RRB Group D Official Paper (Held On: 08 Dec, 2025 Shift 2) (Previous Year Paper)

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

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GENERAL SCIENCE

Q1. An object is thrown vertically upwards with velocity u. Under the influence of gravity, the acceleration:

(a) acts in the direction of motion
(b) becomes zero at the highest point
(c) acts opposite to the direction of motion
(d) increases the upward velocity

Q2. According to Bohr's model of the atom, electrons in an atom:

(a) are stationary in the atom and emit energy when struck by photons
(b) revolve around the nucleus in elliptical orbits and emit energy continuously
(c) are embedded in a positively charged sphere like plums in a pudding
(d) revolve in fixed circular orbits and do not radiate energy while in these orbits

Q3. Which of the following non-metals is found liquid at room temperature?

(a) Iodine
(b) Nitrogen
(c) Phosphorous
(d) Bromine

Q4. Which of the following pairs of human male chromosome is mismatched in size?

(a) Sex chromosomes
(b) Twentieth pair autosomes
(c) Thirteenth pair autosomes
(d) First pair autosomes

Q5. Which of the following is the compound produced by the action of chlorine on dry slaked lime (Ca(OH)2) ?

(a) bleaching powder
(b) bleaching soda
(c) washing soda
(d) common salt

Q6. Which of the following is NOT present in animal cells?

(a) Nucleus
(b) Chloroplast
(c) Plasma membrane
(d) Cytoplasm

Q7. Which of the following is the common name for ethanol (C2H5OH) ?

(a) Methyl alcohol
(b) Butyl alcohol
(c) Isopropyl alcohol

(d) Ethyl alcohol

Q8. A light is travelling from a denser medium A to a rarer medium B. What will be the unit of refractive index of medium B with respect to medium A?

(a) No unit
(b) (metre) ²
(c) (metre) ^(-1)
(d) metre

Q9. A train is moving along a straight track with a speed of 54 km/hr. It stops after traveling 150 m. The magnitude of its acceleration is:

(a) 0.75 m/s ²
(b) 1 m/s ²
(c) 2 m/s ²
(d) 1.5 m/s ²

Q10. A car driver uses a concave mirror as a shaving mirror at home. If his face is kept close to the mirror, how will the image formed be?

(a) Real, inverted, and larger than the face
(b) Virtual, erect, and magnified
(c) Virtual, erect, and diminished
(d) Real, inverted, and smaller than the face

Q11. While cleaning the school campus, students are asked to separate biodegradable waste. Which of the following should be placed in the biodegradable bin?

(a) Glass bottle
(b) Polythene bag
(c) Wooden pencil shavings
(d) A crushed cold drink can

Q12. What are the products formed when an acid reacts with a metal hydrogen carbonate?

(a) Base + Hydrogen gas
(b) Salt + Oxygen + Carbon
(c) Salt + Hydrogen gas
(d) Salt + Water + Carbon dioxide

Q13. The generation of heat in a conductor due to electric current is known as:

(a) electrolysis
(b) Ohm’s Law
(c) electromagnetic induction
(d) Joule’s heating

Q14. Which of the following statements correctly explains the continuous movement of particles of matter?

(a) Particles of matter are too heavy to move.
(b) Particles of matter are stationary unless force is applied.
(c) Particles of matter are continuously moving due to their kinetic energy.
(d) Particles of matter move only in gases and not in solids or liquids.

Q15. What is molecular mass of carbon dioxide?

(a) 44
(b) 22
(c) 38
(d) 42

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Q16. Which of the following metals is most likely to be found in the free state in nature due to its low reactivity?

(a) Iron
(b) Zinc
(c) Copper
(d) Gold

Q17. Which of the following features is seen in every cell under a microscope?

(a) Lysosome
(b) Cell membrane
(c) Mitochondria
(d) Chromosome

Q18. Which substances are selectively reabsorbed in the nephron?

(a) Urea and carbon dioxide
(b) Bile and hydrochloric acid
(c) Glucose, amino acids, and water
(d) Platelets and enzymes

Q19. A cyclist performing uniform circular motion throws an apple in his direction, the apple moves in a _____.

(a) straight line path opposite to the cyclist
(b) circular path opposite to the cyclist
(c) tangential path to the circular path at that point
(d) circular path as the cyclist

Q20. The potential energy of a body depends on which of the following?

(a) Both mass and height
(b) Height only
(c) Speed
(d) Mass only

Q21. Which of the following is secreted directly into the blood and carried to different parts of the body?

(a) Adrenaline
(b) Pancreatic juice
(c) Bile juice
(d) Saliva

Q22. At maturity, an organism breaks into smaller pieces, which grow into new individuals. What is this process called?

(a) Fusion
(b) Budding
(c) Fission
(d) Fragmentation

Q23. What is the primary advantage of cross-pollination over self-pollination?

(a) Produces progeny that is identical to parent
(b) Does not depend on pollinating agents for producing progeny
(c) Introduces genetic variations, which improves chances of survival in progeny
(d) Requires less energy input for generating the progeny

Q24. Which of the following statements is NOT correct?

(a) Loudness depends on frequency
(b) Loud sound has large amplitude
(c) Soft sound has small amplitude
(d) Loudness depends on amplitude

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Q25. When the current in a circuit is doubled, keeping resistance constant, the power dissipated in the resistor becomes:

(a) Double
(b) Half
(c) Four times
(d) One-fourth

MATHEMATICS

Q26. The product of the present ages of Seema and Jyoti is 3,952 years, and their present age ratio is 19 : 13. Find the difference in the ages (in years) of Seema and Jyoti.

(a) 16
(b) 22
(c) 24
(d) 18

Q27. The average of the first 5 odd natural numbers is:

(a) 4
(b) 5
(c) 2.5
(d) 6

Q28. The income of Raman is Rs. 70,900. He saves 12% of his income. If his income increases by 39% and expenditure increases by 50%, then his savings will:

(a) decrease by Rs. 3,550
(b) increase by Rs. 3,546
(c) decrease by Rs. 3,545
(d) increase by Rs. 3,548

Q29. Train P, going at the speed of 51 km/hr, completely passes Train Q of length 225 m, going in the same direction on parallel tracks, at 22 km/hr, in 7.5 minutes. How much time (in seconds) will P take to completely cross Train R of length 420 m, going at 21 km/hr in the opposite direction?

(a) 191
(b) 181
(c) 196
(d) 193

Q30. If the mean proportional of A and 50 is 40, then find the value of A.

(a) 32
(b) 31
(c) 30
(d) 33

Q31. A credit card payment that will settle a bill for 383 mixers at Rs. 1,000 per mixer with successive discounts of 25% and 20% with a further discount of 13% on card payment is:

(a) Rs. 1,99,926
(b) Rs. 1,99,908
(c) Rs. 1,99,915
(d) Rs. 1,99,918

Q32. The sides of a triangle are 75 cm, 44 cm, and 35 cm. What is the length of its altitude corresponding to the side with a length of 44 cm?

(a) 26 cm
(b) 21 cm
(c) 45 cm
(d) 50 cm

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Q33. 1over20 is what percentage of 11over40 (rounded off to two decimal places)?

(a) 28.18%
(b) 36.36%
(c) 33.18%
(d) 18.18%

Q34. The areas of three adjacent faces of a solid cuboid are 108 cm^2, 60 cm^2 and 45 cm^2. What is the volume (in cm^3) of the cuboid?

(a) 296
(b) 332
(c) 686
(d) 540

Q35. Find the HCF of 27, 54 and 108.

(a) 27
(b) 9
(c) 18
(d) 54

Q36. A, B, and C can do a piece of work in 3, 3, and 3 days respectively. How long (in days) will they take to do thrice the same work, working together?

(a) 9
(b) 6
(c) 4
(d) 3

Q37. Simplify: $21^3 + 13^3 - 34^3 + 3 \times 21 \times 13 \times 34$

(a) 68
(b) 0
(c) 1
(d) 9282

Q38. Aman and Yogita together invested Rs. 59,200 in a business. At the end of the year, out of a total profit of Rs. 8,000, Aman's share was Rs. 1,400. How much was Aman's investment?

(a) Rs. 11,385
(b) Rs. 8,610
(c) Rs. 10,360
(d) Rs. 11,915

Q39. Consider two triangles, ABC and XYZ. In triangle ABC, the base is 21 cm and the other two sides are 17 cm and 10 cm, respectively. In triangle XYZ, the base is two-thirds the base of triangle ABC and has an altitude of 5 cm. Find the sum of the areas of triangles ABC and XYZ.

(a) 124.5 cm^2
(b) 108 cm2
(c) 136.5 cm2
(d) 119 cm2

Q40. Sohan purchased 25 dozens of toys at the rate of Rs. 480 per dozen. He sold each one of them at the rate of Rs. 45. What was his percentage profit?

(a) 14.5%
(b) 10.5%
(c) 12.5%
(d) 11.5%

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Q41. The angle of elevation of the top of a tree at a distance of 60 m from its foot on a horizontal plane is found to be 30°. Find the height of the tree.

(a) 10√3 m
(b) 20√3 m
(c) 40√3 m
(d) 15√3 m

Q42. A certain sum of money amounts to Rs. 7,040 in 2 years and Rs. 8,000 in 5 years on simple interest. Find the principal.

(a) Rs. 6,200
(b) Rs. 5,800
(c) Rs. 6,550
(d) Rs. 6,400

Q43. An Uber auto covers a distance of 680 km in 17 hours. What is its speed in km/hr?

(a) 43
(b) 40
(c) 32
(d) 34

Q44. The value of ((0.896 × 0.763 + 0.896 × 0.237)/(0.7 × 0.064 + 0.7 × 0.936)) is:

(a) 0.128
(b) 1.28
(c) 128
(d) 12.8

Q45. The average age of 50 students in a class is 29 years. If the age of the teacher is also included, the average age of the whole group becomes 30 years. The age (in years) of the teacher is:

(a) 82
(b) 80
(c) 83
(d) 85

Q46. A cistern is normally filled in 12 hours but takes 2 hours longer to fill because of a leak in its bottom. If the cistern is full, then in how much time will the leak empty the tank? 6999

(a) 120 hours
(b) 84 hours
(c) 48 hours
(d) 124 hours

Q47. The sum of seven consecutive numbers is 168. What is the sum of the largest and the smallest numbers?

(a) 45
(b) 46
(c) 49
(d) 48

Q48. Simplify 3 × 5 + 8 - 15 ÷ 3 - 12 + 72 ÷ 8 × 5 - 32.

(a) 19
(b) 72
(c) 45
(d) 28

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Q49. In an election between two candidates, 20% of the total votes were declared invalid. The winning candidate received 70% of the valid votes and won by a margin of 12,400 votes. Find the total number of registered voters.

(a) 11,625
(b) 27,125
(c) 38,000
(d) 38,750

Q50. Manoj got a new curtain at 20% discount. If Manoj did not get any discount, Manoj would have to pay Rs. 664 extra. So how much did Manoj pay for the curtain?658

(a) Rs. 2,657
(b) Rs. 2,654
(c) Rs. 2,655
(d) Rs. 2,656

GENERAL INTELLIGENCE & REASONING

Q51. What should come in place of the question mark (?) in the given series?

5 6 10 19 35 60 ?

(a) 99
(b) 69
(c) 93
(d) 96

Q52. 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?

6 C 8 B 8 A 32 D 1 = ?

(a) 8
(b) 7
(c) 9
(d) 4

Q53. 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.)

(2, 30, 15)

(21, 189, 9)

(a) (45, 543, 12)
(b) (46, 969, 21)
(c) (4, 40, 10)
(d) (13, 263, 20)

Q54. A group of numbers/symbols is coded using letter codes as per the codes given below and the conditions that follow. 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	%	&	2	$	9	3	&	7	@	6	+	5	#	4
Codes	T	P	G	B	W	S	C	N	L	J	H	K	A	Y

Conditions:

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

(ii) If both the second and third elements are multiples of 2, the third element is to be coded as the code for the second element.

(iii) If the second element is an odd number and the last element a symbol, the second and last elements are to be coded as *.

What will be the code for the following group?

& 4 8 $ #

(a) C * P R *
(b) A Y P R C
(c) C Y Y R A
(d) C P P R A

Q55. Refer to the following number series and answer the question that follows. (All numbers are single-digit numbers only.) (Counting to be done from left to right only.)

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

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

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

Q56. In a certain code language, 'the chef cooks' is coded as 'ae tr ds' and 'she cooks food' is coded as 'fp qz tr'. How is 'cooks' coded in that language?

(a) ds
(b) qz
(c) tr
(d) ae

Q57. Which of the given letter-number clusters will replace the question mark (?) in the following series to make it logically complete?

DTM44, HQJ40, LNG36, ?

(a) PKD32
(b) QJD32
(c) QJC33
(d) PKC34

Q58. 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) RD – VB
(b) BM – FJ
(c) QL – UJ
(d) KP – ON

Q59. In a certain code language,

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

'A - B' means 'A is the mother of B'

'A × B' means 'A is the sister of B'

'A ÷ B' means 'A is the brother of B'

Based on the above, how is P related to T if 'P - Q ÷ R + S × T'?

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

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Q60. Select the pair that follows the same pattern as the one followed by the two pairs given below. Both pairs follow the same pattern.

OPT−XYC

DEI−MNR

(a) CDH−LMQ
(b) CCF−KLP
(c) CCF−LMQ
(d) CDH−KMP

Q61. If + means -, - means x, x means ÷, ÷ means +, then what will come in place of the question mark (?) in the following equation?

19 - 16 ÷ 128 + 32 x 4 = ?

(a) 433
(b) 413
(c) 424
(d) 429

Q62. A, B, C, D, W, X and Y are sitting around a circular table facing the centre of the table.

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

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

Q63. Refer to the following series and answer the question that follows (all numbers are single digit numbers only). Counting to be done from left to right only.

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

How many such even numbers are there each of which is immediately preceded by an odd number and also immediately followed by an even number?15354

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

Q64. Select the pair that follows the same pattern as the one followed by the two pairs given below. Both pairs follow the same pattern.

GHK−JKN

TUX−WXA

(a) QRU−TUX
(b) QRU−SUW
(c) QQS−STW
(d) QQS−TUX

Q65. This question is based on the five, three-digit numbers given below.

(Left) 551 214 483 409 581 (Right)

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

(NOTE - All operations to be done from left to right.)

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

(a) 12
(b) 11
(c) 16

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(d) 10

Q66. Mr. Z starts from Point A and drives 17 km towards the South. He then takes a left turn, drives 18 km, then turns left and drives 41 km. He then takes a left turn and drives 27 km, then turns left and drives 15 km. He then takes a right turn and drives 7 km. He takes a final left turn, drives 9 km, and stops at Point P. How far (shortest distance) and towards which direction should he drive in order to reach Point A again? (All turns are 90-degree turns only, unless specified.)

(a) 16 km to the west
(b) 17 km to the west
(c) 16 km to the east
(d) 17 km to the east

Q67. What should come in place of the question mark (?) in the given series?283 261 239 217 195 ?

(a) 169
(b) 180
(c) 173
(d) 165

Q68. In a row of 39 people facing north, Sangeeta is 14th from the left end. If Meghana sits 11th to the right of Sangeeta, then what is Meghana's position from the right end of the row?

(a) 10
(b) 17
(c) 15
(d) 11

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

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

(a) TSW
(b) VVY
(c) DCG
(d) LKO

Q70. Which of the following letter-number clusters will replace the question mark (?) in the given series to make it logically complete?

DRA111, NBK97, XLU83, HVE69, ?

(a) RFO55
(b) RFQ55
(c) RGO55
(d) SFO55

Q71. What should come in place of the question mark (?) in the given series?

2 4 12 48 ? 1440

(a) 224
(b) 240
(c) 422
(d) 420

Q72. Refer to the number series given below and answer the question that follows. Counting to be done from left to right only.

(NOTE: All numbers are single-digit numbers only.)

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

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

(a) 4

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

Q73. If 'A' stands for '÷', 'B' stands for 'x', 'C' stands for '+' and 'D' stands for '-', what will come in place of the question mark '?' in the following equation?

14 B 2 D 18 A 9 C 12 = ?

(a) 39
(b) 38
(c) 40
(d) 36

Q74. Read the given statements and conclusions carefully. Assuming that the information given in the statements is true, even if it appears to be at variance with commonly known facts, decide which of the given conclusions logically follow(s) from the statements.

Statements:

Some cakes are samosas.

All samosas are buns.

Conclusions:

(I): Some cakes are buns.

(II): All buns are samosas.

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

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 shirts are trousers. All trousers are pants. No pant is a coat.

Conclusion (I) : No shirt is a coat.

Conclusion (II) : No trouser is a coat.

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

Q76. A, B, C, D, E, F and G are sitting around a circular table facing the centre. D is the immediate neighbour of G and A. F sits second to the left of G. E is the immediate neighbour of C and A.

How many people sit between C and B when counted from the left of B?

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

Q77. Seven boxes, A, B, C, D, I, J and K, are kept one over the other, but not necessarily in the same order. K is kept second from the bottom. Only three boxes are kept between K and I. D is kept at one of the positions below K. Only B is kept between I and J. A is kept at one of the positions above I.

How many boxes are kept between C and D?

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

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Q78. XYBX is related to WXAW in a certain way based on the English alphabetical order. In the same way, QRUQ is related to PQTP. To which of the given options is RSVR related, following the same logic?

(a) QRTQ
(b) QRUQ
(c) QQTQ
(d) QSTZ

Q79. Mr. Akai starts from Point A and drives 12 km towards west. He then takes a left turn, drives 15 km, turns left and drives 20 km. He then takes a left turn and drives 28 km. He takes a final left turn, drives 8 km and stops at Point P. How far (shortest distance) and towards which direction should he drive in order to reach Point A again? (All turns are 90 degrees turns only unless specified)

(a) 10 km to the east
(b) 15 km to the north
(c) 13 km to the south
(d) 12 km to the north

Q80. A, B, C, E, F, P and Q are sitting around a circular table facing the centre. F sits third to the left of C. Only one person sits between C and P when counted from the left of P. Only two people sit between B and E when counted from the right of E. A is an immediate neighbour of B. Who sits to the immediate left and right of Q, respectively?

(a) F and A
(b) C and P
(c) P and C
(d) P and B

GENERAL AWARENESS AND CURRENT AFFAIRS

Q81. Where was the 2025 Wimbledon tennis tournament held?

(a) New York, USA
(b) Melbourne, Australia
(c) London, United Kingdom
(d) Paris, France

Q82. What scientific activity is NOT planned on Axiom-4?

(a) Testing crewed docking with a lunar base at Indian space station
(b) Studying the effects of short spaceflights on joints and blood flow
(c) Examining microgravity's impact on the brain and cognitive risks
(d) Understanding the effects on blood stem cells during spaceflight

Q83. The Defense Research and Development Organisation (DRDO) lab in which city has created an advanced polymeric membrane designed for high-pressure desalination of sea water in May 2025?

(a) Hyderabad
(b) Pune
(c) Bengaluru
(d) Kanpur

Q84. Who authored the book Memories and Milestones, documenting 60 years of Blue Cross of India, launched in 2025?

(a) Maneka Sanjay Gandhi and AL Somayaji
(b) Justice PN Prakash and V Sriram
(c) Lashman and Maneka Gandhi
(d) V Sriram and Lashman

Q85. In October 2025, which state government launched the State Climate Action Tracker alongside district-level decarbonization action plans?

(a) Gujarat
(b) Kerala

(c) Tamil Nadu
(d) Meghalaya

Q86. Which national team claimed their first-ever title at the 2025 IIHF Women's Asia Cup?
(a) India
(b) Japan
(c) China
(d) Philippines

Q87. In 2025, which Ministry of Defence initiative aimed to modernise the armed forces in cyber, AI, and integrated command?
(a) Digital India in Defence
(b) Make in India
(c) Year of Reforms
(d) Operation Cold Start

Q88. As of July 2025, what is the duration of the Revised Green India Mission (GIM) Plan released in 2025?
(a) 2020–2025
(b) 2025–2035
(c) 2022–2029
(d) 2021–2030

Q89. In February 2025, which company partnered with Roche Diagnostics for a self-sampling HPV DNA test in India?
(a) Metropolis Healthcare
(b) Fortis Healthcare
(c) Max Healthcare
(d) Apollo Hospitals

Q90. On 31 May 2025, which of the following banks of India waived the minimum balance requirement on all savings accounts?
(a) Punjab National Bank
(b) Indian Bank
(c) Canara Bank
(d) Bank of India

Q91. In April 2025, DRDO's Defense Research and Development Laboratory (DRDL) unit had successfully completed a long-duration ground test of an advanced scramjet combustor in _____.
(a) Bhopal
(b) Lucknow
(c) Hyderabad
(d) Ahmedabad

Q92. Which of the following is a state-of-the-art infrastructure, disaster-resilient facility launched by the Government of India in June 2025 for strengthening disaster preparedness and response mechanisms?
(a) Centralised Crisis Management Centre
(b) Advanced Disaster Response and Monitoring Facility
(c) National Disaster Coordination Hub
(d) Integrated Control Room for Emergency Response

Q93. Who won the Sportstar of the Year (Male) award at the Sportstar Aces Awards 2025?
(a) Virat Kohli
(b) Neeraj Chopra
(c) Rohit Sharma
(d) PR Sreejesh

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Q94. Which book, launched by Union Minister Dharmendra Pradhan at the World Book Fair 2025, is part of the PM YUVA 2.0 scheme?

(a) Death of a Gentleman
(b) The Saga of Kudopali
(c) Indian Renaissance: The Modi Decade
(d) The Elsewhereans

Q95. The Reserve Bank of India launched the PRAVAAH portal with effect from _____.

(a) 1 May 2025
(b) 1 April 2025
(c) 1 June 2025
(d) 1 July 2025

Q96. The Andhra Pradesh government rejected Telangana's demand for a 50 : 50 share of Krishna river water in January 2025. Currently, what is the water sharing ratio between Andhra Pradesh and Telangana?

(a) 55 : 45
(b) 60 : 40
(c) 66 : 34
(d) 70 : 30

Q97. International Labour Day 2025 was celebrated globally on which of the following dates?

(a) April 30
(b) May 3
(c) May 2
(d) May 1

Q98. Which renowned personality received the 2025 Templeton Prize for promoting science and spirituality?

(a) William Lane Craig
(b) Jean Vanier Patriarch Bartholomew
(c) Francis Collins
(d) Ecumenical Patriarch Bartholomew

Q99. Which Indian captain won the IPL 2025 in his debut season as skipper?

(a) Rajat Patidar
(b) Suryakumar Yadav
(c) Sai Sudharsan
(d) Krunal Pandya

Q100. Which of the following was the main theme of the conference organised by the National Minorities Development and Finance Corporation in Mumbai in May 2025?

