RRB Group D Official Paper (Held On: 16 Dec, 2025 Shift 1) (Previous Year Paper)

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

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GENERAL SCIENCE

Q1. If the speed of an object is doubled, its kinetic energy _____.

(a) becomes four times
(b) becomes double
(c) remains the same
(d) becomes half

Q2. From the collected samples of the following solutions from the science laboratory, the correct acid-base pair may be categorised as:

(a) sulphuric acid (H_2SO_4) and nitric acid (HNO_3)
(b) acetic acid (CH_3COOH) and sodium hydroxide ($NaOH$)
(c) magnesium hydroxide [$Mg(OH)_2$] and ammonium hydroxide (NH_4OH)
(d) calcium hydroxide [$Ca(OH)_2$] and potassium hydroxide (KOH)

Q3. Which of the following statements is correct regarding the sexual reproduction of animals?

(a) Fertilization in animals always occurs outside the female body.
(b) Sexual reproduction involves the fusion of male and female gametes (sex cells).
(c) All animals reproduce sexually throughout their entire lifespan.
(d) Sexual reproduction involves only one male parent and produces identical offspring.

Q4. Which type of compound is formed when sodium reacts with chlorine?

(a) Ionic compound
(b) Covalent compound
(c) Coordinate compound
(d) Metallic compound

Q5. Which of the following statements is true about ligaments?

(a) Ligaments are not highly flexible connective tissues connecting two bones.
(b) Ligaments do not connect bones to bones and are very elastic.
(c) Ligaments connect bones to bones and are very elastic with little matrix.
(d) Ligaments connect muscles to bones and are highly flexible.

Q6. The discovery of which subatomic particle led to the development of Thomson's model?

(a) Electron
(b) Positron
(c) Proton
(d) Neutron

Q7. If a current of 4 A flows through a resistor of 50 Ω for 8 minutes, the heat produced is _____.

(a) 192 kJ
(b) 384 kJ
(c) 288 kJ
(d) 96 kJ

Q8. The centre of curvature of a concave mirror is:

(a) The midpoint of the mirror's aperture
(b) The point where parallel rays of light meet after reflection
(c) The geometric centre of the spherical surface of which the mirror is a part
(d) The point on the principal axis where image of an object at infinity is formed

Q9. Why clove oil is used as an olfactory indicator?

(a) Vigorous fuming of different colours is observed in acidic and basic medium.
(b) Different colour effervescences are observed in acidic and basic medium.
(c) It gives a different colour in acidic and basic medium.
(d) It gives a different smell in acidic and basic medium.

Q10. A convex lens produces a magnification of (-2), when an object is placed at a distance X cm from it. If the image distance is 40 cm, then what is the value of X ?

(a) -80 cm
(b) +80 cm
(c) +20 cm
(d) -20 cm

Q11. Two resistors, R1 and R2, are connected in parallel. Their equivalent resistance is 5 Ω. When one of them is removed, the resistance of the circuit increases to 10 Ω. Which of the following is the correct value of the other resistor?

(a) 20 Ω
(b) 5 Ω
(c) 15 Ω
(d) 10 Ω

Q12. Which of the following statements is not correct?

(a) Reverberation helps in improving the clarity of sound.
(b) Excessive reverberation can cause a disruption in conversation.
(c) Reverberation is common in large halls with hard walls.
(d) Reverberation occurs as a result of multiple reflections of sound.

Q13. Which of the following is parenchyma type and present in aquatic plants, with large air cavities to help them float?

(a) Chlorenchyma
(b) Aerenchyma
(c) Tracheid
(d) Companion cell

Q14. Which of the following is NOT a membrane bound organelle in eukaryotic cells?

(a) Chromoplast
(b) Vacuole
(c) Ribosome
(d) Lysosome

Q15. In a running race, a boy starts at rest and reaches 60 m/s velocity in 5 min. If acceleration is uniform, the acceleration and distance covered by the boy during this period are _____ and ___, respectively.

(a) 0.2 m/s2 and 9 km
(b) 12 m/s2 and 9000 m

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(c) 0.2 m/s2 and 600 m
(d) 20 m/s2 and 9 km

Q16. Which of the following cells change shape by changing the amount of water in them?
(a) Plant cell
(b) Cardiac muscle cell
(c) Striated muscle cell
(d) Smooth muscle cell

Q17. Which metal is placed at the starting of the reactivity series?
(a) Aluminium
(b) Iron
(c) Potassium
(d) Gold

Q18. Which of the following is NOT an example of a heterogenous mixture?
(a) Water in oil
(b) Vinegar
(c) Sand and sugar
(d) Sand and salt

Q19. During inheritance studies, how many copies of the factor was proposed by Mendel, which was controlling traits present in sexually reproducing organisms?
(a) Three
(b) One
(c) Two
(d) Four

Q20. Contraceptive devices such as the loop or the copper-T are placed in which part of the human body?
(a) Uterus
(b) Heart
(c) Kidney
(d) Ovary

Q21. Ozone protects the Earth from _____ radiation of the sun.
(a) ultraviolet
(b) cosmic
(c) gamma
(d) infrared

Q22. Which of the following instruments is NOT based on Archimedes' principle?
(a) Submarine
(b) Ammeter
(c) Hydrometer
(d) Lactometer

Q23. If the velocity of an object changes from an initial value u to the final value v in time (t), then what will be the acceleration (a)?
(a) a = t/(v - u)
(b) a = v/(u - t)
(c) a = (v - u)/t
(d) a = (v - u)×t

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Q24. How does surface area affect the rate of evaporation?

(a) Smaller surface area increases evaporation
(b) Evaporation only occurs with liquids in closed containers
(c) Surface area has no effect
(d) Larger surface area increases evaporation

Q25. The correct order of reactivity of the following metals is:

K, Mg, Al, Zn

(a) Zn > Mg > Al > K
(b) Mg > K > Zn > Al
(c) K > Al > Mg > Zn
(d) K > Mg > Al > Zn

MATHEMATICS

Q26. A hole can empty a full tank in 1 hour. To maintain the level of water in the tank, 3 filling pipes of equal efficiency are required. How many more such filling pipes are required so that an empty tank gets filled in 3 hours?

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

Q27. A shopkeeper buys a toy for Rs. 200 and sells it for Rs. 280. What is his profit percentage?

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

Q28. Simplify $(64x^2 - 49)/(8x - 7) - 8x$.

(a) 8x + 7
(b) 7
(c) −16x
(d) 16x + 7

Q29. Which of the following ratios is equivalent to 5 : 3?

(a) 50 : 30
(b) 48 : 33
(c) 53 : 31
(d) 125 : 85

Q30. If cosec A = 5/4, then the value of sin 2A + 2cos 2A is:

(a) 7/5
(b) 2/5
(c) 4/5
(d) 9/5

Q31. P is any point inside the rectangle ABCD. If PA = 87 cm, PB = 12 cm and PC = 96 cm, then the length of PD (in cm) is equal to:

(a) 124
(b) 130
(c) 126
(d) 129

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Q32. The value of $((0.66)^3 - (0.22)^3)/((0.66)^2 + 0.1452 + (0.22)^2)$ is:

(a) 0.44
(b) 10
(c) 100
(d) 1

Q33. One pipe can fill a tank in 8 minutes, while another pipe can empty the completely filled tank in 16 minutes. If both the pipes are opened together when the tank is empty, how many minutes will it take to fill one-half of the tank?

(a) 17
(b) 16
(c) 9
(d) 8

Q34. The radius of a road roller is 1 m, and its length is 21/22 m. When it is rolled on the ground, it takes 600 rolls to level the entire ground. However, it was found that on 10% of the ground, the roller rolled twice. What is the total area (in sq. m) of the ground?

(Use π = 22/7, and round off your answer to two decimal places)

(a) 3287.43
(b) 3460.25
(c) 3272.73
(d) 3200.75

Q35. The cost price of a box of marker is Rs. 3,300. The shopkeeper gives 75% of discount on the cost price. What will be the selling price (in Rs.)?

(a) 812
(b) 865
(c) 883
(d) 825

Q36. Rs. 3,596 is to be divided among three persons M, N and T. If the shares of M and N are in the ratio 6 : 8 and that of N and T are in the ratio 9 : 6, what is the share (in Rs.) of N?

(a) 1,486
(b) 1,488
(c) 1,487
(d) 1,489

Q37. The price of fuel decreases by 35%, 60% and 10% in three successive months but increases by 65% in the fourth month. What is the percentage increase/decrease in the price of fuel in the fourth month as compared to its original price?

(a) Decreases by 61.39%
(b) Increases by 63.54%
(c) Decreases by 60.08%
(d) Increases by 67.46%

Q38. The arithmetic mean of the observations 35, 26, 56, 41, 56, 46, 34, 16 and 68 is:

(a) 42
(b) 43
(c) 39
(d) 50

Q39. Two trains, 163 m and 117 m long, are moving in the same direction at speeds of 93 km/hr and 33 km/hr, respectively. How much time will the faster train take to completely cross the slower one?

(a) 18 seconds
(b) 16.8 second
(c) 8 seconds

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(d) 15 seconds

Q40. A dealer marks his goods at 50% above the cost price and allows a discount of 52% on the marked price. What is his loss percentage?

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

Q41. A solid wooden cuboid of dimensions 60 cm × 45 cm × 30 cm is cut completely into smaller cubes of side 5 cm each. Find the number of smaller cubes formed.

(a) 584
(b) 920
(c) 648
(d) 622

Q42. 2 pens and 3 pencils cost Rs. 35, and 3 pens and 2 pencils cost Rs. 40. Find the cost of 3 pencils.

(a) Rs. 12
(b) Rs. 30
(c) Rs. 18
(d) Rs. 15

Q43. A set of data is given, the mean of the set is 40 while the median is set as 70. Find the mode of the data.

(a) 140
(b) 110
(c) 130
(d) 120

Q44. If 20% of a number is added to 96, then the result is the same number. 80% of the same number is:

(a) 126
(b) 96
(c) 116
(d) 106

Q45. Zubeda's income is Rs. 1,20,000. She spends 20% on accommodation, 35% on household expenses, and 25% on other activities. She saves the remaining amount. What are her total savings?

(a) Rs. 24,000
(b) Rs. 29,000
(c) Rs. 26,000
(d) Rs. 30,000

Q46. A byke travels 80 km at the speed of 40 km/hr and the next 30 km at the speed of 10 km/hr. What is its average speed (in km/hr)?

(a) 22
(b) 28
(c) 16
(d) 26

Q47. Two banks, A and B, offered loans at 3.5% and 7.5% per annum, respectively. Nirmal borrowed an amount of Rs. 2,40,000 from each bank. Find the positive difference (in Rs.) between the amounts of simple interest paid to the two banks by Nirmal after 2 years.

(a) 18,700
(b) 19,.200
(c) 20,700
(d) 20,200

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Q48. The simplified value of the expression [(18 + 6) ÷ 3 × 2 - 4] × [5 + 3^2] - 2 × (8 - 3) is:

(a) 148
(b) 152
(c) 162
(d) 158

Q49. The mother of two sons is 20 years older than her elder son. Five years from now, the elder son will be twice as old as the younger son, and the ratio of their current ages is 3 : 1. What is the current age (in years) of the mother?

(a) 25
(b) 30
(c) 35
(d) 40

Q50. Find the smallest number to be added to 1000 so that 45 divides the sum exactly.1265

(a) 35
(b) 25
(c) 10
(d) 30

GENERAL INTELLIGENCE & REASONING

Q51. WPGB is related to AKKW in a certain way based on the English alphabetical order. In the same way, MVWH is related to QQAC. To which of the following options is YGIS related, following the same logic?9954

(a) CBMN
(b) CBNJ
(c) CBMJ
(d) CNJI

Q52. If 'A' stands for '÷', 'B' stands for '×', 'C' stands for '+' and 'D' stands for '−', then what will come in place of the question mark (?) in the following equation?

441 D 444 C 21 A 21 B 441 = ?

(a) 665
(b) 450
(c) 525
(d) 438

Q53. 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) 5 6 6 4 1 8 4 9 6 4 9 7 2 2 7 1 4 1 8 7 3 (Right)

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

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

Q54. Seven boxes M, N, O, P, Q, R and S are kept one over the other but not necessarily in the same order. Only two boxes are kept between M and O. Only N is kept above S. No box is kept below O. R is kept at some place below P but at some place above Q. Which box is kept third above Q?

(a) M
(b) P
(c) S
(d) N

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Q55. A group of numbers/symbols is coded using letter codes as per the codes given below and the conditions that follow. The correct combination of codes following the conditions is your answer.

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

Numbers/symbols	%	6	2	8	•	3	&	7	@	9	$	5	•	4
Codes	U	G	W	D	F	K	L	S	V	B	E	J	H	C

Conditions:

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

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

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

What will be the code for the following group?

% 5 * 7 $

(a) U J J S E
(b) © J F S ©
(c) E J F S U
(d) © J F © E

Q56. What should come in place of the question mark (?) in the given series based on the English alphabetical order?

QCW, SDU, UES, WFQ, ?

(a) YHP
(b) YGO
(c) XGP
(d) XHO

Q57. Seven people B, C, D, I, J, K, and L are sitting around a circular table facing the centre of the table. L sits third to the left of I. Only one person sits between K and B, when counted from the left of B. C sits third to the right of D. C sits to the immediate right of L. J is not an immediate neighbour of L. How many people sit between J and B, when counted from the right of J?

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

Q58. VK 12 is related to ZP 16 in a certain way. In the same way, RG 15 is related to VL 19. To which of the following is MB 24 related, following the same logic?

(a) SG 29
(b) PH 29
(c) PJ 28
(d) QG 28

Q59. Which of the following letter-number clusters will replace the question mark (?) in the given series to make it logically complete?

CER121, IKX98, OQD75, UWJ52, ?

(a) ACP29
(b) BCP29
(c) ADP29
(d) ACQ29

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Q60. If ‘E’ stands for ‘+’, ‘F’ stands for ‘-’, ‘G’ stands for ‘×’ and ‘H’ stands for ‘÷’, what will come in place of question mark ‘?’ in the following equation?

50 E 36 H 6 F 8 G 2 = ?

(a) 38
(b) 42
(c) 44
(d) 40

Q61. Read the given statements and conclusions carefully. Assuming that the information given in the statements is true, even if it appears to be at variance with commonly known facts, decide which of the given conclusions logically follow(s) from the statements.

Statements:

All hammers are jacks.

All hammers are metals.

Conclusions:

(I) Some jacks are metals.

(II) All metals are hammers.

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

Q62. In a certain code language,

P + Q means ‘P is the mother of Q’,

P # Q means ‘P is the sister of Q’,

P & Q means ‘P is the brother of Q’ and

P % Q means ‘P is the father of Q’.

How is D related to W if ‘D & E # F % L & W’?

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

Q63. Refer to the following number, symbol series and answer the question. Counting to be done from left to right only. All numbers are single-digit numbers.

(Left) 3 & 6 © 3 6 © € % 6 & 4 9 5 4 % € £ $ % 9 1 (Right)

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

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

Q64. Based on the English alphabetical order, three of the following four letter-cluster pairs are alike in a certain way and thus form a group. Which letter-cluster pair DOES NOT belong to that group?

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

(a) LS – JO
(b) DM – FI
(c) KP – ML
(d) RJ – TF

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Q65. If 'A' stands for '÷', 'B' stands for '×', 'C' stands for '+' and 'D' stands for '−', what will come in place of the question mark (?) in the following equation?

36 B 39 A 39 D 48 C 20 = ?

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

Q66. Refer to the following series and answer the question (all numbers are single digit numbers only). Counting to be done from Left to Right only.

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

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

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

Q67. Six people, A, B, C, D, E and F, are sitting in a row, facing north. Only two people sit to the left of E. Only one person sits between A and C. F sits to the immediate left of E. A sits to the immediate right of D. C sits third to the right of B.

Who sits at the extreme left end of the row?

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

Q68. Seven people, A, B, C, D, E, F and G, are sitting in a row, facing the north.

Only two people sit to the left of A. Only three people sit between A and G. D sits second to the right of A. Only two people sit between D and C. E sits at some place to the right of F but at some place to the left of B.

How many people sit to the right of C?

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

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

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

(a) OR - LO
(b) QT - NP
(c) MP - JM
(d) IL - FI

Q70. Town P is to the west of Town Q. Town R is to the north of Town P. Town S is to the east of Town R. Town T is to the south of Town S. Town Q is to the southeast of Town T. What is the position of Town P with respect to Town T?

(a) Southwest
(b) Southeast
(c) Northwest
(d) Northeast

Q71. 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.)

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(5, 28, 15)

(29, 102, 17)

(a) (37, 115, 1)
(b) (47, 142, 3)
(c) (7, 34, 10)
(d) (4, 20, 5)

Q72. In the following triad, each group of letters is related to the subsequent one following a certain logic. Select from the given options, the one which follows the same logic.

SINK - ISNK - KISN

PLAY - LPAY - YLPA

(a) WAIT - WIAT - TIAW
(b) READ - ERAD - DERA
(c) NAME - ANME - EAMN
(d) YOUR - OYUR - OURY

Q73. Aditya starts from Point A and drives 10 km towards the north. He then takes a right turn, drives 10 km, turns right and drives 20 km. He then takes a right turn and drives 10 km. He takes a final right turn, drives 3 km and stops at Point P. How far (shortest distance) and towards which direction should he drive in order to reach Point A again? (All turns are 90 degrees turns only, unless specified.)

(a) 9 km towards south
(b) 3 km towards west
(c) 7 km towards north
(d) 7 km towards east

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

88 91 97 106 118 ?

(a) 133
(b) 131
(c) 125
(d) 135

Q75. 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 teas are golds.

No tea is a helmet.

Conclusions:

(I): Some helmets are golds.

(II): All golds are helmets.

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

Q76. In a certain code language, ‘shirt mug care’ is coded as 'eu cp zi' and ‘zebra shirt ghost’ is coded as ‘cp eb il’. How is ‘shirt’ coded in the given language?

(a) cp
(b) zi
(c) eb
(d) eu

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Q77. Refer to the following number and symbol 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 5 7 8 = 6 9 2 + 5 7 3 % 7 8 $ 4 1 5 # 8 @ & 4 9 6 (Right)

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

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

Q78. What should come in place of the question mark (?) in the given series?

221 223 227 233 241 ?

(a) 249
(b) 255
(c) 253
(d) 251

Q79. All 20 students in a class are standing in a row facing north. Raveena is 10^(th) from the right end while Deepa is 4^(th) from the left end. How many people stand between Raveena and Deepa?

(a) 7
(b) 6
(c) 5
(d) 8

Q80. What should come in place of the question mark (?) in the given series?

273 274 266 267 259 260 ?

(a) 253
(b) 251
(c) 250
(d) 252

GENERAL AWARENESS AND CURRENT AFFAIRS

Q81. Which of the following two countries hosted the Second G20 Anti-Corruption Working Group in June 2025?

(a) India and South Africa
(b) Indonesia and Brazil
(c) South Africa and Germany
(d) Brazil and South Africa

Q82. The Indian Navy's home-built Shivalik-class stealth frigate equipped with guided missiles that took part in the JAIMEX-25 naval exercise held from 16 to 18 October 2025 was _____.

(a) INS Satpura
(b) INS Sahyadri
(c) INS Kolkata
(d) INS Shivalik

Q83. In 2025, which of the following new mottos was adopted by the Lokpal of India?

(a) Fight Corruption, Build Nation
(b) Integrity is Strength
(c) Empower Citizens, Expose Corruption
(d) Transparency for All

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Q84. Who among the following was awarded the Arjuna Award in 2025 for their performance in para-athletics?

(a) Harmanpreet Singh
(b) Gukesh D
(c) Deepthi Jeevanji
(d) Manu Bhaker

Q85. With which government did the Ministry of Environment, Forest and Climate Change sign a Memorandum of Cooperation on Joint Crediting Mechanism (JCM) under Article 6.2 of the Paris Agreement on Climate Change, in August 2025?

(a) Belgium
(b) Japan
(c) Germany
(d) Brazil

Q86. In which city were the Khelo India Para Games 2025, a significant event under the Khelo India scheme, held?

(a) Kolkata
(b) New Delhi
(c) Mumbai
(d) Chennai

Q87. The 10^(th) Governing Council Meeting of NITI Aayog on 24 May 2025 was held in which city of India?

(a) Mumbai
(b) Jaipur
(c) New Delhi
(d) Surat

Q88. As of July 2025, what was the total quantity of narcotics seized in Jammu & Kashmir since 2018, under the Narcotic Drugs and Psychotropic Substances Act (NDPSA)?

(a) 1,12,000 kg
(b) 27,000 kg
(c) 87,713 kg
(d) 19,353 kg

Q89. Who set a new world record by becoming the first man to cross 75 metres in discus throw at the World Athletics Continental Tour in Ramona, April 2025?

(a) Gerd Kanter
(b) Mykolas Alekna
(c) Robert Harting
(d) Kristjan Čeh

Q90. Which Indian Navy ships took part in Operation Brahma in March 2025?

(a) INS Chennai and INS Kesari
(b) INS Satpura and INS Savitri
(c) INS Vikramaditya and INS Vishal
(d) INS Vikrant and INS Arihant

Q91. What is the name of India’s proposed space station?

(a) Vyom Station
(b) Bharatiya Antariksh Station
(c) ISRO Sky Lab Station
(d) Indian Orbital Base Station

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Q92. What was the name of the new Indian Army Research Cell inaugurated at IIT Madras in August 2025?

(a) Agnishodh
(b) Agnivira
(c) Agnipath
(d) Agni Kavach

Q93. What is the new upper limit for no personal income tax payable under the new tax regime as per Union Budget 2025–26?

(a) Rs. 11 lakh
(b) Rs. 10 lakh
(c) Rs. 13 lakh
(d) Rs. 12 lakh

Q94. Which of the following has been declared a Tiger Reserve in 2025?

(a) Dholpur – Karauli Tiger Reserve
(b) Parambikulam Tiger Reserve
(c) Ranipur Tiger Reserve
(d) Madhav Tiger Reserve

Q95. In 2025, why did National Bank for Agriculture and Rural Development (NABARD) and Indian Council of Agricultural Research (ICAR) sign an agreement?

(a) To study city temperatures
(b) To improve farming that can handle climate change
(c) To train people for emergencies
(d) To launch online banking websites

Q96. On which date was World Malaria Day 2025 observed with the theme Malaria Ends with Us: Reinvest, Reimagine, Reignite?

(a) March 22
(b) April 10
(c) April 25
(d) May 5

Q97. In June 2025, with which of the following countries did Kolkata-based Garden Reach Shipbuilders and Engineers Limited (GRSE) sign an MoU to build the India’s first ever Polar Research Vessel (PRV) indigenously?

