RRB Group D Official Paper (Held On: 19 Dec, 2025 Shift 2) (Previous Year Paper)

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

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GENERAL SCIENCE

Q1. Which of the following is formed by a chemical reaction?

(a) Air
(b) Brass
(c) Water
(d) Soil

Q2. What is the difference in molecular mass between two successive members of a homologous series?

(a) 12u
(b) 14u
(c) 16u
(d) 18u

Q3. An athlete runs around a circular track with radius r, completing one full round in t seconds. Which of the following correctly represents the athlete's speed v ?

(a) v=t/2π r
(b) v=2π r× t
(c) v=2π r/t
(d) v=r/2π t

Q4. Based on the concept of electrical resistance, how are conductors, resistors, and insulators primarily differentiated?

(a) By the ease or difficulty with which they allow the flow of electric charge
(b) By their length and area of cross-section
(c) By their chemical composition (e.g., metal vs. non-metal)
(d) By their ability to generate heat upon current flow

Q5. Why is the female body specifically prepared every month for pregnancy?

(a) To remove waste products
(b) To improve blood circulation
(c) To nourish the potential embryo
(d) To release more sperm

Q6. Which of the following plants reproduces by means of spores?

(a) Rose
(b) Moss
(c) Egg plant
(d) Gram

Q7. If the distance (d) between the Earth and the Moon decreases gradually, then what will happen to the gravitational force (F) between them?

(a) Increases
(b) Decreases
(c) First increases and then decreases
(d) Remains constant

Q8. Power measures:

(a) the height of an object
(b) how fast or slow work is done
(c) the total work done
(d) the energy stored in an object

Q9. In plants, asexual reproduction involves _____.

(a) both parent organisms
(b) fusion of male and female gametes
(c) fusion and fertilisation
(d) only one parent organism

Q10. The distance between the pole and the centre of curvature of a concave mirror is – 50 cm. If the magnification produced is (–1) by this mirror, then what will be the object and the image distance, respectively?

(a) • 50 cm and + 50 cm
(b) • 50 cm and - 50 cm
(c) • 50 cm and + 50 cm
(d) • 50 cm and - 50 cm

Q11. In a v–t graph, if the slope keeps changing, it means:

(a) acceleration is non-uniform
(b) acceleration is uniform
(c) speed is constant
(d) displacement is zero

Q12. Which of the following is NOT correct?

(a) The SI unit of power of lens is Dioptre (D).
(b) A 5D lens has focal length 20 m.
(c) 1 Dioptre = focal length of 1 m.
(d) A 2D lens has focal length 0.5 m.

Q13. Metallurgy is:

(a) prevention of iron from corrosion
(b) heating sulphide ore in excess of air
(c) removing gangue from ores
(d) extraction of metals in pure form from their ores

Q14. What will happen if the dendrites of neurons do not function?

(a) Neurons will produce more electrical impulses
(b) Muscles will contract more strongly
(c) Signals from other neurons will not be received
(d) Signals will be transmitted faster

Q15. When magnesium reacts with dilute hydrochloric acid, the products are:

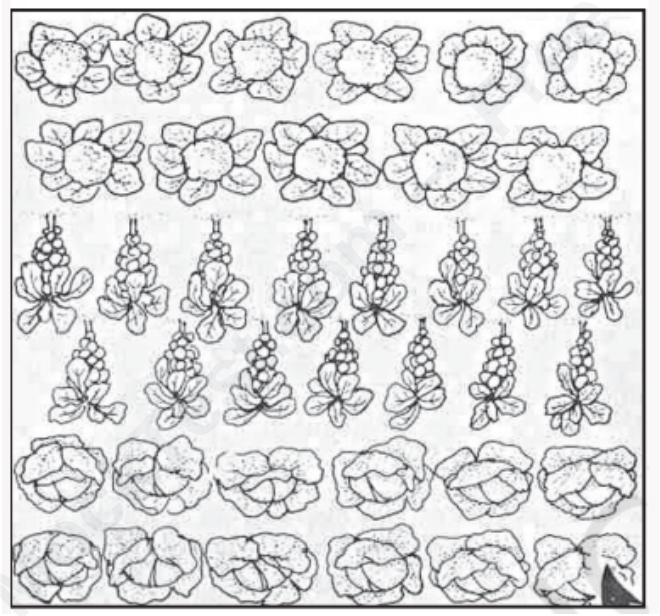
(a) magnesium chloride and oxygen
(b) magnesium chloride and hydrogen
(c) magnesium oxide and water
(d) magnesium hydroxide and hydrogen

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Q16. Which of the following cause(s) movement in muscular tissue?

(a) Contractile proteins
(b) Cartilage
(c) Ligaments
(d) Enzymes

Q17. Identify the cropping pattern in the given picture.



(a) Mixed cropping
(b) Inter cropping
(c) Crop rotation
(d) Terrace farming

Q18. What is the name of the long, fibre-like part of a neuron that carries signals away from the cell body?

(a) Nucleus
(b) Synapse
(c) Axon
(d) Dendrite

Q19. A stethoscope helps a doctor hear a patient's heartbeat clearly. Which principle does a stethoscope use for this purpose?

(a) Multiple reflection of sound
(b) Interference of sound
(c) Refraction of sound
(d) Diffraction of sound

Q20. During photosynthesis, plants take in carbon dioxide and water in the presence of _____.

(a) oxygen and light
(b) glucose and water
(c) energy and starch
(d) sunlight and chlorophyll

Q21. Three resistors of 2 Ω, 3 Ω, and 6 Ω are connected in parallel. The equivalent resistance of the combination is:

(a) 11 Ω
(b) 1 Ω
(c) 6 Ω
(d) 3 Ω

Q22. Which of the following conditions DOES NOT support an increase in the rate of evaporation?

(a) An increase of surface area
(b) An increase in wind speed
(c) An increase of temperature
(d) An increase in humidity

Q23. What happens to the particles in a suspension when the mixture is left undisturbed?

(a) The mixture is stable and does not require stirring.
(b) The mixture is clear and transparent.
(c) The particles settle down when left undisturbed.
(d) The particles are dissolved in the solvent.

Q24. Which of the following conditions is essential for chlorine to react rapidly with an alkane?

(a) Presence of oxygen
(b) Sunlight
(c) High pressure
(d) High temperature

Q25. Which of the following gives H^+ ions in an aqueous solution?

(a) Ammonium hydroxide
(b) Sodium hydroxide
(c) Calcium hydroxide
(d) Hydrochloric acid

MATHEMATICS

Q26. A kite is flying at a height of 75 m, and the string makes an angle of 60° with the ground. What is the length of the string?

(a) 75√3/2 m
(b) 75√3 m
(c) 150 m
(d) 50√3 m

Q27. An 8-digit number is divisible by 45. If the digits are rearranged, then the number must be divisible by:

(a) 3
(b) 5
(c) 45
(d) 15

Q28. A water tank can be filled in 12 hours using three pipes. Pipe Z is three times as fast as pipe C, and pipe C is twice as fast as pipe B. How long will it take pipe B alone to fill the tank?

(a) 50 hours
(b) 100 hours
(c) 108 hours
(d) 96 hours

Q29. In a local election, there were 20,000 voters. Candidate A received 40% of the total votes, and Candidate B received 50% of the total votes. The remaining votes were split equally between two other candidates, C and D. How many votes did Candidate C receive?

(a) 700
(b) 1000
(c) 1200
(d) 600

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Q30. A person travels 60 km by car at a speed of 50 km/hr, then 80 km by bus at a speed of 40 km/hr and finally 100 km by train at a speed of 80 km/hr. What is the average speed (rounded off two decimal places) of the person for the entire trip?

(a) 48.93 km/hr
(b) 59.93 km/hr
(c) 61.93 km/hr
(d) 53.93 km/hr

Q31. The simplified value of √(29+√(41+√(55+√81))) is:

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

Q32. Two banks, A and B, offered loans at 3.5% and 7.5% per annum, respectively. Ashish borrowed an amount of Rs. 2,60,000 from each bank. Find the positive difference (in Rs.) between the amounts of simple interest paid to the two banks by Ashish after 3 years.

(a) 32,200
(b) 32,700
(c) 31,200
(d) 30,700

Q33. After selling an article at a discount of 27%, the profit percentage obtained is 36%. What is the mark-up percentage (rounded off to two decimal places)?

(a) 83.64%
(b) 84.01%
(c) 88.29%
(d) 86.30%

Q34. If the mean proportional of P and 242 is 88, then find the value of P.5766

(a) 31
(b) 34
(c) 32
(d) 35

Q35. Find the HCF of the numbers 2520, 3600, 5880.

(a) 180
(b) 120
(c) 100
(d) 140

Q36. A triangle has sides of length 13 cm, 14 cm and 15 cm. Find the area of the triangle.

(a) 92 cm2
(b) 84 cm^2
(c) 88 cm2
(d) 72 cm2

Q37. A, B and C can do a piece of work in 3, 18 and 9 days, respectively. How long (in days) will they take to do twice the same work, working together?

(a) 8
(b) 5
(c) 12
(d) 4

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Q38. The area of an isosceles triangle is 48 square units. The unequal side (base) has a length of 12 units. Find the perimeter (in units) of the triangle.

(a) 28
(b) 36
(c) 32
(d) 24

Q39. The selling price of an iPhone is Rs. 5,400, after allowing two successive discounts of 10% and 36%. Find the marked price of the iPhone.

(a) Rs. 9,403
(b) Rs. 9,375
(c) Rs. 9,294
(d) Rs. 9,511

Q40. The father's age will be double his son's age after twenty years from now. If the father's age was seven times the son's age five years ago from now, then find their present ages (in years), respectively.

(a) 38, 9
(b) 46, 13
(c) 42, 11
(d) 40, 10

Q41. A cyclist travels 150 km in 5 hours and then another 90 km in 3 hours. What is the average speed of the cyclist for the entire journey?

(a) 30 km/hr
(b) 40 km/hr
(c) 35 km/hr
(d) 45 km/hr

Q42. A shopkeeper calculates his profit per cent on the selling price and his profit is 6.25%. Find his actual profit percentage.

(a) 71/7%
(b) 8%
(c) 10%
(d) 62/3%

Q43. Pushparaj and Himani together invested Rs. 48,600 in a business. At the end of the year, out of a total profit of Rs. 6,600, Pushaparaj's share was Rs. 2,200. What was the investment of Pushparaj?

(a) Rs. 15,365
(b) Rs. 16,200
(c) Rs. 17,280
(d) Rs. 17,170

Q44. If $x = 3 + 2\sqrt{2}$ and $y = 3 - 2\sqrt{2}$, find the value of $x^2 + y^2$ by direct calculation.

(a) 34
(b) 36
(c) 32
(d) 26

Q45. 1/30 is what percentage of 1/80 (rounded off to two decimal places)?

(a) 533.33%
(b) 266.67%
(c) 276.67%
(d) 281.67%

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Q46. The arithmetic mean of the observations 27, 69, 15, 88, 15, 54, 53, 20 and 19 is:

(a) 31
(b) 37
(c) 50
(d) 40

Q47. If the mode of a data exceeds its mean by 10.8, then the mode exceeds the median by _____. (Use empirical formula to find the answer.)

(a) 9.3
(b) 12.9
(c) 7.2
(d) 15.5

Q48. There is a polygon of 10 sides. How many triangles can be drawn using the vertices of the polygon?

(a) 120
(b) 125
(c) 100
(d) 150

Q49. In an election, 30% of the total votes were declared invalid. Of the remaining valid votes, 60% were cast for the winning candidate. What percentage of the total votes did the losing candidate receive?

(a) 35%
(b) 15%
(c) 28%
(d) 40%

Q50. Arohi buys 3 apples and 5 bananas for Rs. 85, while Rhea buys 2 apples and 4 bananas for Rs. 60. What is the total cost (in Rs.) of one apple and one banana?

(a) 25
(b) 18
(c) 30
(d) 20

GENERAL INTELLIGENCE & REASONING

Q51. Which pair of numbers comes in place of the question marks (?) using the given pattern?

2, 6, 3, 24, 4, 60, 5, 120, ?, ?

(a) 6, 210
(b) 6, 216
(c) 6, 504
(d) 6, 36

Q52. Seven people, A, B, C, D, E, F and G, are sitting in a row, facing the north.

Only 1 person sits to the left of E. Only 2 people sit between E and F. C sits immediately to the right of D. G sits immediately to the left of A. Only 1 person sits between F and D.

How many people sit between A and E?

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

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Q53. What will come in the place of '?' in the following equation, if '+' and '-' are interchanged and 'x' and '÷' are interchanged?

163 ÷ 4 - 125 x 5 + 19 = ?

(a) 654
(b) 666
(c) 658
(d) 662

Q54. 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.

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

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

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

Q55. If '+' means '–', '–' means '×', '×' means '÷' and '÷' means '+', then what will come in place of the question mark (?) in the following equation?

7 – 2 + 45 × 3 ÷ 11 = ?

(a) 15
(b) 10
(c) 4
(d) 7

Q56. Seven boxes, L, M, N, O, Q, R and S, are kept one over the other but not necessarily in the same order. Q is kept second from the bottom. Only three boxes are kept between Q and S. R is kept at one of the positions below Q. Only N is kept between S and L. Only two boxes are kept between L and O. How many boxes are kept between M and S?

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

Q57. In a city, a school is 18 km towards the north of a park. A hospital is 21 km towards the west of the school. A restaurant is 21 km towards the west of the park. How far and in which direction is the restaurant from the hospital?

(a) 21 km, north
(b) 18 km, south
(c) 21 km, south
(d) 18 km, north

Q58. This question is based on the five, three-digit numbers given below.

(Left) 192 574 563 189 567 (Right)

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

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

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

(a) 12
(b) 15
(c) 11
(d) 13

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Q59. In a row of 25 people facing north, Ujwala is 5^(th) from the right end. If Siya sits 3^(rd) to the left of Ujwala, then what is Siya's position from the left end of the row?

(a) 17th
(b) 18th
(c) 19th
(d) 20th

Q60. What should come in place of the question mark (?) in the given series?

74 65 55 44 32 ?

(a) 19
(b) 18
(c) 20
(d) 21

Q61. Ravindra starts from Point Y and drives 18 km towards north. He then takes a right turn, drives 45 km, turns right and drives 42 km. He then takes a right turn and drives 26 km. He takes a right turn, drives 89 km. He then turns left, drives 19 km to stop at Point Z. How far (shortest distance) and towards which direction should he drive in order to reach Point Y again?

All turns are 90° turns only unless specified.)

(a) 67 km towards north
(b) 64 km towards west
(c) 61 km towards east
(d) 65 km towards south

Q62. 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 batteries are torches.

All clocks are torches.

Conclusions:

(I) Some batteries are clocks.

(II) All torches are clocks.

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

Q63. Based on the English alphabetical order, three of the following four letter-cluster pairs are alike in a certain way and thus form a group. Which letter-cluster pair DOES NOT belong to that group?

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

(a) GT - EQ
(b) YO - WM
(c) SW - QU
(d) XE - VC

Q64. Refer to the given series and answer the question that follows. (All numbers are single digit numbers only.) Counting to be done from left to right only.

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

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

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

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(d) 2

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

14 B 2 D 18 A 9 C 12 C 18 = ?

(a) 58
(b) 54
(c) 57
(d) 56

Q66. 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) ZDB
(b) KNM
(c) SVU
(d) YBA

Q67. In the following triads, each group of letters is related to the subsequent one following a certain logic. Select from the given options, the one that follows the same logic.

MAID - DAMI - AIMD

FOUR - ROFU - OUFR

(a) WENT - TEWN - NEWT
(b) GOLD - OGLD - DOLG
(c) HUNT - TUHN - UNHT
(d) LOAD - LAOD - DAOL

Q68. What should come in place of the question mark in the given series?

87 75 64 54 45 ?

(a) 35
(b) 33
(c) 37
(d) 41

Q69. 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 chairs are tables.

Some tables are helmets.

Conclusions:

(I): Some chairs are helmets.

(II): All helmets are tables.

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

Q70. Select the set in which the numbers are related in the same way as are the numbers of the following sets.

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

(48, 12, 4)

(30, 2, 15)

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(a) (64, 8, 6)
(b) (70, 8, 9)
(c) (38, 14, 3)
(d) (26, 13, 2)

Q71. O, P, Q, R, W, X and Y are sitting in a straight line facing north.

No one sits to the left of P. Only four people sit between P and Q. Only three people sit to the right of Y. X sits to the immediate left of R. W is not an immediate neighbour of Y.

Who sits third to the left of W?

(a) O
(b) Y
(c) Q
(d) R

Q72. In a certain code language,

A ± B means ‘A is the wife of B’,

A * B means ‘A is the sister of B’,

A Rs. B means ‘A is the father of B’,

and A # B means ‘A is the brother of B’.

