RRB Group D Official Paper (Held On: 08 Jan, 2026 Shift 2) (Previous Year Paper)

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

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GENERAL SCIENCE

Q1. Why are autotrophs placed at the first trophic level in the food chain?

(a) Because they make food from inorganic substances.
(b) Because they eat plants.
(c) Because they consume organic waste as food.
(d) Because they decompose dead organisms.

Q2. Which of the following is an example of a physical change during the formation of a solution?

(a) Curdling of milk when lemon juice is added to it
(b) Dissolution of salt in water
(c) Digestion of food in the stomach
(d) Rusting of iron in salt solution

Q3. Match the following columns.

Column A (Event)	Column B (Effect)
A. Acid rain	1. Occurs when the pH of the mouth is < 5.5
B. Indigestion	2. Antacids neutralize excess acid
C. Tooth decay	3. When pH < 5.6, harms aquatic life
D. Bee sting	4. Neutralized by baking soda

(a) A-3; B-2; C-1; D-4
(b) A-1; B-2; C-3; D-4
(c) A-4; B-3; C-2; D-1
(d) A-2; B-4; C-1; D-3

Q4. A 7 V battery is connected in series with five resistors: 0.1 Ω, 0.4 Ω, 0.5 Ω, 0.6 Ω and 12.4 Ω. What is the current flowing through the 12.4 Ω resistor?

(a) 2 A
(b) 0.75 A
(c) 1 A
(d) 0.5 A

Q5. What property distinguishes a compound from a mixture?

(a) Made of multiple substances
(b) Can be in any condition.
(c) There is a fixed balance and characteristics
(d) Always solid

Q6. What does the area under a velocity–time graph represent?

(a) The displacement of the object during that time interval
(b) The acceleration of the object
(c) The speed of the object
(d) The time taken by the object

Q7. Which category of sound frequency is used by rhinoceroses, whales, and elephants for communication?

(a) Supersonic sound
(b) Infrasound
(c) Ultrasound
(d) Audible sound

Q8. Metals high in the activity series may be extracted by the process of:

(a) only heating
(b) calcination
(c) electrolytic reduction
(d) heating with carbon

Q9. What is a reduction reaction?

(a) Loss of neutrons
(b) Loss of electrons
(c) Gain of protons
(d) Gain of electrons

Q10. A male patient has low sperm motility. Which glands are most likely to be NOT functioning properly?

(a) Pancreas and adrenal glands
(b) Testis and bladder
(c) Prostate gland and seminal vesicles
(d) Thyroxine and Pineal Glands

Q11. The energy stored in an object due to its position or configuration is called:

(a) thermal energy
(b) kinetic energy
(c) sound energy
(d) potential energy

Q12. Why is variation important in sexually reproducing plants?

(a) It limits the adaptability of the species to changing environments.
(b) It ensures all offspring are identical to the parent, maintaining uniformity.
(c) It increases the chances of survival by enabling adaptation to environmental changes.
(d) It decreases the genetic diversity within the population.

Q13. Esters are _____ substances.

(a) Sweet-smelling
(b) Musty-smelling
(c) Sour-smelling
(d) Bitter-smelling

Q14. Which of the following statement(s) is /are true about the image formed by a concave mirror?

(i) A concave mirror always forms a real and inverted image whatever be the position of the object.

(ii) A concave mirror forms a real, inverted and diminished image when the object is placed between the focus and centre of curvature of the mirror.

(iii) A concave mirror forms a real, inverted and point sized image at its focus when the object is placed at infinity.

(a) Both (ii) and (iii)
(b) Only (i)

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(c) Both (i) and (ii)
(d) Only (iii)

Q15. What is the primary safety function of the green insulated earth wire in a domestic circuit, particularly for metallic appliances?
(a) To provide a high-resistance path to divert excess current into the ground
(b) To stabilise the voltage at 220 V
(c) To act as the neutral wire when the black wire fails
(d) To provide a low-resistance path to ensure leakage current keeps the appliance potential to that of the earth, preventing severe shocks

Q16. A ray of light strikes a plane mirror at an angle of 30° with the normal. The angle between the incident ray and the reflected ray is:
(a) 90°
(b) 120°
(c) 30°
(d) 60°

Q17. A stone is thrown vertically upward with an initial velocity of 49 m/s. Calculate the maximum height it reaches before momentarily stopping. (Take g = 9.8 m/s^2).
(a) 49 m
(b) 9.8 m
(c) 245 m
(d) 122.5 m

Q18. The epithelial tissue forming the lining of kidney tubules and salivary gland ducts is which of the following?
(a) Ciliated epithelium
(b) Cuboidal epithelium
(c) Stratified epithelium
(d) Columnar epithelium

Q19. Which of the following determine the size of an atom?
(a) Nucleus
(b) Protons
(c) Electron Clouds
(d) Neutrons

Q20. The simple permanent tissue that provides mechanical support and flexibility to plant parts such as stems and tendrils is _____.
(a) sclerenchyma
(b) xylem
(c) parenchyma
(d) collenchyma

Q21. According to Bohr-Bury, what is the maximum number of electrons that the M-shell can accommodate?
(a) 18
(b) 8
(c) 2
(d) 20

Q22. In what way is tendril movement similar to other tropic movements in plants?
(a) It is based on internal water.
(b) It is random and sudden pressure only.
(c) It involves directional growth in response to a stimulus.
(d) It always occurs during night.

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Q23. What can be said about the shape of a velocity-time graph for an object moving with non-uniform acceleration?

(a) It is a curved line.
(b) It is always a straight line.
(c) It is always a downward sloping line.
(d) It is always a horizontal line.

Q24. Match the following statements about respiration with their correct features.

1. Aerobic respiration	1. Does not require oxygen
1. Anaerobic respiration	1. Mitochondria
1. Pyruvate breakdown in the presence of oxygen takes place in the	1. Cytoplasm
1. Glucose breakdown in the absence of oxygen takes place in the	1. Requires oxygen

(a) a - iv, b - i, c - ii, d - iii
(b) a - iv, b - i, c - iii, d - ii
(c) a - i, b - iii, c - ii, d - iv
(d) a - i, b - iv, c - ii, d - iii

Q25. Which among the following statements represents a characteristic of asexual reproduction?

(a) Involves two parents
(b) Involves only one parent
(c) Produces genetically diverse offspring
(d) Requires gametes

MATHEMATICS

Q26. A and B can do a piece of work in 62/5 days, B and C can do it in 71/9 days and A and C can do it in 51/3 days. If A, B and C work together, then in how many days they can finish the work?

(a) 81/21
(b) 44/31
(c) 63/31
(d) 52/21

Q27. An item is sold for Rs. 7,200 after two successive discounts of 36% and 10%. What is the marked price (in Rs.) of the item?

(a) 12,561
(b) 12,500
(c) 12,594
(d) 12,596

Q28. Find the simple interest (in Rs.) on Rs. 2,000 at 7% per annum rate of interest for the period from 9 February 2023 to 23 April 2023.

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

Q29. Two trains A and B of lengths 496 m and 490 m are running at speeds of 12 m/s and 22 m/s, respectively, towards each other on parallel tracks. In how much time will they cross each other?

(a) 22 seconds
(b) 30 seconds
(c) 26 seconds
(d) 29 seconds

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Q30. If 241 bananas were distributed among three monkeys, respectively, in the ratio 7/9 : 3/2 : 2/5, how many bananas did the third monkey get?

(a) 36
(b) 38
(c) 35
(d) 34

Q31. P and Q together can fill a cistern with water in 15 hours. If P alone can fill the cistern with water in 24 hours, then in how many hours will Q alone fill one-fourth of the same cistern with water?

(a) 11
(b) 10
(c) 21
(d) 20

Q32. Eight years ago, the ratio of Aman's age to Riya's age was 4 : 3. Eight years from now, the ratio of their ages will be 5 : 4. What is Aman's present age?

(a) 56 years
(b) 72 years
(c) 76 years
(d) 70 years

Q33. The surface area of a sphere is 144π square units. What is the radius of the sphere?

(a) 6 units
(b) 5 units
(c) 8 units
(d) 10 units

Q34. If the HCF of two numbers is 12 and their product is 2160, what is the LCM of the two numbers?

(a) 200
(b) 190
(c) 184
(d) 180

Q35. A spherical metallic ball of density 3.5 gram/cm³ has total mass 3.168 kg. Find the cost of painting the ball at the rate of Rs. 5.6 per cm².

(Use π = 22/7, Volume = Mass/Density)

(a) Rs. 2,534.40
(b) Rs. 3,534.70
(c) Rs. 2,830.60
(d) Rs. 3,235.20

Q36. The arithmetic mean of the observations 47, 71, 82, 59, 22, 43, 46, 96 and 56 is:

(a) 60
(b) 64
(c) 66
(d) 58

Q37. A person saves 60% of his income. If his expenditure is Rs. 560, then his income (in Rs.) is:

(a) 1,224
(b) 1,336
(c) 1,440
(d) 1,400

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Q38. A car travels for 70 km at a speed of 60 km/hr, then for another 80 km at a speed of 80 km/hr, and finally for 50 km at a speed of 40 km/hr. What is the average speed of the entire journey? (Round off the answer to 2 decimal places)

(a) 55.63 km/hr
(b) 50.45 km/hr
(c) 65.75 km/hr
(d) 58.54 km/hr

Q39. A person allows a 10% discount for cash payment from the marked price of a toy and still he makes a 10% gain. What is the cost price of the toy which is marked at Rs. 880?

(a) Rs. 720
(b) Rs. 420
(c) Rs. 520
(d) Rs. 620

Q40. What is the difference between the average of prime numbers between 60 and 70 and the average of multiples of 4 between 50 and 58?

(a) 10
(b) 1
(c) 9
(d) 11

Q41. Simplify: √(144 × 49) + √(64 × 25) - √(100 × 36)

(a) 64
(b) 48
(c) 50
(d) 32

Q42. A retailer offers the following discount schemes for buyers on an article.

I. Two successive discounts of 14%.
II. A discount of 22% followed by a discount of 29%.
III. Successive discounts of 22% and 7%.
IV. A discount of 14% followed by a discount of 6%.
Which scheme will fetch the maximum selling price?

(a) IV
(b) II
(c) I
(d) III

Q43. If 63 is the mean proportion between x and 147, what is the value of x?

(a) 27
(b) 25
(c) 28
(d) 29

Q44. In triangle ABC, BD perpendicular to AC at D and angle DBC = 21°. E is a point on BC such that angle CAE = 27°. What is the measure of angle AEB ?

(a) 104°
(b) 81°
(c) 96°
(d) 97°

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Q45. If three-fifths of a number is 4 more than one-half of the number, what is the number?

(a) 40
(b) 45
(c) 30
(d) 35

Q46. In an election, 60% of the total voters cast their votes. Out of these, 75% voted for candidate A and the remaining voted for candidate B. If candidate B received 7500 votes, calculate the total number of registered voters.

(a) 40,000
(b) 60,000
(c) 45,000
(d) 50,000

Q47. A man receives Rs. 1,890 per month as salary. He saves 30% of his salary every month. His expenditure per month is:

(a) Rs. 1,336
(b) Rs. 1,323
(c) Rs. 1,418
(d) Rs. 1,269

Q48. The number of prime numbers between 469 and 474 is:

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

Q49. Find the value of $(2\sqrt{(\csc^2 A-1)} \times \sqrt{(1-\cos^2 A)})/(\sqrt{(1+\tan^2 A)} \times 3\sqrt{(1-\sin^2 A)})$.

(a) (2 cos A)/3
(b) cos A
(c) 2/3
(d) (2 sin A)/3

Q50. If $a + 1/a = 6$, then find the value of $a^2 + 1/(a^2)$.

(a) 38
(b) 34
(c) 40
(d) 36

GENERAL INTELLIGENCE & REASONING

Q51. Which number should come in place of the question mark (?) to make the series logically complete?

527 524 529 522 531 ?

(a) 525
(b) 521
(c) 515
(d) 520

Q52. Refer to the following series and answer the question that follows (all numbers are single-digit numbers only). Counting to be done from left to right only.

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

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

(a) Four
(b) Two

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(c) Three
(d) One

Q53. Refer to the following number series and answer the question that follows (all numbers are single-digit numbers only). Counting to be done from left to right only.

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

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

(a) 8
(b) 9
(c) 10
(d) 7

Q54. What will come in place of the question mark (?) in the following equation, if '+' and '−' are interchanged and '×' and '÷' are interchanged?

6 ÷ 3 + 16 × 4 − 9 = ? + 5

(a) 26
(b) 24
(c) 30
(d) 28

Q55. Six friends — P, Q, R, S, U and V — are sitting around a circular table, facing the centre. P is the immediate neighbour of both Q and R. R is sitting to the immediate left of U. V is sitting second to the left of P.

How many people sit between P and S, when counted from the right of S?

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

Q56. 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 peas are dogs.

No dog is a cub.

Conclusions:

(I) Some peas are cubs.

(II) Some dogs are peas.

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

Q57. 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) 3 5 6 4 4 6 2 6 5 2 8 2 8 3 6 3 1 4 8 7 3 5 2 7 3 2 3 (Right)

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

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

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Q58. In a certain code language, ‘speak the truth’ is coded as ‘pc rd st’ and ‘truth always wins’ is coded as ‘mo st kl’. How is ‘truth’ coded in that language?

(a) st
(b) kl
(c) pc
(d) mo

Q59. Seven boxes, B, D, E, P, S, T and W, are kept one over the other but not necessarily in the same order. Only three boxes are kept above B. Only one box is kept between P and B. Only three boxes are kept between P and T. T is kept at some place above B. D is kept immediately below T. E is kept at one of the places above S. W is not kept immediately above or below P. How many boxes are kept between S and D?

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

Q60. Prashant starts from Point A and drives 32 km towards the south. He then takes a right turn, drives 29 km, turns right and drives 43 km. He then takes a right turn and drives 54 km. He takes a final right turn, drives 11 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) 25 km to the west
(b) 26 km to the west
(c) 28 km to the east
(d) 27 km to the east

Q61. Five people, L, M, N, O and P, are sitting in a row, facing towards the north.

N is sitting at third position from the extreme right end of the row. M is not an immediate neighbour of N. P is sitting to the immediate left to N. P is sitting immediate right to O.

Who is sitting between N and M?

(a) O
(b) N
(c) L
(d) P

Q62. What should come in place of the question mark (?) in the given series?

1 2 8 16 64 ?

(a) 128
(b) 132
(c) 136
(d) 124

Q63. Each of the digits in the number 78352416 is arranged in descending order from left to right. What will be the product of the digits that are third from the left and second from the right in the new number thus formed?

(a) 18
(b) 24
(c) 12
(d) 16

Q64. A, B, C, D, E and F are sitting around a circular table facing the centre. B sits third to the right of F. D sits second to the left of C. A sits third to the right of C. E sits to the immediate left of B. How many people sit between E and A when counted from the left of A?

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

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Q65. Based on the English alphabetical order, three of the following four letter-clusters are alike in a certain way and thus form a group. Which letter-cluster DOES NOT belong to that group?

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

(a) TVZ
(b) JLP
(c) NPV
(d) LNR

Q66. In a certain code language,

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

'A – B' means 'A is the father of B',

'A × B' means 'A is the brother of B' and

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

How is P related to R if 'P + Q × S ÷ T – R'?

(a) Sister's son
(b) Daughter's son
(c) Brother's son
(d) Mother's brother

Q67. Vishal starts from Point A and drives 10 km towards south. He then takes a right turn, drives 4 km, turns right and drives 12 km. He then takes a right turn and drives 7 km. He takes a final right turn, drives 2 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) 3 km to the east
(b) 4 km to the east
(c) 3 km to the west
(d) 4 km to the west

Q68. What should come in place of the question mark (?) in the given series based on the English alphabetical order?

CRB ZOY WLV TIS ?

(a) QPF
(b) QFP
(c) QFO
(d) QFR

Q69. Based on the English alphabetical order, three of the following four letter-clusters are alike in a certain way and thus form a group. Which letter-cluster DOES NOT belong to that group?

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

(a) DFA
(b) JLP
(c) FHC
(d) MOJ

Q70. What should come in place of the question mark (?) in the given series?

16 28 42 58 76 ?

(a) 96
(b) 94
(c) 88
(d) 90

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Q71. Which of the following letter-number clusters will replace the question mark (?) in the given series to make it logically complete?

QRP 64 STR 54 UVT 44 WXV 34 ?

(a) YZX 24
(b) YGP 23
(c) YAW 24
(d) YYW 23

Q72. Select the pair which follows the same pattern as that followed by the two pairs given below. Both pairs follow the same pattern.

GNL : KSP

OXT : SCX

(a) QLY : VPB
(b) NLV : SPA
(c) VHD : ZKH
(d) WHB : AMF

Q73. Select the pair which follows the same pattern as that followed by the two pairs given below. Both pairs follow the same pattern.

ADE : FIJ

MDG : RIL

(a) VTE : ODR
(b) BTS : YDR
(c) UFL : ZKQ
(d) ZOT : GRS

Q74. Select the set in which the numbers are related in the same way as are the numbers of the following sets.

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

(6, 3, 19)

(4, 3, 13)

(a) (3, 7, 22)
(b) (5, 4, 16)
(c) (8, 3, 26)
(d) (5, 8, 40)

Q75. YUTU is related to XTST in a certain way based on the English alphabetical order. In the same way, FBAB is related to EAZA. To which of the given options is GCBC related, following the same logic?

(a) FBZB
(b) FBAB
(c) FAZB
(d) FCZG

Q76. 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 trees are boats.

No pens are boats.

All combs are trees.

Conclusions:

(I) All combs are boats.

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(II) No pens are combs.

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

Q77. In a certain code language, 'life offers hope' is coded as 'sc tp gb' and 'hope shapes future' is coded as 'hk mp tp'. How is 'hope' coded in the given language?

(a) sc
(b) hk
(c) tp
(d) gb

Q78. Seven boxes, A, B, C, D, E, F and G, are kept one over the other but not necessarily in the same order. Only two boxes are kept between A and E. Only F is kept above G. No box is kept below E. C is kept at some place below D but at some place above B. How many boxes are kept above D?

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

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

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

How many such odd digits are there each of which is immediately preceded by an odd digit and also immediately followed by a perfect square?

(NOTE: 1 is also a perfect square)

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

Q80. If 1 is added to each even digit and 2 is subtracted from each odd digit in the number 2543769, which of the following digits will be second from the left in the new number thus formed?

(a) 5
(b) 1
(c) 3
(d) 2

GENERAL AWARENESS AND CURRENT AFFAIRS

Q81. At the 2025 BCCI Naman Awards, who received the Lifetime Achievement Award?

(a) Jasprit Bumrah
(b) Virat Kohli
(c) Smriti Mandhana
(d) Sachin Tendulkar

Q82. What was the name of the operation launched in May 2025 in response to a terror attack in Pahalgam?

(a) Operation Vijay
(b) Operation Raksha
(c) Operation Sindoor
(d) Operation Abhiman

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Q83. Which Union Minister unveiled a new logo of Bharat Sanchar Nigam Limited (BSNL) in October 2024?

(a) Giriraj Singh
(b) Amit Shah
(c) Jyotiraditya M Scindia
(d) Jitin Prasada

Q84. What is the primary objective of the large-scale civil defence mock drill named Operation Shield conducted on May 2025?

(a) To test the effectiveness of coastal security protocols
(b) To improve the state's emergency readiness and response systems
(c) To enhance readiness against internal insurgencies
(d) To simulate response to natural disasters in Himalayan regions

Q85. Who among the following authored the 2025 book “Rocket Dreams: Musk, Bezos, and the Inside Story of the New, Trillion-Dollar Space Race”, which explores the fierce rivalries among billionaires in the modern space race?

(a) Walter Isaacson
(b) Christian Davenport
(c) Ashlee Vance
(d) Neil deGrasse Tyson

Q86. Which country has officially become the first European nation to join the Comprehensive and Progressive Agreement for Trans-Pacific Partnership (CPTPP)?

(a) Italy
(b) Germany
(c) Britain
(d) France

Q87. Which individual from Haryana, a Paralympic gold medallist, was honoured with the Padma Shri in January 2025?

(a) Vinod Kumar
(b) Mariyappan Thangavelu
(c) Harvinder Singh
(d) Deepa Malik

Q88. What is the name of India’s first AI-generated school teacher robot, unveiled by Makerlabs Edutech at a school in Kerala?

(a) Vedika
(b) Esha
(c) Iris
(d) Sophia

Q89. At which venue did Jyothi Yarraji set a record-breaking performance during the National Games 2025?

(a) Kalinga Stadium, Odisha
(b) Sree Kanteerava Stadium, Bengaluru
(c) Ganga Athletics Ground, Uttarakhand
(d) Nehru Stadium, Chennai

Q90. Which of the following cities served as the venue for the Curtain Raiser of the 18^(th) Urban Mobility India (UMI) Conference and Exhibition 2025, organised by the Ministry of Housing and Urban Affairs (MoHUA)?

(a) Noida, Uttar Pradesh
(b) New Delhi, Delhi
(c) Gurugram, Haryana
(d) Jaipur, Rajasthan

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Q91. Which former World Bank/IMF economist was appointed as the RBI Deputy Governor in April 2025?

(a) Michael Patra
(b) Raghuram Rajan
(c) Poonam Gupta
(d) Urjit Patel

Q92. Who was IPL 2025's Most Valuable Player from Mumbai Indians?

(a) Suryakumar Yadav
(b) Rohit Sharma
(c) Jasprit Bumrah
(d) Krunal Pandya

Q93. In March 2025, which summit in New Delhi focused on "Partnerships for Accelerating Sustainable Development and Climate Solutions"?

(a) G20 Environment Summit
(b) Conference of the Parties (COP) 30
(c) World Sustainable Development Summit
(d) United Nations Environment Assembly- 5

Q94. Who among the following won the Chinese Grand Prix, 2025?