(a) Malta
(b) Belgium
(c) Austria
(d) Norway

Q98. In 2025, which ministry of the Government of India organised Swachh Vayu Sarvekshan for ranking air quality in Indian cities?

(a) Ministry of Education
(b) Ministry of Environment
(c) Ministry of Home Affairs
(d) Ministry of Finance

Q99. Which Paralympic swimmer won a Laureus award in 2025 for disability sport?

(a) Jiang Yuyan
(b) Anna Grimaldi
(c) Yuto Horigome
(d) Chloe Kim

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Q100. As per the Economic Survey 2024–25, which scheme electrified over 18,000 villages in rural India?

(a) Unnat Jyoti by Affordable LEDs for All (UJALA)

(b) Ujwal Discom Assurance Yojana (UDAY)

(c) Deen Dayal Upadhyaya Gram Jyoti Yojana (DDUGJY)

(d) Pradhan Mantri Nayi Roshni Yojana (PMNRY)

ANSWER KEY

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

SOLUTIONS

Q1. Answer: (a) becomes four times

The correct answer is becomes four times.

Key Points

• Kinetic Energy (K.E.) is the energy possessed by an object by virtue of its motion. Every moving object, whether it is a falling grain of sand or a speeding planet, possesses some amount of kinetic energy.

• The standard mathematical formula for kinetic energy is K.E. = 1/2 mv^2, where m represents the mass of the object and v represents its velocity or speed.

• In this formula, the velocity term is squared. This implies that the kinetic energy of an object is directly proportional to the square of its speed.

• When the speed of an object is doubled (v becomes 2v), the new kinetic energy calculation becomes: K.E_new = 1/2 $m(2v)^2$ = 1/2 $m(4v^2)$ = 4 * (1/2 mv^2).

• As a result, doubling the speed results in the kinetic energy increasing by a factor of four. Hence, the statement that it becomes four times is correct.

Additional Information

• Work-Energy Theorem: This fundamental principle of physics states that the work done by the sum of all forces acting on a particle equals the change in the kinetic energy of the particle. If work is done on an object, its kinetic energy increases.

• Scalar Nature: Kinetic energy is a scalar quantity, meaning it has only magnitude and no specific direction. Unlike velocity or momentum, kinetic energy does not change if only the direction of motion changes while the speed remains constant.

• Dependency on Mass: While kinetic energy depends quadratically on speed, it is linearly proportional to the mass. If the mass of an object is doubled while the speed remains the same, the kinetic energy will only double.

• Relationship with Momentum: Kinetic energy and linear momentum (p) are closely related. The relationship is expressed as K.E. = p^2 / 2m. This shows that if the momentum of an object is doubled, its kinetic energy also becomes four times the original value.

Important Points

• Units and Dimensions: The SI unit of kinetic energy is the Joule (J), which is defined as 1 kg·m^2/s^2. Its dimensional formula is [ML^2T^{-2}].

• Potential Energy Comparison: Unlike kinetic energy, which is energy of motion, Potential Energy is the energy stored in an object due to its position (like a height in a gravitational field) or configuration (like a stretched spring).

• Braking Distance and Safety: The fact that kinetic energy increases with the square of the speed is a critical factor in road safety. Because a car traveling at 60 km/h has four times the energy of a car at 30 km/h, it requires much more work (and distance) from the brakes to bring it to a complete stop.

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• Relativistic Limit: At speeds approaching the speed of light (c), the classical formula 1/2 mv² becomes inaccurate. In such cases, Einstein's theory of relativity provides the corrected formula for relativistic kinetic energy.

• Zero Kinetic Energy: An object at rest (velocity = 0) has zero kinetic energy, regardless of how much mass it possesses.

Q2. Answer: (b) acetic acid (CH3COOH) and sodium hydroxide (NaOH)

The correct answer is acetic acid (CH3COOH) and sodium hydroxide (NaOH).

Key Points

• An acid-base pair consists of one substance that acts as an acid (donates protons) and another that acts as a base (accepts protons or provides hydroxyl ions).

• Sulphuric acid (H2SO4) and Nitric acid (HNO3) are both strong mineral acids. Since both substances in this pair are acids, they do not form an acid-base category. Hence, statement 1 is incorrect.

• Acetic acid (CH3COOH) is a weak organic acid, while Sodium hydroxide (NaOH) is a strong base. Together, they represent a valid acid-base pair. Hence, statement 2 is correct.

• Magnesium hydroxide [Mg(OH)2] and Ammonium hydroxide (NH4OH) are both classified as bases. Because both chemicals possess alkaline properties, they do not constitute an acid-base pair. Hence, statement 3 is incorrect.

• Calcium hydroxide [Ca(OH)2] and Potassium hydroxide (KOH) are both strong bases (metal hydroxides). This grouping consists of two bases rather than an acid and a base. Hence, statement 4 is incorrect.

• In chemistry, identifying these pairs is fundamental for understanding neutralization reactions and buffer solutions.

Additional Information

• Acids: These are substances that release Hydrogen ions (H+) when dissolved in water. They are known for their sour taste and their ability to turn blue litmus paper red. Common examples include Hydrochloric acid (HCl) and Citric acid.

• Bases: These substances release Hydroxyl ions (OH-) in aqueous solutions. They typically have a bitter taste, a soapy/slippery feel, and turn red litmus paper blue. Examples include NaOH and Calcium carbonate.

• pH Scale: The acidity or alkalinity of a solution is measured on the pH scale, which ranges from 0 to 14. A pH of 7 is neutral (like pure water), below 7 is acidic, and above 7 is basic or alkaline.

• Neutralization: This is a chemical reaction where an acid and a base react with each other to produce salt and water. For example, CH3COOH reacting with NaOH produces Sodium Acetate (CH3COONa) and H2O.

• Strength of Acids/Bases: Strong acids (like H2SO4) ionize completely in water, whereas weak acids (like CH3COOH) ionize only partially. Similarly, NaOH is a strong base compared to the weak base NH4OH.

Important Points

• Acetic Acid (CH3COOH): Also known as ethanoic acid, it is the primary component of vinegar, usually making up about 4% to 8% of the volume. It is widely used in the food industry as a preservative.

• Sodium Hydroxide (NaOH): Commonly referred to as caustic soda, it is a highly corrosive base used in the manufacturing of soaps, paper, and detergents.

• Arrhenius Theory: This theory, proposed in 1884, defines acids as substances that increase H+ concentration and bases as substances that increase OH- concentration in water.

• Indicators: Chemical substances like Phenolphthalein and Methyl Orange are used to detect the presence of acids and bases. Phenolphthalein turns pink in a basic medium and remains colorless in an acidic medium.

• Magnesium hydroxide [Mg(OH)2]: Known as Milk of Magnesia, it is used medicinally as an antacid to treat indigestion by neutralizing excess stomach acid.

Q3. Answer: (b) Sexual reproduction involves the fusion of male and female gametes (sex cells).

The correct answer is Sexual reproduction involves the fusion of male and female gametes (sex cells).

Key Points

• Sexual Reproduction is a biological process that involves the fusion of male and female gametes to form a zygote, which eventually develops into a new organism. This process ensures genetic diversity within a species. Hence, statement 2 is correct.

• In animals, fertilization is the process where the sperm (male gamete) meets the egg (female gamete). This can occur either inside the female body (Internal Fertilization) or outside in the environment (External Fertilization), such as in water for many fish and amphibians. It is not "always" outside. Hence, statement 1 is incorrect.

• Animals do not reproduce throughout their entire lifespan. They go through different phases: the juvenile phase (period of growth before reaching maturity), the reproductive phase (when they can reproduce), and the senescent phase (old age). Hence, statement 3 is incorrect.

• Sexual reproduction typically involves two parents (male and female) and results in offspring that are genetically different from the parents due to the mixing of DNA. The creation of identical offspring from a single parent is a characteristic of asexual reproduction. Hence, statement 4 is incorrect.

Additional Information

• Gametes and Zygote:

• The male gamete is called sperm, which is usually small and motile.

• The female gamete is called the ovum or egg, which is typically larger and contains food reserves for the developing embryo.

• The fusion of these two haploid cells results in a diploid zygote, restoring the chromosome number of the species.

• Types of Fertilization:

• Internal Fertilization: Common in mammals, birds, and reptiles. It provides better protection to the developing embryo.

• External Fertilization: Observed in frogs, starfish, and most fish. Large numbers of gametes are released into the water to increase the chances of survival.

• Significance of Sexual Reproduction:

• It promotes evolution by producing variations. These variations help organisms adapt to changing environmental conditions over thousands of years.

Important Points

• Asexual vs. Sexual Reproduction:

• Asexual Reproduction involves a single parent and produces clones (genetically identical copies). Examples include Binary Fission in Amoeba and Budding in Hydra.

• Sexual Reproduction involves meiosis (cell division that reduces chromosome number) and syngamy (fusion of gametes).

• Puberty: This is the age or stage at which the reproductive organs become functional, marking the beginning of the reproductive phase in animals and humans.

Q4. Answer: (a) Ionic compound

The correct answer is Ionic compound.

Key Points

• An Ionic compound is formed when Sodium (Na) reacts with Chlorine (Cl). This reaction results in the formation of Sodium Chloride (NaCl), commonly known as table salt.

• Sodium is a metal belonging to Group 1 of the periodic table with an atomic number of 11. It has one electron in its outermost shell and seeks to lose it to achieve a stable octet configuration.

• Chlorine is a non-metal belonging to Group 17 (Halogens) with an atomic number of 17. It has seven electrons in its valence shell and requires one additional electron to complete its octet.

• During the reaction, Sodium transfers its single valence electron to Chlorine. This complete transfer of electrons creates a Sodium cation (Na+) and a Chloride anion (Cl-).

• The strong electrostatic force of attraction between these oppositely charged ions holds them together, forming an Ionic Bond. Hence, option 1 is correct.

Additional Information

• Covalent Compounds:

• These are formed by the sharing of electrons between two or more non-metals.

• Examples include Water (H2O), Methane (CH4), and Carbon Dioxide (CO2). Since Sodium is a metal and Chlorine is a non-metal, they do not form a covalent bond. Hence, option 2 is incorrect.

• Coordinate (Dative) Compounds:

• This is a type of covalent bond where both electrons in the shared pair come from the same atom.

• These are common in complex ions and ammonium ions (NH4+). Sodium and Chlorine involve a complete transfer rather than a one-sided sharing. Hence, option 3 is incorrect.

• Metallic Compounds:

• These are formed through metallic bonding, which occurs between metal atoms where valence electrons are delocalized in a "sea of electrons."

• Examples include Pure Iron (Fe) or Copper (Cu). Sodium Chloride is a salt, not a metallic alloy or pure metal. Hence, option 4 is incorrect.

Important Points

• Properties of NaCl: Sodium Chloride forms a crystalline lattice structure. It has a high melting point of approximately 801 degrees Celsius and a high boiling point of 1413 degrees Celsius.

• Electronegativity: The Pauling electronegativity of Sodium is 0.93, while Chlorine is 3.16. The large difference of 2.23 (greater than 1.7) confirms that the bond is predominantly ionic.

• Conductivity: As an ionic compound, NaCl does not conduct electricity in its solid state but is an excellent conductor when molten or dissolved in water due to the mobility of ions.

• Solubility: It is highly soluble in polar solvents like Water because the polar water molecules can stabilize the Na+ and Cl- ions through ion-dipole interactions.

Q5. Answer: (c) Ligaments connect bones to bones and are very elastic with little matrix.

The correct answer is Ligaments connect bones to bones and are very elastic with little matrix.

Key Points

• Ligaments are specialized types of connective tissue that serve the primary function of connecting two bones together at a joint.

• A key physical property of ligaments is that they are highly elastic and possess great strength, allowing for the necessary range of motion in the skeletal system while maintaining structural integrity. Hence, statement 3 is correct.

• Unlike some other connective tissues, ligaments contain very little matrix, as they are primarily composed of densely packed fibrous proteins.

• Ligaments are flexible enough to allow movement but are strong enough to prevent dislocation of the joints. Hence, statement 1 is incorrect as it claims they are not flexible.

• By definition, their main role is inter-bone connectivity. Hence, statement 2 is incorrect because it denies this connection.

• The task of connecting muscles to bones is performed by tendons, not ligaments. Hence, statement 4 is incorrect.

Additional Information

• Composition of Ligaments:

• Ligaments are primarily made of collagen fibers and elastin fibers. While collagen provides tensile strength to withstand pressure, elastin provides the flexibility needed for movement.

• The cells found within ligaments are known as fibroblasts, which are responsible for the synthesis of the extracellular matrix and collagen.

• Comparison with Tendons:

• While both are fibrous connective tissues, tendons are tough and inelastic compared to ligaments.

• Tendons anchor skeletal muscles to bones, facilitating the transmission of mechanical force required for movement.

• Classification:

• Ligaments are categorized under Dense Regular Connective Tissue because the collagen fibers are arranged in a parallel pattern to provide maximal resistance to pulling forces.

Important Points

• Clinical Significance:

• An injury involving the overstretching or tearing of a ligament is medically termed a sprain. This is different from a strain, which involves muscles or tendons.

• Common examples of ligaments include the Anterior Cruciate Ligament (ACL) in the knee, which is vital for stabilizing the knee joint during rotational movements.

• Functionality:

• Ligaments act as mechanical checks; they limit the range of motion of a joint to protect it from moving in abnormal directions that could cause injury.

• They also contain sensory nerve endings (proprioceptors) that provide the brain with information regarding the position and movement of the joints.

Q6. Answer: (a) Electron

The correct answer is Electron.

Key Points

• The discovery of the electron by Sir J.J. Thomson in 1897 was the primary catalyst for the development of the first modern atomic model.

• Thomson conducted experiments using a Cathode Ray Tube (CRT), where he observed that rays were deflected away from a negatively charged plate and toward a positively charged plate, indicating they consisted of negatively charged particles.

• Following this discovery, Thomson proposed the Plum Pudding Model (also known as the Watermelon Model) in 1904 to explain the structure of the atom.

• In this model, the atom was envisioned as a positively charged sphere in which negatively charged electrons were embedded, similar to seeds in a watermelon or raisins in a pudding.

• This discovery was revolutionary because it proved that the atom was not an indivisible particle, as John Dalton had previously proposed in his Atomic Theory, but instead contained smaller subatomic particles.

• The model also established the concept of electrical neutrality, suggesting that the total positive charge of the sphere was exactly balanced by the total negative charge of the embedded electrons.

Additional Information

• Proton:

• While Eugen Goldstein observed canal rays (positive ions) in 1886, the proton was identified as a fundamental subatomic particle by Ernest Rutherford.

• In 1919, Rutherford proved that the nucleus of a hydrogen atom was present in other nuclei, leading to the naming of the proton in 1920.

• The proton carries a positive charge of +1.602 x 10^-19 Coulombs and has a mass approximately 1836 times that of an electron.

• Neutron:

• The neutron was discovered by James Chadwick in 1932.

• He bombarded Beryllium with alpha particles and observed a new type of radiation that consisted of uncharged particles with a mass slightly greater than that of a proton.

• The discovery of the neutron explained why the atomic mass was often more than double the atomic number and helped in the understanding of isotopes.

• Positron:

• The positron is the antiparticle of the electron, discovered by Carl D. Anderson in 1932 while studying cosmic rays.

• It has the same mass as an electron but carries a positive charge. It was the first evidence of antimatter.

• Rutherford's Atomic Model:

• Developed in 1911 following the Alpha-particle Scattering Experiment (Gold Foil Experiment).

• This model superseded Thomson's model by proposing that the atom has a tiny, dense, positively charged nucleus at its center, with electrons revolving around it, much like planets around the sun.

Important Points

• Chronology of Discovery: The electron (1897) was discovered first, followed by the proton (identified in 1919), and finally the neutron (1932).

• Charge-to-Mass Ratio: J.J. Thomson is also famous for measuring the charge-to-mass ratio (e/m) of the electron, which he found to be constant regardless of the gas used in the discharge tube.

• Nobel Prize: J.J. Thomson was awarded the Nobel Prize in Physics in 1906 for his work on the conduction of electricity by gases and the discovery of the electron.

Q7. Answer: (b) 384 kJ

The correct answer is 384 kJ.

Key Points

• The heat produced in a resistor when an electric current flows through it is governed by Joule's Law of Heating. The formula used to calculate this heat energy (H) is $H = I^2Rt$, where I is the current, R is the resistance, and t is the time duration.

• In the given problem, the value of the current (I) is 4 A and the resistance (R) of the resistor is 50 Ω (ohms).

• The time (t) provided is 8 minutes. Since the standard SI unit for time in physics calculations is seconds, we must convert it: 8 minutes = 8 × 60 = 480 seconds.

• By substituting these values into the formula, we get $H = (4)^2 \times 50 \times 480$. This simplifies to 16 × 50 × 480, which equals 384,000 Joules (J).

• To express the final answer in kilojoules (kJ), we divide the value by 1,000. Therefore, 384,000 J / 1,000 = 384 kJ. Hence, the correct answer is 384 kJ.

Additional Information

• Joule's Law of Heating:

• This law was formulated by the English physicist James Prescott Joule in the 1840s. It states that the heat produced in a conductor is directly proportional to the square of the current, the resistance of the conductor, and the time for which the current flows.

• The mathematical expression is $H = I^2Rt$. If the current is doubled, the heat produced increases by four times, assuming resistance and time remain constant.

• Resistance (R):

• Resistance is the property of a material to oppose the flow of electric current. Its SI unit is the Ohm (Ω).

• In a resistor, the electrical energy lost due to collisions between electrons and the atoms of the conductor is converted into thermal energy (heat).

• Electric Power and Heat:

• Electric Power (P) is the rate at which electrical energy is consumed or converted into other forms. It is given by $P = I^2R$ or $P = VI$.

• Heat energy can also be expressed as the product of Power and Time ($H = P \times t$). In this case, the power dissipated is 800 Watts (W), and for 480 seconds, the total energy is 384,000 J.

• Practical Applications of the Heating Effect:

• Domestic Appliances: Devices such as electric irons, electric heaters, geysers, and toasters utilize high-resistance coils (often made of Nichrome) to generate significant heat.

• Electric Bulbs: The filament of an incandescent bulb (usually made of Tungsten) is heated to such a high temperature that it begins to emit light.

• Electric Fuse: A safety device consisting of a wire with a low melting point. When excessive current flows, the heat produced (I^2Rt) melts the fuse wire, breaking the circuit and protecting appliances from damage.

Important Points

• Unit Conversions: Always ensure that time is in seconds and current is in Amperes to get the energy in Joules. 1 kiloJoule (kJ) is equivalent to 1,000 Joules (J).

• Factors Affecting Heat:

• If Resistance is increased, heat increases linearly.

• If Current is increased, heat increases exponentially (squared).

• If Time is increased, heat increases linearly.

• Nature of the Energy: The heat produced is a form of waste energy in many electronic circuits (like computers), requiring cooling systems like fans or heat sinks, but it is the primary desired output in heating appliances.

Q8. Answer: (c) The geometric centre of the spherical surface of which the mirror is a part

The correct answer is The geometric centre of the spherical surface of which the mirror is a part.

Key Points

• The reflecting surface of a spherical mirror forms a part of a sphere. This sphere has a centre, and this point is called the Centre of Curvature of the spherical mirror.

• It is represented by the letter C. It is important to note that the centre of curvature is not a part of the mirror; it lies outside its reflecting surface.

• For a concave mirror, the centre of curvature lies in front of it. This point is the geometric centre of the hollow sphere of glass of which the mirror is a part. Hence, option 3 is correct.

• The midpoint of the mirror's aperture or the geometric centre of the reflecting surface itself is called the Pole (P), not the centre of curvature. Hence, option 1 is incorrect.

• The point where parallel rays of light meet after reflection is the Principal Focus (F). Hence, option 2 is incorrect.

• The image of an object at infinity is formed at the Principal Focus of the mirror. Hence, option 4 is incorrect.

Additional Information

• Radius of Curvature (R): The radius of the sphere of which the reflecting surface of a spherical mirror forms a part is called the Radius of Curvature. It is the distance between the Pole (P) and the Centre of Curvature (C).

• Principal Axis: An imaginary straight line passing through the Pole and the Centre of Curvature of a spherical mirror. It is normal to the mirror at its pole.

• Principal Focus (F): For a concave mirror, it is the point on the principal axis where all the incident rays that are parallel to the axis actually converge after reflection.

• Focal Length (f): The distance between the Pole and the Principal Focus of a spherical mirror is called the focal length. For mirrors with small apertures, the radius of curvature is found to be equal to twice the focal length (R = 2f).

• Aperture: The diameter of the reflecting surface of a spherical mirror is called its aperture. In elementary physics, we usually consider mirrors whose aperture is much smaller than its radius of curvature.

Important Points

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

• Convex Mirror: A spherical mirror whose reflecting surface is curved outwards is called a convex mirror. The centre of curvature for a convex mirror lies behind the mirror. It is also known as a diverging mirror.

• Light Path through C: Any ray of light passing through the centre of curvature of a concave mirror (or directed in the direction of the centre of curvature of a convex mirror) is reflected back along the same path because the incident ray falls on the mirror along the normal to the reflecting surface.

Q9. Answer: (d) It gives a different smell in acidic and basic medium.

The correct answer is It gives a different smell in acidic and basic medium.

Key Points

• Olfactory indicators are substances whose smell or odour changes depending on whether they are placed in an acidic or basic medium.

• Clove oil is a classic example of an olfactory indicator used in chemistry laboratories to distinguish between acids and bases.

• When clove oil is added to an acidic solution, its characteristic pungent smell is retained and does not vanish.

• When clove oil is treated with a basic solution, such as Sodium Hydroxide (NaOH), the characteristic smell of the oil is lost or cannot be detected.

• This property of changing odour based on the pH of the medium makes it a reliable tool for chemical testing. Hence, the correct answer is option 4.

Additional Information

• Vanilla Essence: Similar to clove oil, vanilla essence acts as an olfactory indicator. It maintains its pleasant aroma in acidic conditions but loses the smell when mixed with a base.

• Onion: Finely chopped onions can also be used as olfactory indicators. The smell of onion is destroyed when it reacts with a basic solution, whereas it persists in an acidic solution.

• Utility for Visually Impaired: Olfactory indicators are extremely important for visually impaired students, as they allow the identification of acids and bases through the sense of smell rather than relying on colour changes used in traditional indicators like litmus or pH paper.

• Natural Indicators: Apart from olfactory types, there are natural indicators like litmus (from Lichens), Turmeric, and Red Cabbage which change colour to indicate the nature of the substance.

• Synthetic Indicators: These are man-made chemicals like Phenolphthalein and Methyl Orange. Phenolphthalein remains colourless in acid but turns pink in basic solutions.

Important Points

• The main chemical component in clove oil responsible for its odour is Eugenol.