How is D related to O if 'D Rs. R # A * C ± O’?

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

Q73. A, B, C, D, E and F are sitting around a circular table facing the centre. B sits second to the left of D. E is an immediate neighbour of B. A sits to the immediate left of B. C sits second to the right of D. F sits to the immediate left of C. What is the position of A with respect to C?

(a) Second to the left
(b) Immediate right
(c) Second to the right
(d) Immediate left

Q74. In a certain code language, ‘what a surprise’ is coded as ‘kd oc ip’ and ‘what is it’ is coded as ‘kd mp co’. How is ‘what’ coded in that language?

(a) mp
(b) kd
(c) oc
(d) ip

Q75. Refer to the following number series and answer the question that follows (all numbers are single-digit numbers only).

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

How many unique numbers in the series are prime numbers (each number counted only once, regardless of repetitions)?

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

Q76. Which of the following letter-number clusters will replace the question mark (?) in the given series to make it logically complete?

RV23, QU32, PT41, OS50, ?

(a) NS59

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(b) NR59
(c) NS58
(d) NR58

Q77. In a certain code language, ‘wet pig kit’ is coded as ‘zp ww hz’ and ‘thing kit head’ is coded as ‘ww ym ce’. How is ‘kit’ coded in that language?
(a) hz
(b) ww
(c) ym
(d) zp

Q78. In the following triads, each group of letters is related to the subsequent one following a certain logic. Select from the given options, the one that follows the same logic.
COLD - DLCO - CLOD
HOUR - RUHO - HUOR
(a) RICE - ICRE - ICER
(b) GREY - YEGR - GERY
(c) BUGS - SGBU - UGBS
(d) SUIT - SIUT - TIUS

Q79. In the following triads, each group of letters is related to the subsequent one following a certain logic. Select from the given options, the one that follows the same logic.
FOUR - ORUF - RUOF
RIFT - ITFR - TFIR
(a) GRAM - GARM - MARG
(b) QUIT - UQIT - TUIQ
(c) OPEN - POEN - NPEO
(d) HUTS - USTH - STUH

Q80. Which of the following letter-number clusters will replace the question mark (?) in the given series to make it logically complete?
HLE23, JJH21, LHK19, NFN17, ?
(a) PEQ18
(b) PDP18
(c) PEP15
(d) PDQ15

GENERAL AWARENESS AND CURRENT AFFAIRS

Q81. In June 2025, the Monetary Policy Committee (MPC) voted to reduce the policy repo rate by 50 basis points (bps) with immediate effect to:
(a) 7.50%
(b) 4.50%
(c) 5.50%
(d) 6.50%

Q82. Who among the following authored the 2025 book 'Original Sin'?
(a) Jake Tapper and Alex Thompson
(b) Bob Woodward and Carl Bernstein
(c) Michael Wolff and Maggie Haberman
(d) Ron Suskind and Jonathan Martin

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Q83. Which sprinter broke his own national 200 m record with a run of 20.02 seconds in Ostrava?

(a) Victor Lopez
(b) Reynier Mena
(c) Lamine Yamal
(d) Gout Gout

Q84. Which of the following was launched by the Ministry of New and Renewable Energy in September 2025, aligning with India's Net Zero and renewable energy goals?

(a) National Policy on Geothermal Energy
(b) National Solar Energy Sustainability Framework
(c) National Wind Energy Policy
(d) National Offshore Wind Energy Mission

Q85. According to the World Bank's Spring 2025 Poverty and Equity Brief, what was India's extreme poverty rate in 2022-2023?

(a) 1.3%
(b) 3.2%
(c) 1.5%
(d) 2.3%

Q86. In June 2025, the Government of India planned to shut down the National Polio Surveillance Network (NPSN) established by which international organisation?

(a) United Nations Environment Programme
(b) World Bank
(c) World Health Organization
(d) United Nations Development Programme

Q87. Which summit saw the participation of 16 states, the EU, and NATO in early March 2025?

(a) UN General Assembly
(b) Shangri-La Dialogue
(c) London Summit on Ukraine
(d) Munich Security Conference

Q88. Which jurist was designated as the 53rd Chief Justice of India on 30 October 2025 and assumed office on 24 November 2025?

(a) Justice PS Narasimha
(b) Justice BV Nagarathna
(c) Justice Vikram Nath
(d) Justice Surya Kant

Q89. Which Indian state was involved in a boundary dispute with Assam in 2025?

(a) Himachal Pradesh
(b) Sikkim
(c) Bihar
(d) Meghalaya

Q90. The Government of India launched a new programme named 'NAVYA' to provide vocational training to adolescent girls in non-traditional job roles. In which district was this programme first launched in June 2025?

(a) Bilaspur, Chhattisgarh
(b) Jaipur, Rajasthan
(c) Sonbhadra, Uttar Pradesh
(d) Raipur, Chhattisgarh

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Q91. What was the new Cash Reserve Ratio (CRR) level after the December 2024 cut?

(a) 5.0%
(b) 4.0%
(c) 3.5%
(d) 4.5%

Q92. In 2025, which two Indian cities were recognised as 'Wetland Cities'?

(a) Agra and Surat
(b) Jhansi and Moradabad
(c) Jabalpur and Dewas
(d) Udaipur and Indore

Q93. What is the projected space budget of India for the year 2025–26?

(a) Rs. 33,416 crore
(b) Rs. 23,416 crore
(c) Rs. 13,416 crore
(d) Rs. 43,416 crore

Q94. Which state was ranked the best-performing in the Management Effectiveness Evaluation (MEE) 2020–2025 of National Parks and Protected Areas?

(a) Kerala
(b) Uttarakhand
(c) Tamil Nadu
(d) Himachal Pradesh

Q95. The women's Kabaddi World Cup, 2025, was won by:

(a) China
(b) India
(c) Pakistan
(d) Bangladesh

Q96. Which honour was conferred upon cricketer R Ashwin by President Droupadi Murmu at Rashtrapati Bhavan in April 2025?

(a) Padma Bhushan
(b) Padma Shri
(c) Padma Vibhushan
(d) Arjuna Award

Q97. Which translator was awarded for translating Anuradha Sharma Pujari's Kanchan (Assamese) into Bodo (awarded in March 2025)?

(a) Basudeb Das
(b) Uttara Bwiswmuthiary
(c) Suvash Satpathy
(d) Anjan Sarma

Q98. On 23 August 2025, the Defence Research and Development Organisation (DRDO) successfully carried out the inaugural flight trials of the Integrated Air Defence Weapon System (IADWS) off the shoreline in _____.

(a) Odisha
(b) Tamil Nadu
(c) Andhra Pradesh
(d) West Bengal

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Q99. In May 2025, who addressed the Global Space Exploration Conference (GLEX 2025) on behalf of India?

(a) Amit Shah
(b) Narendra Modi
(c) S Somanath
(d) Dr. Jitendra Singh

Q100. In the Union Budget, 2025-26, what is the key focus of the Sports Budget as announced by the Government of India?

(a) Promoting e-sports only
(b) Nurturing young talent and infrastructure
(c) Funding private sports leagues
(d) Building stadiums abroad

ANSWER KEY

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

SOLUTIONS

Q1. Answer: (c) Water

The correct answer is Water.

Key Points

• Water is a chemical compound consisting of two hydrogen atoms and one oxygen atom, represented by the chemical formula H_2O.

• It is formed through a chemical reaction (such as the combustion of hydrogen in the presence of oxygen) where the constituent elements undergo a transformation to form a new substance with entirely different properties. Hence, statement 3 is correct.

• During the formation of water, chemical bonds (specifically polar covalent bonds) are created between the atoms. This process usually involves the release of energy, making it an exothermic reaction.

• Compounds like water have a fixed composition by mass. In water, hydrogen and oxygen always combine in a fixed ratio of 1:8 by mass, regardless of the source.

• Unlike mixtures, the components of a compound like water cannot be separated by simple physical methods like filtration or evaporation; they require chemical methods like electrolysis to break back down into elements.

Additional Information

• Air:

• Air is a homogeneous mixture of various gases. It is not formed by a chemical reaction because the individual gases retain their own chemical properties.

• The major constituents of air include Nitrogen (78%), Oxygen (21%), Argon (0.93%), and Carbon dioxide (0.04%).

• Since it is a physical mixture, its components can be separated using physical processes like fractional distillation of liquid air. Hence, statement 1 is incorrect.

• Brass:

• Brass is an alloy, which is categorized as a solid solution or a mixture of metals.

• It is primarily composed of Copper (Cu) and Zinc (Zn). The proportions of these metals can be varied to create different types of

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brass with specific mechanical and electrical properties.

• In an alloy, the constituent metals do not chemically react to form new compounds; they are simply mixed at a molecular level while in a molten state. Hence, statement 2 is incorrect.

• Soil:

• Soil is a heterogeneous mixture of organic matter, minerals, gases, liquids, and organisms that together support life.

• The formation of soil, known as pedogenesis, is a physical and biological process involving the weathering of rocks and the decomposition of organic material over hundreds of years.

• Because it is a mixture, its composition varies greatly depending on the geographical location, climate, and parent rock material. Hence, statement 4 is incorrect.

Important Points

• Chemical Reaction vs. Physical Change:

• A chemical reaction involves the breaking and making of chemical bonds, leading to the formation of a new substance with new properties. Examples include rusting of iron, digestion of food, and photosynthesis.

• A physical change only alters the state or appearance of a substance without changing its molecular composition. Examples include melting of ice, dissolving salt in water, or shredding paper.

• Characteristics of Compounds:

• Compounds are homogeneous in nature.

• They have specific melting and boiling points.

• Properties of a compound are entirely different from its constituent elements. For example, Hydrogen is combustible and Oxygen supports combustion, but Water is used to extinguish fires.

Q2. Answer: (b) 14u

The correct answer is 14u.

Key Points

• A homologous series is a group of organic compounds that have the same functional group and similar chemical properties, in which successive members differ by a CH2 unit.

• In any homologous series, the difference in the molecular formula between two consecutive members is always -CH2- (methylene group).

• The molecular mass of a compound is the sum of the atomic masses of all the atoms present in its molecule.

• The atomic mass of Carbon (C) is 12u and the atomic mass of Hydrogen (H) is 1u.

• Therefore, the mass of a CH2 unit is calculated as: 12 + (2 × 1) = 14u. Hence, the difference in molecular mass between two successive members is 14u.

• This constant difference of 14u is a fundamental characteristic of homologous series like Alkanes, Alkenes, Alkynes, and Alcohols.

Additional Information

• General Formula:

• Each homologous series can be represented by a general molecular formula. For example, Alkanes follow CnH2n+2, Alkenes follow CnH2n, and Alkynes follow CnH2n-2.

• As the value of n (number of carbon atoms) increases by 1, the number of hydrogen atoms increases by 2, maintaining the 14u mass difference.

• Physical Properties:

• As the molecular mass increases in a series, there is a gradual change in physical properties.

• For instance, the melting point and boiling point increase with increasing molecular mass because the intermolecular forces (Vander Waals forces) become stronger as the size of the molecule grows.

• Density and solubility also show systematic variations as one moves down the series.

• Chemical Properties:

• Members of a homologous series exhibit similar chemical properties because they possess the same functional group.

• For example, all Alcohols (containing the -OH group) react similarly with Sodium metal to release Hydrogen gas.

• Examples of Successive Members:

• In the Alkane series: Methane (CH4) has a mass of 16u, and Ethane (C2H6) has a mass of 30u. The difference is 14u.

• In the Alcohol series: Methanol (CH3OH) has a mass of 32u, and Ethanol (C2H5OH) has a mass of 46u. The difference is 14u.

Important Points

• Unified Atomic Mass Unit (u): It is the standard unit used to express atomic and molecular weights, defined as 1/12th of the mass of an atom of Carbon-12.

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• Gradation: The systematic change in properties is called gradation. While chemical properties remain mostly constant, the reactivity might decrease slightly as the carbon chain length increases.

• Isomers: While successive members differ by CH2, it is important to note that compounds with the same molecular formula but different structures are called isomers, and they do not constitute "successive members" in this context.

Q3. Answer: (c) v=2π r/t

The correct answer is v = 2π r / t.

Key Points

• The speed of an object is defined as the total distance traveled divided by the total time taken to cover that distance.

• In this scenario, the athlete is running on a circular track. The distance covered in one full round is equal to the circumference of the circle.

• The mathematical formula for the circumference of a circle with radius r is given by 2πr.

• The time taken to complete one full round is provided as t seconds.

• By applying the basic formula for average speed (Speed = Distance / Time), we substitute the distance with 2πr and the time with t.

• Therefore, the correct expression for the athlete's speed v is v = 2π r / t. Hence, option 3 is correct.

Additional Information

• Uniform Circular Motion:

• When an object moves in a circular path at a constant speed, it is said to be in uniform circular motion.

• Although the speed remains constant, the velocity of the object is constantly changing because its direction of motion changes at every point along the circle.

• The SI unit for speed in this context is meters per second (m/s).

• Distinction between Speed and Velocity:

• Speed is a scalar quantity, representing only the magnitude of motion. In one full round, the speed is 2πr/t.

• Velocity is a vector quantity. Since the athlete returns to the starting point after one full round, the net displacement is zero. Consequently, the average velocity for one complete revolution is 0.

• Angular Velocity:

• The rate at which the central angle changes is called angular velocity (represented by the Greek letter omega, ω).

• The relationship between linear speed (v) and angular velocity (ω) is v = r × ω.

• For one complete revolution, the angle covered is 2π radians, making ω = 2π / t.

• Centripetal Acceleration:

• An object in circular motion experiences acceleration directed toward the center of the circle, known as centripetal acceleration.

• The magnitude of this acceleration is calculated as a = v^2 / r or a = ω^2 × r.

Important Points

• Mathematical Constant Pi (π): The value of π is approximately 3.14159 or the fraction 22/7. It represents the ratio of a circle's circumference to its diameter.

• Frequency and Period: The time t is known as the time period of the motion. The frequency (f), which is the number of rounds per second, is the reciprocal of the time period (f = 1/t).

• Applications: These formulas are fundamental in classical mechanics and are used to calculate the orbits of satellites, the motion of planets, and the design of centrifuges and racing tracks.

Q4. Answer: (a) By the ease or difficulty with which they allow the flow of electric charge

p data-end="93" data-start="0">The correct answer is By the ease or difficulty with which they allow the flow of electric charge.

Key Points

• Electrical Resistance is the property of a material that opposes the flow of electric current. It is fundamentally defined by how easily or with what difficulty electrons can move through a substance.

• Conductors are materials that offer very low resistance to the flow of electric charge. This is because they have a high density of free electrons that can move easily when a potential difference is applied. Hence, the primary differentiation is based on the flow of charge.

• Insulators, on the other hand, possess extremely high resistance. Their electrons are tightly bound to their atoms, making it very difficult for a current to pass through them under normal conditions.

• Resistors are components or materials that have a specific, measurable amount of resistance. They are used in circuits to limit current or to provide a specific voltage drop according to Ohm's Law.

• While factors like length, area of cross-section, and chemical composition affect the magnitude of resistance, the categorization into conductors, resistors, and insulators is defined by the material's inherent ability to permit or obstruct the electric charge.

Additional Information

• Conductors: These are typically metals such as Silver, Copper, and Aluminum. Silver is the best known electrical conductor at room temperature. They are widely used in electrical wiring and power transmission lines.

• Insulators: Examples include Rubber, Glass, Plastic, and Dry Wood. These materials are essential for safety, as they are used to coat wires to prevent electric shocks and short circuits.

• Ohm's Law: Discovered by Georg Simon Ohm in 1827, it states that the current (I) through a conductor between two points is directly proportional to the voltage (V) across the two points, expressed as V = IR, where R is the resistance.

• SI Unit: The standard unit of electrical resistance is the Ohm, symbolized by the Greek letter Ω (Omega). One ohm is defined as the resistance that allows 1 Ampere of current to flow when 1 Volt of potential difference is applied.

• Semiconductors: There is another class of materials whose resistance falls between conductors and insulators. Their conductivity can be manipulated by adding impurities (doping), which is the basis for modern electronics like transistors and diodes.

Important Points

• Factors affecting Resistance: The resistance of a conductor is directly proportional to its length (L) and inversely proportional to its area of cross-section (A). This is expressed by the formula $R = \rho(L/A)$, where ρ (rho) represents the resistivity of the material.

• Temperature Dependence: For most metallic conductors, resistance increases as the temperature rises because the atoms vibrate more vigorously, obstructing the flow of electrons. Conversely, for semiconductors and insulators, resistance typically decreases with an increase in temperature.