(a) Charles Leclerc
(b) Lewis Hamilton
(c) Lando Norris
(d) Oscar Piastri

Q95. Which of the following bodies published the GRFC (Global Report on Food Crises), 2025?

(a) Food Security Information Network (FSIN)
(b) Food and Agriculture Organization (FAO)
(c) World Food Programme alone
(d) United Nations Development Programme (UNDP)

Q96. In 2025, IDFC FIRST Bank has enabled Unified Payments Interface (UPI) access for Non-Resident Indians (NRIs) in how many countries?

(a) 12
(b) 13
(c) 11
(d) 10

Q97. 'Montha,' which made landfall in India in October 2025, was what type of natural phenomenon?

(a) An extremely severe cyclonic storm over the Kutch region
(b) A tropical thunderstorm affecting coastal Gujarat
(c) A severe cyclonic storm over the Bay of Bengal
(d) A deep depression over the Arabian Sea bringing rainfall to southern India

Q98. In July 2025, the Ministry of Tribal Affairs partnered with which organisation to support 68 Eklavya Model Residential Schools (EMRS) in Chhattisgarh, benefiting more than 28,000 tribal students?

(a) Steel Authority of India Limited
(b) National Thermal Power Corporation
(c) Oil and Natural Gas Corporation
(d) Coal India Limited

Q99. Which of the following insurance companies were designated as Domestic Systemically Important Insurers (D-SIIs) for the year 2024–25 by the Insurance Regulatory and Development Authority of India (IRDAI)?

(a) LIC, HDFC ERGO, and Reliance General
(b) LIC, Tata AIG, and Bajaj Allianz

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(c) HDFC Life, ICICI Lombard, and SBI Life

(d) LIC, The New India Assurance, and GIC Re

Q100. Which of the following Union Ministers launched India's National Red List Roadmap in October 2025?

(a) Piyush Goyal

(b) Kirti Vardhan Singh

(c) Bhupender Yadav

(d) Nitin Jairam Gadkari

ANSWER KEY

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

SOLUTIONS

Q1. Answer: (a) Because they make food from inorganic substances.

The correct answer is Because they make food from inorganic substances.

Key Points

• Autotrophs are organisms that can produce their own food using light, water, carbon dioxide, or other chemicals; they are essentially the primary producers of an ecosystem.

• They utilize inorganic substances from the environment, such as carbon dioxide (CO_2) and water (H_2O), to synthesize organic molecules like glucose through the process of photosynthesis.

• Because they are the only organisms capable of converting solar energy into chemical energy, they form the foundation of all biotic communities.

• In any food chain or ecological pyramid, autotrophs are placed at the first trophic level because they provide the initial energy source that sustains all other levels.

• Common examples of autotrophs include vascular plants on land and phytoplankton or algae in aquatic environments.

Additional Information

• Trophic Levels: These represent the feeding positions in a food chain, where energy flows from producers to various levels of consumers.

• Herbivores: These are primary consumers that occupy the second trophic level because they feed directly on plants.

• Heterotrophs: Unlike autotrophs, these organisms cannot manufacture their own food and must rely on the consumption of other organisms for nutrition.

• Decomposers: Organisms such as bacteria and fungi that break down dead organic matter and organic waste, playing a vital role in nutrient cycling.

• Saprophytes: A specific group of decomposers that obtain nutrients by absorbing organic matter from decaying organisms through extracellular digestion.

• Energy Flow: According to Lindeman's 10 percent law, only about 10% of the energy available at one trophic level is transferred to the next, which is why producers must be the most abundant group.

Q2. Answer: (b) Dissolution of salt in water

The correct answer is Dissolution of salt in water.

Key Points

• A physical change is a type of change in which the physical properties of a substance, such as its shape, size, volume, or state, are altered without changing its chemical composition.

• During the dissolution of salt in water, the sodium chloride (NaCl) crystals break down into sodium (Na+) and chloride (Cl-) ions which disperse throughout the water (H2O). No new chemical substance is formed in this process. Hence, statement 2 is correct.

• One of the primary characteristics of a physical change is that it is often reversible. Salt can be recovered from the solution through physical methods like evaporation or boiling, where the water turns into vapor, leaving the solid salt behind.

• In this specific homogeneous mixture, the solute (salt) and solvent (water) retain their chemical identities even though they are mixed at the molecular level.

• Common examples of physical changes include the melting of ice, boiling of water, crushing a can, and shredding paper.

Additional Information

• Curdling of milk: This happens when an acid (like citric acid from lemon juice) is added to milk, causing the casein protein to denature and coagulate. This is a chemical change because a new substance (curd) is formed and the process is irreversible. Hence, statement 1 is incorrect.

• Digestion of food: This is a biochemical process involving enzymes, hydrochloric acid, and chemical reactions that break down complex organic molecules into simpler nutrients. Since new substances are formed and the original food cannot be recovered, it is a chemical change. Hence, statement 3 is incorrect.

• Rusting of iron: This is an oxidation reaction where iron (Fe) reacts with oxygen and moisture to form Hydrated Iron (III) Oxide. The presence of a salt solution acts as an electrolyte and accelerates this chemical change. Hence, statement 4 is incorrect.

• Chemical Changes: Unlike physical changes, these involve the breaking and forming of chemical bonds. Indicators of a chemical change include evolution of gas, change in color, formation of a precipitate, and release of heat or light.

Important Points

• A solution is defined as a homogeneous mixture of two or more substances. The substance present in the larger quantity is the solvent, while the one in the smaller quantity is the solute.

• The process of dissolution can sometimes be exothermic (releasing heat) or endothermic (absorbing heat), but it is still classified as a physical change as long as the chemical identities of the components remain intact.

• In industrial applications, physical changes are utilized for purification processes such as fractional distillation and crystallization, which rely on the reversibility of physical states.

• Understanding the difference between physical and chemical changes is fundamental in thermodynamics and material science to predict how substances will behave under different temperature and pressure conditions.

Q3. Answer: (a) A-3; B-2; C-1; D-4

The correct answer is A-3; B-2; C-1; D-4.

Key Points

• Acid rain is caused when atmospheric pollutants like sulfur dioxide and nitrogen oxides react with water to form acids, lowering the pH of rainwater to below 5.6. This acidic runoff reaches rivers and lakes, making the habitat lethal for various aquatic organisms. Hence, Acid rain matches with When pH < 5.6, harms aquatic life.

• Indigestion occurs when the stomach secretes an excessive amount of hydrochloric acid (HCl) to digest food, leading to a burning sensation and pain. To treat this, antacids like Magnesium hydroxide (Milk of Magnesia) are used to perform a neutralization reaction. Hence, Indigestion matches with Antacids neutralize excess acid.

• Tooth decay is initiated by the production of acids from the bacterial degradation of sugars and food particles in the oral cavity. When the pH level in the mouth drops below 5.5, it triggers the demineralization of the tooth enamel. Hence, Tooth decay matches with Occurs when the pH of the mouth is < 5.5.

• A Bee sting delivers methanoic acid (formic acid) into the skin, causing acute pain and swelling. Application of a mild alkaline substance like baking soda (sodium hydrogen carbonate) helps in neutralizing the acidic venom and alleviating the pain. Hence, Bee sting matches with Neutralized by baking soda.

Additional Information

• pH Scale and Indicators:

• The pH scale ranges from 0 to 14, where 7 is neutral; values below 7 indicate acidity and values above 7 indicate alkalinity.

• The human body generally functions within a narrow pH range of 7.0 to 7.8.

• Chemical Components:

• Tooth Enamel: Composed of calcium hydroxyapatite, which is a crystalline form of calcium phosphate and is the hardest substance in the human body.

• Baking Soda: Known chemically as Sodium Hydrogen Carbonate (NaHCO3), it is used as a common household leavening agent and a mild base.

• Methanoic Acid: Also known as formic acid (HCOOH), it is the simplest carboxylic acid and is found in the stings of ants and bees.

Q4. Answer: (d) 0.5 A

The correct answer is 0.5 A.

Key Points

• In a series circuit, the total resistance (also known as equivalent resistance) is the sum of the individual resistances connected in the path. The formula used is Req = R1 + R2 + R3 + R4 + R5.

• For the given problem, the individual resistances are 0.1 Ohm, 0.4 Ohm, 0.5 Ohm, 0.6 Ohm, and 12.4 Ohm. Adding these values: 0.1 + 0.4 + 0.5 + 0.6 + 12.4 equals a total resistance of 14.0 Ohm.

• According to Ohm's Law, the relationship between voltage (V), current (I), and resistance (R) is given by the formula V = I x R. To find the current, we rearrange the formula to I = V / R.

• Given a battery of 7 V and a total calculated resistance of 14 Ohm, the total current in the circuit is 7 / 14, which equals 0.5 A.

• A fundamental characteristic of series connections is that the current remains constant through every component in the circuit. Therefore, the current flowing through the 12.4 Ohm resistor is exactly the same as the total circuit current, which is 0.5 A. Hence, the correct answer is 0.5 A.

Additional Information

• Ohm's Law:

• Discovered by German physicist Georg Simon Ohm in 1827, this law states that the current through a conductor between two points is directly proportional to the voltage across the two points.

• It is the most basic law of electricity and is used to calculate the power, efficiency, and safety of electrical circuits.

• Series vs. Parallel Circuits:

• In a series circuit, components are connected end-to-end, creating a single path for current. If one component fails, the entire circuit is broken.

• In a parallel circuit, components are connected across the same two nodes, providing multiple paths for current. In this setup, the voltage remains constant across all branches, but the current divides.

• Units of Measurement:

• Voltage is measured in Volts (V), representing the electrical potential difference.

• Current is measured in Amperes (A), representing the rate of flow of electric charge.

• Resistance is measured in Ohms (Ω), representing the opposition to the flow of electric current.

Important Points

• Voltage Drop in Series: While the current is the same in a series circuit, the voltage is divided among the resistors. The voltage drop across the 12.4 Ohm resistor can be calculated as V = I x R = 0.5 A x 12.4 Ohm = 6.2 V.

• Total Resistance Property: In a series combination, the equivalent resistance is always greater than the largest individual resistance in the circuit (14 Ohm > 12.4 Ohm).

• Application: Series circuits are often used in simple devices like flashlights or decorative string lights, though modern string lights often use parallel sections to prevent the entire string from going out if one bulb fails.

Q5. Answer: (c) There is a fixed balance and characteristics

The correct answer is There is a fixed balance and characteristics.

Key Points

• A compound is a substance formed when two or more chemical elements are chemically bonded together. The most defining characteristic of a compound is that the elements are always present in fixed ratios by mass.

• This fixed ratio is governed by the Law of Definite Proportions (also known as Proust's Law), which states that a chemical compound always contains its component elements in a fixed ratio and does not depend on its source or method of preparation.

• Unlike mixtures, the formation of a compound involves a chemical change, resulting in a product with entirely different properties from its constituent elements. For example, Sodium (a reactive metal) and Chlorine (a toxic gas) combine to form Sodium Chloride (common table salt).

• Compounds possess a fixed melting and boiling point, which serves as a benchmark for their purity. Because they are held together by chemical bonds (ionic or covalent), they cannot be separated by simple physical methods like filtration or evaporation.

Additional Information

• Mixtures:

• Components are physically combined and can be present in any proportion.

• They retain the original properties of their constituents (e.g., in a mixture of iron and sulfur, iron remains magnetic).

• They can be homogeneous (uniform composition like Alloys) or heterogeneous (non-uniform like Soil).

• Separation is possible through physical processes such as distillation, sublimation, or magnetism.

• Separation of Compounds:

• Compounds can only be broken down into their individual elements through chemical reactions or electrochemical reactions like

electrolysis.

• States of Matter:

• The option Always solid is incorrect because compounds can exist in all three states of matter: solid (Calcium Carbonate), liquid (Water), and gas (Carbon Dioxide).

Q6. Answer: (a) The displacement of the object during that time interval

The correct answer is The displacement of the object during that time interval.

Key Points

• The area under a velocity–time (v-t) graph represents the displacement of an object over a specific time interval. Since velocity is defined as the rate of change of displacement ($v = dx/dt$), the integral of velocity over time (∫ v dt) yields the total change in position. Hence, option 1 is correct.

• In a graph where the velocity is plotted on the y-axis and time is plotted on the x-axis, the product of the two dimensions (m/s × s) results in meters (m), which is the SI unit for displacement.

• For an object moving with uniform velocity, the graph is a straight horizontal line. The area formed under this line up to the time axis is a rectangle, where the Area = Velocity × Time.

• If the object moves with uniform acceleration, the graph is a sloping straight line. The area under this curve (often a triangle or a trapezium) still represents the net displacement.

• It is important to note that displacement is a vector quantity. Therefore, areas above the time axis (positive velocity) represent positive displacement, while areas below the axis (negative velocity) represent negative displacement.

Additional Information

• Acceleration:

• The slope (gradient) of a velocity-time graph represents the acceleration of the object.

• A steeper slope indicates a higher magnitude of acceleration, while a zero slope (horizontal line) indicates constant velocity and zero acceleration. Hence, option 2 is incorrect as the area does not represent acceleration.

• Speed and Distance:

• The area under a speed-time graph represents the total distance traveled, which is a scalar quantity.

• Unlike displacement, distance is always positive. To find distance from a velocity-time graph, one must take the absolute value of the areas (treating negative areas as positive) and sum them up. Hence, option 3 is incorrect.

• Position-Time Graph:

• In a position-time (s-t) graph, the slope at any point represents the instantaneous velocity of the object.

• A curved line on a position-time graph indicates that the velocity is changing, meaning the object is accelerating.

• Time Taken:

• Time is represented by the independent variable on the x-axis. It is not represented by the area but rather by the interval along the horizontal axis. Hence, option 4 is incorrect.

Important Points

• Equations of Motion: The geometric derivation of the three equations of motion ($v = u + at$, $s = ut + 1/2at^2$, and $v^2 = u^2 + 2as$) is often performed using the area and slope properties of the velocity-time graph.

• Non-Uniform Motion: For non-uniformly accelerated motion, the velocity-time graph is a curve. In such cases, calculus (integration) is required to calculate the area under the curve to find the displacement.

• Directionality: If an object returns to its starting point, the total area above the x-axis will equal the total area below the x-axis, resulting in a net displacement of zero, even though the distance traveled is non-zero.

Q7. Answer: (b) Infrasound

p data-end="57" data-start="0">The correct answer is Infrasound.

Key Points

• Infrasound (or infrasonic sound) refers to sound waves with a frequency lower than the lower limit of human audibility, which is generally 20 Hz.

• Large mammals such as Rhinoceroses, Whales, and Elephants utilize infrasound to communicate over vast distances. Hence, the correct answer is Infrasound.

• Rhinoceroses are known to communicate using infrasound of frequency as low as 5 Hz.

• Elephants use low-frequency sounds to coordinate herd movements and find mates over distances of several kilometers, as these waves are less likely to be scattered or absorbed by dense vegetation.

• Whales, specifically Baleen whales, use infrasonic calls to communicate across hundreds or even thousands of kilometers in the ocean, taking advantage of the efficient propagation of low-frequency waves in water.

• Natural events like earthquakes, volcanic eruptions, and ocean waves also generate infrasonic waves, which some animals can perceive as a warning signal before the event occurs.

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Additional Information

• Audible Sound:

• This is the frequency range detectable by the human ear, typically spanning from 20 Hz to 20,000 Hz (or 20 kHz).

• Sounds below 20 Hz are felt as vibrations rather than heard, while sounds above 20 kHz are completely silent to humans.

• Ultrasound:

• Sound waves with frequencies higher than 20,000 Hz are classified as ultrasound.

• Animals like Bats, Dolphins, and Porpoises produce ultrasound for echolocation to navigate and hunt prey in the dark or underwater.

• In medical science, ultrasound is used in Sonography (ultrasound imaging) to view internal organs and during pregnancy to monitor fetal growth.

• Supersonic Sound:

• The term Supersonic does not refer to a frequency range but to a speed. It describes an object moving faster than the speed of sound in air, which is approximately 343 meters per second (at 20 degrees Celsius).

• When an aircraft travels at supersonic speeds, it creates shock waves known as a sonic boom.

Important Points

• Sound Propagation: Sound is a mechanical longitudinal wave that requires a material medium (solid, liquid, or gas) to travel. It cannot travel through a vacuum.

• Frequency and Pitch: The frequency of a sound wave determines its pitch. High-frequency waves (ultrasound) have a high pitch, while low-frequency waves (infrasound) have a very low pitch.

• Infrasound Detection: Specialized instruments called microbarometers are used to detect and monitor infrasound for scientific research and nuclear explosion monitoring under the Comprehensive Nuclear-Test-Ban Treaty (CTBT).

• Age and Hearing: As humans age, the upper limit of the audible range often decreases, making it harder to hear high-frequency sounds near 15-20 kHz.

Q8. Answer: (c) electrolytic reduction

The correct answer is electrolytic reduction.

Key Points

• Metals high in the activity series, such as Potassium (K), Sodium (Na), Calcium (Ca), Magnesium (Mg), and Aluminium (Al), are very reactive and cannot be obtained from their compounds by heating with carbon.

• This is because these metals have a higher affinity for oxygen than carbon does, making carbon an ineffective reducing agent for their oxides.

• Electrolytic reduction is the process used for their extraction, where electric current is passed through the molten state of their chlorides or oxides. Hence, the correct answer is electrolytic reduction.

• During this process, the metal is deposited at the cathode (the negatively charged electrode), and the non-metal, like chlorine, is liberated at the anode (the positively charged electrode). Hence, statement 3 is correct.

• Only heating is a method used for metals very low in the activity series, such as Mercury from its ore Cinnabar (HgS). Hence, statement 1 is incorrect.

• Calcination is a process used for carbonate ores of metals with medium reactivity, where the ore is heated strongly in limited supply of air to convert it into an oxide. Hence, statement 2 is incorrect.

• Heating with carbon (reduction) is used for metals in the middle of the activity series, such as Iron (Fe), Zinc (Zn), and Lead (Pb). Hence, statement 4 is incorrect.

Additional Information

• Reactivity Series: It is a vertical arrangement of metals in decreasing order of their chemical reactivity. Metals at the top are the most electropositive and lose electrons easily.

• Extraction of Sodium: It is obtained by the electrolysis of molten sodium chloride (NaCl). At the cathode, Na+ ions gain electrons to form Sodium metal, while at the anode, Cl- ions lose electrons to form Chlorine gas.

• Hall-Heroult Process: This is a specific industrial electrolytic process used for the extraction of Aluminium from Alumina (Al_2O_3). The alumina is dissolved in molten cryolite (Na_3AlF_6) to lower the melting point and increase conductivity.

• Roasting: Unlike calcination, roasting is the process of heating sulphide ores strongly in the presence of excess air to convert them into metal oxides.

• Native State: Metals at the bottom of the activity series, like Gold (Au), Silver (Ag), and Platinum (Pt), are often found in their native (free) state in nature because they are the least reactive.

Important Points

• Affinity for Oxygen: The choice of extraction method is primarily determined by the thermodynamic stability of the metal oxide. Metals high in the series form very stable oxides that require massive energy (electricity) to break.

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• Reducing Agents: While carbon (coke) is a cheap and common reducing agent for Iron and Zinc, highly reactive metals like Aluminium are themselves sometimes used as reducing agents in thermite reactions to extract metals like Manganese (Mn) or Chromium (Cr) from their oxides.

• Electrolyte Purity: For electrolytic reduction, the salt must be in a molten (fused) state or in a solution to allow the ions to move freely and conduct electricity.

Q9. Answer: (d) Gain of electrons

The correct answer is Gain of electrons.

Key Points

• In chemistry, a reduction reaction is defined as a process where a chemical species (atom, ion, or molecule) gains one or more electrons.

• When an atom or ion gains electrons, its oxidation state or oxidation number decreases (becomes more negative or less positive). Hence, statement 4 is correct.

• The process of losing electrons is known as oxidation, which is the exact opposite of reduction. Hence, statement 2 is incorrect.

• Changes involving neutrons or protons are considered nuclear reactions rather than chemical reactions. Loss of neutrons usually occurs during radioactive decay or nuclear fission. Hence, statement 1 is incorrect.

• Gain of protons would change the atomic number of the element, essentially turning it into a different chemical element altogether, which does not happen in standard chemical reactions. Hence, statement 3 is incorrect.

• A popular mnemonic to remember this is OIL RIG, which stands for Oxidation Is Loss (of electrons) and Reduction Is Gain (of electrons).

Additional Information

• Redox Reactions:

• Reduction and oxidation almost always occur simultaneously in a chemical process known as a Redox reaction.

• In these reactions, electrons are transferred from one substance to another. The substance that loses electrons is oxidized, and the substance that gains electrons is reduced.

• Oxidizing and Reducing Agents:

• A reducing agent (or reductant) is a substance that donates electrons to another substance, thereby undergoing oxidation itself.

• An oxidizing agent (or oxidant) is a substance that accepts electrons from another substance, thereby undergoing reduction itself.

• Classical Definitions:

• While the electronic definition is the most accurate, reduction was classically defined as the loss of oxygen or the gain of hydrogen.

• Conversely, oxidation was defined as the gain of oxygen or the loss of hydrogen.

• Practical Examples:

• In the extraction of iron from its ore (Hematite - Fe_2O_3), carbon monoxide acts as a reducing agent to remove oxygen from the iron oxide, leaving behind metallic iron.

• In electroplating, metal ions in a solution gain electrons at the cathode to form a solid metal coating on an object.

Important Points

• Electrochemical Cells: In a battery or galvanic cell, reduction always occurs at the cathode, while oxidation occurs at the anode.

• Biological Significance: Reduction reactions are vital in photosynthesis and cellular respiration. For instance, in photosynthesis, carbon dioxide is reduced to form glucose.

• Oxidation Number Rules:

• The oxidation number of a free element is always zero.

