufficient exposure to real-world legal challenges before taking on judicial roles.

Q96. Answer: (c) Aam Aadmi Party

The correct answer is Aam Aadmi Party.

Key Points

• The Visavadar Assembly Constituency in Gujarat held its by-election in June 2025. The election was necessitated due to a vacancy in the seat.

• The Aam Aadmi Party (AAP), led by prominent leaders such as Arvind Kejriwal, won the by-election, marking a significant achievement for the party in Gujarat's political landscape.

• AAP's victory in this constituency reflects its growing influence and acceptance among voters in Gujarat, a state traditionally dominated by the Bharatiya Janata Party (BJP) and the Indian National Congress (INC).

• The party's campaign focused on key issues like education, healthcare, and governance, resonating strongly with the electorate.

• This win is a part of AAP's broader strategy to expand its presence beyond its stronghold in Delhi and Punjab, where it has already established itself as a significant political force.

Additional Information

• Aam Aadmi Party (AAP):

• AAP was founded in 2012 by Arvind Kejriwal and others as an anti-corruption movement following the India Against Corruption (IAC) campaign.

• The party's primary focus is on governance reforms, education, healthcare, and anti-corruption policies.

• It gained national prominence after its historic victory in the Delhi Assembly elections, forming the government in 2013, 2015, and 2020.

• AAP also won the Punjab Assembly elections in 2022, forming its second state government.

• Visavadar Constituency:

• Located in the Junagadh district of Gujarat, the Visavadar Assembly Constituency is a significant political seat in the state.

• This constituency has traditionally witnessed contests between the BJP and the Congress.

• The by-election in June 2025 was closely watched as a test of political strategies and voter preferences in Gujarat.

• Significance of the By-election:

• The by-election result is seen as a litmus test for political parties ahead of the 2027 Gujarat Assembly elections.

• AAP's win indicates a shift in voter sentiment and poses a challenge to the dominance of established parties like the BJP and Congress in Gujarat.

• Other Political Parties in Gujarat:

• Bharatiya Janata Party (BJP): The ruling party in Gujarat, known for its stronghold in the state since 1995.

• Indian National Congress (INC): The primary opposition party in Gujarat, which has faced declining voter support in recent years.

• Bahujan Samaj Party (BSP): A smaller party focusing on Dalit and backward class representation.

Important Points

• Political Expansion of AAP: AAP has been strategically working to expand its political base in states beyond Delhi and Punjab, including Gujarat, Uttar Pradesh, and Goa.

• Voter Sentiment: The victory highlights the importance of addressing local issues and presenting a credible alternative to traditional political parties.

• Impact on Gujarat Politics: AAP's entry disrupts the BJP-Congress duopoly and introduces a new dimension to the state's electoral landscape.

Q97. Answer: (a) Iceland

The correct answer is Iceland.

Key Points

• Iceland ranked the highest in the Global Gender Gap Report 2025, continuing its legacy as the most gender-equal nation globally.

• Iceland has been consistently performing well in gender equality metrics such as economic participation, educational attainment, health and survival, and political empowerment.

• The nation has achieved nearly 91.2% of gender parity, according to the World Economic Forum's latest report.

• Iceland’s success is attributed to progressive policies like mandatory parental leave for both genders, equal pay laws, and strong representation of women in politics and business.

• The Global Gender Gap Report, published by the World Economic Forum, evaluates gender equality across nations using various indices and is considered a crucial tool for assessing global progress.

Additional Information

• Global Gender Gap Report:

• The Global Gender Gap Report was first introduced by the World Economic Forum in 2006.

• It measures gender equality across four dimensions: Economic Participation and Opportunity, Educational Attainment, Health and Survival, and Political Empowerment.

• The report ranks countries based on their performance in closing the gender gap, with 0 representing absolute inequality and 1 representing absolute equality.

• It serves as a crucial benchmark for policymakers to address gender disparities globally.

• Iceland’s Gender Equality Initiatives:

• Iceland has a mandatory parental leave policy, where both parents are entitled to three months of leave, ensuring shared parenting responsibilities.

• The country passed equal pay legislation in 2018, requiring companies to prove they pay men and women equally.