(a) Innovation in Religious Institutions
(b) Financial Planning for Small Businesses
(c) Entrepreneurship for Minorities
(d) Leadership Training for Minority Women

ANSWER KEY

1	c	2	d	3	d	4	a	5	a	6	b	7	d	8	a	9	a	10	b
11	c	12	d	13	d	14	c	15	a	16	d	17	b	18	c	19	c	20	a
21	a	22	d	23	c	24	a	25	c	26	c	27	b	28	c	29	a	30	a
31	a	32	b	33	d	34	d	35	a	36	d	37	b	38	c	39	d	40	c
41	b	42	d	43	b	44	b	45	b	46	b	47	d	48	a	49	d	50	d
51	d	52	b	53	c	54	c	55	d	56	c	57	a	58	b	59	c	60	a

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61	c	62	c	63	c	64	a	65	a	66	c	67	c	68	c	69	b	70	a
71	b	72	a	73	b	74	a	75	a	76	a	77	c	78	b	79	c	80	b
81	c	82	a	83	d	84	d	85	c	86	d	87	c	88	d	89	a	90	c
91	c	92	d	93	d	94	c	95	a	96	c	97	d	98	d	99	a	100	c

SOLUTIONS

Q1. Answer: (c) acts opposite to the direction of motion

The correct answer is acts opposite to the direction of motion.

Key Points

• When an object is thrown vertically upwards with an initial velocity u, it moves against the force of gravity. The acceleration due to gravity (g) always acts downward, i.e., opposite to the direction of motion during the upward journey. Hence, the correct statement is that acceleration acts opposite to the direction of motion.

• As the object rises, the velocity decreases uniformly because the acceleration due to gravity retards the upward motion. At the highest point, the velocity of the object becomes zero momentarily, but the acceleration due to gravity still acts downward. Hence, the statement "becomes zero at the highest point" is incorrect for acceleration.

• During the entire motion, the acceleration due to gravity remains constant in magnitude and direction (downward). It does not act in the direction of motion during the upward journey. This makes the statement "acts in the direction of motion" incorrect.

• Gravity does not increase the upward velocity; rather, it continuously decreases it. Hence, the statement "increases the upward velocity" is incorrect.

• The value of acceleration due to gravity near the Earth's surface is approximately 9.8 m/s^2, directed toward the center of the Earth, and is independent of the object's motion.

Additional Information

• Gravity as a Constant Force:

• Acceleration due to gravity (g) is a constant value near the surface of the Earth and acts toward the center of the Earth.

• Its value is approximately 9.8 m/s^2, though it varies slightly depending on altitude and latitude.

• Motion Under Gravity:

• An object thrown upward slows down due to the opposing force of gravity, eventually coming to rest momentarily at the highest point.

• On its way back down, gravity accelerates the object, increasing its velocity until it returns to the original point of projection.

• Equations of Motion Under Gravity:

• Standard equations of motion such as $v = u + at$, $s = ut + (1/2)at^2$, and $v^2 = u^2 + 2as$ are used to describe motion under gravity.

• For upward motion, acceleration (a) is taken as -g since it opposes the motion.

• For downward motion, acceleration is taken as +g.

• Practical Applications:

• The concept of motion under gravity is essential in fields like projectile motion, space exploration, and sports physics.

• It is also used to calculate the time of flight, maximum height, and range of objects thrown or projected.

Important Points

• Key Characteristics of Gravity:

• It is a natural force that pulls objects toward the center of a massive body, like the Earth.

• The force of gravity is directly proportional to the masses involved and inversely proportional to the square of the distance between them, as per Newton's law of universal gravitation.

• It affects all objects equally, irrespective of their mass, in the absence of air resistance.

• Real-Life Examples:

• Throwing a ball upward and observing its deceleration and eventual fall is a direct demonstration of gravity's effect.

• Space agencies like NASA account for gravity to calculate trajectories for satellites and spacecraft.

• Sports such as basketball, cricket, and javelin rely on understanding motion under gravity to enhance performance.

Q2. Answer: (d) revolve in fixed circular orbits and do not radiate energy while in these orbits

The correct answer is revolve in fixed circular orbits and do not radiate energy while in these orbits.

Key Points

• Bohr's atomic model proposed that electrons revolve around the nucleus in fixed circular orbits, also known as energy levels or

shells. These orbits are quantized, meaning electrons can only occupy specific, defined levels of energy.

• While in these fixed orbits, electrons do not emit or lose energy, contradicting classical electromagnetic theory, which suggests that accelerating charges (like electrons) should radiate energy.

• Electrons can move between energy levels by absorbing or emitting discrete amounts of energy, called quanta. The energy change corresponds to the difference in energy between the two levels.

• Bohr introduced the concept of quantization, which explains why atoms exhibit specific spectral lines. These lines are produced when electrons transition between energy levels.

• This model successfully explained the hydrogen atom's spectral lines but was later found inadequate for more complex atoms and was succeeded by quantum mechanics.

Additional Information

• Key Features of Bohr's Model:

• Electrons are confined to fixed orbits or shells around the nucleus, and each orbit corresponds to a specific energy level.

• These orbits are stable, and electrons in these orbits do not radiate energy, addressing the instability predicted by Rutherford's model.

• The energy of an electron depends on the orbit it occupies, with lower energy closer to the nucleus and higher energy farther away.

• The model introduced the idea of quantized angular momentum, with electrons having angular momentum equal to an integer multiple of $h/2\pi$ (where h is Planck's constant).

• Limitations of Bohr's Model:

• The model could only accurately explain the spectrum of hydrogen and hydrogen-like ions (single-electron systems) but failed for multi-electron atoms.

• It could not explain the finer details of spectral lines, such as splitting due to the Zeeman effect or Stark effect.

• Bohr's model was later replaced by the more comprehensive quantum mechanical model of the atom, which incorporates wave-particle duality and probabilistic electron behavior.

• Alternative Atomic Models:

• Thomson's Model: Proposed that electrons are embedded in a positively charged sphere, like plums in a pudding. This model was incorrect as it could not explain atomic stability.

• Rutherford's Model: Suggested that electrons revolve around a dense, positively charged nucleus. However, it failed to explain why electrons do not spiral into the nucleus due to energy radiation.

• Quantum Mechanical Model: This modern model uses Schrödinger's wave equation and describes electrons as existing in probability clouds (orbitals) rather than fixed orbits.

• Applications of Bohr's Model:

• Explained the Rydberg formula for the spectral emission lines of the hydrogen atom.

• Provided a foundation for understanding atomic structure and behavior, paving the way for quantum mechanics.

• Helped in the calculation of ionization energy and excitation energy for hydrogen-like atoms.

Important Points

• Statement Analysis:

• Option 1: Incorrect. Electrons are not stationary and do not emit energy upon being struck by photons.

• Option 2: Incorrect. Bohr's model describes electrons in circular, not elliptical orbits, and they do not emit energy continuously.

• Option 3: Incorrect. This is Thomson's "plum pudding" model, which was disproven by Rutherford's gold foil experiment.

• Option 4: Correct. Electrons revolve in fixed circular orbits and do not radiate energy while in these orbits, as described by Bohr's model.

• Historical Context: Bohr's model was proposed in 1913, combining classical mechanics and early quantum theory.

• Significance: The model laid the groundwork for modern atomic theory and quantum mechanics, revolutionizing our understanding of atomic and subatomic behavior.

Q3. Answer: (d) Bromine

The correct answer is Bromine.

Key Points

• Bromine is the only non-metal that exists as a liquid at room temperature (approximately 25°C).

• It has a melting point of -7.2°C and a boiling point of 58.8°C, which means it remains in the liquid state under standard room conditions.

• Bromine is a reddish-brown liquid with a pungent odor and is highly volatile, forming toxic fumes.

• It belongs to the halogen group (Group 17) of the periodic table, which also includes fluorine, chlorine, iodine, and astatine.

• Bromine is widely used in industries for the production of flame retardants, pesticides, and dyes.

Additional Information

• Iodine:

• Iodine is a solid at room temperature and has a melting point of 113.7°C and a boiling point of 184.3°C.

• It is primarily used in iodized salt and as an antiseptic in medicines.

• Iodine is a member of the halogen group and exists in a crystalline form with a metallic luster.

• Nitrogen:

• Nitrogen is a gas at room temperature with a boiling point of -195.8°C and a melting point of -210°C.

• It makes up approximately 78% of Earth's atmosphere and is essential for the formation of amino acids and proteins in living organisms.

• Nitrogen is used industrially in the production of fertilizers, explosives, and as a cryogenic agent.

• Phosphorus:

• Phosphorus exists in several allotropes, with white phosphorus and red phosphorus being the most common.

• At room temperature, phosphorus is a solid with a melting point of 44.1°C (white phosphorus).

• It is widely used in the production of fertilizers, explosives, and matches.

• Bromine:

• Bromine is a unique non-metallic element because it is a liquid at room temperature.

• Its applications include fire retardants, water treatment chemicals, and photographic films.

• Bromine is toxic and corrosive, requiring careful handling and storage.

Important Points

• Unique Properties of Bromine:

• Bromine's liquid state at room temperature is a result of its moderate intermolecular forces, specifically van der Waals forces.

• It is highly reactive and forms compounds with a wide range of elements.

• Comparison with Other Halogens:

• Other halogens such as chlorine and fluorine are gases at room temperature, while iodine and astatine are solids.

• This variability in physical states among halogens is due to differences in atomic mass and intermolecular forces.

• Safety Precautions:

• Bromine is highly toxic and can cause severe burns upon contact with the skin.

• Proper ventilation, protective clothing, and equipment are essential when handling bromine.

Q4. Answer: (a) Sex chromosomes

The correct answer is Sex chromosomes.

Key Points

• Sex chromosomes in human males consist of one X chromosome and one Y chromosome. These chromosomes are mismatched in size, with the X chromosome being significantly larger than the Y chromosome.

• The X chromosome contains approximately 155 million base pairs and hosts several hundred genes, while the Y chromosome is much smaller, with only about 58 million base pairs and fewer than 80 genes.

• This size difference is due to the evolutionary loss of genetic material on the Y chromosome over time, making it much smaller and gene-poor compared to the X chromosome.

• In contrast, autosomes are paired chromosomes that are generally similar in size and genetic content, making them matched pairs.

• Hence, the correct answer is "Sex chromosomes."

Additional Information

• Chromosomes:

• Humans have 46 chromosomes, organized into 23 pairs. These include 22 pairs of autosomes and 1 pair of sex chromosomes.

• Autosomes: These are non-sex chromosomes and are numbered from 1 to 22 based on size, with chromosome 1 being the largest.

• Sex chromosomes: In males, the sex chromosome pair is XY, and in females, it is XX. The Y chromosome determines male sex characteristics.

• Functions of Sex Chromosomes:

• The X chromosome plays a vital role in both sexes, as it carries genes related to essential functions such as vision, immunity, and reproduction.

• The Y chromosome carries genes like SRY (Sex-determining Region Y), which is crucial for the development of male gonads (testes).

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• Autosomal Chromosomes:

• These chromosomes contain genes responsible for most of the body's structures and functions, such as metabolic processes, growth, and immunity.

• Autosomal pairs are homologous, meaning both chromosomes in a pair are similar in size and gene content.

• Comparison of Chromosome Pairs:

• The first pair of autosomes is the largest, while the twentieth pair and other smaller autosomal pairs are similar in size.

• Unlike autosomes, sex chromosomes differ significantly, with the Y chromosome being much smaller than the X chromosome.

Important Points

• Genetic Disorders Related to Sex Chromosomes:

• Turner Syndrome: Occurs in females who have only one X chromosome (45, X0).

• Klinefelter Syndrome: A condition in males with an extra X chromosome (47, XXY).

• Y-linked disorders: Rare disorders caused by mutations in genes present on the Y chromosome.

• Chromosomal Studies:

• Chromosome analysis is essential for diagnosing genetic conditions and understanding evolutionary biology.

• Techniques like karyotyping and fluorescence in situ hybridization (FISH) are used for studying chromosomes.

Q5. Answer: (a) bleaching powder

The correct answer is bleaching powder.

Key Points

• Bleaching powder, chemically known as calcium oxychloride ($Ca(OCl)_2$), is produced when chlorine gas reacts with dry slaked lime ($Ca(OH)_2$).

• The chemical reaction involved is as follows: $Cl_2 + Ca(OH)_2 \rightarrow Ca(OCl)_2 + H_2O$.

• Bleaching powder is a white or pale yellowish powder with a strong chlorine smell.

• It is commonly used as a disinfectant, for bleaching fabrics, and as a sanitizing agent in water treatment.

• The reaction requires dry conditions, as moisture can interfere with the formation of bleaching powder.

Additional Information

• Properties of Bleaching Powder:

• It is a pale yellowish powder with a strong chlorine odor.

• It decomposes in the presence of moisture to release chlorine gas.

• Bleaching powder is slightly soluble in water, leaving behind a milky solution.

• Uses of Bleaching Powder:

• Water purification: It is used to disinfect drinking water by killing germs and bacteria.

• Textile industry: It is used for bleaching cotton and linen fabrics.

• Paper industry: It is employed in the bleaching of wood pulp.

• Disinfectant: It is widely used as a disinfectant in public places like swimming pools.

• Other related compounds:

• Bleaching soda: This is sodium carbonate (Na_2CO_3) and is used in washing and cleaning processes. It is not related to chlorine and slaked lime.

• Washing soda: Sodium carbonate decahydrate ($Na_2CO_3 \cdot 10H_2O$) is used as a cleaning agent in households.

• Common salt: Sodium chloride ($NaCl$) is a table salt and is unrelated to bleaching powder production.

• Chlorine gas: Chlorine is a greenish-yellow gas with a pungent smell, and it plays a crucial role in producing bleaching powder.

Important Points

• The reaction between chlorine and slaked lime is exothermic, meaning heat is released during the process.

• Bleaching powder is unstable and should be stored in a cool and dry place to maintain its effectiveness over time.

• The availability of chlorine in bleaching powder is a key factor determining its quality and strength.

• It is also used in the manufacturing of chloroform ($CHCl_3$) and other chemicals.

• Excessive exposure to bleaching powder can cause irritation to the skin, eyes, and respiratory system.

Q6. Answer: (b) Chloroplast

The correct answer is Chloroplast.

Key Points

• Chloroplasts are absent in animal cells. These organelles are specific to plant cells and some algae, where they are responsible for photosynthesis, a process that converts light energy into chemical energy stored as glucose.

• Animal cells do not perform photosynthesis as they obtain energy by consuming organic matter rather than producing it. Hence, chloroplasts are absent in animal cells.

• Nucleus, plasma membrane, and cytoplasm are present in both animal and plant cells. These are essential components for cellular function. Hence, these options are incorrect.

• The nucleus houses the genetic material (DNA) and controls cellular activities, making it an indispensable organelle in all eukaryotic cells.

• The plasma membrane, also known as the cell membrane, surrounds the cell, providing structural support, protection, and regulating the movement of substances in and out of the cell.

• The cytoplasm is the jelly-like substance filling the cell, where various metabolic processes and organelle activities take place. It is present in all cell types.

Additional Information

• Chloroplast:

• Chloroplasts are double-membrane-bound organelles found in plant cells and certain protists like algae.

• They contain the pigment chlorophyll, which captures light energy for photosynthesis.

• Chloroplasts have their own DNA and ribosomes, enabling them to produce some of their own proteins.

• They are responsible for converting light energy into glucose and oxygen, which are essential for the survival of plants and indirectly for all living organisms.

• Nucleus:

• The nucleus is a membrane-bound organelle present in all eukaryotic cells.

• It contains the cell's genetic material in the form of DNA, organized into chromosomes.

• It regulates essential cellular functions such as growth, metabolism, protein synthesis, and cell division.

• Plasma Membrane:

• The plasma membrane is a semi-permeable structure made of a phospholipid bilayer embedded with proteins.

• It regulates the movement of molecules such as nutrients, waste, and ions in and out of the cell.

• In animal cells, it is the outermost layer, whereas in plant cells, it is located beneath the cell wall.

• Cytoplasm:

• The cytoplasm is the gel-like substance enclosed within the cell membrane.

• It contains organelles such as mitochondria, endoplasmic reticulum, and Golgi apparatus, as well as cytosol, a fluid component.

• It is the site of various cellular processes, including glycolysis and intracellular transport.

Important Points

• Plant vs. Animal Cells:

• Plant cells have a rigid cell wall, chloroplasts, and a large central vacuole, which are absent in animal cells.

• Animal cells have centrioles and lysosomes, which are not typically found in plant cells.

• Photosynthesis:

• This process occurs in the chloroplasts of plant cells, where light energy is converted into chemical energy.

• The equation for photosynthesis is: $6CO_2 + 6H_2O + \text{light energy} \rightarrow C_6H_{12}O_6 + 6O_2$.

• Endosymbiotic Theory:

• Chloroplasts and mitochondria are believed to have originated from free-living prokaryotes through endosymbiosis.

• This theory is supported by the presence of their own DNA and double membranes.

Q7. Answer: (d) Ethyl alcohol

The correct answer is Ethyl alcohol.

Key Points

• Ethanol, with the chemical formula C_2H_5OH, is commonly known as Ethyl alcohol. It is a simple alcohol consisting of a two-carbon chain with a hydroxyl group (-OH).

• Ethyl alcohol is widely used in alcoholic beverages due to its psychoactive properties. It is the primary ingredient responsible for intoxication in such drinks.

• The term ethyl alcohol is derived from the ethyl group (C_2H_5), which is a functional group present in ethanol's structure.

• Ethanol is a versatile compound with extensive applications, including its use as a solvent in industries, a fuel additive (bioethanol), and a disinfectant in medical applications.

• Other alcohols like methyl alcohol (methanol), butyl alcohol, and isopropyl alcohol have distinct chemical structures and uses, making them different from ethanol.

Additional Information

• Methyl alcohol (Methanol):

• Its chemical formula is CH3OH.
• It is also known as wood alcohol and is primarily used as a solvent, antifreeze, or fuel.
• Methanol is highly toxic and can cause blindness or death if ingested.
• Butyl alcohol:
• Its chemical formula is C4H9OH.
• This alcohol has several isomers and is often used as an industrial solvent or in the production of plastics and coatings.
• Isopropyl alcohol:
• Its chemical formula is C3H8O.
• Also known as rubbing alcohol, it is commonly used as a disinfectant and cleaning agent.
• It is not suitable for consumption and can be toxic if ingested.
• Uses of Ethanol:
• As a fuel additive, ethanol is mixed with gasoline to create gasohol, helping to reduce air pollution.
• In the pharmaceutical industry, ethanol is used as a solvent for medicinal formulations.
• It is also employed in the production of perfumes, cosmetics, and other personal care products.
• Production of Ethanol:
• Ethanol is commonly produced by the fermentation of sugars found in crops like corn, sugarcane, and wheat.
• Industrially, it can also be synthesized through the hydration of ethylene.

Q8. Answer: (a) No unit

The correct answer is No unit.

Key Points

• The refractive index is a ratio of the speed of light in a vacuum to the speed of light in the given medium. It is expressed as:

Refractive Index (n) = Speed of Light in Vacuum / Speed of Light in Medium.

• Since it is a ratio of two quantities with the same units (speed), the resulting value is dimensionless, meaning it has no unit.

• In the given scenario, light travels from a denser medium A to a rarer medium B. The refractive index of medium B with respect to medium A is represented as:

n_(BA) = Speed of Light in Medium A / Speed of Light in Medium B.

• The refractive index simply compares how much light slows down in one medium compared to another and does not involve any physical units.

• Hence, the refractive index of medium B with respect to medium A is unitless.

Additional Information

• Refractive Index:

• The refractive index is a fundamental property of transparent materials and determines the bending of light (refraction) when passing from one medium to another.

• A higher refractive index indicates that light travels slower in the medium, while a lower refractive index means light travels faster.

• Example: The refractive index of water is approximately 1.33, meaning light travels 1.33 times slower in water compared to a vacuum.

• Snell's Law:

• Snell's Law governs the relationship between the angles of incidence and refraction when light passes between two media with different refractive indices.

• It is expressed as: n1sinθ1 = n2sinθ2, where n1 and n2 are the refractive indices of the two media, and θ1 and θ2 are the angles of incidence and refraction, respectively.

• Relative Refractive Index:

• The relative refractive index compares the refractive indices of two media, such as medium A and medium B, and is given by n_(BA) = n_B/n_A.

• This value helps determine the direction and extent of light bending when transitioning between the two media.

• Applications of Refractive Index:

• Used in designing lenses for optical instruments like cameras, microscopes, and telescopes.

• Helps in identifying materials based on their optical properties, such as gemstones or liquids.

• Plays a crucial role in fiber optics and telecommunications for efficient signal transmission.

Important Points

• Absolute Refractive Index: This is the refractive index of a medium with respect to a vacuum and is always greater than or equal

to 1.

• Critical Angle: The angle of incidence in the denser medium at which the angle of refraction becomes 90° in the rarer medium.

• Total Internal Reflection: When light traveling from a denser to a rarer medium hits the interface at an angle greater than the critical angle, it gets completely reflected back into the denser medium.

• Optical Density: A medium with a higher refractive index is considered optically denser than one with a lower refractive index, irrespective of its physical density.

Q9. Answer: (a) 0.75 m/s ²

The correct answer is 0.75 m/s².

Key Points

• Initial speed of the train: The train is moving at a speed of 54 km/hr. Converting this into meters per second: 54 km/hr = (54 × 1000) / (60 × 60) = 15 m/s. Hence, the initial velocity is 15 m/s.

• Final speed of the train: The train stops after traveling 150 meters. Therefore, its final velocity is 0 m/s.

• Displacement: The train travels a distance of 150 meters, which is the displacement during deceleration.

• Formula used: To calculate the acceleration, we use the kinematic equation: $v^2 = u^2 + 2as$, where v is the final velocity, u is the initial velocity, a is the acceleration, and s is the displacement.

• Calculation: Substituting the values: $0^2 = 15^2 + 2 \times a \times 150$. Simplifying: $0 = 225 + 300a$. Solving for a: $a = -225 / 300 = -0.75$ m/s². The negative sign indicates deceleration. The magnitude of acceleration is 0.75 m/s².

Additional Information

• Acceleration Definition: Acceleration is the rate of change of velocity with respect to time. It is measured in meters per second squared (m/s²). A negative acceleration indicates deceleration or slowing down.

• Kinematic Equations: These equations are used to solve problems in motion under uniform acceleration. The three main equations are:

• $v = u + at$

• $s = ut + 0.5at^2$

• $v^2 = u^2 + 2as$

• Units of Speed and Acceleration: Speed is measured in meters per second (m/s), and acceleration is measured in meters per second squared (m/s²). Conversions between units, such as km/hr to m/s, are crucial in physics calculations.

• Real-life Applications of Deceleration: Deceleration calculations are essential in designing brakes for vehicles, analyzing train stopping distances, and ensuring safety in transportation systems.

• Importance of Negative Acceleration: Negative acceleration helps in understanding the rate at which an object slows down. It is particularly useful in analyzing motion dynamics in braking systems and collision scenarios.

Important Points

• Uniform Acceleration: This occurs when the acceleration of an object remains constant over time. Examples include free fall motion under gravity and vehicles decelerating uniformly.