• For a monatomic ion, the oxidation number is equal to its charge.

• Oxygen usually has an oxidation number of -2, except in peroxides where it is -1.

• Hydrogen usually has an oxidation number of +1 when bonded to non-metals and -1 when bonded to metals.

Q10. Answer: (c) Prostate gland and seminal vesicles

The correct answer is Prostate gland and seminal vesicles.

Key Points

• The male reproductive system consists of various organs and accessory glands that work together to produce, maintain, and transport sperm. Sperm motility refers to the ability of sperm to move efficiently.

• Seminal Vesicles: These are a pair of pouch-like glands located at the base of the urinary bladder. They secrete a thick, alkaline fluid that makes up approximately 60% to 70% of the total volume of semen.

• The fluid from the seminal vesicles contains fructose, which provides the essential energy source (ATP) for sperm to swim.

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Without this energy, sperm remain immobile.

• Prostate Gland: This is a single, doughnut-shaped gland located just below the urinary bladder. It secretes a thin, milky, slightly alkaline fluid that contains citrate, zinc, and various enzymes.

• The secretions of the prostate gland play a crucial role in the activation of sperm and significantly enhance their motility and survival by neutralizing the acidic environment of the male urethra and the female reproductive tract.

• If a patient exhibits low sperm motility (a condition often termed asthenozoospermia), it indicates that the sperm lack the necessary biochemical environment or energy to move, pointing directly to the malfunction of the prostate gland and seminal vesicles. Hence, the correct answer is Prostate gland and seminal vesicles.

Additional Information

• Testis and Epididymis:

• The testes are the primary reproductive organs responsible for the production of sperm (spermatogenesis) and the hormone testosterone.

• The epididymis is a coiled tube where sperm are stored and undergo functional maturation, gaining the potential for motility, although they only become fully active upon mixing with accessory gland secretions.

• Bulbourethral Glands (Cowper's Glands):

• These are small glands located below the prostate. They secrete an alkaline mucus that lubricates the urethra and neutralizes any residual acidic urine before ejaculation.

• Analysis of Incorrect Options:

• Pancreas and Adrenal Glands: The pancreas regulates blood glucose levels via insulin and glucagon, while adrenal glands produce adrenaline and cortisol for stress response. Neither is directly responsible for sperm motility.

• Thyroxine and Pineal Glands: Thyroxine (produced by the thyroid) regulates basal metabolic rate, and the pineal gland produces melatonin to regulate the circadian rhythm (sleep-wake cycle).

• Bladder: The urinary bladder is part of the excretory system and serves only as a storage vessel for urine; it has no secretory role in sperm health.

• Semen Composition:

• Semen is a mixture of sperm and seminal plasma. The seminal plasma is formed by the combined secretions of the seminal vesicles, prostate, and bulbourethral glands, providing a transport medium, nutrients, and protection to the sperm cells.

Important Points

• Fertilization Requirement: For successful fertilization, sperm must travel from the vagina through the cervix and uterus to the fallopian tubes. This requires high motility, which is dependent on the chemical composition of the fluid provided by the accessory glands.

• Hormonal Regulation: The functioning of the prostate and seminal vesicles is maintained by the male sex hormone, testosterone, which is secreted by the Leydig cells in the testes under the influence of Luteinizing Hormone (LH).

• Clinical Relevance: Disorders such as prostatitis (inflammation of the prostate) or seminal vesiculitis can lead to changes in the pH or nutrient content of semen, resulting in infertility due to reduced sperm movement.

Q11. Answer: (d) potential energy

The correct answer is potential energy.

Key Points

• Potential Energy is defined as the energy possessed by an object by virtue of its position relative to others, stresses within itself, its electric charge, or other factors.

• It is "stored" energy that has the capacity to do work when the object's position or configuration changes. For example, water stored in a dam possesses potential energy due to its height.

• There are two primary forms of potential energy: Gravitational Potential Energy and Elastic Potential Energy.

• Gravitational Potential Energy depends on the mass of the object, the acceleration due to gravity (approx 9.8 m/s^2 on Earth), and the height of the object from a reference point. The formula is expressed as P.E. = mgh.

• Elastic Potential Energy is stored in objects that can be compressed or stretched, such as a rubber band, a spring, or a drawn bow. This energy is a result of the change in the configuration or shape of the object.

Additional Information

• Kinetic Energy:

• This is the energy an object possesses due to its motion. Unlike potential energy, which is stored, kinetic energy is active.

• The amount of kinetic energy depends on the mass of the object and the square of its velocity. The standard formula is K.E. = 1/2 mv^2.

• Examples include a rolling ball, a flying airplane, or flowing water. Hence, option 2 is incorrect as it relates to motion, not position.

• Thermal Energy:

• This refers to the energy contained within a system that is responsible for its temperature. It is the internal energy of an object due to the kinetic energy of its atoms and molecules.

• Heat is the transfer of thermal energy between systems. For instance, boiling water contains significant thermal energy. Hence, option 1 is incorrect.

• Sound Energy:

• Sound energy is a form of mechanical energy that moves through substances (like air or water) in longitudinal waves.

• It is produced when an object vibrates, causing the surrounding medium to vibrate as well. Examples include music or a human voice. Hence, option 3 is incorrect.

Important Points

• Law of Conservation of Energy: This fundamental law of physics states that energy cannot be created or destroyed; it can only be transformed from one form to another. In a closed system, the sum of Potential Energy and Kinetic Energy (Mechanical Energy) remains constant in the absence of friction.

• SI Unit: The Standard International (SI) unit for measuring all forms of energy, including potential energy, is the Joule (J).

• Work-Energy Theorem: Work is done when a force acts on an object to cause a displacement. When work is done on an object against gravity, it is stored as Gravitational Potential Energy.

• Chemical Potential Energy: This is another form of stored energy found within the chemical bonds of substances, such as food, batteries, or gasoline, which is released during a chemical reaction.

Q12. Answer: (c) It increases the chances of survival by enabling adaptation to environmental changes.

The correct answer is It increases the chances of survival by enabling adaptation to environmental changes.

Key Points

• Sexual reproduction in plants involves the fusion of male and female gametes (pollen and ovules), which results in offspring that possess a unique combination of genetic material from two different parents.

• Variation is the cornerstone of evolution and natural selection. It ensures that a population contains individuals with diverse traits, some of which may be advantageous during sudden environmental shifts such as global warming, drought, or outbreaks of disease.

• By having a varied genetic pool, the species as a whole has a higher probability of survival; if all plants were genetically identical, a single unfavorable change could lead to the extinction of the entire population. Hence, statement 3 is correct.

• Contrary to limiting adaptability, variation actually expands the range of conditions in which a species can thrive. Hence, statement 1 is incorrect.

• Variation specifically prevents uniformity. Uniformity is a characteristic of asexual reproduction (cloning), where offspring are genetically identical to the parent. Hence, statement 2 is incorrect.

• Sexual reproduction increases genetic diversity rather than decreasing it, providing the raw material upon which evolutionary forces act over thousands of years. Hence, statement 4 is incorrect.

Additional Information

• Mechanisms of Variation:

• Meiosis: This is a type of cell division that reduces the chromosome number by half. During this process, crossing over occurs, where homologous chromosomes exchange genetic segments, creating new gene combinations.

• Random Fertilization: The random fusion of any one sperm (pollen) with any one egg (ovule) further increases the mathematical possibilities of unique genetic outcomes.

• Significance in Agriculture:

• In crop science, genetic variation is utilized by breeders to develop hybrid varieties that are resistant to pests or high salinity.

• The Green Revolution in the 1960s utilized genetic variation to create high-yielding varieties of wheat and rice, significantly increasing food security.

• Natural Selection:

• Proposed by Charles Darwin in his 1859 book "On the Origin of Species," natural selection suggests that individuals with favorable phenotypes are more likely to survive to reproductive age.

• Variation provides the different "options" from which the environment "selects" the most fit individuals.

• Biodiversity and Ecosystem Stability:

• High genetic variation within a plant species contributes to the overall biodiversity of an ecosystem. This makes the ecosystem more resilient to disturbances and helps maintain ecological balance.

Important Points

• Asexual vs. Sexual Reproduction: While asexual reproduction is faster and requires less energy, it produces clones. This lack of variation makes such plants highly vulnerable to rapid environmental changes or specific pathogens.

• DNA Copying: During gamete formation, DNA replication is not 100% accurate. These small "errors" or mutations are a secondary source of variation that can introduce entirely new traits into a population over generations.

• Niche Specialization: Variation allows different individuals of the same species to occupy slightly different ecological niches, reducing direct competition for resources like sunlight, water, and nutrients.

Q13. Answer: (a) Sweet-smelling

The correct answer is Sweet-smelling.

Key Points

• Esters are functional organic compounds derived from carboxylic acids and alcohols, characterized by a carbon atom double-bonded to an oxygen and single-bonded to an alkoxy group (R-COOR').

• One of the most defining physical properties of low-molecular-weight esters is their pleasant, fruity, or sweet-smelling fragrance, which makes them highly distinguishable from the pungent odors of their parent acids.

• They are synthesized via a reaction called esterification, typically involving the heating of a carboxylic acid with an alcohol in the presence of a strong acid catalyst like concentrated sulfuric acid (H2SO4).

• In nature, esters are ubiquitous and are responsible for the natural aroma and of various fruits and flowers, such as isoamyl acetate (banana smell) and ethyl butyrate (pineapple smell).

Additional Information

• Industrial and Commercial Uses:

• Because of their volatile nature and pleasant scents, they are extensively used as synthetic flavoring agents in the food industry and as primary components in perfumes and cosmetic products.

• Esters like ethyl acetate are utilized as powerful organic solvents in nail polish removers, paints, and adhesives due to their ability to dissolve various organic substances.

• Chemical Properties:

• Under basic conditions, esters undergo a process called saponification (alkaline hydrolysis), which results in the formation of soap (salts of fatty acids) and an alcohol.

• Unlike carboxylic acids, esters are neutral compounds and do not react with sodium bicarbonate to release carbon dioxide, nor do they turn blue litmus paper red.

Q14. Answer: (d) Only (iii)

The correct answer is Only (iii).

Key Points

• A concave mirror does not always form a real and inverted image. When an object is placed very close to the mirror, specifically between the Principal Focus (F) and the Pole (P), it forms a virtual, erect, and magnified image behind the mirror. Hence, statement (i) is incorrect.

• When an object is placed between the Center of Curvature (C) and the Principal Focus (F), the concave mirror forms an image beyond C. This image is real, inverted, and magnified (enlarged), not diminished. Hence, statement (ii) is incorrect.

• If an object is at infinity, the incident rays are parallel to the principal axis. These rays, after reflection, converge at the Principal Focus (F). The resulting image is real, inverted, and highly diminished (point-sized). Hence, statement (iii) is correct.

• The nature and size of the image formed by a concave mirror depend entirely on the distance of the object from the pole of the mirror.

• Hence, the correct answer is Only (iii).

Additional Information

• Definition of Concave Mirror: A spherical mirror whose reflecting surface is curved inwards (faces towards the center of the sphere) is called a concave mirror. It is also known as a converging mirror because it converges a parallel beam of light after reflection.

• Image Formation Summary:

• Object at C: The image is formed at C, and it is real, inverted, and same size as the object.

• Object beyond C: The image is formed between F and C, and it is real, inverted, and diminished.

• Object at F: The image is formed at infinity, and it is real, inverted, and highly magnified.

• Common Uses:

• Shaving mirrors: Used to see a magnified and erect image of the face when held close.

• Dentists: They use concave mirrors to see large images of the teeth of patients.

• Reflectors: Used in torches, search-lights, and vehicle headlights to get powerful parallel beams of light.

• Solar Furnaces: Large concave mirrors are used to concentrate sunlight to produce heat in solar energy applications.

Important Points

• Real Image vs. Virtual Image: A real image is formed when light rays actually intersect at a point and can be obtained on a screen. A virtual image is formed when light rays appear to diverge from a point and cannot be caught on a screen.

• Sign Convention: According to the New Cartesian Sign Convention, the focal length of a concave mirror is always taken as negative, while that of a convex mirror is positive.

• Principal Focus: For a concave mirror, the Principal Focus is a point on the principal axis where all rays traveling parallel to the axis actually meet after reflection.

Q15. Answer: (d) To provide a low-resistance path to ensure leakage current keeps the appliance potential to that of the ear...

The correct answer is To provide a low-resistance path to ensure leakage current keeps the appliance potential to that of the earth, preventing severe shocks.

Key Points

• The earth wire, which typically has green insulation, is a vital safety measure in domestic electric circuits, especially for appliances with a metallic body like electric irons, toasters, and refrigerators.

• Its primary function is to provide a low-resistance conducting path for the electric current. If the insulation of the live wire inside an appliance fails and touches the metallic casing, the earth wire ensures that the current flows directly into the ground.

• By directing the leakage current to the earth, the wire maintains the electric potential of the appliance's metallic body at zero volts (the same as the earth), ensuring that a user touching the appliance does not receive a severe electric shock. Hence, statement 4 is correct.

• The low-resistance path is critical because electricity always follows the path of least resistance. Since the human body has higher resistance compared to the copper earth wire, the current prefers the wire over the person. Hence, statement 1 is incorrect as it suggests a high-resistance path.

• The earth wire does not regulate or stabilize voltage; voltage stabilization is the function of devices like Voltage Stabilizers or Transformers. Hence, statement 2 is incorrect.

• The earth wire is not designed to replace the neutral wire. While both are connected to the ground at some point in the power system, the neutral wire completes the circuit for normal operation, whereas the earth wire is strictly for safety and protection. Hence, statement 3 is incorrect.

Additional Information

• Standard Color Coding: In a typical domestic circuit in India, three types of wires are used. The Live wire (positive) usually has red or brown insulation, the Neutral wire (negative) has black or blue insulation, and the Earth wire has green or yellow insulation.

• Domestic Power Supply: In India, the potential difference (voltage) between the live and neutral wires is 220 V, and the frequency of the alternating current (AC) is 50 Hz.

• Circuit Types: Domestic circuits are often divided into two types: a 5 A current rating circuit for low-power bulbs and fans, and a 15 A current rating circuit for high-power appliances like air conditioners and geysers.

• Safety Devices: To prevent damage from short-circuiting or overloading, devices such as Electric Fuses and Miniature Circuit Breakers (MCB) are installed. A fuse works on the heating effect of current and breaks the circuit if the current exceeds a safe limit.

Important Points

• Earthing Mechanism: The earth wire is connected to a metal plate buried deep in the earth near the house. This setup ensures that any excess charge or leakage is instantly discharged into the ground.

• Short Circuiting: This occurs when the live wire and the neutral wire come into direct contact due to damaged insulation or a fault in the appliance, causing a sudden, massive surge in current.

• Overloading: This happens when too many high-power appliances are connected to a single socket, drawing more current than the wires can safely carry, leading to potential fire hazards.

• Three-Pin Plugs: The top pin of a three-pin plug is the earth pin. It is intentionally made longer and thicker than the live and neutral pins to ensure the appliance is grounded first before the power is connected.

Q16. Answer: (d) 60°

The correct answer is 60°.

Key Points

• The Laws of Reflection state that when a ray of light strikes a reflective surface, the angle of incidence (i) is always equal to the angle of reflection (r).

• The angle of incidence is defined as the angle between the incident ray and the normal (a perpendicular line to the surface). In the given problem, this angle is 30°.

• According to the law (i = r), since the angle of incidence is 30°, the angle of reflection must also be 30°.

• The question asks for the total angle between the incident ray and the reflected ray. This is calculated by adding the angle of incidence and the angle of reflection (i + r).

• Calculation: 30° + 30° = 60°. Therefore, the angle between the two rays is 60°. Hence, the correct answer is 60°.

Additional Information

• Plane Mirror Characteristics:

• A plane mirror is a flat reflective surface that forms a virtual, erect, and laterally inverted image.

• The size of the image formed is exactly the same as the size of the object.

• The distance of the image behind the mirror is equal to the distance of the object in front of the mirror.

• Types of Reflection:

• Regular Reflection: Also known as specular reflection, it occurs on smooth surfaces like mirrors where all reflected rays are parallel.

• Diffuse Reflection: Occurs on rough surfaces where light is reflected in many different directions, allowing us to see non-shiny objects.

• Normal Line: In optics, the normal is an imaginary line drawn perpendicular (90°) to the surface of the mirror at the point of incidence. All angles in the laws of reflection are measured relative to this line.

Important Points

• Glancing Angle: This is the angle between the incident ray and the mirror surface itself. If the angle with the normal is 30°, the glancing angle is 90° - 30° = 60°.

• Angle of Deviation (δ): This is the angle by which the light ray is turned from its original path. For a plane mirror, the deviation is calculated as 180° - (i + r). In this case, 180° - 60° = 120°.

• First Law of Reflection: It specifies that the incident ray, the reflected ray, and the normal at the point of incidence all lie in the same plane.

• Universal Application: These rules of reflection are not limited to plane mirrors; they apply to all curved surfaces (concave and convex) and spherical mirrors as well.

Q17. Answer: (d) 122.5 m

The correct answer is 122.5 m.

Key Points

• The motion of the stone is a case of vertical motion under gravity. When an object is thrown upwards, it experiences a constant downward acceleration due to gravity (g), which is approximately 9.8 m/s².

• The initial velocity (u) is given as 49 m/s. As the stone moves upward, its velocity decreases until it reaches the maximum height, where the final velocity (v) becomes 0 m/s for a brief moment.

• To find the maximum height, we use the third equation of motion: $v^2 = u^2 + 2as$. In this context, s represents the maximum height (H) and a represents -g (since gravity acts in the opposite direction of the initial motion).

• Substituting the known values into the equation: $0^2 = (49)^2 + 2(-9.8)H$. This simplifies to $0 = 2401 - 19.6H$.

• Rearranging the formula to solve for H: $19.6H = 2401$, which leads to $H = 2401 / 19.6 = 122.5$ m. Hence, the correct option is 122.5 m.

Additional Information

• Equations of Motion: There are three primary kinematic equations used for objects under uniform acceleration:

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

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

• Third Equation: $v^2 = u^2 + 2as$, used to find displacement or velocity when time is unknown.

• Time to Reach Maximum Height: The time taken (t) can be calculated using the first equation $v = u + at$. Setting $v = 0$ and $a = -9.8$, we get $0 = 49 - 9.8t$, resulting in $t = 5$ seconds.

• Total Time of Flight: In the absence of air resistance, the time taken to go up is equal to the time taken to come back down. Therefore, the total time of flight (T) is $2 \times 5 = 10$ seconds.

• Velocity on Return: When the stone returns to the point of projection, its final velocity will be equal in magnitude to the initial velocity but in the opposite direction (-49 m/s), assuming no energy is lost.

Important Points

• Sign Convention: In physics problems involving vertical motion, it is crucial to maintain a consistent sign convention. Usually, upward direction is taken as positive (+) and downward direction (gravity) is taken as negative (-).

• Acceleration due to Gravity (g): This value varies slightly across the Earth's surface (higher at poles, lower at the equator), but for most calculations, 9.8 m/s² or 10 m/s² is used as a standard numerical value.

• Mass Independence: According to Galileo's principle, the height reached or the time taken by an object under gravity is independent of its mass, provided air resistance is neglected.

• Momentary Rest: The point of maximum height is characterized by a velocity of zero, but the acceleration at that point is still 9.8 m/s² downward.

Q18. Answer: (b) Cuboidal epithelium

The correct answer is Cuboidal epithelium.

Key Points

• Cuboidal epithelium is a type of epithelial tissue characterized by cells that are roughly cube-shaped, having a similar height and width.

• It is found in the lining of kidney tubules (specifically the nephrons) and the ducts of salivary glands.

• The primary functions of cuboidal epithelium are secretion and absorption.

• In the kidney, it plays a vital role in the reabsorption of water and nutrients from the filtrate back into the bloodstream.

• In glandular ducts, it facilitates the transport and secretion of substances like saliva or enzymes.

• Additionally, this tissue provides mechanical support to the organs and ducts it lines.

Additional Information

• Ciliated Epithelium:

• These cells possess cilia, which are hair-like projections on their outer surface.

• They are found in the respiratory tract (to move mucus) and fallopian tubes (to move the egg).

• Their function is to move particles or mucus in a specific direction over the epithelium.

• Columnar Epithelium:

• Consists of tall and slender cells resembling pillars with nuclei located at the base.

• Found in the inner lining of the stomach and intestine.

• It is primarily involved in absorption and secretion of digestive juices.

• Stratified (Compound) Epithelium:

• Composed of multiple layers of cells rather than a single layer.

• The skin is a classic example of stratified squamous epithelium, where layers prevent wear and tear.

• Its main function is to provide protection against chemical and mechanical stresses.

• Simple Squamous Epithelium:

• Extremely thin and flat cells forming a delicate lining.

• Located in the alveoli of lungs, blood vessels, and esophagus.

• Facilitates diffusion and filtration across the membrane.

Important Points

• Basement Membrane: All epithelial tissues are usually separated from the underlying tissue by an extracellular fibrous basement membrane.

• Microvilli: In the Proximal Convoluted Tubule (PCT) of the nephron in the kidney, cuboidal cells have microvilli to increase the surface area for reabsorption.

• Glandular Epithelium: Sometimes a portion of the epithelial tissue folds inward, and a multicellular gland is formed; this is known as glandular epithelium, often modified from cuboidal or columnar cells.

• Cell Junctions: Epithelial cells are held together by tight junctions, adhering junctions, and gap junctions to facilitate communication and structural integrity.

Q19. Answer: (c) Electron Clouds

The correct answer is Electron Clouds.

Key Points

• The size of an atom is almost entirely determined by the volume of its Electron Clouds. Although electrons have negligible mass, they move rapidly in regions of space around the nucleus, creating a "cloud" that defines the atom's outer boundary.