• Women in Iceland hold significant political representation, with over 40% of parliamentary seats occupied by women.

• Public protests, such as the 1975 Women’s Strike, played a critical role in shaping Iceland’s gender equality policies.

• Other High-Ranking Countries:

• Norway: Known for its robust policies on gender equality, including strong parental leave and workplace equality programs.

• Sweden: A pioneer in gender-neutral policies and equal representation in government and corporate sectors.

• Germany: Despite significant advancements, Germany trails behind Nordic countries in achieving full gender parity.

• Importance of Gender Equality:

• Gender equality is essential for achieving sustainable development and ensuring social justice.

• It contributes to higher economic productivity and fosters a more inclusive society.

• Eliminating gender disparities is crucial for achieving global goals like the United Nations Sustainable Development Goal 5, which focuses on gender equality.

Important Points

• Historical Trends: Iceland has been ranked first in the Global Gender Gap Report for more than a decade, showcasing its consistent commitment to gender equality.

• Impact of Policies: Iceland's proactive measures, such as equal pay laws and gender quotas, have significantly influenced its performance.

• Global Challenges: Despite progress in some countries, global gender parity is projected to take over 130 years to achieve, highlighting the need for accelerated efforts.

Q98. Answer: (c) Saweety Boora

The correct answer is Saweety Boora.

Key Points

• Saweety Boora, a prominent Indian boxer, won the Arjuna Award for her outstanding achievements in boxing in January 2025.

• The Arjuna Award is one of India's prestigious sports honors, given to athletes who have displayed excellence in their respective sports disciplines at the national and international levels.

• Saweety Boora has represented India in multiple international boxing tournaments, showcasing her skills and dedication to the sport.

• She is recognized for her remarkable performances in the light heavyweight category, where she has won several medals for India, including titles in the Asian and World Championships.

• Her contribution to Indian boxing has significantly elevated the country's status in the global boxing arena, making her a deserving recipient of the Arjuna Award.

Additional Information

• Arjuna Award:

• The Arjuna Award was instituted in 1961 by the Government of India to recognize outstanding achievements in sports.

• It includes a bronze statue of Arjuna, a certificate, ceremonial dress, and a cash prize.

• The award aims to motivate athletes to achieve excellence and bring pride to the nation.

• Saweety Boora:

• She hails from Haryana, a state known for producing many talented athletes in India.

• Her journey in boxing began at a young age, and she has consistently proven her mettle in competitions.

• Boora has also contributed to promoting boxing among women in India, inspiring young athletes to pursue the sport.

• Other Boxing Achievements:

• India has a strong presence in women's boxing, with athletes like Mary Kom and Nikhat Zareen earning international accolades.

• Saweety Boora's achievements are a continuation of India's legacy in boxing, particularly in women's sports.

• Haryana's Contribution to Sports:

• Haryana is considered a sports hub in India, producing numerous Olympic medalists and world champions.

• The state offers robust support to athletes through government schemes, training facilities, and financial assistance.

Important Points

• Selection Process for Arjuna Award:

• The selection committee considers performance over the last four years and overall contribution to the sport.

• Athletes must have demonstrated consistent excellence and contributed to sports development.

• India's International Boxing Success:

• India has earned significant recognition in boxing, particularly in recent years, with athletes winning medals in the Olympics, Asian Games, and World Championships.

• The rise of women boxers like Saweety Boora reflects the growing popularity and support for women's sports in the country.

Q99. Answer: (a) James

The correct answer is James.

Key Points

• The Pulitzer Prize for Fiction is awarded annually for distinguished fiction by an American author, preferably dealing with American life.

• The novel "James" was recognized and awarded the 2025 Pulitzer Prize for Fiction for its exceptional storytelling, character development, and literary merit.

• The book explores themes of human connection, identity, and resilience, resonating deeply with readers and critics alike.

• It stood out among its competitors due to its unique narrative structure and profound exploration of contemporary issues.

• The Pulitzer board's decision highlighted the novel's impact on modern literature and its ability to address universal themes through a compelling story.

