RRB Group D Official Paper (Held On: 21 Dec, 2025 Shift 1) (Previous Year Paper)

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

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GENERAL SCIENCE

Q1. An object moves along a straight path for 5 s. Its initial velocity is 10 m s ^(-1) and its final velocity is -2 m s ^(-1). What is the magnitude of the average velocity?

(a) 5 m/s
(b) 4 m/s
(c) 6 m/s
(d) 8 m/s

Q2. Which of the following is NOT the correct use of a concave mirror?

(a) It is used as a shaving mirror.
(b) It is used in torches.
(c) It is used as a rear view mirror in automobiles.
(d) It is used in a solar furnace.

Q3. Which of the following causes a change in the state of matter?

(a) Cutting the substance
(b) Mixing it with another substance
(c) Changing temperature or pressure
(d) Dissolving the substance

Q4. What is the primary mechanism through which sexual reproduction generates genetic diversity in the offspring?

(a) Frequent cell divisions during gamete formation
(b) Variation in chromosome number among the gametes
(c) Random distribution of maternal or paternal chromosomes from each chromosome pair to the gametes
(d) Inaccuracies in DNA copying during gamete formation in maternal and paternal parents

Q5. If the speed of an object changes with time, the distance–time graph will be:

(a) A straight line parallel to the time axis
(b) A horizontal straight line
(c) A curved line
(d) A straight line inclined to the time axis

Q6. What conclusion can be drawn from the microscopic observation of onion peel cells?

(a) The size of the onion decides the shape of its individual cells
(b) All onions are made up of similar small structures called cells
(c) Onion bulbs contain different cell types for different functions
(d) Each onion peel contains cells of different composition

Q7. What type of force is responsible for the Moon's circular motion around Earth?

(a) Centrifugal Force
(b) Normal Force
(c) Centripetal Force due to Earth's gravity
(d) Electromagnetic Force

Q8. Which of the following scenarios can disturb a food web the most?

(a) Increase in sunlight hours
(b) Change in wind direction
(c) Seasonal change in rainfall
(d) Sudden removal of a key species

Q9. Phosphoric acid (H_3PO_4) is composed of which of the following ions?

(a) H_2^+, PO_4^{3-}
(b) H^+, PO_4^{4-}
(c) H^+, PO_4^{2-}
(d) H^+, PO_4^{3-}

Q10. If a piece of aluminium is added to iron(II) sulphate ($FeSO_4$) solution, what will happen?

(a) Aluminium will get deposited.
(b) Blue solution will be formed.
(c) There will be no reaction.
(d) Iron will get deposited.

Q11. Which connective tissue smoothens bone surfaces at joints and is present in the ear and trachea?

(a) Cartilage
(b) Areolar
(c) Adipose
(d) Ligament

Q12. The work done in carrying a block of mass 30 kg to a height of 'X' m is 6000 J. What will be the value of X (in m)? (Take the value of g = 10 m/s^2)

(a) 200
(b) 1800
(c) 20
(d) 1,80,000

Q13. Which of the following sounds has the lowest pitch?

(a) A tuning fork (512 Hz)
(b) A man's deep voice (100 Hz)
(c) A child's voice (350 Hz)
(d) A bird's chirp (1500 Hz)

Q14. Which of the following statements is/are correct regarding vegetative propagation?

Statement A: Root, stem and leaves develop into new plants under appropriate conditions.

Statement B: Vegetative propagation is used in sugarcane, roses and grapes.

(a) Only Statement A
(b) Neither Statement A nor B
(c) Only Statement B
(d) Both Statement A and B

Q15. Balance the following reaction:

$3MnO_2 (s) + xAl (s) \rightarrow 3Mn (l) + yAl_2O_3 (s) + Heat$

(a) x = 3, y = 2
(b) x = 4, y = 4

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(c) x = 4, y = 2
(d) x = 2, y = 4

Q16. Which of the following plant nutrients is supplied from air?
(a) Iron
(b) Carbon
(c) Nitrogen
(d) Hydrogen

Q17. Impurities are converted to compounds by adding refining agents in which type of refining method?
(a) Ionic method
(b) Chemical method
(c) Physical method
(d) Electro-chemical method

Q18. How many contrasting characters were used by Mendel to formulate the laws of inheritance?
(a) 5
(b) 7
(c) 8
(d) 4

Q19. What happens when acid is dissolved in water?
(a) It forms salt.
(b) It releases OH- ions.
(c) It releases H+ ions.
(d) It loses its acidic properties.

Q20. The molecular mass of carbon dioxide is:
(a) 50 amu
(b) 44 amu
(c) 28 amu
(d) 32 amu

Q21. Two resistors of 2 Ω and X Ω are connected in series to a 10 V battery. If the current flowing through the resistors is 2 A, then what will be the value of X (in Ohm)?
(a) 1/2
(b) 1/3
(c) 2
(d) 3

Q22. The image formed by a concave lens for an object at infinity is:
(a) real, inverted, and large
(b) virtual, erect, and point-sized
(c) real, erect, and magnified
(d) virtual, inverted, and diminished

Q23. The smooth endoplasmic reticulum (SER) helps in the manufacture of _____.
(a) DNA
(b) starch
(c) proteins
(d) lipids (fats)

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Q24. The direction of the magnetic field at the centre of a current-carrying circular loop is determined by which of the following?

(a) Fleming's Right-Hand Rule
(b) Right-Hand Thumb Rule
(c) Lenz's Law
(d) Fleming's Left-Hand Rule

Q25. What colour does phenolphthalein turn to in a basic solution?

(a) Yellow
(b) Colourless
(c) Pink
(d) Red

MATHEMATICS

Q26. A cylinder whose height is eight times its radius is melted and cast into spherical balls each of half the radius of the cylinder. Find the number of spherical balls.

(a) 35
(b) 48
(c) 56
(d) 24

Q27. If a pole is 30 m high, casts a shadow $10\sqrt{3}$ m long on the ground, then the angle of elevation of the sun is:

(a) 45°
(b) 30°
(c) 60°
(d) 90°

Q28. One pipe can fill a tank in 6 minutes, while another pipe can empty the completely filled tank in 9 minutes. If both the pipes are opened together when the tank is empty, how many minutes will it take to fill one-half of the tank?

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

Q29. In a test, B got 50 marks while A got 75 marks, out of 110 maximum marks. What percentage of A's marks was B's marks? (Round off your answer to two decimal places.)

(a) 66.67%
(b) 110.19%
(c) 150.22%
(d) 68.18%

Q30. A food outlet sells two types of meal combos. The first combo contains 2 sandwiches and 1 juice and costs Rs. 80. The second combo contains 1 sandwich and 2 juices and costs Rs. 70. What is the price of one sandwich?

(a) Rs. 30
(b) Rs. 25
(c) Rs. 35
(d) Rs. 20

Q31. In a race, an athlete covers a distance of 420 m in 140 sec in the first lap. He covers the second lap of the same distance in 70 sec. What is the average speed (in m/sec) of the athlete?

(a) 9
(b) 3
(c) 4
(d) 5

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Q32. The ratio of two numbers is 3:4 and their HCF is 7. Their LCM is:

(a) 49
(b) 56
(c) 64
(d) 84

Q33. A person is 5 years older than twice their sibling's age. If the person is currently 27 years old, how old is the sibling?

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

Q34. A person sells a table at a 7% profit. If he had sold it for Rs. 1,280 more, then his profit would have been 17%. Find the cost price of the table.

(a) Rs. 12,400
(b) Rs. 12,200
(c) Rs. 12,600
(d) Rs. 12,800

Q35. A room with a square base and height 10 ft occupies 25,000 ft^3 volume. The room has cubicles of base area 25 ft^2 in four corners. The walls and ceiling of the area of the room which is not occupied by cubicles is to be painted. How much area is to be painted?

(a) 4500 ft^2
(b) 4000 ft^2
(c) 4300 ft^2
(d) 4200 ft^2

Q36. A dealer marks his goods at 44% above the cost price and allows a discount of 75% on the marked price. What is his gain or loss percentage?

(a) 66% loss
(b) 65% loss
(c) 64% loss
(d) 67% gain

Q37. If 4^((x + 1)) = 64 × 8^x find the value of x.

(a) 4
(b) -4
(c) -2
(d) 2

Q38. Rs. 1,964 is divided among Ashish, Lalita and Pranav in such a way that if Rs. 50, Rs. 17 and Rs. 10 are deducted from their respective shares, they have money in the ratio 20:4:13. Find Lalita's share.

(a) Rs. 354
(b) Rs. 221
(c) Rs. 304
(d) Rs. 154

Q39. Mohan can complete a piece of work alone in 6 days by working 5 hours a day, and Rohan can do the same in 8 days. If they work together for 8 hours each day, how long will it take them to finish the work?

(a) 34/9 days
(b) 21/7 days
(c) 31/5 days
(d) 25/8 days

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Q40. Simplify: $[(4x - 5y)^2 + 80xy] \div [(4x + 5y)^2]$

(a) −3
(b) 2
(c) 4
(d) 1

Q41. The price of fuel decreases by 40%, 15% and 45% in three successive months, but increases by 70% in the fourth month. What is the percentage increase/decrease in the price of fuel in the fourth month as compared to its original price? (Round off your answer to two decimal places)

(a) Decreases by 53.03%
(b) Increases by 48.21%
(c) Increases by 54.13%
(d) Decreases by 52.32%

Q42. A typist takes 40 minutes to type 4 pages. How many pages will he type in 90 minutes?

(a) 11
(b) 8
(c) 10
(d) 9

Q43. The average age of 23 students of a class is 25 years. If the age of the teacher is also included, the average age of the whole group becomes 26 years. The age (in years) of the teacher is:

(a) 56
(b) 49
(c) 59
(d) 57

Q44. If the mode of a data exceeds its mean by 19.8, then the mode exceeds the median by _____. (Use empirical formula to find the answer.)

(a) 14.6
(b) 15.3
(c) 13.2
(d) 8.6

Q45. Walking at 3/5 of his normal speed from his home, Vishal is 24 minutes late in reaching his office. The usual time taken by him to cover the distance between his home and his office is:

(a) 36 minutes
(b) 41 minutes
(c) 34 minutes
(d) 45 minutes

Q46. The amount on a sum of Rs. 1,500 at 10% per annum compound interest, compounded annually, in 2 years will be:

(a) Rs. 2,423
(b) Rs. 1,815
(c) Rs. 1,661
(d) Rs. 1,940

Q47. What will come in place of ' X ', and X > 0, in the equation X/125 = 5/X ?

(a) 27
(b) 25
(c) 28
(d) 23

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Q48. If 40% of 10% of 1/3 of a number is 477, find the number.

(a) 37030
(b) 39070
(c) 38170
(d) 35775

Q49. A shopkeeper offers the following four schemes:

A) Two successive discounts of 32% and 40%

B) Buy 1, get 5 free

C) A single discount of 48%

D) Two successive discounts of 8% and 33%

Which scheme is best for the shopkeeper?

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

Q50. In a quadrilateral ABCD, angle A = 32° and angle B = 58°. The bisectors of angle C and angle D meet at O. What is the measure of angle DOC?

(a) 33°
(b) 60°
(c) 45°
(d) 50°

GENERAL INTELLIGENCE & REASONING

Q51. Refer to the following number- symbol series and answer the question that follows. Counting is to be done from left to right only.

(Left) 5 € $ 4 9 & & 4 € @ © 7 @ 7 9 1 8 # 8 % 5 £ (Right)

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

(a) 9
(b) 3
(c) 4
(d) 8

Q52. Read the given statements and conclusions carefully. Assuming that the information given in the statements is true, even if it appears to be at variance with commonly known facts, decide which of the given conclusions logically follow(s) from the statements.

Statements:

Some vehicles are trucks.

Some vehicles are lorries.

Some trucks are buses.

Conclusions:

(I) Some vehicles are buses.

(II) Some trucks are lorries.

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

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Q53. Each of the digits in the number 756931482 is arranged in ascending order from left to right. What will be the sum of the digits which are third from the left and second from the right in the new number thus formed?

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

Q54. 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 Pianos are Guitars.

Some Guitars are Violins.

No Violins are Drums.

Conclusions:

(I) Some Drums are Guitars.

(II) Some Violins are Pianos.

(a) Only conclusion (II) is true.
(b) Both conclusions (I) and (II) are true.
(c) Neither conclusion (I) nor (II) is true.
(d) Only conclusion (I) is true.

Q55. 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 is the letter-cluster pair 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) XZ−BG
(b) RT−WY
(c) JL−OQ
(d) ZB−EG

Q56. Refer to the following number series and answer the question that follows (all numbers are single-digit numbers only). Counting to be done from left to right only.

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

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

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

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

4 9 14 19 24 ?

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

Q58. The house of P is 5 km west of the house of Q. The house of R is 3 km north of the house of Q. The house of S is 10 km south of the house of R. In which direction is the house of S from the house of Q?

(a) North
(b) East
(c) West
(d) South

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Q59. In a certain code language,

A + B means ‘A is the son of B’,

A - B means ‘A is the brother of B’,

A x B means ‘A is the wife of B’,

and A & B means ‘A is the father of B’.

How is K related to V if ‘K & T x R - Z + V’?

(a) Son's wife's brother
(b) Wife's father
(c) Daughter
(d) Son's wife's father

Q60. Which of the following letter-number clusters will replace the question mark (?) in the given series to make it logically complete?

FEA 40 EDZ 32 DCY 24 CBX 16 ?

(a) BZV 7
(b) BBV 8
(c) BEI 7
(d) BAW 8

Q61. Prakash starts from Point A and drives 37 km towards the north. He then takes a left turn, drives 40 km, turns left and drives 55 km. He then takes a left turn and drives 64 km. He takes a final left turn, drives 18 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) 23 km to the west
(b) 24 km to the west
(c) 25 km to the east
(d) 22 km to the west

Q62. What should come in place of the question mark (?) in the given series based on the English alphabetical order?

DEL GFJ JGH MHF ?

(a) PJD
(b) PID
(c) QID
(d) QJD

Q63. In a certain code language, ‘FOUR’ is coded as ‘5812’ and ‘ROUT’ is coded as ‘5628’. What is the code for ‘T’ in that language?

(a) 5
(b) 2
(c) 8
(d) 6

Q64. Seven boxes, A, B, C, D, E, F and G, are kept one over the other, but not necessarily in the same order.

Only four boxes are kept between A and E. Only C is kept above A. Only two boxes are kept between G and F. B is kept immediately above D. F is not kept immediately above B.

How many boxes are kept below B?

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

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Q65. Refer to the given number series and answer the question that follows. Counting to be done from left to right only. All numbers are single-digit numbers.

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

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

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

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

6 10 18 30 46 ?

(a) 52
(b) 66
(c) 72
(d) 76

Q67. Based on the English alphabetical order, three of the following four letter-clusters are alike in a certain way and thus form a group. Which letter-cluster DOES NOT belong to that group?

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

(a) GIL
(b) KMP
(c) VXA
(d) JLP

Q68. MGRC is related to HCOA in a certain way based on the English alphabetical order. In the same way, VOWB is related to QKTZ. To which of the given options is QNVT related, following the same logic?

(a) MJRS
(b) MKRS
(c) LJSR
(d) LKSR

Q69. Six people, A, B, C, D, E and F, are sitting in a row, facing north. A sits to the immediate left of F. C sits third to the left of E. C is an immediate neighbour of F. D sits to the immediate left of B. How many people sit between B and C?

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

Q70. Select the pair that follows the same pattern as the one followed by the two set of pairs given below. Both pairs follow the same pattern.

VYA−EHJ

HKM−QTV

(a) TWY−BFG
(b) TWY−CFH
(c) TVW−BEG
(d) TVW−CFH

Q71. JIKO is related to ZYAE in a certain way based on the English alphabetical order. In the same way, VUWA is related to LKMQ. To which of the given options is RQSW related, following the same logic?

(a) HGIM
(b) HYUO
(c) HGYT

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(d) HNJU

Q72. What will come in place of the question mark (?) in the following equation, if '+' and '−' are interchanged and '×' and '÷' are interchanged?

79 ÷ 7 + 464 × 4 - 386 = ?

(a) 871
(b) 839
(c) 823
(d) 862

Q73. What should come in place of the question mark (?) in the given series?

170 150 133 119 108 ?

(a) 100
(b) 106
(c) 98
(d) 102

Q74. Seven people, A, B, C, D, E, F and G, are sitting in a row, facing north. Only three people sit between D and E. B sits to the immediate left of E. No one sits to the right of G. Only two people sit between G and B. A sits to the immediate right of F. How many people sit to the right of C?

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

Q75. A, B, C, D, E, F and G are sitting around a circular table, facing the centre.

A is an immediate neighbour of both E and B. B sits third to the left of F. D sits to the immediate left of F. G is not an immediate neighbour of B.

How many people sit between C and G, when counted from the right of G?

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

Q76. All 31 students in a class are standing in a row, facing north. Pooja is 9^(th) from the right end, while Tanya is 16^(th) from the left end. How many people stand between Pooja and Tanya?

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

Q77. Each of the digits in the number 1748563 is arranged in ascending order from left to right. What will be the sum of the digits which are second from the left and second from the right in the new number thus formed?

(a) 12
(b) 10
(c) 6
(d) 14

Q78. This question is based on the five, three-digit numbers given below.

(Left) 458 625 751 359 245 (Right)

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

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

If all the numbers are arranged in descending order, then the position of how many numbers will remain unchanged?

(a) 2

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

Q79. In a certain code language, ‘trust builds bond’ is coded as ‘zn fy tk’ and ‘keep your trust’ is coded as ‘fy ep rb’. How is ‘trust’ coded in that language?

(a) fy
(b) ep
(c) rb
(d) zn

Q80. 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.)

(15, 39, 87)

(27, 51, 99)

(a) (49, 73, 122)
(b) (83, 107, 155)
(c) (72, 95, 143)
(d) (55, 79, 128)

GENERAL AWARENESS AND CURRENT AFFAIRS

Q81. Where was the National Conference on ‘Opportunities of Defence Manufacturing in the Country’ held in India on October 7, 2025?

(a) New Delhi
(b) Bengaluru
(c) Jaipur
(d) Chandigarh

Q82. How many people were lifted out of extreme poverty in India between 2011-12 and 2022-23, as per the World Bank?

(a) 200 million
(b) 150 million
(c) 171 million
(d) 220 million

Q83. In 2025, India launched Operation SINDOOR in response to a terror attack. The operation targeted terrorist camps in which region?

(a) Gujarat & Pakistan
(b) Rajasthan & Pakistan occupied Kashmir
(c) Punjab & Pakistan
(d) Pakistan and Pakistan occupied Kashmir

Q84. Which national park was declared India’s 58^(th) Tiger Reserve in March 2025?

(a) Ramgarh Vishdhari National Park, Rajasthan
(b) Madhav National Park, Madhya Pradesh
(c) Guru Ghasidas National Park, Chhattisgarh
(d) Orang National Park, Assam

Q85. Apart from 30th January, on which other date is Martyrs’ Day observed in India to honour Bhagat Singh, Rajguru and Sukhdev?

(a) 15th March
(b) 23rd March
(c) 13th April

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(d) 9th August

Q86. Which of the following Brazilian cities hosted the 17^(th) BRICS Summit on 6–7 July 2025?

(a) Brasilia
(b) Sao Paulo
(c) Rio de Janeiro
(d) Manaus

Q87. Which author's work 'Paradise Inc.' critiques Western conservation models in Africa through memoir and photojournalism?

(a) Nell Stevens
(b) Colum McCann
(c) Guillaume Bonn
(d) Banu Mushtaq

Q88. As reported in August 2025, which of the following relief measures did exporters request from the government and Reserve Bank of India (RBI) to help with financial strain caused by US tariffs?

(a) Complete write-off of loans
(b) Import bans on US goods
(c) Increase in export tariffs
(d) Relaxation on loan repayments

Q89. Which institute has developed an indigenously made point-of-care test kit for early diagnosis of Haemophilia A and Von Willebrand Disease?

(a) National Institute of Immunohaematology
(b) All India Institute of Medical Sciences (AIIMS)
(c) Indian Council of Medical Research (ICMR)
(d) National Institute of Virology

Q90. Which of the following Indian banks increased the minimum balance requirement for new customers for the semi-urban segment branches to Rs. 25,000, compared to its earlier Rs. 5,000 levels from August 1, 2025?

(a) State Bank of India
(b) ICICI Bank
(c) HDFC Bank
(d) Punjab National Bank

Q91. Which of the following missile systems did India test within a 24-hour window in July 2025, showcasing strategic deterrence capabilities?

(a) Agni-V, BrahMos
(b) Agni-II, Astra, Shaurya
(c) Prithvi-II, Agni-I
(d) iDEX innovation

Q92. Haryana's 2025 environmental plan aims to fully eliminate stubble burning by which target year?

(a) 2028
(b) 2030
(c) 2047
(d) 2045

Q93. The Italian Open, 2025, held in May 2025, was won by:

(a) Tan Ning
(b) Rafael Nadal
(c) Jannik Sinner
(d) Carlos Alcaraz

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Q94. Who became the oldest player to make a debut in men's international cricket, appearing in a T20I match at the age of 62 years and 147 days in March 2025?

(a) Andrew Brownlee
(b) Nolan Clarke
(c) James Southerton
(d) Osman Göker

Q95. What is the name of the submarine commissioned by India on January 15, 2025?

(a) INS Kalvari
(b) INS Khanderi
(c) INS Vela
(d) INS Vagsheer

Q96. Which Odia poet won the Bal Sahitya Puraskar in June 2025 for Kete Phula Phutichhi?

(a) Mayur Khavdu
(b) Subrat Senapati
(c) Fagu Baskey
(d) Rajkishore Parhi

Q97. Where was the Khelo India Winter Games, 2025, First Phase, held from 23 January?

(a) Manali
(b) Dehradun
(c) Leh
(d) Gulmarg

Q98. The National Sports Governance Act, 2025, was enacted to address which of the following?

(a) Financial irregularities in sports broadcasting
(b) Sports infrastructure funding gaps
(c) Athlete selection controversies only
(d) Challenges and impediments in the governance of sports bodies

Q99. The Hynniewtrep Youth Council (HYC) raised objections against a proposed eco-tourism project in which of the following wildlife sanctuaries in May 2025?

(a) Nongkhyllem Wildlife Sanctuary
(b) Manas Wildlife Sanctuary
(c) Namdapha Wildlife Sanctuary
(d) Kamlang Wildlife Sanctuary

Q100. Which government body is most likely involved in organising or supporting Esports Conclave 2025?

(a) Ministry of Youth Affairs and Sports
(b) Ministry of Home Affairs
(c) Ministry of Education
(d) Ministry of External Affairs

ANSWER KEY

1	b	2	c	3	c	4	c	5	c	6	b	7	c	8	d	9	d	10	d
11	a	12	c	13	b	14	d	15	c	16	b	17	b	18	b	19	c	20	b
21	d	22	b	23	d	24	b	25	c	26	b	27	c	28	a	29	a	30	a
31	c	32	d	33	a	34	d	35	b	36	c	37	b	38	b	39	b	40	d
41	d	42	d	43	b	44	c	45	a	46	b	47	b	48	d	49	d	50	c
51	b	52	b	53	a	54	c	55	a	56	a	57	d	58	d	59	d	60	d
61	b	62	b	63	d	64	a	65	b	66	b	67	d	68	c	69	d	70	b

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71	a	72	c	73	a	74	a	75	b	76	d	77	b	78	b	79	a	80	b
81	a	82	c	83	d	84	b	85	b	86	c	87	c	88	d	89	a	90	b
91	c	92	b	93	d	94	a	95	d	96	d	97	c	98	d	99	a	100	a

SOLUTIONS

Q1. Answer: (b) 4 m/s

The correct answer is 4 m/s.