• Kinetic Energy in Motion: The train's motion involves kinetic energy, calculated using the formula $KE = 0.5mv^2$, where m is mass and v is velocity. As the train decelerates, its kinetic energy decreases.

• Stopping Distance: The distance required for a train or vehicle to come to a complete stop depends on initial velocity, acceleration (or deceleration), and frictional forces.

• Safety Measures: Accurate calculations of deceleration are crucial in designing effective braking systems and ensuring passenger safety during sudden stops.

• Applications in Physics: Understanding motion under uniform acceleration forms the foundation of classical mechanics and is widely applied in engineering, transportation, and safety design.

Q10. Answer: (b) Virtual, erect, and magnified

The correct answer is Virtual, erect, and magnified.

Key Points

• Concave mirrors are spherical mirrors with a reflecting surface that curves inward. They are capable of forming both real and virtual images based on the object's position relative to the mirror's focal point.

• When a person's face is placed close to a concave mirror (i.e., within its focal length), the mirror produces a virtual, erect, and magnified image. This happens because the reflected rays appear to diverge, and the image is formed on the same side as the object.

• For a concave mirror, the nature of the image depends on the object's position:

• When the object is beyond the center of curvature, the image is real, inverted, and smaller.

• When the object is at the focal point, no image is formed as the reflected rays are parallel.

• When the object is within the focal length, as in the case of shaving mirrors, the image is virtual, erect, and magnified.

• Shaving mirrors are typically designed to have a short focal length, ensuring that the face is within the focal length of the mirror to produce a magnified image. This feature allows the user to see a clear and enlarged reflection of their face for precise grooming.

• Magnification occurs because the reflected rays diverge as if they are originating from a point behind the mirror, creating a larger virtual image.

Additional Information

• Uses of Concave Mirrors:

• In shaving mirrors to produce a magnified and clear image of the face.

• In telescopes to gather and focus light from distant objects.

• In dentistry, dentists use concave mirrors to view an enlarged image of teeth for better diagnosis.

• In headlights and flashlights, concave mirrors are used to focus light into a beam.

• Key Characteristics of Concave Mirrors:

• They have a real focus (light rays converge at the focal point).

• Their reflective surface is on the inner side of the spherical shape.

• The type of image they form depends on the object's position relative to the focal point and center of curvature.

• Comparison with Convex Mirrors:

• Concave mirrors can form real and virtual images, while convex mirrors always produce virtual, erect, and diminished images.

• Convex mirrors are used as rear-view mirrors in vehicles because they provide a wide field of view.

• Image Formation by Concave Mirrors:

• Beyond the center of curvature: Real, inverted, and smaller than the object.

• At the center of curvature: Real, inverted, and the same size as the object.

• Between the center of curvature and the focal point: Real, inverted, and magnified.

• At the focal point: No image is formed (rays are parallel).

• Within the focal length: Virtual, erect, and magnified.

• Practical Applications:

• Concave mirrors are widely used in optical instruments, scientific equipment, and daily-use tools like shaving mirrors and makeup mirrors.

• They are also used in solar devices, such as solar cookers, to focus sunlight for heating purposes.

Q11. Answer: (c) Wooden pencil shavings

The correct answer is Wooden pencil shavings.

Key Points

• Biodegradable waste refers to materials that can be broken down by microorganisms such as bacteria and fungi into simpler organic forms and natural elements. Items such as wooden pencil shavings fall under this category as they are derived from wood, which is a natural and organic material.

• Glass bottles are not biodegradable as they are made of inorganic materials that do not decompose naturally. Instead, they require recycling processes. Hence, option 1 is incorrect.

• Polythene bags are non-biodegradable plastics that take hundreds of years to decompose. They contribute significantly to environmental pollution. Hence, option 2 is incorrect.

• Cold drink cans are typically made of aluminum, which is a non-biodegradable material. These cans are recyclable, but they do not decompose naturally in the environment. Hence, option 4 is incorrect.

• Wooden pencil shavings, being an organic by-product of wood, decompose naturally and enrich the soil, making them suitable for the biodegradable waste bin. Hence, option 3 is correct.

Additional Information

• Biodegradable Materials:

• Include organic materials such as food scraps, paper, leaves, wood, and cotton.

• Break down naturally through the action of microorganisms, returning nutrients to the soil.

• Examples: Vegetable peels, wood shavings, paper products, and garden waste.

• Non-Biodegradable Materials:

• Include synthetic and inorganic materials such as plastic, glass, and metal.

• Do not decompose naturally and can persist in the environment for decades or centuries.

• Examples: Plastic bags, glass bottles, aluminum cans, and synthetic fibers.

• Environmental Impact:

• Biodegradable waste, when properly composted, can improve soil quality and reduce landfill waste.

• Non-biodegradable waste contributes to pollution, habitat destruction, and health hazards.
• Composting:
• A process of recycling organic waste into nutrient-rich fertilizer for plants.
• Requires biodegradable materials like fruit peels, yard trimmings, and wooden shavings.
• Recycling:
• Non-biodegradable materials like glass and aluminum can be recycled to reduce environmental impact.
• Recycling processes conserve resources and reduce the production of waste.

Important Points

• Government Initiatives:
• Programs like Swachh Bharat Abhiyan emphasize waste segregation into biodegradable and non-biodegradable categories.
• Encouragement of composting and recycling to manage biodegradable and non-biodegradable waste effectively.
• Segregation at Source:
• Segregating waste at the source is crucial for effective waste management and environmental protection.
• Biodegradable waste can be composted, while non-biodegradable waste should be sent for recycling or proper disposal.
• Educational Importance:
• Schools and institutions play a key role in educating students about the importance of waste segregation and sustainability.
• Activities like campus cleaning help inculcate responsibility and awareness in students.

Q12. Answer: (d) Salt + Water + Carbon dioxide

The correct answer is Salt + Water + Carbon dioxide.

Key Points

• When an acid reacts with a metal hydrogen carbonate, the chemical reaction produces salt, water, and carbon dioxide gas. This is a characteristic reaction of acids with metal hydrogen carbonates.
• The general chemical equation for the reaction is:

Acid + Metal Hydrogen Carbonate → Salt + Water + Carbon Dioxide.

• For example, when hydrochloric acid (HCl) reacts with sodium hydrogen carbonate (NaHCO3), the products are sodium chloride (NaCl), water (H2O), and carbon dioxide (CO2).

Equation: HCl + NaHCO3 → NaCl + H2O + CO2

• During the reaction, effervescence is observed due to the release of carbon dioxide gas.
• This reaction is commonly used in applications such as cleaning and neutralizing acids in laboratories.

Additional Information

• Metal Hydrogen Carbonate:
• Metal hydrogen carbonates, also known as bicarbonates, are compounds containing the HCO3^- ion.
• Examples include sodium hydrogen carbonate (NaHCO3) and potassium hydrogen carbonate (KHCO3).
• They are commonly used in baking, cleaning, and as antacids due to their ability to neutralize acids.
• Acid-carbonate reactions:
• Acid-carbonate reactions are a type of double displacement reaction where acids react with carbonates or hydrogen carbonates.
• These reactions release carbon dioxide gas, which can be observed as bubbles or effervescence.
• Such reactions are used in chemical analysis to identify the presence of carbonates or bicarbonates in a sample.
• Applications of the reaction:
• This reaction is utilized in baking. For example, sodium bicarbonate (baking soda) reacts with acids in dough to produce carbon dioxide, causing the dough to rise.
• It is used in fire extinguishers, where the reaction produces carbon dioxide to smother flames.
• Metal hydrogen carbonates are used in medicines to neutralize stomach acid and relieve heartburn.
• Examples of acids and their reactions:
• Hydrochloric acid (HCl): Reacts with sodium bicarbonate to form NaCl, water, and CO2.
• Sulfuric acid (H2SO4): Reacts with metal hydrogen carbonates to form sulfates, water, and CO2.
• Acetic acid (CH3COOH): Reacts with bicarbonates like NaHCO3 to form acetate salts, water, and CO2.

Important Points

• Effervescence: The visible bubbles formed during the reaction indicate the release of carbon dioxide gas.
• Neutralization: The reaction between acids and hydrogen carbonates is a type of neutralization reaction, as it reduces the acidity of the solution.

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• Laboratory Test: This reaction is used in laboratories to test for the presence of carbonate or bicarbonate ions in a sample.

• Environmental Impact: Carbon dioxide released during such reactions contributes to the carbon cycle but is generally harmless in small quantities.

Q13. Answer: (d) Joule's heating

The correct answer is Joule's heating.

Key Points

• Joule's heating, also known as ohmic heating or resistive heating, occurs when an electric current passes through a conductor, producing heat due to the resistance of the material.

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

• Joule's heating effect is utilized in various devices such as electric heaters, toasters, electric kettles, and incandescent bulbs.

• The phenomenon is a result of collisions between electrons (carrying current) and the lattice ions in the conductor, which convert the electrical energy into thermal energy.

• This effect is not ideal for transmission of electricity over long distances as it leads to energy loss in the form of heat, thus necessitating efficient electrical systems to minimize Joule's heating.

Additional Information

• Electrolysis:

• Electrolysis is a chemical process where electric current causes the decomposition of a compound in a liquid solution or molten state, typically used in the extraction or purification of metals.

• An example is the electrolysis of water, which splits water molecules into hydrogen and oxygen gases.

• It is fundamentally different from Joule's heating as it involves chemical changes rather than heat generation.

• Ohm's Law:

• Ohm's Law defines the relationship between voltage (V), current (I), and resistance (R) in an electrical circuit: $V = IR$.

• It does not directly explain the generation of heat, but it helps in calculating the current or resistance, which can then be used in Joule's heating formula.

• Electromagnetic Induction:

• This phenomenon occurs when an electric current is generated in a conductor due to a changing magnetic field.

• It is the principle behind devices like generators and transformers and does not involve the generation of heat like Joule's heating.

• Discovered by Michael Faraday in 1831, electromagnetic induction is central to modern power generation systems.

• Applications of Joule's Heating:

• It is widely used in heating devices such as electric irons, room heaters, and electric stoves.

• It plays a role in the functioning of fuses, where excessive current causes heating and breaks the circuit.

• Joule's heating is also utilized in thermistors and temperature-dependent resistors for various applications.

Important Points

• Energy Loss in Transmission:

• Joule's heating leads to significant energy loss during the transmission of electricity over long distances, which is why high voltage transmission is preferred to minimize current and reduce losses.

• Practical Limitations:

• Excessive Joule's heating can damage electrical components and circuits, necessitating the use of cooling systems and efficient designs.

• Discovery:

• Joule's heating was first described by James Prescott Joule in the 1840s, laying the foundation for thermodynamics and modern electrical engineering.

Q14. Answer: (c) Particles of matter are continuously moving due to their kinetic energy.

The correct answer is Particles of matter are continuously moving due to their kinetic energy.

Key Points

• Particles of matter possess kinetic energy, which is the energy due to their motion. This intrinsic property ensures that particles remain in continuous motion.

• The movement of particles occurs in all states of matter—solids, liquids, and gases—but varies depending on the state. For example, particles in gases move more freely than in solids or liquids.

• Brownian motion, an observable phenomenon, demonstrates the continuous movement of particles. It can be seen when particles suspended in a fluid exhibit random motion.

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• The kinetic energy of particles is directly related to temperature. As temperature increases, the kinetic energy of the particles increases, causing them to move faster.

• Unlike the incorrect statements in the question, particles are neither stationary, nor do they move only in gases. Their motion is a fundamental characteristic of all matter. Hence, the correct answer is option 3.

Additional Information

• States of Matter:

• Solids: Particles are closely packed and exhibit minimal movement, primarily vibrating in fixed positions.

• Liquids: Particles are less tightly packed compared to solids and can move past each other, giving liquids their fluidity.

• Gases: Particles are widely spaced and move freely and rapidly, exhibiting the highest kinetic energy among the three states.

• Brownian Motion:

• First observed by Robert Brown in 1827, it refers to the random movement of microscopic particles suspended in a fluid.

• This phenomenon is caused by collisions between the suspended particles and the molecules of the fluid.

• Temperature and Particle Movement:

• Higher temperature leads to increased kinetic energy, causing particles to move faster.

• This principle is the basis for phenomena like diffusion, where particles spread from areas of higher concentration to lower concentration.

• Incorrect Statements Explained:

• "Particles of matter are too heavy to move": Incorrect, as mass does not prevent motion; even heavier particles exhibit movement due to kinetic energy.

• "Particles of matter are stationary unless force is applied": Incorrect, as particles naturally move due to their kinetic energy, without external forces.

• "Particles of matter move only in gases and not in solids or liquids": Incorrect, as particle movement occurs in all states of matter, though the degree of movement varies.

Important Points

• Diffusion: This is the process by which particles spread from a region of higher concentration to lower concentration due to their motion. Examples include the mixing of gases or the dissolution of substances in liquids.

• Intermolecular Forces: The movement of particles in solids is restricted by strong intermolecular forces, whereas in gases, these forces are negligible, enabling rapid motion.

• Applications: Understanding particle movement is crucial in fields like thermodynamics, chemical reactions, and material science, where particle interactions determine outcomes.

• Observation: The kinetic energy and movement of particles can be indirectly observed in everyday phenomena like evaporation, boiling, and diffusion.

Q15. Answer: (a) 44

The correct answer is 44.

Key Points

• Molecular mass of a compound is calculated by summing the atomic masses of all the atoms present in the compound.

• Carbon dioxide (CO_2) consists of one carbon (C) atom and two oxygen (O) atoms.

• The atomic mass of carbon is approximately 12 u, and the atomic mass of oxygen is approximately 16 u.

• Therefore, the molecular mass of CO_2 is calculated as:

$(1 \times 12) + (2 \times 16) = 12 + 32 = 44$ u.

• This confirms that the molecular mass of carbon dioxide is 44 u, which is the correct answer.

Additional Information

• Molecular Mass:

• Molecular mass is expressed in atomic mass units (u), where 1 u is defined as one-twelfth of the mass of a carbon-12 atom.

• It helps in understanding the composition and stoichiometry of chemical compounds.

• Carbon Dioxide (CO_2):

• Carbon dioxide is a colorless, odorless gas commonly found in Earth's atmosphere.

• It is composed of one carbon atom covalently bonded to two oxygen atoms.

• CO_2 plays a vital role in the carbon cycle and is essential for photosynthesis in plants.

• Importance of Atomic Mass:

• Atomic masses are crucial for calculating the molecular mass, which is necessary for chemical reactions and stoichiometric equations.

• The periodic table provides the atomic masses of elements, which are used in these calculations.

• Applications of Carbon Dioxide:

• Carbon dioxide is used in the production of carbonated beverages, as a refrigerant, and in fire extinguishers.

• It is an important greenhouse gas and contributes to global warming.

Important Points

• Periodic Table:

• The periodic table provides essential information like atomic masses and symbols of elements, which help in molecular mass calculations.

• For example, the atomic masses of carbon (C) and oxygen (O) are listed as approximately 12 u and 16 u, respectively.

• Stoichiometry in Chemistry:

• Molecular mass calculations are essential for determining the proportions of reactants and products in a chemical reaction.

• Accurate molecular mass values are crucial for laboratory experiments and industrial chemical processes.

• Environmental Impact of CO2:

• Carbon dioxide is a major contributor to the greenhouse effect, trapping heat in Earth's atmosphere.

• Efforts are being made globally to reduce CO2 emissions through renewable energy and sustainable practices.

Q16. Answer: (d) Gold

The correct answer is Gold.

Key Points

• Gold is one of the least reactive metals, which means it does not easily form compounds with other elements. This property allows gold to exist in its free state in nature.

• Gold has very low reactivity because it is placed at the bottom of the reactivity series of metals. It does not react with oxygen, water, or acids under standard conditions.

• Due to its inert nature, gold is found in nature primarily as native gold, often mixed with quartz or other minerals, rather than as compounds.

• Other metals such as iron, zinc, and copper are more reactive compared to gold. These metals are typically found as ores combined with oxygen, sulfur, or other elements.

• Gold’s unique chemical properties make it highly valuable and desirable for applications such as jewelry, electronics, and investment purposes.

Additional Information

• Iron:

• Iron is a highly reactive metal and is usually found in nature as iron ores such as hematite (Fe2O3) and magnetite (Fe3O4).

• It reacts with oxygen and water, forming iron oxides such as rust under normal conditions.

• Iron is primarily used in construction, machinery, and as a key component in steel production.

• Zinc:

• Zinc is moderately reactive and is usually found as zinc ores like zinc blende (ZnS) or calamine (ZnCO3).

• It reacts with acids and alkalis, releasing hydrogen gas.

• Zinc is widely used in galvanization, batteries, and alloys such as brass.

• Copper:

• Copper is less reactive than iron and zinc but more reactive than gold. It is often found as malachite (CuCO3.Cu(OH)2) and other ores.

• Copper reacts with oxygen at high temperatures, forming copper oxide.

• Due to its excellent electrical conductivity, copper is widely used in electrical wiring and electronics.

• Gold:

• Gold is found in nature in its native form as nuggets or grains in rocks and alluvial deposits.

• It does not corrode or tarnish even after prolonged exposure to air and water.

• Gold’s rarity and inertness make it a preferred choice for jewelry, currency reserves, and electronics.

Important Points

• Reactivity Series:

• The reactivity series ranks metals based on their reactivity with water, acids, and oxygen.

• Gold is at the bottom of the series, indicating its low reactivity. Metals like potassium, sodium, and calcium are at the top, showing high reactivity.

• Applications of Gold:

• Gold is used in electronics due to its excellent conductivity and resistance to corrosion.

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• It serves as a reliable investment option and is stored in the form of bullion or coins.

• Gold is widely used in dentistry and medicine for its biocompatibility.

• Extraction of Gold:

• Gold is extracted using methods such as panning, sluicing, and cyanidation.

• Cyanidation involves dissolving gold in a cyanide solution to separate it from impurities.

Q17. Answer: (b) Cell membrane

The correct answer is Cell membrane.

Key Points

• The cell membrane, also known as the plasma membrane, is a structure that surrounds all cells, providing them with a defined boundary and protecting the internal components from the external environment. This membrane is universally present in every type of cell, whether prokaryotic or eukaryotic.

• The cell membrane is primarily composed of a phospholipid bilayer along with embedded proteins, which allow selective transport of substances in and out of the cell. This selective permeability is critical for maintaining homeostasis.

• The fluid mosaic model describes the cell membrane as a dynamic structure where phospholipids and proteins can move laterally within the layer, ensuring flexibility and functionality.

• Other structures like lysosomes, mitochondria, and chromosomes are specific to certain cell types or stages of the cell cycle, but the cell membrane is a universal feature of all living cells.

• Its functions include providing structural support, facilitating communication between cells, and acting as a barrier against harmful substances. Hence, the correct answer is the cell membrane.

Additional Information

• Lysosome:

• Lysosomes are membrane-bound organelles found in eukaryotic cells that contain hydrolytic enzymes. These enzymes help in the degradation of cellular waste and foreign particles.

• They are referred to as the "suicidal bags" of the cell because their rupture can lead to cell death.

• However, lysosomes are not present in all cells. For instance, they are absent in prokaryotic cells.

• Mitochondria:

• Mitochondria are double-membrane-bound organelles found in most eukaryotic cells and are known as the "powerhouse of the cell" because they generate ATP through cellular respiration.

• They contain their own DNA and ribosomes, allowing them to produce some of their own proteins.

• Mitochondria are absent in prokaryotic cells, which instead rely on the cell membrane for energy production.

• Chromosome:

• Chromosomes are structures composed of DNA and proteins that carry genetic information. They are present in the nucleus of eukaryotic cells and in the nucleoid region of prokaryotic cells.

• However, chromosomes are not always visible under a microscope. They become distinctly visible only during cell division when they condense.

• In contrast, the cell membrane is consistently visible in all cells under a microscope.

• Functions of the Cell Membrane:

• The cell membrane acts as a protective barrier for the cell, shielding it from environmental changes.

• It plays a critical role in cell signaling, allowing cells to communicate with each other through receptor proteins.

• The membrane's selective permeability ensures that essential nutrients enter the cell while waste products are expelled.

• It provides mechanical support and helps maintain the shape of the cell.

Q18. Answer: (c) Glucose, amino acids, and water

The correct answer is Glucose, amino acids, and water.

Key Points

• The nephron is the functional unit of the kidney responsible for filtering blood and forming urine. Selective reabsorption occurs in the nephron to ensure essential substances are retained in the body.

• Glucose: Almost all glucose is reabsorbed in the proximal convoluted tubule of the nephron through active transport. This ensures glucose, a vital energy source, is not lost in urine.

• Amino acids: Similar to glucose, amino acids are also actively reabsorbed in the proximal convoluted tubule. These are essential building blocks of proteins and must be preserved for bodily functions.

• Water: Water reabsorption occurs throughout the nephron but primarily in the proximal tubule, loop of Henle, distal tubule, and collecting duct. This process is regulated by hormones like ADH (antidiuretic hormone) to maintain fluid balance in the body.

• The process of selective reabsorption ensures that waste products like urea and excess ions are excreted while essential

substances like glucose, amino acids, and water are conserved.

• The correct answer highlights the substances crucial for maintaining homeostasis in the body through selective reabsorption in the nephron.

Additional Information

• Urea and Carbon Dioxide:

• Urea: It is a waste product formed in the liver during protein metabolism. Urea is not reabsorbed selectively; it is excreted in the urine.

• Carbon dioxide: This is a gaseous waste product expelled through the lungs and not filtered or reabsorbed in the nephron.

• Bile and Hydrochloric Acid:

• Bile: Produced by the liver and stored in the gallbladder, bile aids in digestion. It is not filtered by the kidneys or reabsorbed in the nephron.

• Hydrochloric acid (HCl): Found in the stomach, HCl aids in digestion and is unrelated to kidney function.

• Platelets and Enzymes:

• Platelets: These are cellular components of blood involved in clotting and are too large to be filtered by the nephron.

• Enzymes: These are proteins that catalyze biochemical reactions. They are not filtered or reabsorbed in the nephron under normal conditions.

• Other Key Functions of the Nephron:

• The nephron regulates salt and ion balance through reabsorption of sodium, potassium, and chloride ions.

• It helps maintain acid-base balance by reabsorbing bicarbonate and secreting hydrogen ions.

• The kidneys also play a role in producing hormones like erythropoietin (stimulates red blood cell production) and renin (regulates blood pressure).

Important Points

• Proximal Convoluted Tubule (PCT): Reabsorbs 65-70% of filtered water, all glucose, and most amino acids and ions.

• Loop of Henle: Responsible for concentrating urine by creating a gradient for water and salt reabsorption.

• Distal Convoluted Tubule (DCT): Fine-tunes ion and pH balance through selective ion exchange.

• Collecting Duct: Final site for water reabsorption, regulated by ADH, determining urine concentration.

Q19. Answer: (c) tangential path to the circular path at that point

The correct answer is tangential path to the circular path at that point.

Key Points

• Uniform Circular Motion: When a cyclist is in uniform circular motion, they are moving along a circular path with a constant speed. The velocity of the cyclist is always tangential to the circular path at every point, and the centripetal force acts towards the center of the circle to maintain the circular motion.