• Joule Heating: When current flows through a resistor, electrical energy is converted into heat energy. This is known as Joule's Law of Heating, expressed as $H = I^2Rt$. This principle is utilized in appliances like electric irons, heaters, and toasters.

• Superconductors: These are special materials that exhibit zero electrical resistance when cooled below a certain critical temperature. This allows current to flow indefinitely without any energy loss.

Q5. Answer: (c) To nourish the potential embryo

The correct answer is To nourish the potential embryo.

Key Points

• The female reproductive system undergoes a series of cyclic changes every month, known as the menstrual cycle, specifically to prepare for a possible pregnancy.

• During this cycle, the uterus (womb) prepares itself by thickening its inner lining, called the endometrium. This lining becomes rich with blood vessels and nutrients.

• The primary biological purpose of this preparation is to nourish the potential embryo if fertilization of the egg by a sperm occurs. Hence, option 3 is correct.

• If an egg is fertilized, it travels to the uterus and embeds itself in the thickened endometrium, a process known as implantation. The lining then provides the necessary environment for the embryo to grow and receive oxygen and sustenance before the placenta is fully formed.

• If fertilization does not take place, the prepared lining is no longer needed and is shed through the vagina, resulting in menstruation.

Additional Information

• The Menstrual Cycle:

• The average length of the menstrual cycle is 28 days, although it can vary between 21 to 35 days in healthy adults.

• It is regulated by a complex interplay of hormones including Estrogen, Progesterone, Follicle-Stimulating Hormone (FSH), and Luteinizing Hormone (LH).

• Phases of the Cycle:

• Follicular Phase: Starts on the first day of periods and ends with ovulation. Estrogen levels rise to thicken the uterine lining.

• Ovulation: Occurs around day 14 when a mature egg is released from the ovary into the fallopian tube.

• Luteal Phase: After ovulation, the corpus luteum produces progesterone, which maintains the thickness of the endometrium to support a potential pregnancy.

• Hormonal Role:

• Progesterone is often called the "pregnancy hormone" because its primary function is to prepare the uterus for implantation and prevent uterine contractions that might disturb a developing embryo.

Important Points

• Incorrect Options Analysis:

• To remove waste products: While menstruation involves shedding tissue, the preparation phase of the cycle is a constructive biological process aimed at growth and nurturing, not waste removal. Hence, statement 1 is incorrect.

• To improve blood circulation: Although blood flow to the uterus increases during the cycle, this is a secondary physiological effect meant to deliver nutrients to the endometrium, not the primary objective of the cycle itself. Hence, statement 2 is incorrect.

• To release more sperm: Sperm are male gametes produced in the testes of the male reproductive system. The female body does not release sperm; it releases an ovum (egg). Hence, statement 4 is incorrect.

• Implantation: This occurs approximately 6 to 12 days after ovulation. Successful implantation is the definitive start of clinical pregnancy.

• Age Factors: The monthly preparation begins at menarche (the first period, usually between ages 10-15) and continues until menopause (usually between ages 45-55).

Q6. Answer: (b) Moss

The correct answer is Moss.

Key Points

• Mosses belong to the Bryophyta division of the plant kingdom. They are non-vascular plants that do not produce flowers, fruits, or seeds.

• These plants reproduce primarily through spores, which are unicellular reproductive units. These spores are produced in a structure called a capsule or sporangium. Hence, statement 2 is correct.

• Unlike higher plants, mosses do not have true roots, stems, or leaves. Instead, they have rhizoids that help in anchoring the plant to the substrate and absorbing moisture.

• The plants Rose, Egg plant (Brinjal), and Gram are all Angiosperms. Angiosperms are flowering plants that reproduce through seeds enclosed within a fruit. Hence, statements 1, 3, and 4 are incorrect.

• Mosses exhibit a life cycle known as alternation of generations, where the gametophyte (the green leafy part) is the dominant phase.

Additional Information

• Classification of Plants based on Reproduction:

• Cryptogams: These are non-flowering and seedless plants. They reproduce via spores. Examples include Algae (Thallophyta), Mosses (Bryophyta), and Ferns (Pteridophyta).

• Phanerogams: These are seed-bearing plants. They are further divided into Gymnosperms (naked seeds) and Angiosperms (seeds inside fruits).

• Characteristics of Mosses:

• They usually grow in damp, humid, and shady locations to facilitate fertilization, as they require a film of water for the sperm to swim to the egg.

• Sphagnum, a type of moss, is often used as fuel (peat) and in horticulture due to its high water-retention capacity.

• Seeds vs. Spores:

• A seed is a multicellular structure containing an embryo and a food supply (endosperm) protected by a seed coat.

• A spore is typically unicellular, microscopic, and lacks the nutrient reserves found in seeds, making them more vulnerable to environmental stress.

Important Points

• Amphibians of the Plant Kingdom: Bryophytes (like mosses) are frequently referred to by this name because, while they live on soil, they are absolutely dependent on external water for sexual reproduction.

• Vascular Tissue: Unlike Rose or Gram, mosses lack Xylem and Phloem (specialized tissues for conducting water and minerals). This limits their size, which is why they remain small and low-growing.

• Ecological Importance: Mosses are among the first organisms to colonize bare rocks along with lichens. They decompose rocks and form soil, making the environment suitable for the growth of higher plants.

• Examples of Spore-bearing Plants: Other than mosses, Ferns (Pteridophytes), Horsetails, and Liverworts also reproduce through spores.

Q7. Answer: (a) Increases

The correct answer is Increases.

Key Points

• The relationship between the gravitational force and the distance between two celestial bodies is governed by Newton's Law of Universal Gravitation, formulated by Sir Isaac Newton in 1687.

• The law states that the gravitational force (F) between two objects is directly proportional to the product of their masses and inversely proportional to the square of the distance (d) between their centers.

• Mathematically, the formula is expressed as $F = G \times (m1 \times m2) / d^2$, where G is the universal gravitational constant, m1 is the mass of the Earth, and m2 is the mass of the Moon.

• Because the distance (d) is in the denominator as a squared term, even a small decrease in distance leads to a significant increase in the force of attraction. This is known as the Inverse Square Law.

• If the distance (d) between the Earth and the Moon decreases gradually, the value of $1/d^2$ increases, which directly causes the

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gravitational force (F) to increase. Hence, the correct option is Increases.

Additional Information

• Universal Gravitational Constant (G): This is a physical constant involved in the calculation of gravitational effects. Its value is approximately 6.674 × 10^-11 N·m²/kg². It remains constant throughout the universe regardless of the environment or the nature of the bodies.

• Mass of the Earth and Moon: The Earth has a mass of approximately 5.972 × 10²^4 kg, while the Moon has a mass of about 7.347 × 10^{22} kg. Because both masses are very large, the resulting gravitational force is powerful enough to maintain the Moon's orbital velocity.

• Nature of Gravitational Force: It is a conservative force, meaning the work done by gravity on an object is independent of the path taken. It is also a central force, acting along the line joining the centers of the two masses.

• Vector Quantity: Gravitational force is a vector quantity, meaning it has both magnitude and direction. The direction is always attractive, pulling the Moon toward the center of the Earth and vice versa.

Important Points

• Tidal Effects: The gravitational pull of the Moon is the primary cause of ocean tides on Earth. If the distance decreased, the tidal force (which is proportional to $1/d^3$) would increase even more rapidly than the gravitational force, leading to much more extreme high and low tides.

• Roche Limit: If the Moon were to decrease its distance significantly and cross a specific threshold called the Roche Limit (approximately 9,500 km to 18,000 km from Earth depending on composition), the tidal forces would overcome the Moon's own gravity, causing it to break apart and potentially form a ring system around Earth.

• Current Reality: In reality, the Moon is not moving closer; it is actually receding from the Earth at a rate of approximately 3.8 centimeters per year due to tidal acceleration and the transfer of angular momentum.

• Barycenter: The Earth and Moon actually orbit around a common center of mass called the Barycenter. As the distance decreases, the location of this Barycenter would shift closer to the center of the Earth, altering the Earth's "wobble" in space.

Q8. Answer: (b) how fast or slow work is done

The correct answer is how fast or slow work is done.

Key Points

• Power is defined as the rate of doing work or the rate of transferring energy. It determines how quickly a particular task is completed. Hence, the correct answer is how fast or slow work is done.

• In physical terms, if an agent does a certain amount of Work (W) in a Time interval (t), then the Average Power is calculated as the ratio of work to time. The mathematical expression is Power = Work / Time.

• The SI unit of power is the Watt (W), which is equivalent to one Joule per second (1 J/s). This unit was named in honor of James Watt, the 18th-century developer of the steam engine.

• Because power only has magnitude and no specific direction, it is classified as a Scalar quantity.

• The concept of power is essential in evaluating the efficiency of engines, motors, and electrical appliances, where the speed of energy consumption or output is more critical than the total energy used.

Additional Information

• Units of Power:

• Beyond the Watt, other common units include the Kilowatt (kW), which equals 1,000 Watts, and the Megawatt (MW), which equals 1,000,000 Watts.

• In the automotive and industrial sectors, Horsepower (hp) is frequently used. One standard unit of Horsepower is approximately equal to 746 Watts.

• Power vs. Energy:

• While Energy is the capacity to do work (measured in Joules), Power is the speed at which that energy is used. For example, two people might climb the same flight of stairs (doing the same work), but the one who runs up faster generates more Power.

• The total work done refers to the total energy expended and does not account for the time duration, which distinguishes it from power.

• Electrical Power:

• In electrical circuits, power is the product of Voltage (V) and Current (I). The formula is P = V x I. This is crucial for determining the electricity consumption of household devices.

Important Points

• Dimensional Formula: The dimensional representation of power is [ML^2T^-3]. This is derived from the dimensions of work [ML^2T^-2] divided by the dimension of time [T].

• Instantaneous Power: This refers to the power at a specific moment in time. It can be calculated as the dot product of Force (F) and Velocity (v), expressed as P = F. v.

• Commercial Unit of Energy: It is important to distinguish power from the Kilowatt-hour (kWh). Although it contains the word

"watt," the kWh is actually a unit of Energy (Power multiplied by Time), used by utility companies to bill for electricity usage. 1 kWh is equal to 3.6 million Joules.

• Energy Stored: The energy stored in an object (like potential or kinetic energy) is a measure of its capacity to do work, not the rate at which it is done. Similarly, the height of an object is a spatial dimension that influences Potential Energy but does not measure power directly.

Q9. Answer: (d) only one parent organism

The correct answer is only one parent organism.

Key Points

• Asexual reproduction is a mode of reproduction that does not involve the fusion of gametes or change in the number of chromosomes.

• In plants, asexual reproduction involves only one parent organism to produce offspring. Hence, statement 4 is correct.

• The process of sexual reproduction requires both parent organisms (male and female) to contribute genetic material. Hence, statement 1 is incorrect.

• The fusion of male and female gametes is a primary characteristic of sexual reproduction, which leads to genetic variation. Hence, statement 2 is incorrect.

• Fusion and fertilisation are steps specifically associated with sexual cycles to form a zygote; these do not occur in asexual methods. Hence, statement 3 is incorrect.

• The resulting offspring in asexual reproduction are genetically identical to the parent, often referred to as clones, as they are produced through mitotic divisions.

Additional Information

• Vegetative Propagation:

• This is a common form of asexual reproduction in plants where new plants are produced from roots, stems, leaves, and buds.

• Stem: Examples include Potato (tubers with eyes), Ginger (rhizomes), and Sugar cane.

• Roots: Plants like Sweet potato and Dahlia can give rise to new plants from their adventitious roots.

• Leaves: The Bryophyllum (sprout leaf plant) has buds in the margins of its leaves that can grow into new plants when they fall on moist soil.

• Budding:

• Commonly observed in Yeast, where a small bulb-like projection called a bud grows out from the parent body, matures, and eventually detaches to form a new individual.

• Fragmentation:

• In certain Algae like Spirogyra, the plant body breaks into two or more fragments, and each piece grows into a complete new organism.

• Spore Formation:

• Plants like Ferns and Mosses reproduce through spores. These are asexual bodies covered by a hard protective coat to survive unfavorable conditions like high temperature and low humidity.

Important Points

• Comparison of Reproduction Modes:

• Asexual Reproduction: Only one parent is involved, no seeds are produced, and it occurs in a short period of time.

• Sexual Reproduction: Two parents are involved, seeds are produced through the pollination and fertilization process, and it takes a longer time to complete.

• Advantages of Asexual Reproduction:

• Plants produced this way reach maturity faster and bear flowers and fruits earlier than those produced from seeds.

• It is an economical and quick method for multiplication, especially in agriculture and horticulture (e.g., grafting, layering).

• Disadvantages:

• Since there is no genetic recombination, the offspring lack diversity, making them highly susceptible to the same diseases or environmental changes.

Q10. Answer: (d) • 50 cm and - 50 cm

The correct answer is - 50 cm and - 50 cm.

Key Points

• The distance between the pole (P) and the centre of curvature (C) of a spherical mirror is known as the Radius of Curvature (R). For the given concave mirror, this distance is - 50 cm.

• According to the New Cartesian Sign Convention, the distance of the object and image are measured from the pole. Since the centre of curvature of a concave mirror lies in front of the reflecting surface, R is taken as negative.

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• The Magnification (m) produced by a mirror is the ratio of the image distance to the object distance with a negative sign, expressed as m = -v/u. Given m = - 1, it implies that - 1 = -v/u, which simplifies to v = u.

• A magnification of - 1 specifically indicates that the image is real, inverted, and the same size as the object. This specific condition occurs in a concave mirror only when the object is placed exactly at the Centre of Curvature (C).

• By using the Mirror Formula (1/f = 1/v + 1/u) and knowing that the focal length (f) is R/2 (which is - 25 cm), substituting v = u gives 1/(-25) = 1/u + 1/u. Solving this leads to u = - 50 cm and consequently v = - 50 cm. Hence, the calculated object and image distances are both - 50 cm.

Additional Information

• Concave Mirror: It is a converging mirror where the reflecting surface is curved inwards. It has the ability to produce real as well as virtual images depending on the object's position relative to the Focus (F) and Pole (P).

• Object Distance (u): By convention, the object is always placed to the left of the mirror, meaning the object distance (u) is always negative in numerical problems involving mirror equations.

• Image Distance (v): For real images formed by a concave mirror, the image is formed in front of the mirror, so v is negative. For virtual images (when the object is between P and F), the image is formed behind the mirror, making v positive.

• Significance of Magnification (m):

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

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

• If |m| = 1, the image is the same size as the object.

• If |m| > 1, the image is enlarged.

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

Important Points

• Relation between R and f: For spherical mirrors of small apertures, the Radius of Curvature is exactly twice the focal length (R = 2f). In this case, f = - 50 / 2 = - 25 cm.

• Real Image Formation: Since the magnification is - 1, the height of the image (h') is equal to the height of the object (h) but in the opposite direction (inverted).

• Ray tracing: When an object is at C, rays of light parallel to the principal axis pass through F after reflection, and rays passing through F become parallel to the principal axis, intersecting exactly at C below the principal axis.

• Numerical Value Consistency: The question provides - 50 cm as the distance to the centre of curvature. Since u and v coincide at C for m = - 1, both must mathematically equal the Radius of Curvature value of - 50 cm.

Q11. Answer: (a) acceleration is non-uniform

The correct answer is acceleration is non-uniform.

Key Points

• In a v–t graph (Velocity-Time graph), the slope of the line represents the acceleration of the moving object.

• If the slope keeps changing at different points on the graph, it indicates that the rate of change of velocity is not constant over time. Hence, statement 1 is correct.

• Uniform acceleration is represented by a straight line with a constant slope, meaning the velocity increases or decreases by equal amounts in equal intervals of time. Hence, statement 2 is incorrect.

• If the speed is constant, the velocity does not change, resulting in a slope of zero. This is represented by a horizontal straight line parallel to the time axis. Hence, statement 3 is incorrect.

• The displacement of an object is calculated by the area under the curve of a v–t graph. A changing slope describes how the velocity is changing, but it does not imply that the displacement is zero. Hence, statement 4 is incorrect.

• Hence, the correct answer is acceleration is non-uniform.

Additional Information

• Acceleration:

• It is a vector quantity defined as the rate of change of velocity with respect to time.

• The SI unit of acceleration is m/s² (meters per second squared).

• Non-uniform acceleration occurs when an object's velocity changes by unequal amounts in equal intervals of time, resulting in a curved line on a v–t graph.

• Graph Interpretations:

• In a Distance-Time graph, the slope represents speed.

• In a Displacement-Time graph, the slope represents velocity.

• In a Velocity-Time graph, a positive slope indicates acceleration, while a negative slope indicates retardation or deceleration.