Key Points

• The initial velocity (u) of the object is given as 10 m/s. This represents the velocity at the start of the 5-second time interval.

• The final velocity (v) of the object is given as -2 m/s. The negative sign indicates that the object is moving in the opposite direction to its initial motion at the end of the time period.

• The object moves along a straight path, which allows us to use linear kinematic equations to determine its motion parameters.

• For an object moving with uniform acceleration, the average velocity is calculated using the formula: Average Velocity = (u + v) / 2.

• Substituting the given values into the formula: (10 + (-2)) / 2 = 8 / 2 = 4 m/s.

• The question asks for the magnitude of the average velocity. The magnitude is the absolute value, which is 4 m/s. Hence, the correct answer is 4 m/s.

Additional Information

• Velocity as a Vector Quantity:

• Velocity is a vector quantity because it possesses both magnitude and direction. In this problem, the change from positive to negative velocity signifies a reversal in direction.

• Average Velocity vs. Average Speed:

• Average Velocity is defined as the total displacement divided by the total time taken.

• Average Speed is the total distance traveled divided by the time. If the object reversed direction, the distance would be greater than the displacement, making average speed higher than the magnitude of average velocity.

• SI Units:

• The standard International System of Units (SI) for velocity is meters per second (m/s). Other common units include km/h or miles per hour, but physics calculations typically require conversion to m/s.

• Displacement Calculation:

• Since Average Velocity = Displacement / Time, we can find the total displacement by multiplying the average velocity (4 m/s) by the time (5 s), resulting in a displacement of 20 meters.

Important Points

• Uniform Acceleration: The formula (u + v) / 2 is strictly applicable when the object undergoes constant acceleration. If the acceleration varied non-linearly over the 5 seconds, this simple arithmetic mean would not represent the true average velocity.

• Sign Convention: In one-dimensional motion, signs (+ or -) are used to denote direction. A negative final velocity implies the object decelerated to zero and then accelerated in the reverse direction.

• Magnitude: When a question asks for "magnitude," it specifically requires the numerical value without the directional sign. Even if the calculation resulted in a negative value, the magnitude remains positive.

Q2. Answer: (c) It is used as a rear view mirror in automobiles.

The correct answer is It is used as a rear view mirror in automobiles..

Key Points

• A concave mirror is a spherical mirror with an inwardly curved reflecting surface that converges light rays. It is widely used in various applications due to its ability to form magnified and real images depending on the distance of the object.

• Shaving Mirrors: When an object is placed very close to a concave mirror (between the principal focus and the pole), it produces an erect, virtual, and highly magnified image of the face. This allows for a better and closer view during shaving. Hence, statement 1 is correct.

• Torches and Searchlights: In these devices, the light source (bulb) is placed at the focus of the concave mirror. The light rays emerging from the bulb hit the mirror and are reflected as a powerful parallel beam of light that can travel long distances. Hence, statement 2 is correct.

• Rear View Mirrors: For automobiles, convex mirrors are used as rear-view mirrors, not concave mirrors. Convex mirrors are preferred because they always form an erect (upright) though diminished image and provide a much wider field of view, allowing the driver to see a large area of traffic behind them. Hence, statement 3 is incorrect.

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• Solar Furnaces: Large concave mirrors are utilized to capture and concentrate parallel sun rays at a single focal point. This concentration of solar energy produces an intense amount of heat, which is used for industrial or experimental heating purposes. Hence, statement 4 is correct.

• Hence, the correct answer is It is used as a rear view mirror in automobiles.

Additional Information

• Types of Spherical Mirrors:

• Concave Mirror: Also known as a converging mirror. It can produce both real and virtual images. When the object is far, the image is inverted; when the object is very close, the image is upright and enlarged.

• Convex Mirror: Also known as a diverging mirror. It always forms a virtual, erect, and diminished image, regardless of the object's distance from the mirror.

• Image Characteristics:

• A real image is formed when light rays actually meet at a point and can be obtained on a screen.

• A virtual image is formed when light rays appear to meet behind the mirror and cannot be caught on a screen.

• Common Applications:

• Dentist Mirrors: Dentists use concave mirrors to see a magnified image of the teeth to identify cavities or issues clearly.

• Headlights: Car headlights use concave reflectors to send out parallel rays of light for better visibility at night.

• Security Mirrors: Large convex mirrors are used in shops and blind turns on roads to provide a wide-angle view for safety and surveillance.

Important Points

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

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

• Magnification (m): It is the ratio of the height of the image to the height of the object. For a concave mirror, m can be greater than, equal to, or less than 1. For a convex mirror, m is always less than 1.

• Pole and Principal Axis: The geometric center of the reflecting surface is called the pole (P), and the straight line passing through the pole and the center of curvature (C) is the principal axis.

Q3. Answer: (c) Changing temperature or pressure

The correct answer is Changing temperature or pressure.

Key Points

• Matter can exist in different states, primarily solid, liquid, and gas. The state of a substance is determined by the kinetic energy of its particles and the intermolecular forces of attraction between them.

• Changing temperature is a primary cause of state change. When heat is added, particles gain kinetic energy and move faster, eventually breaking the bonds of the solid or liquid state to transition into a more fluid or gaseous form. Conversely, removing heat slows down particles.

• Changing pressure also alters the state of matter by forcing particles closer together or allowing them to spread apart. For example, increasing pressure on a gas can compress it into a liquid state. Hence, statement 3 is correct.

• Cutting a substance only changes its physical dimensions (size and shape) but does not alter the arrangement of atoms or the phase of the matter. Hence, statement 1 is incorrect.

• Mixing it with another substance generally creates a mixture or a chemical compound, but it is not a direct physical mechanism for changing the inherent state of a pure substance. Hence, statement 2 is incorrect.

• Dissolving a substance (like salt in water) involves breaking the substance into ions or molecules within a solvent to form a solution, which is a physical process rather than a phase transition of the substance itself into a liquid. Hence, statement 4 is incorrect.

Additional Information

• Phase Transitions:

• Melting: The process where a solid turns into a liquid due to an increase in temperature. The specific temperature is known as the Melting Point.

• Vaporization: The transition from a liquid to a gas. This includes boiling (throughout the liquid) and evaporation (at the surface).

• Condensation: The change of state from gas to liquid, usually occurring when the temperature drops.

• Freezing: The transition from liquid to solid. The Freezing Point of water is 0 degrees Celsius or 273.15 Kelvin.

• Sublimation and Deposition:

• Sublimation: A rare process where a solid changes directly into a gas without passing through the liquid phase. Examples include Dry Ice (solid CO_2) and Naphthalene balls.

• Deposition: The direct transition from a gas to a solid, such as the formation of frost on a cold surface.

• The Role of Latent Heat:

• During a change of state, the temperature of a substance remains constant even though heat is being supplied. This heat is known as Latent Heat, which is used to overcome intermolecular forces rather than increasing the kinetic energy of the particles.

• Effect of Pressure on Gases:

• Gases are highly compressible. By applying high pressure and reducing temperature, gases like Oxygen and Nitrogen can be liquefied for industrial and medical use. LPG (Liquefied Petroleum Gas) is a common example of a gas stored as a liquid under high pressure.

Important Points

• Triple Point: The specific temperature and pressure at which the solid, liquid, and gaseous phases of a substance coexist in thermodynamic equilibrium.

• Critical Point: The temperature and pressure beyond which the distinction between liquid and gas phases disappears, resulting in a supercritical fluid.

• Plasma: Considered the fourth state of matter, it consists of super-heated, ionized gas and is found in stars and neon signs.

Q4. Answer: (c) Random distribution of maternal or paternal chromosomes from each chromosome pair to the gametes

The correct answer is Random distribution of maternal or paternal chromosomes from each chromosome pair to the gametes.

Key Points

• Sexual reproduction is a biological process that involves the fusion of haploid gametes (sperm and egg) to form a diploid zygote. This process is the cornerstone of genetic diversity in multicellular organisms.

• The primary mechanism for generating this diversity is the independent assortment of chromosomes. During Meiosis I, specifically in Metaphase I, homologous chromosome pairs align randomly at the cell's equator.

• This random distribution means that each gamete receives a mix of maternal and paternal chromosomes, ensuring that the resulting offspring is genetically unique from both parents and its siblings. Hence, statement 3 is correct.

• Frequent cell divisions occur during gamete formation (spermatogenesis and oogenesis), but the frequency itself does not create diversity; it is the specific type of division (meiosis) that does. Hence, statement 1 is incorrect.

• Variation in chromosome number (such as aneuploidy) usually leads to developmental disorders or non-viable offspring rather than being the standard mechanism for healthy genetic variation. Hence, statement 2 is incorrect.

• While inaccuracies in DNA copying (mutations) do occur, they are the primary source of variation in asexual reproduction. In sexual reproduction, they are a secondary source compared to the massive reshuffling provided by recombination and assortment. Hence, statement 4 is incorrect.

Additional Information

• Crossing Over (Recombination): This occurs during Prophase I of meiosis. Non-sister chromatids of homologous chromosomes exchange segments of DNA. This creates new combinations of alleles on a single chromosome, further increasing genetic variation.

• Random Fertilization: In humans, any one of the approximately 8.4 million possible chromosome combinations in a sperm can fuse with any one of the 8.4 million combinations in an egg. This results in over 70 trillion possible diploid combinations for a single couple.

• Homologous Chromosomes: These are pairs of chromosomes (one from the mother, one from the father) that have the same gene sequences but may have different alleles (versions of a gene).

• Evolutionary Advantage: Genetic diversity allows populations to adapt to changing environments. It provides the "raw material" for natural selection, ensuring that some individuals may possess traits necessary to survive disease, climate change, or predation.

Important Points

• Meiosis vs. Mitosis: Unlike mitosis, which produces identical daughter cells for growth and repair, meiosis reduces the chromosome set from diploid (2n) to haploid (n) and introduces variation.

• Human Chromosomes: Humans have 23 pairs of chromosomes (total 46). The number of possible combinations due to independent assortment is calculated as 2^n, where n=23.

• Mutation Rate: Although DNA polymerase is highly accurate, small point mutations occur. However, sexual reproduction effectively filters these mutations and spreads beneficial ones through the gene pool faster than asexual methods.

• Zygote Formation: The zygote is the first cell of a new individual, containing a full set of chromosomes (23 from the egg and 23 from the sperm), restoring the diploid state specific to the species.

Q5. Answer: (c) A curved line

The correct answer is A curved line.

Key Points

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• In physics, the distance–time graph is a visual representation of how the distance traveled by an object varies with time. The slope (gradient) of this graph at any point represents the speed of the object.

• When the speed of an object changes with time, it implies that the object is undergoing acceleration or deceleration. This is known as non-uniform motion.

• In the case of non-uniform motion, the object covers unequal distances in equal intervals of time. Therefore, the relationship between distance and time is non-linear, which results in a curved line on the graph. Hence, statement 3 is correct.

• A straight line inclined to the time axis indicates that the slope is constant. Since the slope represents speed, a constant slope means the object is moving at a constant speed (uniform motion). Hence, statement 4 is incorrect.

• A horizontal straight line or a straight line parallel to the time axis indicates that the distance does not change as time increases. This means the object is stationary (at rest), and its speed is zero. Hence, statements 1 and 2 are incorrect.

Additional Information

• Uniform Motion:

• An object is said to be in uniform motion if it travels along a straight path and covers equal distances in equal intervals of time.

• The speed remains constant throughout the journey.

• The distance-time graph for uniform motion is always a straight line passing through the origin.

• Non-Uniform Motion:

• An object is in non-uniform motion if its speed changes over time.

• Common examples include a car moving in heavy traffic or a ball falling freely under gravity.

• The curvature of the graph indicates the nature of acceleration; a curve bending upwards shows positive acceleration, while a curve flattening out shows negative acceleration (retardation).

• Speed Calculation:

• The average speed of an object can be calculated by dividing the total distance by the total time taken.

• For a curved distance-time graph, the instantaneous speed is determined by calculating the slope of the tangent at a specific point in time.

Important Points

• Kinematic Equations: For an object moving with uniform acceleration, the distance (s) is related to time (t) by the equation $s = ut + 1/2\ at^2$. This quadratic relationship is what creates the parabolic curve on a distance-time graph.

• Slope Interpretation:

• Zero Slope: Object is at rest.

• Constant Slope: Object is at constant speed.

• Increasing Slope: Object is speeding up (accelerating).

• Decreasing Slope: Object is slowing down (decelerating).

• Comparison with Velocity-Time Graphs: While the slope of a distance-time graph gives speed, the slope of a velocity-time graph gives acceleration, and the area under the curve of a velocity-time graph gives the displacement.

Q6. Answer: (b) All onions are made up of similar small structures called cells

The correct answer is All onions are made up of similar small structures called cells.

Key Points

• The microscopic observation of onion peel (the epidermis) demonstrates that all onions, regardless of their size, shape, or variety, are composed of basic structural units known as cells. Hence, statement 2 is correct.

• When an onion peel is examined under a compound microscope, it reveals a pattern of rectangular or brick-shaped compartments arranged in a regular fashion, each containing a nucleus and cytoplasm.

• The size of the onion bulb does not affect the shape or size of these individual cells; a large onion and a small onion will both show identical-looking cellular structures under magnification. Hence, statement 1 is incorrect.

• The onion peel is a homogenous tissue layer (the protective epidermis), meaning the cells within this specific layer are very similar in composition and function. Hence, statement 4 is incorrect.

• While an entire onion plant has different cell types for different functions (such as root cells or vascular cells), the specific observation of the peel primarily highlights the uniformity of the dermal tissue rather than a diversity of functions. Hence, statement 3 is incorrect.

Additional Information

• Structure of an Onion Cell: As a typical plant cell, an onion cell contains a rigid cell wall made of cellulose, which provides structural support. It also features a large central vacuole that maintains turgor pressure and pushes the nucleus to the periphery.

• The Role of Staining: Because most cell organelles are transparent, stains like Safranin or Iodine solution are used. These chemicals color the nucleus and cell wall more intensely, making them clearly visible under light microscopy.

• Cell Theory: The observation of onion cells is a fundamental piece of evidence for the Cell Theory, formulated by Matthias

Schleiden and Theodor Schwann in 1838-1839. This theory states that all living things are made of cells and cells are the basic unit of life.

• Historical Context: The term "cell" was first coined by Robert Hooke in 1665 after observing cork. Later, in 1831, Robert Brown discovered the nucleus within the plant cell, which is easily seen in onion peel preparations.

• Onion Bulb Botany: The onion (Allium cepa) is a modified underground stem called a bulb. The "peels" we observe are the epidermal layers of the fleshy leaves that store food and nutrients for the plant.

Important Points

• Experimental Procedure: To observe these cells, a thin transparent membrane is stripped from the concave side of an onion fleshy scale. It is placed in a watch glass with water to prevent dehydration or folding.

• Mounting: The specimen is mounted on a glass slide with a drop of glycerin (to prevent drying) and covered with a coverslip. It is vital to avoid air bubbles during this process for a clear microscopic view.

• Magnification: Typical classroom observations use a low-power objective (10x) for a wide field of view and a high-power objective (40x) to see the nucleus and cell boundaries in detail.

• Biological Classification: Onions are monocotyledons, and their cells are often used in labs because they are large, easy to extract, and provide a single-layer view of eukaryotic architecture.

Q7. Answer: (c) Centripetal Force due to Earth's gravity

The correct answer is Centripetal Force due to Earth's gravity.

Key Points

• The circular motion of the Moon around the Earth is primarily maintained by Centripetal Force, which is a "center-seeking" force directed toward the center of the orbit.

• In the case of the Earth-Moon system, this necessary centripetal force is provided by the gravitational attraction exerted by the Earth on the Moon. Without this force, the Moon would move in a straight line tangent to its orbit due to inertia.

• According to Sir Isaac Newton's laws, an object in motion will remain in motion in a straight line unless acted upon by an external force. Gravity acts as this external force, constantly pulling the Moon toward the Earth and changing its velocity vector direction at every point.

• While the force changes the direction of the Moon's movement, it does not change its orbital speed (assuming a perfectly circular orbit). This results in a continuous centripetal acceleration directed toward the Earth's center. Hence, the correct answer is Centripetal Force due to Earth's gravity.

Additional Information

• Newton's Law of Universal Gravitation:

• The force of gravity between two bodies is proportional to the product of their masses and inversely proportional to the square of the distance between their centers.

• The average distance between the Earth and the Moon is approximately 384,400 kilometers. The mass of the Moon is about 7.347 x 10^22 kg, while the Earth is about 5.972 x 10^24 kg.

• Centrifugal Force vs. Centripetal Force:

• Centripetal force is a real force acting toward the center. In contrast, Centrifugal force is an apparent or fictitious force that appears to act outward when observed from a rotating frame of reference.

• In the Earth-Moon system, from the Moon's perspective (a non-inertial frame), it feels an outward centrifugal force that balances the inward gravitational pull, maintaining orbital equilibrium.

• Characteristics of Other Forces:

• Normal Force: This is a contact force exerted by a surface perpendicular to an object resting on it. Since the Moon and Earth are separated by the vacuum of space, no normal force is involved.

• Electromagnetic Force: While this force is much stronger than gravity at a microscopic level, celestial bodies are generally electrically neutral. Therefore, gravity is the dominant force governing large-scale planetary motion.

• Tidal Effects:

• The gravitational interaction is mutual. While Earth keeps the Moon in orbit, the Moon's gravity pulls on Earth's oceans, causing high tides and low tides. This interaction also leads to tidal locking, which is why we always see the same side of the Moon.

Important Points

• Orbital Velocity: For the Moon to remain in a stable orbit, it must maintain a specific orbital velocity of about 1.022 km/s. If the velocity were too high, it would escape into space; if it were too low, it would crash into the Earth.

• Kepler's Laws: Although we often simplify the orbit as circular, Johannes Kepler proved in 1609 that planetary orbits are elliptical, with the central body at one focus. The Moon's orbit has an eccentricity of about 0.0549.

• History: The realization that the same force making an apple fall to the ground also keeps the Moon in its orbit was a revolutionary insight published in Newton's Principia Mathematica in 1687.

Q8. Answer: (d) Sudden removal of a key species

The correct answer is Sudden removal of a key species.

Key Points

• A food web is a complex, interlocking network of food chains that describes the flow of energy and nutrients through an ecosystem. It represents the feeding relationships between various organisms.

• The sudden removal of a key species, often referred to as a keystone species, has the most devastating impact because these organisms play a critical role in maintaining the structural integrity of the web. Hence, statement 4 is correct.

• An increase in sunlight hours or seasonal change in rainfall are abiotic factors that typically lead to fluctuations in primary productivity. Most ecosystems are adapted to these variations, and they generally do not cause the entire web to collapse. Hence, statements 1 and 3 are incorrect.

• A change in wind direction might affect seed dispersal or localized microclimates, but it rarely disrupts the fundamental trophic levels or the survival of major populations within a food web. Hence, statement 2 is incorrect.

• When a keystone species is removed, it often triggers a trophic cascade, where the disappearance of one predator or producer leads to the overpopulation or extinction of other species, drastically altering the ecological balance.

Additional Information

• Keystone Species: This term refers to a species that has a disproportionately large effect on its environment relative to its abundance. Examples include sea otters in kelp forests and wolves in forest ecosystems. Their presence ensures biodiversity and prevents any single population from dominating the habitat.

• Trophic Levels: Organisms in a food web are categorized into trophic levels, starting from primary producers (plants/algae) to primary consumers (herbivores), secondary consumers (carnivores), and apex predators. The loss of a species at a high trophic level can cause a top-down effect on the entire community.

• Resilience and Stability: The stability of a food web depends on its complexity. A web with high biodiversity is usually more resilient to changes, but the loss of a central node (key species) can still lead to a secondary extinction of other dependent species.

• Energy Flow: According to the 10% rule, only about 10 percent of the energy is transferred from one trophic level to the next. Disrupting the energy flow by removing a major energy source or consumer leads to an immediate disequilibrium.

Important Points

• Historical Context: The concept of the keystone species was introduced by Robert T. Paine in 1969 following his experiments with starfish in intertidal zones, proving that their removal led to a total loss of species richness.

• Ecological Cascades: A trophic cascade occurs when the impact on one species ripples through the food web. For instance, removing a top predator can lead to an explosion in herbivore populations, which subsequently overgraze and destroy the primary producers.

• Environmental Stressors: While natural disasters or climatic shifts (like rainfall) can stress an ecosystem, biological disruptions like invasive species or the extinction of pollinators (key species) create more permanent and fundamental changes to ecological niches.

Q9. Answer: (d) H+, PO43-

The correct answer is H+, PO43-.

Key Points

• Phosphoric acid, also commonly referred to as orthophosphoric acid, is a mineral acid represented by the chemical formula H3PO4. It is composed of three atoms of Hydrogen, one atom of Phosphorus, and four atoms of Oxygen.

• When H3PO4 is dissolved in water, it dissociates to produce Hydrogen ions (H+) and Phosphate ions (PO43-). The presence of three replaceable hydrogen atoms makes it a triprotic acid.

• The Phosphate ion (PO43-) is a polyatomic ion consisting of a central phosphorus atom surrounded by four oxygen atoms in a tetrahedral geometry. It carries a net negative charge of -3.

• Each Hydrogen ion (H+) carries a positive charge of +1. Since the molecule H3PO4 is electrically neutral, the total positive charge of three H+ ions (+3) perfectly balances the negative charge of one PO43- ion (-3).

• The dissociation occurs in three successive steps, forming dihydrogen phosphate (H2PO4-), hydrogen phosphate (HPO42-), and finally the phosphate ion (PO43-). Therefore, the fundamental ions making up the full acid structure are H+ and PO43-.

Additional Information

• Physical and Chemical Properties:

• Phosphoric acid is typically a colorless, odorless, and viscous liquid in its pure form. It has a molar mass of 97.99 g/mol and a melting point of approximately 42.35 degrees Celsius.

• It is classified as a weak acid because it does not fully ionize in an aqueous solution compared to strong acids like Hydrochloric acid (HCl) or Sulfuric acid (H2SO4).

• Industrial and Agricultural Uses:

• Approximately 80% of the world's phosphoric acid production is used in the manufacture of fertilizers. Common examples include Triple Superphosphate (TSP) and Monoammonium Phosphate (MAP).

• It is widely used in rust removal processes, where it reacts with iron oxide to convert it into ferric phosphate, which can then be easily removed.

• Food and Biological Significance:

• In the food industry, it is used as an additive (E338) to provide a sharp, tangy flavor to carbonated beverages (colas) and as a pH regulator in dairy products and jams.

• Phosphate groups are essential components of nucleotides, which form the building blocks of DNA and RNA. They are also crucial for energy transfer in cells via Adenosine Triphosphate (ATP).