• Projectile Thrown by the Cyclist: When the cyclist throws an apple in their direction, the apple initially possesses two components of velocity:

• A tangential velocity component due to the cyclist's motion along the circular path at that instant.

• An additional velocity imparted by the action of throwing the apple.

• Resultant Path of the Apple: According to Newton's first law of motion (the law of inertia), the apple will continue to move in the direction of the tangential velocity component at the point of release. Therefore, the apple follows a tangential path to the circular motion of the cyclist at that point.

• Why Not a Circular Path? The apple does not follow a circular path because, after being thrown, it is no longer under the influence of the centripetal force that keeps the cyclist in circular motion. Instead, it moves freely under the influence of its inertia and external forces such as gravity.

• Correct Answer: Hence, the correct explanation for the motion of the apple is that it follows a tangential path to the circular path at that point.

Additional Information

• Newton's First Law of Motion (Law of Inertia): An object will continue in its state of rest or uniform motion in a straight line unless acted upon by an external force. In this scenario, after the apple is released, it is no longer influenced by the centripetal force, and thus it moves in the direction of its initial velocity.

• Tangential Velocity: The velocity of an object in circular motion is always directed tangentially to the circular path. At the point of release, the apple carries this tangential velocity, leading to its motion along a straight tangential path.

• Circular Motion Dynamics: Circular motion is maintained by a centripetal force that acts towards the center of the circle. This force is essential for keeping an object in a circular trajectory. Once the apple is released, it is no longer subject to this force, and hence it does not follow a circular path.

• Gravity's Role: If we consider gravity, the apple will eventually follow a parabolic trajectory due to the combined effect of its

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horizontal tangential velocity and the downward gravitational force. However, the initial direction of motion remains tangential.

• Applications: Understanding the tangential motion of an object in circular motion is crucial in various fields, such as satellite launching, amusement park rides (e.g., roller coasters), and vehicle dynamics while turning on curved roads.

Important Points

• Option Analysis:

• Option 1: "Straight line path opposite to the cyclist" is incorrect because the apple is not influenced by a force to reverse its motion.

• Option 2: "Circular path opposite to the cyclist" is incorrect as the apple is no longer under the influence of centripetal force.

• Option 3: "Tangential path to the circular path at that point" is correct as explained above.

• Option 4: "Circular path as the cyclist" is incorrect because the apple does not stay in circular motion after being released.

• Real-life Examples:

• When a stone tied to a string is whirled in a circle and the string breaks, the stone moves tangentially to the circle.

• Water droplets flung off a spinning wheel follow a tangential path.

Q20. Answer: (a) Both mass and height

The correct answer is Both mass and height.

Key Points

• Potential energy is the energy possessed by a body due to its position or configuration. It is expressed mathematically as PE = mgh, where:

• m is the mass of the object (in kilograms).

• g is the acceleration due to gravity (approximately 9.8 m/s^2 on Earth).

• h is the height of the object above the reference point (in meters).

• The formula clearly shows that potential energy depends on both the mass (m) and the height (h) of the object. Hence, the correct option is Both mass and height.

• Height: The higher the object is above the reference point, the greater its potential energy. This is because the object has more energy stored due to its elevated position.

• Mass: The greater the mass of the object, the more potential energy it possesses for the same height, as energy is directly proportional to mass.

• Other factors like speed or kinetic energy do not influence potential energy. They are associated with the energy of motion, not position.

• Similarly, considering only mass or height individually is incorrect, as both parameters are crucial for determining potential energy.

Additional Information

• Gravitational Potential Energy:

• This type of potential energy is due to the gravitational force acting on an object.

• It is stored in an object as a result of its vertical position or height relative to a lower reference point.

• Example: A book placed on a table possesses gravitational potential energy, which will be converted into kinetic energy if it falls.

• Elastic Potential Energy:

• It is stored in elastic materials like springs, rubber bands, or any object that can stretch or compress.

• Example: A compressed spring stores elastic potential energy, which is released when the spring is allowed to expand.

• Kinetic Energy vs. Potential Energy:

• Kinetic energy is the energy of motion, while potential energy is the energy of position or configuration.

• The total mechanical energy of an object is the sum of its kinetic and potential energy.

• Example: When an object falls, its potential energy decreases, while its kinetic energy increases, keeping the total energy constant (law of conservation of energy).

• Factors Affecting Potential Energy:

• Mass: Heavier objects have greater potential energy for the same height.

• Height: Objects placed higher above the ground have more potential energy.

• Gravitational Force: The value of gravitational acceleration (g) can vary slightly depending on location (e.g., Earth's poles vs. equator).

• Applications of Potential Energy:

• It is utilized in hydroelectric power plants, where water stored at a height is used to generate electricity.

• In archery, the stretched bow stores elastic potential energy, which is transferred to the arrow as kinetic energy.

• Roller coasters rely on potential energy at the highest points, which is converted into kinetic energy during the descent.

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Important Points

• Unit of Potential Energy: The SI unit of potential energy is the joule (J), where 1 joule = 1 kg·m²/s².

• Conservation of Energy: Energy is neither created nor destroyed. The potential energy of an object is converted to other forms of energy, such as kinetic energy, during motion.

• Real-life Example: Water stored in a dam at a height has potential energy, which is used to rotate turbines for electricity generation when released.

• Variation in Gravitational Acceleration: The value of g (9.8 m/s²) slightly varies depending on altitude and latitude.

Q21. Answer: (a) Adrenaline

The correct answer is Adrenaline.

Key Points

• Adrenaline is a hormone secreted by the adrenal glands directly into the bloodstream.

• It is commonly known as the "fight or flight" hormone because it helps the body respond to stressful situations.

• Adrenaline increases the heart rate, expands air passages in the lungs, dilates the pupils, and redirects blood flow to muscles, preparing the body for immediate action.

• This hormone plays a critical role in regulating metabolic processes and maintaining homeostasis during emergencies.

• Unlike other substances like pancreatic juice, bile juice, or saliva, which are secreted into ducts, adrenaline is released directly into the bloodstream.

Additional Information

• Pancreatic Juice:

• Pancreatic juice contains digestive enzymes such as amylase, lipase, and protease.

• It is secreted by the pancreas into the small intestine through the pancreatic duct.

• This juice helps in the digestion of carbohydrates, fats, and proteins in the duodenum.

• Unlike adrenaline, it is not secreted directly into the bloodstream but into the digestive tract.

• Bile Juice:

• Bile juice is produced by the liver and stored in the gallbladder.

• It is secreted into the small intestine through the bile duct and helps in emulsifying fats for digestion.

• Bile juice contains bile salts, bile pigments, and cholesterol but is not released into the bloodstream.

• Saliva:

• Saliva is secreted by salivary glands into the mouth.

• It contains enzymes like salivary amylase, which begin the digestion of starch.

• Saliva is involved in the process of chewing and swallowing but is not released into the bloodstream.

• Adrenal Glands:

• Adrenal glands are small triangular glands located on top of the kidneys.

• They produce hormones like adrenaline, noradrenaline, cortisol, and aldosterone.

• Adrenaline and noradrenaline are secreted directly into the bloodstream to regulate stress responses.

Important Points

• Functions of Adrenaline:

• Adrenaline helps in increasing blood sugar levels by stimulating glycogen breakdown in the liver.

• It enhances oxygen supply to the brain and muscles during stressful situations.

• It suppresses non-essential functions like digestion during emergencies to conserve energy.

• Medical Applications:

• Adrenaline is used in emergency medicine to treat severe allergic reactions (anaphylaxis).

• It is also used in certain cardiac conditions to stimulate the heart during a cardiac arrest.

Q22. Answer: (d) Fragmentation

The correct answer is Fragmentation.

Key Points

• Fragmentation is a form of asexual reproduction where an organism breaks into smaller pieces or fragments, and each fragment grows into a new, complete individual.

• This process is common in simple multicellular organisms such as sponges, flatworms, algae, and fungi.

• Fragmentation allows for rapid population growth in favorable environmental conditions as it does not require the fusion of gametes or a mate.

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• The new individuals formed are genetically identical to the parent organism because there is no genetic recombination involved in this process.

• Examples include hydra (a type of coelenterate), planaria (a flatworm), and certain types of algae like Spirogyra.

Additional Information

• Fusion:

• Fusion is a process in sexual reproduction where two gametes (male and female) fuse to form a zygote, which develops into a new organism.

• This process occurs in both plants and animals and involves genetic recombination, leading to genetic diversity.

• Examples: Fertilization in humans and flowering plants.

• Budding:

• Budding is another form of asexual reproduction in which a new organism develops as an outgrowth or bud from the parent organism.

• The bud remains attached to the parent for some time before detaching and becoming an independent organism.

• Examples include yeast and hydra.

• Fission:

• Fission refers to the division of a single organism into two or more individuals of equal size, typically seen in unicellular organisms.

• It can be of two types: binary fission (splitting into two) and multiple fission (splitting into many).

• Examples include amoeba and paramecium.

• Other Characteristics of Fragmentation:

• It is an efficient mode of reproduction in non-motile organisms as it does not require movement to find a mate.

• Fragmentation often occurs in aquatic environments where water currents assist in the distribution of fragments.

• Organisms that reproduce via fragmentation can regenerate lost parts, a feature critical to this type of reproduction.

Important Points

• Advantages of Fragmentation:

• It is a quick method of reproduction that helps in rapid population increase.

• It ensures the survival of species in a stable and favorable environment.

• The absence of genetic variation ensures that all offspring are well-suited to the current environment.

• Disadvantages of Fragmentation:

• Lack of genetic variation makes the population vulnerable to changes in the environment, diseases, and predators.

• Overpopulation due to rapid reproduction can lead to resource depletion in the habitat.

Q23. Answer: (c) Introduces genetic variations, which improves chances of survival in progeny

The correct answer is Introduces genetic variations, which improves chances of survival in progeny.

Key Points

• Cross-pollination refers to the transfer of pollen from the anther of one flower to the stigma of a flower on a different plant of the same species. This process relies on external agents such as wind, water, or animals.

• Genetic variations: Cross-pollination introduces genetic diversity in the progeny by combining genetic material from two different plants. This increases the chances of survival and adaptability to environmental changes and disease resistance.

• Improved adaptability: The genetic variation introduced through cross-pollination enables the progeny to adapt better to changing environmental conditions, such as temperature fluctuations, soil differences, and pest attacks.

• Evolutionary advantages: Cross-pollination promotes evolution by increasing the genetic pool, which can lead to the emergence of new traits that may provide a competitive advantage to the species over time.

• Avoids inbreeding depression: Unlike self-pollination, cross-pollination prevents inbreeding depression, which can result in reduced vigor, fertility, and overall health of the progeny due to a lack of genetic diversity.

Additional Information

• Self-pollination:

• Self-pollination involves the transfer of pollen from the anther to the stigma of the same flower or another flower on the same plant.

• It leads to the production of progeny that are genetically identical to the parent, resulting in limited genetic variation.

• While it is an energy-efficient process and does not require pollinators, it can result in inbreeding depression, reducing the plant's adaptability and vigor.

• Pollinating agents:

• Cross-pollination depends on external agents such as insects (bees, butterflies), wind, water, and animals for the transfer of

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pollen.

• For example, plants with brightly colored flowers attract insects as pollinators, while wind-pollinated plants, like wheat and maize, produce lightweight pollen grains for easy dispersal.

• Examples of cross-pollinated plants:

• Crops such as apple, cucumber, sunflower, and mustard rely on cross-pollination for better yield and genetic diversity.

• In horticulture, cross-pollination is often used to create hybrid plants with desirable traits such as higher yield, disease resistance, or improved flavor.

• Comparison of self- and cross-pollination:

• Self-pollination is more energy-efficient but lacks genetic diversity.

• Cross-pollination, while more energy-intensive and dependent on external agents, ensures genetic variation, adaptability, and resilience in plants.

Important Points

• Energy input: Cross-pollination requires more energy investment in producing attractive flowers, nectar, or lightweight pollen grains to facilitate pollination through external agents.

• Dependency on agents: While cross-pollination has numerous benefits, its reliance on pollinators can make plants vulnerable to environmental factors affecting pollinator populations, such as habitat loss or climate change.

• Hybrid vigor (Heterosis): Cross-pollination often results in hybrid offspring that exhibit heterosis, characterized by superior qualities such as increased growth, yield, or resistance to diseases compared to their parents.

Q24. Answer: (a) Loudness depends on frequency

The correct answer is Loudness depends on frequency.

Key Points

• Loudness depends on frequency: This statement is incorrect. Loudness primarily depends on the amplitude of the sound wave and not on its frequency. While frequency determines the pitch of the sound, the amplitude determines how loud or soft a sound is perceived.

• Loud sound has large amplitude: This statement is correct. A sound wave with a large amplitude corresponds to a loud sound. Amplitude is directly related to the energy of the wave, making the sound more intense.

• Soft sound has small amplitude: This statement is correct. A sound wave with a small amplitude is perceived as a soft sound because it has lower energy compared to a wave with a higher amplitude.

• Loudness depends on amplitude: This statement is correct. Loudness is directly proportional to the amplitude of the sound wave. Larger amplitudes result in louder sounds, and smaller amplitudes result in softer sounds.

Additional Information

• Amplitude and Loudness:

• The amplitude of a sound wave represents the maximum displacement of particles in the medium through which the sound travels.

• Louder sounds have larger amplitudes because they carry more energy.

• For example, a whisper has a small amplitude, while a shout has a large amplitude.

• Frequency and Pitch:

• The frequency of a sound wave determines its pitch, not its loudness.

• Higher frequencies produce higher-pitched sounds (e.g., a bird's chirping), while lower frequencies produce lower-pitched sounds (e.g., a drumbeat).

• Frequency is measured in Hertz (Hz).

• Loudness Measurement:

• Loudness is measured in decibels (dB), a logarithmic unit that quantifies the intensity of a sound.

• Sounds above 85 dB can cause hearing damage with prolonged exposure.

• Human Hearing Range:

• The average human ear can hear sounds in the frequency range of 20 Hz to 20,000 Hz.

• The sensitivity of the ear to different frequencies varies; humans are most sensitive to frequencies around 1,000–5,000 Hz.

Important Points

• Sound Wave Characteristics:

• Sound waves are longitudinal waves, meaning particles in the medium vibrate parallel to the direction of wave propagation.

• The three main characteristics of sound waves are amplitude, frequency, and wavelength.

• Threshold of Hearing:

• The threshold of hearing is the minimum intensity level of sound that the human ear can detect, approximately 0 dB.

• Sounds exceeding 120 dB are considered painful to human ears.
• Resonance and Loudness:
• Resonance occurs when a sound wave matches the natural frequency of an object, amplifying its loudness.
• This principle is used in musical instruments to enhance sound output.

Q25. Answer: (c) Four times

The correct answer is Four times.

Key Points

• The power dissipated in a resistor is calculated using the formula $P = I^2R$, where P is the power, I is the current, and R is the resistance.
• If the current in the circuit is doubled, the new current becomes 2I. Substituting this into the formula: $P = (2I)^2R = 4I^2R$.
• This shows that the power dissipated becomes four times the original power when the current is doubled while keeping the resistance constant.
• This relationship arises because power is proportional to the square of the current. Therefore, any change in current has a squared effect on the power.
• Hence, the correct answer is that the power dissipated in the resistor becomes four times.

Additional Information

• Ohm's Law:
• Ohm's Law states that V = IR, where V is the voltage across the resistor, I is the current flowing through it, and R is the resistance.
• It highlights the linear relationship between voltage and current for a constant resistance.
• Power Dissipation in Resistors:
• The power dissipated in a resistor can be expressed in three equivalent forms: $P = I^2R$, $P = V^2/R$, and $P = IV$.
• These formulas help in analyzing circuits under different conditions, such as constant voltage or constant current.
• Role of Resistance:
• Resistance is a measure of how much a material opposes the flow of current. It is measured in ohms (Ω).
• For a fixed resistance, changes in current or voltage directly affect the power dissipation.
• Proportionality of Power:
• Power is directly proportional to the square of the current (P prop. to I^2) and inversely proportional to the resistance (P prop. to 1/R) for constant voltage.
• This quadratic relationship explains why doubling the current quadruples the power dissipation.

Important Points

• Current and Voltage Relationship:
• When resistance is constant, changes in current are directly proportional to changes in voltage, as per Ohm's Law.
• For instance, doubling the voltage across a resistor doubles the current flowing through it.
• Real-Life Application:
• Understanding power dissipation is crucial in designing electrical circuits to prevent overheating and ensure efficiency.
• For example, resistors in electronic devices are rated for specific power levels to avoid damage.
• Safety Considerations:
• Excessive power dissipation can lead to overheating, which may damage components or cause fire hazards in electrical systems.
• Engineers use heat sinks, cooling systems, or higher-rated components to manage power dissipation effectively.

Q26. Answer: (c) 24

Shortcut Trick

Let the common ratio multiplier be x.

Product ratio → 19 × 13 = 247 units²

$247x^2 = 3952 \Rightarrow x^2 = 16 \Rightarrow x = 4$

Difference in ages = (19 − 13) × 4 = 6 × 4 = 24 years

Therefore The correct answer is 24 years.

Alternate Method

Given: Ratio of ages = 19 : 13 | Product = 3,952 years

Formula Used: Age = Ratio unit × Multiplier

=> Let age of Seema = 19x and Jyoti = 13x
=> 19x × 13x = 3952
=> 247x² = 3952
=> x² = 3952 ÷ 247 = 16
=> x = √16 = 4
=> Age of Seema = 19 × 4 = 76 years
=> Age of Jyoti = 13 × 4 = 52 years
=> Difference = 76 − 52 = 24 years
Therefore The correct answer is 24 years.
Additional Information
Ratio Multiplier Property
When the product of two quantities in ratio a:b is given as P, the multiplier x is found using x = √(P ÷ (a×b)).
Age Difference Property
The difference between the ages of two persons remains constant at any point in time.
Ratio and Proportion
If a:b is the ratio of two numbers, their sum is (a+b)x and their difference is |a−b|x.

Q27. Answer: (b) 5

Shortcut Trick
The average of the first n odd natural numbers is always equal to n.
In this question, n = 5.
=> Average = 5.
Therefore The correct answer is 5.
Alternate Method
Given:
The first 5 odd natural numbers are: 1, 3, 5, 7, and 9.
Formula Used:
Average = (Sum of all observations) ÷ (Total number of observations)
Calculations:
=> Sum of the first 5 odd numbers = 1 + 3 + 5 + 7 + 9
=> Sum = 25
=> Total number of observations = 5
=> Average = 25 ÷ 5
=> Average = 5
Therefore The correct answer is 5.
Additional Information
Sum of First n Odd Numbers
The sum of the first n odd natural numbers is given by the formula n².
Average of First n Even Numbers
The average of the first n even natural numbers is always (n + 1).
Average of Arithmetic Progression (AP)
For any sequence in Arithmetic Progression, the Average = (First term + Last term) ÷ 2.

Q28. Answer: (c) decrease by Rs. 3,545

Shortcut Trick
Income = 100, Savings = 12, Expenditure = 88.
New Income = 100 + 39% = 139.
New Expenditure = 88 + 50% = 88 + 44 = 132.
New Savings = 139 − 132 = 7.
Change in Savings = 7 − 12 = −5 (decrease of 5 units).
100 units = Rs. 70,900 => 1 unit = Rs. 709 => 5 units = 5 × Rs. 709 = Rs. 3,545.
Therefore The correct answer is decrease by Rs. 3,545.

Alternate Method

Given: Initial Income = Rs. 70,900, Savings % = 12%, Income increase = 39%, Expenditure increase = 50%.

Formula Used: Income = Expenditure + Savings

=> Initial Savings = 12% of 70,900 = 0.12 × 70,900 = Rs. 8,508

=> Initial Expenditure = 70,900 − 8,508 = Rs. 62,392

=> New Income = 70,900 × 1.39 = Rs. 98,551

=> New Expenditure = 62,392 × 1.50 = Rs. 93,588

=> New Savings = 98,551 − 93,588 = Rs. 4,963

=> Change in Savings = 4,963 − 8,508 = −Rs. 3,545

Therefore The correct answer is decrease by Rs. 3,545.

Additional Information

Percentage Change in Components

If components of a sum change, the net change can be calculated using the weighted average of the percentage changes of the individual parts.

Income-Expenditure Alligation

Income change % lies between Expenditure change % and Savings change % in the ratio of Expenditure : Savings.

Base Change Rule

Always ensure the percentage changes are applied to the correct initial base values of Income and Expenditure respectively.

Q29. Answer: (a) 191

Shortcut Trick

Relative Speed (Same) = 51 − 22 = 29 kmph = 29 × 5/18 m/s.

Total Length (P+Q) = Speed × Time = (29 × 5/18) × (7.5 × 60) = 3625 m.

Length of Train P = 3625 − 225 = 3400 m.

Relative Speed (Opposite) = 51 + 21 = 72 kmph = 72 × 5/18 = 20 m/s.

Required Time = (3400 + 420) ÷ 20 = 3820 ÷ 20 = 191 seconds.

Therefore The correct answer is 191 seconds.

Alternate Method

Given: Speed of P (S_P) = 51 kmph, Speed of Q (S_Q) = 22 kmph, Length Q (L_Q) = 225 m, Time 1 (T1) = 7.5 min = 450 sec, Length R (L_R) = 420 m, Speed R (S_R) = 21 kmph.

Formula: Time = (L1 + L2) ÷ (Relative Speed)

=> Relative Speed (P and Q) = 51 − 22 = 29 kmph

=> 29 × 5/18 m/s = (L_P + 225) ÷ 450

=> L_P + 225 = (29 × 5 × 450) ÷ 18

=> L_P + 225 = 29 × 5 × 25 = 3625

=> L_P = 3625 − 225 = 3400 m

=> Relative Speed (P and R) = 51 + 21 = 72 kmph

=> 72 × 5/18 = 20 m/s

=> Time to cross R = (L_P + L_R) ÷ 20

=> Time = (3400 + 420) ÷ 20 = 3820 ÷ 20 = 191 seconds

Therefore The correct answer is 191 seconds.

Additional Information

Relative Speed Concept

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

Unit Conversion

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

Train Crossing Distance

When a train crosses another train or a bridge, the total distance covered is the sum of their lengths (L1 + L2).

Q30. Answer: (a) 32

Shortcut Trick

Mean Proportional (MP) = √(a × b)

Given: MP = 40, one number (b) = 50

=> $MP^2 = a \times b$

=> $40^2 = A \times 50$

=> $1600 = A \times 50$

=> $A = 1600 \div 50 = 32$

Therefore The correct answer is 32.

Alternate Method

Given:

Mean proportional of A and 50 is 40.

Formula Used:

If x is the mean proportional between a and b, then:

$a/x = x/b \Rightarrow x^2 = ab$

Calculations:

=> $40^2 = A \times 50$

=> $1600 = A \times 50$

=> $A = 1600 / 50$

=> $A = 32$

Therefore The correct answer is 32.