• Equations of Motion:

• For uniform acceleration, the three kinematic equations used are $v = u + at$, $s = ut + 1/2at^2$, and $v^2 = u^2 + 2as$, where u is initial

velocity and v is final velocity.

• These equations cannot be directly applied to non-uniform acceleration; instead, calculus (differentiation and integration) is required.

Important Points

• Instantaneous Acceleration: When the slope of a v–t graph is changing, the acceleration at any specific second is called instantaneous acceleration, which is the slope of the tangent at that point.

• Zero Acceleration: This occurs when an object moves with constant velocity. The v–t graph is a flat line, and the slope is 0.

• Area Calculation: To find the total distance traveled from a v–t graph, one must calculate the magnitude of the area between the curve and the time axis.

• Real-world Examples: A car driving through heavy traffic or a bus stopping at intervals are classic examples of non-uniform acceleration, where the v–t graph would show a continuously changing slope.

Q12. Answer: (b) A 5D lens has focal length 20 m.

The correct answer is A 5D lens has focal length 20 m..

Key Points

• The power of a lens is defined as the ability of a lens to converge or diverge light rays. Mathematically, it is the reciprocal of its focal length (f) in meters.

• The SI unit of power of a lens is Dioptre, which is denoted by the symbol D. If the focal length is expressed in meters (m), then power is expressed in dioptres. Hence, statement 1 is correct.

• For a lens with a power of 5D, the focal length (f) can be calculated using the formula f = 1/P. Here, f = 1/5 = 0.2 meters. Since 0.2 meters is equal to 20 centimeters (cm), the claim that it has a focal length of 20 m is mathematically incorrect. Hence, statement 2 is incorrect.

• By definition, 1 Dioptre is the power of a lens whose focal length is exactly 1 meter (1 D = 1 m^-¹). This serves as the standard unit for ophthalmic prescriptions. Hence, statement 3 is correct.

• For a lens with a power of 2D, the focal length is calculated as f = 1/P = 1/2 = 0.5 meters. This is a consistent application of the lens power formula. Hence, statement 4 is correct.

• Hence, the incorrect statement (and the correct answer) is "A 5D lens has focal length 20 m."

Additional Information

• Nature of Lenses and Sign Convention:

• A Convex lens (converging lens) has a positive focal length; therefore, its power is always positive.

• A Concave lens (diverging lens) has a negative focal length; therefore, its power is always negative.

• When an optician prescribes a corrective lens with a power of +2.0 D, it means the person requires a convex lens. Conversely, a power of -2.0 D indicates a requirement for a concave lens.

• Combination of Lenses:

• When multiple thin lenses are placed in contact with each other, the total power (P) of the combination is the algebraic sum of the individual powers of the lenses.

• Formula: P = P1 + P2 + P3 + ...

• This principle is widely used in designing camera lenses, microscopes, and telescopes to minimize aberrations and improve image quality.

Important Points

• Focal Length Conversion: While calculating power, it is vital to ensure the focal length is in meters. If the focal length is given in centimeters (cm), the formula used is P = 100/f (in cm).

• Lensmeter: The professional instrument used by optometrists and opticians to verify the correct power of a spectacle lens is known as a Lensmeter or Focimeter.

• Human Eye Power: The cornea and crystalline lens of the human eye provide a combined power of approximately 60 dioptres when the eye is at rest, focusing on distant objects.

• Magnification: While power relates to the bending of light, magnification refers to the ratio of the height of the image to the height of the object. They are related but distinct concepts in optics.

Q13. Answer: (d) extraction of metals in pure form from their ores

The correct answer is extraction of metals in pure form from their ores.

Key Points

• Metallurgy is the branch of science and technology concerned with the properties of metals and their production and purification.

• It encompasses the entire sequence of processes required to extract metals from their natural ores and refine them into a pure form suitable for industrial and commercial use.

• The process of Metallurgy typically involves several stages, including crushing and grinding of the ore, concentration (removing

impurities), extraction (reducing the ore to metal), and refining (purifying the metal). Hence, statement 4 is the correct definition.

• It utilizes various chemical, physical, and electrolytic methods depending on the reactivity of the metal being extracted. For example, highly reactive metals like Sodium or Aluminium are extracted via electrolysis, while less reactive metals like Iron are extracted using chemical reduction.

Additional Information

• Ores and Gangue:

• An ore is a naturally occurring solid material from which a metal or valuable mineral can be profitably extracted. Examples include Bauxite (for Aluminium), Hematite (for Iron), and Cinnabar (for Mercury).

• Gangue refers to the undesirable earthy, sandy, or rocky impurities (like silica and clay) associated with the ore. The process of removing gangue is known as concentration or ore dressing. Hence, statement 3 is a sub-process of metallurgy but not its definition.

• Roasting and Calcination:

• Roasting is the process of heating sulphide ores strongly in the presence of excess air to convert them into metal oxides. Hence, statement 2 describes the specific process of roasting.

• Calcination involves heating carbonate or hydrated ores in the absence or limited supply of air to remove moisture and volatile impurities, converting them into oxides.

• Corrosion Prevention:

• Corrosion is the gradual degradation of metals due to oxidation or chemical reactions with the environment (e.g., rusting of iron).

• While Metallurgy includes the study of alloys (like Stainless Steel) to resist corrosion, the prevention of iron from corrosion is a protective application or surface treatment (like galvanization) rather than the definition of metallurgy itself. Hence, statement 1 is incorrect.

Important Points

• Flux and Slag: During the extraction process, a substance called Flux is added to remove the remaining gangue. The combination of Flux and Gangue forms a fusible material called Slag, which is easily separated from the molten metal.

• Pyrometallurgy: This involves thermal treatment of ores, such as smelting in a blast furnace, commonly used for Iron, Copper, and Zinc.

• Hydrometalurgy: This involves the use of aqueous solutions (leaching) to extract metals from ores, often used for Gold and Silver.

• Electrometallurgy: This uses electrical energy for the electrolytic reduction of ores or electrolytic refining of metals like Copper to achieve 99.9% purity.

Q14. Answer: (c) Signals from other neurons will not be received

The correct answer is Signals from other neurons will not be received.

Key Points

• Dendrites are the projections of a neuron (nerve cell) that receive signals (information) from other neurons. They act like the "antennae" of the cell, and their primary function is to pick up chemical signals called neurotransmitters.

• If the dendrites do not function, the neuron will lose its ability to detect incoming stimuli from the synapse (the gap between neurons). Consequently, the Signals from other neurons will not be received. Hence, statement 3 is correct.

• A neuron produces electrical impulses (action potentials) only after it has processed incoming signals received through its dendrites. If these inputs are blocked, the frequency of impulses would likely drop to zero rather than increasing. Hence, statement 1 is incorrect.

• Muscle contraction occurs when motor neurons send signals to muscle fibers. If the dendrites of these motor neurons fail to receive signals from the Central Nervous System (CNS), the muscles will not receive the "command" to contract, leading to paralysis or weakness rather than stronger contractions. Hence, statement 2 is incorrect.

• The speed of signal transmission is determined by the axon's diameter and the presence of the myelin sheath, not by the functionality of the dendrites. Dendrite failure stops signal reception entirely rather than accelerating it. Hence, statement 4 is incorrect.

Additional Information

• Structure of a Neuron:

• Cell Body (Soma): Contains the nucleus and maintains the cell's metabolic functions.

• Axon: A long, tail-like structure that transmits electrical impulses away from the cell body toward other neurons or effector organs like muscles.

• Myelin Sheath: An insulating layer around the axon that increases the conduction velocity of the nerve impulse.

• The Synapse:

• The synapse is the junction between the axon terminal of one neuron and the dendrite of another.

• Communication here is usually chemical, involving the release of neurotransmitters like acetylcholine, dopamine, or serotonin.

• Direction of Impulse:

• In a typical neuron, the impulse flows in a unidirectional manner: Dendrites → Cell Body → Axon → Axon Terminal.

Important Points

• Sensory Neurons: These carry signals from receptors (like skin or eyes) to the brain or spinal cord. If their dendrites fail, the body cannot sense pain, temperature, or touch.

• Motor Neurons: These carry instructions from the CNS to muscles or glands. Dendrite failure here results in a loss of voluntary movement.

• Interneurons: Found within the brain and spinal cord, they connect sensory and motor neurons. They are essential for reflex arcs and complex cognitive processes.

• Action Potential: This is a rapid change in membrane potential that travels along the axon. It is an "all-or-none" phenomenon triggered at the axon hillock once the dendrites have collected enough excitatory stimulus.

Q15. Answer: (b) magnesium chloride and hydrogen

The correct answer is magnesium chloride and hydrogen.

Key Points

• When Magnesium (Mg), which is a reactive metal, reacts with dilute hydrochloric acid (HCl), it undergoes a single displacement reaction.

• In this chemical reaction, magnesium displaces the hydrogen atoms from the hydrochloric acid to form a salt and release gas.

• The balanced chemical equation for this reaction is: Mg (s) + 2HCl (aq) → MgCl2 (aq) + H2 (g).

• The primary products formed are magnesium chloride (MgCl2) and hydrogen gas (H2). Hence, the correct answer is magnesium chloride and hydrogen.

• During the reaction, effervescence (bubbling) is clearly visible, which indicates the evolution of hydrogen gas.

Additional Information

• Nature of the Reaction:

• This is an exothermic reaction, meaning heat energy is released into the surroundings during the process, making the test tube or container feel warm.

• It is also categorized as a redox reaction (reduction-oxidation), where magnesium is oxidized (loses electrons) and hydrogen ions are reduced (gain electrons).

• The Reactivity Series:

• Magnesium is located high in the reactivity series, well above hydrogen. This high reactivity allows it to easily displace hydrogen from dilute mineral acids like HCl or H2SO4.

• Metals lower than hydrogen in the series, such as copper, silver, or gold, do not react with dilute hydrochloric acid to produce hydrogen gas.

• Testing for the Products:

• The presence of hydrogen gas can be confirmed using the Pop Test. When a burning splinter is brought near the mouth of the test tube, the gas burns with a characteristic "pop" sound.

• Magnesium chloride remains in the solution as a colorless aqueous salt. If the water is evaporated, white crystals of magnesium chloride can be obtained.

• Common Misconceptions:

• Magnesium oxide is formed when magnesium burns in oxygen, not when it reacts with hydrochloric acid.

• Magnesium hydroxide is typically formed when magnesium oxide reacts with water or through the reaction of magnesium salts with strong bases.

Important Points

• Atomic Number: Magnesium has an atomic number of 12 and belongs to Group 2 (Alkaline Earth Metals) of the Periodic Table.

• Valency: The valency of magnesium is +2, which is why it combines with two chlorine atoms (each with a valency of -1) to form MgCl2.

• Application: This reaction is a standard laboratory method for the preparation of hydrogen gas on a small scale, although zinc is more commonly used for this purpose due to its controlled rate of reaction.

• Safety: Since the reaction is exothermic and produces flammable hydrogen gas, it should be performed with caution in a ventilated laboratory.

Q16. Answer: (a) Contractile proteins

The correct answer is Contractile proteins.

Key Points

• Muscular tissue consists of elongated cells, also known as muscle fibers, which are responsible for movement in our body.

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• Muscles contain special proteins called contractile proteins, which contract and relax to cause movement. These proteins, primarily actin and myosin, slide past each other to change the length and shape of the cell. Hence, statement 1 is correct.

• Cartilage is a specialized type of connective tissue that provides a smooth surface at the joints and gives flexibility to structures like the nose and ears. While it supports the skeletal system, it does not possess the ability to contract and cause movement. Hence, statement 2 is incorrect.

• Ligaments are very elastic and fibrous connective tissues that connect bone to bone. They provide stability to the joints but do not have the contractile properties required to initiate movement in muscular tissue. Hence, statement 3 is incorrect.

• Enzymes are biological catalysts that regulate chemical reactions within the body. While they are necessary for metabolic processes (including those that provide energy for muscles), they are not structural components that cause physical movement through contraction. Hence, statement 4 is incorrect.

Additional Information

• Types of Muscular Tissues:

• Skeletal Muscle: These are mostly attached to bones and help in body movement. They are called voluntary muscles because we can move them by conscious will. They show alternate light and dark bands (striations) under a microscope, hence called striated muscles.

• Smooth Muscle: These are found in the walls of hollow internal organs such as the alimentary canal and blood vessels. They are involuntary muscles because their movement cannot be directly controlled. They do not have striations.

• Cardiac Muscle: These are found only in the heart. They are involuntary and show rhythmic contraction and relaxation throughout life. They are branched and uninucleated.

• Functional Mechanism:

• The primary mechanism of muscle contraction is described by the Sliding Filament Theory, proposed in 1954.

• In this process, the thin filaments (actin) slide over the thick filaments (myosin), which shortens the sarcomere, the basic functional unit of the muscle fiber.

Important Points

• Energy Source: Muscle contraction requires a significant amount of energy in the form of ATP (Adenosine Triphosphate). The mitochondria within muscle cells are responsible for producing this energy.

• Role of Calcium: Calcium ions (Ca^{2+}) play a vital role in muscle movement by binding to regulatory proteins, which then allows actin and myosin to interact.

• Tendon vs Ligament: While ligaments connect bones to bones, tendons are fibrous tissues that connect muscles to bones, transmitting the force of muscle contraction to the skeletal system to facilitate locomotion.

Q17. Answer: (b) Inter cropping

The correct answer is Inter cropping.

Key Points

• Inter cropping is a farming practice that involves growing two or more crops simultaneously on the same piece of land in a definite row pattern.

• In this method, a few rows of one crop alternate with a few rows of a different crop, such as soybean + maize or finger millet + cowpea.

• The primary objective is to increase productivity per unit area and ensure that the crops do not compete for the same nutrients, as crops with different nutrient requirements are usually selected.

• This pattern helps in pest management because it prevents pests and diseases from spreading to all plants of one crop type throughout the field.

• It provides insurance against crop failure due to abnormal weather conditions, ensuring some yield is always obtained from at least one crop.

Additional Information

• Mixed Cropping:

• It is the practice of growing two or more crops simultaneously on the same land, but without a definite row arrangement.

• The seeds are mixed before sowing, making it difficult to apply fertilizers or pesticides specifically to one crop.

• Examples include wheat and gram or groundnut and sunflower, often used to reduce the risk of total crop loss.

• Crop Rotation:

• This involves growing different crops on the same piece of land in a pre-planned succession or time sequence.

• For example, a farmer might grow wheat in one season and legumes (like peas or beans) in the next to replenish nitrogen levels in the soil.

• The duration of rotation can vary from one year to three years depending on moisture availability.

• Terrace Farming:

• This is an agricultural practice used on hilly or mountainous terrain where "steps" or terraces are cut into the slopes.

• Its main function is to reduce soil erosion and water runoff, allowing crops to be grown on steep gradients.

• It is widely practiced in countries like India (Himalayan region), China, and Japan for rice and tea cultivation.

Important Points

• Nutrient Management: In Inter cropping, crops are chosen such that their root systems operate at different depths to maximize nutrient uptake from different layers of the soil.

• Resource Efficiency: This cropping pattern optimizes the use of natural resources such as solar energy, water, and land area compared to monocropping.

• Economic Stability: For small-scale farmers, Inter cropping provides a diverse food supply and marketable surplus at different times of the year, improving income security.

Q18. Answer: (c) Axon

The correct answer is Axon.

Key Points

• A neuron is the basic functional unit of the nervous system, designed to transmit information to other nerve cells, muscle, or gland cells.

• The Axon is a long, slender, tube-like projection of a nerve cell that conducts electrical impulses, known as action potentials, away from the cell body (soma).

• While a neuron may have many dendrites, it typically has only one axon, which can range in length from a fraction of a millimeter to over 1 meter in humans.

• The primary function of the axon is to transmit information to different neurons, muscles, and glands; it acts as the primary "output" cable of the cell.

• The axon hillock is the specialized part of the cell body where the axon begins and where the summation of signals occurs before an impulse is fired.

Additional Information

• Dendrites:

• These are short, branched extensions of a neuron that receive signals from other neurons and carry them toward the cell body.

• They serve as the "input" sensors of the neuron, increasing the surface area available to receive neurotransmitters.

• Synapse:

• The synapse is the microscopic junction or gap between the axon terminal of one neuron and the dendrite or cell body of another.

• Information is transmitted across this gap through chemical signaling using molecules called neurotransmitters.

• Nucleus:

• Found within the soma (cell body), the nucleus contains the genetic material (DNA) and coordinates the cell's activities like growth and reproduction.

• It is essential for the metabolic maintenance and protein synthesis required for the neuron's survival.

• Soma (Cell Body):

• This is the core part of the neuron that contains the nucleus and other organelles like mitochondria and ribosomes.

• It integrates incoming signals from the dendrites and maintains the life of the nerve cell.