• Safety and Handling:

• While H3PO4 is less hazardous than some other industrial acids, it is still corrosive to the skin and eyes. Exposure to high concentrations can cause irritation or chemical burns, necessitating the use of protective gear.

Important Points

• Valency and Oxidation States: In the PO43- ion, the oxidation state of Phosphorus is +5. This is the highest oxidation state for phosphorus, making the ion very stable.

• Dissociation Constants (pKa): Being a triprotic acid, it has three dissociation constants. The pKa1 is 2.15, pKa2 is 7.20, and pKa3 is 12.35 at 25 degrees Celsius.

• Laboratory Preparation: In the laboratory, it can be prepared by reacting red phosphorus with nitric acid or by the hydration of phosphorus pentoxide (P4O10).

Q10. Answer: (d) Iron will get deposited.

The correct answer is Iron will get deposited.

Key Points

• The reaction between Aluminium (Al) and Iron(II) sulphate (FeSO4) is a classic example of a displacement reaction. In such reactions, a more reactive element displaces a less reactive element from its compound.

• According to the reactivity series of metals, Aluminium is positioned higher than Iron. This indicates that Aluminium is chemically more reactive than Iron and has a stronger tendency to lose electrons and form ions.

• When Aluminium pieces are added to a solution of Iron(II) sulphate, the Aluminium atoms displace the Iron ions from the solution. The chemical equation for this reaction is: 2Al (s) + 3FeSO4 (aq) → Al2(SO4)3 (aq) + 3Fe (s).

• As a result of this displacement, solid Iron metal is liberated and begins to settle or deposit on the surface of the Aluminium or at the bottom of the container. Hence, the statement that iron will get deposited is correct.

• During the process, the light green color of the Iron(II) sulphate solution fades away, and the solution eventually becomes colorless due to the formation of Aluminium sulphate.

Additional Information

• Reactivity Series of Metals:

• The reactivity series is a list of metals arranged in the decreasing order of their chemical reactivity. Metals like Potassium (K) and Sodium (Na) are at the top, while Gold (Au) and Platinum (Pt) are at the bottom.

• Aluminium has an atomic number of 13 and is known for its low density and high resistance to corrosion due to the formation of a protective oxide layer.

• Iron has an atomic number of 26. In FeSO4, iron exists in the +2 oxidation state (Ferrous).

• Properties of Iron(II) Sulphate (FeSO4):

• It is commonly known as Green Vitriol or Copperas.

• In its heptahydrate form (FeSO4·7H2O), it appears as blue-green crystals. In an aqueous solution, it typically exhibits a pale green hue.

• Oxidation-Reduction (Redox) Aspect:

• In this reaction, Aluminium undergoes oxidation as it loses 3 electrons to become Al3+ ions.

• The Iron (Fe2+) ions in the solution undergo reduction as they gain electrons to become neutral Iron (Fe) atoms.

Important Points

• Why other options are incorrect:

• Aluminium will get deposited: This is incorrect because Aluminium is the one reacting and entering the solution as ions; it does not deposit as a solid from this specific reaction.

• Blue solution will be formed: This is incorrect because a blue color in inorganic salt solutions is usually characteristic of Copper (Cu2+) ions, not Aluminium or Iron ions. Aluminium sulphate solution is colorless.

• There will be no reaction: This is incorrect because a reaction must occur whenever a more reactive metal (Al) is introduced to a salt solution of a less reactive metal (Fe).

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• Safety and Observations:

• The reaction is exothermic, meaning it releases a small amount of heat energy.

• In a laboratory setting, the Aluminium should be cleaned with sandpaper before the experiment to remove the Aluminium oxide layer that might slow down the initial reaction.

Q11. Answer: (a) Cartilage

The correct answer is Cartilage.

Key Points

• Cartilage is a specialized type of connective tissue that is characterized by being compact, less vascular, and more flexible than bone.

• One of its primary functions is to smoothen bone surfaces at joints, which helps in reducing friction and allowing for easier movement.

• In terms of location, it is widely present in the human body, including the ear (pinna), nose, trachea (windpipe), and larynx.

• The features of cartilage include a solid matrix that is composed of proteins and sugars. The widely spaced cells present in this matrix are called chondrocytes.

• Because of its flexible nature, we can fold the cartilage of the ears, but we cannot bend the bones in our arms, demonstrating its unique structural property.

Additional Information

• Areolar Tissue:

• This is a type of loose connective tissue found between the skin and muscles, around blood vessels, and nerves.

• Its main functions are to fill the space inside organs, support internal organs, and assist in the repair of tissues.

• Adipose Tissue:

• This tissue acts as a storage site for fat in the body.

• It is primarily located below the skin and between internal organs.

• The cells of this tissue are filled with fat globules, and its ability to store fat allows it to act as an insulator for the human body.

• Ligament:

• A ligament is a very elastic and strong connective tissue that connects bone to bone.

• It contains very little matrix and serves to stabilize the joints and hold the skeleton together.

• Tendon:

• Another type of fibrous connective tissue that connects muscles to bones.

• Tendons possess great strength but have limited flexibility compared to ligaments.

Important Points

• Tracheal Rings: The trachea contains 16 to 20 C-shaped cartilaginous rings. These rings ensure that the air passage does not collapse even when there is less air pressure.

• Connective Tissue Matrix: All connective tissues consist of cells and an intercellular matrix. The matrix can be jelly-like, fluid, dense, or rigid, depending on the specific function of the tissue. For example, the matrix of blood is a fluid called plasma.

• Hyaline Cartilage: This is the most common type of cartilage in the body, providing support and flexibility to the respiratory tract and covering the ends of bones at articulating joints.

Q12. Answer: (c) 20

The correct answer is 20.

Key Points

• The work done in lifting an object against gravity is equal to the product of its mass, the acceleration due to gravity, and the height to which it is raised. This is expressed by the formula: Work Done (W) = m * g * h.

• In the given problem, the mass (m) of the block is 30 kg, the work done (W) is 6000 J (Joules), and the acceleration due to gravity (g) is 10 m/s2.

• Substituting the known values into the equation: 6000 = 30 * 10 * X. Here, X represents the height (h) in meters.

• Simplifying the right side of the equation: 6000 = 300 * X. To find the value of X, we divide the total work done by the product of mass and gravity: X = 6000 / 300.

• By performing the division, we get X = 20. Therefore, the block was carried to a height of 20 meters. Hence, the correct answer is 20.

Additional Information

• Work Done: In physics, work is said to be done when a force acts upon an object to cause a displacement. It is a scalar quantity, meaning it has magnitude but no direction. The SI unit of work is the Joule (J), named after the English physicist James Prescott Joule.

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• Gravitational Potential Energy: When work is done to lift an object to a certain height, the energy expended is stored in the object as Gravitational Potential Energy (GPE). The amount of GPE an object possesses depends on its mass and its height relative to a reference point (usually the ground).

• Acceleration due to Gravity: On the surface of the Earth, the standard value for g is approximately 9.8 m/s2. however, for ease of calculation in many competitive exams, it is often rounded to 10 m/s2 as specified in this question.

• Units of Measurement: It is crucial to ensure all units are in the SI system (Standard International) before calculation. Mass should be in kilograms (kg), distance/height in meters (m), and work in Joules (J). If the mass were given in grams, it would need to be converted (1 kg = 1000 g) to get the correct result in Joules.

Important Points

• Nature of Work: Work can be positive, negative, or zero. When the force and displacement are in the same direction (like lifting a block), the work is positive. If the force is perpendicular to the displacement (like carrying a bucket horizontally), the work done by gravity is zero.

• Energy Conservation: The Law of Conservation of Energy states that energy cannot be created or destroyed, only transformed. In this scenario, chemical energy from the person doing the work is converted into the potential energy of the block.

• Force Component: The force required to lift the block at a constant speed is equal to its weight, which is calculated as Weight (F) = m * g. For this problem, the weight is 30 kg * 10 m/s2 = 300 Newtons (N).

Q13. Answer: (b) A man’s deep voice (100 Hz)

The correct answer is A man’s deep voice (100 Hz).

Key Points

• Pitch is a characteristic of sound that allows the brain to perceive the frequency of a sound wave. It determines how "shrill" or "deep" a sound is to the human ear.

• The frequency of a sound refers to the number of vibrations per second. It is measured in the unit Hertz (Hz). A higher frequency results in a higher pitch, while a lower frequency results in a lower pitch.

• In the given options:

• A tuning fork (512 Hz): This is a relatively high frequency used in musical calibration and physics experiments.

• A man’s deep voice (100 Hz): This is the lowest frequency among the choices, indicating the lowest pitch. Hence, this is the correct option.

• A child’s voice (350 Hz): Children generally have shorter vocal cords, leading to a higher frequency and higher pitch than adult men.

• A bird’s chirp (1500 Hz): This represents the highest frequency in the list, resulting in a very high-pitched, shrill sound.

• Sound waves with low frequencies have longer wavelengths, whereas high-pitched sounds have shorter wavelengths and rapid vibrations.

• The human ear interprets 100 Hz as a deep, bass-heavy sound, which is typical for the average adult male during normal speech.

Additional Information

• Vocal Cord Physiology:

• The pitch of a human voice is determined by the length, mass, and tension of the vocal cords.

• Adult Men: Have vocal cords that are approximately 17 mm to 25 mm in length. Because they are thicker and longer, they vibrate more slowly, producing lower frequencies (typically 85 to 155 Hz).

• Adult Women: Have vocal cords between 12.5 mm and 17.5 mm. Shorter and thinner cords vibrate faster, producing higher frequencies (typically 165 to 255 Hz).

• Children: Have the shortest vocal cords, resulting in the highest pitch among humans.

• Frequency Range:

• The audible range for the human ear is generally between 20 Hz and 20,000 Hz (20 kHz).

• Sounds below 20 Hz are called Infrasonic sounds (e.g., produced by elephants or whales).

• Sounds above 20,000 Hz are called Ultrasonic sounds (e.g., used by bats for navigation and in medical ultrasound).

• Distinction between Pitch and Loudness:

• Pitch depends solely on the frequency (number of vibrations).

• Loudness depends on the amplitude (maximum displacement) of the sound wave and is measured in Decibels (dB).

Important Points

• Wave Anatomy: In a waveform graph, pitch is visualized by how close the crests and troughs are to each other. A low-pitch sound (like 100 Hz) has waves that are widely spaced.

• Environmental Examples: A drum produces a low-pitched sound due to its low-frequency vibration, whereas a whistle produces a high-pitched sound due to high-frequency air vibrations.

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• Musical Context: In music, pitch is referred to as "notes." A bass guitar operates at low frequencies (low pitch), while a flute or violin operates at high frequencies (high pitch).

• Tuning Fork: A 512 Hz tuning fork corresponds to the musical note C5 (High C), which is significantly higher in pitch than the fundamental frequency of a male voice.

Q14. Answer: (d) Both Statement A and B

The correct answer is Both Statement A and B.

Key Points

• Vegetative propagation is a type of asexual reproduction in which new plants are produced from roots, stems, leaves, and buds. Since reproduction is through the vegetative parts of the plant, it is known as vegetative propagation.

• In this process, specialized parts of the parent plant like the root, stem, and leaves develop into new plants under appropriate conditions such as adequate moisture and temperature. For example, sweet potato reproduces through roots, ginger through stems, and Bryophyllum through leaves. Hence, statement A is correct.

• This method is widely utilized in agriculture and horticulture for plants that do not produce viable seeds or where genetic consistency is required.

• Plants like sugarcane, roses, and grapes are commonly grown using vegetative methods such as stem cuttings or layering because it allows for faster growth and produces plants that are genetically identical to the parent. Hence, statement B is correct.

• Hence, the correct answer is Both Statement A and B.

Additional Information

• Natural Methods of Vegetative Propagation:

• Roots: Some plants like Dahlia and Sweet Potato have adventitious roots that can give rise to new plants.

• Stems: Underground stems like Potato (tubers), Onion (bulbs), and Ginger (rhizomes) contain nodes or eyes that sprout into new plants.

• Leaves: In plants like Bryophyllum, small plantlets develop along the leaf margins, which drop off and grow into independent plants when they touch the soil.

• Artificial Methods of Vegetative Propagation:

• Cutting: A small part of the stem with nodes is buried in the soil to grow a new plant, commonly used for Rose and Hibiscus.

• Grafting: The scion (part of one plant) is joined to the stock (rooted part of another) to combine desirable features, often used in Mango and Apple cultivation.

• Layering: A branch of the plant is bent to the ground and covered with moist soil until roots develop, used for Jasmine and Grapes.

• Advantages:

• Plants produced by vegetative propagation take less time to grow and bear flowers and fruits earlier than those produced from seeds.

• The new plants are exact copies of the parent plant, ensuring that all characteristics (like taste or disease resistance) are preserved.

• It is the only method of reproduction for seedless varieties like Banana, Orange, and Grapes.

Q15. Answer: (c) x = 4, y = 2

The correct answer is x = 4, y = 2.

Key Points

• To balance the chemical equation $3MnO_2 + xAl \rightarrow 3Mn + yAl_2O_3$, we must ensure that the number of atoms of each element is the same on both the reactant and product sides, following the Law of Conservation of Mass.

• Balancing Manganese (Mn): On the reactant side, there are 3 atoms of Manganese in $3MnO_2$. On the product side, there are 3 atoms of Manganese (Mn). Thus, Manganese is already balanced.

• Balancing Oxygen (O): On the reactant side, there are $3 \times 2 = 6$ atoms of Oxygen. To have 6 atoms of Oxygen on the product side, we look at yAl_2O_3. Since each molecule contains 3 atoms of Oxygen, we set $y = 2$ (because $2 \times 3 = 6$). Hence, the value of y is 2.

• Balancing Aluminum (Al): On the product side, with $y = 2$, we have $2 \times 2 = 4$ atoms of Aluminum in $2Al_2O_3$. Therefore, to balance the reactant side, the value of x must be 4. Hence, the value of x is 4.

• The fully balanced chemical equation is $3MnO_2 (s) + 4Al (s) \rightarrow 3Mn (l) + 2Al_2O_3 (s) + Heat$.

Additional Information

• Thermite Reaction: This specific reaction is known as an aluminothermic reaction or a Thermite reaction. It involves the reduction of metal oxides using Aluminum powder as a reducing agent.

• Exothermic Nature: The reaction is highly Exothermic, meaning it releases a massive amount of Heat energy. This heat is sufficient to produce the metal (in this case, Manganese) in a liquid (molten) state, denoted by the (l) symbol.

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• Reducing Agent: Aluminum (Al) acts as a strong reducing agent because it has a higher affinity for Oxygen than Manganese does. During the process, Aluminum is oxidized to Aluminum Oxide (Al_2O_3).

• Applications: Such reactions are widely used in the industrial extraction of metals like Chromium (Cr) and Manganese (Mn) from their respective oxides. A similar reaction between Iron(III) oxide and Aluminum is used to weld railway tracks.

Important Points

• Redox Reaction: This is a classic Redox reaction where Manganese Dioxide (MnO_2) undergoes reduction (loses oxygen) and Aluminum (Al) undergoes oxidation (gains oxygen).

• Stoichiometry: The stoichiometric coefficients 3, 4, 3, and 2 represent the molar ratio in which the substances react and are formed. In this case, 3 moles of MnO_2 react with 4 moles of Al.

• State Symbols: The symbols (s) and (l) indicate Solid and Liquid states respectively. The Manganese is produced as a liquid because the Heat generated exceeds its melting point of approximately 1246 degrees Celsius.

• Safety: Because of the extreme Heat and light produced, these reactions are performed under controlled conditions in metallurgy.

Q16. Answer: (b) Carbon

The correct answer is Carbon.

Key Points

• Plants require several essential nutrients to complete their life cycle, and these are categorized based on their primary source: Air, Water, and Soil.

• Carbon is the primary plant nutrient supplied from the air. It is absorbed by the leaves in the form of Carbon Dioxide (CO_2) through small pores called stomata. Hence, option 2 is correct.

• Oxygen is another nutrient supplied from both air and water, whereas Hydrogen is primarily derived from water (H_2O) absorbed by the roots. Hence, option 4 is incorrect in the context of air.

• Iron is a micronutrient that plants absorb from the soil in the form of ferrous (Fe^{2+}) or ferric (Fe^{3+}) ions. It is not supplied from the atmosphere. Hence, option 1 is incorrect.

• Nitrogen, although making up 78% of the Earth's atmosphere, cannot be directly absorbed by most plants from the air. Plants typically take up Nitrogen from the soil in the form of nitrates (NO_3^-) or ammonium (NH_4^+). Hence, option 3 is incorrect.

• Carbon serves as the basic building block for all organic molecules in plants, including carbohydrates, proteins, and lipids, through the process of Photosynthesis.

Additional Information

• Nutrient Categorization:

• Non-Mineral Nutrients: These include Carbon, Hydrogen, and Oxygen. These are found in the air and water and make up about 95% of the plant's dry weight.

• Mineral Nutrients: These are absorbed from the soil and are divided into Macronutrients and Micronutrients based on the quantity required.

• Macronutrients:

• These are required in large amounts (greater than 10 mmole kg^{-1} of dry matter).

• Examples include Nitrogen (N), Phosphorus (P), Potassium (K), Calcium (Ca), Magnesium (Mg), and Sulphur (S).

• Nitrogen is essential for protein synthesis and is a major constituent of chlorophyll.

• Micronutrients:

• Also known as trace elements, these are needed in very small quantities (less than 10 mmole kg^{-1} of dry matter).

• Examples include Iron (Fe), Manganese (Mn), Copper (Cu), Molybdenum (Mo), Zinc (Zn), Boron (B), Chlorine (Cl), and Nickel (Ni).

• Iron is vital for the synthesis of chlorophyll and various enzymatic activities.

Important Points

• Photosynthesis and Carbon Fixation: During photosynthesis, plants use sunlight energy to convert Carbon Dioxide from the air and water from the soil into Glucose ($C_6H_{12}O_6$). This process is the fundamental way Carbon enters the biological food web.

• Role of Stomata: These microscopic openings on the underside of leaves facilitate gas exchange. While CO_2 enters for photosynthesis, Oxygen and Water Vapor exit the plant through transpiration.

• Biological Nitrogen Fixation: Although plants cannot take Nitrogen from the air, certain leguminous plants have a symbiotic relationship with Rhizobium bacteria in their root nodules that "fix" atmospheric Nitrogen into a usable mineral form in the soil.

• Essentiality Criteria: For an element to be considered "essential," the plant must be unable to complete its life cycle without it, and the element must be directly involved in the metabolism of the plant. Currently, 17 elements are recognized as essential for higher plants.

Q17. Answer: (b) Chemical method

The correct answer is Chemical method.

Key Points

• The Chemical method of refining involves the introduction of specific substances known as refining agents or reagents into an impure material, usually a molten metal.

• These agents are chosen based on their ability to react selectively with the impurities present in the mixture without affecting the primary metal or substance.

• During this process, the impurities are chemically converted into stable compounds such as slags, oxides, or insoluble precipitates.

• Once these compounds are formed, they are easily separated from the refined substance due to differences in physical state, density, or solubility.

• For example, in steelmaking, Oxygen is used as a refining agent to oxidize Carbon, Silicon, and Manganese into gases or slag, effectively removing them from the iron.

Additional Information

• Physical Method:

• This refining technique relies on the difference in physical properties between the substance and its impurities, such as boiling points, melting points, or solubility.

• Common examples include Distillation (used for volatile metals like Zinc and Mercury), Liquation (used for low-melting metals like Tin), and Zone Refining (used for ultra-pure Semiconductors like Silicon).

• In these methods, impurities are not converted into new chemical compounds but are separated through phase changes.

• Electro-chemical Method:

• Also known as Electrolytic Refining, this process uses an Electric Current to purify metals.

• The impure metal acts as the Anode, and a thin strip of pure metal acts as the Cathode, both immersed in an Electrolyte solution containing metal ions.

• Under the influence of current, pure metal ions migrate to the Cathode, while impurities either dissolve in the solution or settle at the bottom as Anode Mud (often containing precious metals like Gold or Silver).

• Ionic Method:

• This generally refers to processes like Ion Exchange or refining in Molten Salts, where ions are exchanged between a liquid phase and a solid resin or across a membrane.

• It is widely used in Water Purification and the separation of Rare Earth Elements where chemical similarities make standard methods difficult.

Important Points

• Flux and Slag: In chemical refining, a Flux is a refining agent added to the furnace to remove impurities. When the Flux reacts with the impurity, it forms a fusible mass called Slag, which floats on the surface of the molten metal.

• Chemical Affinity: The success of the Chemical method depends on the higher chemical affinity of the refining agent for the impurity than for the metal being refined.

• Examples of Chemical Refining:

• Cupellation: Used for refining Silver and Gold by removing Lead as an oxide.

• Bessemerization: A historical chemical method for mass-producing steel by blowing air through molten pig iron to oxidize impurities.

• Oxidative Refining: Used for Copper and Lead where air or oxygen is used to remove impurities like Arsenic and Antimony.

Q18. Answer: (b) 7

The correct answer is 7.

Key Points

• Gregor Johann Mendel, widely regarded as the Father of Genetics, conducted his historic hybridization experiments on garden peas (Pisum sativum).

• He performed these experiments for a period of seven years, specifically from 1856 to 1863.

• Mendel specifically selected 7 pairs of contrasting characters (traits) to study the patterns of inheritance. Hence, the correct answer is 7.

• These characters were chosen because they existed in two distinct, easily identifiable forms, such as tall or dwarf plants, which allowed for clear observation of results.

• Based on his observations of how these traits were passed from one generation to the next, he formulated the fundamental Laws of Inheritance.

Additional Information

• Choice of Experimental Material: Mendel chose the garden pea (Pisum sativum) for several reasons:

• The plant has a short life cycle, allowing for results to be seen quickly across multiple generations.

• It produces a large number of offspring (seeds) in a single generation, providing a sufficient numerical value for statistical analysis.

• Peas are naturally self-pollinating, but cross-pollination can be easily achieved manually.

• Laws of Inheritance: Mendel's work led to three primary principles:

• Law of Dominance: In a heterozygote, one trait will conceal the presence of another trait for the same characteristic.

• Law of Segregation: During gamete formation, the alleles for each gene segregate from each other so that each gamete carries only one allele for each gene.

• Law of Independent Assortment: Genes for different traits can segregate independently during the formation of gametes.

• Historical Context: Mendel presented his findings at the Natural History Society of Brunn in 1865, and they were published in 1866. However, his work remained largely unrecognized until its rediscovery in 1900 by Hugo de Vries, Carl Correns, and Erich von Tschermak.

Important Points

• Mendel studied the following 7 contrasting characters, each having a dominant and a recessive trait:

• Stem Height: The dominant trait is Tall and the recessive is Dwarf.

• Flower Color: The dominant trait is Violet (or Purple) and the recessive is White.

• Flower Position: The dominant trait is Axial (along the stem) and the recessive is Terminal (at the tip).

• Pod Shape: The dominant trait is Full (Inflated) and the recessive is Constricted.

• Pod Color: The dominant trait is Green and the recessive is Yellow.

• Seed Shape: The dominant trait is Round and the recessive is Wrinkled.

• Seed Color: The dominant trait is Yellow and the recessive is Green.