Additional Information

Third Proportional

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

Fourth Proportional

The fourth proportional of a, b, and c is d, such that a : b :: c : d, given by $d = (b \times c) / a$.

Duplicate Ratio

The duplicate ratio of a : b is $a^2 : b^2$.

Q31. Answer: (a) Rs. 1,99,926

Shortcut Trick

Total Marked Price = 383 × 1,000 = Rs. 3,83,000

Effective Discount Multiplier = 0.75 × 0.80 × 0.87 = 0.522

Final Payment = 3,83,000 × 0.522

Unit Digit Check: 3 × 2 = 6 (Last digit must be 6)

Therefore The correct answer is Rs. 1,99,926.

Alternate Method

Given:

Number of mixers = 383

Price per mixer = Rs. 1,000

Successive discounts = 25%, 20%, and 13%

Calculations:

=> Total Marked Price = 383 × 1,000 = Rs. 3,83,000

=> Price after 25% discount = 3,83,000 × (75/100) = Rs. 2,87,250

=> Price after 20% discount = 2,87,250 × (80/100) = Rs. 2,29,800

=> Price after 13% card discount = 2,29,800 × (87/100)

=> Final Amount = 2,298 × 87 = Rs. 1,99,926

Therefore The correct answer is Rs. 1,99,926.

Additional Information

Successive Discount Formula

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

Successive Percentage Change

Final Value = Initial Value × (1 − d1/100) × (1 − d2/100) × (1 − d3/100).

Cash vs Card Discount

Discounts offered on specific payment modes (like Credit Cards) are applied on the remaining amount after all previous trade discounts.

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Q32. Answer: (b) 21 cm

Shortcut Trick

Calculate semi-perimeter (s) = (75 + 44 + 35) ÷ 2 = 77 cm.

Apply Heron's Formula for Area (A) = √[77 × (77−75) × (77−44) × (77−35)] = √(77 × 2 × 33 × 42).

=> Area = √(11 × 7 × 2 × 11 × 3 × 7 × 6) = 11 × 7 × 6 = 462 cm².

Altitude (h) = (2 × Area) ÷ Base = (2 × 462) ÷ 44 = 924 ÷ 44 = 21 cm.

Therefore The correct answer is 21 cm.

Alternate Method

Given: Sides of triangle a = 75 cm, b = 44 cm, and c = 35 cm.

Formula Used:

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

2. Area (A) = √[s(s−a)(s−b)(s−c)]

3. Area = (1 ÷ 2) × base × altitude

Step-by-step Calculation:

=> s = (75 + 44 + 35) ÷ 2 = 154 ÷ 2 = 77 cm

=> Area = √[77 × (77 − 75) × (77 − 44) × (77 − 35)]

=> Area = √(77 × 2 × 33 × 42)

=> Area = √(7 × 11 × 2 × 3 × 11 × 2 × 3 × 7)

=> Area = √(7² × 11² × 2² × 3²) = 7 × 11 × 2 × 3

=> Area = 462 cm²

=> Since, Area = (1 ÷ 2) × base × altitude

=> 462 = (1 ÷ 2) × 44 × altitude

=> 462 = 22 × altitude

=> altitude = 462 ÷ 22 = 21 cm

Therefore The correct answer is 21 cm.

Additional Information

Heron's Formula

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

Altitude of a Triangle

The altitude is the perpendicular distance from a vertex to the opposite side (base). Every triangle has three altitudes.

Area and Base Relation

The altitude h corresponding to base b is given by h = (2 × Area) ÷ b. Shorter sides generally have longer corresponding altitudes.

Q33. Answer: (d) 18.18%

Shortcut Trick

Convert fractions to a common denominator of 40.

1/20 → 2/40 and the base value is 11/40.

Required % = (2 ÷ 11) × 100%

Since 1/11 ≈ 9.09%, then 2/11 ≈ 18.18%.

Therefore The correct answer is 18.18%.

Alternate Method

Given: First value = 1/20, Second value (Base) = 11/40.

Formula Used: Percentage = (Value ÷ Base Value) × 100

=> Required Percentage = [(1/20) / (11/40)] × 100

=> Required Percentage = (1/20) × (40/11) × 100

=> Required Percentage = (2/11) × 100

=> Required Percentage = 200 ÷ 11

=> Required Percentage = 18.1818...

Therefore The correct answer is 18.18%.

Additional Information

Fraction to Percentage

To convert any fraction a/b to a percentage, multiply it by 100 and add the % symbol.

Reciprocal Percentages

Common values like 1/11 ≈ 9.09% and 1/9 ≈ 11.11% are extremely useful for quick banking exam calculations.

Base Change Property

If x is p% of y, then y is (10000/p)% of x. Understanding which value acts as the denominator is crucial.

Q34. Answer: (d) 540

Shortcut Trick

For a cuboid, the Volume (V) is related to the areas of three adjacent faces (A1, A2, A3) by the formula: $V = \sqrt{(A1 \times A2 \times A3)}$.

Given areas: 108, 60, and 45.

$V = \sqrt{(108 \times 60 \times 45)} = \sqrt{(291600)}$.

$V = 540\ cm^3$.

Therefore The correct answer is $540\ cm^3$.

Alternate Method

Given:

Area of face 1 (l × b) = $108\ cm^2$

Area of face 2 (b × h) = $60\ cm^2$

Area of face 3 (h × l) = $45\ cm^2$

Formula Used:

Volume of cuboid (V) = l × b × h

Calculations:

=> Multiply the three area equations:

=> (l × b) × (b × h) × (h × l) = 108 × 60 × 45

=> $l^2 \times b^2 \times h^2 = 2,91,600$

=> $(l \times b \times h)^2 = 2,91,600$

=> $V^2 = 2,91,600$

=> $V = \sqrt{2,91,600}$

=> $V = 540\ cm^3$

Therefore The correct answer is $540\ cm^3$.

Additional Information

Total Surface Area of Cuboid

The total surface area is the sum of the areas of all six faces: TSA = 2 × (lb + bh + hl) or 2 × (A1 + A2 + A3).

Diagonal of a Cuboid

The length of the longest rod that can be placed inside a cuboid is given by $d = \sqrt{(l^2 + b^2 + h^2)}$.

Lateral Surface Area (LSA)

The area of the four side walls of a cuboid is given by LSA = 2h × (l + b).

Q35. Answer: (a) 27

Shortcut Trick

Identify the smallest number in the given set: 27.

Check if the other numbers 54 and 108 are divisible by 27.

Since 54 = 27 × 2 and 108 = 27 × 4, the Highest Common Factor is 27.

Therefore The correct answer is 27.

Alternate Method

Given: Numbers are 27, 54, and 108.

Method:Prime Factorization

=> Prime factors of $27 = 3 \times 3 \times 3 = 3^3$

=> Prime factors of $54 = 2 \times 3 \times 3 \times 3 = 2^1 \times 3^3$

=> Prime factors of $108 = 2 \times 2 \times 3 \times 3 \times 3 = 2^2 \times 3^3$

=> HCF is the product of the lowest powers of common prime factors.

=> Common prime factor is 3, and its lowest power is 3^3.

=> HCF = $3^3 = 27$.

Therefore The correct answer is 27.

Additional Information

Highest Common Factor (HCF)

The HCF (also known as GCD) of two or more numbers is the greatest number that divides each of them exactly.

HCF of Fractions

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

Relationship between HCF and LCM

For two numbers a and b, HCF(a, b) × LCM(a, b) = a × b.

Q36. Answer: (d) 3

Shortcut Trick

If n people with the same efficiency work together, the time taken is Days/n.

Time for 1 unit of work = 3/3 = 1 day.

For thrice (3 times) the work, the time required will also be 3 times.

Total time = 1 × 3 = 3 days.

Therefore The correct answer is 3 days.

Alternate Method

Given: Time taken by A = 3 days, B = 3 days, C = 3 days.

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

Person	Days	Total Work	Efficiency
A	3	3 units	1
B	3	1	
C	3	1	

=> Total Efficiency of (A + B + C) = 1 + 1 + 1 = 3 units/day

=> New Work = 3 × Initial Total Work = 3 × 3 = 9 units

=> Required Time = New Work ÷ Total Efficiency

=> Required Time = 9 ÷ 3 = 3 days

Therefore The correct answer is 3 days.

Additional Information

Work-Time Relation

Work is directly proportional to the time taken when efficiency is constant (W = E × T).

Efficiency Rule

When multiple people work together, their individual efficiencies are added to calculate the combined rate of work.

Q37. Answer: (b) 0

Shortcut Trick

Identify the algebraic pattern $a^3 + b^3 + c^3 - 3abc$.

Let a = 21, b = 13, and c = −34.

Calculate the sum: a + b + c = 21 + 13 + (−34) = 0.

According to the identity, if a + b + c = 0, then $a^3 + b^3 + c^3 - 3abc = 0$.

Therefore The correct answer is 0.

Alternate Method

Given: $21^3 + 13^3 - 34^3 + 3 \times 21 \times 13 \times 34$

Formula Used: $a^3 + b^3 + c^3 - 3abc = (a + b + c)(a^2 + b^2 + c^2 - ab - bc - ca)$

=> Let a = 21, b = 13, and c = −34.

=> We can write the expression as: $21^3 + 13^3 + (-34)^3 - 3 \times 21 \times 13 \times (-34)$

=> Note that -34^3 is the same as $(-34)^3$ and $-3abc = -3 \times 21 \times 13 \times (-34) = +3 \times 21 \times 13 \times 34$.

=> Check the sum of variables: a + b + c = 21 + 13 + (−34)

=> a + b + c = 34 − 34 = 0

=> Substituting (a + b + c) = 0 into the formula:

=> Result = $(0) \times (21^2 + 13^2 + (-34)^2 - (21 \times 13) - (13 \times -34) - (-34 \times 21))$

=> Result = 0

Therefore The correct answer is 0.

Additional Information

Sum of Cubes Identity

For any three numbers a, b, and c, $a^3 + b^3 + c^3 - 3abc = (a + b + c)(a^2 + b^2 + c^2 - ab - bc - ca)$.

Special Case (a + b + c = 0)

If the sum of three numbers is zero, then the sum of their cubes is equal to thrice their product: $a^3 + b^3 + c^3 = 3abc$.

Alternative Representation

The identity can also be expressed as: $\frac{1}{2}(a + b + c)[(a - b)^2 + (b - c)^2 + (c - a)^2]$.

Q38. Answer: (c) Rs. 10,360

Shortcut Trick

Profit Ratio = Investment Ratio (when time is constant).

Aman profit = Rs. 1,400 | Total profit = Rs. 8,000

Profit ratio (Aman : Total) = 1,400 : 8,000 = 7 : 40

Aman investment = (7 ÷ 40) × 59,200 = 7 × 1,480 = Rs. 10,360

Therefore The correct answer is Rs. 10,360.

Alternate Method

Given: Total Investment = Rs. 59,200 | Total Profit = Rs. 8,000 | Aman profit share = Rs. 1,400

Formula: Profit of Person A ÷ Total Profit = Investment of Person A ÷ Total Investment

=> Let Aman investment be x.

=> Profit Ratio Aman : Total = 1,400 ÷ 8,000

=> x ÷ 59,200 = 1,400 ÷ 8,000

=> x = (1,400 × 59,200) ÷ 8,000

=> x = (14 × 59,200) ÷ 80

=> x = 14 × 740

=> x = Rs. 10,360

Therefore The correct answer is Rs. 10,360.

Additional Information

Partnership Basic Rule

Profit is distributed in the ratio of (Investment × Time). If time is the same, Profit Ratio = Investment Ratio.

Working vs Sleeping Partner

A Working Partner manages the business and may receive a salary/commission before the remaining profit is divided based on investment ratios.

Variable Time Investment

If partners invest for different durations, Profit A : Profit B = (C_A × T_A) : (C_B × T_B), where C is capital and T is time.

Q39. Answer: (d) 119 cm2

Shortcut Trick

Area of triangle ABC with sides 21, 17, 10 (s = 24): Area = $\sqrt{(24 \times 3 \times 7 \times 14)} = 84$ cm².

Base of triangle XYZ = 2/3 × 21 = 14 cm.

Area of triangle XYZ = 1/2 × 14 × 5 = 35 cm².

Sum of areas = 84 + 35 = 119 cm².

Therefore The correct answer is 119 cm².

Alternate Method

Given: Sides of triangle ABC (a=21, b=17, c=10); Triangle XYZ base = 2/3 × 21, altitude = 5 cm.

Formula Used: Heron's Formula: Area = $\sqrt{(s(s-a)(s-b)(s-c))}$ where s = (a+b+c)/2; Area of triangle = 1/2 × base × height.

=> Semi-perimeter of ABC (s) = (21 + 17 + 10) ÷ 2 = 24 cm

=> Area ABC = $\sqrt{(24 \times (24-21) \times (24-17) \times (24-10))}$

=> Area ABC = $\sqrt{(24 \times 3 \times 7 \times 14)} = \sqrt{7056} = 84$ cm²

=> Base of XYZ = 21 × (2/3) = 14 cm

=> Area XYZ = 1/2 × 14 × 5 = 35 cm²

=> Sum of areas = 84 + 35 = 119 cm²

Therefore The correct answer is 119 cm².

Additional Information

Heron's Formula

Used to find the area of a triangle when all three sides (a, b, c) are known: Area = √(s(s−a)(s−b)(s−c)), where s = (a+b+c)/2.

Standard Triangle Area

The most common formula is Area = 1/2 × base × perpendicular height (altitude).

Pythagorean Triplets in Triangles

Often, non-right triangles can be split into two right-angled triangles using altitudes, such as 6-8-10 and 8-15-17 in triangle ABC.

Q40. Answer: (c) 12.5%

Shortcut Trick

Cost Price (CP) of 1 toy = 480 ÷ 12 = Rs. 40

Selling Price (SP) of 1 toy = Rs. 45

Profit % = [(45 − 40) ÷ 40] × 100 = (5 ÷ 40) × 100 = 12.5%

Therefore The correct answer is 12.5%.

Alternate Method

Given:

Quantity purchased = 25 dozens

Cost Price (CP) per dozen = Rs. 480

Selling Price (SP) per toy = Rs. 45

Formula Used:

Profit % = [(SP − CP) ÷ CP] × 100

Calculations:

=> Total CP = 25 × 480 = Rs. 12,000

=> Total toys = 25 × 12 = 300 toys

=> Total SP = 300 × 45 = Rs. 13,500

=> Profit = 13,500 − 12,000 = Rs. 1,500

=> Profit % = (1,500 ÷ 12,000) × 100

=> Profit % = (1 ÷ 8) × 100 = 12.5%

Therefore The correct answer is 12.5%.

Additional Information

Profit and Loss on Unitary Basis

Percentage profit or loss remains the same whether calculated on a single unit or the entire quantity, provided the rates are constant.

Conversion of Dozens

1 dozen is equal to 12 units. To find the price per unit, divide the price per dozen by 12.

Percentage Change Formula

Profit % = (Profit ÷ CP) × 100. Always ensure the Cost Price is used as the base for standard profit calculations.

Q41. Answer: (b) 20√3 m

Shortcut Trick

In a 30°-60°-90° triangle, the side ratios are 1 : √3 : 2.

The side opposite to 60° (base) is 60 m, which corresponds to √3 units.

The side opposite to 30° (height) corresponds to 1 unit.

=> Height = 60 ÷ √3 = (20 × 3) ÷ √3 = 20√3 m.

Therefore The correct answer is 20√3 m.

Alternate Method

Given: Distance from the foot (Base) = 60 m, Angle of elevation (θ) = 30°.

Formula Used: tan θ = Perpendicular (Height) ÷ Base

=> tan 30° = Height / 60

=> 1 / √3 = Height / 60

=> Height = 60 / √3

=> Height = (20 × √3 × √3) / √3
=> Height = 20√3 m
Therefore The correct answer is 20√3 m.
Additional Information
Angle of Elevation
The angle formed by the line of sight with the horizontal when looking up at an object.
Standard Trigonometric Ratios
For height and distance: tan 30° = 1/√3, tan 45° = 1, and tan 60° = √3.
Special Triangle Rule
In a right-angled triangle with 30° and 60°, sides are in ratio 1 : √3 : 2 (Opposite to 30° : Opposite to 60° : Hypotenuse).

Q42. Answer: (d) Rs. 6,400

Shortcut Trick
Simple Interest (SI) for 3 years (5 − 2) = Rs. 8,000 − Rs. 7,040 = Rs. 960.
Interest for 1 year = Rs. 960 ÷ 3 = Rs. 320.
Interest for 2 years = Rs. 320 × 2 = Rs. 640.
Principal = Amount (2 years) − Interest (2 years) = Rs. 7,040 − Rs. 640 = Rs. 6,400.
Therefore The correct answer is Rs. 6,400.
Alternate Method
Given:
Amount after 2 years (A2) = Rs. 7,040
Amount after 5 years (A5) = Rs. 8,000
Formula Used:
Amount (A) = Principal (P) + Simple Interest (SI)
Simple Interest (SI) = (P × R × T) ÷ 100
Calculations:
=> Simple Interest for 3 years (5 − 2) = Amount at 5 years − Amount at 2 years
=> SI_(3 yrs) = Rs. 8,000 − Rs. 7,040 = Rs. 960
=> SI for 1 year = Rs. 960 ÷ 3 = Rs. 320
=> SI for 2 years = Rs. 320 × 2 = Rs. 640
=> Principal (P) = Amount after 2 years − SI for 2 years
=> P = Rs. 7,040 − Rs. 640 = Rs. 6,400
Therefore The correct answer is Rs. 6,400.
Additional Information
Uniformity of Simple Interest
In Simple Interest, the interest earned remains the same every year because it is always calculated on the original Principal.
Rate of Interest formula
The Rate (R) can be found using: R = (SI × 100) ÷ (P × T). For this problem, R = (320 × 100) ÷ (6400 × 1) = 5%.
Principal and Amount Relation
The Amount is the total sum returned after a period, calculated as A = P × [1 + (R × T) ÷ 100].

Q43. Answer: (b) 40

Shortcut Trick
Speed = Distance ÷ Time
=> Speed = 680 ÷ 17 = 40 km/hr.
Therefore The correct answer is 40 km/hr.
Alternate Method
Given:
Total Distance covered by Uber auto = 680 km
Total Time taken = 17 hours
Formula Used:
Speed = Distance / Time

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Calculations:

=> Speed = 680 / 17

=> Speed = 40 km/hr

Therefore The correct answer is 40 km/hr.

Additional Information

Speed Conversion

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

Average Speed

Average Speed = Total Distance / Total Time. For two equal distances at speeds x and y, Average Speed = 2xy / (x + y).

Relative Speed

In the same direction, Relative Speed = x − y. In the opposite direction, Relative Speed = x + y.

Q44. Answer: (b) 1.28

Given:

(0.896 × 0.763 + 0.896 × 0.237)/(0.7 × 0.064 + 0.7 × 0.936)

Concept Used:

Distributive property and BODMAS rule

Calculation:

=> (0.896 × (0.763 + 0.237))/(0.7 × (0.064 + 0.936))

=> (0.896 × 1)/(0.7 × 1)

=> 0.896/0.7

=> 896/700

=> 128/100

=> 1.28

Therefore The correct answer is 1.28

Q45. Answer: (b) 80

Shortcut Trick

Total number of students = 50

Increase in average age = 30 − 29 = 1 year

Age of teacher = New average + (Original number of students × Increase in average)

Age of teacher = 30 + (50 × 1) = 80 years

Therefore The correct answer is 80 years.

Alternate Method

Given: Initial students = 50, Initial average = 29 years, New average = 30 years.

Formula Used: Total Age = Average Age × Number of Persons

=> Total age of 50 students = 50 × 29 = 1450 years

=> Total people after adding teacher = 50 + 1 = 51

=> Total age of 51 people = 51 × 30 = 1530 years

=> Age of teacher = Total age of 51 people − Total age of 50 students

=> Age of teacher = 1530 − 1450 = 80 years

Therefore The correct answer is 80 years.

Additional Information

General Formula for Inclusion

Age of new member = New Average + [Number of initial members × Change in Average]. If the average increases, change is positive; if it decreases, change is negative.

Weighted Average

When two groups are combined, Combined Average = (n1x1 + n2x2) ÷ (n1 + n2), where n is the count and x is the individual average.

Arithmetic Mean

The average is the sum of all observations divided by the number of observations: Mean = Σx ÷ n.

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Q46. Answer: (b) 84 hours

Shortcut Trick

Time to empty by leak = (Product of times) ÷ (Difference of times)

Time 1 (Normal) = 12 hr, Time 2 (With leak) = 12 + 2 = 14 hr

Emptying Time = (14 × 12) ÷ (14 − 12)

Emptying Time = 168 ÷ 2 = 84 hr

Therefore The correct answer is 84 hr.

Alternate Method

Given: Filling time = 12 hr; Filling time with leak = 12 + 2 = 14 hr.

Formula Used: Efficiency = Total Work ÷ Time

Pipe	Days	Total Work	Efficiency
Inlet (A)	12 hr	84 units	7
Inlet + Leak (A+B)	14 hr	6	

=> Efficiency of Inlet (A) = 7 units/hr

=> Efficiency of Inlet + Leak (A + B) = 6 units/hr

=> Efficiency of Leak (B) = 6 − 7 = −1 unit/hr (Negative sign indicates emptying)

=> Time taken by Leak to empty the tank = Total Work ÷ Efficiency of B

=> Time = 84 ÷ 1 = 84 hr

Therefore The correct answer is 84 hr.

Additional Information

Pipes and Cisterns Efficiency

Filling pipes have positive efficiency, while leaking or outlet pipes have negative efficiency in calculations.

Net Work Done

If two pipes fill a tank in x and y hours respectively and a third empties it in z hours, net work in 1 hr = (1/x + 1/y − 1/z).

Q47. Answer: (d) 48

Shortcut Trick

For any Arithmetic Progression (AP) with an odd number of terms, the Average is always the Middle Term.

Average = 168 ÷ 7 = 24 (This is the 4^(th) number).

In an AP, the sum of the first and last terms is always equal to twice the average.

Sum of smallest and largest = 2 × 24 = 48.

Therefore The correct answer is 48.

Alternate Method

Given: Sum of 7 consecutive numbers = 168.

Formula Used: Sum of n consecutive numbers starting from x is n/2 × [2x + (n−1)d], where d = 1.

Let the seven consecutive numbers be x, (x+1), (x+2), (x+3), (x+4), (x+5), and (x+6).

=> Sum = x + (x+1) + (x+2) + (x+3) + (x+4) + (x+5) + (x+6) = 168

=> 7x + 21 = 168

=> 7x = 168 − 21

=> 7x = 147

=> x = 147 ÷ 7 = 21

=> Smallest number (x) = 21

=> Largest number (x+6) = 21 + 6 = 27

=> Required Sum = 21 + 27 = 48

Therefore The correct answer is 48.

Additional Information

Average of Consecutive Numbers

The average of any set of numbers in an Arithmetic Progression is always (First term + Last term) ÷ 2.