Important Points

• Myelin Sheath: Many axons are covered with a fatty insulating layer called the myelin sheath, produced by Schwann cells in the peripheral nervous system or oligodendrocytes in the central nervous system.

• Nodes of Ranvier: These are periodic gaps in the myelin sheath where the axon membrane is exposed; they facilitate the rapid "jumping" of impulses, a process called saltatory conduction.

• Axon Terminals: At its end, an axon branches into several terminals (telodendria), which contain synaptic vesicles that store and release chemicals to communicate with the next cell.

• Direction of Flow: In a typical neuron, the flow of information is unidirectional: Dendrites → Cell Body → Axon → Axon Terminals.

Q19. Answer: (a) Multiple reflection of sound

The correct answer is Multiple reflection of sound.

Key Points

• A stethoscope is a vital medical instrument used by doctors to listen to sounds produced within the body, primarily the heartbeat and lung sounds.

• The basic principle behind the functioning of a stethoscope is the multiple reflection of sound. Sound waves originating from the patient's body travel through the air-filled tube of the stethoscope.

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• As the sound waves move through the tube, they undergo successive reflections from the inner walls of the tubing. This ensures that the sound energy remains confined within the tube and is directed toward the doctor's ears without significant loss of intensity. Hence, statement 1 is correct.

• The instrument consists of a chest piece, which typically has a diaphragm (for high-frequency sounds) and a bell (for low-frequency sounds), connected to binaural earpieces by flexible tubing.

• When the heart beats, it creates pressure waves. The diaphragm of the stethoscope vibrates due to these waves, and these vibrations are converted into sound waves that undergo multiple reflections to reach the observer.

Additional Information

• Interference of Sound:

• Interference is the phenomenon that occurs when two or more sound waves overlap to form a resultant wave of greater, lower, or the same amplitude.

• While interference is a fundamental property of waves, it is not the primary mechanism used in a standard stethoscope to transmit heartbeat sounds. Hence, statement 2 is incorrect.

• Refraction of Sound:

• Refraction involves the bending of sound waves as they pass from one medium to another or through a medium with varying properties like temperature or density.

• For instance, sound travels faster in warm air than in cold air, causing it to bend. This principle is not utilized by a stethoscope to guide sound to the ears. Hence, statement 3 is incorrect.

• Diffraction of Sound:

• Diffraction refers to the bending of waves around the corners of an obstacle or through an aperture.

• This explains why we can hear someone talking from around a corner, but it is not the method by which a stethoscope amplifies or clarifies internal body sounds. Hence, statement 4 is incorrect.

• Historical Context:

• The first stethoscope was invented by René Laennec in 1816 in France. It was a simple wooden tube used for auscultation.

• Before this invention, doctors practiced immediate auscultation by placing their ear directly on the patient's chest.

Important Points

• Laws of Reflection: Sound follows the same laws of reflection as light. The angle of incidence is equal to the angle of reflection, and the incident wave, reflected wave, and the normal all lie in the same plane.

• Applications of Multiple Reflection:

• Megaphones and horns are designed to send sound in a particular direction by using multiple reflections.

• The ceilings of concert halls and cinema halls are often curved so that sound after reflection reaches all corners of the hall.

• Soundboards are sometimes placed behind speakers in large halls to reflect sound toward the audience.

• Modern Stethoscopes: Today, electronic stethoscopes are available that use piezoelectric crystals to convert sound vibrations into electrical signals, which are then amplified and processed for better clarity and noise reduction.

Q20. Answer: (d) sunlight and chlorophyll

The correct answer is sunlight and chlorophyll.

Key Points

• Photosynthesis is the biological process by which green plants, algae, and some bacteria convert light energy into chemical energy. During this process, plants take in carbon dioxide (CO_2) from the air and water (H_2O) from the soil.

• This conversion requires sunlight, which acts as the primary energy source to break down water molecules and combine them with carbon dioxide. Hence, the requirement of sunlight is essential.

• Chlorophyll is the green pigment found within the chloroplasts of plant cells. Its primary function is to trap or absorb light energy from the sun, specifically in the red and blue wavelengths of the visible spectrum. Hence, the presence of chlorophyll is necessary for the reaction to occur.

• The chemical reaction results in the formation of glucose (a simple sugar used for food) and the release of oxygen into the atmosphere as a byproduct.

• Regarding the options: Option 1 mentions oxygen, which is a product, not a requirement. Hence, statement 1 is incorrect. Option 2 mentions glucose, which is the result of the process. Hence, statement 2 is incorrect. Option 3 mentions starch, which is the stored form of energy. Hence, statement 3 is incorrect. Option 4 correctly identifies sunlight and chlorophyll as the factors required to catalyze the reaction. Hence, statement 4 is correct.

Additional Information

• The Chemical Equation: The balanced chemical equation for photosynthesis is $6CO_2 + 6H_2O + \text{light energy} \rightarrow C_6H_{12}O_6 + 6O_2$. This shows that six molecules of carbon dioxide and six molecules of water are converted into one molecule of glucose and six molecules of oxygen.

• Autotrophic Nutrition: Plants are classified as autotrophs because they can produce their own food. This process is the

foundation of the food chain on Earth, as almost all life depends on the energy captured by plants.

• Role of Stomata: Carbon dioxide enters the plant through tiny pores on the underside of leaves called stomata. These pores also facilitate transpiration, the process of water vapor loss from the plant.

• Water Transport: Water is absorbed by the roots from the soil through the process of osmosis and is transported upward to the leaves through a specialized tissue called the xylem.

• Chloroplasts: These are organelles found in the mesophyll cells of leaves. They contain thylakoids, where the light-dependent reactions occur, and the stroma, where the light-independent (Calvin Cycle) reactions take place.

Important Points

• Light-Dependent Reactions: These occur in the grana of the chloroplasts. During this stage, solar energy is converted into chemical energy in the form of ATP and NADPH. Photolysis of water also occurs here, releasing oxygen.

• Light-Independent Reactions (Calvin Cycle): These take place in the stroma. Here, the ATP and NADPH produced earlier are used to "fix" carbon dioxide into glucose. This stage does not directly require light but depends on the products of the light-dependent stage.

• Factors Affecting Photosynthesis: Several environmental factors influence the rate of photosynthesis, including light intensity, carbon dioxide concentration, temperature (optimum range usually 25°C to 35°C), and the availability of water.

• Historical Context: Scientists like Jan Ingenhousz in 1779 demonstrated that plants require light to produce oxygen, and Julius von Sachs in 1854 provided evidence that glucose is produced and stored as starch in plants.

Q21. Answer: (b) 1 Ω

The correct answer is 1 Ω.

Key Points

• When resistors are connected in a parallel combination, the reciprocal of the equivalent resistance (Rp) is equal to the sum of the reciprocals of the individual resistances.

• The mathematical formula for three resistors in parallel is 1/Rp = 1/R1 + 1/R2 + 1/R3. In this case, the values are 2 Ω, 3 Ω, and 6 Ω.

• Applying the values: 1/Rp = 1/2 + 1/3 + 1/6. To solve this, we find a common denominator, which is 6. The calculation becomes 3/6 + 2/6 + 1/6 = 6/6.

• Solving for Rp, we get 1/Rp = 1, which means the equivalent resistance is 1 Ω. Hence, the correct answer is 1 Ω.

• A fundamental characteristic of parallel circuits is that the total resistance is always less than the value of the smallest individual resistor in the combination. Since 1 Ω is less than 2 Ω, the result is consistent with physical laws.

Additional Information

• Series Combination:

• In a series circuit, the total resistance is the algebraic sum of individual resistances: Rs = R1 + R2 + R3.

• If these three resistors (2 Ω, 3 Ω, and 6 Ω) were connected in series, the equivalent resistance would be 11 Ω.

• In series, the current remains constant through all components, but the voltage drops across each resistor.

• Domestic Wiring Systems:

• Most household electrical appliances are connected in parallel.

• This arrangement ensures that every appliance receives the same voltage (220V in India) and can be operated independently using separate switches.

• If one appliance fails or is turned off in a parallel circuit, the others continue to function normally.

• Ohm's Law:

• Formulated by Georg Simon Ohm in 1827, it states that the current (I) through a conductor is directly proportional to the potential difference (V) across it, provided physical conditions remain constant: V = IR.

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

Important Points

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

• Conductance: The reciprocal of resistance is called conductance (G), measured in Siemens (S) or mho. In parallel circuits, the total conductance is simply the sum of individual conductances (Gp = G1 + G2 + G3).

• Current Distribution: In a parallel combination, the total current from the source is divided among the branches. The branch with the lowest resistance (the 2 Ω resistor in this example) will carry the highest current.

• Power Dissipation: In parallel, the resistor with the lowest resistance dissipates the most power since Power P = V^2 / R and V is constant for all.

Q22. Answer: (d) An increase in humidity

The correct answer is An increase in humidity.

Key Points

• Evaporation is a surface phenomenon in which molecules of a liquid undergo a phase transition into the vapor state at any temperature below its boiling point.

• An increase of surface area: Since evaporation happens at the surface, increasing the exposed area allows more molecules to escape into the air simultaneously, thereby increasing the rate of evaporation. Hence, statement 1 supports an increase.

• An increase in wind speed: Higher wind speed helps in moving the water vapor particles away from the liquid's surface, decreasing the concentration of vapor in the immediate vicinity and accelerating the process. Hence, statement 2 supports an increase.

• An increase of temperature: When the temperature rises, a greater number of particles gain enough kinetic energy to overcome the intermolecular forces of attraction and escape as vapor. Hence, statement 3 supports an increase.

• An increase in humidity: Humidity represents the amount of water vapor already present in the atmosphere. The air can only hold a fixed amount of moisture at a specific temperature; if the humidity is high, the air becomes saturated, which significantly reduces the rate of evaporation. Hence, statement 4 does not support an increase and is the correct answer.

Additional Information

• Kinetic Energy and Evaporation: Molecules in a liquid move at different velocities. Only those at the surface with high kinetic energy can break free from the liquid's pull. As temperature increases, the average kinetic energy of the system rises, leading to faster evaporation.

• Cooling Effect: Evaporation causes a cooling effect because the escaping high-energy particles leave behind lower-energy particles, reducing the overall temperature of the liquid. This is the principle behind sweating in humans and the cooling of water in earthen pots (matkas).

• Nature of Liquid: The rate also depends on the intermolecular forces. Liquids like acetone, petrol, or perfume have weak forces and evaporate much faster than water at room temperature.

• Atmospheric Pressure: A decrease in atmospheric pressure generally leads to an increase in the rate of evaporation, as there is less pressure exerted on the surface of the liquid.

Important Points

• Difference between Boiling and Evaporation: While boiling is a bulk phenomenon that occurs at a specific boiling point throughout the entire liquid, evaporation is a surface phenomenon that occurs at all temperatures.

• Latent Heat of Vaporization: During evaporation, the liquid absorbs heat energy (latent heat) from the surroundings or the body it is in contact with, which facilitates the phase change and results in cooling.

• Practical Examples:

• Spreading wet clothes on a clothesline increases the surface area, making them dry faster.

• In coastal areas where humidity is very high, clothes take a longer time to dry compared to arid regions or deserts.

• Using a fan increases the wind speed, which helps in drying spilled water on the floor quickly.

Q23. Answer: (c) The particles settle down when left undisturbed.

The correct answer is The particles settle down when left undisturbed.

Key Points

• A suspension is defined as a heterogeneous mixture in which the solid particles are spread throughout the liquid without dissolving in it.

• The most distinct characteristic of a suspension is its instability; when the mixture is left undisturbed, the solute particles settle down at the bottom of the container due to the influence of gravity. Hence, statement 3 is correct.

• This process of particles settling at the bottom is known as sedimentation. Once the particles have settled, the liquid above can be poured off, or the particles can be separated using filtration.

• Unlike true solutions, the particles in a suspension are not dissolved in the solvent; they remain suspended in the bulk of the medium. Hence, statement 4 is incorrect.

• Because the particles eventually separate from the medium, a suspension is considered an unstable mixture that usually requires constant stirring or agitation to keep the particles distributed. Hence, statement 1 is incorrect.

Additional Information

• Particle Size and Visibility:

• The particles in a suspension are quite large, typically with a diameter greater than 1000 nanometers (or 1 micrometer).

• Due to their relatively large size, these particles are visible to the naked eye, giving the mixture a cloudy or opaque appearance rather than being clear and transparent. Hence, statement 2 is incorrect.

• Optical Properties (Tyndall Effect):

• When the particles are suspended in the medium, they are large enough to scatter a beam of light passing through them, a

phenomenon known as the Tyndall effect.

• However, once the particles settle down, the suspension breaks, and the mixture loses its ability to scatter light.

• Separation Techniques:

• Since a suspension is a physical mixture with large particles, the components can be easily separated by physical methods such as filtration using a filter paper or decantation.

Important Points

• Common Examples:

• Chalk powder in water: The chalk particles stay suspended while stirred but settle at the bottom over time.

• Muddy water: Soil and clay particles are suspended in river water or rainwater.

• Milk of Magnesia: A suspension of magnesium hydroxide in water used as an antacid.

• Flour in water: Creates a milky suspension that eventually settles.

• Comparison with Colloids and Solutions:

• True Solution: Homogeneous, particle size < 1 nm, stable, does not show Tyndall effect, and particles never settle.

• Colloid: Heterogeneous but appears homogeneous, particle size between 1 nm and 1000 nm, stable, shows Tyndall effect, and particles do not settle under gravity.

• Suspension: Heterogeneous, particle size > 1000 nm, unstable, shows Tyndall effect (temporarily), and particles settle down.

Q24. Answer: (b) Sunlight

The correct answer is Sunlight.

Key Points

• Alkanes are saturated hydrocarbons characterized by single bonds between carbon atoms. Due to their stable nature, they are often referred to as paraffins, meaning they have little affinity for chemical reagents under normal conditions.

• For Chlorine to react rapidly with an alkane, the presence of Sunlight (specifically Ultraviolet (UV) radiation) is essential to provide the necessary activation energy. Hence, the correct answer is Sunlight.

• This specific type of reaction is known as a Substitution Reaction or Photochemical Halogenation. In this process, one or more Hydrogen atoms of the alkane are replaced by Halogen atoms.

• The energy from Sunlight causes the homolytic fission of the Chlorine-Chlorine (Cl-Cl) bond, leading to the formation of highly reactive Chlorine Free Radicals.

• Presence of oxygen: Oxygen can actually act as an inhibitor in free radical reactions because it reacts with radicals to form less reactive peroxy radicals, thereby slowing down the reaction. Hence, statement 1 is incorrect.

• High pressure: While pressure affects the rate of gaseous reactions, it is not the primary trigger or essential condition for the initiation of the alkane-chlorine substitution process. Hence, statement 3 is incorrect.

• High temperature: Although the reaction can occur at high temperatures (typically between 250 to 400 degrees Celsius) in the dark, Sunlight is the most common and "essential" catalyst for the rapid reaction cited in standard organic chemistry. Hence, statement 4 is less appropriate compared to Sunlight in this context.

Additional Information

• Free Radical Mechanism: The reaction follows a three-step mechanism: Initiation, Propagation, and Termination.

• Initiation: The UV light breaks the Cl_2 molecule into two Cl radicals.

• Propagation: A Chlorine radical reacts with Methane (CH_4) to form a Methyl radical (CH_3) and Hydrogen Chloride (HCl). The Methyl radical then reacts with another Cl_2 molecule to form Chloromethane (CH_3Cl).

• Termination: Two radicals combine to form a stable molecule, ending the chain reaction.

• Chain Reaction: Chlorination is a chain reaction because the propagation step regenerates a radical that continues the process until the reactants are consumed or radicals are destroyed.

• Multiple Substitution: If Chlorine is present in excess, the reaction continues until all Hydrogen atoms in the alkane are replaced, forming products like Dichloromethane (CH_2Cl_2), Chloroform ($CHCl_3$), and Carbon Tetrachloride (CCl_4).

• Reactivity of Halogens: The rate of reaction with alkanes varies among halogens. Fluorine reacts explosively (most reactive), Chlorine and Bromine react at moderate rates under Sunlight, while Iodine reacts very slowly and the reaction is reversible.

Important Points

• In diffused sunlight, the reaction proceeds at a controlled rate to give a mixture of alkyl halides. However, in direct sunlight, the reaction can be vigorous or even explosive, sometimes resulting in the complete decomposition of the alkane into Carbon and Hydrogen Chloride.

• The necessity of light classifies this as a Photochemical Reaction. Without light or high heat, Alkanes and Chlorine can be stored together in the dark for long periods without any significant reaction.

• Homolytic Fission: This occurs when a covalent bond breaks such that each atom takes one electron from the shared pair, resulting in neutral atoms or groups with unpaired electrons called Free Radicals.