• It is crucial to note the difference between pod and seed color; for pods, green is dominant, whereas for seeds, yellow is dominant.

• Mendel used true-breeding lines (pure-breeding) for all 7 characters to ensure consistency in his P (parental) generation.

Q19. Answer: (c) It releases H+ ions.

The correct answer is It releases H+ ions.

Key Points

• According to the Arrhenius Theory of acids and bases, an acid is defined as a substance that increases the concentration of hydrogen ions (H+) when dissolved in water.

• When an acid molecule enters an aqueous solution, it undergoes dissociation or ionization, a process where the chemical bond between a hydrogen atom and the rest of the molecule breaks, releasing a positively charged H+ ion. Hence, statement 3 is correct.

• In a practical chemical sense, these H+ ions (protons) do not remain isolated in the solution; they immediately bond with water molecules (H_2O) to form hydronium ions (H_3O^+).

• The degree of this release determines the strength of the acid. Strong acids, such as Hydrochloric acid (HCl) or Sulfuric acid (H_2SO_4), dissociate 100% in water, while weak acids like Acetic acid (CH_3COOH) only release ions partially.

• Dissolving an acid in water does not make it lose its properties; rather, it activates its acidic behavior by allowing the ions to move freely and react. Hence, statement 4 is incorrect.

Additional Information

• The pH Scale: The acidity of a solution is measured using the pH scale, which typically ranges from 0 to 14. Solutions with a pH value less than 7 are considered acidic, and the value is directly related to the logarithmic concentration of H+ ions.

• Bases and OH- Ions: Unlike acids, bases (specifically alkalis) are substances that release hydroxide ions (OH-) when dissolved in water. This increases the pH of the solution above 7. Hence, statement 2 is incorrect.

• Formation of Salt: While acids are involved in the formation of salt, this occurs during a neutralization reaction where an acid reacts with a base. Simply dissolving an acid in water does not produce salt. Hence, statement 1 is incorrect.

• Common Characteristics: Acids are known for their sour taste, their ability to turn blue litmus paper to red, and their ability to conduct electricity in aqueous form due to the presence of mobile ions.

Important Points

• Exothermic Nature: The process of dissolving a concentrated acid in water is highly exothermic, meaning it releases a significant amount of heat energy.

• Safety Protocols: Due to the heat generated, one must always add acid to water slowly with constant stirring. Adding water to acid can cause the mixture to flash-boil and splatter, leading to severe chemical burns.

• Electrolytes: Because acids release ions (H+) in water, they act as electrolytes, allowing the solution to carry an electric current,

which is a fundamental principle used in lead-acid batteries.

Q20. Answer: (b) 44 amu

The correct answer is 44 amu.

Key Points

• The molecular mass of a chemical compound is calculated by summing the atomic masses of every individual atom present in its chemical formula.

• Carbon Dioxide is represented by the chemical formula CO2, which indicates that one molecule of the gas contains one atom of Carbon and two atoms of Oxygen.

• The atomic mass of Carbon (C) is approximately 12.01 amu (atomic mass units), which is typically rounded to 12 amu for standard educational calculations.

• The atomic mass of Oxygen (O) is approximately 15.99 amu, which is standardly rounded to 16 amu.

• To find the molecular mass of CO2, the calculation is as follows: (1 atom of Carbon x 12 amu) + (2 atoms of Oxygen x 16 amu) = 12 + 32 = 44 amu. Hence, the correct answer is 44 amu.

Additional Information

• Physical Properties of CO2: Carbon Dioxide is a colorless and odorless gas at standard temperature and pressure. It is approximately 1.5 times as dense as air and occurs naturally in Earth's atmosphere as a trace gas.

• Chemical Nature: It consists of a carbon atom covalently double-bonded to two oxygen atoms. It is a linear molecule and is non-polar despite the polarity of the individual C-O bonds due to its symmetrical shape.

• Dry Ice: Below a temperature of -78.5 degrees Celsius, Carbon Dioxide undergoes sublimation, changing directly from a gas to a solid form known as dry ice, which is widely used for refrigeration and cooling.

• Biological Importance: Carbon Dioxide is a vital component of the carbon cycle. It is consumed by plants, algae, and cyanobacteria during the process of photosynthesis to produce energy and oxygen.

• Industrial Uses: It is used in the food industry to provide carbonation in soft drinks, in fire extinguishers as it does not support combustion, and in welding as an inert shielding gas.

Important Points

• Atomic Mass Unit (amu): This is a unit of mass used to express atomic and molecular weights. It is defined as exactly 1/12th of the mass of an atom of Carbon-12. In modern terminology, it is often referred to as the unified atomic mass unit (u) or the Dalton (Da).

• Molar Mass vs. Molecular Mass: While molecular mass is the mass of a single molecule (measured in amu), molar mass is the mass of one mole of the substance (6.022 x 10^23 molecules), expressed in grams per mole (g/mol). For CO2, the molar mass is 44.01 g/mol.

• Comparison with other gases:

• Carbon Monoxide (CO): Molecular mass is 28 amu (12 + 16).

• Oxygen Gas (O2): Molecular mass is 32 amu (16 x 2).

• Nitrogen Gas (N2): Molecular mass is 28 amu (14 x 2).

• Methane (CH4): Molecular mass is 16 amu (12 + 4).

• Greenhouse Effect: CO2 is a primary greenhouse gas. Since the Industrial Revolution, human activities such as deforestation and the burning of fossil fuels have significantly increased its atmospheric concentration, contributing to global warming.

Q21. Answer: (d) 3

The correct answer is 3.

Key Points

• In a series circuit, the equivalent resistance (R_eq) is the sum of all individual resistances connected in the path. In this case, the total resistance is given by the formula R_eq = R1 + R2.

• According to Ohm's Law, the relationship between Voltage (V), Current (I), and Resistance (R) is defined by the equation V = I * R.

• Given the Voltage (V) is 10 V and the Current (I) is 2 A, we can calculate the total resistance of the circuit using the formula R_eq = V / I. Substituting the values: 10 / 2 = 5 Ohm. Hence, the total resistance of the circuit is 5 Ohm.

• We are provided with one resistor of 2 Ohm and another unknown resistor X Ohm connected in series. Therefore, 2 + X = 5.

• Solving for X, we subtract 2 from 5: X = 5 - 2 = 3 Ohm. Hence, the value of the unknown resistor X is 3.

Additional Information

• Ohm's Law: Discovered by the German physicist Georg Simon Ohm in 1827, it states that the current through a conductor between two points is directly proportional to the voltage across the two points, provided physical conditions like temperature remain constant.

• Series Combination: In a series connection, there is only one path for the flow of electric current. Consequently, the current (I)

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remains the same through all components, while the total potential difference (Voltage) is distributed across them.

• Parallel Combination: In a parallel circuit, components are connected across the same two nodes. Here, the potential difference (V) across each resistor remains the same, but the total current is the sum of currents through each branch. The formula for equivalent resistance is 1/R_eq = 1/R1 + 1/R2 + ... + 1/Rn.

• Resistance: It is the property of a conductor to oppose the flow of electric current. The SI unit of resistance is the Ohm, symbolized by the Greek letter Omega (Ω).

• Electric Power: In such circuits, the power dissipated can be calculated using P = V * I or P = I^2 * R. For this specific circuit, the total power consumed is 10 V * 2 A = 20 Watts.

Important Points

• Factors affecting Resistance: The resistance of a uniform metallic conductor is directly proportional to its length (L) and inversely proportional to the area of cross-section (A). It is represented as R = ρ (L / A), where ρ (rho) is the electrical resistivity of the material.

• Resistivity: This is a characteristic property of the material. Metals and alloys have very low resistivity in the range of 10^-8 Ωm to 10^-6 Ωm, making them good conductors. Insulators like rubber and glass have high resistivity in the range of 10^12 to 10^17 Ωm.

• Temperature Dependency: For most metallic conductors, resistance increases with an increase in temperature. In contrast, for semiconductors, the resistance typically decreases as the temperature rises.

• Ammeter and Voltmeter: An Ammeter is used to measure current and is always connected in series because it has low resistance. A Voltmeter is used to measure potential difference and is always connected in parallel because it has high resistance.

Q22. Answer: (b) virtual, erect, and point-sized

The correct answer is virtual, erect, and point-sized.

Key Points

• A concave lens is also known as a diverging lens because it diverges the light rays that pass through it parallel to its principal axis.

• When an object is placed at infinity, the incident rays are parallel to the principal axis. After refraction through the concave lens, these rays appear to diverge from the principal focus (F1) located on the same side as the object.

• The image formed under these conditions is virtual, meaning it cannot be obtained on a screen, and it is erect (upright).

• In terms of size, the image is highly diminished or point-sized at the focus.

• This behavior is consistent regardless of the focal length of the concave lens, as its primary function is to spread out light rays.

Additional Information

• Image Formation for Other Positions: Unlike convex lenses, a concave lens always produces a virtual, erect, and diminished image, regardless of the object's distance from the lens. If the object is moved from infinity closer to the optical center, the image moves from the focus toward the optical center and increases slightly in size, but remains smaller than the object.

• Lens Formula and Magnification: The relationship between object distance (u), image distance (v), and focal length (f) is given by 1/f = 1/v - 1/u. For a concave lens, the magnification (m = v/u) is always positive and less than 1, confirming the image is always erect and diminished.

• Sign Convention: According to the Cartesian sign convention, the focal length of a concave lens is always taken as negative. Similarly, the image distance (v) is also negative because the virtual image is formed on the left side of the lens (the same side as the object).

• Practical Applications: Concave lenses are widely used in spectacles to correct Myopia (nearsightedness), in peepholes of house doors to provide a wide view of people outside, and in flashlights to spread the light beam over a larger area.

• Power of Lens: The power of a concave lens is expressed in Dioptres (D) and is always negative, calculated as the reciprocal of the focal length in meters (P = 1/f).

Q23. Answer: (d) lipids (fats)

The correct answer is lipids (fats).

Key Points

• The Smooth Endoplasmic Reticulum (SER) is a membrane-bound network of tubules that lacks ribosomes on its surface, distinguishing it from the Rough Endoplasmic Reticulum (RER).

• The primary function of the SER is the manufacture of fat molecules, or lipids, which are crucial for various cellular functions and the overall health of the organism.

• The lipids produced by the SER, along with proteins produced by the RER, are used to build the cell membrane. This biological process is known as membrane biogenesis.

• In animal cells, the Smooth Endoplasmic Reticulum is also responsible for the synthesis of steroid hormones, such as estrogen and testosterone.

• The SER functions as a storage organelle for calcium ions (Ca2+), which is particularly vital in muscle cells where it is called the sarcoplasmic reticulum.

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Additional Information

• Detoxification: In the liver cells of vertebrates, the Smooth Endoplasmic Reticulum plays a critical role in detoxifying various poisons, toxins, and drugs, making them water-soluble so they can be excreted from the body.

• Rough Endoplasmic Reticulum (RER): Unlike the SER, the RER is studded with ribosomes, which are the sites of protein synthesis. The RER is involved in the folding and modification of proteins that are destined for secretion or for the cell membrane.

• Structural Components: The Endoplasmic Reticulum (ER) exists in three morphological forms: cisternae (flattened sacs), vesicles (spherical or oblong bags), and tubules (branching structures).

• Intracellular Transport: The ER serves as a channel for the transport of materials, particularly proteins, between different regions of the cytoplasm or between the cytoplasm and the nucleus.

• Biochemical Framework: The ER provides a large surface area for various biochemical activities and enzymatic reactions necessary for the cell's survival.

Important Points

• Discovery: The Endoplasmic Reticulum was first observed by Keith R. Porter, Albert Claude, and Ernest F. Fullam in 1945 using electron microscopy.

• Golgi Apparatus Interaction: Lipids and proteins synthesized in the ER are often sent to the Golgi apparatus for further processing, packaging, and distribution to other parts of the cell.

• Starch and DNA: Starch is a carbohydrate synthesized and stored in amyloplasts (a type of plastid) in plant cells, while DNA (Deoxyribonucleic acid) is the genetic material primarily found in the nucleus and mitochondria.

Q24. Answer: (b) Right-Hand Thumb Rule

The correct answer is Right-Hand Thumb Rule.

Key Points

• The Right-Hand Thumb Rule, also frequently referred to as Maxwell's Corkscrew Rule, is the primary method used to determine the direction of the magnetic field associated with a current-carrying conductor.

• When applying this rule to a circular loop, if we curl the fingers of the right hand in the direction of the current flowing through the loop, the extended thumb points toward the direction of the magnetic field at the centre of the loop.

• Conversely, if the thumb is pointed in the direction of the current along any small segment of the wire, the curl of the fingers shows the direction of the magnetic field lines encircling that segment.

• At the centre of the circular loop, all the magnetic field lines produced by different segments of the wire aid each other, resulting in a magnetic field that is perpendicular to the plane of the loop.

• If the current flows in a clockwise direction when viewed from one side, the magnetic field at the centre is directed inwards (away from the observer); if the current flows counter-clockwise, the field is directed outwards (towards the observer). Hence, the correct answer is Right-Hand Thumb Rule.

Additional Information

• Fleming’s Left-Hand Rule:

• This rule is used to determine the direction of the force (motion) acting on a current-carrying conductor placed within an external magnetic field.

• In this rule, the forefinger represents the magnetic field, the middle finger represents the current, and the thumb represents the force or motion of the conductor. It is the basis for the working of electric motors.

• Fleming’s Right-Hand Rule:

• This rule is primarily used to identify the direction of the induced current when a conductor moves inside a magnetic field.

• The thumb indicates the direction of motion, the forefinger points in the direction of the magnetic field, and the middle finger points in the direction of the induced current. This principle is utilized in electric generators.

• Lenz’s Law:

• Formulated by Heinrich Lenz in 1834, this law states that the direction of an induced electromotive force (EMF) is always such that it opposes the change in magnetic flux that produced it.

• It is a qualitative law that follows the principle of conservation of energy.

• Magnitude of Magnetic Field in a Loop:

• The strength of the magnetic field (B) at the centre of a circular loop of radius (R) carrying a current (I) is given by the formula B = (μ0 * I) / (2 * R).

• Here, μ0 represents the permeability of free space, which has a constant value of approximately 4π × 10^-^7 T·m/A.

• The magnetic field is directly proportional to the current and inversely proportional to the radius of the loop. If the loop has N turns, the field strength is multiplied by N.

Q25. Answer: (c) Pink

The correct answer is Pink.

Key Points

• Phenolphthalein is a synthetic chemical compound frequently utilized as an acid-base indicator in laboratory settings and industrial applications.

• In a basic solution (alkaline medium), phenolphthalein molecules undergo a structural transformation that results in the solution turning a vibrant pink or magenta colour. Hence, the correct option is Pink.

• In contrast, when phenolphthalein is added to an acidic solution or a neutral solution, it remains completely colourless because the molecular structure does not change in the same way under low pH conditions.

• This indicator is highly effective for titrations, where it helps determine the equivalence point of a reaction between an acid and a base.

• The transition of colour is very sharp, making it easy for researchers to identify when a solution has crossed the threshold from acidic to basic.

Additional Information

• pH Range: Phenolphthalein operates within a specific pH range, typically turning from colourless to pink between pH 8.2 and pH 10.0.

• Chemical Formula: The molecular formula for phenolphthalein is $C_{20}H_{14}O_4$. It belongs to the phthalein family of dyes and is synthesized from phthalic anhydride and phenol.

• Other Common Indicators:

• Litmus: Derived from lichens, it turns red in acids and blue in bases.

• Methyl Orange: Commonly used for titrations involving strong acids; it turns red in acid and yellow in base.

• Turmeric: A natural indicator that stays yellow in acid but turns reddish-brown in bases.

• China Rose: A natural indicator that turns dark pink (magenta) in acid and green in base.

• Universal Indicator: This is a mixture of several indicators that exhibits a variety of colours (from red to dark violet) to indicate the specific pH value of a solution across the full 0 to 14 scale.

Important Points

• History: Phenolphthalein was first discovered and synthesized in 1871 by the renowned German chemist Adolf von Baeyer.

• Forensic Use: It is a primary component of the Kastle-Meyer test, a presumptive test used in forensic science to detect the presence of hemoglobin (blood) at crime scenes.

• Extreme pH Behavior: Interestingly, in extremely basic environments where the pH is greater than 13.0, phenolphthalein can actually turn colourless again due to a further chemical reaction forming a different ionic species.

• Industrial and Medical Uses: While its most common use today is as a pH indicator, it was historically used as a laxative in pharmaceutical products before being largely phased out due to safety concerns.

• Physical Properties: In its pure form, phenolphthalein is a white to yellowish-white crystalline powder that is often dissolved in alcohol for use as a laboratory reagent.

Q26. Answer: (b) 48

Shortcut Trick

Number of balls (N) = Volume of Cylinder ÷ Volume of one Sphere

$N = (\pi \times r^2 \times 8r) \div [4/3 \times \pi \times (r/2)^3]$

$N = (8 \times \pi r^3) \div (\pi r^3/6)$

$N = 8 \times 6 = 48$

Therefore The correct answer is 48.

Alternate Method

Given:

Radius of cylinder = r

Height of cylinder (h) = 8r

Radius of each spherical ball (R) = r/2

Formula Used:

Volume of Cylinder = $\pi r^2 h$

Volume of Sphere = $(4/3)\pi R^3$

Calculations:

=> Volume of Cylinder = $\pi \times r^2 \times 8r = 8\pi r^3$

=> Volume of one ball = $(4/3) \times \pi \times (r/2)^3$

=> Volume of one ball = (4/3) × π × (r³/8) = πr³/6

=> Number of balls = (Total Volume) ÷ (Volume of 1 ball)

=> Number of balls = (8πr³) ÷ (πr³/6)

=> Number of balls = 8 × 6 = 48

Therefore The correct answer is 48.

Additional Information

Total Surface Area of Cylinder

The total surface area includes the curved surface and two circular bases: TSA = 2πrh + 2πr² = 2πr(h + r).

Surface Area of Sphere

The surface area of a sphere with radius R is given by the formula: A = 4πR².

Conservation of Volume

When one solid object is melted and recast into another shape, the total volume remains constant provided there is no wastage.

Q27. Answer: (c) 60°

Shortcut Trick

Ratio of Height to Shadow = 30 : 10√3

Dividing by 10√3, we get √3 : 1

In a right-angled triangle, if the ratio of sides is √3 : 1, the angle opposite to √3 is 60°.

Therefore The correct answer is 60°.

Alternate Method

Given: Height of the pole (AB) = 30 m, Length of shadow (BC) = 10√3 m.

Formula Used: tan θ = Perpendicular ÷ Base

=> Let the angle of elevation be θ.

=> tan θ = AB ÷ BC

=> tan θ = 30 ÷ 10√3

=> tan θ = 3 ÷ √3

=> tan θ = √3

=> θ = tan^(−1)(√3)

=> θ = 60°

Therefore The correct answer is 60°.

Additional Information

Standard Trigonometric Ratios

tan 30° = 1/√3, tan 45° = 1, and tan 60° = √3. These are frequently used in height and distance problems.

Angle of Elevation vs Depression

The Angle of Elevation is the angle between the horizontal line and the line of sight when looking up, whereas the Angle of Depression is looking down. Both are numerically equal when measured from alternate interior positions.

Right Triangle Properties

In a 30°-60°-90° triangle, the sides are in the ratio 1 : √3 : 2. Since our ratio of Shadow : Height was 1 : √3, the angle opposite the height must be 60°.

Q28. Answer: (a) 9

Shortcut Trick

Net rate of filling = (1/6 − 1/9) = 1/18 tank per minute.

Time to fill full tank = 18 minutes.

Time to fill one-half of the tank = 18 ÷ 2 = 9 minutes.

Therefore The correct answer is 9 minutes.

Alternate Method

Pipe	Time (min)	Total Work (LCM)	Efficiency
Filling Pipe (A)	6	18 units	+3
Emptying Pipe (B)	9	−2	

=> Total Capacity of tank = LCM(6, 9) = 18 units.

=> Combined Efficiency (A + B) = 3 − 2 = 1 unit/min.
=> Target Work = 1/2 of 18 units = 9 units.
=> Time Required = Target Work ÷ Combined Efficiency = 9 ÷ 1 = 9 minutes.
Therefore The correct answer is 9 minutes.
Additional Information
Pipes and Cisterns Concept
Filling pipes contribute positive efficiency, while emptying pipes (leakage) contribute negative efficiency.
Net Work Formula
If pipe A fills in 'x' hours and pipe B empties in 'y' hours, net time = (xy) ÷ (y − x) where y > x.
LCM Method
The Total Work is always assumed as the Least Common Multiple of individual times to simplify efficiency as integers.

Q29. Answer: (a) 66.67%

Shortcut Trick
Required percentage = (B marks ÷ A marks) × 100
Ratio of B to A = 50 : 75 = 2 : 3
Percentage = (2 ÷ 3) × 100 = 66.666...
Rounding to two decimal places, we get 66.67%.
Therefore The correct answer is 66.67%.
Alternate Method
Given:
Marks obtained by A = 75
Marks obtained by B = 50
Maximum Marks = 110
Formula Used:
Percentage of X with respect to Y = (X ÷ Y) × 100
Calculations:
=> Required Percentage = (B's marks ÷ A's marks) × 100
=> Required Percentage = (50 ÷ 75) × 100
=> Required Percentage = (2 ÷ 3) × 100
=> Required Percentage = 200 ÷ 3
=> Required Percentage = 66.6666...
=> Rounding to two decimal places = 66.67%
Therefore The correct answer is 66.67%.
Additional Information
Percentage Base Change
When calculating what percent X is of Y, Y is the denominator (base). If the question asked what percent of B's marks was A's marks, the base would be B (50).
Rounding Rules
If the third decimal digit is 5 or greater, increase the second decimal digit by 1. Here, 66.666... becomes 66.67.
Percentage Change Formula
Percentage Increase/Decrease = (Difference ÷ Original Value) × 100.

Q30. Answer: (a) Rs. 30

Shortcut Trick
Add both combos: 3 Sandwiches + 3 Juices = Rs. 80 + Rs. 70 = Rs. 150.
Divide by 3 to find 1 Sandwich + 1 Juice = Rs. 150 ÷ 3 = Rs. 50.
Subtract this from the first combo: (2 Sandwiches + 1 Juice) − (1 Sandwich + 1 Juice) = Rs. 80 − Rs. 50.
Price of one Sandwich = Rs. 30.
Therefore The correct answer is Rs. 30.
Alternate Method
Given:

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Combo 1: 2 Sandwiches and 1 Juice = Rs. 80

Combo 2: 1 Sandwich and 2 Juices = Rs. 70

Formula Used:

Method of Substitution or Elimination in Linear Equations.

Let the price of one Sandwich be S and one Juice be J.

=> 2S + J = 80 ... (1)

=> S + 2J = 70 ... (2)

From (1), J = 80 − 2S. Substitute this in (2):

=> S + 2(80 − 2S) = 70

=> S + 160 − 4S = 70

=> −3S = 70 − 160

=> −3S = −90

=> S = 30

Therefore The correct answer is Rs. 30.

Additional Information

Linear Equations in Two Variables

An equation of the form ax + by + c = 0 where a, b ≠ 0. It represents a straight line on a graph.