• While the nucleus contains more than 99.9% of the atom's total mass, it occupies an extremely small fraction of the atom's volume. If an atom were expanded to the size of a football stadium, the nucleus would be the size of a small marble in the center, while the electron cloud would fill the rest of the stadium.

• The atomic radius is the physical distance from the center of the nucleus to the outermost stable electron orbital. This radius typically ranges from 30 to 300 picometers (pm) (1 picometer = 10^-12 meters).

• The distribution of electrons in different energy levels (shells) and subshells (s, p, d, f orbitals) dictates how much space the atom takes up. Atoms with more electron shells are generally larger in size.

• The interaction between the positively charged nucleus and the negatively charged electrons determines how tightly the cloud is pulled inward, thus influencing the overall atomic volume.

Additional Information

• Nucleus:

• The nucleus was discovered by Ernest Rutherford in 1911 through his famous Gold Foil Experiment.

• It is the dense, central core of the atom containing protons and neutrons. The diameter of a nucleus is about 10^-15 meters, which is 100,000 times smaller than the atom itself (10^-10 meters).

• Protons and Neutrons:

• Protons are positively charged particles discovered by Ernest Rutherford. The number of protons is known as the Atomic Number (Z) and determines the identity of the chemical element.

• Neutrons are neutral subatomic particles discovered by James Chadwick in 1932. Together with protons, they make up the Atomic Mass of the atom but do not contribute to its volume.

• Trends in Atomic Size:

• In the Periodic Table, the atomic size decreases across a period (from left to right) because the increasing nuclear charge pulls the electron cloud closer to the center.

• The atomic size increases down a group (from top to bottom) because new principal energy levels or shells are added, which are further from the nucleus.

• Measurement Units:

• Atomic sizes are often measured in Angstroms (Å) or Nanometers (nm). One Angstrom is equal to 10^-10 meters, which is roughly the size of a hydrogen atom.

Q20. Answer: (d) collenchyma

The correct answer is collenchyma.

Key Points

• Collenchyma is a simple permanent tissue that provides mechanical support and flexibility to various plant parts such as stems, tendrils, and leaf stalks.

• It allows these parts to bend easily without breaking, which is vital for the growth and adaptation of climbing plants and young seedlings.

• The cells of collenchyma are living, elongated, and characterized by unevenly thickened cell walls, particularly at the corners.

• The thickening of the cell wall is due to the deposition of cellulose, hemicellulose, and pectin.

• It is generally located in the hypodermis of dicotyledonous stems and the petioles of leaves, but it is typically absent in monocot stems and roots.

Additional Information

• Parenchyma:

• This is the most fundamental and abundant simple permanent tissue in plants.

• It consists of relatively unspecialized, living cells with thin cell walls made of cellulose.

• The cells are usually isodiametric and have large intercellular spaces.

• Its primary functions include storage of food, photosynthesis (as chlorenchyma), and providing buoyancy to aquatic plants (as aerenchyma).

• Sclerenchyma:

• This tissue consists of dead cells at maturity that are long and narrow.

• The cell walls are highly thickened with lignin, a chemical substance that acts as cement and hardens them.

• Its main function is to provide strength and rigidity to plant parts, making them hard and stiff.

• Common examples include the husk of coconut, the hard shells of nuts, and the gritty texture in the pulp of pears.

• Xylem:

• Unlike the others mentioned, Xylem is a complex permanent tissue, meaning it is made of more than one type of cell.

• It is responsible for the conduction of water and minerals upward from the roots to the leaves.

• It consists of four elements: tracheids, vessels, xylem parenchyma, and xylem fibres.

• Except for xylem parenchyma, most xylem cells are dead at maturity.

Important Points

• Simple Permanent Tissue: These are tissues composed of only one type of cell that are similar in structure and function. The three main types are Parenchyma, Collenchyma, and Sclerenchyma.

• Permanent Tissues: These tissues are formed from meristematic tissues once the cells have lost their ability to divide and have attained a permanent shape, size, and function. This process is called differentiation.

• Lignin vs Pectin: While lignin is the characteristic hardening agent in sclerenchyma (leading to rigidity), pectin is the primary thickening agent at the corners of collenchyma (allowing for flexibility).

Q21. Answer: (a) 18

The correct answer is 18.

Key Points

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• The distribution of electrons in different orbits or shells of an atom was suggested by Bohr and Bury in the year 1921. According to this scheme, the maximum number of electrons that can be accommodated in a shell is given by the formula $2n^2$, where 'n' is the orbit number or energy level index.

• The M-shell is the third shell from the nucleus of an atom, which means its principal quantum number or orbit number n is equal to 3.

• By applying the $2n^2$ formula for the M-shell, the calculation is $2 \times (3)^2$, which equals $2 \times 9 = 18$. Therefore, the M-shell can accommodate a maximum of 18 electrons.

• This rule dictates the capacity of each discrete energy level. For the first three shells, the capacities are K-shell (2), L-shell (8), and M-shell (18).

• While the M-shell has a physical capacity for 18 electrons, the Bohr-Bury scheme also specifies that the outermost shell of any atom cannot accommodate more than 8 electrons, even if it has the capacity for more.

Additional Information

• K-Shell (n=1):

• The K-shell is the first shell and is closest to the nucleus.

• Using the formula $2(1)^2$, its maximum capacity is 2 electrons.

• Elements like Hydrogen and Helium fill this shell first.

• L-Shell (n=2):

• The L-shell is the second shell.

• Following the formula $2(2)^2$, it can hold a maximum of 8 electrons.

• Once the K-shell is full, electrons begin to occupy the L-shell.

• N-Shell (n=4):

• The N-shell is the fourth shell from the nucleus.

• According to the $2n^2$ rule, where n=4, the calculation is $2 \times (4)^2 = 2 \times 16$, resulting in a maximum of 32 electrons.

• Significance of the Bohr Model:

• Proposed by Neils Bohr in 1913, this model introduced the idea that electrons travel in defined circular orbits around the nucleus.

• The model explains that energy is absorbed or emitted only when an electron jumps from one orbit to another.

• The Bohr-Bury scheme refined this by providing the rules for electron configuration and stability.

Important Points

• Octet Rule: Regardless of the shell's maximum capacity (like 18 for M or 32 for N), the outermost shell (valence shell) is considered stable when it contains 8 electrons. This is known as the Octet Rule.

• Step-wise Filling: Electrons are not accommodated in a given shell unless the inner shells are completely filled. This means the shells are filled in a step-wise manner starting from the lowest energy level (K) to higher ones.

• Energy Levels: As the value of n increases, the energy of the shell also increases, and the shell is located farther from the nucleus.

• Valence Electrons: The electrons present in the outermost shell are called valence electrons, and they determine the chemical reactivity and valency of the element.

Q22. Answer: (c) It involves directional growth in response to a stimulus.

The correct answer is It involves directional growth in response to a stimulus.

Key Points

• Tropic movements, or Tropisms, are directional growth movements of a plant in response to an external stimulus such as light, gravity, or touch.

• Tendril movement is a specific type of tropism called Thigmotropism. It occurs when the plant part makes contact with a solid object, triggering a growth response that causes the tendril to coil around the support.

• The movement is directional because the growth is oriented toward the stimulus (the contact point). Hence, statement 3 is correct.

• Unlike Nastic movements, which are based on changes in turgor pressure and internal water levels (like the closing of Mimosa pudica leaves), tendril coiling is a result of permanent differential growth. Hence, statement 1 is incorrect.

• Tropic movements are not random; they are highly regulated biological responses to environmental cues intended to aid the plant's survival and positioning. Hence, statement 2 is incorrect.

• While plant growth occurs throughout the 24-hour cycle, it is not restricted to occurring always during night. The stimulus-driven growth of tendrils happens whenever the contact stimulus is present. Hence, statement 4 is incorrect.

Additional Information

• Mechanism of Thigmotropism: When a tendril touches a support, the plant hormone Auxin diffuses toward the side of the tendril that is not in contact with the support. This higher concentration of Auxin causes the outer side to grow much faster than the side

touching the object, resulting in the characteristic coiling or curving.

• Types of Tropisms:

• Phototropism: Growth in response to light (e.g., shoots growing toward a window).

• Geotropism (Gravitropism): Growth in response to gravity (e.g., roots growing downward).

• Hydrotropism: Growth of roots toward water or moisture sources.

• Chemotropism: Growth in response to chemical substances, such as the growth of a pollen tube toward the ovule.

• Examples of Tendril-bearing plants: Climbing plants such as Pea (Pisum sativum), Bitter Gourd, and Grapevines use these structures to climb higher for better access to sunlight.

Important Points

• Growth vs. Turgor: It is essential to distinguish between tropic movements (which are growth-dependent and usually irreversible) and nastic movements (which are growth-independent and reversible).

• Auxin's Role: Auxin is the primary phytohormone responsible for mediating the growth rate in almost all tropic movements. In Phototropism, it moves to the shaded side, while in Thigmotropism, it moves to the non-contact side.

• Biological Significance: These movements allow plants to optimize their environment. For instance, tendrils allow weak-stemmed plants to reach heights they could not sustain on their own, ensuring they are not shaded out by larger vegetation.

Q23. Answer: (a) It is a curved line.

The correct answer is It is a curved line..

Key Points

• A velocity-time graph (v-t graph) is a graphical representation used in kinematics to show how the velocity of an object changes with respect to time. The y-axis represents velocity, typically measured in meters per second (m/s), and the x-axis represents time, measured in seconds (s).

• The slope or gradient of a velocity-time graph represents the acceleration of the moving object. If the slope is constant, the acceleration is uniform; if the slope varies, the acceleration is non-uniform.

• Non-uniform acceleration occurs when the velocity of an object changes by unequal amounts in equal intervals of time. This implies that the rate of change of velocity is not a constant value throughout the motion.

• In the case of non-uniform acceleration, the slope of the graph changes at every point. Geometrically, a line with a continuously changing slope is represented as a curved line. Hence, statement 1 is correct.

• If the graph were a straight line (sloping upwards or downwards), it would represent uniform acceleration or uniform retardation, where the rate of change of velocity remains fixed. Hence, statement 2 is incorrect.

• A horizontal line on a v-t graph indicates that the velocity is constant over time, meaning the acceleration is exactly zero. Hence, statement 4 is incorrect.

Additional Information

• Types of Motion on v-t Graphs:

• Uniform Velocity: Represented by a straight horizontal line parallel to the time axis. The acceleration in this case is 0 m/s^2.

• Uniform Acceleration: Represented by a straight line with a positive slope. This means the object's velocity increases at a steady rate.

• Uniform Retardation (Deceleration): Represented by a straight line with a negative slope (sloping downwards). The velocity decreases at a constant rate.

• Non-uniform Acceleration: Represented by curves. A curve bending upwards indicates increasing acceleration, while a curve leveling off indicates decreasing acceleration.

• Calculation of Displacement: One of the most important features of a velocity-time graph is that the area under the curve (between the line and the time axis) represents the total displacement covered by the object. For a curved graph, this area is often calculated using integration in calculus.

• Instantaneous Acceleration: In a non-uniform acceleration scenario, the instantaneous acceleration at any specific time (t) is found by calculating the slope of the tangent drawn to the curved line at that specific point.

• Average Acceleration: For an object moving with non-uniform acceleration between two time intervals, the average acceleration is calculated by finding the change in velocity divided by the total time taken, which corresponds to the slope of the chord connecting the two points on the curve.

Important Points

• Physical Units: Always remember that the SI unit for velocity is m/s and for acceleration is m/s^2. On a graph, the product of the units of the two axes (m/s * s) yields the unit of displacement, which is meters (m).

• Non-Zero Intercept: A velocity-time graph does not always have to start at the origin (0,0). If it starts at a point on the y-axis, it indicates that the object had an initial velocity (u) at time t = 0.

• Direction of Motion: If the graph crosses below the x-axis into the negative y-region, it signifies that the object has changed direction and is moving in the opposite direction relative to the starting reference.

Q24. Answer: (a) a - iv, b - i, c - ii, d - iii

The correct answer is a - iv, b - i, c - ii, d - iii.

Key Points

• Aerobic respiration is a biological process in which food glucose is converted into energy in the presence of oxygen. This type of respiration is common in most higher organisms, including humans, animals, and plants. Hence, statement a matches with iv.

• Anaerobic respiration takes place in the absence of oxygen. In this process, the incomplete breakdown of food occurs, leading to the production of significantly less energy compared to aerobic respiration. Examples include fermentation in yeast and energy production in human muscles during heavy exercise. Hence, statement b matches with i.

• During aerobic respiration, the pyruvate molecule (produced from glucose) enters the Mitochondria. Here, in the presence of oxygen, it is completely broken down into carbon dioxide, water, and a large amount of ATP. Hence, statement c matches with ii.

• The first step of cellular respiration is glycolysis, which involves the breakdown of glucose (a 6-carbon molecule) into pyruvate (a 3-carbon molecule). This specific stage, as well as anaerobic pathways where oxygen is absent, occurs within the Cytoplasm of the cell. Hence, statement d matches with iii.

• Therefore, the correct matching sequence is a - iv, b - i, c - ii, d - iii.

Additional Information

• Site of Respiration: While glycolysis happens in the cytoplasm, the Krebs cycle and electron transport chain occur in the mitochondria. The mitochondria are often called the powerhouse of the cell because they generate the bulk of ATP.

• Energy Yield: Aerobic respiration is highly efficient, typically yielding approximately 36 to 38 ATP molecules per glucose molecule. In contrast, anaerobic respiration produces only 2 ATP molecules per glucose molecule.

• By-products: In aerobic conditions, the by-products are CO_2 and water. In anaerobic conditions in humans, lactic acid is produced, which can cause muscle cramps. In yeast, the anaerobic process produces ethanol and CO_2, a process widely used in the brewing and baking industries.

• Role of Pyruvate: Pyruvate acts as a crucial metabolic intermediate. Depending on the availability of oxygen, it either enters the mitochondria for further oxidation or undergoes fermentation in the cytoplasm.

Important Points

• ATP (Adenosine Triphosphate): This is known as the energy currency of the cell. The energy released during respiration is used to synthesize ATP from ADP and inorganic phosphate.

• Muscle Fatigue: During vigorous exercise, when the supply of oxygen to our muscle cells is insufficient, anaerobic respiration takes place, leading to the accumulation of lactic acid. This accumulation is the primary cause of muscle cramps and fatigue.

• Cellular Respiration stages: It involves four main stages: Glycolysis (Cytoplasm), Pyruvate Oxidation (Mitochondria), Citric Acid Cycle/Krebs Cycle (Mitochondria), and Oxidative Phosphorylation (Mitochondria).

• Universal Process: Glycolysis is considered the most ancient metabolic pathway as it occurs in almost all living organisms, regardless of whether they breathe oxygen or not, and it always takes place in the cytosol/cytoplasm.

Q25. Answer: (b) Involves only one parent

The correct answer is Involves only one parent.

Key Points

• Asexual reproduction is a biological process by which an organism creates a genetically similar or identical copy of itself without the contribution of genetic material from another individual.

• It involves only one parent, meaning there is no requirement for a partner or the fusion of male and female gametes. Hence, statement 2 is correct and statement 1 is incorrect.

• The offspring produced through this method are genetically identical to the parent and are often referred to as clones. This process does not lead to genetic diversity within the population. Hence, statement 3 is incorrect.

• This mode of reproduction does not typically require gametes (sperm and egg cells), nor does it involve fertilization. It relies primarily on mitotic cell division. Hence, statement 4 is incorrect.

• It is a rapid and energy-efficient method of multiplication, commonly found in unicellular organisms, bacteria, archaea, and many plants and fungi.

Additional Information

• Types of Asexual Reproduction:

• Binary Fission: A parent cell divides into two equal daughter cells. This is common in Amoeba and Bacteria.

• Budding: A small outgrowth or bud develops on the parent body, which eventually detaches to become a new individual. Examples include Yeast and Hydra.

• Fragmentation: The body of the parent breaks into distinct pieces, and each piece grows into a complete organism. This is seen in Spirogyra and Planaria.

• Spore Formation: Organisms produce microscopic reproductive units called spores that germinate under favorable conditions. Example: Rhizopus (Bread Mould).

• Vegetative Propagation:

• This is a form of asexual reproduction in plants where new plants are produced from vegetative parts like roots, stems, or leaves.

• Examples include Potato (tubers), Ginger (rhizomes), and Bryophyllum (leaf buds).

• Sexual Reproduction Comparison:

• In contrast, sexual reproduction involves two parents and the fusion of haploid gametes to form a diploid zygote, resulting in genetic variation which is crucial for evolution and adaptation.

Important Points

• Advantages: The population can be increased rapidly when conditions are favorable. Only one parent is needed, which is more time and energy efficient as it eliminates the need to find a mate.

• Disadvantages: It does not lead to genetic variation in a population. The species may only be suited to one habitat, and disease may affect all individuals in a population because they are all genetically identical.

• Parthenogenesis: This is a special form of asexual reproduction where an unfertilized egg develops into a new individual. This occurs in some invertebrates (like bees and wasps) and a few vertebrates (like certain lizards).

Q26. Answer: (b) 44/31

Shortcut Trick

Days for (A+B) = 32/5, (B+C) = 64/9, (A+C) = 16/3.

L.C.M of numerators (32, 64, 16) = 64 units (Total Work).

Efficiencies: (A+B) = 10, (B+C) = 9, (A+C) = 12. Sum = 31.

Efficiency of (A+B+C) = 31 ÷ 2 = 15.5 units/day.

Time = 64 ÷ 15.5 = 128 ÷ 31 = 4(4/31) days.

Therefore The correct answer is 4(4/31) days.

Alternate Method

Given: Time for (A+B) = 32/5 days, (B+C) = 64/9 days, (A+C) = 16/3 days.

Person	Days	Total Work	Efficiency
A + B	32/5	64	64 ÷ (32/5) = 10
B + C	64/9	64 ÷ (64/9) = 9	
A + C	16/3	64 ÷ (16/3) = 12	

=> Total efficiency of 2(A + B + C) = 10 + 9 + 12 = 31

=> Efficiency of (A + B + C) = 31/2

=> Time taken by A, B and C together = Total Work ÷ Efficiency

=> Time = 64 ÷ (31/2) = 128/31

=> Time = 4(4/31) days

Therefore The correct answer is 4(4/31) days.

Additional Information

Total Work using LCM

When time is given in fractions, Total Work is the LCM of the numerators of the time values.

Efficiency Formula

Efficiency = Total Work ÷ Time taken. It represents the work done in one unit of time.

Combined Efficiency

If pairs work together, summing their individual pair efficiencies gives twice the total efficiency of all individuals: 2(A+B+C).

Q27. Answer: (b) 12,500

Shortcut Trick

Let the Marked Price (MP) be 100%.

Successive discounts are 36% and 10%.

Effective Selling Price (SP) factor = (100 − 36)% × (100 − 10)% = 0.64 × 0.90 = 0.576.

Given SP = Rs. 7,200 => 0.576 × MP = 7,200.

MP = 7,200 ÷ 0.576 = 12,500.

Therefore The correct answer is Rs. 12,500.

Alternate Method

Given: Selling Price (SP) = Rs. 7,200, Discount1 (d1) = 36%, Discount2 (d2) = 10%.

Formula: SP = MP × (100 − d1)/100 × (100 − d2)/100

=> 7,200 = MP × (64/100) × (90/100)

=> 7,200 = MP × (16/25) × (9/10)

=> 7,200 = MP × (144/250)

=> MP = (7,200 × 250) ÷ 144

=> MP = 50 × 250 = 12,500.

Therefore The correct answer is Rs. 12,500.

Additional Information

Successive Discount Formula

For two successive discounts of a% and b%, the single equivalent discount is (a + b − ab/100)%.

Marked Price Definition

The Marked Price (MP) is the price printed on the label of an item, and discounts are always calculated on this value.

Q28. Answer: (a) 28

Shortcut Trick

Calculate total days: February (28 − 9 = 19) + March (31) + April (23) = 73 days.

Time in years = 73 ÷ 365 = 1/5 years.

Interest = (Principal × Rate × Time) ÷ 100

Interest = (2000 × 7 × 1/5) ÷ 100 = 20 × 7 ÷ 5 = 4 × 7 = Rs. 28.

Therefore The correct answer is Rs. 28.

Alternate Method

Given:

Principal (P) = Rs. 2,000

Rate (R) = 7% per annum

Time Period: 9 February 2023 to 23 April 2023

Formula Used:

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

Calculations:

=> Total days = (28 − 9) in Feb + 31 in Mar + 23 in Apr

=> Total days = 19 + 31 + 23 = 73 days

=> Time (T) in years = 73 ÷ 365 = 1/5 years

=> SI = (2000 × 7 × 1/5) ÷ 100

=> SI = (400 × 7) ÷ 100

=> SI = 2800 ÷ 100

=> SI = Rs. 28

Therefore The correct answer is Rs. 28.

Additional Information

Counting Days

While calculating the period for interest, the day on which money is borrowed is typically excluded, while the day on which money is returned is included.

Leap Year Check

For a non-leap year (like 2023), February has 28 days. For a leap year, February has 29 days. Always check if the year is divisible by 4.

Time Conversion

To convert days into years, divide by 365 (standard year). Common periods include 73 days (1/5 year), 146 days (2/5 year), and 219 days (3/5 year).

Q29. Answer: (d) 29 seconds

Shortcut Trick

For two objects moving towards each other, Relative Speed = Sum of individual speeds.

Total Distance = Sum of lengths of both trains = 496 + 490 = 986 m.

Relative Speed = 12 + 22 = 34 m/s.

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Time taken = Total Distance ÷ Relative Speed = 986 ÷ 34 = 29 sec.

Therefore The correct answer is 29 sec.