Q25. Answer: (d) Hydrochloric acid

The correct answer is Hydrochloric acid.

Key Points

• Hydrochloric acid (HCl) is a strong mineral acid that completely dissociates in an aqueous solution to release Hydrogen ions (H+) and chloride ions (Cl-). This ability to donate protons makes it a classic example of an Arrhenius acid. Hence, statement 4 is correct.

• Ammonium hydroxide (NH4OH) is a weak base formed when ammonia reacts with water. In an aqueous medium, it dissociates into Ammonium ions (NH4+) and Hydroxide ions (OH-), rather than hydrogen ions. Hence, statement 1 is incorrect.

• Sodium hydroxide (NaOH), commonly known as caustic soda, is a strong base. When dissolved in water, it fully ionizes to produce Sodium ions (Na+) and Hydroxide ions (OH-). Hence, statement 2 is incorrect.

• Calcium hydroxide (Ca(OH)2), also referred to as slaked lime, is an inorganic compound that acts as a base. It dissociates in water to yield Calcium ions (Ca2+) and Hydroxide ions (OH-). Hence, statement 3 is incorrect.

Additional Information

• Arrhenius Theory of Acids and Bases: Proposed by Svante Arrhenius in 1887, this theory states that acids are substances that increase the concentration of H+ ions in water, while bases increase the concentration of OH- ions.

• Formation of Hydronium Ions: In an aqueous solution, H+ ions (protons) do not exist in isolation due to their high reactivity. They immediately combine with water molecules (H2O) to form Hydronium ions (H3O+).

• Strong vs. Weak Acids: Strong acids like Sulfuric acid (H2SO4) and Nitric acid (HNO3) ionize completely in solution, providing a high concentration of H+ ions. Weak acids, such as Acetic acid (CH3COOH), only partially ionize.

• pH Scale: The pH value of a solution is a measure of its Hydrogen ion concentration. A pH value less than 7 indicates an acidic solution, while a pH greater than 7 indicates a basic or alkaline solution.

• Industrial and Biological Importance: Hydrochloric acid is a vital component of gastric juice in the human stomach, maintaining a pH of approximately 1.5 to 3.5 to facilitate the digestion of proteins.

Important Points

• Electrolytic Nature: Substances that produce ions in aqueous solutions, such as HCl or NaOH, are known as electrolytes because they allow the solution to conduct electricity.

• Neutralization: When an acid (source of H+) reacts with a base (source of OH-), they undergo a neutralization reaction to produce water (H2O) and a salt.

• Indicators: Solutions containing H+ ions turn blue litmus paper red, while solutions containing OH- ions turn red litmus paper blue.

Q26. Answer: (d) 50√3 m

Shortcut Trick

In a 30°−60°−90° triangle, the sides are in the ratio 1 : √3 : 2.

Side opposite to 60° (Height) = 75 m => √3 units = 75 m.

Side opposite to 90° (String length) = 2 units => (75/√3) × 2.

=> 25√3 × 2 = 50√3 m.

Therefore The correct answer is 50√3 m.

Alternate Method

Given: Height of the kite (AB) = 75 m, Angle of elevation (θ) = 60°.

Formula Used: sin θ = Perpendicular / Hypotenuse

=> Let the length of the string be L.

=> sin 60° = 75 / L

=> √3 / 2 = 75 / L

=> L = (75 × 2) / √3

=> L = 150 / √3

=> L = (150 × √3) / (√3 × √3) = 150√3 / 3

=> L = 50√3 m.

Therefore The correct answer is 50√3 m.

Additional Information

Trigonometric Ratios

For a right-angled triangle, sin θ = Opposite/Hypotenuse, cos θ = Adjacent/Hypotenuse, and tan θ = Opposite/Adjacent.

Standard Values

Common values for 60°: sin 60° = √3/2, cos 60° = 1/2, and tan 60° = √3.

Angle of Elevation

The angle of elevation is the angle between the horizontal line of sight and the object when looking upwards.

Q27. Answer: (a) 3

Shortcut Trick

A number divisible by 45 must be divisible by both 5 and 9.

Divisibility by 9 depends only on the sum of digits.

Rearranging the digits does not change the sum of digits, so the new number remains divisible by 9.

Since the new number is divisible by 9, it must also be divisible by 3.

Therefore The correct answer is 3.

Alternate Method

Given: An 8-digit number is divisible by 45.

Formula Used: Divisibility rule of 45 (divisible by 5 and 9). Divisibility rule of 9 (sum of digits is divisible by 9).

=> Divisibility by 45 → Divisible by 5 and 9 (since 5 × 9 = 45 and gcd(5,9)=1).

=> Divisibility rule of 9: The sum of the digits of the 8-digit number must be a multiple of 9.

=> When digits are rearranged, the sum of digits remains the same.

=> Therefore, the rearranged number is definitely divisible by 9.

=> Any number divisible by 9 is also divisible by its factor, 3.

=> Note: Divisibility by 5 depends on the last digit; rearranging might move the 0 or 5 from the unit place, so divisibility by 5, 15, or 45 is not guaranteed.

Therefore The correct answer is 3.

Additional Information

Divisibility by 9 and 3

A number is divisible by 9 (or 3) if and only if the sum of its digits is divisible by 9 (or 3). This property is independent of the position of the digits.

Divisibility by 5

A number is divisible by 5 if its last digit is either 0 or 5. Rearranging digits can change the last digit, thus losing divisibility by 5.

Composite Divisibility

If a number is divisible by n, it is also divisible by every factor of n. Since 3 is a factor of 45, the number is always divisible by 3.

Q28. Answer: (c) 108 hours

Shortcut Trick

Ratio of efficiencies of pipes Z : C : B = (3×2) : 2 : 1 = 6 : 2 : 1.

Total efficiency = 6 + 2 + 1 = 9 units/hr.

Total Capacity of Tank = Total efficiency × Total time = 9 × 12 = 108 units.

Time taken by Pipe B alone = Total Capacity ÷ Efficiency of B = 108 ÷ 1 = 108 hours.

Therefore The correct answer is 108 hr.

Alternate Method

Given:

Time taken by (Z + C + B) together = 12 hours

Efficiency of Pipe C = 2 × Efficiency of Pipe B

Efficiency of Pipe Z = 3 × Efficiency of Pipe C = 3 × (2 × Efficiency of B) = 6 × Efficiency of B

Pipe	Efficiency (units/hr)
Pipe B	1
Pipe C	2
Pipe Z	6
Total (Z+C+B)	9

Calculations:

=> Total work (Tank capacity) = Combined efficiency × Time

=> Total work = 9 × 12 = 108 units

=> Time for Pipe B = Total work ÷ Efficiency of B

=> Time for Pipe B = 108 ÷ 1 = 108 hours

Therefore The correct answer is 108 hr.

Additional Information

Efficiency and Time Relation

The efficiency of a pipe is inversely proportional to the time taken to fill the tank. If efficiency ratio is x:y, the time ratio is y:x.

Total Work Formula

Total Capacity = LCM of individual times or Efficiency × Time. In Pipes and Cisterns, filling pipes have positive efficiency and leakage/outlet pipes have negative efficiency.

Q29. Answer: (b) 1000

Shortcut Trick

Total percentage = 100%

Remaining percentage for C and D = 100% − (40% + 50%) = 10%

Since votes are split equally, Candidate C percentage = 10% ÷ 2 = 5%

Votes for C = 5% of 20,000 = 1000

Therefore The correct answer is 1000 votes.

Alternate Method

Given:

Total number of voters = 20,000

Votes for Candidate A = 40%

Votes for Candidate B = 50%

Calculations:

=> Total percentage of votes for A and B = 40% + 50% = 90%

=> Total percentage of votes for C and D = 100% − 90% = 10%

=> Since C and D split remaining votes equally, C gets = 10% ÷ 2 = 5%

=> Number of votes for Candidate C = (5 ÷ 100) × 20,000

=> Number of votes for Candidate C = 5 × 200 = 1000

Therefore The correct answer is 1000 votes.

Additional Information

Percentage Base Change

When calculating percentages of a fixed total, the values are additive. Percentage = (Part ÷ Whole) × 100.

Ratio in Elections

If votes are split equally, the ratio between the candidates is 1:1, meaning each gets half of the combined remainder.

Valid vs Total Votes

In complex election problems, always distinguish between Total Voters, Votes Polled, and Valid Votes.

Q30. Answer: (d) 53.93 km/hr

Shortcut Trick

Total Distance = 60 + 80 + 100 = 240 km

Total Time = (60/50) + (80/40) + (100/80) = 1.2 + 2 + 1.25 = 4.45 hours

Average Speed = Total Distance ÷ Total Time = 240 ÷ 4.45 ≈ 53.93 km/hr

Therefore The correct answer is 53.93 km/hr.

Alternate Method

Given:

Distance1 = 60 km, Speed1 = 50 km/hr

Distance2 = 80 km, Speed2 = 40 km/hr

Distance3 = 100 km, Speed3 = 80 km/hr

Formula Used:

Average Speed = Total Distance ÷ Total Time

Time = Distance ÷ Speed

Calculations:

=> Time1 = 60 ÷ 50 = 1.2 hours

=> Time2 = 80 ÷ 40 = 2 hours

=> Time3 = 100 ÷ 80 = 1.25 hours

=> Total Time = 1.2 + 2 + 1.25 = 4.45 hours

=> Total Distance = 60 + 80 + 100 = 240 km

=> Average Speed = 240 ÷ 4.45 = 53.9325...

Therefore The correct answer is 53.93 km/hr.

Additional Information

Average Speed (Equal Distances)

If a person covers two equal distances at speeds x and y, the Average Speed = 2xy ÷ (x + y).

Relative Speed

When two objects move in the same direction, relative speed is (u − v). In opposite directions, it is (u + v).

Conversion of Units

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

Q31. Answer: (a) 6

Shortcut Trick

Solve the nested square roots from the innermost part to the outermost part.

√81 = 9

√(55 + 9) = √64 = 8

√(41 + 8) = √49 = 7

√(29 + 7) = √36 = 6

Therefore The correct answer is 6.

Alternate Method

Given: √(29+√(41+√(55+√81)))

Step-by-step simplification:

=> √(29+√(41+√(55+9))) (Since √81 = 9)

=> √(29+√(41+√64))

=> √(29+√(41+8)) (Since √64 = 8)

=> √(29+√49)

=> √(29+7) (Since √49 = 7)

=> √36 = 6

Therefore The correct answer is 6.

Additional Information

Perfect Squares

A perfect square is a number that is the square of an integer. Identifying them (like 36, 49, 64, 81) helps in solving nested roots quickly.

BODMAS in Surds

Always simplify the inner-most bracket or radical first, then move outwards following arithmetic operations.

Q32. Answer: (c) 31,200

Shortcut Trick

Since the Principal (P) and Time (T) are identical for both banks, calculate the difference in Interest Rates.

Difference in Rate of Interest = 7.5% − 3.5% = 4% per annum.

Total Interest Difference for 3 years = 4% × 3 = 12% of Principal.

Required Positive Difference = 12% of Rs. 2,60,000 = (12/100) × 2,60,000 = 12 × 2,600 = Rs. 31,200.

Therefore The correct answer is Rs. 31,200.

Alternate Method

Given: Principal (P) = Rs. 2,60,000, Time (T) = 3 years, Rate A = 3.5%, Rate B = 7.5%

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

=> Interest from Bank A = (2,60,000 × 3.5 × 3) ÷ 100

=> Interest from Bank A = 2,600 × 10.5 = Rs. 27,300

=> Interest from Bank B = (2,60,000 × 7.5 × 3) ÷ 100

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=> Interest from Bank B = 2,600 × 22.5 = Rs. 58,500

=> Positive Difference = 58,500 − 27,300

=> Positive Difference = Rs. 31,200

Therefore The correct answer is Rs. 31,200.

Additional Information

Simple Interest (SI) Properties

Simple interest is calculated only on the Principal amount. If the Principal and Time are constant, the interest is directly proportional to the Rate (SI prop. to R).

SI Difference Formula

The difference between SI at two different rates R1 and R2 for the same principal and time is given by: Difference = [P × T × (R2 − R1)] ÷ 100.

Amount Formula

The total Amount (A) at the end of the period is the sum of the Principal and the Simple Interest: A = P + SI.

Q33. Answer: (d) 86.30%

Shortcut Trick

Use the direct relationship formula: MP/CP = (100 + Profit%)/(100 − Discount%).

MP/CP = (100 + 36)/(100 − 27) = 136/73.

Mark-up = MP − CP = 136 − 73 = 63 units.

Mark-up percentage = (63/73) × 100 ≈ 86.30%.

Therefore The correct answer is 86.30%.

Alternate Method

Given: Discount = 27%, Profit = 36%.

Formulas: SP = CP × (100 + P%)/100 | SP = MP × (100 − D%)/100 | Mark-up% = (MP − CP)/CP × 100.

=> Let Cost Price (CP) be 100.

=> Selling Price (SP) = 100 + 36% of 100 = 136.

=> Marked Price (MP) = SP × 100 / (100 − Discount%) = 136 × 100 / 73 ≈ 186.3013.

=> Mark-up Percentage = (186.3013 − 100) = 86.3013%.

Therefore The correct answer is 86.30%.

Additional Information

Marked Price and Mark-up

Marked price is the price displayed on an article. Mark-up percentage is the percentage increase from Cost Price to Marked Price.

The CP-MP Relationship

CP × (1 + Mark-up%) × (1 − Discount%) = CP × (1 + Profit%). This simplifies to the ratio MP/CP used in the shortcut.

Q34. Answer: (c) 32

Shortcut Trick

Mean Proportional (MP) = √(a × b)

88 = √(P × 242)

Square both sides: 88 × 88 = P × 242

P = (88 × 88) ÷ 242 = 7744 ÷ 242 = 32

Therefore The correct answer is 32.

Alternate Method

Given: First number = P, Second number = 242, Mean Proportional = 88.

Formula Used: If b is the mean proportional between a and c, then $b^2 = a \times c$.

=> $88^2 = P \times 242$

=> 7744 = P × 242

=> P = 7744 ÷ 242

=> P = 32

Therefore The correct answer is 32.

Additional Information

Third Proportional

If a, b, and c are in continued proportion, then c is the third proportional to a and b, where $c = b^2/a$.

Fourth Proportional

If a:b :: c:d, then d is the fourth proportional, calculated as d = (b × c) ÷ a.

Continued Proportion

Three numbers a, b, and c are in continued proportion if a/b = b/c, which implies $b^2 = ac$.

Q35. Answer: (b) 120

Shortcut Trick

Identify the Highest Common Factor (HCF) by checking the options from largest to smallest.

Check if 180 divides all numbers: 5880 ÷ 180 is not an integer.

Check if 120 divides all numbers: 2520/120 = 21, 3600/120 = 30, 5880/120 = 49.

Since 120 divides all three numbers and is the largest such value among options, it is the HCF.

Therefore The correct answer is 120.

Alternate Method

Given: Numbers are 2520, 3600, and 5880.

Method: Prime Factorization Method.

=> Prime factors of 2520 = $2^3 \times 3^2 \times 5^1 \times 7^1$

=> Prime factors of 3600 = 2^4 × $3^2 \times 5^2$

=> Prime factors of 5880 = $2^3 \times 3^1 \times 5^1 \times 7^2$

=> HCF = Product of lowest powers of common prime factors

=> HCF = $2^3 \times 3^1 \times 5^1$

=> HCF = 8 × 3 × 5 = 120

Therefore The correct answer is 120.

Additional Information

Definition of HCF

The Highest Common Factor (HCF), also known as Greatest Common Divisor (GCD), is the largest positive integer that divides each of the integers without a remainder.

Relationship between HCF and LCM

For two numbers a and b: HCF(a, b) × LCM(a, b) = a × b. This property does not directly apply to three or more numbers in the same simple product form.

Division Method for HCF

Divide the larger number by the smaller one, then divide the previous divisor by the remainder. Continue until the remainder is zero; the last divisor is the HCF.

Q36. Answer: (b) 84 cm²

Shortcut Trick

Calculate the semi-perimeter (s): (13 + 14 + 15) ÷ 2 = 21 cm.

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

Area = √[21 × (21−13) × (21−14) × (21−15)] = √(21 × 8 × 7 × 6) = 84 cm².

Therefore The correct answer is 84 cm².

Alternate Method

Given: The lengths of the three sides of the triangle are a = 13 cm, b = 14 cm, and c = 15 cm.