Substitution Method

A method to solve a system of equations by expressing one variable in terms of the other and substituting it into the second equation.

Elimination Method

Scaling equations to make coefficients of one variable equal, then adding or subtracting them to eliminate that variable.

Q31. Answer: (c) 4

Shortcut Trick

Average speed when equal distances are covered is given by the harmonic mean of the individual speeds.

Speed in first lap (u) = 420 ÷ 140 = 3 m/sec.

Speed in second lap (v) = 420 ÷ 70 = 6 m/sec.

Average speed = (2 × u × v) ÷ (u + v) = (2 × 3 × 6) ÷ (3 + 6) = 36 ÷ 9 = 4 m/sec.

Therefore The correct answer is 4 m/sec.

Alternate Method

Given:

Distance of first lap = 420 m, Time taken = 140 sec

Distance of second lap = 420 m, Time taken = 70 sec

Formula Used:

Average Speed = Total Distance ÷ Total Time

Calculations:

=> Total Distance = 420 + 420 = 840 m

=> Total Time = 140 + 70 = 210 sec

=> Average Speed = 840 ÷ 210

=> Average Speed = 4 m/sec

Therefore The correct answer is 4 m/sec.

Additional Information

Average Speed for Equal Distances

When a journey is split into two equal distances with speeds u and v, the average speed is 2uv ÷ (u + v). For three equal distances with speeds u, v, and w, the formula is 3uvw ÷ (uv + vw + wu).

Average Speed for Equal Time Intervals

If an object travels at speed u for a certain time duration t and at speed v for another equal time duration t, the average speed is the arithmetic mean: (u + v) ÷ 2.

Unit Conversion

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

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Q32. Answer: (d) 84

Shortcut Trick

For two numbers in ratio a:b with HCF = H,

LCM = H × a × b

LCM = 7 × 3 × 4

LCM = 84

Therefore The correct answer is 84.

Alternate Method

Given: Ratio = 3 : 4 and HCF = 7

Let the two numbers be 3x and 4x.

=> HCF of 3x and 4x is x.

=> Given x = 7.

=> Number 1 = 3 × 7 = 21

=> Number 2 = 4 × 7 = 28

=> LCM(21, 28) = 3 × 4 × 7 = 84

Therefore The correct answer is 84.

Additional Information

Product Rule

For any two numbers A and B, HCF × LCM = A × B.

Co-prime Numbers

If two numbers are co-prime (HCF = 1), then their LCM is simply their product.

HCF and LCM of Fractions

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

Q33. Answer: (a) 11 years

Shortcut Trick

Subtract the additional years from the person's age and then halve the result.

Sibling's age = (Person's age − 5) ÷ 2

Sibling's age = (27 − 5) ÷ 2 = 22 ÷ 2 = 11

Therefore The correct answer is 11 years.

Alternate Method

Given:

Person's Age = 27 years

Let the Sibling's Age be x.

Equation:

According to the question: 2x + 5 = 27

Calculations:

=> 2x = 27 − 5

=> 2x = 22

=> x = 22 ÷ 2

=> x = 11

Therefore The correct answer is 11 years.

Additional Information

Linear Equations in One Variable

Equations where the highest power of the variable is 1, used to find unknown ages or values by translating verbal statements into mathematical expressions.

Age Relation Rules

If person A is n years older than B, A = B + n. If A is n times as old as B, A = n × B. These can be combined as A = (n × B) + m.

Verification Method

Always plug the answer back into the original condition: 2 × 11 + 5 = 22 + 5 = 27. This confirms the solution is correct.

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Q34. Answer: (d) Rs. 12,800

Shortcut Trick

Difference in Profit Percentage = 17% − 7% = 10%.

According to the question, 10% of Cost Price = Rs. 1,280.

100% of Cost Price (CP) = 1,280 × (100 ÷ 10).

Cost Price = Rs. 12,800.

Therefore The correct answer is Rs. 12,800.

Alternate Method

Given: Initial Profit = 7%, New Profit = 17%, Price difference = Rs. 1,280.

Formulas: SP = CP × (100 + P%) ÷ 100 | Difference in SP = CP × (P2% − P1%) ÷ 100.

=> Let the Cost Price be x.

=> First Selling Price (SP1) = 1.07x.

=> Second Selling Price (SP2) = 1.17x.

=> Difference: SP2 − SP1 = 1.17x − 1.07x = 0.10x.

=> 0.10x = 1,280 => x = 1,280 ÷ 0.10 = 12,800.

Therefore The correct answer is Rs. 12,800.

Additional Information

Profit and Loss Variations

When there is a shift from loss to profit, the percentage gap is the sum of the loss% and profit%. For profit to profit, take the difference.

Formula for Price Change

CP = (Difference in Price × 100) ÷ (Difference in Profit/Loss Percentages).

Q35. Answer: (b) 4000 ft²

Shortcut Trick

Total ceiling area = 2500 ft².

Unoccupied ceiling area = 2500 − (4 × 25) = 2400 ft².

Wall area = 4 × side × height = 4 × 50 × 10 = 2000 ft².

Cubicle wall area reduction = 4 × (2 × 5 × 10) = 400 ft².

Total painted area = 2400 + 2000 − 400 = 4000 ft².

Therefore The correct answer is 4000 ft².

Alternate Method

Given:

=> Volume of the room = 25,000 ft³

=> Height of the room (h) = 10 ft

=> Base area of each cubicle = 25 ft²

Formula Used:

=> Volume = Base Area × Height

=> Base Area of square room = a² (where a is the side length)

=> Total painted area = (Unoccupied Ceiling Area) + (Painted Wall Area)

Calculations:

=> Base Area of the room = 25,000 ÷ 10 = 2500 ft²

=> Side of the room (a) = √2500 = 50 ft

=> Side of each cubicle (c) = √25 = 5 ft

=> Unoccupied ceiling area = Total Base Area − (4 × Cubicle Base Area)

=> Unoccupied ceiling area = 2500 − (4 × 25) = 2400 ft²

=> Painted wall area: Since the 4 corners contain cubicles of 5 ft × 5 ft, the walls of the room inside these cubicles are not painted, but the outer partition walls of the cubicles facing the room are painted.

=> For each corner, the room walls of length 5 ft + 5 ft = 10 ft are not painted, but the cubicle partition walls of length 5 ft + 5 ft = 10 ft are painted.

=> Therefore, the total perimeter of the walls to be painted remains the same as the perimeter of the room = 4 × 50 = 200 ft.

=> But the partition walls of the cubicles block the corner room walls, maintaining an equivalent surface area. Thus, the total wall

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area to be painted is equal to the total original wall area of the room minus the blocked parts plus the new partition walls, which sums up to: 4 × 50 × 10 − 4 × (5 + 5) × 10 + 4 × (5 + 5) × 10 = 2000 ft².

=> However, the walls enclosed within the cubicles (which are 2 walls of the room per cubicle) are not painted. The new partition walls of the cubicles facing the inside of the room are painted. This means the perimeter being painted is exactly equal to the boundary of the unoccupied region.

=> Perimeter of unoccupied region = 4 × (50 − 2 × 5) + 4 × (2 × 5) = 4 × 40 + 40 = 200 ft.

=> Painted Wall Area = Perimeter × Height = 200 × 10 = 2000 ft².

=> Total Painted Area = 2400 + 2000 = 4400 ft². Since the outer walls of the cubicles are part of the cubicle structures and only the room's walls are to be painted, we deduct the cubicle wall overlap: 2000 (Room walls) − 400 (covered by cubicles) = 1600 ft².

=> Total Painted Area = 2400 (Ceiling) + 1600 (Remaining Room Walls) = 4000 ft².

Therefore The correct answer is 4000 ft².

Additional Information

Total Surface Area of a Cuboid

The total surface area of a cuboid is given by 2(lb + bh + hl), where l, b, and h are length, breadth, and height respectively.

Lateral Surface Area of a Room

The area of the four walls of a room is equal to its perimeter multiplied by the height: 2(l + b) × h.

2

Q36. Answer: (c) 64% loss

Shortcut Trick

Net percentage change = a + b + (a × b) ÷ 100

Here, markup percentage a = +44% and discount percentage b = −75%.

Net change = 44 − 75 + (44 × −75) ÷ 100

Net change = −31 − (3300 ÷ 100) = −31 − 33 = −64%

Negative sign indicates a loss.

Therefore The correct answer is 64% loss.

Alternate Method

Given → Markup % = 44%, Discount % = 75%.

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

=> Let the Cost Price (CP) be 100.

=> Marked Price (MP) = 100 + 44% of 100 = 144.

=> Selling Price (SP) = 144 − 75% of 144.

=> SP = 144 − (0.75 × 144) = 144 − 108 = 36.

=> Since CP (100) > SP (36), it is a Loss.

=> Loss% = (100 − 36) ÷ 100 × 100 = 64%.

Therefore The correct answer is 64% loss.

Additional Information

Marked Price & Discount

The Marked Price is the price printed on the label. Discount is always calculated on the Marked Price to arrive at the Selling Price.

Successive Percentage Formula

When an item is marked up and then discounted, the overall Gain/Loss% can be found using x + y + (xy/100), where x is markup and y is discount (negative).

Q37. Answer: (b) -4

Shortcut Trick

Convert all terms to base 2

4 = 2², 64 = 2^6, 8 = 2³

2^(2(x+1)) = 2^6 × 2^(3x) = 2^(6+3x)

Equate powers => 2x + 2 = 6 + 3x => x = −4

Therefore Answer = −4

Alternate Method

Given:

4^((x + 1)) = 64 × 8^x

Formula used:

a^m × aⁿ = a^(m+n), (a^m)ⁿ = a^(mn)

Calculation:

=> 4^((x+1)) = (2²)^((x+1)) = 2^(2x+2)

=> 64 × 8^x = 2^6 × (2³)^x = 2^(6+3x)

=> 2^(2x+2) = 2^(6+3x)

=> 2x + 2 = 6 + 3x

=> 2 − 6 = 3x − 2x

=> −4 = x

Therefore The correct answer is −4.

Additional Information

Exponent Rule

a^m × aⁿ = a^(m+n)

Power of Power

(a^m)ⁿ = a^(mn)

Equal Bases

If bases are equal, equate exponents directly

Standard Bases

4 = 2², 8 = 2³, 64 = 2^6

Q38. Answer: (b) Rs. 221

Shortcut Trick

Total amount = Rs. 1,964. Total deduction = 50 + 17 + 10 = Rs. 77.

Remaining amount = 1,964 − 77 = Rs. 1,887.

Divide Rs. 1,887 in ratio 20 : 4 : 13. Sum of parts = 37 units.

37 units = Rs. 1,887 → 1 unit = Rs. 51.

Lalita's reduced share = 4 × 51 = Rs. 204. Original share = 204 + 17 = Rs. 221.

Therefore The correct answer is Rs. 221.

Alternate Method

Given: Total amount = Rs. 1,964. Ratio after deductions = 20 : 4 : 13. Deductions = Rs. 50, Rs. 17, Rs. 10.

Formula: Actual Share = (Ratio Part × Value of 1 unit) + Deduction

=> Total deduction = 50 + 17 + 10 = Rs. 77

=> Remaining amount to be divided = 1,964 − 77 = Rs. 1,887

=> Sum of ratio parts = 20 + 4 + 13 = 37 units

=> 37 units = Rs. 1,887

=> 1 unit = 1,887 ÷ 37 = Rs. 51

=> Lalita's share after deduction = 4 units × Rs. 51 = Rs. 204

=> Lalita's original share = 204 + 17 = Rs. 221

Therefore The correct answer is Rs. 221.

Additional Information

Ratio and Proportion

When values are subtracted from original shares, always subtract the total deduction from the total sum before applying the ratio parts.

Compound Ratio

The compound ratio of (a : b) and (c : d) is given by (ac : bd).

Invertendo and Alternendo

If a/b = c/d, then b/a = d/c (Invertendo) and a/c = b/d (Alternendo).

Q39. Answer: (b) 21/7 days

Shortcut Trick

Total work in man-hours:

Mohan = 6 days × 5 hours = 30 hours

Rohan = 8 days × 5 hours = 40 hours (assuming same hours/day initially)
Combined time in hours = (30 × 40) ÷ (30 + 40) = 1200 ÷ 70 = 120/7 hours
Days required at 8 hours/day = (120/7) ÷ 8 = 15/7 = 2(1/7) days
Therefore The correct answer is 2(1/7) days.
Alternate Method
Given:
Mohan takes 6 days at 5 hours/day = 30 hours
Rohan takes 8 days at 5 hours/day = 40 hours

Person	Total Hours	Total Work (LCM)	Efficiency (Work/hr)
Mohan	30	120 units	4
Rohan	40	3	

Calculations:
=> Combined Efficiency = 4 + 3 = 7 units/hour
=> Total hours required = 120 ÷ 7 hours
=> Number of days at 8 hours per day = (120 ÷ 7) ÷ 8
=> Number of days = 15/7 days
=> Number of days = 2(1/7) days
Therefore The correct answer is 2(1/7) days.
Additional Information
Work-Hours Relation
Total Work = Persons × Days × Hours per day. This is often solved using the M1D1H1/W1 = M2D2H2/W2 formula.
Combined Efficiency
When multiple people work together, their efficiencies (work done per unit time) are added to find the total time taken for the task.

Q40. Answer: (d) 1

Shortcut Trick
Apply the algebraic identity: $(a - b)^2 + 4ab = (a + b)^2$.
In this expression, let a = 4x and b = 5y. Then $4ab = 4(4x)(5y) = 80xy$.
The numerator $(4x - 5y)^2 + 80xy$ simplifies exactly to $(4x + 5y)^2$.
The entire expression becomes $(4x + 5y)^2 \div (4x + 5y)^2 = 1$.
Therefore The correct answer is 1.
Alternate Method
Given: $[(4x - 5y)^2 + 80xy] \div [(4x + 5y)^2]$
Formula Used: $(a - b)^2 = a^2 - 2ab + b^2$ and $(a + b)^2 = a^2 + 2ab + b^2$
=> Expand the numerator: $(4x)^2 - 2(4x)(5y) + (5y)^2 + 80xy$
=> Numerator = $16x^2 - 40xy + 25y^2 + 80xy$
=> Numerator = $16x^2 + 40xy + 25y^2$
=> Now, expand the denominator: $(4x + 5y)^2 = (4x)^2 + 2(4x)(5y) + (5y)^2$
=> Denominator = $16x^2 + 40xy + 25y^2$
=> Expression = $(16x^2 + 40xy + 25y^2) \div (16x^2 + 40xy + 25y^2)$
=> Simplified Value = 1
Therefore The correct answer is 1.
Additional Information
Binomial Square Identities
The expansion of $(a \pm b)^2$ is a core concept in algebra, given by $a^2 \pm 2ab + b^2$.
Relationship between Identities
The identities are linked such that $(a + b)^2 - (a - b)^2 = 4ab$ and $(a + b)^2 + (a - b)^2 = 2(a^2 + b^2)$.
Simplification Rule
Any non-zero expression divided by itself, such as $k \div k$, always results in 1.

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Q41. Answer: (d) Decreases by 52.32%

Shortcut Trick

Use the multiplying factor method: Final Price = Initial Price × (1 − r1) × (1 − r2) × (1 − r3) × (1 + r4).

Net multiplier = 0.60 × 0.85 × 0.55 × 1.70 = 0.47685.

Net change = (1 − 0.47685) × 100 = 52.315% decrease.

Therefore The correct answer is Decreases by 52.32%.

Alternate Method

Given: Initial Price = 100, Successive Decreases = 40%, 15%, 45%, Increase = 70%.

=> Price after 1st month = 100 × (60/100) = 60

=> Price after 2nd month = 60 × (85/100) = 51

=> Price after 3rd month = 51 × (55/100) = 28.05

=> Price after 4th month = 28.05 × (170/100) = 47.685

=> Total decrease = 100 − 47.685 = 52.315%

=> Rounding off to two decimal places = 52.32%

Therefore The correct answer is Decreases by 52.32%.

Additional Information

Successive Percentage Change

For two changes a% and b%, the net change is [a + b + (a × b)/100]%. Use negative for decrease.

Multiplying Factor

A decrease of x% is equivalent to multiplying the value by (1 − x/100), while an increase is (1 + x/100).

Base Value Selection

Always assume 100 as the initial value in percentage problems to simplify calculations and direct conversion to %.

Q42. Answer: (d) 9

Shortcut Trick

Time taken for 1 page = 40 ÷ 4 = 10 minutes.

Pages typed in 90 minutes = 90 ÷ 10 = 9 pages.

Therefore The correct answer is 9 pages.

Alternate Method

Given:

Time1 = 40 minutes, Work1 = 4 pages

Time2 = 90 minutes, Work2 = x pages

Formula Used:

Using the Work and Time relationship: (W1 / T1) = (W2 / T2)

Calculations:

=> 4 / 40 = x / 90

=> 1 / 10 = x / 90

=> x = 90 ÷ 10

=> x = 9

Therefore The correct answer is 9 pages.

Additional Information

Direct Proportion

When one quantity increases, the other also increases. Formula: x1/y1 = x2/y2.

Unitary Method

Find the value of a single unit first, then multiply by the required number of units.

Efficiency and Time

Work = Efficiency × Time. Here, typing speed is the constant efficiency.

Q43. Answer: (b) 49

Shortcut Trick

Age of new member = New Average + (Initial Count × Increase in Average)

Increase in average = 26 − 25 = 1 year

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Age of teacher = 26 + (23 × 1)
Age of teacher = 26 + 23 = 49 years
Therefore The correct answer is 49 years.
Alternate Method
Given:
Initial number of students = 23; Initial average age = 25 years
New number of people (students + teacher) = 24; New average age = 26 years
Formula: Total Age = Number of People × Average Age
=> Total age of 23 students = 23 × 25 = 575 years
=> Total age of 24 people (including teacher) = 24 × 26 = 624 years
=> Age of the teacher = Total age of 24 people − Total age of 23 students
=> Age of the teacher = 624 − 575 = 49 years
Therefore The correct answer is 49 years.
Additional Information
Inclusion in Average
When a new member joins, their value = New Average + Old Count × (New Average − Old Average).
Exclusion from Average
When a member leaves, their value = Old Average + New Count × (Old Average − New Average).
Weighted Average Formula
The combined average of two groups is (n1x1 + n2x2) ÷ (n1 + n2), where n is the count and x is the average.

Q44. Answer: (c) 13.2

Shortcut Trick
The empirical relationship between central tendencies is: Mode − Median = 2/3 (Mode − Mean).
Given that the Mode exceeds the Mean by 19.8, we have: (Mode − Mean) = 19.8.
Substituting the value: Required difference = 2/3 × 19.8.
Required difference = 2 × 6.6 = 13.2.
Therefore The correct answer is 13.2.
Alternate Method
Given:
Mode − Mean = 19.8
Formula Used:
The Empirical Formula: Mode = 3 Median − 2 Mean
Calculations:
=> From the formula: Mode = 3 Median − 2 Mean
=> Mode − Mean = (3 Median − 2 Mean) − Mean
=> Mode − Mean = 3 Median − 3 Mean = 3 (Median − Mean)
=> 19.8 = 3 (Median − Mean)
=> Median − Mean = 19.8 ÷ 3 = 6.6
=> Now, Mode − Median = (Mode − Mean) − (Median − Mean)
=> Mode − Median = 19.8 − 6.6
=> Mode − Median = 13.2
Therefore The correct answer is 13.2.
Additional Information
Empirical Relationship
For a moderately skewed distribution, the relationship is Mode = 3 Median − 2 Mean.
Symmetric Distribution
In a perfectly symmetrical distribution (like the Normal Distribution), the values of Mean, Median, and Mode are equal: Mean = Median = Mode.
Positively Skewed Distribution
When the tail is on the right side, the relationship is typically Mean > Median > Mode.
Negatively Skewed Distribution

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When the tail is on the left side, the relationship is typically Mode > Median > Mean.

Q45. Answer: (a) 36 minutes

Shortcut Trick

Speed Ratio = 5 : 3 (Normal : New)

Time Ratio = 3 : 5 (Inverse of speed as distance is constant)

Difference in time units = 5 − 3 = 2 units

2 units = 24 minutes => 1 unit = 12 minutes

Usual Time = 3 units = 3 × 12 minutes = 36 minutes

Therefore The correct answer is 36 min.

Alternate Method

Given: New speed = 3/5 of Normal speed, Late time = 24 minutes.

Formula Used: Usual Time = [Late Time × Numerator] ÷ [Denominator − Numerator]

=> Let the usual time be T.

=> New time = T + 24

=> Since Distance = Speed × Time, S × T = (3/5)S × (T + 24)

=> T = 3/5 (T + 24)

=> 5T = 3T + 72

=> 2T = 72

=> T = 36 minutes

Therefore The correct answer is 36 min.

Additional Information

Speed-Time Inverse Proportionality

When distance is constant, speed is inversely proportional to time (S1/S2 = T2/T1).

Late/Early Logic

If a person is late by 'L' minutes at a/b of usual speed, Usual Time = [a × L] / |b − a|.

Relative Speed

Used for two moving bodies; add speeds if moving in opposite directions, subtract if in the same direction.

Q46. Answer: (b) Rs. 1,815

Shortcut Trick

Effective rate for 10% compound interest for 2 years = 10 + 10 + (10 × 10)/100 = 21%.

Total Amount = Principal × (100% + Effective Rate%)

=> Amount = 1,500 × 121%

=> Amount = 15 × 121 = 1,815.

Therefore The correct answer is Rs. 1,815.

Alternate Method

Given:

Principal (P) = Rs. 1,500

Rate (R) = 10% per annum

Time (n) = 2 years

Formula Used:

Amount (A) = $P(1 + R/100)^n$

Calculations:

=> $A = 1,500 \times (1 + 10/100)^2$

=> $A = 1,500 \times (110/100) \times (110/100)$

=> $A = 1,500 \times (11/10) \times (11/10)$

=> $A = 1,500 \times 121/100$

=> $A = 15 \times 121$

=> $A = 1,815$

Therefore The correct answer is Rs. 1,815.

Additional Information

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Compound Interest Formula

Compound Interest (CI) is calculated as CI = A − P, where A = P(1 + r/n)^(nt).

Difference between CI and SI for 2 Years

The difference (D) for two years is given by D = P(R/100)².

Successive Percentage for 2 Years

The net effective rate for two successive increases of a% and b% is (a + b + ab/100)%.

Q47. Answer: (b) 25

Cross multiply => X × X = 125 × 5

=> X² = 625

=> X = √625 = 25 (since X > 0)

Therefore Answer = 25

Given:

X ÷ 125 = 5 ÷ X

Formula used:

If a/b = c/d => ad = bc

Calculation:

=> X/125 = 5/X

=> X × X = 125 × 5

=> X² = 625

=> X = ±25

=> Since X > 0 => X = 25

Therefore The correct answer is 25.

Cross Multiplication

If a/b = c/d then a × d = b × c

Quadratic Equation

x² = k => x = ±√k

Condition Check

Given X > 0, so only positive root is valid

Perfect Square

625 = 25²

Q48. Answer: (d) 35775

Shortcut Trick

Product of fractions: (40/100) × (10/100) × (1/3) × Number = 477

(2/5) × (1/10) × (1/3) × Number = 477

(1/75) × Number = 477

Number = 477 × 75 = 35775

Therefore The correct answer is 35775.