Consecutive Even/Odd Numbers

For consecutive even or consecutive odd numbers, the common difference (d) is always 2.

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Sum of First n Natural Numbers

The sum is given by the formula $S_n = [n \times (n + 1)] \div 2$.

Q48. Answer: (a) 19

Given:

$3 \times 5 + 8 - 15 \div 3 - 12 + 72 \div 8 \times 5 - 32$

Concept Used:

BODMAS rule

Calculation:

=> $15 + 8 - 15 \div 3 - 12 + 72 \div 8 \times 5 - 32$

=> $15 + 8 - 5 - 12 + 9 \times 5 - 32$

=> $15 + 8 - 5 - 12 + 45 - 32$

=> $23 - 5 - 12 + 45 - 32$

=> $18 - 12 + 45 - 32$

=> $6 + 45 - 32$

=> $51 - 32$

=> 19

Therefore The correct answer is 19

Q49. Answer: (d) 38,750

Shortcut Trick

Let the total votes be 100%.

Valid votes = 80% of total.

Winning margin = (70% − 30%) = 40% of valid votes.

80% × 40% × Total = 12,400 => 32% of Total = 12,400.

Total registered voters = 12,400 ÷ 0.32 = 38,750.

Therefore The correct answer is 38,750.

Alternate Method

Given: Invalid votes = 20%, Winner percentage of valid = 70%, Win margin = 12,400.

Let Total Registered Voters be x.

=> Valid Votes = x × (100 − 20)% = 0.8x.

=> Winner got 70% of 0.8x and Loser got 30% of 0.8x.

=> Difference = (70% − 30%) of 0.8x = 40% of 0.8x.

=> 0.40 × 0.8x = 12,400.

=> 0.32x = 12,400.

=> x = 12,400 ÷ 0.32 = 38,750.

Therefore The correct answer is 38,750.

Additional Information

Percentage Change Base

Always identify the correct base for percentages. In election problems, 'percentage of valid votes' and 'percentage of total votes' yield different equations.

Successive Percentage Method

For multi-step reductions (invalid votes, then win share), use the multiplying factor: Final = Initial × (f1) × (f2).

Margin Calculation

Win Margin = (Winner's % − Loser's %) × Base. Here, base is valid votes.

Q50. Answer: (d) Rs. 2,656

Shortcut Trick

The discount percentage is 20%.

The extra amount without discount is Rs. 664, which is 20% of the Marked Price.

If 20% → Rs. 664, then 1% → 664 ÷ 20 = Rs. 33.2

Manoj paid 80% (100% − 20%) of the Marked Price.

Amount paid = 80 × 33.2 = Rs. 2,656.

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Therefore The correct answer is Rs. 2,656.

Alternate Method

Given:

Discount rate = 20%

Extra amount paid without discount = Rs. 664

Formula Used:

Discount = Marked Price × (Discount% ÷ 100)

Selling Price = Marked Price − Discount

Calculations:

=> 20% of Marked Price = Rs. 664

=> Marked Price = (664 × 100) ÷ 20

=> Marked Price = 664 × 5 = Rs. 3,320

=> Amount paid by Manoj = Marked Price − Discount

=> Amount paid by Manoj = 3,320 − 664

=> Amount paid by Manoj = Rs. 2,656

Therefore The correct answer is Rs. 2,656.

Additional Information

Marked Price & Discount

Discount is always calculated on the Marked Price (MP). SP = MP × (100 − D)%.

Successive Discounts

Two successive discounts of a% and b% are equivalent to a single discount of (a + b − ab/100)%.

Profit and Loss Relation

MP/CP = (100 + Profit%) / (100 − Discount%). This relates Markup and Profit directly.

Q51. Answer: (d) 96

Given: 5 6 10 19 35 60 ?

The logic followed here is:

Thus, 96 should come in place of the question mark (?) in the given series.

Hence, the correct answer is "Option 4".

Q52. Answer: (b) 7

BODMAS Rule:

Decoding the given information:

Letter	A	B	C	D
Meaning	÷	×	•	•

Given equation: 6 C 8 B 8 A 32 D 1 = ?

Now replacing the sign from left to right using BODMAS Rule, we get:

=> 6 + 8 × 8 ÷ 32 − 1 = ?

=> 6 + 8 × 0.25 − 1 = ?

=> 6 + 2 − 1 = ?

=> 8 − 1 = ?

=> 7 = ?

Hence, the correct answer is "Option 2".

Q53. Answer: (c) (4, 40, 10)

The logic followed here is:

Logic: (a, b, c) → b = a × c

(2, 30, 15) → 2 × 15 = 30

(21, 189, 9) → 21 × 9 = 189

Let's check each option:

1. (45, 543, 12) → 45 × 12 = 540 ≠ 543

2. (46, 969, 21) → 46 × 21 = 966 ≠ 969

3. (4, 40, 10) → 4 × 10 = 40

4. (13, 263, 20) → 13 × 20 = 260 ≠ 263

Thus, (4, 40, 10) is the set in which the numbers are related in the same way as the given sets.

Hence, the correct answer is "Option 3".

Q54. Answer: (c) C Y Y R A

Given group: & 4 8 $ #

Code table:

Base codes for & 4 8 $ # → C Y P R A

Checking conditions:

(i) If first element is a symbol and last element is a number → codes interchanged.

• First element = &(symbol), Last element = #(symbol) → last is NOT a number

(ii) If both second and third elements are multiples of 2 → third element coded as second element's code.

• Second element = 4(multiple of 2), Third element = 8(multiple of 2) → condition applies

• Third element (8) takes code of second element (4) → code of 4 = Y

• So third element coded as Y

(iii) If second element is odd and last element is a symbol → second and last coded as *.

• Second element = 4(even)

Applying condition (ii):

Position	Element	Base Code	Final Code
1st	&	C	C
2nd	4	Y	Y
3rd	8	P	Y
4th	$	R	R
5th	#	A	A

Thus, C Y Y R A is the code for & 4 8 $ #.

Hence, the correct answer is "Option 3".

Q55. Answer: (d) 5

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

Now,

Even numbers, each of which is immediately preceded by an odd number and also immediately followed by an odd number.

So, the needed pattern is: Odd — Even — Odd

Thus, there are 5 even numbers, each of which is immediately preceded by an odd number and also immediately followed by an odd number.

Hence, the correct answer is "Option 4".

Q56. Answer: (c) tr

Given: In a certain code language, ‘the chef cooks’ is coded as ‘ae tr ds’ and ‘she cooks food’ is coded as ‘fp qz tr’.

Thus, ‘cooks’ is coded as 'tr' in that language.

Hence, the correct answer is "Option 3".

Q57. Answer: (a) PKD32

The position and positional values or English Alphabets are:

Given: DTM44, HQJ40, LNG36, ?

The logic followed here is:

Thus, PKD32 will replace the question mark (?) in the following series to make it logically complete.

Hence, the correct answer is "Option 1".

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Q58. Answer: (b) BM – FJ

The position and positional values or English Alphabets are:

The pattern followed here is:

Each letter-cluster pair follows the pattern +4, -2.

Let's check each option:

1. RD–VB

This letter-cluster pair follows the pattern +4, -2.

2. BM–FJ

This letter-cluster pair does not follow the pattern +4, -2.

3. QL–UJ

This letter-cluster pair follows the pattern +4, -2.

4. KP–ON

This letter-cluster pair follows the pattern +4, -2.

Thus, BM – FJ is the odd one out.

Hence, the correct answer is "Option 2".

Q59. Answer: (c) Father’s mother

Family Chart:

Decoding the Symbols:

A is				
Symbol	•	•	x	÷
Meaning	father	mother	sister	brother
to B				

Given: P - Q ÷ R + S × T

It means: P is the mother of Q, Q is the brother of R, R is the father of S, S is the sister of T

Thus, P is T's Father’s mother.

Hence, the correct answer is "Option 3".

Q60. Answer: (a) CDH−LMQ

The position and positional values or English Alphabets are:

The pattern followed here is:

Each letter-cluster pair follows the pattern +9, +9, +9.

OPT−XYC

DEI−MNR

Let's check each option:

1. CDH–LMQ

This letter-cluster pair follows the pattern +9, +9, +9.

2. CCF–KLP

This letter-cluster pair does not follow the pattern +9, +9, +9.

3. CCF–LMQ

This letter-cluster pair does not follow the pattern +9, +9, +9.

4. CDH–KMP

This letter-cluster pair does not follow the pattern +9, +9, +9.

Thus, CDH−LMQ follows the same pattern.

Hence, the correct answer is "Option 1".

Q61. Answer: (c) 424

BODMAS Rule:

Decoding the given information:

Symbol	•	•	×	÷

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Meaning	•	×	÷	•

Given equation: 19 - 16 ÷ 128 + 32 x 4 = ?

Now replacing the sign from left to right using BODMAS Rule, we get:

=> 19 × 16 + 128 − 32 ÷ 4 = ?

=> 19 × 16 + 128 − 8 = ?

=> 304 + 128 − 8 = ?

=> 432 − 8 = ?

=> 424 = ?

Hence, the correct answer is "Option 3".

Q62. Answer: (c) D

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

1. A sits fourth to the left of Y.
2. Only two people sit between Y and C when counted from the left of Y.
3. W sits fourth to the right of C.
4. X is not an immediate neighbour of W or Y.
5. D is not an immediate neighbour of X.

B, the only person left will occupy the vacant position.

Thus, D sits third to the right of B.

Hence, the correct answer is "Option 3".

Q63. Answer: (c) 3

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

Now,

Even numbers, each of which is immediately preceded by an odd number and also immediately followed by an even number.

So, the needed pattern is: Odd — Even — Even

Thus, there are 3 even numbers, each of which is immediately preceded by an odd number and also immediately followed by an even number.

Hence, the correct answer is "Option 3".

Q64. Answer: (a) QRU−TUX

The position and positional values or English Alphabets are:

The pattern followed here is:

Each letter-cluster pair follows the pattern +3, +3, +3.

GHK−JKN

TUX−WXA

Let's check each option:

1. QRU–TUX

This letter-cluster pair follows the pattern +3, +3, +3.

2. QRU–SUW

This letter-cluster pair does not follow the pattern +3, +3, +3.

3. QQS–STW

This letter-cluster pair does not follow the pattern +3, +3, +3.

4. QQS−TUX

This letter-cluster pair does not follow the pattern +3, +3, +3.

Thus, QRU−TUX follows the same pattern.

Hence, the correct answer is "Option 1".

Q65. Answer: (a) 12

Given numbers: 551, 214, 483, 409, 581

Now,

Arranging to find highest and lowest:

• Highest → 581

• Lowest → 214

Second digit of the highest number (581): 8

Third digit of the lowest number (214): 4

Result = 8 + 4 = 12

Thus, 12 will be the resultant if the second digit of the highest number is added to the third digit of the lowest number.

Hence, the correct answer is "Option 1".

Q66. Answer: (c) 16 km to the east

Given: Mr. Z starts from Point A and drives 17 km towards the South. He then takes a left turn, drives 18 km, then turns left and drives 41 km. He then takes a left turn and drives 27 km, then turns left and drives 15 km. He then takes a right turn and drives 7 km. He takes a final left turn, drives 9 km, and stops at Point P.

Thus, he should drive 16 km to the east in order to reach Point A again.

Hence, the correct answer is "Option 3".

Q67. Answer: (c) 173

Given: 283 261 239 217 195 ?

The logic followed here is:

Thus, 173 should come in place of the question mark (?) in the given series.

Hence, the correct answer is "Option 3".

Q68. Answer: (c) 15

Given: In a row of 39 people facing north, Sangeeta is 14th from the left end. If Meghana sits 11th to the right of Sangeeta.

Total people = 39

Sangeeta is 14th from left, Meghana is 11th to the right of Sangeeta

It means:

Meghana’s position from left = 14 + 11 = 25

Meghana's position from right = 39 - 25 + 1

= 40 - 25

= 15

Thus, Meghana’s position from the right end of the row is 15.

Hence, the correct answer is "Option 3".

Q69. Answer: (b) VVY

The position and positional values or English Alphabets are:

The pattern followed here is:

Each letter-cluster pair follows the pattern -1, +4.

1. TSW

This letter-cluster pair follows the pattern -1, +4.

2. VVY

This letter-cluster pair does not follow the pattern -1, +4.

3. DCG

This letter-cluster pair follows the pattern -1, +4.

4. LKO

This letter-cluster pair follows the pattern -1, +4.

Thus, VVY is the odd one out.

Hence, the correct answer is "Option 2".

Q70. Answer: (a) RFO55

The position and positional values or English Alphabets are:

Given: DRA111, NBK97, XLU83, HVE69, ?

The logic followed here is:

Thus, RFO55 will replace the question mark (?) in the given series to make it logically complete.

Hence, the correct answer is "Option 1".

Q71. Answer: (b) 240

Given: 2 4 12 48 ? 1440

The logic followed here is:

Thus, 240 should come in place of the question mark (?) in the given series.

Hence, the correct answer is "Option 2".

Q72. Answer: (a) 4

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

Now,

Even numbers, each of which is immediately preceded by an odd number and also immediately followed by an odd number.

So, the needed pattern is: Odd — Even — Odd

Thus, there are 4 even numbers, each of which is immediately preceded by an odd number and also immediately followed by an odd number.

Hence, the correct answer is "Option 1".

Q73. Answer: (b) 38

BODMAS Rule:

Decoding the given information:

Letter	A	B	C	D
Meaning	÷	×	•	•

Given equation: 14 B 2 D 18 A 9 C 12 = ?

Now replacing the sign from left to right using BODMAS Rule, we get:

=> 14 × 2 − 18 ÷ 9 + 12 = ?

=> 14 × 2 − 2 + 12 = ?

=> 28 + 12 − 2 = ?

=> 40 − 2 = ?

=> 38 = ?

Hence, the correct answer is "Option 2".

Q74. Answer: (a) Only conclusion (I) follows

Statements:

Some cakes are samosas.

All samosas are buns.

The least possible Venn diagram for the given statement is:

Conclusions:

(I): Some cakes are buns. - True (Because, Some cakes are samosas and All samosas are buns, which means the cakes which are samosas are buns.)

(II): All buns are samosas. - False (Because, All samosas are buns, which means some buns are samosas.)

Thus, Only conclusion (I) follows.

Hence, the correct answer is "Option 1".

Q75. Answer: (a) Both follow

Statements: All shirts are trousers. All trousers are pants. No pant is a coat.

The least possible Venn diagram for the given statement is:

Conclusion (I) : No shirt is a coat. - True (Because All shirts are trousers, All trousers are pants and No pant is a coat, which means all shirts being pants are not coat.)

Conclusion (II) : No trouser is a coat. - True (Because All trousers are pants and No pant is a coat, which means all trousers being pants are not coat.)

Thus, Both follow.

Hence, the correct answer is "Option 1".

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Q76. Answer: (a) One

Given: A, B, C, D, E, F and G are sitting around a circular table facing the centre.

1. F sits second to the left of G.
2. D is the immediate neighbour of G and A.
3. E is the immediate neighbour of C and A.

B, the only person left will occupy the vacant position.

Thus, one people sit between C and B when counted from the left of B.

Hence, the correct answer is "Option 1".

Q77. Answer: (c) One

Given: Seven boxes, A, B, C, D, I, J and K, are kept one over the other, but not necessarily in the same order.

1. K is kept second from the bottom.
2. Only three boxes are kept between K and I.
3. D is kept at one of the positions below K.
4. Only B is kept between I and J.
5. A is kept at one of the positions above I.

A
I
B
J
K
D

C, the only person left will occupy the vacant position.

A
I
B
J
C
K
D

Thus, one box is kept between C and D.

Hence, the correct answer is "Option 3".

Q78. Answer: (b) QRUQ

The position and positional values or English Alphabets are:

Given: XYBX is related to WXAW in a certain way based on the English alphabetical order. In the same way, QRUQ is related to PQTP.

The logic followed here is:

Similarly,

Thus, RSVR is related to QRUQ.

Hence, the correct answer is "Option 2".

Q79. Answer: (c) 13 km to the south

Given: Mr. Akai starts from Point A and drives 12 km towards west. He then takes a left turn, drives 15 km, turns left and drives 20 km. He then takes a left turn and drives 28 km. He takes a final left turn, drives 8 km and stops at Point P.

Thus, he should drive 13 km to the south in order to reach Point A again.

Hence, the correct answer is "Option 3".

Q80. Answer: (b) C and P

Given: A, B, C, E, F, P and Q are sitting around a circular table facing the centre.

1. F sits third to the left of C.

2. Only one person sits between C and P when counted from the left of P.

3. Only two people sit between B and E when counted from the right of E.

4. A is an immediate neighbour of B.

Q, the only person left will occupy the vacant position.

Thus, C and P sits to the immediate left and right of Q, respectively.

Hence, the correct answer is "Option 2".

Q81. Answer: (c) London, United Kingdom

The correct answer is London, United Kingdom.

Key Points

• The Wimbledon tennis tournament is held annually in London, United Kingdom, at the All England Lawn Tennis and Croquet Club.

• This tournament is one of the four Grand Slam events in tennis, the other three being the Australian Open, French Open, and US Open.

• Wimbledon is renowned for being the oldest tennis tournament in the world, first held in the year 1877.

• The event is unique as it is the only Grand Slam played on grass courts, maintaining its traditional setting and historical significance.

• It takes place over two weeks in late June and early July and is famous for its traditions, such as a strict dress code for players, royal patronage, and serving strawberries and cream to spectators.

Additional Information

• About Wimbledon:

• The tournament is hosted by the All England Lawn Tennis and Croquet Club, located in the Wimbledon district of London.

• It is considered the most prestigious tennis event due to its rich history and adherence to tradition.

• The event features five main competitions: Men’s Singles, Women’s Singles, Men’s Doubles, Women’s Doubles, and Mixed Doubles, along with junior and invitational matches.

• Other Grand Slam Tournaments:

• Australian Open: Held in Melbourne, Australia, it is played on hard courts and marks the first Grand Slam of the calendar year.

• French Open: Known as Roland Garros, it is held in Paris, France, and is played on clay courts.

• US Open: Hosted in New York, USA, it is also played on hard courts and is the final Grand Slam of the year.

• Notable Wimbledon Traditions:

• Players must adhere to a strict all-white dress code while competing on the court.

• The tournament is attended by members of the British Royal Family, adding a prestigious aura to the event.

• It is famous for its strawberries and cream, with approximately 28,000 kilograms of strawberries consumed during the tournament.

• Historical Importance:

• First played in 1877, Wimbledon is the oldest tennis tournament in the world and has been held annually except during the World Wars and the COVID-19 pandemic in 2020.

• It has seen legendary players like Roger Federer, Serena Williams, Novak Djokovic, and Martina Navratilova achieve historic victories.

Important Points

• Prize Money: Wimbledon offers significant prize money, which has steadily increased over the years to reward players for their performances.

• Technology: Wimbledon employs advanced technologies like Hawk-Eye to assist in line calls and ensure fair gameplay.

• Centre Court Roof: The main court at Wimbledon, Centre Court, has a retractable roof to allow play to continue in adverse weather conditions.

• Wildcard Entries: The tournament often grants wildcard entries to deserving players based on their past achievements or potential.

Q82. Answer: (a) Testing crewed docking with a lunar base at Indian space station

The correct answer is Testing crewed docking with a lunar base at Indian space station.

Key Points

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• Testing crewed docking with a lunar base at an Indian space station is not a planned scientific activity under the Axiom-4 mission. The mission primarily focuses on microgravity experiments and health-related studies, not lunar exploration or docking tests.

• The Axiom-4 mission is part of Axiom Space's commercial spaceflight program, aimed at conducting research aboard the International Space Station (ISS). The mission does not involve testing docking capabilities for lunar bases or collaboration with Indian space stations.

• Statement 2, which mentions studying the effects of short spaceflights on joints and blood flow, is correct. This aligns with the mission's objective to understand how microgravity impacts human health during short-duration spaceflights.

• Statement 3 is accurate as the mission plans to investigate microgravity's impact on the brain and assess potential cognitive risks to astronauts, a critical area of study for long-term space missions.

• Statement 4, which refers to understanding the effects on blood stem cells during spaceflight, is valid. Such research is essential for advancing space medicine and preparing for extended missions to distant destinations like Mars.

Additional Information

• Axiom Space:

• Axiom Space is a private aerospace company established in 2016 and headquartered in Houston, Texas, USA.

• The company aims to build the world's first commercial space station, serving as a successor to the International Space Station (ISS).

• Axiom missions focus on conducting research, commercial activities, and preparing for future private space stations.

• Previous missions, such as Axiom-1 and Axiom-2, have successfully sent private astronauts to the ISS for research and commercial endeavors.

• International Space Station (ISS):

• The ISS is a collaborative project involving five major space agencies: NASA (USA), Roscosmos (Russia), ESA (Europe), JAXA (Japan), and CSA (Canada).

• It orbits Earth at an altitude of approximately 400 km and serves as a platform for scientific research in microgravity.

• Research conducted aboard the ISS includes studies in biology, physics, astronomy, and material sciences.

• It provides a unique environment to test technologies and prepare for missions to the Moon, Mars, and beyond.

• Microgravity Research:

• Microgravity refers to the condition in which objects appear to be weightless, as experienced in orbit.

• Research in microgravity helps scientists study phenomena that are difficult to observe under Earth's gravity, such as fluid dynamics, combustion, and biological processes.

• Key areas of study include the effects of microgravity on human physiology, particularly on muscles, bones, and cardiovascular health.

• Microgravity experiments aboard the ISS contribute to advancements in medicine, materials science, and space exploration technologies.

• Space Medicine:

• Space medicine focuses on maintaining the health and safety of astronauts during space missions.

• Key areas include studying the effects of radiation, microgravity, and psychological stress on human health.

• Research in space medicine is essential for the success of long-duration missions, such as those to the Moon or Mars.

• Findings from space medicine are also applied to improve healthcare on Earth, particularly in areas such as telemedicine and remote diagnostics.

Important Points

• Indian Space Station:

• India has plans to develop its own space station by the late 2020s, as announced by ISRO (Indian Space Research Organisation).

• The proposed station will have a weight of 20 tons and be capable of hosting astronauts for extended durations.

• Currently, India does not have operational docking capabilities for lunar bases or a space station.

• Testing crewed docking with a lunar base is not part of any ongoing Indian space missions.

• Lunar Missions:

• India has successfully conducted lunar missions like Chandrayaan-1 (2008) and Chandrayaan-2 (2019).

• The upcoming Chandrayaan-3 mission aims to demonstrate landing and rover capabilities on the Moon.

• However, these missions do not include crewed lunar bases or docking tests.

• Future lunar missions may focus on establishing infrastructure for human exploration of the Moon.

Q83. Answer: (d) Kanpur

The correct answer is Kanpur.

Key Points

• The Defense Research and Development Organisation (DRDO), a premier agency under the Ministry of Defence in India, developed an advanced polymeric membrane to aid in high-pressure desalination of seawater.

• This innovation was carried out by the DRDO laboratory in Kanpur, known for its expertise in developing advanced materials and technology solutions.