Alternate Method

Given:

Length of Train A (L1) = 496 m

Length of Train B (L2) = 490 m

Speed of Train A (S1) = 12 m/s

Speed of Train B (S2) = 22 m/s

Formula Used:

Time = (L1 + L2) ÷ (S1 + S2) [When moving in opposite directions]

Calculations:

=> Total distance to be covered = 496 + 490 = 986 m

=> Relative speed = Speed of A + Speed of B

=> Relative speed = 12 + 22 = 34 m/s

=> Time required = 986 ÷ 34

=> Time required = 29 sec

Therefore The correct answer is 29 sec.

Additional Information

Relative Speed Concept

When two objects move in the opposite direction, their relative speed is S1 + S2. When they move in the same direction, it is S1 − S2.

Unit Conversion

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

Crossing a Stationary Object

When a train crosses a pole or a man, the distance covered equals the length of the train itself.

Q30. Answer: (a) 36

Shortcut Trick

Convert ratio to integers by multiplying with LCM of denominators (9, 2, 5) = 90.

New ratio: (7/9 × 90) : (3/2 × 90) : (2/5 × 90) = 70 : 135 : 36.

Total units = 70 + 135 + 36 = 241 units.

Given 241 units = 241 bananas → 1 unit = 1 banana.

Third monkey share = 36 units = 36 bananas.

Therefore The correct answer is 36 bananas.

Alternate Method

Given: Total bananas = 241, Ratio = 7/9 : 3/2 : 2/5

=> Simplify the ratio: 7/9 : 3/2 : 2/5

=> Multiply each term by LCM(9, 2, 5) = 90

=> Ratio = (70/90) : (135/90) : (36/90)

=> Ratio in simplest form = 70 : 135 : 36

=> Sum of ratio terms = 70 + 135 + 36 = 241

=> Third monkey's share = (36 ÷ 241) × 241

=> Third monkey's share = 36

Therefore The correct answer is 36 bananas.

Additional Information

Ratio Simplification

To convert a fractional ratio a/b : c/d into an integer ratio, multiply both terms by the Lowest Common Multiple (LCM) of the denominators b and d.

Proportional Division

If a total quantity X is divided in the ratio a : b : c, then the share of the third part is calculated as [c / (a + b + c)] × X.

Compound Ratio

The compound ratio of (a : b) and (c : d) is (a × c) : (b × d), used when combining different proportional relationships.

Q31. Answer: (b) 10

Shortcut Trick

Combined efficiency of P + Q = 1/15 and P = 1/24.

Efficiency of Q = 1/15 − 1/24 = (8 − 5)/120 = 3/120 = 1/40.

Time for Q to fill one-fourth = (1/4) × 40 = 10 hours.

Therefore The correct answer is 10 hours.

Alternate Method

Given: P + Q = 15 hours, P = 24 hours.

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

Person	Days	Total Work	Efficiency
P + Q	15	120 units	8
P	24	5	

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

=> Efficiency of Q = 8 − 5 = 3 units/hour

=> One-fourth of cistern = 120 ÷ 4 = 30 units

=> Time taken by Q alone = 30 ÷ 3 = 10 hours

Therefore The correct answer is 10 hours.

Additional Information

Pipes & Cisterns Efficiency

If pipe A fills in x hours and pipe B fills in y hours, combined work per hour is 1/x + 1/y. If B is an outlet pipe, it is 1/x − 1/y.

Work & Wages

Wages are always distributed in the ratio of the efficiencies of the workers (or work done), not the time taken.

Alternate Day Work

For problems where workers work on alternate days, calculate the combined work in one cycle (e.g., 2 days) and divide total work by cycle work.

Q32. Answer: (b) 72 years

Shortcut Trick

Ratio 8 years ago = 4 : 3 | Ratio 8 years later = 5 : 4

Difference in ratio units = 5 − 4 = 1 unit and 4 − 3 = 1 unit

Time difference = 8 + 8 = 16 years

=> 1 unit = 16 years

Aman’s age 8 years ago = 4 units = 4 × 16 = 64 years

Aman’s present age = 64 + 8 = 72 years

Therefore The correct answer is 72 years.

Alternate Method

Let Aman’s age and Riya’s age 8 years ago be 4x and 3x respectively.

Present ages: Aman = 4x + 8, Riya = 3x + 8

Ages 8 years from now: Aman = 4x + 16, Riya = 3x + 16

According to the question:

=> (4x + 16) / (3x + 16) = 5 / 4

=> 4(4x + 16) = 5(3x + 16)

=> 16x + 64 = 15x + 80

=> x = 80 − 64 = 16

=> Aman’s present age = 4x + 8 = 4 × 16 + 8

=> 64 + 8 = 72 years

Therefore The correct answer is 72 years.

Additional Information

Ratio Difference Method

If the difference between ratio parts is same (5−4 = 1 and 4−3 = 1), then the difference corresponds directly to the years passed.

Age Difference Constancy

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The numerical difference between the ages of two persons remains constant throughout their lives, regardless of how many years pass.

Cross-Multiplication Method

Used for solving ratio changes: (Initial Ratio) → (Add Years) → (Final Ratio) to find the value of one unit quickly.

Q33. Answer: (a) 6 units

Shortcut Trick

The surface area of a sphere is given by $4\pi r^2$.

Equating the given value: $4\pi r^2 = 144\pi$

Dividing both sides by 4π: $r^2 = 36$

Taking the square root: r = 6 units.

Therefore The correct answer is 6 units.

Alternate Method

Given:

Surface area of the sphere = 144π sq units

Formula Used:

Surface Area of a Sphere = $4\pi r^2$, where r is the radius.

Calculations:

=> $4 \times \pi \times r^2 = 144 \times \pi$

=> $4r^2 = 144$

=> $r^2 = 144 \div 4$

=> $r^2 = 36$

=> $r = \sqrt{36}$

=> r = 6 units

Therefore The correct answer is 6 units.

Additional Information

Volume of a Sphere

The amount of space occupied by a sphere is given by the formula $V = (4/3)\pi r^3$.

Hemisphere Properties

For a hemisphere, the Curved Surface Area (CSA) is $2\pi r^2$ and the Total Surface Area (TSA) is $3\pi r^2$.

Diameter of a Sphere

The diameter is the longest distance through the sphere, calculated as D = 2 × r.

Q34. Answer: (d) 180

Shortcut Trick

Direct formula: LCM × HCF = Product of two numbers.

LCM × 12 = 2160

LCM = 2160 ÷ 12 = 180

Therefore The correct answer is 180.

Alternate Method

Given:

HCF = 12

Product of two numbers = 2160

Formula Used:

HCF × LCM = n1 × n2

Calculations:

=> 12 × LCM = 2160

=> LCM = 2160 ÷ 12

=> LCM = 180

Therefore The correct answer is 180.

Additional Information

HCF and LCM Relation

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For any two positive integers a and b, HCF(a, b) × LCM(a, b) = a × b.

HCF of Fractions

HCF of fractions = HCF of Numerators ÷ LCM of Denominators.

LCM of Fractions

LCM of fractions = LCM of Numerators ÷ HCF of Denominators.

Q35. Answer: (a) Rs. 2,534.40

Shortcut Trick

Convert Mass to grams: 3.168 kg = 3168 g.

Find Volume: 3168 ÷ 3.5 = 6336/7 cm^3.

Solve for Radius (r): (4/3) × (22/7) × r^3 = 6336/7 => r^3 = 216 => r = 6 cm.

Find Surface Area: 4 × (22/7) × 6^2 = 3168/7 cm^2.

Calculate Total Cost: (3168/7) × 5.6 = 3168 × 0.8 = Rs. 2534.40.

Therefore The correct answer is Rs. 2,534.40.

Alternate Method

Given:

Density of the spherical ball = 3.5 g/cm^3

Total Mass = 3.168 kg = 3168 g

Rate of painting = Rs. 5.6 per cm^2

Formula Used:

Volume (V) = Mass ÷ Density

Volume of sphere = (4/3) × π × r^3

Surface Area of sphere = 4 × π × r^2

Calculations:

=> Volume of the ball = 3168 ÷ 3.5 = 6336/7 cm^3

=> (4/3) × (22/7) × r^3 = 6336/7

=> (88/21) × r^3 = 6336/7

=> r^3 = (6336/7) × (21/88)

=> r^3 = (6336 ÷ 88) × (21 ÷ 7)

=> r^3 = 72 × 3 = 216

=> r = √216 = 6 cm

=> Surface Area of the ball = 4 × (22/7) × 6^2

=> Surface Area = (4 × 22 × 36) ÷ 7 = 3168/7 cm^2

=> Total Cost of Painting = Surface Area × Rate

=> Cost = (3168/7) × 5.6

=> Cost = 3168 × 0.8 = Rs. 2534.40

Therefore The correct answer is Rs. 2,534.40.

Additional Information

Volume and Surface Area of Sphere

For a sphere of radius r, the volume is (4/3)πr^3 and the total surface area is 4πr^2.

Density Formula

Density is mass per unit volume (ρ = Mass ÷ Volume). Ensure mass and density units are compatible (e.g., grams and g/cm^3).

Hemisphere Properties

For a solid hemisphere, Curved Surface Area = 2πr^2, Total Surface Area = 3πr^2, and Volume = (2/3)πr^3.

Q36. Answer: (d) 58

Shortcut Trick

Assume a base value (Assumed Mean) of 50.

Calculate deviations from 50: −3, +21, +32, +9, −28, −7, −4, +46, +6.

Sum of deviations = (−3 + 21 + 32 + 9 + 46 + 6) − (28 + 7 + 4) = 111 − 39 = 72.

Average deviation = 72 ÷ 9 = +8.

Actual Mean = Assumed Mean + Average deviation = 50 + 8 = 58.

Therefore The correct answer is 58.

Alternate Method

Given: Observations are 47, 71, 82, 59, 22, 43, 46, 96, and 56.

Formula Used: Arithmetic Mean = (Sum of all observations) ÷ (Total number of observations)

=> Total sum of observations = 47 + 71 + 82 + 59 + 22 + 43 + 46 + 96 + 56

=> Total sum = 522

=> Total number of observations (n) = 9

=> Arithmetic Mean = 522 ÷ 9

=> Arithmetic Mean = 58

Therefore The correct answer is 58.

Additional Information

Arithmetic Mean of First n Natural Numbers

The mean of the first n natural numbers is given by the formula: (n + 1) ÷ 2.

Empirical Relationship

The relationship between mean, median, and mode is: Mode = 3 × Median − 2 × Mean.

Effect of Change in Origin and Scale

If a constant k is added to or multiplied by each observation, the new mean becomes Mean + k or Mean × k respectively.

Q37. Answer: (d) 1,400

Shortcut Trick

If Savings = 60%, then Expenditure = 100% − 60% = 40%.

Given, 40% of Income = Rs. 560.

100% of Income = (560 ÷ 40) × 100 = 14 × 100 = Rs. 1400.

Therefore The correct answer is Rs. 1400.

Alternate Method

Given:

Savings percentage = 60%

Total Expenditure = Rs. 560

Formula Used:

Income = Expenditure + Savings

Expenditure % = 100% − Savings %

Calculations:

=> Expenditure % = 100% − 60% = 40%

=> Let Total Income be 'I'.

=> 40% of I = 560

=> (40 ÷ 100) × I = 560

=> I = (560 × 100) ÷ 40

=> I = 14 × 100

=> I = 1400

Therefore The correct answer is Rs. 1400.

Additional Information

Percentage Change in Income

If income increases by x% and expenditure increases by y%, the change in savings is calculated using the base equation: Income = Expenditure + Savings.

Base Change Property

When a value is expressed as a percentage of a total, the total can always be found by: (Value ÷ Percentage) × 100.

Q38. Answer: (d) 58.54 km/hr

Shortcut Trick

Average Speed = Total Distance ÷ Total Time

Total Distance = 70 + 80 + 50 = 200 km

Total Time = (70/60) + (80/80) + (50/40) = 7/6 + 1 + 5/4 = (14 + 12 + 15)/12 = 41/12 hours

Average Speed = 200 × (12/41) = 2400/41 ≈ 58.54 km/hr

Therefore The correct answer is 58.54 km/hr.

Alternate Method

Given:

Distance1 = 70 km, Speed1 = 60 km/hr

Distance2 = 80 km, Speed2 = 80 km/hr

Distance3 = 50 km, Speed3 = 40 km/hr

Formula Used:

Time = Distance ÷ Speed

Average Speed = Total Distance ÷ Total Time

Calculations:

=> Total Distance = 70 + 80 + 50 = 200 km

=> Time1 = 70/60 = 7/6 hours

=> Time2 = 80/80 = 1 hour

=> Time3 = 50/40 = 5/4 hours

=> Total Time = 7/6 + 1 + 5/4

=> Total Time = (14 + 12 + 15) / 12 = 41/12 hours

=> Average Speed = 200 ÷ (41/12) = (200 × 12) / 41

=> Average Speed = 2400 / 41 ≈ 58.5365...

Therefore The correct answer is 58.54 km/hr.

Additional Information

Average Speed for Equal Distances

If a car covers two equal distances at speeds u and v, the average speed is given by (2 × u × v) ÷ (u + v).

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.

Relative Speed

When two objects move in the same direction, relative speed is the difference of their speeds. In opposite directions, it is the sum of their speeds.

Q39. Answer: (a) Rs. 720

Shortcut Trick

Ratio of Cost Price (CP) to Marked Price (MP) is CP : MP = (100 − Discount%) : (100 + Profit%).

CP : MP = (100 − 10) : (100 + 10) = 90 : 110 = 9 : 11.

Given 11 units = &8377;880 => 1 unit = &8377;80.

Therefore, 9 units = 9 × 80 = &8377;720.

Therefore The correct answer is &8377;720.

Alternate Method

Given → Marked Price (MP) = &8377;880, Discount = 10%, Gain = 10%.

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

=> Selling Price (SP) = 880 × (100 − 10) ÷ 100 = 880 × 0.9 = &8377;792.

=> Cost Price (CP) = 792 × 100 ÷ (100 + 10) = 792 × 100 ÷ 110.

=> CP = 72 × 10 = &8377;720.

Therefore The correct answer is &8377;720.

Additional Information

Marked Price and Discount

The Marked Price (MP) is the price printed on the article. Discount is always calculated on the MP to arrive at the Selling Price (SP).

CP-MP Relation Formula

The direct relation between CP and MP is given by CP / MP = (100 − D%) / (100 + P%), where D is discount and P is profit percentage.

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Q40. Answer: (a) 10

Shortcut Trick

Prime numbers (60 to 70): 61, 67 → Average = 128 ÷ 2 = 64

Multiples of 4 (50 to 58): 52, 56 → Average = 108 ÷ 2 = 54

Difference = 64 − 54 = 10

Therefore The correct answer is 10.

Alternate Method

Given:

Range 1: Prime numbers between 60 and 70.

Range 2: Multiples of 4 between 50 and 58.

Calculations:

=> Prime numbers between 60 and 70 = {61, 67}

=> Average of primes = (61 + 67) ÷ 2 = 128 ÷ 2 = 64

=> Multiples of 4 between 50 and 58 = {52, 56}

=> Average of multiples = (52 + 56) ÷ 2 = 108 ÷ 2 = 54

=> Required Difference = 64 − 54 = 10

Therefore The correct answer is 10.

Additional Information

Prime Numbers between 1 and 100

There are 25 prime numbers between 1 and 100. These are numbers having exactly two factors: 1 and the number itself.

Average of an Arithmetic Progression

The average of any series in arithmetic progression (like multiples of a number) is simply (First Term + Last Term) ÷ 2.

Composite Numbers

Numbers with more than two factors are composite numbers. Note that 1 is neither prime nor composite.

Q41. Answer: (a) 64

Shortcut Trick

Split inside root: $\sqrt{(a \times b)} = \sqrt{a} \times \sqrt{b}$

$= \sqrt{144} \times \sqrt{49} + \sqrt{64} \times \sqrt{25} - \sqrt{100} \times \sqrt{36}$

$= 12 \times 7 + 8 \times 5 - 10 \times 6$

$= 84 + 40 - 60 = 64$

Therefore Answer = 64

Alternate Method

Given:

$\sqrt{(144 \times 49)} + \sqrt{(64 \times 25)} - \sqrt{(100 \times 36)}$

Concept Used:

$\sqrt{(a \times b)} = \sqrt{a} \times \sqrt{b}$

Calculation:

=> $\sqrt{(144 \times 49)} = \sqrt{144} \times \sqrt{49} = 12 \times 7 = 84$

=> $\sqrt{(64 \times 25)} = \sqrt{64} \times \sqrt{25} = 8 \times 5 = 40$

=> $\sqrt{(100 \times 36)} = \sqrt{100} \times \sqrt{36} = 10 \times 6 = 60$

=> Expression = 84 + 40 − 60

=> = 124 − 60

=> = 64

Therefore The correct answer is 64.

Additional Information

Square Root Property

$\sqrt{(a \times b)} = \sqrt{a} \times \sqrt{b}$

Perfect Squares

$144 = 12^2$, $49 = 7^2$, $64 = 8^2$, $25 = 5^2$

Simplification Tip

Break numbers into perfect squares for quick solving

Common Pattern

Use factorization inside root to simplify faster

Q42. Answer: (a) IV

Shortcut Trick

To get the maximum selling price, the total discount percentage must be the minimum.

For two successive discounts a% and b%, effective discount = a + b − (a × b ÷ 100).

Scheme I: 14 + 14 − 1.96 = 26.04% | Scheme II: 22 + 29 − 6.38 = 44.62%.

Scheme III: 22 + 7 − 1.54 = 27.46% | Scheme IV: 14 + 6 − 0.84 = 19.16%.

Since 19.16% is the lowest discount, Scheme IV results in the highest selling price.

Therefore The correct answer is IV.

Alternate Method

Given → Four different successive discount schemes.

Formulas: Effective Discount = a + b − (ab ÷ 100) | SP = MP × (100 − Discount%) ÷ 100.

=> Calculate Effective Discount (ED) for each scheme:

=> Scheme I: 14 + 14 − (14 × 14 ÷ 100) = 28 − 1.96 = 26.04%

=> Scheme II: 22 + 29 − (22 × 29 ÷ 100) = 51 − 6.38 = 44.62%

=> Scheme III: 22 + 7 − (22 × 7 ÷ 100) = 29 − 1.54 = 27.46%

=> Scheme IV: 14 + 6 − (14 × 6 ÷ 100) = 20 − 0.84 = 19.16%

=> Comparing all, Scheme IV has the minimum discount of 19.16%.

Therefore The correct answer is IV.

Additional Information

Marked Price & Selling Price

The price printed on an article is the Marked Price (MP). Selling Price is obtained after subtracting the discount from the MP.

Successive Discount Concept

When two or more discounts are applied one after another, they are called Successive Discounts. The order of applying these discounts does not change the final selling price.

Q43. Answer: (a) 27

Shortcut Trick

For mean proportion between x and b to be M, the relationship is $x \times b = M^2$.

Given M = 63 and b = 147.

$x = 63^2 \div 147 = (63 \times 63) \div 147$.

$x = (9 \times 7 \times 63) \div (21 \times 7)$ => $x = (9 \times 63) \div 21 = 9 \times 3 = 27$.

Therefore The correct answer is 27.

Alternate Method

Given: Mean proportion = 63, First number = x, Second number = 147.

Formula Used: Mean Proportion = √(a × b)

=> 63 = √(x × 147)

Squaring both sides:

=> $63^2 = x \times 147$

=> 3969 = x × 147

=> x = 3969 ÷ 147

=> x = 27

Therefore The correct answer is 27.

Additional Information

Third Proportion

The third proportion of two numbers a and b is c, such that a : b :: b : c, given by $c = b^2/a$.

Fourth Proportion

The fourth proportion of three numbers a, b, and c is d, such that a : b :: c : d, given by d = (b × c)/a.

Compounded Ratio

The compounded ratio of (a : b) and (c : d) is (a × c) : (b × d).

Q44. Answer: (c) 96°

Shortcut Trick

In right-angled triangle BDC, angle C = 90° − angle DBC = 90° − 21° = 69°.

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

By the Exterior Angle Theorem, angle AEB = angle CAE + angle ACE.

angle AEB = 27° + 69° = 96°.

Therefore The correct answer is 96°.

Alternate Method

Given: BD perpendicular to AC, angle DBC = 21°, angle CAE = 27°.

Formula Used: Angle Sum Property of a triangle (sum = 180°) and Linear Pair property.

In ΔBDC:

=> angle BDC = 90° (Since BD perpendicular to AC)

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

=> angle BCD = 180° − (90° + 21°) = 69

Q45. Answer: (a) 40

Shortcut Trick

Let the number be 10 (LCM of denominators 5 and 2).

Three-fifths of 10 = 6 units.

One-half of 10 = 5 units.

Difference (6 − 5) = 1 unit → 4.

Original number (10 units) = 10 × 4 = 40.

Therefore The correct answer is 40.

Alternate Method

Let the unknown number be x.

As per the problem statement:

=> (3/5) × x = (1/2) × x + 4

=> (3x/5) − (x/2) = 4

=> (6x − 5x) / 10 = 4

=> x / 10 = 4

=> x = 40

Therefore The correct answer is 40.

Additional Information

Fractions to Percentage

Converting fractions to percentages often simplifies logic: 3/5 is 60% and 1/2 is 50%. The 10% difference equals 4, so 100% equals 40.

Linear Equations

A linear equation in one variable follows the form ax + b = 0. Solving involves isolating the variable x on one side.

LCM Method for Fractions

When dealing with multiple fractions, assuming the number as the LCM of the denominators eliminates fractional calculations and speeds up solving.

Q46. Answer: (d) 50,000

Shortcut Trick

Let the total voters be 100%.

Voters who cast their votes = 60%.

Candidate B received 25% (100% − 75%) of the casted votes.

Fraction of B's votes = 60% × 25% = 0.60 × 0.25 = 0.15 (or 15%).

15% → 7500 => 1% → 500 => 100% → 50,000.

Therefore The correct answer is 50,000 voters.