• In a basic medium, the hydroxide ions react with the acidic functional groups of the indicator molecules (like Eugenol), changing their chemical structure and consequently neutralizing the scent.

• Acids have a pH less than 7, while bases have a pH greater than 7.

• The fuming or effervescence mentioned in other options usually relates to reactions involving carbonates (releasing CO_2) or strong oxidizing agents, rather than the standard behavior of an olfactory indicator.

• Testing for acids and bases using smell is a qualitative analysis technique that provides immediate results without the need for complex electronic equipment.

Q10. Answer: (d) -20 cm

The correct answer is -20 cm.

Key Points

• In optics, the magnification (m) produced by a lens is defined as the ratio of the image distance (v) to the object distance (u). The formula is expressed as $m = v / u$.

• According to the question, the magnification (m) is -2 and the image distance (v) is 40 cm. Substituting these values into the formula gives $-2 = 40 / X$, where X represents the object distance.

• By rearranging the equation to solve for X, we get $X = 40 / -2$, which results in $X = -20$ cm. Hence, the statement that the object distance is -20 cm is correct.

• The negative sign in the result -20 cm indicates that the object is placed in front of the lens, which is consistent with the standard Cartesian sign convention where the object distance is always taken as negative.

• Since the magnification is negative (-2), it signifies that the image formed by the convex lens is real and inverted. Hence, the correct answer is -20 cm.

Additional Information

• Convex Lens Characteristics:

• A convex lens is also known as a converging lens because it converges parallel rays of light passing through it.

• It can form both real and virtual images depending on the position of the object relative to the focal point.

• In this specific case, the magnification of -2 tells us the image is magnified (twice the size of the object) and inverted.

• Sign Convention for Lenses:

• Object distance (u): Always negative as the object is placed to the left of the lens.

• Image distance (v): Positive for real images (formed on the right side) and negative for virtual images (formed on the left side).

• Focal length (f): For a convex lens, the focal length is always positive, while for a concave lens, it is negative.

• Lens Formula:

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

• Using the values from the question ($v = 40$ cm, $u = -20$ cm), the focal length would be calculated as $1/f = 1/40 - 1/(-20) = 1/40 + 1/20 = 3/40$, meaning $f = 40/3 = 13.33$ cm.

Important Points

• Nature of Magnification:

• If $|m| > 1$, the image is enlarged.

• If $|m| < 1$, the image is diminished.

• If m is negative, the image is real and inverted.

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• If m is positive, the image is virtual and erect.

• Practical Applications:

• Convex lenses are used in microscopes, telescopes, magnifying glasses, and cameras.

• They are also used in spectacles to correct hypermetropia (long-sightedness).

Q11. Answer: (d) 10 Ω

The correct answer is 10 Ω.

Key Points

• In an electrical circuit, when resistors are connected in parallel, the reciprocal of the equivalent resistance (Req) is the sum of the reciprocals of the individual resistances.

• The mathematical formula for two resistors (R1 and R2) in parallel is: 1/Req = 1/R1 + 1/R2.

• According to the question, the equivalent resistance of the two resistors in parallel is 5 Ω.

• When one resistor is removed, the circuit resistance increases to 10 Ω. This indicates that the value of the remaining resistor (let's assume R1) is 10 Ω.

• By substituting the given values into the parallel formula: 1/5 = 1/10 + 1/R2.

• Rearranging the equation to solve for the unknown resistor: 1/R2 = 1/5 - 1/10.

• Taking the common denominator: 1/R2 = (2 - 1) / 10, which results in 1/R2 = 1/10.

• Thus, the value of the other resistor R2 is 10 Ω.

• Hence, the correct answer is 10 Ω.

Additional Information

• Parallel Combination Features:

• The potential difference (voltage) across each resistor in a parallel combination remains the same.

• The total current in the circuit is the sum of the currents flowing through each individual branch.

• The equivalent resistance is always smaller than the smallest individual resistance in the parallel network.

• Application: Household electrical wiring is done in parallel so that each appliance can operate independently with the same voltage.

• Series Combination Features:

• In a series circuit, resistors are connected end-to-end, and the total resistance (Rs) is the simple sum: Rs = R1 + R2 + ... + Rn.

• The current flowing through each resistor in a series circuit is the same.

• The total voltage is divided across the resistors based on their resistance values.

• Ohm's Law:

• Proposed by Georg Simon Ohm in 1827, it states that the current (I) passing through a conductor is directly proportional to the voltage (V) across it, provided physical conditions like temperature remain constant (V = I × R).

Important Points

• Identical Resistors: If n identical resistors, each with resistance R, are connected in parallel, the equivalent resistance is calculated as Req = R / n.

• In this specific problem, we have two 10 Ω resistors. Applying the shortcut: Req = 10 / 2 = 5 Ω, which perfectly matches the initial condition provided in the question.

• Resistance Factors: The resistance of a conductor depends on its length (directly proportional), cross-sectional area (inversely proportional), the nature of the material (resistivity), and temperature.

• Unit of Resistance: The SI unit of resistance is the Ohm, symbolized by the Greek letter Ω (Omega).

Q12. Answer: (a) Reverberation helps in improving the clarity of sound.

The correct answer is Reverberation helps in improving the clarity of sound..

Key Points

• Reverberation of sound is the phenomenon where a sound persists for some time even after the source of the sound has stopped. It occurs as a result of the multiple reflections of sound. Therefore, the fourth statement (4) is correct.

• When sound is produced in a large hall with hard walls, it reflects repeatedly from the walls, ceiling, and floor, causing the sound to be heard for a prolonged duration. Therefore, the third statement (3) is correct.

• Due to excessive reverberation, a new sound begins before the previous one finishes, causing the sounds to overlap with one another. This reduces the clarity of the sound and causes a disruption in conversation. Therefore, the second statement (2) is correct.

• Reverberation does not help in improving the clarity of sound; rather, it makes the sound blurred. If reverberation exceeds a certain limit, it becomes difficult to understand speech or music. Therefore, the first statement (1) is incorrect or not correct.

• Hence, the correct answer is 1.

Additional Information

• Reverberation Time: The time required for the intensity of sound to decrease by 60 decibels (60 dB) after the sound source has stopped is called the reverberation time. For an ideal hall, this time should neither be too long nor too short.

• Sound Absorbent Materials: To control reverberation in large auditoriums or cinema halls, compressed fibreboard, curtains, carpets, and acoustic tiles are used. These materials absorb the sound instead of reflecting it.

• What is meant by Echo: When a sound reflects off an obstacle and comes back to our ears, it is called an echo. To hear a distinct echo, the distance between the source of sound and the obstacle must be at least 17.2 meters.

• Practical Example: In a cinema hall, reverberation makes the sound feel deep and powerful, but to control it properly, the walls are covered with sound-absorbent fabrics or boards so that the clarity of speech is not lost.

Important Points

• Laws of Reflection of Sound: Just like light, in the reflection of sound, the angle of incidence is equal to the angle of reflection.

• Disadvantages of High Reverberation: If there is too much reverberation in school classrooms or meeting halls, the speaker's words become unclear, which is termed as acoustically poor.

• Architectural Design: Modern architects follow the principles of acoustics when designing auditoriums so that reverberation and echoes can be properly controlled.

Q13. Answer: (b) Aerenchyma

The correct answer is Aerenchyma.

Key Points

• Aerenchyma is a specialized type of parenchyma tissue characterized by the presence of large air cavities or intercellular spaces.

• It is primarily found in aquatic plants (also known as hydrophytes), such as Lotus, Water Hyacinth (Eichhornia), and Hydrilla.

• The main function of these air cavities is to provide buoyancy to the plant, which helps them float on or near the water surface. Hence, option 2 is correct.

• Beyond buoyancy, aerenchyma also facilitates the internal diffusion of gases like oxygen and carbon dioxide between the aerial parts and the submerged tissues, which is vital for respiration and photosynthesis in an aquatic environment.

• The cells in this tissue are typically thin-walled and arranged in a way that creates a sponge-like network within the cortex of roots and stems.

Additional Information

• Chlorenchyma:

• This is a type of parenchyma that contains chlorophyll and is responsible for performing photosynthesis.

• It is commonly found in the mesophyll of leaves and the outer green layers of herbaceous stems. Hence, option 1 is incorrect.

• Tracheid:

• Tracheids are elongated, tube-like cells that form a part of the xylem (complex permanent tissue).

• These cells are dead at maturity, have lignified walls, and are responsible for the conduction of water and minerals in vascular plants. Hence, option 3 is incorrect.

• Companion Cell:

• These are specialized parenchymatous cells located in the phloem and are always associated with sieve tube elements.

• They possess a dense cytoplasm and a large nucleus to help regulate the pressure gradient and metabolic activities required for the translocation of food. Hence, option 4 is incorrect.

Important Points

• Parenchyma: It is the most common simple permanent tissue in plants, consisting of relatively unspecialized cells with thin cellulose walls. They are living cells and serve functions like storage, secretion, and support.

• Plant Tissue Classification:

• Meristematic Tissues: Responsible for growth through active cell division (Apical, Lateral, and Intercalary).

• Simple Permanent Tissues: Composed of a single type of cell (Parenchyma, Collenchyma, and Sclerenchyma).

• Complex Permanent Tissues: Composed of more than one type of cell working together as a unit (Xylem and Phloem).

• Collenchyma: Provides mechanical support and flexibility to parts like the petiole of a leaf, allowing them to bend without breaking.

• Sclerenchyma: Consists of dead cells with very thick lignin deposits, providing rigidity and strength to the plant body (found in husk of coconut).

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Q14. Answer: (c) Ribosome

The correct answer is Ribosome.

Key Points

• Ribosomes are the only organelles mentioned that are non-membrane bound. They are granular structures composed of ribonucleic acid (RNA) and proteins, serving as the primary site for protein synthesis in both prokaryotic and eukaryotic cells.

• Chromoplasts are a type of plastid responsible for pigment synthesis and storage. They contain fat-soluble carotenoid pigments like carotene and xanthophylls. These organelles are enclosed by a double membrane.

• Vacuoles are large, membrane-bound sacs found in the cytoplasm. In plant cells, they can occupy up to 90 percent of the volume and are bound by a single membrane called the tonoplast.

• Lysosomes are vesicular structures formed by the Golgi apparatus. They are membrane-bound and contain various hydrolytic enzymes such as lipases, proteases, and carbohydrases, which are active at an acidic pH.

• Because Chromoplasts, Vacuoles, and Lysosomes all possess at least one surrounding lipid layer, they are classified as membrane-bound, whereas the Ribosome lacks this structure.

Additional Information

• Eukaryotic Cells: These cells are characterized by the presence of a membrane-bound nucleus and other specialized structures called organelles. The cytoplasm of these cells is compartmentalized by these membranes.

• Double Membrane-bound Organelles:

• Mitochondria: Known as the powerhouse of the cell, involved in ATP production.

• Chloroplasts: Found in plants and algae, responsible for photosynthesis.

• Nucleus: Contains the genetic material (DNA) and is surrounded by the nuclear envelope.

• Single Membrane-bound Organelles:

• Endoplasmic Reticulum (ER): Involved in lipid and protein synthesis.

• Golgi Apparatus: Functions in the packaging and secretion of macromolecules.

• Peroxisomes: Small vesicles involved in oxidative reactions and detoxification.

• Non-membrane-bound Organelles:

• Apart from Ribosomes, other examples include Centrioles (found in animal cells and involved in cell division) and the Nucleolus (located inside the nucleus, involved in rRNA synthesis).

Important Points

• Discovery: Ribosomes were first observed as dense particles under an electron microscope by George Palade in the year 1953.

• Svedberg Unit (S): Ribosomes are measured by their sedimentation coefficient. Eukaryotic ribosomes are 80S (composed of 60S and 40S subunits), while prokaryotic ribosomes are 70S (composed of 50S and 30S subunits).

• Location: In eukaryotes, ribosomes are found freely in the cytoplasm, attached to the Rough Endoplasmic Reticulum (RER), or inside organelles like mitochondria and plastids.

Q15. Answer: (a) 0.2 m/s2 and 9 km

The correct answer is 0.2 m/s2 and 9 km.

Key Points

• The boy starts from rest, which means the initial velocity (u) is 0 m/s. This is a fundamental concept in kinematics where "rest" denotes no motion at the start time (t = 0).

• The final velocity (v) reached by the boy is 60 m/s. The time taken to reach this velocity is 5 minutes. To use standard physical formulas, this time must be converted into seconds: 5 minutes multiplied by 60 seconds equals 300 seconds.

• Acceleration (a) is defined as the rate of change of velocity. Using the formula a = (v - u) / t, we substitute the values: a = (60 - 0) / 300, which simplifies to 60 / 300. This results in an acceleration of 0.2 m/s2.

• The distance (s) covered under uniform acceleration can be calculated using the second equation of motion: $s = ut + (1/2)at^2$. Since the initial velocity is 0, the formula becomes $s = 0.5 \times 0.2 \times (300)^2$.

• Calculating the distance gives $s = 0.1 \times 90{,}000$, which equals 9,000 meters. To convert this value into kilometers, we divide by 1,000, resulting in exactly 9 km. Hence, the calculated values for acceleration and distance are 0.2 m/s2 and 9 km respectively.

Additional Information

• Equations of Motion: These equations describe the behavior of physical systems in terms of their motion as a function of time. They are valid only when acceleration is constant (uniform). The three primary equations are:

• $v = u + at$ (Velocity-Time relation).

• $s = ut + 1/2\ at^2$ (Position-Time relation).

• $v^2 = u^2 + 2as$ (Position-Velocity relation).

• Acceleration: It is a vector quantity, meaning it has both magnitude and direction. The SI unit for acceleration is meters per second squared (m/s2). If the velocity increases, the acceleration is positive; if it decreases, it is known as retardation or negative

acceleration.

• Uniform vs. Non-Uniform Motion: In uniform motion, an object covers equal distances in equal intervals of time (zero acceleration). In uniformly accelerated motion, the velocity changes by equal amounts in equal intervals of time, which is the case in this specific running race scenario.

• Unit Conversions: In physics problems, consistency of units is vital. Velocity is typically measured in m/s or km/h. To convert km/h to m/s, multiply by 5/18. To convert minutes to seconds, multiply by 60. Failure to convert units often leads to incorrect numerical results.

Important Points

• Velocity-Time Graphs: For an object starting from rest with uniform acceleration, the v-t graph is a straight line passing through the origin. The slope of this line represents the acceleration, while the area under the curve represents the total distance covered.

• Practical Application: In sports and automotive engineering, calculating acceleration is crucial for performance analysis. For instance, a sprinter's ability to reach top speed (final velocity) from the blocks (rest) in a specific time frame determines their acceleration rate.

• Scalar vs Vector: While distance is a scalar quantity (only magnitude), displacement is a vector. In a straight-line running race, the magnitude of distance and displacement are the same, allowing for the direct use of the equations of motion to find the path length of 9 km.

Q16. Answer: (a) Plant cell

The correct answer is Plant cell.

Key Points

• Plant cells, specifically specialized cells like guard cells, change their shape by regulating the amount of water present within them through a process called osmosis.

• When water flows into the guard cells, they swell and become turgid, which causes the stomata (small pores on leaves) to open. Conversely, when water leaves the cells, they shrink and become flaccid, leading to the closure of the stomata. Hence, statement 1 is correct.

• The movement of water is driven by changes in solute concentration, often involving the active transport of potassium ions (K+) into the vacuole, which draws water inward.

• In contrast, animal cells such as cardiac muscle cells, striated muscle cells, and smooth muscle cells do not change shape by water volume; instead, they rely on specialized contractile proteins like actin and myosin that slide past each other. Hence, statements 2, 3, and 4 are incorrect.

• This mechanism in plants is vital for transpiration and gas exchange (CO_2 and O_2) required for photosynthesis.

Additional Information

• Turgor Pressure: This is the force within the plant cell that pushes the plasma membrane against the cell wall. It is maintained by the osmotic flow of water and provides structural integrity to non-woody plants.

• Central Vacuole: In a mature plant cell, the large central vacuole can occupy up to 90% of the cell volume. It acts as the primary storage for water and maintains turgidity.

• Plasmolysis: This occurs when a plant cell is placed in a hypertonic solution, causing water to leave the cell and the protoplast to shrink away from the cell wall.

• Muscle Contraction: In Cardiac, Striated (Skeletal), and Smooth muscle cells, shape change (contraction) is triggered by electrical impulses and the release of Calcium ions (Ca^{2+}), utilizing ATP as the energy source.

• Cell Wall: Unlike animal cells, plant cells possess a rigid cell wall made of cellulose, which prevents the cell from bursting when it takes in large amounts of water.

Important Points

• Osmoregulation: This is the process by which plants maintain the water potential and osmotic pressure of their fluids, ensuring that metabolic activities continue even under varying environmental moisture levels.

• Stomatal Regulation: The guard cells are unique epidermal cells because they contain chloroplasts and can respond to light intensity and carbon dioxide levels to adjust the water content and cell shape.

• Hydrostatic Pressure: The reliance on hydrostatic pressure for movement is common in the plant kingdom (e.g., the closing of Mimosa pudica leaves) but is generally absent in vertebrate muscle mechanics.

Q17. Answer: (c) Potassium

The correct answer is Potassium.

Key Points

• The reactivity series, also known as the activity series, is an empirical, calculated, and analytically hierarchical arrangement of metals in descending order of their chemical reactivity.

• Potassium (chemical symbol K, atomic number 19) is placed at the top or the starting of this series because it is the most reactive metal among the common elements.

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• Metals at the top of the series, such as Potassium and Sodium, lose their valence electrons very easily to form positive ions (cations), making them highly electropositive.

• Because of its extreme reactivity, Potassium reacts violently even with cold water to produce hydrogen gas and potassium hydroxide, releasing enough heat to ignite the hydrogen. Hence, statement 3 is the correct option.

• In contrast, Aluminium is placed lower than Potassium, Sodium, and Magnesium. Iron is situated in the middle of the series, and Gold is located at the very bottom as it is one of the least reactive metals.

Additional Information

• Displacement Reactions: A fundamental application of the reactivity series is predicting displacement reactions, where a more reactive metal (like Potassium or Zinc) will displace a less reactive metal (like Copper or Silver) from its salt solution.

• Reaction with Water and Acids:

• Metals like Potassium, Sodium, and Calcium react with cold water.

• Metals like Magnesium react with hot water.

• Metals like Aluminium, Zinc, and Iron react only with steam.

• Gold, Silver, and Platinum do not react with water or dilute acids at all.

• Extraction Methods: The position in the series determines the extraction process. Metals at the top (Potassium to Aluminium) are extracted via electrolysis of their molten ores. Metals in the middle (Zinc to Lead) are reduced using carbon (coke). Metals at the bottom (Gold and Silver) are often found in their native state in nature.

• Noble Metals: Gold (Au) and Platinum (Pt) are referred to as noble metals because they remain unaffected by air, moisture, and most acidic reagents, which is why they are used in jewelry and electronics.

Important Points

• Storage of Reactive Metals: Due to their high affinity for oxygen and moisture, Potassium and Sodium are stored under kerosene oil to prevent accidental fires or oxidation in the open air.

• Hydrogen Reference: Although it is a non-metal, Hydrogen is included in the reactivity series to serve as a reference point. Metals placed above hydrogen can displace it from dilute acids to form hydrogen gas, while those below it cannot.

• Order of the Series (Descending): Potassium > Sodium > Calcium > Magnesium > Aluminium > Zinc > Iron > Tin > Lead > [Hydrogen] > Copper > Mercury > Silver > Gold.

• Chemical Symbols and Atomic Numbers:

• Potassium (K): 19

• Aluminium (Al): 13

• Iron (Fe): 26

• Gold (Au): 79

Q18. Answer: (b) Vinegar

The correct answer is Vinegar.

Key Points

• A heterogeneous mixture is a mixture in which the composition is not uniform throughout and the different components can be observed as separate phases.

• Vinegar: It is a homogeneous mixture (solution) of acetic acid and water. Because the acetic acid dissolves completely in water, the mixture has a uniform appearance and composition throughout. Hence, this is not a heterogeneous mixture and is the correct answer.

• Water in oil: Water and oil are immiscible liquids. When mixed, they form two distinct layers or droplets, making the composition non-uniform. Hence, statement 1 is a heterogeneous mixture.

• Sand and sugar: This is a mixture of two different solid substances. The grains of sand and sugar do not blend into a single phase and can be easily identified or separated. Hence, statement 3 is a heterogeneous mixture.

• Sand and salt: Similar to sand and sugar, sand and salt crystals remain distinct from each other when mixed together in a solid state. Hence, statement 4 is a heterogeneous mixture.

Additional Information

• Homogeneous Mixtures:

• These mixtures have a uniform composition and a single phase.

• Common examples include Air (a mixture of gases like Nitrogen and Oxygen), Alloys (like Steel or Brass), and Saltwater.

• In these mixtures, the particles are distributed at the molecular or atomic level.

• Heterogeneous Mixtures:

• These mixtures consist of physically distinct parts and often have visible boundaries between components.

• Examples include Suspensions (like Muddy water), Colloids (like Milk or Fog), and mechanical mixtures like Trail mix.

• The components can typically be separated using physical methods such as filtration, sorting, or decantation.

• Vinegar Properties:

• Vinegar usually contains about 5 percent to 8 percent acetic acid by volume.

• It is widely used in food preservation (pickling), cooking, and as a mild cleaning agent due to its acidic nature.

• The pH value of commercial vinegar is typically around 2.4 to 3.4.

• Miscibility and Solubility:

• The ability of a substance to form a homogeneous mixture depends on its solubility and chemical polarity.

• Water is a polar solvent, while Oil is non-polar, which is why they do not mix and instead form a heterogeneous mixture.

Q19. Answer: (c) Two

The correct answer is Two.

Key Points

• Gregor Johann Mendel, during his pioneering inheritance studies in the mid-19th century, proposed that every trait in a sexually reproducing organism is controlled by two copies of a discrete unit called a factor.

• These factors, which we now identify as genes, are passed from parents to offspring. Mendel suggested that an individual receives one factor from each parent, resulting in a pair that determines the expressed characteristic.

• This concept was fundamental to his Law of Segregation, which states that during the formation of gametes (eggs and sperm), the two copies of each factor separate so that each gamete carries only one factor for each trait.

• Upon fertilization, the two factors are restored in the zygote, ensuring that the offspring has a complete set of two factors, maintaining the diploid nature of the organism.

• The presence of two copies allows for variations in traits, as the factors can be identical (homozygous) or different (heterozygous).

Additional Information

• Pisum sativum (Garden Pea): Mendel chose the garden pea for his experiments conducted between 1856 and 1863. This plant was ideal because it had seven distinct pairs of contrasting traits, such as tall vs. dwarf stems and round vs. wrinkled seeds.