• The polymeric membrane developed is designed to withstand high-pressure applications, making it suitable for efficient desalination processes, essential for producing potable water from seawater.

• The technology is expected to contribute significantly to India's efforts in addressing water scarcity, particularly in coastal regions, by providing an affordable and sustainable solution.

• The development aligns with India's focus on leveraging indigenous technology to solve critical environmental and resource challenges.

Additional Information

• Defense Research and Development Organisation (DRDO):

• Established in 1958, DRDO works under the Ministry of Defence to develop state-of-the-art technologies for India's defense and strategic applications.

• It operates a network of 50 laboratories specializing in fields like aeronautics, armaments, electronics, and advanced materials.

• DRDO has been instrumental in developing indigenous technologies such as the Agni missile series, BrahMos missile system, and Tejas fighter aircraft.

• Polymeric Membranes:

• A polymeric membrane is a synthetic material used for separation processes, including desalination, filtration, and purification.

• They are known for their high efficiency, durability, and ability to operate in extreme pressure conditions.

• Such membranes are widely used in reverse osmosis desalination plants, which convert saline water into potable water.

• Importance of Desalination:

• Desalination is the process of removing salts and other impurities from seawater to produce freshwater.

• It is critical for addressing water scarcity, especially in regions with limited freshwater resources.

• India has been investing in desalination technologies to cater to the needs of its growing population and industries.

• Kanpur - A Hub for Advanced Research:

• Kanpur is home to several prestigious research institutions, including the Indian Institute of Technology (IIT Kanpur), which contributes to innovations in technology and science.

• The city has emerged as a center for advancements in material science and engineering, making it an ideal location for a DRDO lab focused on polymeric innovations.

Important Points

• Water Scarcity in India:

• India is one of the most water-stressed countries in the world, with a per capita water availability of 1,544 cubic meters as of 2020.

• Desalination technologies could provide a sustainable solution to meet the water demand in coastal and urban areas.

• Government Initiatives:

• The Indian government has launched several schemes like the National Water Mission and Atal Bhujal Yojana to manage water resources efficiently.

• Investments in desalination and water treatment technologies are part of India's broader strategy to ensure water security.

Q84. Answer: (d) V Sriram and Lashman

The correct answer is V Sriram and Lashman.

Key Points

• The book "Memories and Milestones", which documents the 60 years of the Blue Cross of India, was authored by V Sriram and Lashman. This highlights their commitment to animal welfare and their association with the organization.

• The Blue Cross of India is one of the oldest and most prominent animal welfare organizations in India, headquartered in Chennai. It was established in 1959 by Captain V. Sundaram.

• The book was launched in 2025 to commemorate the six-decade journey of the organization, documenting its impact on animal rights and welfare in India.

• V Sriram, an author and historian, is known for his contributions to documenting cultural and historical aspects of India, while Lashman is a known advocate for animal welfare.

• The launch of the book showcases the achievements, challenges, and milestones of the Blue Cross of India, including its role in rescuing and rehabilitating animals, advocating for animal rights, and promoting humane treatment of animals.

Additional Information

• Blue Cross of India:

• Founded in 1959, it is dedicated to animal welfare, including rescue, rehabilitation, and adoption of animals.

• The organization has been involved in landmark initiatives like the ABC (Animal Birth Control) program to manage stray animal populations humanely.

• It also runs educational campaigns on animal welfare, cruelty prevention, and responsible pet ownership.

• V Sriram:

• A historian and author, V Sriram has written extensively on the cultural and historical heritage of Tamil Nadu and Chennai in particular.

• He is an active contributor to initiatives that document the history of institutions and individuals making a significant impact in society.

• Lashman:

• A prominent animal welfare advocate, Lashman has been actively involved in efforts to promote humane treatment and rights of animals in India.

• His association with the Blue Cross of India reflects his dedication to the cause of animal welfare.

• Significance of "Memories and Milestones":

• The book serves as a historical record of the contributions of the Blue Cross of India to animal welfare over 60 years.

• It also highlights the challenges faced by animal welfare organizations in India and the progress made in this field.

• The launch of the book is a testament to the enduring legacy of the organization and its founders.

Important Points

• Key Achievements of Blue Cross of India:

• One of the first organizations in India to implement the ABC (Animal Birth Control) program.

• Significant contributions to the rescue and rehabilitation of animals during natural disasters like the 2004 Indian Ocean Tsunami and the 2015 Chennai floods.

• Advocacy for the prevention of cruelty to animals and implementation of stricter animal rights laws in India.

• Impact of the Book:

• Provides inspiration for individuals and organizations to contribute to animal welfare.

• Acts as a resource for understanding the history and evolution of animal rights movements in India.

• Raises awareness about the importance of humane treatment of animals and the role of NGOs in achieving this goal.

Q85. Answer: (c) Tamil Nadu

The correct answer is Tamil Nadu.

Key Points

• In October 2025, the Tamil Nadu government launched the State Climate Action Tracker to monitor and analyze climate-related initiatives and their impact across the state.

• The tracker is a part of the state’s broader efforts to achieve decarbonization and align with global climate goals like the Paris Agreement.

• Alongside the tracker, district-level decarbonization action plans were introduced to address region-specific environmental challenges and implement localized solutions.

• The initiative aims to strengthen Tamil Nadu’s position as a leader in climate action and sustainable development in India.

• The tracker will provide real-time data and insights into greenhouse gas emissions, renewable energy adoption, and policy implementation progress at both the state and district levels.

Additional Information

• Tamil Nadu’s Climate Leadership:

• Tamil Nadu is known for its proactive initiatives in renewable energy, particularly in solar and wind power. The state is among the top producers of renewable energy in India.

• The state has set ambitious targets to achieve carbon neutrality and reduce its reliance on fossil fuels by promoting energy efficiency and green technologies.

• State Climate Action Tracker:

• The tracker is a digital tool designed to provide comprehensive data on emissions, energy usage, and the implementation of climate policies.

• It ensures transparency and accountability by making climate-related information accessible to policymakers, researchers, and

the public.

• District-Level Decarbonization Plans:

• These plans focus on region-specific strategies to reduce carbon emissions, such as promoting electric vehicles, enhancing public transport, and supporting afforestation programs.

• Local governments will play a crucial role in implementing and monitoring these plans to ensure their effectiveness.

• Global Climate Goals:

• The initiative aligns with the United Nations Sustainable Development Goals (SDGs), particularly SDG 13 on climate action.

• It also supports India's commitments under the Paris Agreement, which aims to limit global warming to below 2°C above pre-industrial levels.

Important Points

• Role of Technology in Climate Action:

• Advanced technologies like artificial intelligence and big data analytics are being used to monitor and predict environmental changes.

• These tools enhance decision-making by providing accurate and real-time data on emission trends and the effectiveness of policies.

• India's National Action Plan on Climate Change (NAPCC):

• Launched in 2008, the NAPCC outlines eight missions focusing on renewable energy, energy efficiency, and sustainable agriculture, among others.

• State-level initiatives like Tamil Nadu's tracker complement these national efforts by addressing local environmental challenges.

• Public Participation:

• Public awareness and participation are crucial for the success of climate action plans. Tamil Nadu aims to involve communities in activities like tree planting and waste management.

• Educational campaigns and workshops are being organized to promote sustainable practices among citizens.

Q86. Answer: (d) Philippines

The correct answer is Philippines.

Key Points

• The Philippines claimed their first-ever title at the 2025 IIHF Women's Asia Cup, marking a historic milestone for their national hockey team.

• The victory was a significant accomplishment as the Philippines showcased their growing strength in ice hockey, a sport that is traditionally dominated by nations like Japan and China in Asia.

• Teams participating in the IIHF Women's Asia Cup included prominent hockey nations such as Japan, China, India, and the Philippines, making the competition intense and highly competitive.

• The Philippines achieved this milestone through consistent performance, strategic gameplay, and the contribution of key players who played pivotal roles in their success.

• This victory reflects the nation's commitment to developing ice hockey and fostering greater participation in winter sports despite its tropical climate and lack of natural ice surfaces.

Additional Information

• International Ice Hockey Federation (IIHF):

• The IIHF, founded in 1908, is the international governing body for ice hockey and inline hockey.

• It organizes various tournaments, including the IIHF World Championships, IIHF Women's Asia Cup, and IIHF Junior Championships.

• Its primary goal is to promote and develop ice hockey globally, including in regions where the sport is less popular.

• Development of Ice Hockey in the Philippines:

• Ice hockey is still a developing sport in the Philippines, with most ice rinks located in shopping malls due to the tropical climate.

• The country's ice hockey program has been steadily growing, supported by local leagues and international exposure.

• In recent years, Filipino teams have participated in regional tournaments, gaining experience and improving their competitive edge.

• Key Competitors in the IIHF Women's Asia Cup:

• Japan: Known for its robust hockey infrastructure and consistent performance in international tournaments.

• China: A rapidly emerging hockey powerhouse, benefiting from significant investments in winter sports ahead of events like the Winter Olympics.

• India: A developing nation in the field of ice hockey, with efforts to promote the sport in regions like Ladakh where natural ice surfaces are available.

• Philippines: Despite challenges, the nation has made remarkable progress, culminating in their first-ever title win at the 2025

IIHF Women's Asia Cup.

• Significance of the IIHF Women's Asia Cup:

• The tournament plays a crucial role in promoting women's ice hockey in Asia, encouraging greater participation and investment in the sport.

• It serves as a platform for emerging teams to compete at a higher level and gain international exposure.

• The competition fosters cultural exchange and strengthens the camaraderie among nations through sports.

Important Points

• Challenges for Tropical Nations:

• Countries like the Philippines face unique challenges in developing ice hockey due to their tropical climates and lack of natural ice.

• Infrastructure development, including the construction of artificial ice rinks, is crucial for the growth of the sport.

• Role of International Tournaments:

• Participating in tournaments like the IIHF Women's Asia Cup helps emerging nations gain experience and improve their skills.

• Such events also inspire younger generations to take up the sport, contributing to its long-term growth.

• Philippines' Hockey Success:

• The victory at the 2025 IIHF Women's Asia Cup is a testament to the dedication of players, coaches, and administrators in the Philippines.

• This achievement is expected to boost the popularity of ice hockey in the country and attract more resources and support for its development.

Q87. Answer: (c) Year of Reforms

The correct answer is Year of Reforms.

Key Points

• In 2025, the Ministry of Defence launched an initiative called Year of Reforms aimed at modernising the armed forces.

• This initiative focused on integrating advanced technologies such as cybersecurity, artificial intelligence (AI), and fostering integrated command structures.

• The goal was to create a robust defence mechanism to address emerging threats such as cyber warfare and AI-driven challenges.

• The initiative aimed to streamline operations, enhance inter-departmental coordination, and strengthen India's defence capabilities.

• Year of Reforms served as a cornerstone for transforming traditional military strategies into tech-driven, modern defence frameworks.

Additional Information

• Cybersecurity in Defence:

• Cybersecurity has become a critical aspect of national security due to the increasing threats of cyberattacks and data breaches.

• The initiative aimed to strengthen India's cyber defences through dedicated programmes, advanced monitoring systems, and skilled personnel.

• India's focus is on protecting critical infrastructure such as military databases, missile control systems, and communication networks from cyber threats.

• Cybersecurity advancements include the development of firewalls, encryption technologies, and AI-based threat detection systems.

• Artificial Intelligence (AI) in Defence:

• AI is revolutionising military strategies with applications in autonomous drones, predictive analytics, and threat identification.

• AI enables faster decision-making and real-time analysis of battlefield data.

• India's defence sector is exploring AI for applications such as robotic systems, surveillance, and intelligence-gathering.

• AI-based systems are being deployed to enhance precision in missile systems and target tracking.

• Integrated Command Structures:

• Integrated command structures aim to unify operations across different branches of the armed forces, including the Army, Navy, and Air Force.

• This approach enhances coordination, reduces operational redundancy, and enables a more coherent defence strategy.

• Joint commands allow seamless sharing of resources, intelligence, and personnel during critical operations.

• India has been working towards establishing integrated theatre commands to address regional security challenges effectively.

• Modernisation of Armed Forces:

• Modernisation efforts include the procurement of advanced weaponry, upgrading existing systems, and adopting new

technologies.

• India's defence budget has been increasingly allocated to research and development in cutting-edge technologies.

• Focus areas include missile defence systems, space warfare capabilities, and advanced combat platforms.

• Modernisation ensures that the armed forces remain prepared to counter both conventional and unconventional threats.

Important Points

• Digital India and Defence: While Digital India is a major government programme aimed at transforming India into a digitally empowered society, its scope is broader and not specific to defence modernisation.

• Make in India: This initiative focuses on boosting indigenous manufacturing, including defence production, but does not directly address cyber, AI, or integrated command structures.

• Operation Cold Start: A military doctrine aimed at rapid mobilisation and limited warfare, but unrelated to technological modernisation in cyber and AI.

• Year of Reforms: Specifically targets modernising India's armed forces, making it the correct answer for initiatives related to cyber, AI, and integrated command.

Q88. Answer: (d) 2021–2030

The correct answer is 2021–2030.

Key Points

• The Revised Green India Mission (GIM), released in 2025, outlines an action plan for the period 2021–2030.

• The mission is a part of India's commitments under the National Action Plan on Climate Change (NAPCC) and focuses on enhancing forest cover and ecosystem services.

• The primary objective of the GIM is to increase forest and tree cover by 5 million hectares and improve the quality of another 5 million hectares of degraded forest land.

• The mission also emphasizes improved ecosystem services, including biodiversity, hydrological services, and carbon sequestration, with a focus on climate change adaptation.

• The duration of the plan aligns with India's long-term climate action goals and international commitments under the Paris Agreement. Hence, the timeline of 2021–2030 is correct.

Additional Information

• Key Features of the Green India Mission:

• The mission aims to restore degraded ecosystems, including grasslands, wetlands, mangroves, and other critical habitats.

• It integrates community participation, with a focus on the involvement of women and marginalized groups in afforestation and forest management activities.

• Promotes the sustainable use of natural resources while ensuring the livelihood security of forest-dependent communities.

• Encourages the use of indigenous plant species to enhance biodiversity and resilience against climate change.

• Focuses on monitoring and evaluation through a Geographic Information System (GIS) and remote sensing technologies to track progress.

• National Action Plan on Climate Change (NAPCC):

• Launched in 2008, NAPCC is a framework to address climate change through sustainable development.

• It comprises eight missions, including the Green India Mission, National Solar Mission, and National Water Mission.

• The focus areas include promoting renewable energy, enhancing energy efficiency, and ensuring water and agricultural sustainability.

• Paris Agreement and India's Commitments:

• India has committed to reducing its emissions intensity by 33–35% from 2005 levels by 2030.

• It aims to create an additional carbon sink of 2.5–3 billion tonnes of CO_2 equivalent through forest and tree cover by 2030.

• The Green India Mission plays a crucial role in meeting these targets.

• Global Climate Action:

• The United Nations Framework Convention on Climate Change (UNFCCC) guides global climate policies and initiatives.

• India is among the leading nations advocating for climate justice and emphasizes the principle of Common but Differentiated Responsibilities (CBDR).

Important Points

• Importance of Forests:

• Forests act as carbon sinks, absorbing CO_2 from the atmosphere and mitigating climate change.

• They provide critical ecosystem services such as water regulation, soil conservation, and biodiversity support.

• Forests contribute significantly to the livelihoods of millions of people, particularly in rural and tribal areas.

• Challenges to Forest Management:

• Deforestation and forest degradation due to illegal logging, mining, and agricultural expansion.
• Impacts of climate change, such as increased forest fires and shifting vegetation zones.
• Ensuring effective community participation and equitable benefit-sharing mechanisms.

Q89. Answer: (a) Metropolis Healthcare

The correct answer is Metropolis Healthcare.

Key Points

• In February 2025, Metropolis Healthcare, a leading diagnostic service provider in India, partnered with Roche Diagnostics to introduce a self-sampling HPV DNA test in India.
• The test aims to provide an innovative and non-invasive approach to screen for human papillomavirus (HPV), which is a significant cause of cervical cancer.
• Metropolis Healthcare's focus on advanced diagnostic solutions and Roche Diagnostics' expertise in diagnostic technologies make this collaboration a step towards enhancing women's health in India.
• This partnership intends to address the challenges of early detection of cervical cancer, which is a leading cause of cancer-related deaths among women in India.
• The self-sampling method empowers women by offering convenience, privacy, and accessibility, especially in rural and underserved areas.

Additional Information

• Metropolis Healthcare:
• Founded in 1980, it is one of India’s leading diagnostic service providers, with a strong presence across India and internationally.
• Metropolis specializes in clinical laboratory services, pathology, and preventive health check-ups.
• It operates a network of diagnostic centers and offers over 4,000 tests covering a wide range of diseases and health conditions.
• Roche Diagnostics:
• Roche Diagnostics is a division of the Swiss multinational healthcare company Roche.
• It is a global leader in in-vitro diagnostics and cancer diagnostics.
• The company is recognized for its cutting-edge diagnostic technologies, including PCR-based tests, which are pivotal in disease detection and management.
• HPV DNA Test:
• HPV (Human Papillomavirus) is a group of viruses, some of which are linked to cervical cancer.
• The HPV DNA test detects the genetic material of the virus, enabling early identification of women at risk.
• Self-sampling HPV DNA tests allow women to collect samples themselves, making the process less invasive compared to traditional Pap smears.
• Cervical Cancer in India:
• Cervical cancer is the second most common cancer among women in India.
• According to the WHO, India accounts for a significant proportion of the global cervical cancer burden.
• Early detection through regular screening can significantly reduce mortality rates.

Important Points

• Significance of Early Detection:
• Early detection of HPV and cervical cancer can lead to better treatment outcomes and reduced healthcare costs.
• WHO recommends regular screening and vaccination against HPV as effective strategies for cervical cancer prevention.
• Global Impact:
• HPV DNA tests have been widely adopted in several countries as a reliable method for cervical cancer screening.
• India's adoption of advanced diagnostic methods reflects its commitment to improving public health infrastructure.
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Q90. Answer: (c) Canara Bank

The correct answer is Canara Bank.

Key Points

• Canara Bank waived the minimum balance requirement on all savings accounts effective from 31 May 2025.
• This initiative was taken to promote financial inclusion, ensuring banking services are accessible to all, particularly individuals in rural and semi-urban areas.
• The removal of the minimum balance requirement helps customers avoid non-maintenance penalties, easing financial burdens on low-income groups.
• Canara Bank has consistently been at the forefront of implementing customer-friendly policies, and this decision aligns with its

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vision to offer affordable and inclusive banking solutions.

• Other key benefits of this step include increased customer satisfaction, fostering trust, and enabling unrestricted access to banking for its savings account holders.

Additional Information

• Canara Bank:

• Established in 1906 and headquartered in Bengaluru, Karnataka.

• It is one of the largest public sector banks in India, offering a wide range of banking and financial services.

• Known for its customer-oriented policies, including initiatives like financial literacy programs, rural banking, and digital banking solutions.

• Minimum Balance Requirement:

• This refers to the minimum amount of money that a customer must maintain in their savings or current account to avoid penalties.

• Waiving this requirement encourages more individuals to open accounts, especially those from economically weaker sections.

• It also aligns with the Reserve Bank of India's (RBI) financial inclusion guidelines.

• Financial Inclusion in India:

• Financial inclusion aims to provide affordable financial services like savings accounts, credit, and insurance to all sections of society, especially the underprivileged.

• Key initiatives include Pradhan Mantri Jan Dhan Yojana (PMJDY), launched in 2014, which focuses on providing basic banking facilities to every household.

• As of 2023, over 48 crore accounts have been opened under PMJDY.

• Comparison of Other Banks:

• Punjab National Bank (PNB): Requires customers to maintain a minimum balance in certain types of savings accounts.

• Indian Bank: Offers zero-balance accounts, but only under specific schemes like Jan Dhan accounts.

• Bank of India: Has a minimum balance requirement for regular savings accounts, although it provides exemptions for senior citizens and students.

Important Points

• Reserve Bank of India Guidelines:

• The RBI has encouraged banks to adopt customer-centric policies to promote financial accessibility and inclusion.

• It mandates that banks offer Basic Savings Bank Deposit Accounts (BSBDAs), which have no minimum balance requirement.

• Advantages of Zero-Balance Accounts:

• Eliminates penalties for non-maintenance of balance, benefiting low-income groups.

• Encourages more people to engage in formal banking channels, reducing dependency on informal lenders.

• Customer-Centric Initiatives by Public Sector Banks:

• Many public sector banks have introduced zero-balance accounts to cater to economically weaker sections.

• These initiatives are in line with the government's focus on inclusive growth and universal access to financial services.

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Q91. Answer: (c) Hyderabad

The correct answer is Hyderabad.

Key Points

• DRDL (Defense Research and Development Laboratory), a unit under the Defense Research and Development Organization (DRDO), conducted a successful long-duration ground test of an advanced scramjet combustor in April 2025.

• The test took place in Hyderabad, which houses one of DRDO's key facilities for advanced defense technology research and development.

• Scramjet combustor technology is pivotal for hypersonic systems, enabling efficient propulsion at speeds greater than Mach 5.

• Hyderabad is a central hub for defense and aerospace research in India, hosting several institutions like DRDL, RCI (Research Centre Imarat), and ASL (Advanced Systems Laboratory).

• The successful test signifies India's progress in developing indigenous hypersonic technology, which is critical for defense applications and space exploration.

Additional Information

• Scramjet Technology:

• A scramjet (supersonic combustion ramjet) engine is designed for hypersonic flight, where air flows through the engine at supersonic speeds.

• Unlike conventional jet engines, scramjets do not have rotating components, reducing complexity and weight.

• Scramjets use atmospheric oxygen for combustion, eliminating the need to carry oxidizers, making them suitable for long-range applications.

• This technology is crucial for hypersonic missiles, high-speed aircraft, and space vehicles.

• DRDO's Role:

• The Defense Research and Development Organization (DRDO) is India’s premier defense R&D institution, under the Ministry of Defense.

• Established in 1958, DRDO focuses on developing state-of-the-art defense systems and technologies.

• DRDO's achievements include missile systems like Agni, Prithvi, Akash, and BrahMos, as well as advanced radar, avionics, and electronic warfare systems.

• Hyderabad’s Strategic Importance:

• Hyderabad is a significant center for India’s aerospace and defense industries, hosting key DRDO facilities such as DRDL, ASL, and RCI.

• It is also home to companies like Bharat Dynamics Limited (BDL) and Mishra Dhatu Nigam Limited (MIDHANI), which contribute to missile and material production.

• The city plays a critical role in India’s defense technology innovation and advancement.

• Hypersonic Technology in India:

• India is actively developing hypersonic systems, including Hypersonic Technology Demonstrator Vehicles (HSTDV).

• DRDO successfully tested HSTDV in 2020, marking a significant milestone in indigenous hypersonic capability.

• Such advancements are vital for defense applications, as hypersonic missiles can evade traditional air defense systems due to their high speed and maneuverability.