Formula Used:

To find the area of a scalene triangle, we use Heron's Formula:

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

2. Area = √[s × (s − a) × (s − b) × (s − c)]

Calculations:

=> s = (13 + 14 + 15) ÷ 2

=> s = 42 ÷ 2 = 21 cm

=> Area = √[21 × (21 − 13) × (21 − 14) × (21 − 15)]

=> Area = √[21 × 8 × 7 × 6]

=> Area = √[7056]

=> Area = 84 cm²

Therefore The correct answer is 84 cm².

Additional Information

Heron's Formula Application

This formula is particularly useful for finding the area of a scalene triangle when the vertical height is unknown but all three side lengths are available.

Perimeter vs. Semi-perimeter

The Perimeter is the sum of all sides (a+b+c), while the Semi-perimeter (s) is exactly half of that value.

Right-Angled Triangle Area

For a triangle where base (b) and height (h) are perpendicular, the area simplifies to: Area = 1/2 × b × h.

Q37. Answer: (d) 4

Shortcut Trick

Combined Efficiency method: Total Work (LCM) ÷ Combined Efficiency.

LCM of 3, 18, and 9 = 18 units (Original Work).

Efficiency of A + B + C = (18÷3) + (18÷18) + (18÷9) = 6 + 1 + 2 = 9 units/day.

Time for twice the work = (2 × 18) ÷ 9 = 36 ÷ 9 = 4 days.

Therefore The correct answer is 4 days.

Alternate Method

Given: Time taken by A = 3 days, B = 18 days, C = 9 days.

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

Person	Days	Total Work	Efficiency
A	3	18	18 ÷ 3 = 6
B	18	18 ÷ 18 = 1	
C	9	18 ÷ 9 = 2	

=> Total combined efficiency of A + B + C = 6 + 1 + 2 = 9 units/day.

=> Original Work = 18 units.

=> Twice the work = 2 × 18 = 36 units.

=> Time required = 36 ÷ 9 = 4 days.

Therefore The correct answer is 4 days.

Additional Information

Pipes & Cisterns

This logic is identical to filling a tank where efficiency represents the rate of flow per hour/minute.

Work & Wages

Wages are always distributed in the ratio of efficiency (or work done) of the individuals, not the days taken.

Fraction Method

Combined 1-day work = (1/d1 + 1/d2 + 1/d3). Total time = Total Work / Combined 1-day work.

Q38. Answer: (c) 32

Shortcut Trick

Height (h) = (2 × Area) ÷ Base = (2 × 48) ÷ 12 = 8 units.

The height divides the base into two equal parts of 6 units each.

Using Pythagorean triplet (6, 8, 10), the equal side (a) = 10 units.

Perimeter = (2 × equal side) + base = 20 + 12 = 32 units.

Therefore The correct answer is 32 units.

Alternate Method

Given:

Area of Isosceles Triangle = 48 square units

Base (b) = 12 units

Formula Used:

Area = (1/2) × Base × Height

Perimeter = 2a + b (where a = equal sides)

Calculations:

=> 48 = (1/2) × 12 × Height

=> 48 = 6 × Height

=> Height = 8 units

In an Isosceles Triangle, the Height bisects the Base at 90°. Let equal side be 'a'.

Using Pythagoras Theorem in the right-angled half:

=> $a^2 = 8^2 + (12 \div 2)^2$

=> $a^2 = 64 + 36 = 100$

=> $a = \sqrt{100} = 10$ units

=> Perimeter = a + a + b

=> Perimeter = 10 + 10 + 12 = 32 units

Therefore The correct answer is 32 units.

Additional Information

General Area Formula

The area of an isosceles triangle with equal sides 'a' and base 'b' can also be calculated as Area = $(b/4) \times \sqrt{(4a^2 - b^2)}$.

Altitude Property

The altitude (height) drawn to the unequal side of an isosceles triangle acts as both the median and the angle bisector.

Pythagorean Triplets

Standard integer sets that satisfy $a^2 + b^2 = c^2$, such as (3, 4, 5), (6, 8, 10), and (5, 12, 13), help in solving geometry questions quickly.

Q39. Answer: (b) Rs. 9,375

Shortcut Trick

Net multiplier for successive discounts of 10% and 36%:

Multiplier = (100 − 10)/100 × (100 − 36)/100 = 0.9 × 0.64 = 0.576

Marked Price (MP) = SP ÷ 0.576 = 5,400 ÷ 0.576

MP = 5,400,000 ÷ 576 = 9,375

Therefore The correct answer is Rs. 9,375.

Alternate Method

Given: Selling Price (SP) = Rs. 5,400, Discount1 = 10%, Discount2 = 36%.

Formulas: SP = MP × (100 − D1%)/100 × (100 − D2%)/100

=> Let Marked Price be x.

=> 5,400 = x × (90/100) × (64/100)

=> 5,400 = x × (9/10) × (16/25)

=> x = (5,400 × 10 × 25) ÷ (9 × 16)

=> x = (600 × 250) ÷ 16

=> x = 150,000 ÷ 16 = 9,375

Therefore The correct answer is Rs. 9,375.

Additional Information

Successive Discounts

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

Marked Price

MP is the price printed on the label, and discounts are always calculated on this value to reach the SP.

Q40. Answer: (d) 40, 10

Shortcut Trick

Check options: 5 years ago, Father's age must be 7 times Son's age.

Option (4): 40 − 5 = 35 and 10 − 5 = 5. Since 35 = 7 × 5, it satisfies the first condition.

After 20 years: 40 + 20 = 60 and 10 + 20 = 30. Since 60 = 2 × 30, it satisfies the second condition.

Therefore The correct answer is 40, 10 years.

Alternate Method

Let Son's age 5 years ago be x and Father's age be 7x.

=> Present ages: Father = 7x + 5, Son = x + 5.

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=> After 20 years: Father = 7x + 25, Son = x + 25.

=> According to question: 7x + 25 = 2 × (x + 25)

=> 7x + 25 = 2x + 50

=> 5x = 25 => x = 5

=> Father's present age = 7(5) + 5 = 40 years.

=> Son's present age = 5 + 5 = 10 years.

Therefore The correct answer is 40, 10 years.

Additional Information

Ratio Difference Concept

The age difference between two people always remains constant regardless of the number of years passed.

Linear Equations in Ages

If 'n' years are added to the present age, the ratio changes. Always define variables based on the earliest time frame given to simplify calculations.

Verification Tip

In multiple-choice questions, back-substitution of options into the given conditions is often the fastest way to find the answer.

Q41. Answer: (a) 30 km/hr

Shortcut Trick

Average Speed = Total Distance ÷ Total Time

Total Distance = 150 + 90 = 240 km

Total Time = 5 + 3 = 8 hours

Average Speed = 240 ÷ 8 = 30 km/hr

Therefore The correct answer is 30 km/hr.

Alternate Method

Given:

Distance1 = 150 km, Time1 = 5 hours

Distance2 = 90 km, Time2 = 3 hours

Formula Used:

Average Speed = (D1 + D2) ÷ (T1 + T2)

Calculations:

=> Total Distance = 150 km + 90 km = 240 km

=> Total Time = 5 hours + 3 hours = 8 hours

=> Average Speed = 240 ÷ 8

=> Average Speed = 30 km/hr

Therefore The correct answer is 30 km/hr.

Additional Information

Average Speed for Equal Distances

When two equal distances are covered at speeds x and y, the average speed = 2xy ÷ (x + y).

Relative Speed

If two objects move in the same direction, relative speed = S1 − S2. In opposite directions, relative speed = S1 + S2.

Unit Conversion

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

Q42. Answer: (d) 62/3%

Shortcut Trick

Profit on Selling Price = 6.25% = 1/16.

This means if SP = 16 units, then Profit = 1 unit.

Cost Price (CP) = SP − Profit = 16 − 1 = 15 units.

Actual Profit% (on CP) = (Profit ÷ CP) × 100.

Actual Profit% = (1 ÷ 15) × 100 = 20 ÷ 3 = 6(2/3)%.

Therefore The correct answer is 6(2/3)%.

Alternate Method

Given: Profit on SP = 6.25%

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

=> Let the Selling Price (SP) be 100.

=> Profit = 6.25% of 100 = 6.25.

=> Cost Price (CP) = SP − Profit = 100 − 6.25 = 93.75.

=> Actual Profit% = (6.25 ÷ 93.75) × 100.

=> Actual Profit% = (625 ÷ 9375) × 100 = (1 ÷ 15) × 100 = 6.66% or 6(2/3)%.

Therefore The correct answer is 6(2/3)%.

Additional Information

Profit Calculation Bases

Standard Profit Percentage is always calculated on the Cost Price unless specified otherwise. When calculated on SP, the denominator changes, affecting the final percentage value.

Fractional Equivalents

6.25% = 1/16 | 6.66% = 1/15 | 8.33% = 1/12. Knowing these helps in fast ratio conversions.

Q43. Answer: (b) Rs. 16,200

Shortcut Trick

Ratio of Profit = Ratio of Investment (when time is constant).

Total profit = Rs. 6,600 and Pushparaj's profit = Rs. 2,200.

Ratio (Pushparaj : Total) = 2,200 : 6,600 = 1 : 3.

Since the total investment is Rs. 48,600, Pushparaj's investment = 1/3 × 48,600.

Pushparaj's investment = Rs. 16,200.

Therefore The correct answer is Rs. 16,200.

Alternate Method

Given: Total Investment = Rs. 48,600, Total Profit = Rs. 6,600, Pushparaj's Profit = Rs. 2,200.

Formulas: Profit Share = (Individual Investment × Time) / (Total Investment × Time) × Total Profit.

=> Let the investment of Pushparaj be P and Himani be H.

=> P + H = 48,600.

=> Profit ratio P : H = 2,200 : (6,600 − 2,200) = 2,200 : 4,400 = 1 : 2.

=> Investment ratio is also 1 : 2.

=> Pushparaj's investment = [1 / (1 + 2)] × 48,600.

=> Pushparaj's investment = 1/3 × 48,600 = 16,200.

Therefore The correct answer is Rs. 16,200.

Additional Information

Partnership Basics

When the time period for investment is the same for all partners, the profit is distributed in the ratio of their initial investments.

Compound Partnership

If the time periods are different, the profit is distributed in the ratio of (Investment × Time Period) for each partner.

Q44. Answer: (a) 34

Shortcut Trick

For conjugate pairs $x = a + b$ and $y = a - b$, the sum of their squares is $x^2 + y^2 = 2(a^2 + b^2)$.

Here, $a = 3$ and $b = 2\sqrt{2}$.

=> $x^2 + y^2 = 2 \times (3^2 + (2\sqrt{2})^2)$

=> $2 \times (9 + 8) = 2 \times 17 = 34$.

Therefore The correct answer is 34.

Alternate Method

Given: $x = 3 + 2\sqrt{2}$ and $y = 3 - 2\sqrt{2}$

Formula Used: $(a + b)^2 = a^2 + b^2 + 2ab$ and $(a - b)^2 = a^2 + b^2 - 2ab$

=> $x^2 = (3 + 2\sqrt{2})^2 = 3^2 + (2\sqrt{2})^2 + 2 \times 3 \times 2\sqrt{2}$

=> $x^2 = 9 + 8 + 12\sqrt{2} = 17 + 12\sqrt{2}$

=> $y^2 = (3 - 2\sqrt{2})^2 = 3^2 + (2\sqrt{2})^2 - 2 \times 3 \times 2\sqrt{2}$

=> $y^2 = 9 + 8 - 12\sqrt{2} = 17 - 12\sqrt{2}$

=> $x^2 + y^2 = (17 + 12\sqrt{2}) + (17 - 12\sqrt{2})$

=> $x^2 + y^2 = 17 + 17 = 34$

Therefore The correct answer is 34.

Additional Information

Algebraic Identity for Sum of Squares

The expression $x^2 + y^2$ can be efficiently calculated using the sum and product: $x^2 + y^2 = (x + y)^2 - 2xy$.

Product of Conjugates

For any conjugate pair $a + \sqrt{b}$ and $a - \sqrt{b}$, their product is always a rational number: $(a + \sqrt{b})(a - \sqrt{b}) = a^2 - b$.

Sum of Conjugates

The sum of $(a + \sqrt{b})$ and $(a - \sqrt{b})$ is 2a, which eliminates the irrational part of the expression.

Q45. Answer: (b) 266.67%

Shortcut Trick

Required percentage = (Value ÷ Base) × 100

Required percentage = [(1/30) ÷ (1/80)] × 100

Required percentage = (80 ÷ 30) × 100 = 800 ÷ 3 = 266.666...

Rounding off to two decimal places, we get 266.67%.

Therefore The correct answer is 266.67%.

Alternate Method

Given:

First fraction = 1/30

Second fraction (Base) = 1/80

Formula Used:

Percentage = (A / B) × 100

Calculations:

=> Required % = [(1/30) / (1/80)] × 100

=> Required % = (1/30) × (80/1) × 100

=> Required % = (80 / 30) × 100

=> Required % = (8/3) × 100

=> Required % = 800 / 3

=> Required % = 266.666...

=> Required % ≈ 266.67%

Therefore The correct answer is 266.67%.

Additional Information

Percentage Change

Percentage change = [(New Value − Old Value) / Old Value] × 100.

Fraction to Percentage

To convert any fraction x/y into a percentage, multiply it by 100 and add the % symbol.

Reciprocal Percentages

1/3 = 33.33%, 2/3 = 66.67%, 4/3 = 133.33%, 8/3 = 266.67%.

Q46. Answer: (d) 40

Shortcut Trick

Assume a base mean of 40 and calculate the net deviation.

Deviations: (27−40), (69−40), (15−40), (88−40), (15−40), (54−40), (53−40), (20−40), (19−40)

=> −13 + 29 − 25 + 48 − 25 + 14 + 13 − 20 − 21 = 0

Correct Mean = Assumed Mean + (Net Deviation ÷ Total Count) = 40 + (0 ÷ 9) = 40.

Therefore The correct answer is 40.

Alternate Method

Given: Observations are 27, 69, 15, 88, 15, 54, 53, 20, and 19.

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

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=> Total count of observations (n) = 9

=> Sum = 27 + 69 + 15 + 88 + 15 + 54 + 53 + 20 + 19

=> Sum = 360

=> Arithmetic Mean = 360 ÷ 9

=> Mean = 40

Therefore The correct answer is 40.

Additional Information

Properties of Arithmetic Mean

The sum of the deviations of items from their arithmetic mean is always zero, i.e., $\sum(x - x) = 0$.

Weighted Arithmetic Mean

Used when different observations have different importance or weights: $x_w = \sum(w \times x) \div \sum w$.

Median and Mode

Median is the middle value in a sorted list; Mode is the value that appears most frequently in the data set.

Q47. Answer: (c) 7.2

Shortcut Trick

The empirical relationship is defined as: (Mode − Mean) = 3 × (Median − Mean).

Given: Mode − Mean = 10.8.

Substitute the value: 10.8 = 3 × (Median − Mean) => (Median − Mean) = 3.6.

Required value: (Mode − Median) = (Mode − Mean) − (Median − Mean).

Calculated: 10.8 − 3.6 = 7.2.

Therefore The correct answer is 7.2.

Alternate Method

Given:

Difference between Mode and Mean = 10.8

=> Mode − Mean = 10.8

=> Mean = Mode − 10.8

Formula Used:

Empirical formula: Mode = 3 × Median − 2 × Mean

Calculations:

=> Mode = 3 × Median − 2 × (Mode − 10.8)

=> Mode = 3 × Median − 2 × Mode + 21.6

=> Mode + 2 × Mode − 3 × Median = 21.6

=> 3 × Mode − 3 × Median = 21.6

=> 3 × (Mode − Median) = 21.6

=> Mode − Median = 21.6 ÷ 3

=> Mode − Median = 7.2

Therefore The correct answer is 7.2.

Additional Information

Empirical Relationship

In a moderately skewed distribution, the relationship is approximately Mode = 3 Median − 2 Mean.

Symmetric Distribution

For a perfectly symmetrical distribution (like the Normal distribution), the Mean = Median = Mode, and the difference between any two is 0.

Skewness Property

If Mode > Median > Mean, the distribution is negatively skewed (skewed to the left). If Mean > Median > Mode, it is positively skewed (skewed to the right).

Q48. Answer: (a) 120

Shortcut Trick

For a polygon with n sides, the number of triangles formed by joining its vertices is given by the combination formula ${}^{n}C3$.

Here, n = 10.

Number of triangles = ^(10)C3 = (10 × 9 × 8) ÷ (3 × 2 × 1)

Number of triangles = 10 × 3 × 4 = 120.

Therefore The correct answer is 120.

Alternate Method

Given:

Number of vertices of the polygon (n) = 10

Formula Used:

To form a triangle, we need to select 3 vertices out of n available vertices.