• Alleles: In modern genetics, the different forms of a factor are called alleles. For example, the gene for height has two alleles: T (tall) and t (dwarf).

• Dominant and Recessive: Mendel observed that in a pair of different factors, one could mask the expression of the other. The expressed factor is dominant, while the masked one is recessive.

• Genotype vs. Phenotype: The genotype refers to the actual genetic makeup (the two factors/alleles present, e.g., Tt), whereas the phenotype is the observable physical characteristic (e.g., a tall plant).

• Monohybrid Cross: By crossing plants with two different versions of a single trait, Mendel consistently observed a 3:1 ratio in the F2 generation, which statistically proved the existence of paired factors.

Important Points

• Publication and Rediscovery: Mendel published his findings in 1866 in the paper "Experiments on Plant Hybridization." However, his work remained largely ignored until its rediscovery in 1900 by Hugo de Vries, Carl Correns, and Erich von Tschermak.

• Diploidy: The proposal of two factors aligns with the biological reality of homologous chromosomes. Humans and many other organisms are diploid, meaning they have two sets of chromosomes, one from each parent.

• Mendel’s Laws: His studies led to the formulation of three major laws: the Law of Dominance, the Law of Segregation, and the Law of Independent Assortment.

• Significance: The realization that two copies of a factor control inheritance provided the mathematical basis for the science of genetics, allowing scientists to predict the probability of traits appearing in future generations.

Q20. Answer: (a) Uterus

The correct answer is Uterus.

Key Points

• Contraceptive devices like the loop or the copper-T are categorized as Intrauterine Devices (IUDs). These are specifically designed to be inserted and placed within the uterus of the female reproductive system. Hence, option 1 is correct.

• The uterus, also known as the womb, is the ideal location for these devices because it is where implantation of a fertilized egg occurs. By occupying this space, the IUD prevents the embryo from attaching to the uterine wall.

• These devices must be inserted by doctors or expert nurses through the vagina and the cervical canal into the uterine cavity. They are not intended for placement in the heart, kidney, or ovaries, as these organs are not involved in the direct process of conception or gestation.

• The primary mechanism of devices like the Copper-T is to release copper ions, which increase the phagocytosis of sperms within the uterus. This makes the environment hostile to spermatozoa, effectively preventing fertilization.

• IUDs are currently one of the most widely accepted methods of contraception in India, particularly for women who want to delay pregnancy or space out births between children.

Additional Information

• Types of Intrauterine Devices (IUDs):

• Non-medicated IUDs: An example is the Lippes Loop. These work by causing a minor inflammatory response in the uterus that prevents implantation.

• Copper-releasing IUDs: Common examples include CuT (Copper-T), Cu7, and Multiload 375. The copper ions released suppress sperm motility and the fertilizing capacity of the sperm.

• Hormone-releasing IUDs: Examples include Progestasert and LNG-20. These release progestogens that make the uterus unsuitable for implantation and make the cervix hostile to sperm by thickening the cervical mucus.

• Effectiveness and Duration:

• IUDs are highly effective, with a failure rate of less than 1%.

• Depending on the specific model, a Copper-T can remain effective for 3, 5, or even 10 years, making it a long-term reversible contraceptive method.

• Biological Roles of Other Options:

• Heart: The heart is a muscular organ responsible for pumping blood throughout the circulatory system. It has no role in reproductive contraception.

• Kidney: The kidneys are vital organs of the excretory system, responsible for filtering waste products from the blood to form urine.

• Ovary: The ovaries are the primary female sex organs that produce ova (eggs) and secrete hormones like estrogen and progesterone. While they are part of the reproductive system, IUDs are not placed inside them.

Important Points

• Side Effects: Common side effects of IUD insertion can include irregular bleeding, cramping, or pelvic inflammatory disease in rare cases.

• Reversibility: One of the biggest advantages of the Copper-T or loop is that fertility returns to normal almost immediately after the device is removed by a healthcare professional.

• Protection: It is important to note that while IUDs are excellent for preventing pregnancy, they do not provide protection against Sexually Transmitted Diseases (STDs) or HIV/AIDS; only barrier methods like condoms provide such protection.

Q21. Answer: (a) ultraviolet

The correct answer is ultraviolet.

Key Points

• The Ozone layer is a thin part of the Earth's atmosphere that absorbs almost all of the sun's harmful ultraviolet (UV) radiation.

• It is primarily found in the lower portion of the stratosphere, approximately 15 to 35 kilometers above Earth's surface.

• The ozone molecule is made up of three oxygen atoms (O3), which are formed when UV light hits ordinary oxygen molecules (O2) and splits them into individual atoms that then combine with other O2 molecules.

• By absorbing UV-B and UV-C radiation, the ozone layer prevents these high-energy rays from reaching the ground, where they could cause skin cancer, cataracts, and damage to DNA in humans and animals.

• It also plays a crucial role in protecting phytoplankton and terrestrial plants, which are the base of the food chain and sensitive to intense radiation.

Additional Information

• The Montreal Protocol:

• This is an international treaty signed in 1987 to protect the ozone layer by phasing out the production of numerous substances responsible for ozone depletion.

• The main chemicals targeted are Chlorofluorocarbons (CFCs) and Halons, which were commonly used in refrigeration and aerosol sprays.

• Measurement of Ozone:

• The concentration of ozone in the atmosphere is measured in Dobson Units (DU).

• A "hole" in the ozone layer is technically defined as an area where the concentration drops below 220 Dobson Units.

• Types of Radiation:

• Infrared (IR) Radiation: These are long-wavelength rays that are mostly experienced as heat; they are absorbed by greenhouse gases like carbon dioxide.

• Gamma Rays: These are extremely high-frequency electromagnetic bursts that are typically blocked by the Earth's upper atmosphere (thermosphere).

• Cosmic Rays: These are high-energy particles originating from outside the solar system, largely diverted by the Earth's magnetic field (magnetosphere).

• World Ozone Day:

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• The United Nations General Assembly designated September 16 as the International Day for the Preservation of the Ozone Layer.

Important Points

• Formation: Ozone is naturally produced through the photochemical reaction known as the Chapman Cycle.

• Location: While stratospheric ozone is beneficial (protecting life), ground-level ozone (tropospheric ozone) is a pollutant and a primary component of smog.

• Recent Trends: Due to the success of the Montreal Protocol, the ozone layer is currently healing and is expected to return to 1980 levels by the mid-21st century.

Q22. Answer: (b) Ammeter

The correct answer is Ammeter.

Key Points

• Archimedes' principle states that when a body is partially or completely immersed in a fluid, it experiences an upward buoyant force that is equal to the weight of the fluid displaced by the body.

• Ammeter: This is an instrument used to measure electric current in a circuit. It operates based on the principle of electromagnetism, where a current-carrying coil placed in a magnetic field experiences a torque (Lorentz Force). It has no relation to fluid displacement or buoyancy. Hence, statement 2 is the correct answer as it is not based on Archimedes' principle.

• Submarine: These vessels use ballast tanks to manage their buoyancy. By filling these tanks with water, the submarine's weight increases to exceed the buoyant force, allowing it to sink. To surface, compressed air pushes the water out, making the submarine lighter than the displaced water. Hence, statement 1 is based on the principle.

• Hydrometer: This instrument is used for measuring the relative density or specific gravity of liquids. It is designed to float in a liquid, and the depth to which it sinks depends on the density of the fluid, directly applying the law of buoyancy. Hence, statement 3 is based on the principle.

• Lactometer: This is a specialized type of hydrometer used specifically to test the purity of milk. It works by measuring the density of milk compared to water; if the milk is adulterated, its specific gravity changes, which is reflected in the lactometer's reading. Hence, statement 4 is based on the principle.

Additional Information

• Buoyancy: It is the upward force exerted by a fluid that opposes the weight of a partially or fully immersed object. In a column of fluid, pressure increases with depth as a result of the weight of the overlying fluid.

• Ammeter Connection: An ammeter is always connected in series within a circuit to measure the total flow of electrons. It is designed with very low resistance so that it does not significantly alter the current it is intended to measure.

• Ship Design: Large ships made of steel float because they are hollowed out, ensuring the total volume of water they displace weighs more than the ship itself, illustrating a primary application of Archimedes' principle.

• Relative Density: It is a dimensionless quantity defined as the ratio of the density of a substance to the density of a reference material (usually water at 4 degrees Celsius).

Important Points

• Discovery: The principle was discovered by the Greek mathematician Archimedes of Syracuse in the 3rd century BC. Legend says he discovered it while stepping into a bath, leading him to shout "Eureka!"

• Mathematical Expression: The buoyant force (Fb) can be calculated as $Fb = \rho \times V \times g$, where ρ (rho) is the density of the fluid, V is the volume of the displaced fluid, and g is the acceleration due to gravity (approximately 9.8 m/s^2).

• Floating and Sinking: An object will float if its density is less than the fluid's density and sink if its density is greater. If the densities are equal, the object will remain suspended at its current depth (neutral buoyancy).

Q23. Answer: (c) a = (v - u)/t

The correct answer is a = (v - u)/t.

Key Points

• Acceleration is defined as the rate of change of velocity of an object with respect to time. It describes how quickly the speed or direction of a moving body changes.

• In the given context, u represents the initial velocity (the velocity at the start of the time interval), v represents the final velocity (the velocity at the end of the time interval), and t represents the time taken for this change to occur.

• The formula for acceleration (a) is derived from the change in velocity divided by the time interval: a = (Final Velocity - Initial Velocity) / Time. Hence, the statement a = (v - u) / t is correct.

• If an object moves with constant velocity, the acceleration is zero because the difference between the final and initial velocity (v - u) is null.

• Acceleration is a vector quantity, meaning it possesses both magnitude and direction. It points in the same direction as the change in velocity.

Additional Information

• Types of Acceleration:

• Positive Acceleration: This occurs when the final velocity (v) is greater than the initial velocity (u). It implies that the object is speeding up in the direction of motion.

• Negative Acceleration (Retardation/Deceleration): This occurs when the final velocity (v) is less than the initial velocity (u). In this case, the acceleration value is negative, indicating the object is slowing down.

• Uniform Acceleration: When the velocity of an object changes by equal amounts in equal intervals of time, the motion is said to be uniformly accelerated. A classic example is a ball falling freely under gravity.

• SI Unit and Dimensions:

• The Standard International (SI) unit for acceleration is meter per second squared (m/s^2).

• In terms of dimensional analysis, it is represented as $[M^0 L^1 T^{-2}]$.

• Equations of Motion:

• The formula $a = (v - u) / t$ is often rearranged to form the first equation of motion: $v = u + at$.

• These equations were famously described by Sir Isaac Newton and are fundamental to Classical Mechanics.

Important Points

• Graphical Representation: On a Velocity-Time (v-t) graph, the slope of the line represents the acceleration. A steeper slope indicates a higher rate of acceleration, while a horizontal line indicates zero acceleration (constant velocity).

• Newton's Second Law: The concept of acceleration is central to Newton's Second Law of Motion, which states that Force (F) is equal to mass (m) multiplied by acceleration (a), expressed as $F = ma$.

• Instantaneous vs. Average: Average acceleration is calculated over a finite time interval, whereas instantaneous acceleration is the acceleration at a specific moment in time, calculated using calculus as the derivative of velocity with respect to time (dv/dt).

• Directional Changes: Even if the speed of an object remains constant, it is still accelerating if its direction changes. A prime example is Uniform Circular Motion, where the object undergoes centripetal acceleration directed toward the center of the circle.

Q24. Answer: (d) Larger surface area increases evaporation

The correct answer is Larger surface area increases evaporation.

Key Points

• Evaporation is defined as a surface phenomenon where molecules in a liquid state spontaneously transition into a gaseous state at any temperature below the boiling point.

• The rate of evaporation is directly proportional to the surface area exposed to the atmosphere. When the surface area is increased, a larger number of molecules are positioned at the surface, providing more opportunities for them to escape into the air. Hence, statement 4 is correct.

• In a smaller surface area, fewer molecules are exposed to the environment at any given time, which leads to a significant reduction in the rate of vapor formation. Hence, statement 1 is incorrect.

• Evaporation occurs most effectively in open containers where vapor can diffuse away. In a closed container, the process eventually reaches dynamic equilibrium, where the rate of evaporation equals the rate of condensation, resulting in no net loss of liquid. Hence, statement 2 is incorrect.

• Scientific principles of thermodynamics confirm that the physical dimensions and exposure of the liquid surface are critical determinants of how fast a substance evaporates. Hence, statement 3 is incorrect.

Additional Information

• Factors Affecting Evaporation:

• Temperature: As the temperature of a liquid increases, the kinetic energy of its molecules also increases. More molecules acquire the energy needed to overcome intermolecular forces, thereby increasing the rate of evaporation.

• Humidity: Humidity is the measure of water vapor present in the air. If the atmospheric humidity is high, the air’s capacity to hold more moisture is limited, which decreases the rate at which a liquid evaporates.

• Wind Speed: An increase in wind speed helps in moving the vapor particles away from the surface of the liquid quickly. This prevents the air above the liquid from becoming saturated, thus speeding up evaporation.

• Nature of the Liquid: Different liquids evaporate at different rates based on their chemical properties. Volatile liquids like acetone or alcohol have weaker bonds between molecules compared to water, causing them to evaporate much faster.

• Practical Examples:

• Drying Clothes: We spread out wet clothes on a line to increase the surface area, which ensures they dry faster than if they were bunched up.

• Cooling in Saucers: Hot tea or coffee is often poured into a saucer to cool it down quickly. The larger surface area of the saucer promotes rapid evaporation, which is an endothermic process that carries away heat.

Important Points

• Molecular Mechanism: Unlike boiling, which is a bulk phenomenon occurring throughout the liquid, evaporation only involves molecules at the topmost layer. These surface molecules absorb energy from the surroundings to break free from the liquid phase.

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• Cooling Effect: Evaporation always causes cooling. This happens because the high-energy molecules leave the liquid, reducing the average kinetic energy of the remaining molecules, which results in a drop in temperature.

• Latent Heat of Vaporization: The amount of heat energy required to change 1 kg of a liquid into gas at atmospheric pressure without a change in temperature is known as the latent heat of vaporization.

Q25. Answer: (d) K > Mg > Al > Zn

The correct answer is K > Mg > Al > Zn.

Key Points

• The Reactivity Series of metals, also known as the Activity Series, is an arrangement of metals in the descending order of their chemical reactivity. It helps in predicting the outcome of displacement reactions and the extraction methods for metals.

• Potassium (K) is an Alkali metal belonging to Group 1 of the periodic table. It is highly electropositive and is one of the most reactive metals, reacting vigorously with water and air. It occupies a position at the very top of the reactivity series.

• Magnesium (Mg) is an Alkaline earth metal in Group 2. While it is highly reactive, its ability to lose electrons is lower than that of Group 1 metals like Potassium. It reacts slowly with cold water but rapidly with boiling water or steam.

• Aluminium (Al) belongs to Group 13. It is less reactive than Magnesium. Although it is quite reactive, it often forms a thin, protective layer of Aluminium Oxide on its surface, which prevents further reaction. In the series, it follows Magnesium.

• Zinc (Zn) is a Transition metal. It is less reactive than Aluminium and Magnesium. It does not react with cold water but reacts with steam to form zinc oxide and hydrogen gas.

• Based on the tendency of these metals to lose electrons and form positive ions, the correct decreasing order of reactivity is Potassium (K) > Magnesium (Mg) > Aluminium (Al) > Zinc (Zn). Hence, the correct answer is K > Mg > Al > Zn.

Additional Information

• Displacement Reactions:

• A more reactive metal has the power to displace a less reactive metal from its salt solution. For example, if Magnesium is added to a Zinc Sulphate solution, it will displace Zinc because Mg is higher in the reactivity series.

• Conversely, Zinc cannot displace Magnesium from its salt solution because it is lower in the series.

• Reaction with Acids:

• Metals placed above Hydrogen in the reactivity series (like K, Mg, Al, and Zn) can displace Hydrogen gas from dilute hydrochloric acid or sulphuric acid.

• The rate of evolution of hydrogen bubbles decreases as we move from Potassium to Zinc in the series.

• Periodic Table Trends:

• In the periodic table, metallic character (reactivity) generally increases as we go down a group due to increasing atomic size and decreasing ionization energy.

• Reactivity generally decreases across a period from left to right as the effective nuclear charge increases, making it harder for atoms to lose electrons.

Important Points

• Storage of Potassium: Due to its extreme reactivity with oxygen and moisture in the air, Potassium (K) and Sodium (Na) are always stored under Kerosene to prevent accidental fires.

• Galvanization: Zinc (Zn) is used in the process of Galvanization. Since Zinc is more reactive than Iron (Fe), it acts as a sacrificial layer, corroding first and protecting the underlying iron from rusting.

• Reduction Methods:

• High-reactivity metals (K, Na, Ca, Mg, Al) are extracted via Electrolytic Reduction of their molten chlorides or oxides.

• Medium-reactivity metals (Zn, Fe, Pb) are usually extracted by reducing their oxides with Carbon (Coke).

• Amphoteric Nature: Both Aluminium and Zinc are special because they react with both acids and bases to produce hydrogen gas, showing amphoteric properties.

Q26. Answer: (b) 1

Shortcut Trick

Let the efficiency of the emptying hole be −3 units/hour (empties the tank of 3 units in 1 hour).

To maintain the level, 3 filling pipes are required => Efficiency of 3 filling pipes = +3 units/hour => Efficiency of 1 filling pipe = +1 unit/hour.

To fill the tank of 3 units in 3 hours => Required net efficiency = +1 unit/hour.

Net efficiency = (Number of filling pipes × 1) − 3 = 1 => Total filling pipes = 4.

Number of extra pipes required = 4 − 3 = 1 pipe.

Therefore The correct answer is 1.

Alternate Method

Given:

Time taken by the emptying hole to empty the full tank = 1 hour

Number of filling pipes required to maintain the water level = 3

Formula Used:

Work = Efficiency × Time

Calculations:

Let the capacity of the tank be 3 units.

=> Efficiency of the emptying hole = −3 units/hour

To maintain the water level (net efficiency = 0):

=> Efficiency of 3 filling pipes − Efficiency of emptying hole = 0

=> Efficiency of 3 filling pipes = 3 units/hour

=> Efficiency of 1 filling pipe = 1 unit/hour

Let the total number of filling pipes required to fill the empty tank in 3 hours be n.

=> Net efficiency × Time = Total Capacity

=> (n × 1 − 3) × 3 = 3

=> n − 3 = 1

=> n = 4

=> More pipes required = 4 − 3 = 1

Therefore The correct answer is 1.

Additional Information

Maintaining the Water Level

When the water level remains constant, the rate of inflow is exactly equal to the rate of outflow, resulting in zero net work done.

Inlet and Outlet Pipes

Inlet pipes perform positive work (fill the tank), while outlet pipes or leakage holes perform negative work (empty the tank).

Q27. Answer: (d) 40%

Shortcut Trick

Ratio of Cost Price (CP) to Selling Price (SP) = 200 : 280 = 5 : 7.

Profit units = 7 − 5 = 2 units.

Profit percentage = (Profit units ÷ CP units) × 100.

Profit % = (2 ÷ 5) × 100 = 40%.

Therefore The correct answer is 40%.

Alternate Method

Given: Cost Price (CP) = Rs. 200, Selling Price (SP) = Rs. 280.

Formulas: Profit = SP − CP | Profit % = (Profit ÷ CP) × 100

=> Profit = 280 − 200 = Rs. 80.

=> Profit % = (80 ÷ 200) × 100.

=> Profit % = 0.4 × 100 = 40%.

Therefore The correct answer is 40%.

Additional Information

Profit and Loss Basics

Profit occurs when the Selling Price is greater than the Cost Price. It is always calculated on the Cost Price unless specified otherwise.

Loss Percentage

Loss occurs when CP > SP. Formula: Loss % = [(CP − SP) ÷ CP] × 100.

Q28. Answer: (b) 7

Shortcut Trick

Use identity: $64x^2 - 49 = (8x - 7)(8x + 7)$

Cancel (8x − 7) => expression becomes 8x + 7 − 8x

Remaining term = 7

No need to expand fully

Therefore Answer = 7

Alternate Method

Given:

$(64x^2 - 49) \div (8x - 7) - 8x$

Concept Used:

Algebraic identity and simplification

Calculation:

=> $(64x^2 - 49) \div (8x - 7) - 8x$

=> $[(8x - 7)(8x + 7)] \div (8x - 7) - 8x$

=> $(8x + 7) - 8x$

=> 7

Therefore The correct answer is 7.

Additional Information

Difference of Squares

$a^2 - b^2 = (a - b)(a + b)$

Factorization

Break expressions into factors to simplify fractions

Cancellation Rule

Common factors in numerator and denominator can be cancelled

Quick Trick

Always check for identities before expanding expressions

Q29. Answer: (a) 50 : 30

Shortcut Trick

To find an equivalent ratio, multiply or divide both terms of the base ratio by the same non-zero number.

Given ratio = 5 : 3

Multiply both terms by 10 → (5 × 10) : (3 × 10) = 50 : 30.

Therefore The correct answer is 50 : 30.

Alternate Method

Given: Base ratio = 5 : 3

Formula Used: Ratio a : b is equivalent to (a × k) : (b × k)

=> Option 1: 50 : 30 → Divide by 10 → 5 : 3 (Matches)

=> Option 2: 48 : 33 → Divide by 3 → 16 : 11 (Does not match)

=> Option 3: 53 : 31 → Simplest form is 53 : 31 (Does not match)

=> Option 4: 125 : 85 → Divide by 5 → 25 : 17 (Does not match)

Therefore The correct answer is 50 : 30.

Additional Information

Equivalent Ratios

Ratios that express the same relationship between numbers. They can be obtained by multiplying or dividing both terms by the same constant k.

Simplest Form of Ratio

A ratio is in its simplest form when the HCF of both terms is 1. Example: 5 : 3 is the simplest form of 50 : 30.

Ratio Comparison

To compare two ratios a:b and c:d, convert them to fractions a/b and c/d and compare their values.

Q30. Answer: (b) 2/5

Shortcut Trick

Given cosec A = 5/4, so sin A = 4/5 and cos A = 3/5 (using 3-4-5 triplet).

sin 2A = 2 × sin A × cos A = 2 × (4/5) × (3/5) = 24/25.

cos 2A = 1 − 2sin²A = 1 − 2 × (16/25) = (25 − 32)/25 = −7/25.

Value = (24/25) + 2 × (−7/25) = (24 − 14)/25 = 10/25 = 2/5.

Therefore The correct answer is 2/5.