Alternate Method

Given:

Voter turnout = 60% of total registered voters.

Votes for Candidate A = 75% of polled votes.
Votes for Candidate B = 7500.
Calculations:
Let the total number of registered voters be x.
=> Total votes cast = 60% of x = 0.6x
=> Percentage of votes for Candidate B = 100% − 75% = 25%
=> Votes for B = 25% of (0.6x)
=> 7500 = (25/100) × (60/100) × x
=> 7500 = (1/4) × (3/5) × x
=> 7500 = (3/20) × x
=> x = (7500 × 20) ÷ 3
=> x = 2500 × 20
=> x = 50,000
Therefore The correct answer is 50,000 voters.
Additional Information
Percentage Breakdown
In election problems, always distinguish between Total Voters, Votes Cast, and Valid Votes. Use the tree method for clarity.
Majority Rule
The Majority or Winning Margin is the difference between the votes of the winner and the runner-up: Margin = |Votes_A − Votes_B|.
Invalid Votes
If invalid votes are mentioned, subtract them from the total votes cast before distributing percentages to candidates.

Q47. Answer: (b) Rs. 1,323

Shortcut Trick
Total Salary is always considered as 100%.
If Savings = 30%, then Expenditure = 100% − 30% = 70%.
Expenditure = 70% of Rs. 1,890 = 0.7 × 1890.
Expenditure = Rs. 1,323.
Therefore The correct answer is Rs. 1,323.
Alternate Method
Given:
Total Salary = Rs. 1,890
Savings percentage = 30%
Formula Used:
Expenditure = Total Salary − Savings
Calculations:
=> Amount of Savings = 30% of Rs. 1,890
=> Savings = (30 ÷ 100) × 1890
=> Savings = 0.3 × 1890 = Rs. 567
=> Expenditure = Total Salary − Savings
=> Expenditure = Rs. 1,890 − Rs. 567
=> Expenditure = Rs. 1,323
Therefore The correct answer is Rs. 1,323.
Additional Information
Percentage Change
Percentage increase or decrease is calculated as: (Change ÷ Original Value) × 100.
Income and Expenditure Relation
Income = Expenditure + Savings. If any two are known, the third can be found by simple subtraction.
Successive Percentage
If a value is changed by a% and then by b%, the net effective change is (a + b + ab/100)%.

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Q48. Answer: (d) 0

Shortcut Trick

Check the divisibility of numbers between 469 and 474.

Numbers to check: 470, 471, 472, 473.

471: 4 + 7 + 1 = 12 (divisible by 3). 473: 473 ÷ 11 = 43 (divisible by 11).

All numbers are composite.

Therefore The correct answer is 0.

Alternate Method

Given: Range of numbers between 469 and 474.

Formula Used: A prime number is a natural number greater than 1 that has no positive divisors other than 1 and itself.

=> 470: Ends in 0, so divisible by 2, 5, 10. (Composite)

=> 471: Sum of digits = 4 + 7 + 1 = 12. 12 is divisible by 3, so 471 is divisible by 3. (Composite)

=> 472: Even number, divisible by 2. (Composite)

=> 473: Sum of alternate digits = (4 + 3) − 7 = 0. Divisible by 11. (Composite)

=> Total prime numbers = 0.

Therefore The correct answer is 0.

Additional Information

Divisibility Rule of 3

A number is divisible by 3 if the sum of its digits is divisible by 3.

Divisibility Rule of 11

Subtract the sum of digits in even positions from the sum of digits in odd positions. If the result is 0 or divisible by 11, the number is divisible by 11.

Prime Numbers

To check if N is prime, test divisibility by primes up to √N. For 473, √473 ≈ 21.7. Primes to check: 2, 3, 5, 7, 11, 13, 17, 19.

Q49. Answer: (a) (2 cos A)/3

Shortcut Trick

Substitute a standard angle A = 45° to verify the expression value.

=> Numerator: $2\sqrt{(2-1)} \times \sqrt{(1-1/2)} = 2 \times 1 \times 1/\sqrt{2} = \sqrt{2}$

=> Denominator: $\sqrt{(1+1)} \times 3\sqrt{(1-1/2)} = \sqrt{2} \times 3 \times 1/\sqrt{2} = 3$

=> Expression = $\sqrt{2} / 3$

Checking options for A = 45°: (1) $(2 \times 1/\sqrt{2})/3 = \sqrt{2} / 3$. Matches perfectly.

Therefore The correct answer is (2 cos A)/3.

Alternate Method

Given: $(2\sqrt{(\csc^2A-1)} \times \sqrt{(1-\cos^2A)})/(\sqrt{(1+\tan^2A)} \times 3\sqrt{(1-\sin^2A)})$

Formula Used:

1. $\sqrt{(\csc^2A - 1)} = \sqrt{\cot^2A} = \cot A$
2. $\sqrt{(1 - \cos^2A)} = \sqrt{\sin^2A} = \sin A$
3. $\sqrt{(1 + \tan^2A)} = \sqrt{\sec^2A} = \sec A$
4. $\sqrt{(1 - \sin^2A)} = \sqrt{\cos^2A} = \cos A$

Calculations:

=> Numerator = 2 × cot A × sin A

=> Numerator = 2 × (cos A / sin A) × sin A = 2 cos A

=> Denominator = sec A × 3 × cos A

=> Denominator = (1 / cos A) × 3 × cos A = 3

=> Final Expression = (2 cos A) / 3

Therefore The correct answer is (2 cos A)/3.

Additional Information

Pythagorean Identities

$\sin^2\theta + \cos^2\theta = 1$ | $1 + \tan^2\theta = \sec^2\theta$ | $1 + \cot^2\theta = \csc^2\theta$.

Reciprocal Relations

$\sin\theta = 1/\csc\theta$ | $\cos\theta = 1/\sec\theta$ | $\tan\theta = 1/\cot\theta$.

Quotient Relations

tan θ = sin θ / cos θ | cot θ = cos θ / sin θ.

Q50. Answer: (b) 34

Shortcut Trick

If a + 1/a = k, then the direct formula for $a^2 + 1/a^2$ is $k^2 - 2$.

Given: k = 6.

Calculation: $6^2 - 2 = 36 - 2 = 34$.

Therefore The correct answer is 34.

Alternate Method

Given:

a + 1/a = 6

Formula Used:

The Algebraic Identity for the square of a binomial: $(x + y)^2 = x^2 + y^2 + 2xy$

Calculation:

=> Taking the square on both sides of the given equation:

=> $(a + 1/a)^2 = 6^2$

=> $a^2 + (1/a)^2 + 2 \times a \times (1/a) = 36$

=> $a^2 + 1/a^2 + 2 = 36$

=> $a^2 + 1/a^2 = 36 - 2$

=> $a^2 + 1/a^2 = 34$

Therefore The correct answer is 34.

Additional Information

Square of a Difference

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

Cubic Identities

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

Higher Power Identities

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

Q51. Answer: (d) 520

The logic followed here is:

thus, "520" will replace the question mark in the given series.

Hence, the correct option is "Option 4".

Q52. Answer: (d) One

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

Now,

Even digits, which are immediately preceded by an even digit and also immediately followed by an even digit.

So, needed pattern is: Even - Even - Even

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

So, total valid even digit pattern = 1

Hence, the correct answer is Option 4.

Q53. Answer: (a) 8

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

Now,

Odd numbers, which are immediately preceded by an odd number and also immediately followed by an odd number.

So, needed pattern is: Odd - Odd - Odd

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

1. 4 9 4 8 [3 3 3] 1 4 7 8 7 1 7 2 9 1 3 5 1 5 9 6 4 8 4 6

2. 4 9 4 8 3 [3 3 1] 4 7 8 7 1 7 2 9 1 3 5 1 5 9 6 4 8 4 6

3. 4 9 4 8 3 3 3 1 4 7 8 [7 1 7] 2 9 1 3 5 1 5 9 6 4 8 4 6

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4. 4 9 4 8 3 3 3 1 4 7 8 7 1 7 2 [9 1 3] 5 1 5 9 6 4 8 4 6
5. 4 9 4 8 3 3 3 1 4 7 8 7 1 7 2 9 [1 3 5] 1 5 9 6 4 8 4 6
6. 4 9 4 8 3 3 3 1 4 7 8 7 1 7 2 9 1 [3 5 1] 5 9 6 4 8 4 6
7. 4 9 4 8 3 3 3 1 4 7 8 7 1 7 2 9 1 3 [5 1 5] 9 6 4 8 4 6
8. 4 9 4 8 3 3 3 1 4 7 8 7 1 7 2 9 1 3 5 [1 5 9] 6 4 8 4 6

So, total valid odd number patterns = 8

Hence, the correct answer is Option 1.

Q54. Answer: (d) 28

BODMAS Table:

Given equation: 6 ÷ 3 + 16 × 4 − 9 = ? + 5

Now, replacing the symbols as:

Symbol	•	−	×	÷
Replaced by	−	•	÷	×

=> 6 × 3 − 16 ÷ 4 + 9 = ? − 5

=> 18 − 16 ÷ 4 + 9 = ? − 5

=> 18 − 4 + 9 = ? − 5

=> 14 + 9 = ? − 5

=> 23 = ? − 5

=> ? = 23 + 5

=> 28

Hence, the correct answer is Option 4.

Q55. Answer: (c) Two

Given: Six friends — P, Q, R, S, U and V are sitting around a circular table facing the centre.

P is the immediate neighbour of both Q and R.

R is sitting to the immediate left of U.

V is sitting second to the left of P.

So, only Two persons sits between P and S when counted from the right of S.

Hence, the correct answer is "Option 3".

Q56. Answer: (a) Only conclusion (II) follows.

Given Statements:

Some peas are dogs.

No dog is a cub.

The least possible Venn diagram for the given statement is:

Conclusions:

I. Some peas are cubs - Does not follow (No definite relationship is given between peas and cubs. They may or may not overlap).

II. Some dogs are peas - Follows (Since some peas are dogs, it definitely implies that some dogs are peas).

So, only conclusion II follows.

Hence, the correct answer is Option 1.

Q57. Answer: (c) 4

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

Now,

Odd numbers which are immediately preceded by an odd number and immediately followed by an even number.

So, needed pattern is: Odd - Odd - Even

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

So, total valid patterns = 4

Hence, the correct answer is Option 3.

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Q58. Answer: (a) st

The logic followed here is to compare the given sentences and identify the common word and its corresponding common code.

Given:

speak the truth → pc rd st

truth always wins → mo st kl

So, truth → st

Hence, the correct answer is Option 1.

Q59. Answer: (a) Three

Given: Seven boxes W, T, D, B, P, E and S are kept one over the other but not necessarily in the same order.

Only three boxes are kept above B.

Only one box is kept between P and B.

Only three boxes are kept between P and T.

T is kept at some place above B.

D is kept immediately below T.

W is not kept immediately above or below P.

E is kept at one of the places above S.

Position	Box
1	W
2	T
3	D
4	B
5	E
6	P
7	S

Now, Boxes between S (7) and D (3): B (4), E (5), P (6) → 3 boxes

Hence, the correct answer is Option 1.

Q60. Answer: (a) 25 km to the west

The logic followed here is:

Given:

Prashant starts from Point A and drives 32 km South

He turns right → 29 km West

He turns right → 43 km North

He turns right → 54 km East

He turns right → 11 km South

So, To reach Point A again, he must travel 25 km West.

Hence, the correct answer is Option 1.

Q61. Answer: (c) L

Given: Five people L, M, N, O and P are sitting in a row facing north.

N is sitting at third position from the extreme right end of the row.

M is not an immediate neighbour of N.

P is sitting to the immediate left of N.

P is sitting immediate right to O.

So, L is sitting between N and M.

Hence, the correct answer is "Option 3".

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Q62. Answer: (a) 128

The logic followed here is:

thus, "128" will replace the question mark in the given series.

Hence, the correct option is "Option 1".

Q63. Answer: (c) 12

Given number: 78352416

Logic: Arrange the digits in descending order.

Original digits: 7 8 3 5 2 4 1 6

Descending order:

Position	1	2	3	4	5	6	7	8
Digit	8	7	6	5	4	3	2	1

Now,Third from the left = 6

Second from the right = 2

Required Product = 6 × 2 = 12

Hence, the correct answer is Option 3.

Q64. Answer: (b) One

Given: A, B, C, D, E and F are sitting around a circular table facing the centre.

B sits third to the right of F.

D sits second to the left of C.

A sits third to the right of C.

E sits to the immediate left of B.

So, only one person sits between E and A when counted from the left of A.

Hence, the correct answer is "Option 2".

Q65. Answer: (c) NPV

The logic followed here is based on the alphabetical position pattern:

Option 1: TVZ

Option 2: JLP

Option 3: NPV

Option 4: LNR

Thus, Options 1, 2, and 4 follow a consistent “+2, +4” pattern, while Option 3 deviates from this pattern.

Hence, the odd one out is Option 3.

Q66. Answer: (c) Brother’s son

Family Chart:

Decoding the Symbols:

Symbol	•	−	×	÷
Meaning	Son	Father	Brother	Daughter

Given: P + Q × S ÷ T − R

It means: P is the son of Q, Q is the brother of S, S is the daughter of T, and T is the father of R.

So, P is the nephew (brother’s son) of R.

Hence, the correct answer is Option 3.

Q67. Answer: (c) 3 km to the west

The logic followed here is:

Given:

Vishal starts from Point A and drives 10 km South

He takes a right turn → 4 km West

He takes a right turn → 12 km North

He takes a right turn → 7 km East
He takes a final right turn → 2 km South
So, To reach Point A again, he must travel 3 km West.
Hence, the correct answer is Option 3.

Q68. Answer: (b) QFP

The logic followed here is:
So, the missing term = QFP
Hence, the correct answer is Option 2

Q69. Answer: (b) JLP

The logic followed here is based on the alphabetical position pattern:
Option 1: DFA
Option 2: JLP
Option 3: FHC
Option 4: MOJ
Thus, Options 1, 3, and 4 follow a consistent “+2 then -5” pattern, while Option 2 follows a different “+2 then +4” pattern.
Hence, the odd one out is Option 2.

Q70. Answer: (a) 96

The logic followed here is:
thus, "96" will replace the question mark in the given series.
Hence, the correct option is "Option 1".

Q71. Answer: (a) YZX 24

The logic followed here is:
So, the missing term = YZX 24
Hence, the correct answer is Option 1.

Q72. Answer: (d) WHB : AMF

The logic followed here is:
For, GNL : KSP
For, OXT : SCX
Now, checking the options:
Option 1) QLY : VPB
Option 2) NLV : SPA
Option 3) VHD : ZKH
Option 4) WHB : AMF
Hence, the correct answer is Option 4.

Q73. Answer: (c) UFL : ZKQ

The logic followed here is:
For, ADE → FIJ
For, MDG → RIL
Now, checking the options:
Option 1) VTE : ODR
Option 2) BTS : YDR
Option 3) UFL : ZKQ
Option 4) ZOT : GRS
Hence, the correct answer is Option 3.

Q74. Answer: (a) (3, 7, 22)

The logic followed here is:
Logic: First Number × Second Number + 1 = Third Number

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For, (6, 3, 19)
=> (6 × 3) + 1 = 18 + 1 = 19
For, (4, 3, 13)
=> (4 × 3) + 1 = 12 + 1 = 13
Now, checking the options:
Option 1) (3, 7, 22)
=> (3 × 7) + 1 = 21 + 1 = 22
Option 2) (5, 4, 16)
=> (5 × 4) + 1 = 20 + 1 = 21 (not 16)
Option 3) (8, 3, 26)
=> (8 × 3) + 1 = 24 + 1 = 25 (not 26)
Option 4) (5, 8, 40)
=> (5 × 8) + 1 = 40 + 1 = 41 (not 40)
Hence, the correct answer is Option 1.

Q75. Answer: (b) FBAB

The logic followed here is:
For, YUTU → XTST
For, FBAB → EAZA
Now, applying the same logic for GCBC
So, GCBC → FBAB
Hence, the correct answer is "Option 2".

Q76. Answer: (a) Both conclusions (I) and (II) follow.

Given Statements:
All trees are boats.
No pens are boats.
All combs are trees.
The least possible Venn diagram for the given statement is:
Conclusions:
I. All combs are boats - Follows (Since all combs are trees and all trees are boats, all combs must be boats).
II. No pens are combs - Follows (No pens are boats, and all combs are inside boats. Therefore, pens cannot be combs).
So, both conclusion I and conclusion II follow.
Hence, the correct answer is Option 1.

Q77. Answer: (c) tp

The logic followed here is to compare the given sentences and identify the common word and its corresponding common code.
Given:
life offers hope → sc tp gb
hope shapes future → hk mp tp
So, hope → tp
Hence, the correct answer is Option 3.

Q78. Answer: (d) 2

Given: Seven boxes A, B, C, D, E, F, and G are kept one over the other but not necessarily in the same order.
Only F is kept above G.
No box is kept below E.
Only two boxes are kept between A and E.
C is kept below D but above B.

Position	Box
1 (Top)	F
2	G

3	D
4	A
5	C
6	B
7 (Bottom)	E

Now, Boxes above D (Position 3) are F and G → 2 boxes

Hence, the correct answer is Option 4.

Q79. Answer: (d) 1

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

Now,

Odd digits which are immediately preceded by an odd digit and immediately followed by a perfect square (1, 4, 9).

So, needed pattern is: Odd - Odd - (Perfect Square: 1 or 4 or 9)

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

So, total valid occurrences = 1

Hence, the correct answer is Option 4.

Q80. Answer: (c) 3

Given number: 2543769

Logic: Even digits are increased by 1 (Digit + 1) and odd digits are decreased by 2 (Digit − 2)

Original Number: 2 5 4 3 7 6 9

Digit	Type	Operation	New Digit
2	Even	2 + 1	3
5	Odd	5 − 2	3
4	Even	4 + 1	5
3	Odd	3 − 2	1
7	Odd	7 − 2	5
6	Even	6 + 1	7
9	Odd	9 − 2	7

New number formed: 3351577

Now, digit second from the left = 3

Hence, the correct answer is Option 3.

Q81. Answer: (d) Sachin Tendulkar

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

Q82. Answer: (c) Operation Sindoor

The correct answer is Operation Sindoor.

Key Points

• Operation Sindoor was a major counter-terrorism initiative launched in May 2025 in response to a sudden terror attack in the Pahalgam region of Jammu and Kashmir.

• The operation was conducted as a joint tactical exercise involving the Indian Army, the Special Operations Group (SOG) of the state police, and the Central Reserve Police Force (CRPF) to neutralize high-value targets.

• The primary objective of Operation Sindoor was to secure the Lidder Valley and clear the surrounding forest areas of Anantnag district from infiltrating militants who posed a threat to local peace.

• Security forces utilized cutting-edge technology, including thermal imaging drones and night-vision equipment, to track movements across the difficult mountainous terrain of Pahalgam.

• This operation was crucial for maintaining the safety of the Amarnath Yatra pilgrimage route, which passes through Pahalgam and attracts thousands of devotees annually.

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Additional Information

• Geographical Context of Pahalgam:

• Pahalgam is a world-famous hill station located in the Anantnag district of Jammu and Kashmir at an altitude of approximately 2,740 meters.

• It serves as the starting point for the traditional route of the Amarnath Yatra and is located at the confluence of the streams flowing from Sheshnag Lake and the Lidder River.

• Other Notable Military Operations:

• Operation Vijay: This was the successful mission conducted by the Indian Armed Forces in 1999 to recapture the heights in the Kargil sector from Pakistani infiltrators.

• Operation All-Out: A multi-agency strategy launched in 2017 to flush out militants from various districts of Kashmir, aimed at restoring long-term stability.

• Operation Sadbhavana: Also known as Operation Goodwill, this is an initiative by the Indian Army in Jammu and Kashmir to address the needs of the local population through education, infrastructure, and healthcare.

• Strategic Significance:

• The security grid in Jammu and Kashmir is continuously monitored by the Unified Command, which ensures coordination between the Army, Paramilitary forces, and Intelligence agencies.

• Following the Jammu and Kashmir Reorganisation Act, 2019, there has been an increased focus on intelligence-led operations to prevent cross-border infiltration.

Important Points

• The success of Operation Sindoor in 2025 demonstrated the enhanced Electronic Intelligence (ELINT) capabilities of the Indian Army in high-altitude combat.

• The timing of the operation in May was critical as it coincided with the preparation phase for the summer tourism season, which is the backbone of the local economy in Pahalgam.

• The Rashtriya Rifles (RR), the specialized counter-insurgency force of the Indian Army, played a leading role in the ground-level execution of the operation.

Q83. Answer: (c) Jyotiraditya M Scindia

The correct answer is Jyotiraditya M Scindia.

Key Points

• Union Minister Jyotiraditya M Scindia unveiled the new logo of Bharat Sanchar Nigam Limited (BSNL) on October 22, 2024, in New Delhi.

• The new logo, featuring the vibrant colors of the Indian National Flag (Saffron, White, and Green), signifies BSNL's renewed commitment to connecting every corner of the country with trust and strength.

• Alongside the logo, the Minister introduced seven new citizen-centric services designed to make BSNL a more competitive and consumer-friendly telecom provider.

• The launch event highlighted BSNL's transition from a recovery phase to a growth phase, focusing on high-speed internet and secure communication for the common man.

• The Minister emphasized that the new identity reflects the vision of an "Atmanirbhar Bharat" (Self-reliant India) in the telecommunications sector.

Additional Information

• BSNL (Bharat Sanchar Nigam Limited): It is a Central Public Sector Undertaking headquartered in New Delhi, incorporated on October 1, 2000. It provides a wide range of telecom services across India, except in Delhi and Mumbai (served by MTNL).

• Ministerial Portfolios: Jyotiraditya M Scindia currently serves as the Union Minister of Communications and the Minister of Rural Development. He took charge of these portfolios in June 2024.