Alternate Method

Given: 40% of 10% of 1/3 of x = 477

=> Let the number be x.

=> (40/100) × (10/100) × (1/3) × x = 477

=> (0.4) × (0.1) × (1/3) × x = 477

=> (0.04 / 3) × x = 477

=> x = (477 × 3) / 0.04

=> x = 1431 / 0.04

=> x = 35775

Therefore The correct answer is 35775.

Additional Information

Percentage to Fraction Conversion

To simplify calculations, convert percentages to fractions: 40% = 2/5, 10% = 1/10, 25% = 1/4.

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Successive Percentage Rule

A% of B% of C is equivalent to (A × B / 100)% of C. Use this for multi-step percentage problems.

Reverse Calculation

When the final value is given, the original number = Result ÷ (Product of all percentage/fraction multipliers).

Q49. Answer: (d) D

Shortcut Trick

The best scheme for the shopkeeper is the one that offers the minimum discount to the customer.

Scheme A: 32 + 40 − (32 × 40) ÷ 100 = 72 − 12.8 = 59.2%

Scheme B: 5 ÷ (1 + 5) × 100 = 5 ÷ 6 × 100 = 83.33%

Scheme C: Single discount = 48%

Scheme D: 8 + 33 − (8 × 33) ÷ 100 = 41 − 2.64 = 38.36%

Comparing all, Scheme D provides the lowest discount (38.36%), making it the most profitable for the seller.

Therefore The correct answer is D.

Alternate Method

Given → Successive discounts and Buy-Get schemes.

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

=> Calculate effective discount for Scheme A: 32 + 40 − 12.8 = 59.2%.

=> Calculate effective discount for Scheme B: (5 ÷ 6) × 100 = 83.33%.

=> Calculate effective discount for Scheme C: 48%.

=> Calculate effective discount for Scheme D: 8 + 33 − (264 ÷ 100) = 41 − 2.64 = 38.36%.

=> A shopkeeper always prefers the lowest discount rate to maximize the Selling Price.

=> Since 38.36% < 48% < 59.2% < 83.33%, Scheme D is best.

Therefore The correct answer is D.

Additional Information

Best for Customer vs Shopkeeper

The Best Scheme for Customer is the one with the Maximum Discount. Conversely, the Best Scheme for Shopkeeper is the one with the Minimum Discount.

Buy X Get Y Free

In a 'Buy X, Get Y free' offer, the total number of articles given is (X + Y). The discount percentage is calculated on the total articles: [Free Articles ÷ Total Articles] × 100.

Q50. Answer: (c) 45°

Shortcut Trick

For any quadrilateral ABCD, the angle formed by the bisectors of two adjacent angles (say angle C and angle D) is always equal to half the sum of the other two angles (angle A and angle B):

angle DOC = (angle A + angle B) ÷ 2

Substituting the given values:

angle DOC = (32° + 58°) ÷ 2 = 90° ÷ 2 = 45°

Therefore The correct answer is 45°.

Alternate Method

Given:

In quadrilateral ABCD:

angle A = 32°

angle B = 58°

DO and CO are the angle bisectors of angle D and angle C respectively, meeting at point O.

Formula Used:

The sum of all interior angles of a quadrilateral is 360°.

The sum of all interior angles of a triangle is 180°.

Calculations:

In quadrilateral ABCD:

=> angle A + angle B + angle C + angle D = 360°

=> 32° + 58° + angle C + angle D = 360°

=> 90° + angle C + angle D = 360°

=> angle C + angle D = 360° − 90°

=> angle C + angle D = 270°

Dividing the entire equation by 2:

=> (angle C + angle D) ÷ 2 = 270° ÷ 2

=> angle C/2 + angle D/2 = 135°

Since CO and DO are the angle bisectors of angle C and angle D:

=> angle OCD = angle C/2 and angle ODC = angle D/2

=> angle OCD + angle ODC = 135°

Now, in triangle DOC, the sum of all interior angles is 180°:

=> angle DOC + angle OCD + angle ODC = 180°

=> angle DOC + 135° = 180°

=> angle DOC = 180° − 135°

=> angle DOC = 45°

Therefore The correct answer is 45°.

Additional Information

Angle Bisector Theorem in Quadrilaterals

The angle formed by the bisectors of two adjacent angles of a quadrilateral is equal to half the sum of the other two angles: angle DOC = (angle A + angle B) ÷ 2.

Angle Bisectors of Opposite Angles

If the bisectors of opposite angles of a quadrilateral (say angle A and angle C) intersect, the angle between them is equal to half the absolute difference of the other two angles: |angle B − angle D| ÷ 2.

Sum of Interior Angles of a Polygon

The sum of the interior angles of any convex polygon with n sides is (n − 2) × 180°. For a quadrilateral, n = 4, so the sum is 360°.

Q51. Answer: (b) 3

Given: (Left) 5 € $ 4 9 & & 4 € @ © 7 @ 7 9 1 8 # 8 % 5 £ (Right)

Logic followed here is: We need to find symbols in the given series that are immediately preceded by a number and immediately followed by a number.

Pattern: Number → Symbol → Number

(Left) 5 € $ 4 9 & & 4 € @ © 7 @ 7 9 1 8 # 8 % 5 £ (Right)

The patterns observed are: (7@7), (8#8), and (8%5).

Therefore, there are 3 such symbols in the series.

Hence the correct answer is "Option 2".

Q52. Answer: (b) Neither conclusion (I) nor (II) follows.

Given Statements:

Some vehicles are trucks.

Some vehicles are lorries.

Some trucks are buses.

The least possible Venn diagram for the given statement is:

Conclusions:

(I) Some vehicles are buses: Does not follow (Because, Some vehicles are trucks,Some trucks are buses.But the “some trucks” which are buses may or may not be the same trucks which are vehicles.)

(II) Some trucks are lorries: Does not follow (Because, Some vehicles are trucks and Some vehicles are lorries. But trucks and lorries may be different groups of vehicles.So, no definite relation exists between trucks and lorries.)

So, Neither conclusion (I) nor (II) follows.

Hence, the correct answer is "Option 2".

Q53. Answer: (a) 11

Logic followed here is.

Logic: The digits of the given number are rearranged in ascending order (from smallest to largest) from left to right, and then the sum of the digits at the specified positions is calculated.

Given Number: 756931482

Arranging the digits in ascending order →

1	2	3	4	5	6	7	8	9
1st	2nd	3rd	4th	5th	6th	7th	8th	9th

The new number formed is: 123456789

Identifying the required digits:

→ The digit which is third from the left is: 3

→ The digit which is second from the right (8th from the left) is: 8

Sum of these digits:

Sum = 3 + 8 = 11

Hence, the correct answer is "Option 1".

Q54. Answer: (c) Neither conclusion (I) nor (II) is true.

Statements:

1. All Pianos are Guitars.

2. Some Guitars are Violins.

3. No Violins are Drums.

The least possible Venn diagram for the given statement is:

Conclusions:

(I) Some Drums are Guitars: Does not follow (Because, No relation is given between Drums and Guitars. So, we cannot say that some Drums are Guitars.)

(II) Some Violins are Pianos: Does not follow (Because, All Pianos are Guitars and Some Guitars are Violins. But it is not necessary that the Guitars which are Violins are also Pianos.So, no definite relation exists between Violins and Pianos.)

So, Neither conclusion (I) nor conclusion (II) follows.

Hence, the correct answer is "Option 3".

Q55. Answer: (a) XZ−BG

Logic followed here is.

Logic: In each pair, the letters within a cluster have a difference of +2, and the corresponding letters between the two clusters have a difference of +5.

Option 2:

Option 3:

Option 4:

So, in Options 2, 3 and 4, both letters are shifted by +5.

Option 1:

The shift is not +5 for both letters.

Therefore, XZ – BG does not follow the pattern.

Hence, the correct answer is Option 1.

Q56. Answer: (a) Three

Given:

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

Logic followed here is: We need to find even numbers that are immediately preceded by an even number and immediately followed by an odd number.

Pattern: Even Number → Even Number → Odd Number

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

The required even numbers are:

• 2 in (4 2 7)

• 2 in (4 2 5)

• 4 in (6 4 5)

Therefore, there are 3 such even numbers.

Hence, the correct answer is "Option 1".

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Q57. Answer: (d) 29

Given series:

4, 9, 14, 19, 24, ?

Next term:

24 + 5 = 29

Hence, the correct answer is Option 4.

Q58. Answer: (d) South

Logic followed here is based on the directional relationship between the houses.

Step 1: Positioning P and R relative to Q

• House P is 5 km West of House Q.

• House R is 3 km North of House Q.

Reference	House	Distance	Direction
From Q	P	5 km	West
From Q	R	3 km	North

Step 2: Positioning S relative to R

The house of S is 10 km south of the house of R.

Since R is 3 km North of Q, moving south from R involves passing through the position of Q:

• Distance from R to Q = 3 km (South direction)

• Remaining distance from Q to S = Total distance - Distance to Q

• Remaining distance = 10 km - 3 km = 7 km

Segment	Direction	Distance
R to Q	South	3 km
Q to S	South	7 km

Conclusion:

As House S is 7 km directly below House Q on the North-South axis, it is located in the South direction.

Therefore, the house of S is South from the house of Q.

Q59. Answer: (d) Son's wife's father

Symbols and their meanings:

Symbol	Meaning
•	A is the son of B
•	A is the brother of B
x	A is the wife of B
&	A is the father of B

Given Expression: ‘K & T x R - Z + V’: K is the father of T, T is the wife of R, R is the brother of Z, Z is the son of V

The possible Venn diagram is:

Therefore, K is the Son's wife's father of V.

Hence, the corect answer is "Option 4".

Q60. Answer: (d) BAW 8

The pattern followed here is:

Hence, the correct answer is "Option 4".

Q61. Answer: (b) 24 km to the west

Given:

Prakash starts from Point A and drives 37 km towards the north.

He then takes a left turn and drives 40 km.

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He again takes a left turn and drives 55 km.
He then takes a left turn and drives 64 km.
Finally, he takes a left turn and drives 18 km and stops at Point P.
Therefore, the shortest distance is 24 km and the direction is West.
Hence, the correct answer is "Option 2 – 24 km to the West".

Q62. Answer: (b) PID

Given series:
DEL, GFJ, JGH, MHF, ?
Observe each position separately:
Therefore, the next term is PID.
Hence, the correct answer is Option 2.

Q63. Answer: (d) 6

Given:
FOUR → 5812
ROUT → 5628
Find common letters in both words:
Code for "T" is "6".
Hence, the correct answer is Option 4.

Q64. Answer: (a) 3

Given:
• Seven boxes A, B, C, D, E, F and G are kept one over the other.
• Only four boxes are kept between A and E.
• Only C is kept above A.
• Only two boxes are kept between G and F.
• B is kept immediately above D.
• F is not kept immediately above B.
How many boxes are kept below B?
Step 1: Place C and A
"Only C is kept above A"
So A must be in the 2nd position from the top and C in the 1st position.

Position	Box
1	C
2	A
3	
4	
5	
6	
7	

Step 2: Place E
There are exactly four boxes between A and E.
A is at position 2, therefore E must be at position 7.

Position	Box
1	C
2	A
3	

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4	
5	
6	
7	E

Step 3: Place B and D

B is immediately above D.

Possible vacant pairs are:

(3,4), (4,5), (5,6)

Step 4: Place F and G

There are exactly two boxes between F and G.

Also, F is not immediately above B.

The arrangement that satisfies all conditions is:

Position (Top to Bottom)	Box
1	C
2	A
3	G
4	B
5	D
6	F
7	E

Step 5: Count boxes below B

B is at position 4.

Boxes below B are:

• D

• F

• E

Total boxes below B = 3

Therefore, the number of boxes kept below B is 3.

Hence, the correct answer is "Option 1".

Q65. Answer: (b) Three

Given:

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

We need to find the even digits which are:

Immediately preceded by an even digit and immediately followed by an odd digit.

Required pattern:

Even digit → Even digit → Odd digit

Checking the series:

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

The even digits satisfying the condition are:

• 4 in (8 4 3)

• 2 in (8 2 7)

• 4 in (6 4 1)

Therefore, there are 2 such even digits.

Hence, the correct answer is "Option 2".

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Q66. Answer: (b) 66

Given series:

6, 10, 18, 30, 46, ?

Observe the pattern:

So, the next term will be 66.

Hence, the correct answer is "Option 2".

Q67. Answer: (d) JLP

Given letter-clusters:

GIL, KMP, VXA, JLP

Observe the alphabetical pattern:

For GIL,

For KMP,

For VXA,

In the first three letter-clusters, the pattern is:

First letter +2 → Second letter

Second letter +3 → Third letter

But in JLP,

the second gap is +4 instead of +3.

Therefore, JLP does not follow the pattern.

Hence, the correct answer is "Option 4".

Q68. Answer: (c) LJSR

Given:

MGRC → HCOA

VOWB → QKTZ

Observe the pattern:

For, MGRC → HCOA

The same pattern is followed in:

For, VOWB → QKTZ

So, apply the same logic to QNVT.

Therefore,

QNVT → LJSR

Hence, the correct answer is "Option 3".

Q69. Answer: (d) One

Given:

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

• A sits to the immediate left of F.

• C sits third to the left of E.

• C is an immediate neighbour of F.

• D sits to the immediate left of B.

Between B and C, only one person (D) sits.

Hence, the correct answer is "One" (Option 4).

Q70. Answer: (b) TWY−CFH

The logic followed here is:

Logic: Each letter in the second cluster is obtained by adding 9 to the positional value of the corresponding letter in the first cluster.

For VYA − EHJ:

For HKM − QTV:

The pattern observed is: (First cluster letters) + 9 = (Second cluster letters).

Similarly, let's check the options for the same pattern:

Option (2) TWY − CFH:

Therefore, the pair 'TWY − CFH' follows the same pattern.

Hence, the correct answer is "Option 2".

Q71. Answer: (a) HGIM

Given:

JIKO → ZYAE

VUWA → LKMQ

Observe the pattern:

For, JIKO → ZYAE

For, VUWA → LKMQ

Now apply the same logic to RQSW:

Therefore,

RQSW → HGIM

Hence, the correct answer is "Option 1".

Q72. Answer: (c) 823

Shortcut Trick

Swap signs: ÷ → ×, + → −, × → ÷, − → +.

New expression: 79 × 7 − 464 ÷ 4 + 386.

Apply unit digit logic: (9 × 7) − (Unit digit of 464 ÷ 4) + 6.

Unit digit calculation: 3 − 6 + 6 = 3.

Among the options, only 823 ends with the digit 3.

Therefore The correct answer is 823.

Alternate Method

Given expression: 79 ÷ 7 + 464 × 4 − 386

Interchanging '+' with '−' and '×' with '÷':

=> 79 × 7 − 464 ÷ 4 + 386

According to BODMAS rule (Division → Multiplication → Addition → Subtraction):

=> 79 × 7 − 116 + 386

=> 553 − 116 + 386

=> 437 + 386

=> 823

Therefore The correct answer is 823.

Additional Information

BODMAS Rule

Standard order for operations: Brackets, Orders (powers/roots), Division, Multiplication, Addition, and Subtraction.

Mathematical Sign Interchange

Always rewrite the complete expression after replacing all specified symbols before starting any arithmetic calculations.

Unit Digit Method

Useful for saving time by calculating only the last digit of the final result to match with the given options.

Q73. Answer: (a) 100

Logic followed here is: The value for each subsequent number in the series is determined by subtracting a difference that decreases by a constant value of 3 at each step.

Therefore, the code for '?' is 100.

Hence, the correct answer is "Option 1".

Q74. Answer: (a) 1

Given:

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

• Only three people sit between D and E.

• B sits to the immediate left of E.

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• No one sits to the right of G.
• Only two people sit between G and B.
• A sits to the immediate right of F.
Only G sits to the right of C.
Therefore, 1 person sits to the right of C.
Hence, the correct answer is "Option 1".

Q75. Answer: (b) 3

Given:
A, B, C, D, E, F and G are sitting around a circular table facing the centre.
• A is an immediate neighbour of both E and B.
• B sits third to the left of F.
• D sits to the immediate left of F.
• G is not an immediate neighbour of B.
Now count from the right of G:
From G, moving towards the right:
G → B → A → E → C
People between G and C are:
B, A and E
So, 3 people sit between C and G when counted from the right of G.
Hence, the correct answer is "Option 2".

Q76. Answer: (d) 6

Given:
Total students in the class = 31
Pooja is 9^(th) from the right end.
Position of Pooja from the left end:
= 31 − 9 + 1
= 23
So, Pooja is 23^(rd) from the left end.
Tanya is 16^(th) from the left end.
Now find the number of people between them:
= 23 − 16 − 1
= 6
Therefore, 6 people stand between Pooja and Tanya.
Hence, the correct answer is "Option 4".

Q77. Answer: (b) 10

Logic followed here is to arrange the digits of the given number in ascending order and then find the sum of the specified positions.
Given Number:

1	**7**	**4**	**8**	**5**	**6**	**3**

Arranging the digits in ascending order:

1	**3**	**4**	**5**	**6**	**7**	**8**

New number formed = 1345678
Identifying the required digits:
→ Digit which is second from the left = 3
→ Digit which is second from the right = 7
=> Sum of these digits = 3 + 7 = 10
Hence, the correct answer is "Option 2".

Q78. Answer: (b) 3

Logic followed here is: Arrange the given numbers in descending order (from highest to lowest) and compare the new arrangement with the original sequence to determine how many numbers remain in the same position.

Original Sequence →

1^(st)	2^(nd)	3^(rd)	4^(th)	5^(th)
458	625	751	359	245

Descending Order Arrangement →

1^(st)	2^(nd)	3^(rd)	4^(th)	5^(th)
751	625	458	359	245

The pattern observed is that the following numbers have not changed their positions:

1) 625 remains at the 2^(nd) position.

2) 359 remains at the 4^(th) position.

3) 245 remains at the 5^(th) position.

There are 3 such numbers whose positions remain unchanged.

Hence, the correct answer is "Option 3".

Q79. Answer: (a) fy

Given:

“trust builds bond” → “zn fy tk”

“keep your trust” → “fy ep rb”

Therefore, ‘trust’ is coded as ‘fy’.

Hence, the correct answer is "Option 1".

Q80. Answer: (b) (83, 107, 155)

The logic applied here is:

(Third number - Second number) = 2 × (Second number - First number)

Given sets:

(15, 39, 87)

(27, 51, 99)

Observe the pattern:

87 − 39 = 48

39 − 15 = 24

48 = 2 × 24

Similarly,

99 − 51 = 48

51 − 27 = 24

Again,

48 = 2 × 24

Now check the options:

Option 1: (49, 73, 122)

122 − 73 = 49

73 − 49 = 24

49 ≠ 2 × 24

Option 2: (83, 107, 155)

155 − 107 = 48

107 − 83 = 24

48 = 2 × 24

Option 3: (72, 95, 143)

143 − 95 = 48

95 − 72 = 23

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48 ≠ 2 × 23

Option 4: (55, 79, 128)

128 − 79 = 49

79 − 55 = 24

49 ≠ 2 × 24

Therefore, the correct set is:

(83, 107, 155)

Hence, the correct answer is "Option 2".

Q81. Answer: (a) New Delhi

The correct answer is New Delhi.

Key Points

• The National Conference on ‘Opportunities of Defence Manufacturing in the Country’ was organized in New Delhi on October 7, 2025.

• The primary objective of the conference was to bring together policy makers, industry leaders, and Defence Public Sector Undertakings (DPSUs) to discuss the roadmap for achieving self-reliance in the defence sector.

• The event highlighted the importance of the Aatmanirbhar Bharat initiative, aiming to reduce dependency on imports and establish India as a global defence manufacturing hub.

• During the conference, discussions were held regarding the enhancement of private sector participation and the role of MSMEs in the defence supply chain. Hence, the correct answer is New Delhi.

Additional Information

• Strategic Significance of the Venue:

• New Delhi serves as the administrative heart of India, housing the Ministry of Defence and the headquarters of the Indian Armed Forces, making it the ideal location for high-level policy deliberations.

• Hosting such conferences in the national capital ensures immediate coordination between the Government of India and various international and domestic stakeholders.

• Defence Industrial Corridors:

• To promote domestic production, the government has established two Defence Industrial Corridors in Uttar Pradesh and Tamil Nadu.

• These corridors are designed to provide a specialized ecosystem for aerospace and defence manufacturing, attracting investments from both global and local firms.

• Innovations for Defence Excellence (iDEX):

• Launched in April 2018, iDEX aims to foster innovation and technology development in the Defence and Aerospace sector by engaging startups, individual innovators, and R&D institutes.

• The scheme provides grants and support to develop cutting-edge technologies that can be utilized by the Indian military.

• Defence Acquisition Procedure (DAP) 2020:

• The DAP 2020 was formulated to simplify the procurement process and prioritize the ‘Make in India’ initiative.

• It includes categories like Buy (Indian-IDDM), which focuses on products that are indigenously designed, developed, and manufactured.

Important Points

• Defence Exports: India has set an ambitious target to achieve defence exports worth Rs. 35,000 crore (US$ 5 billion) by the year 2025.

• Foreign Direct Investment (FDI): The FDI limit in the defence sector has been enhanced to 74% through the Automatic Route for companies seeking new industrial licenses, and up to 100% through the Government Route where it is likely to result in access to modern technology.

• Positive Indigenisation Lists: The Ministry of Defence has notified several Positive Indigenisation Lists, which consist of items that will be barred from import beyond specified timelines to encourage domestic procurement.

• Budgetary Allocation: In recent years, the Union Budget has consistently increased the allocation for domestic capital procurement to provide a guaranteed market for Indian defence manufacturers.

Q82. Answer: (c) 171 million

The correct answer is 171 million.

Key Points

• According to World Bank data and research papers analyzing the Household Consumption Expenditure Survey (HCES) 2022-23, India lifted approximately 171 million people out of extreme poverty between 2011-12 and 2022-23.

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• The extreme poverty headcount ratio in India, measured at the international poverty line of $2.15 per day (2017 PPP), declined significantly from 18.7% in 2011-12 to 6.4% in 2022-23.

• This decline indicates a steady reduction in poverty despite the economic shocks caused by the COVID-19 pandemic, showcasing the resilience of the Indian economy and the effectiveness of social safety nets.

• The World Bank estimates suggest that rural poverty saw a sharper decline compared to urban poverty during this decade, narrowing the gap between rural and urban living standards.

• The data utilized for these estimates comes from the National Sample Survey Office (NSSO), which released the HCES 2022-23 after a gap of more than a decade since the last official survey in 2011-12.

Additional Information

• International Poverty Line: The World Bank updated the global poverty line in September 2022 to $2.15 per person per day. This is based on 2017 Purchasing Power Parities (PPP) and reflects the value of the $1.90 line (2011 PPP) in 2017 prices.

• Purchasing Power Parity (PPP): This is a metric used to compare the buying power of different currencies, allowing economists to compare economic productivity and standards of living between countries by adjusting for local costs.

• Sustainable Development Goals (SDG): The reduction of poverty is the primary goal of SDG 1 (No Poverty), which aims to eradicate extreme poverty for all people everywhere by 2030.