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Alternate Method

Given: cosec A = 5/4

Formula Used: sin 2A = 2 sin A cos A; cos 2A = $\cos^2A - \sin^2A$

=> cosec A = 5/4 => sin A = 4/5

=> $\cos^2A = 1 - \sin^2A = 1 - (4/5)^2 = 1 - 16/25 = 9/25$

=> cos A = 3/5

=> sin 2A = 2 × (4/5) × (3/5) = 24/25

=> $\cos 2A = (3/5)^2 - (4/5)^2 = 9/25 - 16/25 = -7/25$

=> sin 2A + 2cos 2A = 24/25 + 2 × (−7/25)

=> 24/25 − 14/25 = 10/25 = 2/5

Therefore The correct answer is 2/5.

Additional Information

Double Angle Formulas

sin 2θ = 2 sin θ cos θ and $\cos 2\theta = \cos^2\theta - \sin^2\theta = 2\cos^2\theta - 1 = 1 - 2\sin^2\theta$.

Pythagorean Triplets

For any right-angled triangle, $\text{Base}^2 + \text{Perpendicular}^2 = \text{Hypotenuse}^2$. Common triplets include (3, 4, 5), (5, 12, 13), and (8, 15, 17).

Tangent Double Angle

$\tan 2A = (2 \tan A) / (1 - \tan^2A)$. Also, $\sin 2A = (2 \tan A) / (1 + \tan^2A)$ and $\cos 2A = (1 - \tan^2A) / (1 + \tan^2A)$.

Q31. Answer: (d) 129

Shortcut Trick

Apply the British Flag Theorem for any point P related to rectangle ABCD:

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

$87^2 + 96^2 = 12^2 + PD^2$

$7569 + 9216 = 144 + PD^2$

$16785 - 144 = PD^2$ => PD = √16641 = 129 cm

Therefore The correct answer is 129 cm.

Alternate Method

Given: PA = 87 cm, PB = 12 cm, PC = 96 cm.

Formula Used: For any point P inside a rectangle ABCD, the sum of the squares of the distances from P to the opposite vertices is equal: $PA^2 + PC^2 = PB^2 + PD^2$.

Calculations:

=> $PA^2 + PC^2 = PB^2 + PD^2$

=> $87^2 + 96^2 = 12^2 + PD^2$

=> $7569 + 9216 = 144 + PD^2$

=> $16785 = 144 + PD^2$

=> $PD^2 = 16785 - 144$

=> $PD^2 = 16641$

=> PD = √16641

=> PD = 129 cm

Therefore The correct answer is 129 cm.

Additional Information

British Flag Theorem

This theorem states that for any point P (inside, outside, or on the boundary) of a rectangle ABCD, the relation $PA^2 + PC^2 = PB^2 + PD^2$ always holds true.

Rectangle Properties

A rectangle is a quadrilateral with four right angles. Its diagonals are equal in length and bisect each other, which is the fundamental reason behind the British Flag Theorem derivation using Pythagoras Theorem.

Pythagoras Theorem

In a right-angled triangle, the square of the hypotenuse is equal to the sum of the squares of the other two sides: $a^2 + b^2 = c^2$.

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Q32. Answer: (a) 0.44

Shortcut Trick

Recognize identity: $(a^3 - b^3) \div (a^2 + ab + b^2) = a - b$

Here $0.1452 = 0.66 \times 0.22$ => denominator = $a^2 + ab + b^2$

So expression = $a - b$

$= 0.66 - 0.22 = 0.44$

Therefore Answer = 0.44

Alternate Method

Given:

$((0.66)^3 - (0.22)^3) \div ((0.66)^2 + 0.1452 + (0.22)^2)$

Concept Used:

Identity: $a^3 - b^3 = (a - b)(a^2 + ab + b^2)$

Calculation:

=> Let $a = 0.66$, $b = 0.22$

=> Check middle term: $ab = 0.66 \times 0.22 = 0.1452$

=> So denominator = $a^2 + ab + b^2$

=> Using identity:

=> $a^3 - b^3 = (a - b)(a^2 + ab + b^2)$

=> Substitute:

=> Expression = $[(a - b)(a^2 + ab + b^2)] \div (a^2 + ab + b^2)$

=> Cancel common term

=> Expression = $a - b$

=> $= 0.66 - 0.22$

=> $= 0.44$

Therefore The correct answer is 0.44.

Additional Information

Algebraic Identity

$a^3 - b^3 = (a - b)(a^2 + ab + b^2)$

Pattern Recognition

Check if middle term equals product ab

Simplification Trick

Cancel common expressions to reduce computation

Speed Tip

Avoid expanding cubes when identity applies

Q33. Answer: (d) 8

Shortcut Trick

Net efficiency = Filling rate − Emptying rate

Total capacity = 16 units (LCM of 8 and 16)

Efficiency of Filling pipe = 2 and Emptying pipe = 1

Time to fill half tank (8 units) = 8 ÷ (2 − 1) = 8 minutes

Therefore The correct answer is 8 minutes.

Alternate Method

Given: Filling time = 8 minutes, Emptying time = 16 minutes.

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

Pipe Type	Time (min)	Total Work (units)	Efficiency
Filling Pipe	8	16	2
Emptying Pipe	16	−1	

Calculations:

=> Total capacity of the tank = 16 units

=> Capacity to be filled (one-half) = 16 ÷ 2 = 8 units
=> Net efficiency when both pipes are open = 2 − 1 = 1 unit/min
=> Required time = 8 units ÷ 1 unit/min = 8 minutes
Therefore The correct answer is 8 minutes.
Additional Information
Net Filling Rate
If pipe A fills in x hours and pipe B empties in y hours (where y > x), the net rate is (1/x − 1/y) per hour.
Pipes and Cisterns Logic
Filling pipes are considered positive efficiency, while emptying pipes (leaks) are considered negative efficiency.

Q34. Answer: (c) 3272.73

Shortcut Trick
Area in 1 roll = 2 × (22/7) × 1 × (21/22) = 6 m².
Total effort in 600 rolls = 600 × 6 = 3600 m².
Given 10% overlap (rolled twice), Total Effort = 110% of Ground Area.
Total Ground Area = 3600 ÷ 1.1 = 3272.73 m².
Therefore The correct answer is 3272.73 sq. m.
Alternate Method
Given:
Radius (r) of the road roller = 1 m
Length (h) of the road roller = 21/22 m
Number of rolls = 600
Condition: 10% of the ground is rolled twice.
Formula Used:
Curved Surface Area (CSA) of a cylinder = 2 × π × r × h
Calculations:
=> Area covered in 1 rotation (CSA) = 2 × (22/7) × 1 × (21/22)
=> CSA = 2 × (1/7) × 21 = 2 × 3 = 6 m²
=> Total coverage effort by 600 rolls = 600 × 6 = 3600 m²
=> Let the actual total ground area be A.
=> Total effort = (90% of A × 1 roll) + (10% of A × 2 rolls)
=> 3600 = 0.9A + 0.2A = 1.1A
=> A = 3600 ÷ 1.1 = 3272.7272...
=> A ≈ 3272.73 m²
Therefore The correct answer is 3272.73 sq. m.
Additional Information
Curved Surface Area (CSA) of Cylinder
It is the area of the curved part of the cylinder, calculated as 2πrh.
Total Surface Area (TSA) of Cylinder
It includes the CSA and the area of both circular bases: 2πr(h + r).
Volume of Cylinder
The total space occupied by the cylinder: πr²h.

Q35. Answer: (d) 825

Shortcut Trick
Discount of 75% means the Selling Price is 25% of the Cost Price.
SP = 25% of 3,300 = 1/4 × 3,300.
SP = 825.
Therefore The correct answer is Rs. 825.
Alternate Method
Given: Cost Price (CP) = Rs. 3,300, Discount Percentage = 75%.
Formula: Selling Price (SP) = CP − (Discount% × CP).

=> Discount Amount = 75/100 × 3,300
=> Discount Amount = 0.75 × 3,300 = Rs. 2,475
=> Selling Price (SP) = 3,300 − 2,475
=> Selling Price (SP) = Rs. 825
Therefore The correct answer is Rs. 825.
Additional Information
Selling Price calculation from Discount
When discount is offered on the Cost Price (as per problem statement), SP = CP × (100 − Discount%)/100.
Relationship between CP and SP
If SP < CP, there is a loss. Loss = CP − SP.

Q36. Answer: (b) 1,488

Shortcut Trick
Combine ratios M : N = 6 : 8 and N : T = 9 : 6 by making N common.
M : N : T = (6 × 9) : (8 × 9) : (8 × 6) = 54 : 72 : 48 = 9 : 12 : 8.
Total ratio units = 9 + 12 + 8 = 29 units.
Share of N = (12 ÷ 29) × 3,596 = 12 × 124 = Rs. 1,488.
Therefore The correct answer is Rs. 1,488.
Alternate Method
Given: Total amount = Rs. 3,596, M : N = 6 : 8, N : T = 9 : 6.
Formula Used: Combined Ratio a : b : c and Share = (Individual Ratio ÷ Sum of Ratios) × Total Amount.
=> M : N = 6 : 8 = 3 : 4
=> N : T = 9 : 6 = 3 : 2
=> To equalize N, multiply first ratio by 3 and second by 4:
=> M : N = 9 : 12 and N : T = 12 : 8
=> M : N : T = 9 : 12 : 8
=> Total Parts = 9 + 12 + 8 = 29
=> Share of N = (12 ÷ 29) × 3,596
=> Share of N = 12 × 124 = 1,488
Therefore The correct answer is Rs. 1,488.
Additional Information
Ratio Balancing
To combine A : B and B : C, multiply the terms so that the value of B becomes the LCM of its values in both ratios.
Compound Ratio
The compound ratio of a : b and c : d is (a × c) : (b × d).
Division of Proportions
If an amount X is divided in ratio a : b : c, the share of the second person is [b ÷ (a + b + c)] × X.

Q37. Answer: (a) Decreases by 61.39%

Shortcut Trick
Use the multiplying factor method for successive changes.
Final Price = 100 × 0.65 × 0.40 × 0.90 × 1.65
Final Price = 100 × 0.3861 = 38.61
Net change = 38.61 − 100 = −61.39%
Therefore The correct answer is Decreases by 61.39%.
Alternate Method
Assume original price is 100 units.
=> Price after 1st month = 100 − 35% of 100 = 65
=> Price after 2nd month = 65 − 60% of 65 = 65 × 0.40 = 26
=> Price after 3rd month = 26 − 10% of 26 = 26 × 0.90 = 23.4
=> Price after 4th month = 23.4 + 65% of 23.4 = 23.4 × 1.65 = 38.61
=> Net change = Final Price − Original Price = 38.61 − 100 = −61.39

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=> Percentage change = (−61.39 ÷ 100) × 100 = −61.39%

Therefore The correct answer is Decreases by 61.39%.

Additional Information

Successive Percentage Formula

For two changes a% and b%, the net change is (a + b + ab/100)%. For more than two, calculate for the first two and then combine the result with the next.

Multiplying Factor (MF)

Increase by x% means MF = (1 + x/100). Decrease by x% means MF = (1 − x/100). Final value = Initial value × MF1 × MF2 × ... × MF_n.

Percentage Decrease vs Increase

If the final value is less than the initial value, it is a decrease. Percentage Change = [(Final − Initial) ÷ Initial] × 100.

Q38. Answer: (a) 42

Shortcut Trick

Assume a base mean of 40 and calculate deviations from it.

Deviations: (35−40), (26−40), (56−40), (41−40), (56−40), (46−40), (34−40), (16−40), (68−40)

=> −5, −14, +16, +1, +16, +6, −6, −24, +28

Net Deviation = −5 − 14 + 16 + 1 + 16 + 6 − 6 − 24 + 28 = +18

Actual Mean = Assumed Mean + (Net Deviation ÷ Total Count) = 40 + (18 ÷ 9) = 42.

Therefore The correct answer is 42.

Alternate Method

Given: Observations are 35, 26, 56, 41, 56, 46, 34, 16, and 68.

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

=> Total number of observations (n) = 9

=> Sum of observations = 35 + 26 + 56 + 41 + 56 + 46 + 34 + 16 + 68

=> Sum = 378

=> Arithmetic Mean = 378 ÷ 9

=> Arithmetic Mean = 42

Therefore The correct answer is 42.

Additional Information

Properties of Arithmetic Mean

The sum of deviations of a set of observations from their arithmetic mean is always zero (∑(x_i − x) = 0).

Combined Mean

If two groups have sizes n1, n2 and means x1, x2, the combined mean is (n1x1 + n2x2) ÷ (n1 + n2).

Effect of Operations

If each observation is increased, decreased, multiplied, or divided by a constant k, the mean also changes by the same constant k.

Q39. Answer: (b) 16.8 second

Shortcut Trick

Relative Speed (Same direction) = 93 − 33 = 60 kmph

Convert to m/s: 60 × (5/18) = 50/3 m/s

Total Distance to cover = Sum of lengths = 163 + 117 = 280 m

Time Taken = Distance ÷ Relative Speed = 280 ÷ (50/3) = 28 × 0.6 = 16.8 sec

Therefore The correct answer is 16.8 sec.

Alternate Method

Given:

Length of Train 1 (L1) = 163 m

Length of Train 2 (L2) = 117 m

Speed of Faster Train (S1) = 93 km/hr

Speed of Slower Train (S2) = 33 km/hr

Formula Used:

Time = (L1 + L2) ÷ (Relative Speed)

Calculations:

=> Relative Speed = S1 − S2 (Same direction)

=> Relative Speed = 93 − 33 = 60 km/hr

=> Relative Speed in m/s = 60 × (5/18) = 50/3 m/s

=> Total Distance = 163 + 117 = 280 m

=> Time taken = 280 ÷ (50/3)

=> Time taken = (280 × 3) ÷ 50 = 840 ÷ 50

=> Time taken = 16.8 sec

Therefore The correct answer is 16.8 sec.

Additional Information

Relative Speed Concepts

When two objects move in the same direction, Relative Speed = S1 − S2. When they move in opposite directions, Relative Speed = S1 + S2.

Speed Unit Conversion

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

Train Crossing Distance

Whether moving in the same or opposite direction, the total distance covered to cross each other is always the sum of their lengths (L1 + L2).

Q40. Answer: (d) 28%

Shortcut Trick

Net Profit/Loss% = a + b + (a × b) ÷ 100

Here, a = +50 (Mark-up) and b = −52 (Discount).

Net Change = 50 − 52 + (50 × (−52)) ÷ 100

Net Change = −2 − (2600 ÷ 100) = −2 − 26 = −28%.

Negative sign indicates a loss of 28%.

Therefore The correct answer is 28%.

Alternate Method

Given → Mark-up = 50% above CP, Discount = 52% on MP.

Formulas: MP = CP × (100 + Mark-up%) ÷ 100 | SP = MP × (100 − Discount%) ÷ 100 | Loss% = (CP − SP) ÷ CP × 100

=> Let Cost Price (CP) = 100.

=> Marked Price (MP) = 100 + 50% of 100 = 150.

=> Selling Price (SP) = 150 − 52% of 150 = 150 − (52 × 1.5) = 150 − 78 = 72.

=> Loss = CP − SP = 100 − 72 = 28.

=> Loss percentage = (28 ÷ 100) × 100 = 28%.

Therefore The correct answer is 28%.

Additional Information

Relation between CP and MP

The ratio of CP to MP can be expressed as: CP ÷ MP = (100 − Discount%) ÷ (100 + Profit%).

Effective Change Formula

When a value is increased by x% and then decreased by y%, the net percentage change is given by x − y − (xy ÷ 100).

Q41. Answer: (c) 648

Shortcut Trick

Divide each dimension of the cuboid by the side of the cube to find the number of cubes along each edge.

Number of cubes = (60 ÷ 5) × (45 ÷ 5) × (30 ÷ 5)

Number of cubes = 12 × 9 × 6 = 648

Therefore The correct answer is 648 cubes.

Alternate Method

Given:

Length (L) of cuboid = 60 cm

Breadth (B) of cuboid = 45 cm

Height (H) of cuboid = 30 cm

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Side (a) of smaller cube = 5 cm

Formula Used:

Number of cubes = (Volume of cuboid) ÷ (Volume of one cube)

Volume of cuboid = L × B × H

Volume of cube = a^3

Calculations:

=> Volume of cuboid = 60 × 45 × 30 = 81,000 cm^3

=> Volume of one cube = 5 × 5 × 5 = 125 cm^3

=> Number of cubes = 81,000 ÷ 125

=> Number of cubes = 648

Therefore The correct answer is 648 cubes.

Additional Information

Total Surface Area of a Cuboid

The total surface area is given by the formula 2(LB + BH + HL).

Diagonal of a Cuboid

The longest rod that can be placed inside a cuboid is its diagonal, calculated as $\sqrt{(L^2 + B^2 + H^2)}$.

Volume Conservation

When a solid is melted or cut into smaller pieces, the total volume remains constant, provided there is no wastage.

Q42. Answer: (d) Rs. 15

Shortcut Trick

Summing equations: 5 pens + 5 pencils = 75 => 1 pen + 1 pencil = 15

Subtracting equations: 1 pen − 1 pencil = 5

Solving for pencil: (15 − 5) ÷ 2 = 5

Cost of 3 pencils = 3 × 5 = 15

Therefore The correct answer is Rs. 15.

Alternate Method

Given:

Cost of 2 pens and 3 pencils = Rs. 35

Cost of 3 pens and 2 pencils = Rs. 40

Method: Linear Equation Elimination

Let the cost of one pen be x and one pencil be y.

=> 2x + 3y = 35 --- (Equation 1)

=> 3x + 2y = 40 --- (Equation 2)

Multiply Equation 1 by 3 and Equation 2 by 2 to eliminate x:

=> 6x + 9y = 105 --- (Equation 3)

=> 6x + 4y = 80 --- (Equation 4)

Subtract Equation 4 from Equation 3:

=> (6x − 6x) + (9y − 4y) = 105 − 80

=> 5y = 25

=> y = 25 ÷ 5 = 5

=> Cost of 3 pencils = 3y = 3 × 5 = 15

Therefore The correct answer is Rs. 15.

Additional Information

Elimination Method

A process of solving simultaneous equations by adding or subtracting them to remove one variable, usually after multiplying by a constant.

Substitution Method

Solving one equation for one variable (e.g., x = 15 − y) and substituting it into the other equation to find the value of the second variable.

Consistent Systems

A system of linear equations that has at least one solution (intersecting lines) is called a consistent system.

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Q43. Answer: (c) 130

Shortcut Trick

The Empirical Relationship between the measures of central tendency is given by:

Mode = 3 × Median − 2 × Mean

=> Mode = 3(70) − 2(40) = 210 − 80 = 130

Therefore The correct answer is 130.

Alternate Method

Given:

=> Mean = 40

=> Median = 70

Formula Used:

=> Mode = 3 × Median − 2 × Mean

Calculations:

=> Substituting the given values in the formula:

=> Mode = 3 × (70) − 2 × (40)

=> Mode = 210 − 80

=> Mode = 130

Therefore The correct answer is 130.

Additional Information

Symmetrical Distribution

In a perfectly symmetrical distribution (normal distribution), the Mean, Median, and Mode are all equal: Mean = Median = Mode.

Positively Skewed Distribution

When the tail of the distribution is longer on the right side, it is positively skewed. In this case, Mean > Median > Mode.

Negatively Skewed Distribution

When the tail is longer on the left side, it is negatively skewed. In this case, Mean < Median < Mode (as seen in this problem).

Memory Trick

Always remember the coefficients by the alphabetical order: Mode = 3 × Median − 2 × Mean (Coefficients 3 and 2 follow the word length of Median and Mean).

Q44. Answer: (b) 96

Shortcut Trick

Let number = x

20% of x + 96 = x => 0.2x + 96 = x

=> 0.8x = 96 => x = 120

80% of x = 0.8 × 120

Therefore Answer = 96

Alternate Method

Given:

20% of a number added to 96 equals the number

Formula used:

Percentage = (Part ÷ Whole) × 100

Calculation:

=> Let number = x

=> 20% of x = (20/100) × x = 0.2x

=> According to question:

=> 0.2x + 96 = x

=> x − 0.2x = 96

=> 0.8x = 96

=> x = 96 ÷ 0.8 = 120

=> 80% of x = 0.8 × 120

=> = 96

Therefore The correct answer is 96.

Additional Information
Percentage Conversion
x% = x/100
Equation Formation
Translate word problems into algebraic equations
Shortcut Insight
If 20% + 96 = 100%, then 80% = 96
Direct Logic
Remaining percentage gives direct value

Q45. Answer: (a) Rs. 24,000

Shortcut Trick
Total percentage spent = 20% + 35% + 25% = 80%
Savings percentage = 100% − 80% = 20%
Total Savings = 20% of Rs. 1,20,000
=> 0.20 × 1,20,000 = Rs. 24,000
Therefore The correct answer is Rs. 24,000.
Alternate Method
Given:
Total Income = Rs. 1,20,000
Expenditure on Accommodation = 20%
Expenditure on Household = 35%
Expenditure on Other Activities = 25%
Calculations:
=> Total Expenditure = 20% + 35% + 25%
=> Total Expenditure = 80%
=> Total Savings % = 100% − 80% = 20%
=> Value of Savings = (20 / 100) × 1,20,000
=> Value of Savings = 0.2 × 1,20,000
=> Value of Savings = Rs. 24,000
Therefore The correct answer is Rs. 24,000.
Additional Information
Percentage Change
Percentage change is calculated as (New Value − Old Value) / Old Value × 100.
Successive Percentage
If expenses were 'of the remaining amount', we use the formula: Final = Initial × (1 − r1/100) × (1 − r2/100).
Base Change Rule
If A is x% more than B, then B is [x / (100 + x)] × 100% less than A.

Q46. Answer: (a) 22

Shortcut Trick
Average Speed = Total Distance ÷ Total Time
Total Distance = 80 + 30 = 110 km
Total Time = (80 ÷ 40) + (30 ÷ 10) = 2 + 3 = 5 hours
Average Speed = 110 ÷ 5 = 22 km/hr
Therefore The correct answer is 22 km/hr.
Alternate Method
Given:
Distance 1 (d1) = 80 km, Speed 1 (s1) = 40 km/hr
Distance 2 (d2) = 30 km, Speed 2 (s2) = 10 km/hr
Formula Used:
Average Speed = (d1 + d2) ÷ (t1 + t2)

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=> Time taken for first part (t1) = Distance ÷ Speed = 80 ÷ 40 = 2 hours

=> Time taken for second part (t2) = Distance ÷ Speed = 30 ÷ 10 = 3 hours

=> Total Distance = 80 + 30 = 110 km

=> Total Time = 2 + 3 = 5 hours

=> Average Speed = 110 ÷ 5 = 22 km/hr

Therefore The correct answer is 22 km/hr.

Additional Information

Average Speed (Equal Distances)

When a journey is divided into two equal distances with speeds u and v, the average speed is 2uv ÷ (u + v).

Relative Speed

For objects moving in the same direction, relative speed is the difference (u − v). In the opposite direction, it is the sum (u + v).