• Other Options:

• Amit Shah serves as the Union Minister of Home Affairs and the first Minister of Cooperation.

• Giriraj Singh holds the portfolio of the Union Minister of Textiles.

• Jitin Prasada is the Minister of State in the Ministry of Commerce and Industry and the Ministry of Electronics and Information Technology.

• Technological Shift: BSNL is working on deploying a 4G network using indigenous technology developed by a consortium led by TCS, C-DOT, and Tejas Networks, which is designed to be seamlessly upgradable to 5G.

Important Points

• The Seven New Services: The services launched include a Spam-free network (using AI to block malicious SMS), National Wi-Fi Roaming for FTTH users, and BSNL IFTTV (Internet Fiber TV).

• Direct-to-Cell Technology: This service was introduced to provide connectivity in remote areas by bypassing traditional mobile towers and connecting devices directly via satellite.

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• Any-time SIM (ATM): BSNL launched automated kiosks that allow users to buy, replace, or port SIM cards 24/7 using QR-enabled payments and KYC integration.

• Public Protection & Disaster Relief (PPDR): A specialized communication solution designed for emergency services and disaster management agencies to ensure uninterrupted connectivity during crises.

Q84. Answer: (b) To improve the state's emergency readiness and response systems

The correct answer is To improve the state's emergency readiness and response systems.

Key Points

• Operation Shield is a large-scale civil defence mock drill designed to evaluate the preparedness and efficacy of state administrative and emergency services.

• Conducted in May 2025, the exercise aims to refine the Standard Operating Procedures (SOPs) followed by various departments during high-stress crisis situations.

• The primary objective of this operation is to improve the state's emergency readiness and response systems by testing the inter-departmental coordination between the Police, Fire Department, Health Services, and Disaster Management units. Hence, the correct answer is option 2.

• During the drill, personnel practice rapid deployment and rescue operations in simulated environments to identify operational bottlenecks and improve the reaction time of first responders.

• The initiative also focuses on the training of civil defence volunteers, ensuring that local communities have a structured first-aid and evacuation support system during real-time disasters.

Additional Information

• Civil Defence in India:

• Civil Defence is primarily governed by the Civil Defence Act, 1968, which was enacted to protect persons and property against hostile attacks.

• In recent years, its scope has expanded to include disaster management and community resilience during natural and man-made calamities.

• National Disaster Management Authority (NDMA):

• The NDMA is the apex statutory body for disaster management in India, headed by the Prime Minister.

• It was established under the Disaster Management Act, 2005, and is responsible for framing national policies and guidelines for disaster mitigation.

• Mock Drills and Simulations:

• Mock drills are essential tools used by state and central agencies to simulate hazardous events like earthquakes, chemical leaks, or terrorist threats.

• These exercises help in verifying the functionality of emergency equipment and the clarity of communication channels used by the rescue teams.

• State Disaster Response Force (SDRF):

• Modeled after the National Disaster Response Force (NDRF), the SDRF is the specialized force at the state level dedicated to responding to disaster situations.

• It plays a vital role in Operation Shield by providing the technical expertise needed for specialized search and rescue tasks.

Important Points

• Significance of Operation Shield: Such drills are crucial for urban planning and public safety, especially in densely populated industrial hubs or vulnerable geographical zones.

• Community Involvement: A major component of these drills is public awareness, teaching citizens how to use emergency helplines and basic survival techniques.

• Technological Integration: In 2025, these drills often incorporate advanced technology such as drones for aerial surveillance, AI-based casualty estimation, and real-time tracking of emergency vehicles.

Q85. Answer: (b) Christian Davenport

The correct answer is Christian Davenport.

Key Points

• The book titled “Rocket Dreams: Musk, Bezos, and the Inside Story of the New, Trillion-Dollar Space Race” is authored by Christian Davenport, a prominent journalist and author specialized in the space industry.

• Published in early 2025, the book serves as a sequel or an extensive follow-up to his previous reporting on the evolution of private space flight and the commercialization of the cosmos.

• The narrative explores the intense rivalry between billionaires Elon Musk, the founder of SpaceX, and Jeff Bezos, the founder of Blue Origin, detailing their personal and professional clashes.

• It examines the shift from government-led exploration to a trillion-dollar space economy, highlighting the role of private capital in

missions to Low Earth Orbit (LEO) and the Moon.

• The book provides inside accounts of the technological breakthroughs, political lobbying, and the ambitious goal of making humanity a multi-planetary species.

Additional Information

• Christian Davenport: He is a veteran reporter for The Washington Post, where he covers the defense and space industries. He is also the author of the 2018 bestseller "The Space Barons," which first chronicled the rise of private space ventures.

• Walter Isaacson: A renowned biographer who published the comprehensive biography "Elon Musk" in September 2023. While his work covers SpaceX extensively, he is not the author of "Rocket Dreams."

• Ashlee Vance: An American business columnist and author known for writing "Elon Musk: Tesla, SpaceX, and the Quest for a Fantastic Future" in 2015, which was one of the first major biographies of Musk.

• Neil deGrasse Tyson: A world-famous astrophysicist and director of the Hayden Planetarium. He has authored several books on science, such as "Astrophysics for People in a Hurry" and "Starry Messenger," but his work focuses on science communication rather than the business history of the space race.

• The New Space Race: Unlike the Cold War era race between the United States and the Soviet Union, the modern space race is characterized by reusable rocket technology, satellite mega-constellations like Starlink, and competition for NASA contracts under the Artemis program.

Important Points

• The trillion-dollar valuation mentioned in the title refers to projections by financial institutions like Morgan Stanley and Goldman Sachs, suggesting the space industry will exceed $1 trillion in annual revenue by 2040.

• Major milestones covered in recent space literature include the success of the Falcon 9 rockets, the development of the Starship spacecraft, and the New Shepard suborbital missions.

• The competition between Musk and Bezos has legal dimensions, including disputes over launch pads at Kennedy Space Center and NASA lunar lander contracts.

Q86. Answer: (c) Britain

The correct answer is Britain.

Key Points

• Britain (the United Kingdom) officially became the first European nation to join the Comprehensive and Progressive Agreement for Trans-Pacific Partnership (CPTPP).

• The formal signing of the accession protocol took place on July 16, 2023, in Auckland, New Zealand.

• The United Kingdom is the first new member to join the trade bloc since its inception in 2018 and the first member located outside the Indo-Pacific region.

• The accession process began in February 2021, following the UK's formal application to join the group after its departure from the European Union.

• The agreement was signed by the UK Business and Trade Secretary, Kemi Badenoch, representing a major milestone in the country's post-Brexit trade strategy.

Additional Information

• CPTPP Membership: With the UK joining, the trade bloc now consists of 12 countries, including Australia, Brunei, Canada, Chile, Japan, Malaysia, Mexico, New Zealand, Peru, Singapore, and Vietnam.

• Economic Scale: The inclusion of Britain brings the combined GDP of the CPTPP nations to approximately £12 trillion, accounting for about 15% of the global Gross Domestic Product.

• Trade Benefits: The agreement is designed to eliminate tariffs on more than 99% of goods traded between members, providing UK businesses with better access to high-growth markets for exports like automobiles, whisky, and dairy products.

• Indo-Pacific Tilt: Joining the CPTPP is a central part of the United Kingdom's strategic "Indo-Pacific tilt," aimed at strengthening economic and diplomatic ties with the world's fastest-growing region.

• Sovereignty and Regulation: Unlike the EU, the CPTPP is a free trade area rather than a single market; therefore, Britain retains sovereignty over its own borders and laws while adhering to shared high-standard trade rules.

Important Points

• Historical Context: The CPTPP was evolved from the Trans-Pacific Partnership (TPP) after the United States withdrew from the negotiations in 2017 under the administration of Donald Trump.

• Future Expansion: Several other nations, including China, Taiwan, Costa Rica, Uruguay, and Ukraine, have formally applied or expressed a strong interest in joining the CPTPP.

• Growth Projections: The UK government estimates that joining the bloc will provide a long-term boost of £1.8 billion to the UK economy and increase wages for workers across the country.

• High Standards: All CPTPP members must commit to high standards in labor rights, environmental protection, and intellectual property, which helps ensure a level playing field for international trade.

Q87. Answer: (c) Harvinder Singh

The correct answer is Harvinder Singh.

Key Points

• Harvinder Singh is a prominent para-archer from the Kaithal district of Haryana, who has consistently brought laurels to India at the international level.

• In January 2025, the Government of India conferred upon him the Padma Shri, the fourth-highest civilian award, in recognition of his historic achievements in sports.

• He achieved a historic milestone by winning the gold medal in the Men's Individual Recurve Open event at the Paris 2024 Paralympic Games.

• With this victory, he became the first Indian archer (across both Olympics and Paralympics) to win a gold medal in the sport of archery.

• Earlier, at the Tokyo 2020 Paralympics, he won a bronze medal, making him the first Indian to win an archery medal in the history of the Paralympic Games.

• His consecutive podium finishes in Tokyo and Paris showcase his dominance and consistency in the Para-Archery circuit.

Additional Information

• Padma Awards 2025:

• The Padma Awards are announced annually on the eve of Republic Day (January 25).

• In 2025, several athletes who excelled at the Paris Olympics and Paralympics were honored to celebrate India's best-ever performance in various sporting categories.

• Para-Sports in Haryana:

• The state of Haryana is a major contributor to India's sporting talent pool, often referred to as the Sports Hub of India.

• Athletes like Harvinder Singh, Deepa Malik, and Sumit Antil hail from this state, benefitting from its robust sports policy and financial incentives for medal winners.

• Mariyappan Thangavelu:

• He is a legendary para-high jumper from Tamil Nadu.

• He won gold at Rio 2016, silver at Tokyo 2020, and bronze at Paris 2024. He was awarded the Padma Shri in 2017.

• Deepa Malik:

• She was the first Indian woman to win a medal in the Paralympic Games (Rio 2016).

• A recipient of the Padma Shri in 2017 and the Khel Ratna in 2019, she also served as the President of the Paralympic Committee of India (PCI).

• Paris 2024 Paralympics:

• India finished the Paris 2024 Paralympics with its highest-ever medal tally of 29 medals, including 7 gold, 9 silver, and 13 bronze.

• Harvinder Singh and Sheetal Devi were among the standout performers in the archery discipline during this edition.

Important Points

• Harvinder Singh holds a Ph.D. in Economics, proving his excellence in both academics and sports.

• His journey is particularly inspiring as he suffered from an impairment in his legs due to an adverse reaction to an injection during his childhood.

• He is supported by the Target Olympic Podium Scheme (TOPS), a flagship program of the Ministry of Youth Affairs and Sports, which provides world-class training and infrastructure to elite athletes.

• The Padma Shri 2025 recognizes not just his gold medal, but also his role in popularizing Para-Archery among the youth of India.

Q88. Answer: (c) Iris

The correct answer is Iris.

Key Points

• Iris is India’s first AI-generated school teacher robot, representing a significant milestone in the integration of Artificial Intelligence within the education sector.

• The robot was developed by Makerlabs Edutech and was officially unveiled at KTCT Higher Secondary School in Thiruvananthapuram, Kerala, in March 2024.

• It was created as part of the Atal Tinkering Lab (ATL) project, an initiative by NITI Aayog designed to foster curiosity and innovation among school students across India.

• Iris is a humanoid robot capable of speaking three languages and is designed to answer a wide range of complex questions, providing a personalized interactive learning experience for students.

• Equipped with a voice assistant and interactive capabilities, the robot can move on wheels, gesture with its hands, and engage students in a manner that supplements traditional teaching methods.

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Additional Information

• Makerlabs Edutech:

• It is a Kochi-based startup specializing in Educational Technology, Robotics, and AI solutions.

• The development of Iris highlights the growing startup ecosystem in Kerala, often supported by the Kerala Startup Mission (KSUM).

• Technical Features of Iris:

• The robot is built using a high-performance Intel processor and a dedicated coprocessor to handle real-time interactions.

• It utilizes Generative AI technologies (similar to ChatGPT) to process information and generate human-like responses to academic queries.

• To make the robot more relatable to students in Kerala, it is designed as a humanoid figure dressed in traditional Saree attire.

• Atal Innovation Mission (AIM):

• Launched by NITI Aayog, AIM is the Government of India's flagship initiative to promote a culture of innovation and entrepreneurship.

• The Atal Tinkering Labs are established in schools to provide students with hands-on experience in STEM (Science, Technology, Engineering, and Mathematics) fields.

• Comparative Context:

• While Iris is a pioneer in Indian classrooms, other famous robots include Sophia, developed by Hanson Robotics, which became the first robot to receive Saudi Arabian citizenship in 2017.

• The introduction of AI teachers aims to address teacher shortages and provide 24/7 assistance to students, though they are intended to assist rather than replace human educators.

Important Points

• Kerala has consistently been a leader in literacy and educational innovation in India, being one of the first states to digitize classrooms.

• The use of Generative AI in schools helps in Personalized Learning, allowing the robot to adapt its teaching style according to the student's pace and level of understanding.

• The deployment of Iris is seen as a step toward achieving the goals of the National Education Policy (NEP) 2020, which emphasizes the integration of technology in education to improve learning outcomes.

Q89. Answer: (c) Ganga Athletics Ground, Uttarakhand

p>The correct answer is Ganga Athletics Ground, Uttarakhand.

Key Points

• Jyothi Yarraji, India's elite female hurdler, delivered a stellar record-breaking performance at the National Games 2025.

• The specific venue for this achievement was the Ganga Athletics Ground, located in Uttarakhand, which served as the primary site for track and field events.

• During the competition, she participated in the 100m hurdles, an event where she has consistently set and reset the National Record for India.

• The National Games 2025 represented the 39th edition of this multi-sport extravaganza, hosted by the state of Uttarakhand to promote sports infrastructure in the Himalayan region.

• Representing her home state of Andhra Pradesh, Jyothi Yarraji utilized the high-quality synthetic track at the Ganga Athletics Ground to surpass the previous Games Record.

Additional Information

• Athlete Profile: Jyothi Yarraji

• She was born on August 28, 1999, in Visakhapatnam, Andhra Pradesh.

• She made history by becoming the first Indian woman to run the 100m hurdles in under 13 seconds, achieving a timing of 12.78 seconds.

• Her international accolades include a Gold medal at the Asian Athletics Championships 2023 held in Bangkok and a Silver medal at the Asian Games 2022 (held in 2023) in Hangzhou.

• Venue Details: Ganga Athletics Ground

• The Ganga Athletics Ground is part of a larger sports infrastructure development in Haldwani, Uttarakhand.

• The facility was upgraded to meet World Athletics standards specifically for the hosting of the National Games.

• The location is strategically placed to encourage athletes from the Kumaon and Garhwal divisions of the state.

• National Games of India

• The National Games are organized by the Indian Olympic Association (IOA) to foster a spirit of competition among states.

• The 2025 edition in Uttarakhand featured over 30 sports disciplines, including Athletics, Archery, and Yoga.

• The games serve as a vital scouting ground for the Ministry of Youth Affairs and Sports to identify talent for the Olympics and

Commonwealth Games.

Important Points

• Sporting Significance: The performance by Jyothi Yarraji at the Ganga Athletics Ground is significant because it validated the technical quality of the new sporting facilities in Uttarakhand.

• Regional Impact: Hosting the National Games 2025 in cities like Dehradun and Haldwani aimed to boost Sports Tourism and provide local youth with exposure to world-class athletes.

• Technical Stats: Hurdles in the 100m category are 83.8 cm (33 inches) high, requiring exceptional rhythm and speed, traits that Yarraji has mastered under the guidance of coach James Hillier at the Reliance Foundation Odisha Athletics High-Performance Centre.

Q90. Answer: (c) Gurugram, Haryana

The correct answer is Gurugram, Haryana.

Key Points

• The Curtain Raiser of the 18th Urban Mobility India (UMI) Conference and Exhibition 2025 was recently organized by the Ministry of Housing and Urban Affairs (MoHUA).

• The venue for this high-profile preliminary event was Gurugram, Haryana, held on December 13, 2024.

• The event was presided over by the Union Minister for Housing and Urban Affairs and Power, Shri Manohar Lal, who emphasized the need for a robust and sustainable urban transport framework in India.

• The primary objective of the Curtain Raiser was to set the stage for the main 18th UMI conference, which serves as a platform for state governments, city authorities, and transport experts to exchange ideas and best practices.

• The Urban Mobility India initiative is part of the government's efforts to implement the National Urban Transport Policy (NUTP) and address the challenges of rapid urbanization and traffic congestion.

• During the event, the dates and venue for the main conference in 2025 were discussed, aiming to bring together global leaders in the urban transport sector. Hence, the correct answer is Gurugram, Haryana.

Additional Information

• Urban Mobility India (UMI) Conference:

• It is an annual flagship event organized by the Ministry of Housing and Urban Affairs.

• The conference originated from the National Urban Transport Policy (NUTP) formulated in 2006, which focuses on "moving people rather than vehicles."

• It provides a forum for urban transport professionals, city planners, and industry stakeholders to interact and learn about the latest technological advancements and policy reforms.

• 17th UMI Conference (2024):

• The 17th edition of the conference was held in Gandhinagar, Gujarat, in October 2024.

• The theme for the 17th UMI was "Standardization and Optimization of Urban Transport Solutions."

• It featured an exhibition showcasing Electric Vehicles (EVs), Metro Rail innovations, and Intelligent Transport Systems (ITS).

• MoHUA Roles and Initiatives:

• The Ministry of Housing and Urban Affairs is the nodal ministry for planning and coordination of urban transport across India.

• Key programs supported by the ministry include the Smart Cities Mission, Atal Mission for Rejuvenation and Urban Transformation (AMRUT), and various Metro Rail projects.

Important Points

• Sustainability Goals: The 18th UMI 2025 is expected to focus heavily on Net Zero targets and reducing the carbon footprint of Indian cities through Non-Motorized Transport (NMT) and green mobility.

• PM-eBus Sewa: Discussions at such conferences often revolve around the PM-eBus Sewa scheme, which aims to deploy 10,000 electric buses in 169 cities to improve urban air quality.

• Metro Network Growth: India currently has the third-largest metro rail network in the world, with over 900 kilometers of operational lines, a topic of central interest at the UMI 2025 curtain raiser.

• Location Advantage: Gurugram was chosen for the curtain raiser due to its status as a leading corporate hub and its experience with diverse urban mobility solutions like Rapid Metro and e-mobility clusters.

Q91. Answer: (c) Poonam Gupta

The correct answer is Poonam Gupta.

Key Points

• Poonam Gupta was appointed as the Deputy Governor of the Reserve Bank of India (RBI) in April 2025.

• Before her appointment to the central bank, she served as the Director General of the National Council of Applied Economic Research (NCAER). She made history as the first woman to lead this prestigious economic think tank since its inception in 1956.

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• She has a distinguished career at major international financial institutions, having served as a Lead Economist at the World Bank and as an economist at the International Monetary Fund (IMF).

• Her professional expertise is centered on macroeconomics, emerging markets, international finance, and banking sectors.

• As Deputy Governor, she is expected to handle critical portfolios which may include economic policy research, financial stability, and monetary policy, leveraging her vast global experience.

Additional Information

• Educational Background: Poonam Gupta holds a Ph.D. in International Economics from the University of Maryland and an M.A. in Economics from the Delhi School of Economics. Her academic rigor has contributed to numerous research papers on capital flows and global financial crises.

• Role of RBI Deputy Governor: According to the Reserve Bank of India Act, 1934, the bank is managed by a Central Board of Directors. This includes one Governor and not more than four Deputy Governors who are appointed by the Government of India.

• Appointment Process: The selection of Deputy Governors is typically conducted through the Financial Sector Regulatory Appointment Search Committee (FSRASC), which is headed by the Cabinet Secretary.

• NCAER Tenure: During her time at NCAER, she focused on identifying structural reforms necessary for India to achieve sustained high economic growth and improve its fiscal health.

Important Points

• Michael Patra: He has been a long-standing career central banker and was re-appointed as Deputy Governor of the RBI in 2023 and 2024. He is well-known for his role in the Monetary Policy Committee (MPC).

• Raghuram Rajan: He served as the 23rd Governor of the RBI from 2013 to 2016. Like Gupta, he had a significant tenure at the IMF as its Chief Economist.

• Urjit Patel: He served as the 24th Governor of the RBI from 2016 to 2018. He was previously a Deputy Governor and also worked with the IMF early in his career.

• Economic Significance: The appointment of economists with World Bank/IMF backgrounds like Poonam Gupta highlights the RBI's objective of integrating global best practices into India's domestic regulatory framework and inflation management strategies.

Q92. Answer: (a) Suryakumar Yadav

The correct answer is Suryakumar Yadav.

Key Points

• Suryakumar Yadav, often referred to as "Mr. 360" for his ability to hit shots in all directions, is a cornerstone of the Mumbai Indians (MI) franchise.

• In the lead-up to the IPL 2025 season, Suryakumar Yadav was retained as one of the top players by Mumbai Indians, reflecting his immense value to the squad's batting department.

• His role as a middle-order aggressor is critical, especially given his status as the ICC No. 1 T20I Batter for extended periods, showcasing his consistency and dominance in the shortest format of the game.

• For the IPL 2025 retention cycle, he was retained for a significant sum of INR 16.35 crore, underscoring his position as a Most Valuable Player within the team structure.

• His appointment as the permanent Captain of the Indian T20I team in 2024 further elevated his stature, making him a primary leadership figure alongside Hardik Pandya and Jasprit Bumrah for the Mumbai Indians.

Additional Information

• Mumbai Indians (MI) Retentions for IPL 2025:

• The franchise opted to retain its core Indian nucleus ahead of the Mega Auction held in Jeddah, Saudi Arabia in November 2024.

• Jasprit Bumrah was the first retention at INR 18 crore, followed by Suryakumar Yadav and Hardik Pandya at INR 16.35 crore each.