• Multidimensional Poverty Index (MPI): Unlike income-based poverty, the MPI (tracked by NITI Aayog in India and UNDP globally) measures deprivations in health, education, and living standards. India has seen nearly 24.8 crore people escape multidimensional poverty over a similar nine-year period.

Important Points

• Government Schemes: Programs such as the Pradhan Mantri Garib Kalyan Anna Yojana (PMGKAY), which provides free food grains to over 80 crore people, have played a critical role in preventing households from slipping back into poverty during crises.

• Rural Development: Increased spending on infrastructure, the Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA), and the Pradhan Mantri Awas Yojana (PMAY) have been cited as key drivers for the poverty reduction in rural areas.

• Data Gap: Since the 2017-18 consumer expenditure survey was not released by the Government of India due to "data quality issues," the 2022-23 survey serves as the first official benchmark in 11 years to measure poverty trends accurately.

• Poverty and Inequality Platform (PIP): This is the World Bank's interactive tool that provides the latest estimates for global poverty and inequality based on the most recent available data for various countries.

Q83. Answer: (d) Pakistan and Pakistan occupied Kashmir

The correct answer is Pakistan and Pakistan occupied Kashmir.

Key Points

• Operation SINDOOR was a high-stakes military counter-terrorism operation launched by the Indian Armed Forces in the year 2025.

• The operation was initiated as a direct retaliatory response to a major terror attack targeting Indian security installations, aiming to dismantle the infrastructure of terror.

• The primary targets of this operation were identified as terrorist training camps and active launch pads located deep within Pakistan and across the Line of Control (LoC) in Pakistan occupied Kashmir (PoK). Hence, the correct answer is Pakistan and Pakistan occupied Kashmir.

• This mission utilized advanced surveillance and precision-strike capabilities to ensure maximum impact on the terror modules while minimizing collateral damage.

• The execution of Operation SINDOOR reflects India's evolved military doctrine of proactive deterrence, shifting from a defensive posture to one of "pre-emptive" strikes against cross-border threats.

Additional Information

• Pakistan occupied Kashmir (PoK):

• PoK is a region that has been under the administrative control of Pakistan since the 1947 conflict, but is considered an integral part of India by the Indian government.

• It consists of two main administrative parts: Azad Jammu and Kashmir (AJK) and Gilgit-Baltistan.

• The region is strategically significant due to its geographical location, sharing borders with Afghanistan and China.

• Historical Counter-Terror Operations:

• 2016 Surgical Strikes: Conducted by the Indian Army in response to the Uri attack, targeting launch pads in PoK.

• Operation Bandar (2019): An aerial strike conducted by the Indian Air Force (IAF) on a Jaish-e-Mohammed (JeM) camp in Balakot, located in the Khyber Pakhtunkhwa province of Pakistan.

• These operations signify the "New India" policy of providing a "befitting reply" to acts of state-sponsored terrorism.

• Tactical Significance:

• Modern operations like Operation SINDOOR often involve the use of Unmanned Aerial Vehicles (UAVs), Electronic Warfare

(EW), and satellite imagery provided by ISRO for pinpoint accuracy.

• Such strikes are intended to disrupt the logistics and communication channels of extremist organizations like Lashkar-e-Taiba (LeT) and JeM.

Important Points

• Geopolitical Context: The launch of Operation SINDOOR in 2025 occurred amidst heightening tensions and was justified under the Right to Self-Defense as per Article 51 of the United Nations Charter.

• Line of Control (LoC): The LoC serves as the de facto border between India and Pakistan in the region of Jammu and Kashmir, and most cross-border operations are focused on this 740-km long boundary.

• Strategic Impact: Beyond the immediate destruction of camps, such operations serve as a psychological deterrent and demonstrate technological superiority in the South Asian theater.

Q84. Answer: (b) Madhav National Park, Madhya Pradesh

The correct answer is Madhav National Park, Madhya Pradesh.

Key Points

• Madhav National Park, located in the Shivpuri district of Madhya Pradesh, was officially designated as India’s 58th Tiger Reserve in March 2025.

• The notification was issued by the Ministry of Environment, Forest and Climate Change (MoEFCC) following the final approval from the National Tiger Conservation Authority (NTCA).

• This declaration makes Madhya Pradesh the state with the highest number of tiger reserves in India, bringing its total count to 8 (including Kanha, Bandhavgarh, Panna, Pench, Satpura, Sanjay-Dubri, and Veerangana Durgavati).

• The initiative is part of a broader conservation strategy to reintroduce and stabilize tiger populations in the Gwalior-Chambal region and create a functional wildlife corridor connecting Ranthambore Tiger Reserve in Rajasthan with Kuno National Park and Madhav National Park.

• Historically, Madhav National Park was the shooting reserve of the Maharajas of Gwalior; it was granted the status of a National Park in 1958. Hence, the correct answer is Madhav National Park, Madhya Pradesh.

Additional Information

• Project Tiger:

• Launched on April 1, 1973, from Jim Corbett National Park, it is a centrally sponsored scheme aimed at ensuring a viable population of Bengal Tigers in their natural habitats.

• The project has expanded from an initial 9 reserves to 58 reserves as of 2025, covering over 2% of India's geographical area.

• National Tiger Conservation Authority (NTCA):

• The NTCA is a statutory body under the Ministry of Environment, Forest and Climate Change, constituted under the enabling provisions of the Wildlife (Protection) Act, 1972, as amended in 2006.

• It provides statutory authority to Project Tiger and oversees the management and protection of tiger reserves across various states.

• Tiger Census in India:

• India conducts a nationwide Tiger Census every four years using the M-STrIPES (Monitoring System for Tigers - Intensive Protection and Ecological Status) application.

• According to the 2022 Tiger Census, India is home to approximately 3,682 tigers, which constitutes about 75% of the global wild tiger population.

• Geography of Madhav National Park:

• The park is situated in the Vindhyan Hills and features a diverse ecosystem consisting of dry deciduous forests and flat grasslands.

• It is home to the Sakhya Sagar and Madhav Sagar lakes, which are designated Ramsar Sites, providing a crucial habitat for migratory birds and crocodiles.

Important Points

• Status of Other Options:

• Ramgarh Vishdhari National Park (Rajasthan) was notified as India's 52nd Tiger Reserve in May 2022.

• Orang National Park (Assam) was declared a tiger reserve in 2016, becoming the 49th in the country.

• Guru Ghasidas National Park (Chhattisgarh) and Tamor Pingla Wildlife Sanctuary were combined to be declared the 56th Tiger Reserve in late 2024.

• Significance of Notification:

• Being declared a Tiger Reserve allows the park to receive dedicated funding and specialized protection forces under Project Tiger, enhancing anti-poaching measures and habitat management.

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Q85. Answer: (b) 23rd March

The correct answer is 23rd March.

Key Points

• Martyrs' Day, also known as Shaheed Diwas, is observed on 23rd March every year to pay homage to the great revolutionaries Bhagat Singh, Shivaram Rajguru, and Sukhdev Thapar.

• On this day in 1931, these three young freedom fighters were hanged by the British Government in the Lahore Central Jail.

• They were executed for their involvement in the Lahore Conspiracy Case, specifically for the assassination of British police officer John Saunders in 1928 to avenge the death of Lala Lajpat Rai.

• Although the execution was originally scheduled for 24th March 1931, the British authorities carried it out 11 hours early, on the evening of 23rd March, due to the fear of a massive public uprising.

• The bodies of the three martyrs were secretly cremated by the authorities near the Sutlej River in Ferozepur, Punjab.

• While 30th January is observed as Martyrs' Day to mark the assassination of Mahatma Gandhi in 1948, 23rd March is specifically dedicated to the sacrifice of these three revolutionaries. Hence, the correct answer is 23rd March.

Additional Information

• Bhagat Singh and the HSRA:

• Bhagat Singh was a charismatic Indian revolutionary who played a crucial role in the Hindustan Socialist Republican Association (HSRA), which was founded in 1928 at Feroz Shah Kotla, Delhi.

• In April 1929, Bhagat Singh and Batukeshwar Dutt threw non-lethal bombs into the Central Legislative Assembly to protest against the Public Safety Bill and the Trade Dispute Bill.

• Their intent was not to kill but "to make the deaf hear," and they surrendered voluntarily to use the court trials as a platform to spread their revolutionary ideas.

• Other Significant Dates in the Options:

• 13th April: This date marks the Jallianwala Bagh Massacre that occurred in 1919 in Amritsar, where British troops under General Dyer fired on a peaceful gathering.

• 9th August: This date is associated with the launch of the Quit India Movement in 1942 and the Kakori Train Action (Conspiracy) in 1925.

• 15th March: This day is observed as World Consumer Rights Day globally, but it does not hold a specific national Martyrs' Day status in India.

• Other Martyrs' Days in India:

• 21st October: Observed as Police Martyrs' Day (Police Commemoration Day) to remember the policemen killed by Chinese troops at Hot Springs in Ladakh in 1959.

• 17th November: Observed in Odisha to commemorate the death anniversary of Lala Lajpat Rai, the "Lion of Punjab."

• 19th November: The birthday of Rani Lakshmibai is often observed as Martyrs' Day in the region of Jhansi to honor those who fell in the Rebellion of 1857.

Important Points

• Legal Background: The trio was tried under a special tribunal constituted by the Viceroy Lord Irwin through an ordinance, bypassing the regular court process to ensure a swift execution.

• Legacy: The slogan "Inquilab Zindabad" (Long Live the Revolution) was popularized by Bhagat Singh and became the war cry of the Indian independence movement.

• National Tribute: Every year, the Prime Minister and other leaders pay floral tributes at the National Martyrs Memorial located in Hussainiwala (Ferozepur district, Punjab), where the trio was cremated.

Q86. Answer: (c) Rio de Janeiro

The correct answer is Rio de Janeiro.

Key Points

• Brazil officially assumed the Presidency of the BRICS group for the year 2025, succeeding Russia, which held the chairmanship in 2024.

• The 17th BRICS Summit is scheduled to be hosted in the city of Rio de Janeiro on 6–7 July 2025.

• The summit in Rio de Janeiro represents the first major gathering of the expanded BRICS+ bloc under Brazilian leadership, following the historic expansion that included Egypt, Ethiopia, Iran, and the United Arab Emirates (UAE).

• The Brazilian Chairmanship has prioritized themes such as global governance reform, sustainable development, and energy transition as part of the 2025 agenda.

• The choice of Rio de Janeiro, a major cultural and economic hub, aligns with Brazil's strategy to showcase its international standing and its role in South-South cooperation. Hence, the correct answer is Rio de Janeiro.

Additional Information

• Evolution of BRICS:

• The acronym BRIC was first coined in 2001 by Jim O'Neill of Goldman Sachs to identify the fast-growing economies of Brazil, Russia, India, and China.

• The first formal summit took place in Yekaterinburg, Russia, in June 2009. South Africa was invited to join the group in December 2010, turning the acronym into BRICS.

• Brasilia:

• As the federal capital of Brazil, Brasilia has hosted several high-level diplomatic events, including the 11th BRICS Summit in November 2019.

• It remains the center for administrative and legislative decisions but was not the primary host city for the July 2025 summit.

• Sao Paulo:

• Known as the financial heart of Brazil and the most populous city in the Southern Hemisphere, Sao Paulo frequently hosts BRICS Business Forums and financial track meetings.

• It plays a vital role in trade relations and foreign direct investment within the bloc.

• Manaus:

• Located in the Amazon region, Manaus often serves as a venue for BRICS discussions related to environmental policy, biodiversity, and the bio-economy.

• It is a key location for Brazil's environmental diplomacy but does not serve as the main 2025 summit host.

Important Points

• New Development Bank (NDB): Established during the 6th BRICS Summit in Fortaleza, Brazil (2014), the NDB is headquartered in Shanghai, China. It provides funding for infrastructure and sustainable projects in emerging markets.

• Contingent Reserve Arrangement (CRA): A framework established by BRICS nations to provide liquidity support and protection against global financial pressures, strengthening the financial safety net of member states.

• Rotation Policy: The Chairmanship of BRICS rotates annually among members according to the acronym. Following Brazil in 2025, the presidency will move to Russia (based on the updated rotation including new members).

• BRICS+ Expansion: The 15th Summit in Johannesburg (2023) led to the invitation of new members, significantly increasing the bloc's share of the global GDP and world population.

Q87. Answer: (c) Guillaume Bonn

The correct answer is Guillaume Bonn.

Key Points

• Guillaume Bonn is the author of 'Paradise Inc.', a compelling work that utilizes both memoir and photojournalism to provide a critical look at the state of Africa today.

• The book specifically critiques Western conservation models, arguing that many modern environmental efforts in Africa are extensions of colonial-era mindsets that exclude indigenous voices.

• Through his photography and writing, Guillaume Bonn illustrates how the creation of protected areas often leads to the displacement of local communities, a phenomenon he links to neocolonialism.

• The narrative serves as a first-person account of his experiences living and working on the continent, moving beyond simple travelogue to address deep-seated political and environmental issues.

• The work challenges the "White Savior" narrative frequently associated with wildlife preservation, suggesting that true conservation must involve the people who live alongside the wildlife. Hence, the correct answer is Guillaume Bonn.

Additional Information

• Guillaume Bonn:

• He is a third-generation French-Swiss born in Madagascar and has spent more than three decades documenting conflict and environmental change in Africa.

• He was a contributor to The New York Times, Vanity Fair, and Newsweek, winning several awards for his photojournalism.

• His other significant works include 'The Last Safari' and 'Mal d'Afrique', which explore the decolonization of the African landscape and the vanishing colonial architecture.

• Fortress Conservation:

• This is the specific model critiqued by Guillaume Bonn in 'Paradise Inc.'. It is an environmental protection strategy based on the belief that biodiversity is best preserved by creating national parks free of human habitation.

• Critics argue this model ignores human rights and treats local African tribes as threats to the environment rather than its custodians.

• Other Authors Mentioned:

• Nell Stevens: A British writer known for her unique approach to memoir and biography, such as Mrs Gaskell and Me and Bleaker House.

• Colum McCann: A world-renowned Irish novelist based in New York, famous for Apeirogon and Let the Great World Spin.

• Banu Mushtaq: A distinguished Indian writer and activist who primarily writes in Kannada, focusing on social justice and women's rights.

Important Points

• Theme of Post-Colonialism: 'Paradise Inc.' is highly regarded in environmental humanities for its analysis of how Western NGOs and governments dictate ecological policy in Global South countries.

• Visual Documentation: As a photojournalist, Guillaume Bonn uses images of luxury lodges contrasted with impoverished local villages to highlight the economic disparity created by the tourism-driven conservation industry.

• Geographic Focus: Much of the work focuses on East Africa, particularly Kenya and Tanzania, where the safari industry is a major part of the GDP but often comes at a high social cost.

Q88. Answer: (d) Relaxation on loan repayments

The correct answer is Relaxation on loan repayments.

Key Points

• In August 2025, Indian export bodies and trade associations formally approached the Government of India and the Reserve Bank of India (RBI) to seek immediate financial relief due to the imposition of restrictive US tariffs on Indian goods.

• The primary demand was the Relaxation on loan repayments, which includes a request for a moratorium on principal and interest payments for a specified period to help businesses manage a severe liquidity crunch.

• Exporters highlighted that the high tariffs in the United States have significantly reduced their profit margins and disrupted cash flows, making it difficult to adhere to original debt servicing schedules.

• The request specifically targets the extension of the pre-shipment and post-shipment export credit cycles from the current 270 days to up to 15 months, allowing more time for the realization of export proceeds.

• By securing a relaxation in repayments, exporters aim to prevent their accounts from being classified as Non-Performing Assets (NPAs), which would otherwise restrict their access to future working capital.

Additional Information

• Impact of US Tariffs: The United States is one of India's largest trading partners. When the US government imposes tariffs under Section 232 (national security) or Section 301 (unfair trade practices), it makes Indian products like steel, aluminum, and textiles more expensive for American consumers, leading to a decline in export volume.

• Role of the RBI: As the central bank, the RBI has the authority to issue circulars under the Prudential Framework for Resolution of Stressed Assets. This allows banks to restructure loans for stressed sectors without immediate downgrading of the asset quality.

• Export Credit Guarantee Corporation (ECGC): The ECGC provides credit risk insurance to exporters. During trade disputes, the role of ECGC becomes vital in protecting exporters against the risk of non-payment by foreign buyers affected by domestic policy changes.

• MSME Vulnerability: Small and Medium Enterprises (MSMEs) contribute nearly 45% of India's total exports. These units are the most vulnerable to financial strain caused by international tariffs because they lack the capital reserves to absorb sudden economic shocks.

Important Points

• Comparison of Relief Measures: While a complete write-off of loans (Option 1) would be a direct subsidy, it is rarely implemented as it burdens the banking sector's balance sheet. Relaxation on repayments is preferred as it provides a temporary cushion while maintaining the obligation to repay.

• Retaliatory Measures: Measures like import bans on US goods (Option 2) or increases in export tariffs (Option 3) are trade policy tools managed by the Directorate General of Foreign Trade (DGFT) and the Ministry of Commerce, but they do not provide the immediate financial liquidity required by struggling firms.

• Interest Equalization Scheme: Exporters often utilize this scheme to receive interest subvention on credit. In 2025, alongside repayment relaxation, there were also calls to increase the subvention rates to 5% for all MSME manufacturers to offset increased operational costs.

Q89. Answer: (a) National Institute of Immunohaematology

The correct answer is National Institute of Immunohaematology.

Key Points

• The ICMR-National Institute of Immunohaematology (NIIH), located in Mumbai, has developed an indigenously made point-of-care (POC) test kit for the early diagnosis of Haemophilia A and Von Willebrand Disease (VWD).

• This development is a significant milestone in India's healthcare sector, as it addresses the challenge of diagnosing these bleeding disorders in resource-limited settings where sophisticated laboratory facilities are unavailable.

• The kit is designed to be cost-effective and portable, allowing for rapid testing at the bedside or in small clinics, which is crucial for timely clinical management.

• Traditionally, diagnosing these conditions requires expensive and time-consuming tests like Factor VIII assays or VWF antigen tests, which are often restricted to tertiary care hospitals in major cities.

• The National Institute of Immunohaematology is a premier research institute under the Indian Council of Medical Research (ICMR), focusing on hematology, immunology, and transfusion medicine.

Additional Information

• Haemophilia A:

• It is a genetic disorder caused by a missing or defective clotting factor VIII, a protein necessary for blood to clot.

• Patients with this condition experience prolonged bleeding after an injury and are at risk of internal bleeding, particularly in the joints and muscles.

• The condition primarily affects males, as the gene for Factor VIII is located on the X chromosome.

• Von Willebrand Disease (VWD):

• This is the most common inherited bleeding disorder globally, caused by a deficiency or dysfunction of the Von Willebrand Factor (VWF).

• The VWF protein helps platelets clump together and stick to the blood vessel wall, which is the first step in the blood clotting process.

• Unlike Haemophilia, VWD affects both males and females equally and often presents with symptoms like frequent nosebleeds, bruising, and heavy menstrual bleeding.

• Indian Council of Medical Research (ICMR):

• It is the apex body in India for the formulation, coordination, and promotion of biomedical research.

• Headquartered in New Delhi, it is one of the oldest medical research bodies in the world, funded by the Government of India through the Department of Health Research.

Important Points

• Point-of-Care (POC) Testing: This refers to medical diagnostic testing performed at or near the time and place of patient care. It eliminates the need to send samples to a centralized laboratory, thereby reducing the turnaround time for results.

• Epidemiological Context: India is estimated to have a high burden of Haemophilia patients, but many remain undiagnosed due to the lack of diagnostic infrastructure. The new kit aims to bridge this diagnostic gap.

• Socio-Economic Impact: By reducing the cost of diagnosis from several thousands of rupees to a fraction of the cost, this kit makes healthcare more accessible to the underprivileged sections of society.

• Future Applications: The success of this indigenous technology paves the way for developing similar kits for other rare hematological disorders, supporting the Make in India initiative in the medical devices sector.

Q90. Answer: (b) ICICI Bank

The correct answer is ICICI Bank.

Key Points

• ICICI Bank, one of India's leading private sector lenders, has implemented a substantial revision in its minimum balance requirements for specific branch categories.

• For new customers opening accounts in semi-urban segment branches, the Average Monthly Balance (AMB) requirement has been increased to Rs. 25,000.

• This marks a significant jump from the earlier requirement of Rs. 5,000, representing a five-fold increase in the threshold for semi-urban areas.

• The revised policy is set to come into effect starting from August 1, 2025. Hence, the correct answer is ICICI Bank.

• Such adjustments are often made by private banks to align with their operational costs and to target specific customer segments that maintain higher liquidity in their accounts.

Additional Information

• ICICI Bank (Industrial Credit and Investment Corporation of India):

• It is a prominent Indian multinational bank and financial services company headquartered in Mumbai, Maharashtra.

• The bank was originally promoted in 1955 by the World Bank, the Government of India, and representatives of Indian industry.

• The current Managing Director and CEO of the bank is Sandeep Bakhshi.

• It offers a wide range of banking products and financial services to corporate and retail customers through a variety of delivery channels and specialized subsidiaries.

• Branch Classification in India:

• The Reserve Bank of India (RBI) classifies bank branches based on population. Semi-urban branches are typically located in centers with a population of 10,000 to less than 1,00,000.

• Rural centers have a population up to 9,999, while Urban centers range from 1,00,000 to 9,99,999, and Metropolitan centers have 10,00,000 and above.

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• Average Monthly Balance (AMB):

• AMB is the minimum average balance a customer is required to maintain in their savings account over a month to avoid non-maintenance charges.

• It is calculated by adding the closing balance of each day in the month and dividing the total by the number of days in that month.

Important Points

• Comparison with Public Sector Banks:

• In contrast to private players like ICICI Bank or HDFC Bank, public sector banks like the State Bank of India (SBI) have largely moved away from AMB penalties.

• SBI waived the Average Monthly Balance requirement for all Savings Bank Accounts in March 2020 to encourage financial inclusion and provide relief to its vast customer base.

• Impact on Customers:

• High minimum balance requirements can act as a barrier for low-income individuals in semi-urban areas, potentially shifting them toward Public Sector Banks or Small Finance Banks.

• Failure to maintain the required Rs. 25,000 after the August 1, 2025 deadline will lead to penal charges, which vary based on the percentage of the shortfall.

Q91. Answer: (c) Prithvi-II, Agni-I

The correct answer is Prithvi-II, Agni-I.

Key Points

• India achieved a significant milestone in strategic deterrence by successfully testing the Prithvi-II and Agni-I missile systems within a narrow 24-hour window in July 2025.

• These consecutive tests were conducted as part of the routine user training launches by the Strategic Forces Command (SFC) to validate the operational readiness and technical parameters of India's nuclear-capable arsenal.

• The launches took place from the Integrated Test Range (ITR) at Chandipur and APJ Abdul Kalam Island off the coast of Odisha, demonstrating seamless coordination and logistical efficiency of the defense forces.

• The Prithvi-II test confirmed its high degree of precision and reliability for short-range targets, while the Agni-I test reinforced the strength of India's medium-range strike capabilities. Hence, the correct option is Prithvi-II, Agni-I.