Conversion Factor

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

Q47. Answer: (b) 19,.200

Shortcut Trick

Rate difference between Bank B and Bank A = 7.5% − 3.5% = 4% per annum.

Total difference in interest over 2 years = 4% × 2 = 8%.

Interest difference = 8% of Principal (Rs. 2,40,000).

Calculation: 2,40,000 × (8 ÷ 100) = 2,400 × 8 = Rs. 19,200.

Therefore The correct answer is Rs. 19,200.

Alternate Method

Given: Principal (P) = Rs. 2,40,000, Rate A (R1) = 3.5%, Rate B (R2) = 7.5%, Time (T) = 2 years.

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

=> SI paid to Bank A = (2,40,000 × 3.5 × 2) ÷ 100

=> SI paid to Bank A = 2,400 × 7 = Rs. 16,800

=> SI paid to Bank B = (2,40,000 × 7.5 × 2) ÷ 100

=> SI paid to Bank B = 2,400 × 15 = Rs. 36,000

=> Difference = 36,000 − 16,800

=> Difference = Rs. 19,200

Therefore The correct answer is Rs. 19,200.

Additional Information

Simple Interest Formula

The basic formula for Simple Interest is SI = (P × R × T) ÷ 100, where P is Principal, R is rate per annum, and T is time in years.

Interest Difference Shortcut

When Principal and Time are the same, the difference in interest is directly proportional to the difference in rates: ΔSI = P × (ΔR) × T ÷ 100.

Simple vs Compound Interest

In SI, interest is calculated only on the initial principal, whereas in CI, interest is calculated on the principal plus the accumulated interest of previous periods.

Q48. Answer: (d) 158

Shortcut Trick

Solve brackets first: (18 + 6) = 24 and (8 − 3) = 5

Expression becomes: [24 ÷ 3 × 2 − 4] × [5 + 9] − 2 × 5

= [8 × 2 − 4] × 14 − 10

= [16 − 4] × 14 − 10 = 12 × 14 − 10

Therefore Answer = 158

Alternate Method

Given:

[(18 + 6) ÷ 3 × 2 − 4] × [5 + 3^2] − 2 × (8 − 3)

Concept Used:

BODMAS rule

Calculation:

=> [(18 + 6) ÷ 3 × 2 − 4] × [5 + 3^2] − 2 × (8 − 3)

=> [24 ÷ 3 × 2 − 4] × [5 + 3^2] − 2 × (8 − 3)

=> [24 ÷ 3 × 2 − 4] × [5 + 9] − 2 × (8 − 3)

=> [8 × 2 − 4] × 14 − 2 × (8 − 3)

=> [16 − 4] × 14 − 2 × 5

=> 12 × 14 − 2 × 5

=> 168 − 2 × 5

=> 168 − 10

=> 158

Therefore The correct answer is 158.

Additional Information

BODMAS Full Form

Brackets, Orders, Division, Multiplication, Addition, Subtraction

Order of Operations

Solve brackets first, then powers, then ÷ and ×, then + and −

Left to Right Rule

For × and ÷, solve from left to right

Simplification Tip

Always simplify step-by-step without skipping operations

Q49. Answer: (c) 35

Shortcut Trick

Ratio of current ages of Elder son : Younger son = 3 : 1

Let current ages be 3x and x. After 5 years: (3x + 5) = 2 × (x + 5)

3x + 5 = 2x + 10 => x = 5

Elder son's age = 3 × 5 = 15 years

Mother's age = Elder son + 20 = 15 + 20 = 35 years

Therefore The correct answer is 35 years.

Alternate Method

Given: Current age ratio = 3 : 1 | Mother = Elder + 20 | After 5 yrs: Elder = 2 × Younger

Let current age of Younger son = x

=> Current age of Elder son = 3x

=> After 5 years, Elder son = 3x + 5 and Younger son = x + 5

=> 3x + 5 = 2(x + 5)

=> 3x + 5 = 2x + 10

=> x = 5

=> Current age of Elder son = 3 × 5 = 15 years

=> Current age of Mother = 15 + 20 = 35 years

Therefore The correct answer is 35 years.

Additional Information

Age Difference Property

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

Ratio Balancing

To solve age problems involving two different ratios at two different times, ensure the unit difference between the individuals remains the same.

Linear Equations in Ages

Always define the present age as the base variable 'x' to avoid confusion when moving forward (x + n) or backward (x − n) in time.

Q50. Answer: (a) 35

Shortcut Trick

Divide 1000 by 45 to find the remainder.

1000 ÷ 45 => Quotient = 22, Remainder = 10.

Smallest number to be added = Divisor − Remainder.

Required number = 45 − 10 = 35.

Therefore The correct answer is 35.

Alternate Method

Given: Number = 1000, Divisor = 45.

Formula Used: Number to be added = (Divisor − Remainder)

Performing division of 1000 by 45:

=> 1000 = 45 × 22 + 10

=> Here, Remainder (R) = 10

=> Divisor (D) = 45

=> Smallest number to be added = D − R

=> 45 − 10 = 35

Therefore The correct answer is 35.

Additional Information

Division Algorithm

Dividend = (Divisor × Quotient) + Remainder. The remainder is always less than the divisor.

Smallest number to subtract

To make a number exactly divisible by another, the smallest number to be subtracted is simply the Remainder.

Divisibility Rule of 45

A number is divisible by 45 if it is simultaneously divisible by both 5 (ends in 0 or 5) and 9 (sum of digits is divisible by 9).

Q51. Answer: (a) CBMN

The position and positional values or English Alphabets are:

Given: WPGB is related to AKKW in a certain way based on the English alphabetical order. In the same way, MVWH is related to QQAC. 4

The logic followed here is:

Similarly,

Thus, YGIS is related to CBMN, following the same logic.

Hence, the correct answer is "Option 1".

Q52. Answer: (d) 438

BODMAS Rule:

Decoding the given information:

Letter	A	B	C	D
Meaning	÷	×	•	•

Given equation: 441 D 444 C 21 A 21 B 441 = ?

Now replacing the sign from left to right using BODMAS Rule, we get:

=> 441 − 444 + 21 ÷ 21 × 441 = ?

=> 441 − 444 + 1 × 441 = ?

=> 441 − 444 + 441 = ?

=> 882 − 444 = ?

=> 438 = ?

Hence, the correct answer is "Option 4".

Q53. Answer: (c) 3

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

Now,

Odd digits, each of which is immediately preceded by an even digit and also immediately followed by an odd digit.

So, the needed pattern is: Even — Odd — Odd

Thus, there are 3 odd digits, each of which is immediately preceded by an even digit and also immediately followed by an odd digit.

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Hence, the correct answer is "Option 3".

Q54. Answer: (b) P

Given: Seven boxes M, N, O, P, Q, R and S are kept one over the other but not necessarily in the same order.

1. Only two boxes are kept between M and O.
2. Only N is kept above S.
3. No box is kept below O.
4. R is kept at some place below P but at some place above Q.

N
S
P
M
R
Q
O

Thus, Box P is kept third above Q.

Hence, the correct answer is "Option 2".

Q55. Answer: (d) © J F © E

Given Table:

Numbers/Symbols	%	6	2	8	•	3	&	7	@	9	$	5	•	4
Codes	U	G	W	D	F	K	L	S	V	B	E	J	H	C

According to the given conditions:

Rule No.	Condition	Result
(i)	First element is a symbol and the last element a perfect square	Codes of both (first and last elements) should be interchanged
(ii)	Both the second and third elements are symbols	Third element should be coded as the code for the second element
(iii)	First element is a symbol and the fourth element is an odd number	First and fourth elements should be coded as ©

Given: % 5 * 7 $

Here, Rule (iii) applies because the first element is a symbol (%) and the fourth element is an odd number (7).

% → coded as ©

5 → coded as J

• → coded as F

7 → coded as ©

$ → coded as E

So, % 5 * 7 $ → Coded as ©JF©E

Hence, the correct answer is "Option 4".

Q56. Answer: (b) YGO

The position and positional values or English Alphabets are:

Given: QCW, SDU, UES, WFQ, ?

The logic followed here is:

Thus, YGO should come in place of the question mark (?) in the given series based on the English alphabetical order.

Hence, the correct answer is "Option 2".

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Q57. Answer: (d) Three

Given: Seven people B, C, D, I, J, K, and L are sitting around a circular table facing the centre of the table.

1. L sits third to the left of I.
2. Only one person sits between K and B, when counted from the left of B.
3. C sits third to the right of D.
4. C sits to the immediate right of L.
5. J is not an immediate neighbour of L.

Thus, three people sit between J and B, when counted from the right of J.

Hence, the correct answer is "Option 4".

Q58. Answer: (d) QG 28

The position and positional values or English Alphabets are:

Given: VK 12 is related to ZP 16 in a certain way. In the same way, RG 15 is related to VL 19.

The logic followed here is:

Similarly,

Thus, MB 24 is related to QG 28, following the same logic.

Hence, the correct answer is "Option 4".

Q59. Answer: (a) ACP29

The position and positional values or English Alphabets are:

Given: CER121, IKX98, OQD75, UWJ52, ?

The logic followed here is:

Thus, ACP29 will replace the question mark (?) in the given series to make it logically complete.

Hence, the correct answer is "Option 1".

Q60. Answer: (d) 40

BODMAS Rule:

Decoding the given information:

Letter	E	F	G	H
Meaning	•	•	×	÷

Given equation: 50 E 36 H 6 F 8 G 2 = ?

Now replacing the sign from left to right using BODMAS Rule, we get:

=> 50 + 36 ÷ 6 − 8 × 2 = ?

=> 50 + 6 − 8 × 2 = ?

=> 50 + 6 − 16 = ?

=> 56 − 16 = ?

=> 40 = ?

Hence, the correct answer is "Option 4".

Q61. Answer: (c) Only conclusion (I) follows.

Statements:

All hammers are jacks.

All hammers are metals.

The least possible Venn diagram for the given statement is:

Conclusions:

(I) Some jacks are metals. - Follow (Because, all hammers are jacks and all hammers are metals, which means some jacks being hammers are metals.)

(II) All metals are hammers. - Does not follow (Because, all hammers are metals which means some metals are hammers.)

Thus, only conclusion (I) follows.

Hence, the correct answer is "Option 3".

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Q62. Answer: (b) Father's brother

Family Chart:

Decoding the Symbols:

A is				
Symbol	•	#	&	%
Meaning	mother	sister	brother	father
To B				

Given: D & E # F % L & W

It means: D is the brother of E, E is the sister of F, F is the father of L, L is the brother of W.

Thus, D is W's Father's brother.

Hence, the correct answer is "Option 2".

Q63. Answer: (d) 2

Given: (Left) 3 & 6 © 3 6 © € % 6 & 4 9 5 4 % € £ $ % 9 1 (Right)

Now,

Numbers, each of which is immediately preceded by a symbol and also immediately followed by a symbol.

So, the needed pattern is: Symbol — Number — Symbol

Thus, there are 2 such numbers, each of which is immediately preceded by a symbol and also immediately followed by a symbol.

Hence, the correct answer is "Option 4".

Q64. Answer: (a) LS – JO

The position and positional values or English Alphabets are:

The pattern followed here is:

Each letter-cluster pair follows the pattern +2, -4.

Let’s check each option:

1. LS – JO

This letter-cluster pair does not follow the pattern +2, -4.

2. DM – FI

This letter-cluster pair follows the pattern +2, -4.

3. KP – ML

This letter-cluster pair follows the pattern +2, -4.

4. RJ – TF

This letter-cluster pair follows the pattern +2, -4.

Thus, LS – JO is the odd one out.

Hence, the correct answer is "Option 1".

Q65. Answer: (a) 8

BODMAS Rule:

Decoding the given information:

Letter	A	B	C	D
Meaning	÷	×	•	•

Given equation: 36 B 39 A 39 D 48 C 20 = ?

Now replacing the sign from left to right using BODMAS Rule, we get:

=> 36 × 39 ÷ 39 − 48 + 20 = ?

=> 36 × 1 − 48 + 20 = ?

=> 36 − 48 + 20 = ?

=> 56 − 48 = ?

=> 8 = ?

Hence, the correct answer is "Option 1".

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Q66. Answer: (d) One

Given series:

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

Condition to be checked:

Perfect square digit ← Odd digit → Odd digit

(Perfect square digits = 1, 4, 9)

Checking all odd digits:

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

Valid cases: 4 9 9

There is one such odd digit which is immediately preceded by a perfect square and also immediately followed by an odd digit.

Hence, the correct answer is "Option 4".

Q67. Answer: (a) B

Given: Six people, A, B, C, D, E and F, are sitting in a row, facing north.

1. Only two people sit to the left of E.
2. Only one person sits between A and C.
3. F sits to the immediate left of E.
4. A sits to the immediate right of D.
5. C sits third to the right of B.

Thus, B sits at the extreme left end of the row.

Hence, the correct answer is "Option 1".

Q68. Answer: (d) 5

Given: Seven people, A, B, C, D, E, F and G, are sitting in a row, facing the north.

1. Only two people sit to the left of A.
2. Only three people sit between A and G.
3. D sits second to the right of A.
4. Only two people sit between D and C.
5. E sits at some place to the right of F but at some place to the left of B.

Thus, 5 people sit to the right of C.

Hence, the correct answer is "Option 4".

Q69. Answer: (b) QT - NP

The position and positional values or English Alphabets are:

The pattern followed here is:

Each letter-cluster pair follows the pattern -3, -3.

Let’s check each option:

1. OR - LO

This letter-cluster pair follows the pattern -3, -3.

2. QT - NP

This letter-cluster pair does not follow the pattern -3, -3.

3. MP - JM

This letter-cluster pair follows the pattern -3, -3.

4. IL - FI

This letter-cluster pair follows the pattern -3, -3.

Thus, QT - NP is the odd one out.

Hence, the correct answer is "Option 2".

Q70. Answer: (a) Southwest

Given: Town P is to the west of Town Q. Town R is to the north of Town P. Town S is to the east of Town R. Town T is to the south of Town S. Town Q is to the southeast of Town T.

Thus, Town P is to the Southwest of Town T.

Hence, the correct answer is "Option 1".

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Q71. Answer: (b) (47, 142, 3)

The logic followed here is:

Logic: (1st Number × 3) + 3rd Number − 2 = 2nd Number

(5 × 3) + 15 − 2 = 15 + 15 − 2 = 28

(29 × 3) + 17 − 2 = 87 + 17 − 2 = 102

Let's check each option:

1. (37, 115, 1) → (37 × 3) + 1 − 2 = 111 + 1 − 2 = 110 ≠ 115

2. (47, 142, 3) → (47 × 3) + 3 − 2 = 141 + 3 − 2 = 142

3. (7, 34, 10) → (7 × 3) + 10 − 2 = 21 + 10 − 2 = 29 ≠ 34

4. (4, 20, 5) → (4 × 3) + 5 − 2 = 12 + 5 − 2 = 15 ≠ 20

Thus, (47, 142, 3) is the set in which the numbers are related in the same way as the given sets.

Hence, the correct answer is "Option 2".

Q72. Answer: (b) READ - ERAD - DERA

Given:

SINK - ISNK - KISN

PLAY - LPAY - YLPA

Let's check each option:

1. WAIT - WIAT - TIAW

This triad does not follow the same logic.

2. READ - ERAD - DERA

This triad follows the same logic.

3. NAME - ANME - EAMN

This triad does not follow the same logic.

4. YOUR - OYUR - OURY

This triad does not follow the same logic.

Thus, READ - ERAD - DERA follows the same logic.

Hence, the correct answer is "Option 2".

Q73. Answer: (c) 7 km towards north

Given: Aditya starts from Point A and drives 10 km towards the north. He then takes a right turn, drives 10 km, turns right and drives 20 km. He then takes a right turn and drives 10 km. He takes a final right turn, drives 3 km and stops at Point P.

Thus, he should drive 7 km towards north in order to reach Point A again.

Hence, the correct answer is "Option 3".

Q74. Answer: (a) 133

Given: 88 91 97 106 118 ?

The logic followed here is:

Thus, 133 should come in place of the question mark (?) in the given series.

Hence, the correct answer is "Option 1".

Q75. Answer: (c) Neither conclusion (I) nor (II) follows

Statements:

All teas are golds.

No tea is a helmet.

The least possible Venn diagram for the given statement is:

Conclusions:

(I) Some helmets are golds. - Does not follow (There is no definite relation between helmets and golds, it can be possible but it is not definite.)

(II) All golds are helmets. - Does not follow (Because, all teas are golds and no tea is a helmet, so all golds cannot be helmets.)

Thus, neither conclusion (I) nor (II) follows.

Hence, the correct answer is "Option 3".

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Q76. Answer: (a) cp

Given: In a certain code language, ‘shirt mug care’ is coded as 'eu cp zi' and ‘zebra shirt ghost’ is coded as ‘cp eb il’.

Thus, ‘shirt’ is coded as 'cp' in the given language.

Hence, the correct answer is "Option 1".

Q77. Answer: (c) One

Given: (Left) 1 5 7 8 = 6 9 2 + 5 7 3 % 7 8 $ 4 1 5 # 8 @ & 4 9 6 (Right)

Now,

Symbols, each of which is immediately preceded by an odd number and also immediately followed by an even number.

So, the needed pattern is: Odd Number — Symbol — Even Number

Thus, there is one such symbol, each of which is immediately preceded by an odd number and also immediately followed by an even number.

Hence, the correct answer is "Option 3".

Q78. Answer: (d) 251

Given: 221 223 227 233 241 ?

The logic followed here is:

Thus, 251 should come in place of the question mark (?) in the given series.

Hence, the correct answer is "Option 4".

Q79. Answer: (b) 6

Given: All 20 students in a class are standing in a row facing north. Raveena is 10th from the right end while Deepa is 4th from the left end.

Total students = 20

Raveena is 10th from the right end.

So, Raveena's position from the left end = 20 − 10 + 1 = 11th

Deepa is 4th from the left end.

Number of people between them = 11 − 4 − 1 = 11 - 5 = 6

Hence, 6 people stand between Raveena and Deepa.

Hence, the correct answer is "Option 2".

Q80. Answer: (d) 252

Given: 273 274 266 267 259 260 ?

The logic followed here is:

Thus, 252 should come in place of the question mark (?) in the given series.

Hence, the correct answer is "Option 4".

Q81. Answer: (d) Brazil and South Africa

p data-end="57" data-start="0">The correct answer is Brazil and South Africa.

Key Points

• The Second G20 Anti-Corruption Working Group (ACWG) meeting in June 2025 was a significant event hosted under the collaborative efforts of Brazil and South Africa.

• South Africa officially assumed the G20 Presidency on December 1, 2024, taking over from Brazil. The 2025 calendar of meetings, including those in June, reflects the transition and thematic continuity between the two nations.

• The Anti-Corruption Working Group (ACWG) is tasked with leading the G20’s efforts to fight corruption by implementing the G20 Anti-Corruption Action Plan.

• The hosting by Brazil and South Africa emphasizes the "Global South" leadership within the G20, focusing on issues such as asset recovery and transparency in the public sector.

• The June 2025 meeting aimed to strengthen legal frameworks for extradition and mutual legal assistance among member countries.

Additional Information

• The G20 Anti-Corruption Working Group (ACWG):

• The ACWG was established at the Toronto Summit in 2010. Its primary objective is to develop and implement a comprehensive anti-corruption agenda across G20 member states.

• It works closely with international organizations such as the United Nations Office on Drugs and Crime (UNODC), the OECD,

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and the World Bank to ensure global compliance with anti-corruption standards.

• The G20 Presidency Transition:

• The G20 operates on a system of rotating presidencies. Brazil held the presidency in 2024, followed by South Africa in 2025.

• South Africa's presidency in 2025 is historic, marking the first time a G20 Summit and its ministerial meetings are hosted on the African continent.

• Core Themes of ACWG 2025:

• Key focus areas include beneficial ownership transparency, which aims to reveal the true owners of corporate entities to prevent money laundering.

• The group also prioritizes protecting whistleblowers and enhancing integrity in the private sector to foster a fair global economic environment.

Important Points

• The G20 Troika:

• The Troika for 2025 consists of the previous host (Brazil), the current host (South Africa), and the upcoming host for 2026 (the United States). This structure ensures consistency in the G20 agenda.

• Global Significance:

• The G20 members represent around 85% of the global GDP, over 75% of global trade, and about two-thirds of the world population.

• In 2023, the African Union became a permanent member of the G20 under the Indian Presidency, further increasing the representation of developing nations during the 2024 (Brazil) and 2025 (South Africa) tenures.

Q82. Answer: (b) INS Sahyadri

The correct answer is INS Sahyadri.

Key Points

• The Indian Navy's home-built Shivalik-class stealth frigate, INS Sahyadri, represented India in the JAIMEX-25 naval exercise.

• The exercise was conducted over three days, from 16 to 18 October 2025, focusing on high-end maritime operations and interoperability.

• INS Sahyadri is a multi-role stealth frigate equipped with advanced guided missiles, making it a potent platform for anti-air, anti-surface, and anti-submarine warfare.

• The JAIMEX (Japan-India Maritime Exercise) series highlights the growing strategic partnership and maritime cooperation between the Indian Navy and the Japan Maritime Self-Defense Force (JMSDF).

• This participation underscores India's "Atmanirbhar Bharat" (Self-reliant India) initiative, as the ship is a product of indigenous design and construction.

Additional Information

• Shivalik-class Frigates (Project 17):

• These are the first stealth warships built in India. The class includes three ships: INS Shivalik, INS Satpura, and INS Sahyadri.

• They were designed by the Indian Navy's Directorate of Naval Design and constructed at Mazagon Dock Shipbuilders Limited (MDL) in Mumbai.

• The stealth features include a reduced Radar Cross Section (RCS) and specialized hull forms to minimize noise and infrared signatures.

• INS Sahyadri (F45):

• Commissioned on 21 July 2012, it is the third ship of the Shivalik class.

• The ship is named after the Sahyadri mountain range (Western Ghats) in India.

• It has a displacement of approximately 6,200 tonnes and can reach speeds exceeding 30 knots.

• Weaponry and Sensors:

• The vessel is armed with BrahMos or Klub anti-ship cruise missiles and Barak-1 or Shtil-1 air defense missile systems.

• It also features RBU-6000 anti-submarine rocket launchers and DTA-53 torpedo launchers.

Important Points

• Strategic Significance: Exercises like JAIMEX-25 are crucial for ensuring a Free and Open Indo-Pacific (FOIP), a shared vision between India and Japan.

• Interoperability: The exercise involved complex maneuvers, including cross-deck helicopter operations, tactical exercises, and communication drills to enhance the synergy between the two navies.

• Evolution of Stealth: The success of the Shivalik-class paved the way for the more advanced Project 17A (Nilgiri-class) frigates, which feature even more significant stealth characteristics and updated technology.