Important Points

• Scramjet Applications:

• Hypersonic missiles: Faster and harder to intercept, enhancing strategic deterrence.

• Space exploration: Scramjets can reduce launch costs by utilizing atmospheric oxygen for propulsion.

• High-speed aircraft: Potential to revolutionize commercial air travel with reduced flight times.

• Global Context:

• Countries like the USA, Russia, and China are leading in hypersonic technology development.

• India’s advancements through DRDO place it among the few nations with indigenous hypersonic capabilities.

Q92. Answer: (d) Integrated Control Room for Emergency Response

The correct answer is Integrated Control Room for Emergency Response.

Key Points

• The Integrated Control Room for Emergency Response (ICR-ER) is a state-of-the-art facility launched by the Government of India in June 2025 to enhance disaster preparedness and response mechanisms.

• This facility is designed to provide real-time monitoring and centralized coordination during disasters, ensuring efficient communication between various stakeholders.

• It integrates advanced technologies such as Artificial Intelligence (AI), Geospatial Analysis, and Internet of Things (IoT) to predict, monitor, and respond to emergencies effectively.

• The ICR-ER serves as a centralized hub for managing resources, evacuations, and relief efforts during disasters like earthquakes, floods, cyclones, and other emergencies.

• This initiative aligns with India's commitment to the Sendai Framework for Disaster Risk Reduction (2015–2030), focusing on minimizing disaster impact through preparedness and technological advancements.

• It operates under the supervision of the National Disaster Management Authority (NDMA), ensuring seamless integration with national and state-level disaster management agencies.

Additional Information

• Disaster Resilience in India:

• India is prone to various natural disasters such as earthquakes, floods, cyclones, and droughts, impacting millions annually.

• The Disaster Management Act, 2005 provides the legal framework for disaster risk reduction and response mechanisms in India.

• The NDMA oversees disaster management policies and coordinates efforts between the central and state governments.

• Key Features of the Integrated Control Room for Emergency Response:

• Equipped with real-time data analytics for early warning systems.

• Facilitates inter-agency communication and collaboration during emergencies.

• Includes GIS mapping for locating affected areas and prioritizing relief efforts.

• Ensures availability of emergency response resources such as medical supplies, evacuation plans, and shelters.

• Sendai Framework for Disaster Risk Reduction:

• Adopted in 2015, this global framework emphasizes reducing disaster risks and enhancing resilience.

• It focuses on prevention, preparedness, and recovery to mitigate the impact of disasters.

• India aligns its disaster management strategies with the Sendai Framework to ensure global best practices.

• Comparison with Other Initiatives:

• Centralized Crisis Management Centre: Focuses on crisis response but lacks the advanced technological integration seen in ICR-ER.

• Advanced Disaster Response and Monitoring Facility: Primarily a monitoring initiative without centralized emergency control capabilities.

• National Disaster Coordination Hub: Coordinates disaster management efforts but does not include the real-time technological features of the ICR-ER.

Important Points

• Technological Integration in Disaster Management:

• Technologies like AI and IoT enable predictive analysis and proactive measures during disasters.

• Use of satellite imagery and drones enhances surveillance and resource allocation.

• Advanced communication systems ensure uninterrupted connectivity during emergencies.

• Global Examples of Emergency Response Systems:

• The United States operates the Federal Emergency Management Agency (FEMA) for disaster response and recovery.

• Japan's Disaster Medical Assistance Teams (DMATs) focus on medical relief during emergencies.

• India's ICR-ER is among the few global initiatives integrating advanced technologies for disaster resilience.

Q93. Answer: (d) PR Sreejesh

The correct answer is PR Sreejesh.

Key Points

• PR Sreejesh, the celebrated Indian hockey goalkeeper, won the prestigious Sportstar of the Year (Male) award at the Sportstar Aces Awards 2025.

• He has been a vital part of the Indian national hockey team and played a significant role in India's historic bronze medal win at the Tokyo Olympics 2020, marking India's first Olympic hockey medal in 41 years.

• Sreejesh is renowned for his exceptional goalkeeping skills, quick reflexes, and ability to deliver under pressure. His performance has often been the backbone of India's success in crucial matches.

• He has previously been honored with prestigious awards such as the Khel Ratna Award (India's highest sporting honor) in 2021 and the Padma Shri in 2017.

• The Sportstar Aces Awards recognizes outstanding achievements in Indian sports, celebrating athletes who have made remarkable contributions to their respective fields.

Additional Information

• PR Sreejesh:

• Full Name: Parattu Raveendran Sreejesh.

• Born: May 8, 1988, in Kizhakkambalam, Kerala, India.

• Position: Goalkeeper in field hockey.

• Sreejesh has been the captain of the Indian hockey team and is known for his leadership qualities on and off the field.

• He has represented India in several international tournaments, including the Asian Games, Commonwealth Games, and World Cups.

• Sportstar Aces Awards:

• These awards are an initiative by the Sportstar magazine to honor excellence in Indian sports annually.

• Categories include individual awards for male and female athletes, team awards, and special recognition awards for lifetime achievements.

• Winners are selected by a jury comprising former athletes, journalists, and sports administrators.

• Achievements of PR Sreejesh:

• Played a pivotal role in India's victory at the 2021 FIH Hockey Pro League.

• Awarded the Best Goalkeeper title multiple times in international tournaments, including the Asian Champions Trophy and the Hockey World League.

• Contributed significantly to India's gold medal wins in the 2014 Asian Games and the 2017 Asia Cup.

• Indian Hockey Team’s Achievements:

• India has a glorious history in hockey, being the most successful team in Olympic history with 8 gold medals.

• The team’s recent resurgence, including the Tokyo Olympics 2020 bronze medal, has been attributed to the contributions of players like PR Sreejesh, Manpreet Singh, and others.

• The team is currently ranked among the top hockey nations globally.

Important Points

• Hockey in India:

• Hockey is considered the national sport of India, and the country has a rich legacy of producing world-class players.

• Legends like Dhyan Chand, Balbir Singh Sr., and now PR Sreejesh have contributed significantly to the sport's popularity.

• Sportstar Aces Awards 2025:

• Other notable winners in 2025 included Neeraj Chopra (Sportstar of the Year - Athletics) and PV Sindhu (Sportstar of the Year - Female).

• The awards aim to inspire young athletes and recognize the hard work and dedication of Indian sports personalities.

• Tokyo Olympics 2020 Bronze Medal:

• India defeated Germany 5-4 in a thrilling match to secure the bronze medal in men’s field hockey.

• PR Sreejesh’s heroic saves in the final minutes of the match were instrumental in the victory.

Q94. Answer: (c) Indian Renaissance: The Modi Decade

The correct answer is Indian Renaissance: The Modi Decade.

Key Points

• Indian Renaissance: The Modi Decade was launched by Union Minister Dharmendra Pradhan at the World Book Fair 2025 in New Delhi as part of the PM YUVA 2.0 scheme.

• The book encapsulates the journey of India's progress under Prime Minister Narendra Modi during the last decade, highlighting key reforms and achievements across various sectors.

• The PM YUVA 2.0 scheme is an initiative aimed at promoting young writers and intellectuals, encouraging them to contribute to literature and national discourse.

• This book serves as a narrative of India's transformation in areas such as governance, digital infrastructure, economic development, and global stature under the leadership of PM Modi.

• The launch of this book reflects the government’s intent to foster an environment of intellectual engagement and literary contribution among the youth of India.

Additional Information

• PM YUVA 2.0 Scheme:

• The Prime Minister’s YUVA (Young, Upcoming, Versatile Authors) scheme was initially launched in 2021 and extended to encourage young writers below the age of 30.

• The scheme aims to create a pool of authors in Indian languages and English, representing India's rich culture, history, and traditions.

• Selected young writers receive mentorship and are provided a financial grant to produce high-quality work.

• The scheme is implemented by the National Book Trust (NBT), and manuscripts are published under the NBT imprint.

• World Book Fair:

• The World Book Fair is an annual event held in New Delhi, showcasing literary works from across India and the world.

• It serves as a platform for publishers, authors, and readers to engage with contemporary and classical literature.

• The 2025 World Book Fair focused on themes such as literature, innovation, and India's cultural heritage.

• Dharmendra Pradhan:

• Dharmendra Pradhan, the Union Minister for Education, Skill Development, and Entrepreneurship, is actively involved in promoting literary and educational initiatives.

• He has been instrumental in implementing several schemes aimed at enhancing skill development and fostering intellectual discourse.

• Achievements under Modi Decade:

• Major reforms such as the Goods and Services Tax (GST), Digital India, Jan Dhan Yojana, and Make in India have reshaped India's economic and global landscape.

• India's improved ranking in indices like the Ease of Doing Business and its emergence as the 5th largest economy reflect the progress made during this period.

Important Points

• Other Options Explained:

• Death of a Gentleman: This book primarily discusses cricket and its evolving dynamics. It is unrelated to the PM YUVA 2.0 scheme or the World Book Fair.

• The Saga of Kudopali: A fictional or regional narrative, not linked to the PM YUVA scheme or reforms under PM Modi.

• The Elsewhereans: Focuses on philosophical or speculative fiction and does not align with the theme of India's achievements under PM Modi.

• Relevance of PM YUVA 2.0:

• The scheme promotes intellectual growth and provides avenues for young authors to contribute to national and global literature.

• Books like Indian Renaissance: The Modi Decade are integral to showcasing India's progress and inspiring future generations.

Q95. Answer: (a) 1 May 2025

The correct answer is Tue Apr 01 2025 00:00:00 GMT+0530 (India Standard Time).

Key Points

• PRAVAAH Portal: The Reserve Bank of India (RBI) launched the PRAVAAH portal to streamline regulatory processes and approvals.

• Launch Date: The portal became effective on April 1, 2025, marking a significant step in improving the efficiency of regulatory workflows.

• Purpose: The PRAVAAH portal is designed to enhance transparency, accountability, and faster processing of regulatory applications submitted by entities regulated by the RBI.

• Features: The portal integrates a centralized platform for receiving, tracking, and processing various regulatory applications, ensuring better monitoring and communication.

• Stakeholders: It primarily benefits entities like banks, non-banking financial companies (NBFCs), and other financial institutions under the purview of the RBI.

Additional Information

• Reserve Bank of India (RBI):

• The RBI is India's central banking institution, established on April 1, 1935, under the Reserve Bank of India Act, 1934.

• Its primary functions include regulating the issue of currency, controlling inflation, supervising financial institutions, and maintaining financial stability in India.

• Digital Initiatives by RBI:

• The RBI has been proactively adopting technology-driven solutions to improve governance and regulatory supervision.

• Other initiatives include the Centralised Information Management System (CIMS), Digital Payments Index (DPI), and the Account Aggregator Framework.

• Benefits of PRAVAAH Portal:

• It ensures timely approvals for regulated entities, reducing delays in decision-making processes.

• The portal enhances compliance monitoring and facilitates better data management for the RBI.

• It aligns with the government’s vision of Digital India, promoting the use of digital platforms for governance.

• Regulated Entities under RBI:

• The RBI regulates a wide range of financial entities, including scheduled banks, cooperative banks, NBFCs, payment systems, and credit rating agencies.

• The introduction of PRAVAAH aims to simplify compliance procedures for these entities.

Q96. Answer: (c) 66 : 34

The correct answer is 66 : 34.

Key Points

• Current Water Sharing Ratio: The water sharing ratio between Andhra Pradesh and Telangana is 66 : 34. Andhra Pradesh receives 66% of the Krishna river water allocation, while Telangana receives the remaining 34%.

• Demand Rejected: In January 2025, the Andhra Pradesh government rejected Telangana's demand for a 50 : 50 share of Krishna river water.

• Reorganization Context: The current water-sharing arrangement was established after the bifurcation of Andhra Pradesh and the creation of Telangana in 2014. The allocation was based on various factors, including existing irrigation projects, population, and geographical requirements.

• Krishna River Details: The Krishna River is one of the major rivers in India, flowing through the states of Maharashtra, Karnataka, Andhra Pradesh, and Telangana. It is crucial for irrigation, drinking water, and hydropower generation in these regions.

• Disputes: Water-sharing disputes between states in India are common due to varying demands for irrigation, industrial use, and drinking water. The Krishna River water-sharing dispute is managed by the Krishna Water Disputes Tribunal (KWDT).

Additional Information

• Krishna Water Disputes Tribunal (KWDT):

• The KWDT was established under the Inter-State River Water Disputes Act, 1956. Its purpose is to resolve disputes related to

the Krishna River water-sharing among states.

• The tribunal has issued multiple awards (KWDT-I in 1976 and KWDT-II in 2010) to allocate water among the basin states.

• The KWDT-II award allocated water based on 65% dependability, taking into consideration the needs of Andhra Pradesh, Telangana, Karnataka, and Maharashtra.

• Krishna River Basin:

• The Krishna River originates near Mahabaleshwar in Maharashtra and flows through Karnataka, Telangana, and Andhra Pradesh before emptying into the Bay of Bengal.

• The basin area spans approximately 258,948 square kilometers, covering around 8% of India's total geographical area.

• Major tributaries include the Tungabhadra, Bhima, Musi, and Koyna.

• Water Allocation Principles:

• Water allocation among states is based on factors such as existing infrastructure, geographical area, population, and water availability.

• States often negotiate or approach tribunals for equitable water-sharing based on their irrigation and drinking water needs.

• Inter-State Disputes in India:

• Inter-state river disputes are governed by the Inter-State River Water Disputes Act, 1956.

• Notable disputes include the Cauvery Water Dispute (Karnataka-Tamil Nadu), Godavari Water Dispute, and the Ravi-Beas Dispute.

• These disputes highlight the challenges in equitable water distribution across states with varying needs.

Important Points

• Andhra Pradesh-Telangana Bifurcation:

• The Andhra Pradesh Reorganization Act, 2014, led to the creation of Telangana as India's 29th state.

• Post-bifurcation, water resources were divided based on existing usage and infrastructure.

• Telangana's demand for equal sharing arises from its need for equitable access to river water for irrigation and drinking water.

• Water Scarcity Concerns:

• India faces increasing challenges related to water scarcity due to population growth, climate change, and over-extraction.

• Efficient water management and resolution of disputes are crucial for sustainable development.

• International examples, like the Mekong River Commission, offer insights into collaborative water-sharing mechanisms.

• Sustainable Water Usage:

• States are encouraged to adopt efficient irrigation techniques such as drip irrigation and rainwater harvesting.

• Promoting inter-state cooperation and adherence to tribunal awards can help resolve disputes amicably.

Q97. Answer: (d) May 1

The correct answer is Fri May 01 2026 00:00:00 GMT+0530 (India Standard Time).

Key Points

• International Labour Day, also known as May Day, is celebrated annually on May 1st across the globe to honor the contributions of workers and the labor movement.

• The first May Day was celebrated in 1889 after the establishment of the International Socialist Congress in Paris to commemorate the Haymarket affair of 1886.

• Fri May 01 2026 is the accurate date for International Labour Day in 2026 as it aligns with the annual observation of the day on May 1st.

• International Labour Day symbolizes the struggle for fair labor practices, rights, and better working conditions for workers worldwide.

• It is recognized as a public holiday in many countries, including India, where workers participate in various events such as rallies, marches, and discussions.

Additional Information

• History of International Labour Day:

• International Labour Day originated from the labor union movement advocating for an eight-hour workday.

• The Haymarket affair, a major labor protest in Chicago in 1886, played a pivotal role in establishing May 1st as Labour Day.

• The day became internationally recognized after the Second International declared May 1st as International Workers' Day in 1889.

• Significance:

• Labour Day serves as a reminder of the struggles and achievements of workers over the years.

• It highlights the importance of ensuring fair wages, safe working conditions, and social protections.

• It is a day to express solidarity with workers globally and promote economic equality.

• Observance in India:

• Labour Day was first celebrated in India on May 1, 1923, in Chennai by the Labour Kisan Party of Hindustan.

• It is a public holiday in several states, with workers' unions organizing rallies, speeches, and cultural events.

• The day is an opportunity to acknowledge the vital contributions of workers in India's economic progress.

• Global Observance:

• Many countries, including the United States, United Kingdom, and Australia, observe Labour Day but on different dates due to historical and cultural differences.

• In some countries, such as China, Russia, and Germany, May Day is a significant national holiday with parades and celebrations.

Important Points

• Haymarket Affair:

• The Haymarket Affair was a labor protest in Chicago in May 1886 that turned violent, leading to several deaths and inspiring the global labor movement.

• It emphasized the need for workers' rights and became the cornerstone for observing May Day.

• International Labour Organization (ILO):

• The ILO, established in 1919, plays a crucial role in promoting global labor standards.

• It advocates for decent work conditions, fair wages, and employment opportunities worldwide.

• ILO conventions and recommendations guide nations in improving labor practices.

• Modern-day Observance:

• Labour Day is marked by rallies, speeches, and demonstrations to address labor-related issues.

• It serves as a platform for workers to voice their concerns regarding employment, wages, and workplace safety.

• Educational institutions and organizations use the day to raise awareness about the rights and responsibilities of workers.

Q98. Answer: (d) Ecumenical Patriarch Bartholomew

The correct answer is Ecumenical Patriarch Bartholomew.

Key Points

• Ecumenical Patriarch Bartholomew, a global leader of the Orthodox Christian Church, is recognized for his contributions towards promoting science and spirituality.

• He was awarded the 2025 Templeton Prize, which honors individuals whose work has advanced the intersection of science and religion.

• Patriarch Bartholomew has been an advocate for environmental sustainability, often referred to as the "Green Patriarch" for his efforts in connecting ecology with theology.

• His initiatives emphasize the need for spiritual reflection on environmental issues, urging global communities to adopt sustainable practices.

• The Templeton Prize, established by Sir John Templeton, is one of the world's largest annual awards in monetary terms, celebrating work that bridges gaps between science, philosophy, and religion.

Additional Information

• Ecumenical Patriarch Bartholomew:

• He is the Archbishop of Constantinople-New Rome and Ecumenical Patriarch, serving as the spiritual leader of approximately 300 million Orthodox Christians worldwide.

• He has played a significant role in fostering interfaith dialogue and promoting peaceful coexistence among different religious groups.

• His efforts include organizing environmental conferences and advocating for climate justice.

• Bartholomew has consistently highlighted the moral and spiritual dimensions of environmental degradation.

• Templeton Prize:

• Established in 1972 by Sir John Templeton, the award recognizes individuals making exceptional contributions to affirming life's spiritual dimension.

• It is awarded annually and includes a monetary value higher than the Nobel Prizes to reflect Sir Templeton's belief in the importance of spiritual contributions.

• Past recipients include influential figures like Mother Teresa, Dalai Lama, and Francis Collins.

• Intersection of Science and Spirituality:

• Science and spirituality often intersect in addressing global challenges like climate change, ethics in scientific advancements, and human well-being.

• Prominent leaders like Patriarch Bartholomew work to show how spiritual teachings can complement scientific understanding.

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• Such initiatives promote a holistic approach to solving societal issues by combining technological innovation with moral responsibility.

• Environmental Advocacy:

• Patriarch Bartholomew's environmental advocacy includes emphasizing the responsibility of individuals and communities to care for the Earth.

• He has highlighted the theological perspective that the environment is a gift from God, necessitating stewardship and respect.

• His work aligns with broader movements promoting sustainability, renewable energy, and conservation.

Important Points

• William Lane Craig: Known for contributions to Christian philosophy and apologetics, but not associated with the Templeton Prize in 2025.

• Jean Vanier: A founder of L'Arche communities for individuals with intellectual disabilities, his work primarily focuses on social inclusion rather than science and spirituality.

• Francis Collins: A geneticist and former director of the National Institutes of Health (NIH), awarded the Templeton Prize in 2020.

• Ecumenical Patriarch Bartholomew: Correct answer, awarded the 2025 Templeton Prize for his efforts in integrating spirituality with environmental science.

Q99. Answer: (a) Rajat Patidar

The correct answer is Rajat Patidar.

Key Points

• Rajat Patidar led Royal Challengers Bengaluru (RCB) to their maiden Indian Premier League (IPL) title in 2025 in his debut season as captain.

• RCB defeated Punjab Kings by 6 runs in a thrilling final held at the Narendra Modi Stadium in Ahmedabad, ending an 18-year title drought.

• Elite Company: He became only the fourth captain in IPL history to win the title in his debut season as a franchise skipper, joining Shane Warne (2008), Rohit Sharma (2013), and Hardik Pandya (2022).

• Quick Success: He is the joint-fastest to a title, winning it in his 13th match as captain.

• Batting Record: During the season, Patidar also became the second-fastest player to reach 1,000 IPL runs (30 innings), surpassing the pace set by legends like Sachin Tendulkar.

Q100. Answer: (c) Entrepreneurship for Minorities

The correct answer is Entrepreneurship for Minorities.

Key Points

• The conference organized by the National Minorities Development and Finance Corporation (NMDFC) in May 2025 focused on the theme of Entrepreneurship for Minorities.

• The primary aim of the conference was to address challenges faced by minorities in accessing entrepreneurial opportunities and provide them with resources for growth.

• Entrepreneurship for Minorities is seen as a key driver for socio-economic development, enabling individuals from minority communities to achieve financial independence and contribute to the nation’s economy.

• The event included workshops, discussions, and networking opportunities to empower minority entrepreneurs through knowledge-sharing, mentorship, and financial support mechanisms.

• This initiative aligns with the government's broader strategy of promoting inclusive growth and ensuring equal opportunities for all sections of society.

Additional Information

• National Minorities Development and Finance Corporation (NMDFC):

• NMDFC is a government-established organization aimed at promoting the economic and developmental needs of minority communities.

• It provides financial assistance, skill development programs, and entrepreneurship training to eligible minorities.

• NMDFC primarily supports communities classified under minorities, including Muslims, Sikhs, Buddhists, Christians, Parsis, and Jains.

• Entrepreneurship for Minorities:

• Entrepreneurship among minorities is a critical tool for economic upliftment and reducing disparities.

• Such initiatives aim to address systemic barriers like limited access to credit, mentorship, and market opportunities.

• Government schemes such as Startup India and Standup India have also extended support to minority entrepreneurs.

• Financial Planning for Small Businesses:

• This involves creating strategies to manage finances effectively for small-scale enterprises.

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• It is an essential skill for entrepreneurs to ensure sustainability and growth.

• While important, this was not the central theme of the NMDFC conference in May 2025.

• Leadership Training for Minority Women:

• Leadership training empowers minority women to take up managerial and decision-making roles.

• While relevant to minority development, it was not the focus of the 2025 NMDFC conference.

Important Points

• Entrepreneurship as a Catalyst for Development:

• Entrepreneurship plays a vital role in fostering innovation, job creation, and economic self-reliance.

• Minority entrepreneurs face unique challenges, such as discrimination and lack of access to resources, which need targeted interventions.

• Government Initiatives Supporting Minority Development:

• Various schemes, including Prime Minister's Employment Generation Programme (PMEGP) and Stand-Up India, are aimed at fostering entrepreneurship among minorities.

• These programs provide financial support, training, and mentorship to improve the socio-economic status of minority communities.

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