Additional Information

• Prithvi-II Missile:

• It is a surface-to-surface short-range ballistic missile (SRBM) developed by the DRDO under the Integrated Guided Missile Development Programme (IGMDP).

• The missile is powered by liquid propulsion twin engines and has a strike range of approximately 350 km.

• It is capable of carrying 500 kg to 1000 kg of warheads and uses an advanced inertial guidance system with maneuvering trajectories to hit its target.

• Agni-I Missile:

• Agni-I is a medium-range ballistic missile (MRBM) that serves as a critical component of India's credible minimum deterrence.

• It utilizes a single-stage solid-fuel engine, which allows for quicker mobilization and launch compared to liquid-fueled systems.

• The missile has a range of 700 km to 1200 km and is designed to be road-mobile, enhancing its survivability during conflict.

• Strategic Forces Command (SFC):

• Formed in January 2003, the SFC is part of India's Nuclear Command Authority (NCA).

• It is responsible for the management and administration of the country's tactical and strategic nuclear weapons stockpile.

• The SFC ensures that the "no-first-use" policy of India is backed by a robust and ready delivery system.

• Significance of Testing:

• Testing multiple systems within 24 hours signals to global observers the high level of automation and readiness of India's missile silos and mobile launchers.

• The data gathered from these tests in 2025 helps DRDO scientists refine guidance systems and re-entry technologies for future iterations like Agni-Prime.

Important Points

• Integrated Test Range (ITR): Located in Odisha, this facility provides the necessary infrastructure for performance evaluation of various missiles and rockets.

• Nuclear Triad: India possesses the capability to launch nuclear weapons from land, air, and sea (via INS Arihant), and these missile tests are essential for the land-based leg of the triad.

• Other Missiles: While Agni-V has an intercontinental range (ICBM) of over 5000 km, and BrahMos is a supersonic cruise missile, they were not the specific systems tested in this particular 24-hour window in July 2025.

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Q92. Answer: (b) 2030

The correct answer is 2030.

Key Points

• The Government of Haryana has set a definitive target to achieve zero stubble burning (parali burning) incidents in the state by the year 2030. This commitment is aligned with the state's broader environmental and climate action goals.

• This target is a crucial component of the Haryana State Action Plan on Climate Change (SAPCC), which focuses on reducing the carbon footprint and improving the Air Quality Index (AQI) across the region, particularly affecting the National Capital Region (NCR). Hence, the target year is 2030.

• To achieve this, the state has implemented a robust monitoring mechanism using geospatial technology and satellite data provided by the Haryana Space Applications Centre (HARSAC) to identify Active Fire Locations (AFLs) in real-time.

• The plan emphasizes a transition from traditional disposal methods to sustainable practices, offering financial incentives to farmers. The government provides an incentive of Rs 1,000 per acre to farmers for not burning crop residue and for its proper management.

• The strategy involves the large-scale deployment of Crop Residue Management (CRM) machinery, including Super Seeders, Happy Seeders, Straw Choppers, and Reversible Mould Board Ploughs, with subsidies ranging from 50% to 80% for individual farmers and Custom Hiring Centres (CHCs).

Additional Information

• Impact of Stubble Burning:

• Stubble burning is a major contributor to particulate matter (PM2.5 and PM10) emissions during the months of October and November. This practice occurs primarily during the short window between the harvesting of paddy and the sowing of wheat.

• Beyond air pollution, burning crop residue destroys essential soil nutrients like Nitrogen, Phosphorus, and Potassium, and kills beneficial soil micro-organisms, leading to long-term soil degradation.

• In-situ and Ex-situ Management:

• In-situ management involves mixing the crop residue back into the soil using specialized machinery, which enhances soil fertility.

• Ex-situ management involves collecting the stubble for use in biomass power plants, bio-ethanol production, and the paper industry. Haryana has been promoting the establishment of Compressed Bio-Gas (CBG) plants to utilize surplus straw.

• Mera Pani Meri Virasat Scheme:

• Launched by the Haryana government, this scheme encourages farmers to switch from paddy (a water-intensive crop) to alternative crops like maize, pulses, and oilseeds.

• By diversifying crops, the state aims to reduce the total area under paddy cultivation, thereby naturally reducing the volume of stubble generated in districts like Karnal, Kaithal, and Fatehabad.

• Legal and Regulatory Framework:

• The Commission for Air Quality Management (CAQM) in the NCR and Adjoining Areas issues statutory directions to state governments to implement strict measures against stubble burning.

• Under the Environmental Protection Act, 1986, and orders from the National Green Tribunal (NGT), environmental compensation (fines) can be imposed on farmers who violate the ban on crop residue burning.

Q93. Answer: (d) Carlos Alcaraz

The correct answer is Carlos Alcaraz.

Key Points

• The Italian Open 2025 men's singles title was won by Carlos Alcaraz, the professional tennis player from Spain.

• The tournament was held in May 2025 at the prestigious Foro Italico in Rome, Italy.

• Played on Outdoor Red Clay, the event is a critical part of the ATP Masters 1000 circuit, which represents the highest tier of men's tennis tournaments after the Grand Slams.

• Carlos Alcaraz demonstrated exceptional skill and physical endurance throughout the 2025 edition to secure the championship. Hence, the correct answer is Carlos Alcaraz.

• This victory provided Alcaraz with 1,000 ATP ranking points, further solidifying his position at the top of the professional tennis rankings during the clay-court season.

Additional Information

• Carlos Alcaraz:

• He is a Spanish professional tennis player who became the youngest man to top the ATP rankings at the age of 19.

• Known for his aggressive baseline play and signature drop shots, he has won multiple Grand Slam titles including the US Open, Wimbledon, and the French Open.

• Jannik Sinner:

• A top-ranked Italian professional tennis player, Sinner was a major favorite for the 2025 home tournament.

• He is known for his incredible ball-striking ability and is currently a leading figure in the new generation of tennis stars.

• Rafael Nadal:

• Commonly referred to as the "King of Clay," Nadal holds the record for the most Italian Open titles, having won the tournament 10 times.

• His career includes 22 Grand Slam men's singles titles, including a record 14 French Open titles.

• Tan Ning:

• Tan Ning is a professional Badminton player from China, specializing in women's doubles.

• She is not a tennis player and does not compete in the ATP or WTA tennis circuits, making this option unrelated to the Italian Open tennis tournament.

• The Italian Open (Internazionali BNL d'Italia):

• Established in 1930, it is one of the oldest and most respected tennis tournaments in the world.

• It serves as a premier warm-up event for Roland Garros (the French Open), attracting the world's best players to Rome every year.

Q94. Answer: (a) Andrew Brownlee

The correct answer is Andrew Brownlee.

Key Points

• Andrew Brownlee made history in March 2025 by becoming the oldest player to make a debut in men’s international cricket.

• At the time of his debut, he was aged 62 years and 147 days, surpassing all previous records across the recognized formats of the game.

• He achieved this milestone while representing Greece (the Hellenic Cricket Federation) in a T20I (Twenty20 International) match against Bulgaria.

• The match was part of an international bilateral series or regional tournament recognized by the International Cricket Council (ICC). Hence, the statement regarding his age and debut is correct.

• His participation underscores the unique nature of Associate Member cricket, where veteran players often contribute significantly to the development of the sport in their respective countries.

Additional Information

• Osman Göker:

• Previously held the record for the oldest debutant in T20I cricket.

• He made his debut for Turkey against Romania in August 2023 at the age of 59 years and 181 days.

• Nolan Clarke:

• Holds the record for the oldest debutant in One Day International (ODI) cricket.

• He played his first ODI for the Netherlands during the 1996 Cricket World Cup at the age of 47 years and 240 days.

• James Southerton:

• The oldest player to debut in Test cricket history.

• He played in the very first Test match for England against Australia in 1877 at the age of 49 years and 119 days.

• ICC T20I Status:

• In 2019, the International Cricket Council (ICC) granted full T20 International status to all its 105 members.

• This policy ensured that matches played between Associate nations like Greece, Bulgaria, and Turkey are recorded as official international data.

Important Points

• International Cricket Records: The record for the oldest player to appear in an international match (not just debut) is often held by players from Associate nations in Europe and Asia.

• Greece Cricket: Cricket has a long history in Greece, particularly on the island of Corfu, dating back to the 19th century during the British protectorate.

• Physical Longevity: Andrew Brownlee's feat at the age of 62 is a rare example of athletic longevity in professional sports, especially in a high-intensity format like T20.

• Statistical Significance: Official cricket statistics maintain separate lists for oldest debutants and oldest players overall; Brownlee now tops the debutant list for all men’s international formats as of March 2025.

Q95. Answer: (d) INS Vagsheer

The correct answer is INS Vagsheer.

Key Points

• The Indian Navy officially commissioned INS Vagsheer on January 15, 2025. This submarine represents the sixth and final vessel of the Project-75 (P-75) Kalvari-class.

• The commissioning ceremony took place at the Naval Dockyard in Mumbai, marking a significant milestone in India's naval capabilities and domestic shipbuilding.

• INS Vagsheer was built by Mazagon Dock Shipbuilders Limited (MDL) in Mumbai, in technical collaboration with the Naval Group of France.

• The submarine is designed to operate in various naval theaters, capable of performing diverse missions such as anti-surface warfare, anti-submarine warfare, intelligence gathering, mine laying, and area surveillance.

• The naming of the submarine follows the naval tradition of resurrecting names of illustrious predecessors; it is named after the Sand Fish, a deadly deep-sea predator of the Indian Ocean.

Additional Information

• Project-75 and the Kalvari Class:

• Project-75 involved the construction of six Scorpene-class diesel-electric attack submarines.

• The first five submarines of this class already in active service are INS Kalvari (commissioned in 2017), INS Khanderi (2019), INS Karanj (2021), INS Vela (2021), and INS Vagir (2023).

• These submarines are known for their advanced stealth features, including superior acoustic absorption techniques, low radiated noise levels, and a hydro-dynamically optimized shape.

• Technical Specifications:

• INS Vagsheer is equipped with long-range guided torpedoes and tube-launched anti-ship missiles, providing it with a lethal "punch" to strike targets both on the surface and underwater.

• It features the Submarine Tactical Integrated Combat System (SUBTICS), which integrates all sensors and weapon systems for efficient combat management.

• The submarine can operate at high speeds and reach significant depths, making it difficult for enemy sensors to detect.

Important Points

• Historical Context: The original INS Vagsheer was a Vela-class (Soviet Foxtrot-class) submarine commissioned into the Indian Navy on December 26, 1974, and was decommissioned on April 30, 1997, after two decades of service.

• Atmanirbhar Bharat: The completion of the Project-75 series is a major boost to the "Make in India" and "Atmanirbhar Bharat" (Self-reliant India) initiatives, showcasing India’s prowess in complex underwater engineering.

• Strategic Impact: With the commissioning of INS Vagsheer, the Indian Navy enhances its maritime security posture in the Indian Ocean Region (IOR), ensuring better protection of sea lines of communication and deterrent capabilities against regional threats.

• Future Prospects: Following the completion of Project-75, the Indian government is moving forward with Project-75I, which aims to build even more advanced submarines with Air-Independent Propulsion (AIP) systems to increase underwater endurance.

Q96. Answer: (d) Rajkishore Parhi

The correct answer is Rajkishore Parhi.

Key Points

• The Sahitya Akademi announced the prestigious Bal Sahitya Puraskar for the year 2025 in June 2025, recognizing outstanding contributions to children's literature across multiple Indian languages.

• Rajkishore Parhi was named the winner in the Odia language category for his notable work titled "Kete Phula Phutichhi". Hence, the correct answer is Rajkishore Parhi.

• The book "Kete Phula Phutichhi" is a creative collection of children's poetry designed to engage young readers with rhythmic verses and imaginative themes.

• The selection was made by a three-member jury following a rigorous evaluation process of books published between 2019 and 2023.

• The award ceremony includes the presentation of a copper plaque and a financial prize of Rs. 50,000 to the author for their literary excellence.

Additional Information

• Sahitya Akademi Bal Sahitya Puraskar:

• This annual award was instituted in 2010 to promote and honor high-quality literature specifically written for children.

• It covers works in 24 languages, including those listed in the Eighth Schedule of the Constitution of India, along with English and Rajasthani.

• Other Winners of 2025:

• Mayur Khavdu: Won the award for the Gujarati language for the book "Gharu".

• Fagu Baskey: Recognized in the Santali category for the work "Sabaid".

• Subrat Senapati: While a prominent figure in literary circles, he was a nominee/contemporary in the selection process for Odia literature.

• Significance of the Award:

• The Sahitya Akademi aims to encourage authors to produce original and creative content in regional languages to preserve cultural heritage.

• The awards are traditionally announced alongside the Yuva Puraskar, which targets authors under the age of 35.

Important Points

• Selection Criteria: A book is eligible only if it is an original work by an Indian author and published for the first time during the five years preceding the award year.

• Odia Literature: The state of Odisha has a rich tradition of children's literature, and the win for Rajkishore Parhi marks another milestone in the global recognition of Odia poetry.

• Institution Profile: The Sahitya Akademi was inaugurated on March 12, 1954, and functions as an autonomous organization under the Ministry of Culture, Government of India.

• Award Impact: Winning the Bal Sahitya Puraskar often leads to the translation of the work into other Indian languages, broadening the reach of the author's message to children nationwide.

Q97. Answer: (c) Leh

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

Key Points

• The first phase of the 5th edition of the Khelo India Winter Games 2025 was officially held in Leh, Ladakh.

• The event commenced on 23 January 2025 and concluded on 27 January 2025, marking a significant milestone for winter sports in the Union Territory of Ladakh.

• The first phase in Leh specifically focused on two major sporting disciplines: Ice Hockey and Ice Skating (including short track speed skating).

• The games were inaugurated by the Lieutenant Governor of Ladakh, Brigadier (Dr.) BD Mishra (Retd), alongside officials from the Ministry of Youth Affairs and Sports.

• The competition saw intense participation from various States, Union Territories, and the Services Sports Control Board, highlighting the growing infrastructure for winter sports in India.

Additional Information

• Structure of the Games:

• The Khelo India Winter Games 2025 is organized in a two-phase format. While the first phase took place in Leh, the second phase is scheduled to be held in Gulmarg, Jammu & Kashmir.

• The second phase typically features events such as Alpine Skiing, Snowboarding, and Nordic Skiing, taking advantage of the slopes in the Pir Panjal range.

• Mascot and Symbolism:

• The official mascot for the winter games is often the Snow Leopard, named 'Sheen-e She' (or Shan) in the local dialect, symbolizing the spirit of the Himalayas and conservation efforts in Ladakh.

• The logo of the games incorporates the Dharmachakra (Wheel of Dharma) and elements representing the mountains, reflecting the cultural heritage of the host regions.

• Khelo India Initiative:

• Launched in 2018, the Khelo India programme is a flagship initiative of the Government of India to revive the sports culture at the grassroots level.

• The Winter Games vertical was introduced in 2020 to identify talent for international competitions such as the Winter Olympics and the Asian Winter Games.

• The Ministry of Youth Affairs and Sports provides financial assistance to identified athletes under the Talent Development Scheme.

• Regional Impact:

• Hosting these games in Leh boosts sports tourism and provides local athletes with national-level exposure.

• Venues like the NDS Ice Hockey Rink in Leh have been upgraded to international standards to support the Khelo India mission.

Q98. Answer: (d) Challenges and impediments in the governance of sports bodies

The correct answer is Challenges and impediments in the governance of sports bodies.

Key Points

• The National Sports Governance Act, 2025 was primarily enacted to create a comprehensive legal framework to tackle the deep-rooted challenges and impediments within the administration of sports in the country.

• It aims to bring about structural reforms in the National Sports Federations (NSFs) and the Indian Olympic Association (IOA) to ensure they operate with transparency, accountability, and professionalism. Hence, the correct answer is option 4.

• One of the primary objectives is to address the lack of transparency in the election processes and the extended tenures of office bearers that often lead to a monopoly over sports administration.

• The act provides a statutory basis for the National Sports Development Code of India, transforming it from a set of guidelines into a mandatory legal obligation for all recognized sports bodies.

• It focuses on removing administrative bottlenecks that have historically led to legal disputes, mismanagement of funds, and a lack of proper support for athletes at the grassroots level.

Additional Information

• Good Governance Norms:

• The act mandates the implementation of age and tenure limits for officials, typically restricting the President and other key members to a maximum of 12 years or three terms.

• It emphasizes gender representation, requiring sports bodies to have a minimum percentage of women in their executive committees to promote inclusivity.

• Athlete-Centric Approach:

• A significant feature is the mandatory inclusion of Sportspersons of Outstanding Merit (SOM) in the decision-making process, ensuring at least 25% representation of athletes in the executive body.

• This ensures that the features of sports policies are designed with the direct input of those who have practical experience in the field.

• Regulatory Oversight:

• The act proposes the establishment of an independent Sports Regulatory Board to monitor the compliance of federations with the established governance standards.

• It also brings sports bodies under the ambit of the Right to Information (RTI) Act, making their financial data and administrative decisions accessible to the public.

Important Points

• Dispute Resolution: The National Sports Governance Act, 2025 introduces a specialized Sports Arbitration Tribunal to resolve internal conflicts and selection disputes swiftly, reducing the burden on the judiciary.

• Financial Integrity: It mandates regular audits by the Comptroller and Auditor General (CAG) or government-approved auditors for federations receiving grants and subsidies from the Ministry of Youth Affairs and Sports.

• Anti-Doping and Ethics: The act reinforces compliance with World Anti-Doping Agency (WADA) and National Anti-Doping Agency (NADA) protocols, making the federations directly responsible for the ethical conduct of their members.

• Global Alignment: By streamlining governance, India aims to align its domestic sports law with the Olympic Charter, preventing potential suspensions of the National Olympic Committee by international bodies due to government interference.

Q99. Answer: (a) Nongkhyllem Wildlife Sanctuary

The correct answer is Nongkhyllem Wildlife Sanctuary.

Key Points

• The Hynniewtrep Youth Council (HYC), a prominent socio-political organization in Meghalaya, formally raised strong objections in May 2025 against a proposed eco-tourism project.

• The project was slated to be developed within the Nongkhyllem Wildlife Sanctuary, located in the Ri-Bhoi district of Meghalaya.

• The HYC argued that the introduction of large-scale tourism infrastructure within the sanctuary's core and buffer zones would lead to significant ecological degradation and habitat fragmentation.

• The council expressed fears that such activities would disturb the habitat of endangered species, specifically the Clouded Leopard (the state animal of Meghalaya) and various rare avian species found in the region. Hence, the statement is correct in the context of the sanctuary's protection.

• Objections were also raised regarding the potential violation of the Forest (Conservation) Act, 1980, and the Wildlife Protection Act, 1972, asserting that permanent constructions for tourism are restricted in such sensitive zones.

• The Nongkhyllem Wildlife Sanctuary is recognized as one of the most biodiverse areas in Northeast India, and the HYC demanded that the State Government prioritize conservation over commercial tourism interests.

Additional Information

• Nongkhyllem Wildlife Sanctuary:

• Located in the Ri-Bhoi district of Meghalaya, it covers an area of approximately 29 square kilometers.

• It was officially notified as a sanctuary in 1981 and is managed by the Forest and Environment Department of Meghalaya.

• The sanctuary is a paradise for birdwatchers, hosting over 400 species of birds, including the Rufous-necked Hornbill and the Brown Hornbill.

• It also serves as a vital corridor for the Asian Elephant and is home to the Himalayan Black Bear and the Slow Loris.

• Other Mentioned Sanctuaries:

• Manas Wildlife Sanctuary: Located in Assam, it is a UNESCO World Heritage Site, a Tiger Reserve, and an Elephant Reserve. It is famous for the Rare Golden Langur and the Pygmy Hog.

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• Namdapha Wildlife Sanctuary (National Park): Situated in the Changlang district of Arunachal Pradesh, it is the fourth largest national park in India and is unique for being home to four big cat species: Tiger, Leopard, Snow Leopard, and Clouded Leopard.

• Kamlang Wildlife Sanctuary: Located in the Lohit District of Arunachal Pradesh, it is named after the Kamlang River and contains the famous Glow Lake. It is known for its Alpine and Sub-tropical vegetation.

• Hynniewtrep Youth Council (HYC):

• It is an influential youth-led organization representing the Hynniewtrep (Khasi and Jaintia) people.

• The council focuses on indigenous rights, land protection, and environmental conservation within the state of Meghalaya.

Important Points

• Eco-Tourism Guidelines: Under the Ministry of Environment, Forest and Climate Change (MoEFCC) guidelines, any project within a Protected Area (PA) requires clearance from the National Board for Wildlife (NBWL).

• Meghalaya's Biodiversity: The state is part of the Indo-Burma biodiversity hotspot, making its wildlife sanctuaries critical for global conservation efforts.

• Ri-Bhoi District: Often called the "Gateway to Meghalaya," this district is characterized by its undulating hills and tropical evergreen forests, which provide a rich ecosystem for flora and fauna.

Q100. Answer: (a) Ministry of Youth Affairs and Sports

The correct answer is Ministry of Youth Affairs and Sports.

Key Points

• The Esports Conclave 2025 is a significant gathering aimed at fostering the growth of the competitive gaming ecosystem in India, involving key stakeholders like developers, athletes, and policymakers.

• The Ministry of Youth Affairs and Sports is the most likely body involved because Esports was officially recognized as a "multisport event" by the Government of India in December 2022. Hence, the statement is correct.

• Following an amendment to the Allocation of Business Rules, 1961, the President of India directed that Esports be included under the Department of Sports within this Ministry.

• The Ministry's involvement ensures that Esports athletes receive similar support and recognition as traditional athletes, facilitating their participation in international events like the Asian Games and Commonwealth Games.

• By supporting such conclaves, the Ministry of Youth Affairs and Sports aims to regulate the sector and encourage innovation and professionalism within the Indian gaming community.

Additional Information

• Ministry of Youth Affairs and Sports:

• This Ministry was established to provide infrastructure and support for sports and to harness the potential of the youth. It is divided into two departments: the Department of Youth Affairs and the Department of Sports.

• The Department of Sports was initially created in 1982 during the IX Asian Games held in New Delhi.

• It oversees various autonomous bodies, the most prominent being the Sports Authority of India (SAI), which manages sports training and talent scouting across the country.

• Regulatory Framework for Gaming:

• While the Ministry of Youth Affairs and Sports handles Esports (competitive gaming), the Ministry of Electronics and Information Technology (MeitY) is the nodal ministry for matters related to online gaming content and intermediaries.

• The AVGC (Animation, Visual Effects, Gaming, and Comics) sector is a major focus of the Government of India to boost the digital economy and create employment opportunities for the youth.

Important Points

• Khelo India Programme: This is a flagship initiative under the Ministry of Youth Affairs and Sports introduced in 2017-18 to revive the sports culture in India at the grassroots level by building a strong framework for all sports.

• International Representation: The inclusion of Esports in the 2022 Asian Games as a medal event was a turning point, leading the Indian government to formalize its governance to ensure transparency and excellence in international competitions.

• National Youth Policy: The Ministry is also responsible for the National Youth Policy (2014), which aims to empower the youth population (aged 15-29 years) to achieve their full potential and contribute to the nation's progress.

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