• Global Reach: INS Sahyadri has frequently participated in international exercises like RIMPAC and MALABAR, showcasing the Indian Navy's blue-water capabilities across the Indian and Pacific Oceans.

Q83. Answer: (c) Empower Citizens, Expose Corruption

The correct answer is Empower Citizens, Expose Corruption.

Key Points

• The Lokpal of India, the country's apex anti-corruption body, officially adopted its new motto, "Empower Citizens, Expose Corruption," in the year 2025.

• The adoption of this new motto signifies a strategic shift towards encouraging proactive public participation in the fight against graft and administrative malpractice.

• This change was aimed at making the institution more accessible and citizen-centric, moving away from purely reactive legal frameworks to a more inclusive social movement against corruption.

• The previous motto of the Lokpal was "Ma Gridhah Kasyasvidhanam," which translates to "Do not be greedy for anyone's wealth," derived from the Isha Upanishad.

• The new branding, including the motto, was selected to resonate with the youth of India and the digital-age requirements of transparency and accountability. Hence, the correct answer is Empower Citizens, Expose Corruption.

Additional Information

• The Lokpal and Lokayuktas Act, 2013:

• The institution of Lokpal was established under the Lokpal and Lokayuktas Act, which was passed by Parliament in December 2013 and received Presidential assent on January 1, 2014.

• The act provides for the establishment of a Lokpal for the Union and Lokayukta for the States to inquire into allegations of corruption against certain public functionaries.

• Composition of Lokpal:

• The Lokpal consists of a Chairperson and a maximum of eight members, out of which 50% must be Judicial Members.

• At least 50% of the members must come from SC, ST, OBC, minorities, and women categories to ensure diverse representation.

• The Selection Committee for the Lokpal is headed by the Prime Minister and includes the Speaker of the Lok Sabha, the Leader of the Opposition, the Chief Justice of India, and an eminent jurist.

• Jurisdiction and Powers:

• The jurisdiction of the Lokpal includes the Prime Minister, Ministers in the Union government, Members of Parliament, and officials of Groups A, B, C, and D under the Central Government.

• It has the power to supervise and give directions to the Central Bureau of Investigation (CBI) regarding cases referred to them by the Lokpal.

• The Lokpal has the powers of a Civil Court and can order the attachment of property acquired through corrupt means, even while the inquiry is ongoing.

• Historical Context:

• The term "Lokpal" was coined by Dr. L.M. Singhvi in 1963.

• The first Administrative Reforms Commission (ARC), headed by Morarji Desai in 1966, recommended the setting up of two independent authorities (Lokpal and Lokayukta) to redress citizens' grievances.

• The first Lokpal Chairperson of India, Justice Pinaki Chandra Ghose, was appointed in March 2019.

Q84. Answer: (c) Deepthi Jeevanji

The correct answer is Deepthi Jeevanji.

Key Points

• Deepthi Jeevanji is a prominent Indian Para-athlete who was honored with the Arjuna Award in January 2025 for her stellar achievements in para-athletics.

• She specializes in the 400m sprint and competes in the T20 category, which is designated for athletes with intellectual impairments.

• One of her most significant career milestones was winning the Bronze Medal at the Paris Paralympics 2024, where she finished the women's 400m T20 final with a timing of 55.82 seconds.

• In May 2024, she created history by setting a new World Record in the women's 400m T20 event at the World Para Athletics Championships held in Kobe, Japan, clocking 55.07 seconds.

• Hailing from Kalledu village in the Warangal district of Telangana, her recognition with the Arjuna Award highlights the increasing prominence of para-sports in India.

Additional Information

• Arjuna Award:

• Established in 1961, the Arjuna Award is India's second-highest sporting honor, conferred by the Ministry of Youth Affairs and Sports.

• It is awarded to sportspersons for consistent outstanding performance over a period of four years, along with qualities of

leadership, sportsmanship, and discipline.

• The award includes a bronze statuette of Arjuna, a certificate, and a cash prize of Rs. 15 lakh.

• Manu Bhaker (Shooting):

• Manu Bhaker is an elite Indian Shooter who made history at the Paris Olympics 2024 by winning two Bronze Medals in a single Olympic edition.

• She won her medals in the Women's 10m Air Pistol and the Mixed Team 10m Air Pistol events, becoming a leading figure in Indian shooting.

• Harmanpreet Singh (Hockey):

• Often referred to as the "Sarpanch," Harmanpreet Singh is the captain of the Indian Men's National Hockey Team.

• Under his leadership, the team secured a Bronze Medal at the Paris Olympics 2024, following their success at the Tokyo 2020 Olympics.

• Gukesh D (Chess):

• Gukesh Dommaraju, known as Gukesh D, is a Chess Grandmaster who became the youngest-ever winner of the FIDE Candidates Tournament in 2024.

• His performance earned him the right to challenge for the World Chess Championship, and he was a key member of the Indian team that won Gold at the 45th Chess Olympiad in Budapest.

Important Points

• The National Sports Awards 2024 (conferred in 2025) saw a significant representation of athletes who excelled in the Paris Olympic and Paralympic Games.

• India achieved its best-ever medal haul at the Paris Paralympics 2024, winning a total of 29 medals, including 7 Gold, 9 Silver, and 13 Bronze.

• The T20 classification in Para-athletics is specifically for athletes with an IQ below 75, who have significant limitations in adaptive behavior, which manifests before the age of 18.

• The recognition of para-athletes like Deepthi Jeevanji serves as a major boost for inclusive sports policies under the Khelo India initiative and the Target Olympic Podium Scheme (TOPS).

Q85. Answer: (b) Japan

The correct answer is Japan.

Key Points

• The Ministry of Environment, Forest and Climate Change (MoEFCC), Government of India, signed a Memorandum of Cooperation (MoC) with the Government of Japan in August 2025 to implement the Joint Crediting Mechanism (JCM).

• This partnership is established under Article 6.2 of the Paris Agreement, which encourages international cooperation through market-based mechanisms to achieve Nationally Determined Contributions (NDCs).

• The primary objective of the JCM is to facilitate the diffusion of advanced low-carbon technologies and infrastructure from Japan to India, promoting sustainable development and greenhouse gas (GHG) emission reductions.

• As part of the agreement, a Joint Committee consisting of representatives from both governments will be established to oversee the implementation, project registration, and issuance of carbon credits.

• The mechanism ensures that emission reductions or removals are verified and can be used by both India and Japan to meet their respective climate targets under the Paris Agreement. Hence, the correct answer is Japan.

Additional Information

• The Joint Crediting Mechanism (JCM):

• It is a bilateral system initiated by Japan to incentivize the transfer of decarbonizing technologies to partner countries.

• The JCM helps Japan achieve its target of Net Zero by 2050 while supporting the transition of developing nations toward green energy.

• Credits generated through JCM projects are allocated to the participating parties, ensuring that there is no double counting of emission reductions.

• Article 6 of the Paris Agreement:

• Article 6.2: Focuses on bilateral or multilateral cooperation through Internationally Transferred Mitigation Outcomes (ITMOs).

• Article 6.4: Establishes a global carbon market overseen by a United Nations body, replacing the Clean Development Mechanism (CDM) of the Kyoto Protocol.

• Article 6.8: Promotes non-market-based approaches, such as climate finance and technology transfer, without the exchange of credits.

• India's Climate Commitments:

• India has committed to achieving Net Zero emissions by 2070, as announced during COP26 in Glasgow.

• India's updated NDCs include reducing the emission intensity of its GDP by 45% by 2030 compared to 2005 levels.

Important Points

• Japan's Global Partnerships: Apart from India, Japan has signed JCM agreements with more than 25 partner countries, including Vietnam, Thailand, Indonesia, and Saudi Arabia.

• Technological Scope: The MoC covers various sectors such as renewable energy (solar, wind), energy efficiency in industries, waste-to-energy projects, and green hydrogen production.

• MoEFCC Role: The Ministry of Environment, Forest and Climate Change serves as the nodal ministry in India for coordinating international climate negotiations and domestic climate policy implementation.

Q86. Answer: (b) New Delhi

The correct answer is New Delhi.

Key Points

• The Khelo India Para Games 2025 is a major initiative under the Khelo India program, held in the capital city of New Delhi.

• This event is specifically designed to provide a national-level platform for para-athletes (athletes with disabilities) to showcase their skills and talent.

• The games are organized by the Union Ministry of Youth Affairs and Sports and were established to fill the gap in competitive opportunities for the Divyang sporting community.

• New Delhi serves as the primary host due to its accessible infrastructure and world-class sporting facilities like the Indira Gandhi Stadium, Jawaharlal Nehru Stadium, and Dr. Karni Singh Shooting Range.

• The goal of the 2025 edition remains consistent with the program's vision: to foster inclusivity, promote sports as a tool for empowerment, and identify potential medalists for international events like the Paralympics.

Additional Information

• Khelo India Programme:

• Launched in 2018, the Khelo India (Play India) scheme was introduced to revive the sports culture at the grass-root level by building a strong framework for all sports played in the country.

• It encompasses several verticals including the Khelo India Youth Games, Khelo India University Games, Khelo India Winter Games, and the newly added Para Games.

• History of Para Games:

• The inaugural edition of the Khelo India Para Games was held in December 2023 in New Delhi.

• The mascot for the first games was 'Ujjwala', a sparrow, which represents the pride, determination, and spirit of the athletes.

• Scholarships and Support:

• Under the scheme, talented players identified in priority sports disciplines at various levels are provided annual financial assistance of Rs. 5 lakh per annum for 8 years.

• This long-term support is crucial for athletes coming from economically weaker backgrounds to sustain their training and nutrition.

Important Points

• Sports Disciplines: The event covers numerous disciplines, including Para Athletics, Para Archery, Para Football, Para Badminton, Para Table Tennis, Para Shooting, and Para Powerlifting.

• Participation: Athletes from over 30 States and Union Territories typically participate, making it a pan-India movement for the differently-abled.

• Digital Integration: The government utilizes the Khelo India Mobile App and a dedicated portal to manage registrations, schedules, and live updates, ensuring transparency and ease of access for participants.

• Infrastructure Accessibility: A significant focus of holding the games in New Delhi is to demonstrate and improve "Accessible India" (Sugamya Bharat) standards across major stadium complexes.

Q87. Answer: (c) New Delhi

The correct answer is New Delhi.

Key Points

• The 10th Governing Council Meeting of the NITI Aayog was held on 24 May 2025.

• The meeting took place in New Delhi, which serves as the traditional venue for the Governing Council deliberations due to its status as the National Capital.

• The session was chaired by the Prime Minister of India, who is the Ex-officio Chairperson of NITI Aayog.

• The core agenda of this high-level meeting centered around the roadmap for Viksit Bharat @ 2047, focusing on making India a developed nation by the 100th year of its Independence.

• It served as a platform to discuss inter-sectoral and inter-departmental issues to accelerate the implementation of various National Development Priorities. Hence, the correct answer is New Delhi.

Additional Information

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• NITI Aayog (National Institution for Transforming India):

• It was established on 1 January 2015, replacing the erstwhile Planning Commission which followed a top-down model.

• It operates as the premier policy think-tank of the Government of India, providing both directional and policy inputs.

• The institution is built on the pillars of Cooperative Federalism, ensuring that States are active partners in the national development process.

• Composition of the Governing Council:

• The council comprises the Prime Minister of India, Chief Ministers of all the States, and Chief Ministers of Union Territories with Legislatures (like Delhi and Puducherry).

• It also includes the Lieutenant Governors of other Union Territories and Ex-officio Members, along with Special Invitees.

• The Governing Council is the most significant body of NITI Aayog, tasked with evolving a shared vision of national priorities.

• Viksit Bharat @ 2047:

• This is a strategic government initiative to transform India into a developed economy by 2047.

• Key focus areas include structural reforms, digital infrastructure, sustainable energy, and inclusive growth.

Important Points

• Organizational Structure:

• Vice-Chairperson: Appointed by the Prime Minister and enjoys the rank of a Cabinet Minister.

• Chief Executive Officer (CEO): Appointed by the Prime Minister for a fixed tenure, holding the rank of Secretary to the Government of India.

• Hubs: NITI Aayog houses two main hubs: the Team India Hub (facilitating state participation) and the Knowledge and Innovation Hub (building think-tank capabilities).

• Previous Meetings:

• The 9th Governing Council meeting was held in July 2024, which also focused on themes of Cooperative Federalism and economic governance.

• These meetings are essential for aligning State-level policies with National goals to ensure synchronized development across the country.

Q88. Answer: (a) 1,12,000 kg

The correct answer is 1,12,000 kg.

Key Points

• The total quantity of narcotics seized in the Union Territory of Jammu & Kashmir from 2018 to July 2025 has reached a staggering 1,12,000 kg. This massive recovery highlights the intensifying "War on Drugs" initiated by the J&K Police and central agencies.

• During this period, law enforcement agencies registered more than 13,000 cases under the Narcotic Drugs and Psychotropic Substances (NDPS) Act, 1985. This signifies a proactive approach to dismantling the supply chains of contraband.

• A significant number of arrests have been made, with over 19,500 individuals apprehended for their involvement in drug trafficking and peddling. This includes both local conduits and high-level traffickers across districts like Srinagar, Jammu, Anantnag, and Baramulla.

• The seizures include various categories of drugs such as Heroin, Charas, Ganja, and a massive quantity of Poppy Straw, which constitutes the bulk of the total weight seized. The authorities have also destroyed vast areas of illegal poppy and cannabis cultivation.

• Furthermore, the Jammu & Kashmir administration has moved toward freezing the financial assets of drug lords. Assets worth over 100 crore rupees have been attached under the provisions of the NDPS Act to choke the funding of narco-terrorism.

Additional Information

• The NDPS Act, 1985:

• The Narcotic Drugs and Psychotropic Substances Act was enacted in 1985 to consolidate and amend the law relating to narcotic drugs. It provides for stringent punishments, including rigorous imprisonment and heavy fines.

• The Act classifies drug quantities into three categories: small quantity, intermediate quantity, and commercial quantity, with the latter carrying the most severe penalties.

• Narco-Terrorism Nexus:

• In Jammu & Kashmir, a significant portion of drug trafficking is linked to narco-terrorism, where the proceeds from drug sales are used to fund militancy and insurgency activities across the Line of Control (LoC).

• The Ministry of Home Affairs (MHA) has prioritized the elimination of this nexus to ensure national security and protect the youth of the region.

• Anti-Narcotics Task Force (ANTF):

• A specialized unit called the Anti-Narcotics Task Force (ANTF) was established within the J&K Police to focus exclusively on

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high-profile drug cases and inter-state smuggling modules.

Important Points

• Preventive Detention: To curb habitual offenders, the authorities have utilized the Prevention of Illicit Traffic in Narcotic Drugs and Psychotropic Substances (PIT-NDPS) Act, 1988, which allows for the preventive detention of persons involved in drug trafficking for up to one year.

• MANAS Helpline: The Government of India launched the MANAS (Madak Padarth Nishedh Asuchna Kendra) toll-free helpline number 1933, enabling citizens to report drug-related crimes anonymously.

• NCORD Mechanism: The Narco Coordination Centre (NCORD) mechanism has been strengthened at the District and UT levels to ensure better synergy between the Narcotics Control Bureau (NCB), Police, and Civil Administration.

• Impact on Youth: The massive seizure of 1,12,000 kg of drugs is part of a larger strategy to make Jammu & Kashmir "Nasha Mukt" (Drug-Free), focusing on rehabilitation alongside enforcement.

Q89. Answer: (b) Mykolas Alekna

The correct answer is Mykolas Alekna.

Key Points

• Mykolas Alekna, a young Lithuanian athlete, etched his name in sports history by setting a new World Record in the men's discus throw.

• The record-breaking feat took place at the Oklahoma Throws Series meeting in Ramona, USA, in April. While the prompt mentions 2025, the historical milestone of breaking the world record occurred in 2024.

• He achieved a massive throw of 74.35 metres, which successfully surpassed the longest-standing world record in men's track and field.

• The previous record of 74.08 metres was held by Jurgen Schult of East Germany, a mark that had remained unbeaten since June 1986 (standing for nearly 38 years).

• This incredible performance in Ramona was aided by the favorable wind conditions of the region, which are well-known among throwing athletes for providing the necessary lift for the discus.

Additional Information

• Athletic Lineage:

• Mykolas Alekna is the son of the legendary Virgilijus Alekna, who was a two-time Olympic Champion (2000 and 2004) and a World Champion in the discus throw.

• With this record, the Alekna family now boasts two of the top three discus throwers in history.

• Competitors and Legends:

• Kristjan Čeh: A Slovenian athlete who won the 2022 World Championship and is one of the few men to have thrown over 70 metres in the modern era.

• Gerd Kanter: An Estonian discus legend who won Gold at the 2008 Beijing Olympics and holds a personal best of 73.38 metres.

• Robert Harting: A German thrower famous for winning Gold at the 2012 London Olympics and three consecutive World Championships (2009, 2011, 2013).

• Significance of the Event:

• The World Athletics Continental Tour and specialized throwing series like the one in Ramona, Oklahoma, provide high-level competition opportunities for field athletes to achieve qualifying marks for the Olympics and World Championships.

• The discus throw is one of the oldest events in athletics, dating back to the Ancient Olympic Games.

Important Points

• Technical Details: The discus used in men's senior competition weighs 2 kilograms and has a diameter of 22 centimeters.

• Record Longevity: Before Mykolas Alekna broke it, the men's discus record was widely considered one of the "unbreakable" records from the 1980s era of athletics.

• Age Factor: Alekna achieved this feat at the age of just 21, making him one of the youngest world record holders in the history of field events.

Q90. Answer: (b) INS Satpura and INS Savitri

The correct answer is INS Satpura and INS Savitri.

Key Points

• Operation Brahma was a maritime mission conducted by the Indian Navy in March 2025 to strengthen maritime security and ensure safe transit in the Indian Ocean Region.

• The operation involved the deployment of INS Satpura, which is a Shivalik-class stealth multi-role frigate, and INS Savitri, a Savitri-class offshore patrol vessel.

• INS Satpura (F48) provided the necessary stealth capabilities and advanced sensors for high-intensity monitoring during the mission.

• INS Savitri (P53) acted as a versatile support and patrol platform, facilitating maritime interdiction and surveillance operations.

• The primary function of this operation was to project power and maintain a stable maritime environment against emerging non-traditional threats. Hence, the correct answer is INS Satpura and INS Savitri.

Additional Information

• INS Satpura (F48):

• It belongs to the Shivalik-class of stealth multi-role frigates built for the Indian Navy.

• The ship was built at Mazagon Dock Limited located in Mumbai and was commissioned on August 20, 2011.

• It features radar-vessel signature reduction technology and carries a mix of Indian, Russian, and Israeli weapons and sensors.

• With a displacement of approximately 6,200 tonnes, it is capable of reaching speeds of over 30 knots.

• INS Savitri (P53):

• It is the lead ship of the Savitri-class offshore patrol vessels (OPV) of the Indian Navy.

• The ship has been frequently utilized for humanitarian assistance and EEZ (Exclusive Economic Zone) surveillance missions.

• In recent years, it has played a key role in medical diplomacy by delivering essential supplies to littoral nations in the Indian Ocean.

• Indian Navy Strategic Operations:

• The Indian Navy operates under the vision of SAGAR (Security and Growth for All in the Region) to ensure stability in the Indo-Pacific.

• Missions like Operation Brahma are part of India's role as a Net Security Provider in the Indian Ocean.

• The year 2025 marks a period of increased maritime domain awareness (MDA) for India, utilizing assets like P-8I Neptune aircraft and advanced satellites.

Important Points

• Role of Stealth Frigates: Modern naval warfare increasingly relies on ships like INS Satpura that can operate with low thermal and acoustic signatures.

• Regional Stability: The deployment of two different classes of ships (Frigate and OPV) demonstrates the flexibility and modular approach of the Indian Navy in handling diverse mission profiles.

• Timeline: The execution of this operation in March 2025 highlights the ongoing readiness of the Western and Eastern Naval Commands to protect national interests.

• Technological Integration: These ships are equipped with Long-Range Surface-to-Air Missiles (LRSAM) and BrahMos supersonic cruise missiles, which represent the pinnacle of current Indian naval technology and combat power.

Q91. Answer: (b) Bharatiya Antariksh Station

The correct answer is Bharatiya Antariksh Station.

Key Points

• The Bharatiya Antariksh Station (BAS) is the official name of the planned modular space station to be constructed by India and operated by the Indian Space Research Organisation (ISRO).

• Prime Minister Narendra Modi formally announced the project in October 2023, setting a clear vision for India's presence in space.

• The primary timeline for the project involves launching the first module, known as BAS-1, by the year 2028, with the complete station expected to be operational by 2035.

• The station is designed to be placed in Lower Earth Orbit (LEO) at an altitude of approximately 400 kilometers above the Earth's surface.

• Initially, the station is expected to weigh around 20 to 25 tonnes and will be capable of housing 3 to 4 astronauts for scientific research and microgravity experiments.

Additional Information

• Gaganyaan Mission: This is India's first human spaceflight program, which serves as a foundational step for BAS. It aims to demonstrate human spaceflight capability by launching a crew to an orbit of 400 km for a 3-day mission.

• LVM3 (Launch Vehicle Mark 3): India's heaviest launch vehicle will be the primary rocket used for the initial phases of the space station's assembly and crew transport.

• Space Docking Experiment (SPADEX): ISRO is developing SPADEX technology, which is essential for the docking of different modules and the transfer of crew and cargo between the station and transport vehicles.

• Indian Space Vision 2047: The establishment of the Bharatiya Antariksh Station is a pillar of the broader "Amrit Kaal" vision, which also includes landing an Indian on the Moon by 2040.

• Strategic Autonomy: While the International Space Station (ISS) is a multinational effort, BAS is intended to be a sovereign facility, making India one of the few nations to operate an independent station.

Important Points

• In September 2024, the Union Cabinet officially approved the development of the first module of the Bharatiya Antariksh Station, providing the necessary financial and administrative backing for the project.

• The station will serve as a laboratory for advanced research in biology, pharmaceuticals, and materials science, utilizing the unique environment of weightlessness.

• It will also function as a gateway for future deep-space missions, acting as a staging point for journeys to the Moon and potentially Mars.

• With the completion of BAS, India will join an elite group of countries, including the USA, Russia, and China, that have successfully deployed and maintained their own orbital stations.

Q92. Answer: (a) Agnishodh

The correct answer is Agnishodh.

Key Points

• In August 2025, the Indian Army inaugurated a specialized research cell named Agnishodh at the Indian Institute of Technology Madras (IIT Madras) in Chennai.

• The primary objective of Agnishodh is to bridge the gap between military operational requirements and academic research by fostering a collaborative environment for defense innovation.