Additional Information

• About the Pulitzer Prize:

• The Pulitzer Prize was established in 1917 by provisions in the will of Joseph Pulitzer, a Hungarian-American journalist and newspaper publisher.

• It is administered by Columbia University in New York City and recognizes achievements in journalism, literature, and musical composition.

• The Fiction category specifically honors works of fiction by American authors, published in the preceding calendar year.

• Criteria for the Pulitzer Prize in Fiction:

• The work must be an original piece of fiction written by an American author.

• It should exhibit excellence in prose, character development, and thematic depth.

• Preference is given to works that deal with American life and culture.

• Notable Past Winners:

• 2020: "The Nickel Boys" by Colson Whitehead - A novel addressing racism and injustice in a reform school.

• 2015: "All the Light We Cannot See" by Anthony Doerr - A story set during World War II about a blind French girl and a German boy.

• 2007: "The Road" by Cormac McCarthy - A post-apocalyptic tale of a father and son’s journey.

• Impact of Winning the Pulitzer Prize:

• Winning the Pulitzer elevates the author's visibility and critical acclaim.

• The prize often leads to increased book sales and wider readership.

• It is considered one of the most prestigious awards in American literature.

Important Points

• Nomination and Selection Process:

• Entries are submitted by publishers, and a jury of distinguished writers and critics evaluates the submissions.

• The jury selects finalists and sends their recommendations to the Pulitzer Prize Board, which makes the final decision.

• Eligibility:

• To be eligible, the work must be published in the United States during the award year.

• The author must be an American citizen.

• Other Categories of Pulitzer Prizes:

• Journalism: Includes awards for investigative reporting, public service, and feature writing.

• Music: Recognizes distinguished compositions by American composers.

• Drama: Honors plays that depict American life.

Q100. Answer: (a) Pay taxes, declare assets, hide nothing

The correct answer is Pay taxes, declare assets, hide nothing.

Key Points

• Karnataka's Deputy Chief Minister (DCM), in September 2025, introduced a civic suggestion to improve governance in Bengaluru by encouraging citizens to pay taxes, declare assets, and maintain transparency.

• This recommendation emphasizes the importance of financial accountability among citizens to strengthen Bengaluru's governance system.

• It aims to create a transparent system where individuals and businesses declare their assets and liabilities, reducing corruption and increasing public trust in governance.

• Complying with tax payments and declaring assets ensures a steady flow of funds for the government to improve infrastructure and civic services in Bengaluru.

• This initiative aligns with global best practices for improving governance by enhancing public participation and accountability.

Additional Information

• Importance of Paying Taxes:

• Taxes are the primary source of revenue for the government, used to fund public services such as education, healthcare, transportation, and infrastructure.

• In Bengaluru, a significant portion of tax revenue is allocated for urban development, waste management, and traffic management.

• Failure to pay taxes may lead to penalties and impacts the overall governance and development of the city.

• Declaring Assets:

• Asset declaration ensures transparency and accountability, particularly for public officials and business entities.

• This practice can curb black money circulation and promote ethical governance.

• Globally, countries like the USA and UK have stringent asset declaration norms to ensure compliance and transparency.

• Governance Challenges in Bengaluru:

• Bengaluru faces challenges like traffic congestion, inadequate waste management, and urban sprawl.

• Improved governance through increased transparency and civic responsibility can address these issues effectively.

• Citizen participation in governance, including declaring assets and paying taxes, is a critical step toward resolving these challenges.

• Global Practices in Governance:

• Countries like Singapore have adopted strict asset declaration and tax compliance norms to ensure efficient governance.

• Such measures lead to higher global trust rankings and improved quality of life for citizens.

Important Points

• Volunteer Audit Committees:

• These committees are responsible for auditing government projects, ensuring accountability and transparency in public spending.

• This option was suggested by the DCM but does not directly target governance improvement through citizen financial accountability.

• Monthly Public Grievance Meets:

• Grievance meets aim to address citizen complaints and provide solutions, but they are not directly linked to enhancing governance quality through transparency in taxes and assets.

• Citizen Rating System for Officials:

• This system allows citizens to rate the performance of government officials but does not focus on transparency in financial declarations by citizens.

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