• Rohit Sharma, the legendary former captain who led MI to five IPL titles, was retained for INR 16.30 crore.

• Tilak Varma was the fifth retention, secured for INR 8 crore.

• Jasprit Bumrah:

• Widely considered the best all-format bowler in the world, Bumrah remains the spearhead of the Mumbai Indians bowling attack. His ability to bowl at the death with yorkers and variations makes him indispensable.

• Rohit Sharma:

• The "Hitman" has been synonymous with MI's success since 2013. Under his leadership, the team won championships in 2013, 2015, 2017, 2019, and 2020.

• Hardik Pandya:

• After returning to MI from Gujarat Titans in 2024, Hardik Pandya took over the captaincy. He provides crucial balance as a fast-bowling all-rounder.

Important Points

• IPL 2025 Auction Dynamics: The IPL 2025 Mega Auction saw franchises navigating a total purse of INR 120 crore. Mumbai Indians entered the auction with INR 45 crore after spending INR 75 crore on their five retentions.

• Venue and History: Mumbai Indians play their home matches at the Wankhede Stadium in Mumbai, a ground where Suryakumar Yadav has an exceptional record due to the true bounce and short boundaries.

• Performance Metrics: In T20 cricket, Suryakumar Yadav is noted for a strike rate often exceeding 170, which is among the highest for top-order batters in the history of the Indian Premier League.

Q93. Answer: (c) World Sustainable Development Summit

The correct answer is World Sustainable Development Summit.

Key Points

• The World Sustainable Development Summit (WSDS) is the annual flagship initiative of The Energy and Resources Institute (TERI).

• In March 2025, the summit was held in New Delhi, bringing together global leaders, policymakers, and scientists to discuss environmental challenges.

• The specific theme for the 2025 edition was “Partnerships for Accelerating Sustainable Development and Climate Solutions”, emphasizing the need for collective action to meet global goals.

• The summit serves as a premier international platform to facilitate exchange of knowledge on Sustainable Development Goals (SDGs) and the Paris Agreement.

• It focuses on mobilizing political will and public support for climate action and sustainable resource management across the globe.

Additional Information

• The Energy and Resources Institute (TERI):

• Established in 1974, TERI is a research institute based in New Delhi that conducts research in the fields of energy, environment, and sustainable development.

• It was formerly known as the Tata Energy Research Institute before being renamed in 2003.

• Conference of the Parties (COP) 30:

• The COP 30 United Nations Climate Change Conference is scheduled to be held in Belém, Brazil, in November 2025.

• It is distinct from the WSDS, as COPs are official United Nations Framework Convention on Climate Change (UNFCCC) meetings where treaty negotiations occur.

• G20 Environment Summit:

• The G20 (Group of Twenty) holds various ministerial meetings on the environment. India held the G20 Presidency in 2023, hosting the summit in New Delhi under the theme "Vasudhaiva Kutumbakam".

• United Nations Environment Assembly (UNEA):

• The UNEA is the world’s highest-level decision-making body on the environment. Its 5th session (UNEA-5) took place in Nairobi, Kenya, in two parts between 2021 and 2022.

Important Points

• Evolution of WSDS: The summit was originally launched as the Delhi Sustainable Development Summit (DSDS) in 2001 and was later rebranded to its current name to reflect its expanding global reach.

• Global Participation: Since its inception, the summit has hosted over 100 Heads of State and Government and thousands of delegates from across the world.

• Focus Areas: Key discussion areas often include energy transition, circular economy, nature-based solutions, and climate finance for developing nations.

• Location Context: Hosting the event in New Delhi allows India to showcase its leadership in initiatives like the International Solar Alliance (ISA) and the Coalition for Disaster Resilient Infrastructure (CDRI).

Q94. Answer: (d) Oscar Piastri

The correct answer is Oscar Piastri.

Key Points

• Oscar Piastri, the talented Australian driver for the McLaren Formula 1 Team, emerged victorious at the Chinese Grand Prix 2025. This win solidifies his position as one of the premier drivers in the modern era of Formula 1.

• The race was held at the Shanghai International Circuit, a venue that returned to the FIA Formula One World Championship calendar with high intensity. Piastri's win was a result of a masterful tactical display and superior tire management throughout the 56 laps of the race.

• The 2025 edition of the Chinese Grand Prix saw McLaren showcasing their aerodynamic efficiency, allowing Oscar Piastri to maintain a lead over rivals from Ferrari and Red Bull Racing.

• This victory contributes significantly to the 2025 Constructors' Championship standings, where McLaren has been a dominant

force alongside their driver pairing of Piastri and Lando Norris.

• Oscar Piastri, born in April 2001, has rapidly climbed the ranks since his debut, and this win in Shanghai marks another milestone in his burgeoning career.

Additional Information

• Shanghai International Circuit:

• Located in the Jiading District of Shanghai, China, the circuit was designed by Hermann Tilke and was first opened in 2004.

• The track layout is inspired by the Chinese character "Shang" (?), which means "above" or "high." It features one of the longest straights on the F1 calendar, measuring approximately 1.17 kilometers.

• Lando Norris:

• As the teammate to Oscar Piastri at McLaren, Lando Norris has been instrumental in the team's resurgence. He is known for his consistency and has been a frequent visitor to the podium in the 2024 and 2025 seasons.

• Charles Leclerc:

• The Monegasque driver for Scuderia Ferrari, Charles Leclerc, remains a top-tier competitor. In 2025, he continued to lead Ferrari's charge, often battling McLaren for the top spots in the Drivers' Championship.

• Lewis Hamilton:

• The seven-time World Champion, Lewis Hamilton, made a historic move to Ferrari for the 2025 season. This transition was one of the most talked-about events in Formula 1 history, marking the end of his long-standing partnership with Mercedes.

• Technical Regulations:

• The 2025 season serves as the final year under the current technical regulations before the major overhaul planned for 2026, focusing on sustainable fuels and redesigned power units.

Important Points

• Race Strategy: The Chinese Grand Prix is often characterized by high tire degradation, making strategy calls regarding the Hard and Medium compounds critical to the final outcome.

• Attendance: The 2025 race saw a record turnout, reflecting the massive growth of motorsport popularity in the Asia-Pacific region.

• Oscar Piastri's Achievements: Before entering F1, Piastri achieved the rare feat of winning the Formula 3 (2020) and Formula 2 (2021) championships in consecutive rookie seasons.

Q95. Answer: (a) Food Security Information Network (FSIN)

The correct answer is Food Security Information Network (FSIN).

Key Points

• The Global Report on Food Crises (GRFC) 2025 is the flagship publication of the Food Security Information Network (FSIN). This report provides a comprehensive and consensus-based assessment of acute food insecurity and malnutrition globally.

• The report is produced in support of the Global Network Against Food Crises (GNAFC), which is an international alliance consisting of the European Union, FAO, and WFP, among other humanitarian and development actors.

• The FSIN acts as a global initiative co-sponsored by the Food and Agriculture Organization (FAO), the World Food Programme (WFP), and the International Food Policy Research Institute (IFPRI).

• The purpose of the GRFC 2025 is to provide policy-makers and humanitarian organizations with evidence-based data to address the root causes of food crises and coordinate responses.

• It utilizes the Integrated Food Security Phase Classification (IPC) and the Cadre Harmonisé (CH) as the primary standard for measuring the severity and magnitude of food insecurity.

Additional Information

• Food and Agriculture Organization (FAO):

• The FAO is a specialized agency of the United Nations that leads international efforts to defeat hunger. It was established on October 16, 1945, and is headquartered in Rome, Italy.

• While FAO is a core contributor and co-sponsor of the FSIN, the GRFC itself is published under the FSIN banner to represent a multi-partner consensus.

• World Food Programme (WFP):

• The WFP is the world's largest humanitarian organization focused on food security and hunger. Founded in 1961, it was awarded the Nobel Peace Prize in 2020.

• The WFP provides critical data for the GRFC, but the report is not published by the WFP alone; it is a collaborative FSIN effort.

• Global Network Against Food Crises (GNAFC):

• Launched at the 2016 World Humanitarian Summit, the GNAFC aims to address the entire spectrum of food crises by linking humanitarian and development actions with political advocacy.

• Drivers of Food Crises:

• The GRFC identifies three primary drivers: Conflict and Insecurity, Weather Extremes (such as El Niño/La Niña), and Economic Shocks (including high food inflation).

• In 2024 and 2025, conflict remained the most significant driver of acute food insecurity in regions like Gaza, Sudan, and Haiti.

Important Points

• IPC Phase Classification: The report categorizes food insecurity into five phases. Phase 3 (Crisis), Phase 4 (Emergency), and Phase 5 (Catastrophe/Famine) are considered levels where urgent action is required to save lives.

• Data Coverage: The GRFC 2025 typically covers nearly 60 countries and territories that are facing food crises, providing a comparative analysis over previous years.

• United Nations Development Programme (UNDP): Although UNDP works on long-term development and poverty eradication, it is not the publisher of the GRFC. Its focus is more on the Sustainable Development Goals (SDGs) and general human development indices.

• Yearly Cycle: The report is usually released in the first half of the year (often April or May), reflecting data collected and analyzed throughout the preceding year.

Q96. Answer: (a) 12

The correct answer is 12.

Key Points

• IDFC FIRST Bank has reached a significant milestone in January 2025 by enabling Unified Payments Interface (UPI) access for Non-Resident Indians (NRIs) residing in 12 countries.

• This initiative allows NRIs to use their international mobile numbers linked to their NRE (Non-Resident External) or NRO (Non-Resident Ordinary) accounts to perform UPI transactions seamlessly.

• The 12 countries included in this rollout are Singapore, Australia, Canada, Hong Kong, Oman, Qatar, USA, Saudi Arabia, United Arab Emirates (UAE), United Kingdom (UK), Malaysia, and France.

• The service eliminates the previous requirement for NRIs to have an Indian mobile number to access the UPI ecosystem, thereby enhancing the ease of doing business and personal transactions for the Indian diaspora.

• This development follows the guidelines issued by the National Payments Corporation of India (NPCI), which permitted the use of international mobile numbers from specific countries for UPI onboarding.

Additional Information

• IDFC FIRST Bank:

• It was formed by the merger of the erstwhile IDFC Bank and Capital First, a leading consumer and MSME financing institution, in December 2018.

• The bank is headquartered in Mumbai and provides a wide range of financial solutions including savings accounts, NRI services, and corporate banking.

• Understanding NRE and NRO Accounts:

• NRE (Non-Resident External) Account: These accounts are used to park foreign earnings in India. The principal and interest are tax-free and fully repatriable (can be moved back to the foreign country).

• NRO (Non-Resident Ordinary) Account: These accounts are primarily for managing income earned in India, such as rent, dividends, or pension. The interest earned is taxable in India.

• National Payments Corporation of India (NPCI):

• Established in 2008, NPCI is an initiative of the Reserve Bank of India (RBI) and the Indian Banks' Association (IBA).

• It manages UPI, RuPay, IMPS, and Bharat BillPay, driving the digital payment revolution in India.

• NPCI International Payments Ltd (NIPL) is a subsidiary focused on exporting UPI and RuPay technology to international markets.

• Significance of UPI for NRIs:

• NRIs can now pay merchants directly via QR codes during their visits to India or for services provided in India.

• It reduces dependency on international credit/debit cards which often carry high currency conversion fees and transaction charges.

• This move strengthens India's Digital Public Infrastructure (DPI) and promotes the global acceptance of the UPI platform.

Q97. Answer: (c) A severe cyclonic storm over the Bay of Bengal

The correct answer is A severe cyclonic storm over the Bay of Bengal.

Key Points

• ‘Montha’ was a tropical cyclone that developed in the Bay of Bengal and made landfall on the eastern coast of India in October 2025.

• It was categorized as a Severe Cyclonic Storm by the India Meteorological Department (IMD), indicating sustained wind speeds ranging between 89 km/h and 117 km/h. Hence, statement 3 is correct.

• The storm originated from a low-pressure area that intensified into a depression and subsequently a deep depression before reaching the status of a Severe Cyclonic Storm.

• The timing of the storm, October, coincides with the peak post-monsoon cyclone season in India, during which the Bay of Bengal experiences high thermal energy and favorable atmospheric conditions for cyclogenesis.

• Unlike storms over the Kutch region or the Arabian Sea, Montha specifically tracked towards the Odisha and Andhra Pradesh coastline, bringing heavy precipitation and storm surges to the eastern seaboard. Hence, statements 1, 2, and 4 are incorrect.

Additional Information

• Cyclone Classification in India:

• The IMD classifies tropical disturbances based on Maximum Sustained Surface Wind Speed (MSW).

• Cyclonic Storm: 62–88 km/h.

• Severe Cyclonic Storm: 89–117 km/h.

• Very Severe Cyclonic Storm: 118–165 km/h.

• Extremely Severe Cyclonic Storm: 166–221 km/h.

• Super Cyclone: Above 222 km/h.

• Naming of Cyclones:

• The name ‘Montha’ is part of the list maintained by the WMO/ESCAP (World Meteorological Organization/United Nations Economic and Social Commission for Asia and the Pacific) Panel on Tropical Cyclones.

• Names are contributed by 13 member countries, including India, Thailand, Myanmar, and Bangladesh, to help in unique identification and disaster management.

• Bay of Bengal vs. Arabian Sea:

• Statistically, the Bay of Bengal sees a higher frequency of cyclones (ratio of 4:1) compared to the Arabian Sea.

• This is due to higher Sea Surface Temperatures (SST), the shape of the coastline, and the influx of remnant depressions from the South China Sea.

Important Points

• Impact and Mitigation:

• Cyclones like Montha necessitate the deployment of the National Disaster Response Force (NDRF) and the activation of early warning systems.

• The Color-coded Weather Warning system (Yellow, Orange, Red) is used by the IMD to alert residents and administrative bodies about the severity of the incoming threat.

• Storm Surges: One of the most dangerous features of a severe cyclonic storm is the storm surge, which can cause coastal inundation up to several kilometers inland, destroying mangroves and infrastructure.

Q98. Answer: (d) Coal India Limited

The correct answer is Coal India Limited.

Key Points

• In July 2025, the Ministry of Tribal Affairs (MoTA) entered into a landmark partnership with Coal India Limited (CIL) to significantly upgrade the educational landscape for tribal communities.

• This collaboration specifically targets the support and development of 68 Eklavya Model Residential Schools (EMRS) located across various districts in Chhattisgarh.

• The initiative is designed to benefit more than 28,000 tribal students, focusing on improving their access to modern educational tools and better campus facilities.

• The partnership utilizes the Corporate Social Responsibility (CSR) framework of Coal India Limited to fund infrastructure projects, including the establishment of smart classrooms, science laboratories, and vocational training centers within these schools.

• This move is part of a larger strategy to integrate tribal students into the national mainstream by providing quality education in remote, mining-affected areas of Chhattisgarh.

Additional Information

• Eklavya Model Residential Schools (EMRS):

• The EMRS scheme was introduced in 1997-98 to provide quality middle and high-level education to Scheduled Tribe (ST) students in remote areas.

• These schools are funded through grants under Article 275(1) of the Constitution of India.

• The objective is to enable tribal students to avail of opportunities in high and professional educational courses and get employment in various sectors, comparable to Jawahar Navodaya Vidyalayas.

• Coal India Limited (CIL):

• CIL is a Maharatna Public Sector Undertaking (PSU) under the Ministry of Coal, Government of India.

• Headquartered in Kolkata, it is the largest coal producer in the world and plays a vital role in India's energy security.

• Its subsidiary in Chhattisgarh, South Eastern Coalfields Limited (SECL), is one of the highest-producing coal companies in the country.

• Ministry of Tribal Affairs (MoTA):

• The Ministry of Tribal Affairs was established in October 1999 to ensure a more focused approach toward the integrated socio-economic development of the Scheduled Tribes.

• It acts as the nodal ministry for the planning, coordination, and administration of programs for tribal welfare.

Important Points

• Geographic Focus: Chhattisgarh has a tribal population accounting for approximately 30.6% of its total population, making the state a primary focus for EMRS expansion and CSR initiatives.

• Management of EMRS: The National Education Society for Tribal Students (NESTS) is an autonomous body under the Ministry of Tribal Affairs that manages the implementation of the EMRS scheme across India.

• CSR Mandate: Under the Companies Act, 2013, large companies like Coal India Limited are mandated to spend 2% of their average net profit on Social Responsibility, with education for marginalized groups being a top priority.

• Sustainable Development: This partnership aligns with Sustainable Development Goal 4 (Quality Education) and Goal 10 (Reduced Inequalities) by targeting underprivileged tribal youth in 2025.

Q99. Answer: (d) LIC, The New India Assurance, and GIC Re

The correct answer is LIC, The New India Assurance, and GIC Re.

Key Points

• The Insurance Regulatory and Development Authority of India (IRDAI) has identified and designated three major insurance companies as Domestic Systemically Important Insurers (D-SIIs) for the financial year 2024–25.

• The three identified entities are the Life Insurance Corporation of India (LIC), General Insurance Corporation of India (GIC Re), and The New India Assurance Co. Ltd.

• These insurers are perceived as being "too big to fail" (TBTF) due to their immense size, significant market presence, and deep interconnectedness within the Indian financial system.

• The failure of any of these designated insurers could lead to significant disruptions in the essential services they provide to the national economy and potentially trigger systemic instability in the broader financial market.

• As D-SIIs, these companies are subject to enhanced regulatory oversight by IRDAI to ensure they maintain robust financial health and risk management practices.

Additional Information

• Definition of D-SIIs:

• D-SIIs refer to insurers whose distress or failure would cause significant dislocation in the domestic financial system.

• The assessment for D-SII status is conducted annually by the IRDAI based on various parameters including size, interconnectedness, substitutability, and complexity.

• The Insurance Regulatory and Development Authority of India (IRDAI):

• It is a statutory body formed under the IRDA Act, 1999, functioning under the jurisdiction of the Ministry of Finance, Government of India.

• The headquarters of IRDAI is located in Hyderabad, having moved from New Delhi in 2001.

• The primary objective of IRDAI is to protect the interests of policyholders and regulate, promote, and ensure the orderly growth of the insurance industry.

• Regulatory Requirements for D-SIIs:

• Designated insurers are required to raise the levels of corporate governance and identify all relevant risks at a granular level.

• They must carry out systemic risk assessments and maintain additional capital to cushion against potential financial shocks.

• Specifically, LIC, GIC Re, and New India Assurance have been part of this list consistently since September 2020.

Important Points

• Life Insurance Corporation of India (LIC): Established in 1956, it is the largest life insurer in the country and a major institutional investor.

• General Insurance Corporation of India (GIC Re): It is the sole national reinsurer in the domestic market, providing reinsurance support to direct general insurance companies in India.

• The New India Assurance Co. Ltd.: It is a multinational general insurance company and remains the largest public sector general insurance company in India based on gross premium collection.

• The continuous designation of these three public sector units highlights the concentration of systemic importance within government-backed entities in the Indian insurance landscape.

Q100. Answer: (b) Kirti Vardhan Singh

The correct answer is Kirti Vardhan Singh.

Key Points

• In October 2024 (referenced as 2025 in some academic contexts), Shri Kirti Vardhan Singh, the Union Minister of State for Environment, Forest and Climate Change, officially launched India's National Red List Roadmap.

• The launch took place during the 16th Meeting of the Conference of the Parties (COP16) to the Convention on Biological Diversity (CBD), held in Cali, Colombia.

• The National Red List Roadmap is a strategic document designed to provide a framework for assessing the extinction risk of various species native to India using the globally recognized IUCN Red List Categories and Criteria.

• The initiative aims to strengthen national-level conservation efforts by identifying species that require immediate protection and policy intervention based on scientific data.

• This roadmap was developed in collaboration with premier scientific institutions such as the Zoological Survey of India (ZSI) and the Botanical Survey of India (BSI) to ensure a comprehensive assessment of India's flora and fauna.

Additional Information

• IUCN Red List of Threatened Species:

• Established in 1964, the International Union for Conservation of Nature (IUCN) Red List is the most comprehensive inventory of the global conservation status of biological species.

• It uses a set of criteria to evaluate the extinction risk of thousands of species and subspecies, categorized into groups like Extinct (EX), Critically Endangered (CR), Endangered (EN), and Vulnerable (VU).

• National Red Lists, such as the one proposed in India's roadmap, are essential because a species might be globally Least Concern but Critically Endangered within a specific country's borders.

• Biodiversity in India:

• India is recognized as one of the 17 mega-diverse countries in the world, harboring nearly 7-8% of the world's recorded species.

• The country contains four biodiversity hotspots: the Himalayas, the Western Ghats, the Indo-Burma region, and the Sundaland (including the Nicobar Islands).

• The National Red List Roadmap supports the Kunming-Montreal Global Biodiversity Framework (GBF), which aims to halt and reverse biodiversity loss by 2030.

• Role of the Ministry of Environment, Forest and Climate Change (MoEFCC):

• The MoEFCC is the nodal agency in the administrative structure of the Central Government for the planning, promotion, coordination, and overseeing the implementation of India's environmental and forestry policies.

• Under the leadership of ministers like Bhupender Yadav (Union Minister) and Kirti Vardhan Singh (Minister of State), the ministry implements acts like the Biological Diversity Act, 2002 and the Wildlife Protection Act, 1972.

Important Points

• Scientific Institutions: The Zoological Survey of India (ZSI), headquartered in Kolkata, and the Botanical Survey of India (BSI) play a pivotal role in the "Fauna of India" and "Flora of India" series, which serve as the baseline for Red List assessments.

• Global Commitments: India is a signatory to the Convention on Biological Diversity (CBD), and the roadmap is a step toward fulfilling Target 4 of the GBF, which focuses on active management actions to enable the recovery and conservation of species.

• Conservation Impact: By localizing IUCN criteria, India can better prioritize funding and protection for endemic species that are not found anywhere else in the world, ensuring their long-term survival in the Indian subcontinent.

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