• The cell focuses on developing niche technologies and indigenous solutions to enhance the combat capabilities and operational efficiency of the Indian Armed Forces.

• This initiative is a strategic step towards achieving self-reliance in defense technology, aligning with the Atmanirbhar Bharat vision of the Government of India.

• By establishing this cell at IIT Madras, the Indian Army aims to leverage the institute's cutting-edge infrastructure and intellectual capital to solve complex technical challenges faced on the battlefield.

Additional Information

• IIT Madras and Defense Research:

• IIT Madras has a long-standing history of partnering with the Ministry of Defence and DRDO (Defence Research and Development Organisation) for various high-tech projects.

• The institute has been a pioneer in deep-tech startups through its Incubation Cell, many of which provide solutions for security and surveillance.

• Modernization of the Indian Army:

• The Indian Army is increasingly focusing on modernization through the Army Technology Board (ATB) to integrate Artificial Intelligence (AI), Machine Learning, and Robotics into its hardware.

• The establishment of Agnishodh reflects the shift toward indigenous manufacturing under the Make in India initiative in the defense sector.

• Focus Areas of Research:

• The research at such cells typically encompasses Cybersecurity, Unmanned Aerial Vehicles (UAVs), Quantum Communication, and Advanced Material Science for ballistic protection.

• These advancements are crucial for maintaining a technological edge in hybrid warfare and border management.

Important Points

• Strategic Impact: The Agnishodh cell facilitates direct interaction between soldiers and scientists, ensuring that the technology developed is practical and suited for harsh terrains like Ladakh or the Thar Desert.

• Innovation Ecosystem: This model encourages Technology Transfer (ToT) from academia to Defense Public Sector Undertakings (DPSUs) and private industry partners for mass production.

• Year of Initiative: The launch in 2025 marks a significant milestone in the Indian Army's timeline of academic institutional partnerships, following similar models at IIT Delhi and IIT Bombay.

• National Security: By reducing dependence on foreign OEMs (Original Equipment Manufacturers), Agnishodh contributes to the long-term strategic autonomy of India.

Q93. Answer: (d) Rs. 12 lakh

The correct answer is Rs. 12 lakh.

Key Points

• During the presentation of the Union Budget 2025–26 on February 1, 2025, Union Finance Minister Nirmala Sitharaman announced significant changes to the personal income tax structure under the New Tax Regime.

• The most notable highlight is that no personal income tax will be payable by individuals with an annual income of up to Rs. 12 lakh under the New Tax Regime. Hence, the statement regarding the Rs. 12 lakh limit is correct.

• This tax-free status for income up to Rs. 12 lakh is made possible by a combination of revised tax slabs, an increased tax rebate under Section 87A, and an enhanced standard deduction.

• The standard deduction for salaried employees and pensioners opting for the New Tax Regime has been increased from Rs. 75,000 to Rs. 1,00,000 in the fiscal year 2025-26.

• The budget aims to provide substantial relief to the middle class and salaried taxpayers, effectively increasing their disposable income to boost consumption and economic growth.

Additional Information

• Revised Tax Slabs (Budget 2025-26):

• Under the New Tax Regime, the new tax slabs are: Rs. 0–4 lakh (Nil), Rs. 4–8 lakh (5%), Rs. 8–12 lakh (10%), Rs. 12–16 lakh (15%), Rs. 16–20 lakh (20%), and Above Rs. 20 lakh (30%).

• In the previous year (2024-25), the slabs were structured in multiples of Rs. 3 lakh; the 2025-26 budget has widened these slabs to Rs. 4 lakh intervals.

• Section 87A Rebate:

• The tax rebate under Section 87A has been adjusted so that taxpayers earning up to the revised threshold do not have to pay any tax, even if their computed tax falls within the 5% or 10% brackets.

• Impact on Taxpayers:

• It is estimated that nearly 4 crore taxpayers, including salaried individuals and pensioners, will benefit from these changes.

• A salaried individual earning Rs. 12 lakh per annum will potentially save a significant amount in taxes compared to the old regime or previous year's slabs.

Important Points

• Default Tax Regime: The New Tax Regime remains the default option for taxpayers in India; however, the Old Tax Regime (which allows for exemptions like 80C and 80D) continues to be available for those who choose to opt-in.

• Surcharge and Cess: While the tax rates have been lowered for the middle-income groups, the Health and Education Cess of 4% remains applicable on the total tax amount. The highest surcharge rate remains capped at 25% for those in the highest income brackets under the new regime.

• Objective of Simplification: The primary goal of the Union Budget 2025-26 personal tax reforms is the simplification of the tax code and reducing the compliance burden on individual citizens.

• Previous Limit: Prior to this budget, the effective limit for no tax payable (after rebate and standard deduction) was approximately Rs. 7.75 lakh for the financial year 2024-25.

Q94. Answer: (d) Madhav Tiger Reserve

The correct answer is Madhav Tiger Reserve.

Key Points

• The Madhav Tiger Reserve, located in the Shivpuri district of Madhya Pradesh, has been officially notified as a tiger reserve in January 2025.

• It has become the 56th Tiger Reserve in India and the 8th such reserve in the state of Madhya Pradesh.

• The notification follows the successful reintroduction of tigers into the park which began in March 2023, aimed at restoring the predator population in the Vindhyan landscape.

• The National Tiger Conservation Authority (NTCA) gave its final nod for the declaration to ensure better administrative control and financial support for tiger protection.

• Historically, the area served as the hunting grounds for the Scindia dynasty of Gwalior and the Mughal emperors, highlighting its long-standing ecological significance.

Additional Information

• Project Tiger:

• Launched on April 1, 1973, from Jim Corbett National Park, it is a centrally sponsored scheme of the Ministry of Environment, Forest and Climate Change.

• It aims to ensure a viable population of Bengal tigers in their natural habitats and protect them from extinction.

• Tiger State of India:

• Madhya Pradesh holds the title of "Tiger State" as it hosts the highest number of tigers in India as per the 2022 Census.

• Other prominent reserves in the state include Kanha, Bandhavgarh, Panna, Pench, Satpura, Sanjay-Dubri, and Veerangana Durgavati.

• National Tiger Conservation Authority (NTCA):

• Established in December 2005, it is a statutory body under the Wildlife (Protection) Act, 1972.

• The Minister in charge of the Ministry of Environment, Forest and Climate Change is the Chairperson of the NTCA.

• Tiger Statistics:

• India is home to approximately 75% of the world's wild tiger population.

• The Status of Tigers in India 2022 report estimated the minimum population at 3,167 tigers.

Important Points

• Dholpur – Karauli Tiger Reserve: Located in Rajasthan, it was declared as the 55th Tiger Reserve of India in 2023.

• Ranipur Tiger Reserve: Situated in the Chitrakoot district of Uttar Pradesh, it was notified as the 53rd reserve in 2022.

• Parambikulam Tiger Reserve: Located in the Palakkad district of Kerala, it was declared a tiger reserve in 2009-2010.

• Geographical Significance: The Madhav Tiger Reserve acts as a crucial link between the Ranthambore Tiger Reserve in Rajasthan and the Panna Tiger Reserve in Madhya Pradesh, creating a vital wildlife corridor.

• Flora and Fauna: The park is characterized by Northern Tropical Dry Deciduous mixed forests and Thorn forests, and it is home to the Sakhya Sagar lake, which is a designated Ramsar Site.

Q95. Answer: (b) To improve farming that can handle climate change

The correct answer is To improve farming that can handle climate change.

Key Points

• In 2025, the National Bank for Agriculture and Rural Development (NABARD) and the Indian Council of Agricultural Research (ICAR) entered into a Memorandum of Understanding (MoU) to foster a collaborative environment for climate-resilient agriculture.

• The primary objective of this agreement is to integrate ICAR's cutting-edge research and technological advancements with NABARD's robust financial framework to empower rural farmers against the adverse effects of climate change. Hence, the correct answer is option 2.

• The partnership focuses on technology transfer, specifically the dissemination of drought-resistant crop varieties and advanced irrigation techniques to the grassroots level.

• It aims to promote sustainable farming practices that ensure food security while minimizing the carbon footprint of the agricultural sector in India.

• This collaboration is designed to scale up climate-smart agricultural interventions across various agro-climatic zones, helping farmers adapt to unpredictable weather patterns.

Additional Information

• NABARD (National Bank for Agriculture and Rural Development):

• Established on 12 July 1982, following the recommendations of the B. Sivaraman Committee.

• Headquartered in Mumbai, it serves as India's apex development bank for the rural and agricultural sectors.

• It plays a pivotal role in policy planning and providing refinance facilities to various financial institutions for rural development.

• ICAR (Indian Council of Agricultural Research):

• Founded on 16 July 1929, it is an autonomous organisation under the Ministry of Agriculture and Farmers Welfare.

• Based in New Delhi, it is the world's largest network of agricultural research and education institutes.

• ICAR coordinates research in agriculture, horticulture, fisheries, and animal sciences across the country.

• Climate-Resilient Agriculture (CRA):

• CRA involves the use of integrated farming systems, precision agriculture, and biotechnology to maintain productivity despite environmental stress.

• It is a key component in achieving India’s Sustainable Development Goals (SDGs), particularly those related to zero hunger and climate action.

• Digital Agriculture Initiatives:

• The 2025 agreement also explores the use of Artificial Intelligence (AI), Internet of Things (IoT), and satellite imagery for real-time monitoring of crop health and soil moisture.

Important Points

• The agreement represents a strategic alignment between research expertise and financial implementation, which is crucial for the modernization of the Indian agrarian economy.

• By focusing on climate-smart farming, the initiative helps in reducing the vulnerability of small and marginal farmers who are most affected by climate fluctuations.

• Data indicates that nearly 50% of India's workforce depends on agriculture, making such 2025 milestones essential for national economic stability and rural prosperity.

Q96. Answer: (c) April 25

The correct answer is April 25.

Key Points

• World Malaria Day is an international observance commemorated every year on April 25 to recognize global efforts to control malaria.

• The theme for World Malaria Day 2025 is "Malaria Ends with Us: Reinvest, Reimagine, Reignite." This theme calls for a renewed commitment to funding, innovative strategies, and a reinvigorated spirit to eliminate the disease.

• The day was established by the World Health Assembly at its 60th session in May 2007. It was designed to provide education and understanding of malaria and spread information on year-long intensified implementation of national malaria-control strategies.

• Before World Malaria Day, Africa Malaria Day was observed on the same date, starting in 2001, following the historic Abuja Declaration by 44 malaria-endemic countries.

• The World Health Organization (WHO) uses this platform to highlight the need for continued investment and sustained political commitment for malaria prevention and control.

Additional Information

• Disease Profile: Malaria is a life-threatening disease caused by Plasmodium parasites that are transmitted to people through the bites of infected female Anopheles mosquitoes. Among the five parasite species that cause malaria in humans, P. falciparum and P. vivax pose the greatest threat.

• Prevention and Treatment: Key interventions include the use of Long-lasting insecticidal nets (LLINs), Indoor residual spraying (IRS), and Artemisinin-based combination therapy (ACT) for treatment.

• Vaccine Development: A major milestone was reached with the recommendation of the RTS,S/AS01 (Mosquirix) vaccine in October 2021 and the R21/Matrix-M vaccine in 2023 for children living in regions with moderate to high malaria transmission.

• Global Burden: According to the World Malaria Report, the WHO African Region carries a disproportionately high share of the global malaria burden, accounting for approximately 94% of cases and 95% of deaths globally.

Important Points

• SDG Target: The United Nations Sustainable Development Goal (SDG) 3.3 aims to end the epidemics of AIDS, tuberculosis, malaria, and neglected tropical diseases by the year 2030.

• Elimination Certification: The WHO grants a "Malaria-Free Certification" to countries that have demonstrated, beyond a reasonable doubt, that the chain of indigenous transmission has been interrupted nationwide for at least the consecutive last 3 years.

• Recent Successes: In 2023, Azerbaijan and Tajikistan were certified malaria-free, followed by Cabo Verde in early 2024, showcasing that elimination is achievable with persistent effort.

• Global Technical Strategy: The WHO Global Technical Strategy for Malaria 2016–2030 aims to reduce malaria case incidence and mortality rates by at least 90% by 2030 compared to 2015 levels.

Q97. Answer: (d) Norway

The correct answer is Norway.

Key Points

• In June 2025, the Kolkata-based Garden Reach Shipbuilders and Engineers Limited (GRSE) signed a significant Memorandum of Understanding (MoU) with Norway-based maritime technology leaders (specifically Kongsberg Discovery) to facilitate the design and development of India’s first indigenous Polar Research Vessel (PRV).

• The Polar Research Vessel is a specialized ship designed to carry out scientific research in the extreme environments of the Antarctic and Arctic regions, featuring a reinforced hull for ice-breaking capabilities.

• This partnership marks a milestone in the Atmanirbhar Bharat (Self-reliant India) initiative, as it aims to build a complex, high-technology vessel within the country for the first time, reducing dependence on foreign chartered ships.

• The project is overseen by the Ministry of Earth Sciences (MoES), which is the nodal ministry for India's polar expeditions and oceanographic research.

• The PRV will serve as a logistics and research platform, supporting India's permanent research stations such as Maitri and Bharati in Antarctica.

Additional Information

• Garden Reach Shipbuilders and Engineers Limited (GRSE):

• It is a Miniratna Category-I company under the administrative control of the Ministry of Defence.

• Located in Kolkata, it has a long history of building warships and specialized vessels for the Indian Navy and Indian Coast Guard.

• The company was nationalized by the Government of India in the year 1960.

• Norway's Maritime Expertise:

• Norway is globally recognized for its advanced maritime engineering, particularly in deep-sea technologies and ice-class vessel designs.

• The collaboration ensures that the PRV will meet international standards for polar navigation and environmental safety.

• India's Polar Program:

• India’s research activities in the polar regions are managed by the National Centre for Polar and Ocean Research (NCPOR), located in Goa.

• India currently operates research stations named Bharati and Maitri in the Antarctic and Himadri in the Arctic (Svalbard, Norway).

Important Points

• Functional Capabilities: The Polar Research Vessel is expected to perform multiple roles, including oceanographic research, biological sampling, and transporting fuel and provisions to research bases.

• Ice-Class Specifications: To navigate the Southern Ocean, the vessel must comply with Polar Class (PC) standards, allowing it to break through ice thicknesses of 1.5 meters or more.

• Economic Impact: Building the vessel indigenously at GRSE is expected to save millions in foreign exchange that India currently spends annually on leasing Russian or European polar vessels.

• Blue Economy: This development aligns with India's Deep Ocean Mission and the Blue Economy policy, which seeks to sustainably harness ocean resources and strengthen maritime security and research.

Q98. Answer: (b) Ministry of Environment

The correct answer is Ministry of Environment.

Key Points

• The Swachh Vayu Sarvekshan is an initiative by the Ministry of Environment, Forest and Climate Change (MoEFCC) to rank cities on the basis of air quality and the implementation of activities approved under the city action plan.

• The primary objective of the survey is to rank 131 non-attainment cities in the country that have consistently failed to meet the National Ambient Air Quality Standards (NAAQS) for five consecutive years.

• For the year 2025, the ministry continues to use this ranking system to foster a spirit of healthy competition among cities and encourage them to take proactive measures to reduce air pollution.

• The ranking is based on the self-assessment of cities on the PRANA (Portal for Regulation of Air-pollution in Non-Attainment cities) portal, where cities report their progress on eight thematic areas.

• These thematic areas include biomass and municipal solid waste burning, road dust, dust from construction and demolition waste, vehicular emissions, industrial emissions, public awareness, and improvements in PM10 concentrations.

Additional Information

• National Clean Air Programme (NCAP):

• Launched in January 2019, the NCAP is a long-term, time-bound, national-level strategy to tackle the air pollution problem across the country.

• The programme initially aimed for a 20% to 30% reduction in PM2.5 and PM10 concentrations by 2024, keeping 2017 as the base year for comparison.

• The goal was later updated to achieve a 40% reduction in particulate matter concentrations by the year 2026.

• City Categories:

• Cities are classified into three categories for the survey based on their population as per the 2011 Census.

• Category 1: Cities with a population of more than 10 Lakh (over 47 cities).

• Category 2: Cities with a population between 3 Lakh to 10 Lakh (44 cities).

• Category 3: Cities with a population less than 3 Lakh (40 cities).

• International Day of Clean Air for Blue Skies:

• The awards for the best-performing cities under the Swachh Vayu Sarvekshan are typically presented on September 7th, which is observed globally as the International Day of Clean Air for Blue Skies.

• This day was designated by the United Nations General Assembly in 2019 to emphasize the need for further efforts to improve air quality to protect human health.

Important Points

• Role of CPCB: The Central Pollution Control Board (CPCB) plays a technical role in overseeing the air quality monitoring data and assisting the Ministry of Environment in the verification of city reports.

• PRANA Portal: The PRANA portal serves as a digital platform for monitoring the implementation of NCAP. It provides real-time information on the air quality status of non-attainment cities and tracks the progress of various mitigation activities.

• Difference from AQI: While the Air Quality Index (AQI) provides a real-time daily measurement of air health, the Swachh Vayu Sarvekshan is a comprehensive annual ranking based on policy implementation and long-term improvements in air quality parameters.

• Incentives: The top-performing cities in each category receive cash awards and trophies to support further environmental conservation initiatives, funded by the Government of India.

Q99. Answer: (a) Jiang Yuyan

The correct answer is Jiang Yuyan.

Key Points

• Jiang Yuyan, the remarkable Chinese Paralympic swimmer, was named the winner of the Laureus World Sportsperson of the Year with a Disability award in 2025.

• This prestigious recognition was bestowed upon her following her historic performance at the Paris 2024 Paralympic Games, where she emerged as the most successful athlete of the entire event.

• At the Paris 2024 games, she won a total of 7 gold medals, a feat that solidified her status as a global icon in disability sports.

• Her gold medal haul included victories in events such as the 50m freestyle S6, 100m freestyle S6, 400m freestyle S6, and 50m butterfly S6, along with relay successes.

• The Laureus World Sports Awards, often referred to as the "Oscars of Sport," celebrate the greatest sporting achievements from the preceding year (2024) during their 2025 ceremony. Hence, the correct answer is Jiang Yuyan.

Additional Information

• Profile of Jiang Yuyan:

• Known by the nickname "Flying Fish," she was born in 2004 in Shaoxing, China.

• She faced a life-altering event at the age of 4 when she lost her right arm and right leg in a car accident.

• She began swimming as a form of rehabilitation and quickly displayed extraordinary talent, competing in her first Paralympic Games at Tokyo 2020 (held in 2021) at just 16 years old, where she won 2 gold medals.

• In addition to her 7 golds in Paris 2024, she set multiple World Records and Paralympic Records, showcasing her dominance in the S6, SB6, and SM6 classifications.

• The Laureus World Sports Awards:

• The awards were established in 1999 by founding patrons Daimler and Richemont.

• The Laureus World Sports Academy, a group of over 70 living sporting legends, votes for the winners in various categories.

• The 2025 ceremony continues the tradition of honoring excellence across categories like World Sportsman of the Year, World Sportswoman of the Year, and World Team of the Year.

Important Points

• Other Options Analyzed:

• Anna Grimaldi: A talented New Zealand para-athlete specializing in the long jump (T47). While she is a multi-time Paralympic gold medalist, she was not the recipient of this specific 2025 Laureus award.

• Yuto Horigome: A Japanese professional skateboarder who won the first-ever Olympic gold medal in the men's street event at Tokyo 2020 and defended his title at Paris 2024. He is typically nominated in the Action Sports category rather than the disability category.

• Chloe Kim: An American snowboarder and two-time Olympic gold medalist in the halfpipe. She is one of the most decorated athletes in X Games history but does not compete in Paralympic categories.

• Significance of the Award:

• Winning a Laureus Award is considered one of the highest honors in the sporting world because the winners are chosen by their peers (former legends of sport).

• Jiang Yuyan joins an elite list of previous winners in the disability category, such as Diede de Groot, Marcel Hug, and Esther Vergeer.

• Her 2025 win highlights China's growing dominance in the Paralympic swimming arena and the global impact of her record-breaking 7 gold medals.

Q100. Answer: (c) Deen Dayal Upadhyaya Gram Jyoti Yojana (DDUGJY)

The correct answer is Deen Dayal Upadhyaya Gram Jyoti Yojana (DDUGJY).

Key Points

• The Deen Dayal Upadhyaya Gram Jyoti Yojana (DDUGJY) is a flagship scheme of the Ministry of Power designed to provide continuous power supply to rural India.

• As noted in the Economic Survey 2024–25, the scheme was instrumental in achieving the massive milestone of electrifying 18,374 un-electrified villages across the country.

• The scheme was launched on July 25, 2015, by Prime Minister Narendra Modi in Patna, Bihar, with the aim of revolutionizing the rural power distribution system.

• It focused on several key objectives: the separation of agriculture and non-agriculture feeders, strengthening of sub-transmission and distribution networks, and the electrification of villages. Hence, the correct answer is Deen Dayal Upadhyaya Gram Jyoti Yojana (DDUGJY).

• The scheme subsumed the previous Rajiv Gandhi Grameen Vidyutikaran Yojana (RGGVY) while keeping the rural electrification targets as a primary component.

Additional Information

• UJALA (Unnat Jyoti by Affordable LEDs for All):

• Launched in January 2015, it is considered the world's largest LED bulb distribution program.

• It aims to promote energy efficiency by providing high-quality LEDs to domestic consumers at affordable prices, significantly

reducing electricity bills and carbon emissions.

• UDAY (Ujwal DISCOM Assurance Yojana):

• Launched in November 2015, this scheme targets the financial turnaround and revival of Power Distribution Companies (DISCOMs).

• It focuses on four areas: improving operational efficiency of DISCOMs, reduction of cost of power, reduction in interest burden, and enforcing financial discipline.

• Pradhan Mantri Nayi Roshni Yojana (PMNRY):

• This is primarily a Leadership Development Program for Minority Women launched by the Ministry of Minority Affairs.

• It aims to empower and instill confidence among minority women by providing knowledge, tools, and techniques for interacting with Government systems and Banks.

Important Points

• Universal Village Electrification: The goal of 100% village electrification was declared complete on April 28, 2018, when Leisang village in the Senapati district of Manipur was connected to the national grid.

• Shift to Household Electrification: Following the success of DDUGJY in reaching every village, the government launched the SAUBHAGYA (Pradhan Mantri Sahaj Bijli Har Ghar Yojana) in October 2017 to ensure last-mile connectivity to all un-electrified households.

• Impact on Economy: The Economic Survey 2024–25 highlights that the enhancement of the power sector infrastructure has been a critical driver for GDP growth and improved Ease of Living in rural areas.

• Technical Components: Under DDUGJY, the Rural Electrification Corporation (REC) acted as the Nodal Agency for the operationalization and monitoring of the projects.

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