Number of ways = $^nC_r = n! \div [r! \times (n - r)!]$

Calculations:

=> Total vertices = 10

=> Number of triangles = ^(10)C3

=> ^(10)C3 = (10 × 9 × 8) ÷ (3 × 2 × 1)

=> ^(10)C3 = 720 ÷ 6

=> ^(10)C3 = 120

Therefore The correct answer is 120.

Additional Information

Number of Diagonals

The number of diagonals in a polygon of n sides is given by [n × (n − 3)] ÷ 2.

Sum of Interior Angles

The sum of all interior angles of a polygon with n sides is (n − 2) × 180°.

Triangles with No Common Sides

Number of triangles that can be formed using vertices of a polygon such that no side of the triangle is a side of the polygon is $^nC3 - n - n(n - 4)$.

Q49. Answer: (c) 28%

Shortcut Trick

Assume Total Votes = 100 units.

Valid Votes = 100 − 30% of 100 = 70 units.

Winner gets 60% of valid votes → Loser gets (100% − 60%) = 40% of valid votes.

Loser% of total = 40% of 70 = 28 units.

Therefore The correct answer is 28%.

Alternate Method

Given:

Invalid votes = 30% of Total

Winner share = 60% of Valid votes

Calculations:

=> Let Total Votes = V

=> Valid Votes = V − 0.30V = 0.70V

=> Losing candidate share = (100% − 60%) of Valid Votes

=> Losing candidate share = 40% of 0.70V

=> Losing candidate share = 0.40 × 0.70V = 0.28V

=> Percentage = (0.28V / V) × 100 = 28%

Therefore The correct answer is 28%.

Additional Information

Percentage Change Base

Always identify if the percentage is calculated on the Initial Total or the Remaining/Valid amount to avoid calculation errors.

Successive Percentage Rule

For two successive changes a% and b%, the net effect is [a + b + (ab/100)]%. In elections, multiplication of factors (Valid% × Share%) is often faster.

Valid vs Invalid Votes

Total Votes = Valid Votes + Invalid Votes. Only Valid Votes are considered for determining the winning or losing margin.

Q50. Answer: (a) 25

Shortcut Trick

Compare the total quantities purchased by Arohi and Rhea.

Arohi: 3 apples + 5 bananas = Rs. 85

Rhea: 2 apples + 4 bananas = Rs. 60

Subtracting Rhea's total from Arohi's total: (3 − 2) apples + (5 − 4) bananas = Rs. 85 − Rs. 60

1 apple + 1 banana = Rs. 25

Therefore The correct answer is Rs. 25.

Alternate Method

Given:

Cost of 3 apples and 5 bananas = Rs. 85

Cost of 2 apples and 4 bananas = Rs. 60

Let the cost of one apple be x and the cost of one banana be y.

=> 3x + 5y = 85 → (Equation 1)

=> 2x + 4y = 60 → (Equation 2)

Subtracting Equation 2 from Equation 1:

=> (3x + 5y) − (2x + 4y) = 85 − 60

=> (3x − 2x) + (5y − 4y) = 25

=> x + y = 25

Therefore The correct answer is Rs. 25.

Additional Information

Elimination Method

A process of solving a system of equations by adding or subtracting them to eliminate one variable, making it easier to solve for the other.

Linear Equations in Two Variables

Equations of the form ax + by = c, where a, b, and c are constants and x, y are variables representing unknown quantities.

Substitution Method

Expressing one variable in terms of the other from one equation (e.g., x = 30 − 2y) and substituting it into the second equation.

Q51. Answer: (a) 6, 210

The logic followed here is:

thus, "6, 210" will replace the question mark in the given series.

Hence, the correct option is "Option 1".

Q52. Answer: (a) 4

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

Only 1 person sits to the left of E.

Only 2 people sit between E and F.

C sits immediately to the right of D.

G sits immediately to the left of A.

Only 1 person sits between F and D.

People between them are D, C, F and G = 4 people.

Hence, the correct answer is Option 1.

Q53. Answer: (c) 658

BODMAS Table:

Decoding the given information:

Alphabet	•	−	×	÷
Meaning	−	•	÷	×

Now, replacing the sign from left to right using BODMAS Rule, we get:

=> 163 × 4 + 125 ÷ 5 − 19 = ?

=> 652 + 25 − 19 = ?

=> 677 − 19 = ?

=> 658

Hence, the correct option is "Option 3".

Q54. Answer: (c) 3

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

Now,

Odd numbers, which are immediately preceded by an odd number and also immediately followed by an odd number.

So, Needed pattern is: Odd - Odd - Odd

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

1 5 1, 5 1 5, and 1 5 7

So, total valid odd numbers = 3

Hence, the correct answer is Option 3.

Q55. Answer: (b) 10

BODMAS Table:

Decoding the given information:

Alphabet	•	−	×	÷
Meaning	−	•	÷	×

Now, replacing the sign from left to right using BODMAS Rule, we get:

=> 7 × 2 − 45 ÷ 3 + 11 = ?

=> 14 − 15 + 11 = ?

=> 25 − 15 = ?

=> 10

Hence, the correct option is "Option 2".

Q56. Answer: (b) Two

Given: Seven boxes L, M, N, O, Q, R and S are kept one over the other but not necessarily in the same order.

Q is kept second from the bottom.

Only three boxes are kept between Q and S.

R is kept at one of the positions below Q.

Only N is kept between S and L.

Only two boxes are kept between L and O.

Position	**Box**
7 (Top)	O
6	S
5	N
4	L
3	M
2	Q
1 (Bottom)	R

Boxes between M and S → L, N

Hence, the correct answer is Option 2.

Q57. Answer: (b) 18 km, south

The logic followed here is:

Given:

Park is at reference point (0, 0)

School is 18 km North of Park → (0, 18)

Hospital is 21 km West of School → (-21, 18)
Restaurant is 21 km West of Park → (-21, 0)
According to the given information,
So, Restaurant is 18 km directly South of Hospital.
Hence, the correct answer is Option 2.

Q58. Answer: (a) 12

The logic followed here is:
Given numbers: 192, 574, 563, 189, 567
Arranging in descending order: 574, 567, 563, 192, 189
Highest number = 574
→ Third digit = 4
Lowest number = 189
→ Second digit = 8
Sum = 4 + 8 = 12
Hence, the correct answer is Option 1.

Q59. Answer: (b) 18th

Given:
Ujwala is 5th from the right in a row of 25 people.
Siya sits 3rd to the left of Ujwala.
Ujwala's position from right = 5
Siya is 3rd to the left of Ujwala → Siya's position from right = 5 + 3 = 8
Total number of people = 25
Siya's position from left = 25 − 8 + 1 = 18
Hence, the correct answer is Option 2.

Q60. Answer: (a) 19

The logic followed here is:
thus, "19" will replace the question mark in the given series.
Hence, the correct option is "Option 1".

Q61. Answer: (d) 65 km towards south

The logic followed here is:
Given:
Ravindra starts from Point Y (0, 0)
18 km North
Right turn → 45 km East
Right turn → 42 km South
Right turn → 26 km West
Right turn → 89 km North
Left turn → 19 km West
So, To return to Point Y, Ravindra must move 65 km South.
Hence, the correct answer is Option 4.

Q62. Answer: (c) Neither conclusion (I) nor (II) follows.

Given Statements:
Some batteries are torches.
All clocks are torches.
The least possible Venn diagram for the given statement is:
Conclusions:
I. Some batteries are clocks → Does not follow (Although some batteries are torches and all clocks are torches, there is no definite information that batteries overlap with clocks.)
II. All torches are clocks → Does not follow (The statement says "All clocks are torches," which means Clocks are a subset of

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Torches. It does not mean that all Torches are Clocks.)
So, neither conclusion I nor conclusion II follows.
Hence, the correct answer is Option 3.

Q63. Answer: (a) GT - EQ

The logic followed here is based on the alphabetical position pattern:
Option 1: GT - EQ
Option 2: YO - WM
Option 3: SW - QU
Option 4: XE - VC
Thus, GT - EQ does not follow the pattern.
Hence, the odd one out is Option 1.

Q64. Answer: (b) 3

Given: (Left) 6 9 9 5 8 8 5 4 8 4 2 2 7 6 2 2 7 1 5 9 3 (Right)
Now,
Even digits, which are immediately preceded by an even digit and also immediately followed by an odd digit.
So, Needed pattern is: Even - Even - Odd
(Left) 6 9 9 5 8 8 5 4 8 4 2 2 7 6 2 2 7 1 5 9 3 (Right)
So, total valid even digits = 3
Hence, the correct answer is Option 2.

Q65. Answer: (d) 56

BODMAS Table:
Decoding the given information:

Alphabet	A	B	C	D
Meaning	÷	×	•	–

Now, replacing the sign from left to right using BODMAS Rule, we get:
=> 14 × 2 − 18 ÷ 9 + 12 + 18 = ?
=> 28 − 2 + 12 + 18 = ?
=> 58 − 2 = ?
=> 56
Hence, the correct option is "Option 4".

Q66. Answer: (a) ZDB

The logic followed here is based on the alphabetical position pattern:
Option 1: ZDB
Option 2: KNM
Option 3: SVU
Option 4: YBA
Thus, ZDB does not follow the pattern.
Hence, the odd one out is Option 1.

Q67. Answer: (c) HUNT - TUHN - UNHT

The logic followed here is:
For, MAID → DAMI → AIMD
For, FOUR → ROFU → OUFR
Now, check the options using the same pattern:
Option 1) WENT → TEWN → NEWT
Option 2) GOLD → OGLD → DOLG
Option 3) HUNT → TUHN → UNHT
Option 4) LOAD → LAOD → DAOL

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Hence, the correct answer is Option 3.

Q68. Answer: (c) 37

The logic followed here is:

thus, "37" will replace the question mark in the given series.

Hence, the correct option is "Option 3".

Q69. Answer: (b) Neither conclusion (I) nor (II) follows

Given Statements:

Some chairs are tables.

Some tables are helmets.

The least possible Venn diagram for the given statement is:

Conclusions:

I. Some chairs are helmets → Does not follow (There is no definite information that Chairs overlap with Helmets. The overlap is only a possibility.)

II. All helmets are tables → Does not follow (The statement says only "Some tables are helmets". This does not mean that all Helmets are Tables.)

So, neither conclusion I nor conclusion II follows.

Hence, the correct answer is Option 2.

Q70. Answer: (d) (26, 13, 2)

The logic followed here is:

Logic: First Number = Second Number × Third Number.

For, (48, 12, 4)

=> 12 × 4 = 48

For, (30, 2, 15)

=> 2 × 15 = 30

Now, checking the options using the same pattern:

Option 1) (64, 8, 6)

=> 8 × 6 = 48 ≠ 64

Option 2) (70, 8, 9)

=> 8 × 9 = 72 ≠ 70

Option 3) (38, 14, 3)

=> 14 × 3 = 42 ≠ 38

Option 4) (26, 13, 2)

=> 13 × 2 = 26

Hence, the correct answer is Option 4.

Q71. Answer: (b) Y

O, P, Q, R, W, X and Y are sitting in a straight line facing north.

No one sits to the left of P.

Only four people sit between P and Q.

Only three people sit to the right of Y.

X sits immediately to the left of R.

W is not an immediate neighbour of Y.

Third to the left of W = Y

Hence, the correct answer is Option 2.

Q72. Answer: (a) Wife's father

Family Chart:

Decoding the Symbols:

Symbol →	**±**	**•**	**Rs.**	**#**
Meaning →	Wife	Sister	Father	Brother

Given: D Rs. R # A * C ± O
It means: D is the father of R, R is the brother of A, A is the sister of C, and C is the wife of O.
Thus, D is Wife's father.
Therefore, the correct answer is Option 1.

Q73. Answer: (b) Immediate right

Given: A, B, C, D, E and F sit around a circular table facing the centre.
B sits second to the left of D.
E is an immediate neighbour of B.
A sits to the immediate left of B.
C sits second to the right of D.
F sits to the immediate left of C.
→ A is immediately to the right of C.
Hence, the correct answer is "Option 2".

Q74. Answer: (b) kd

Given:
'what a surprise' is coded as 'kd oc ip'
'what is it' is coded as 'kd mp co'
So, what = kd
Hence, the correct answer is Option 2.

Q75. Answer: (b) Four

Given: (Left) 5 6 3 8 1 4 7 9 2 5 8 3 7 4 6 1 9 2 8 3 7 4 (Right)
Now,
We need to find the count of unique prime numbers in the series.
Prime Numbers = 2, 3, 5, 7
(Left) 5 6 3 8 1 4 7 9 2 5 8 3 7 4 6 1 9 2 8 3 7 4 (Right)
So, total unique prime numbers = 4
Hence, the correct answer is Option 2.

Q76. Answer: (b) NR59

The logic followed here is:
So, 'NR59' will replace the question mark in the given series.
Hence, the correct answer is "Option 2"

Q77. Answer: (b) ww

Given:
'wet pig kit' is coded as 'zp ww hz'
'thing kit head' is coded as 'ww ym ce'
So, kit = ww
Hence, the correct answer is Option 2.

Q78. Answer: (b) GREY - YEGR - GERY

The logic followed here is:
For, COLD → DLCO → CLOD
For, HOUR → RUHO → HUOR
Now, check the options:
Option 1) RICE → ICRE → ICER
Option 2) GREY → YEGR → GERY
Option 3) BUGS → SGBU → UGBS
Option 4) SUIT → SIUT → TIUS
Hence, the correct answer is Option 2.

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Q79. Answer: (d) HUTS - USTH - STUH

The logic followed here is:

For, FOUR → ORUF → RUOF

For, RIFT → ITFR → TFIR

Now, check the options:

Option 1) GRAM → GARM → MARG

Option 2) QUIT → UQIT → TUIQ

Option 3) OPEN → POEN → NPEO

Option 4) HUTS → USTH → STUH

Hence, the correct answer is Option 4.

Q80. Answer: (d) PDQ15

The logic followed here is:

So, 'PDQ15' will replace the question mark in the given series.

Hence, the correct answer is "Option 4"

Q81. Answer: (c) 5.50%

The correct answer is 5.50%.

Key Points

• The Monetary Policy Committee (MPC), in its meeting held in June 2025, decided to reduce the policy repo rate to 5.50%.

• This decision involved a significant reduction of 50 basis points (bps) from the existing rate, aimed at fostering an environment conducive to economic expansion.

• By lowering the repo rate to 5.50%, the Reserve Bank of India (RBI) intends to decrease the cost of borrowing for commercial banks, which typically translates into lower lending rates for businesses and individual consumers.

• The MPC usually meets bi-monthly (every two months) to evaluate the macroeconomic situation, including inflation levels and GDP growth projections, to determine the appropriate policy stance.

• The reduction to 5.50% indicates an accommodative monetary policy stance, which is often used during periods when the central bank wants to encourage spending and investment to boost the economy.

Additional Information

• Monetary Policy Committee (MPC):

• The MPC is a statutory and institutionalized framework under the Reserve Bank of India Act, 1934, specifically Section 45ZB, to maintain price stability.

• It consists of six members: three members from the RBI (including the Governor) and three external members appointed by the Central Government.

• The Governor of the RBI acts as the ex-officio Chairperson of the committee.

• Policy Repo Rate:

• The Repo Rate (Repurchase Rate) is the interest rate at which the RBI lends liquidity to commercial banks against the collateral of government and other approved securities.

• It is the primary tool used by the central bank to control the money supply and liquidity in the economy.

• Basis Points (bps):

• In finance, a basis point is a common unit of measure for interest rates. One basis point is equivalent to 0.01% or 1/100th of a percent.

• Therefore, a reduction of 50 bps is equal to a 0.50% decrease in the interest rate.

Important Points

• Inflation Targeting: The RBI has a primary mandate to keep Consumer Price Index (CPI) inflation within a target of 4% with a tolerance band of +/- 2% (i.e., between 2% and 6%).

• Liquidity Management: Besides the Repo Rate, the RBI uses other instruments like the Reverse Repo Rate, Cash Reserve Ratio (CRR), and Statutory Liquidity Ratio (SLR) to manage the economy.

• Impact of Rate Cuts: A lower repo rate of 5.50% generally makes EMIs (Equated Monthly Installments) for home loans, car loans, and personal loans more affordable, thereby increasing the disposable income of households.

• Decision Making: In the MPC, each member has one vote. In the event of a tie, the Governor has a casting vote.

Q82. Answer: (a) Jake Tapper and Alex Thompson

The correct answer is Jake Tapper and Alex Thompson.

Key Points

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• The book titled "Original Sin: Joe Biden and the End of the Democratic Party as We Know It" was authored by Jake Tapper and Alex Thompson.

• Released in January 2025, the book provides a comprehensive, behind-the-scenes account of the Joe Biden presidency and the internal turmoil within the Democratic Party leading up to the 2024 United States Presidential Election.

• The narrative focuses on the critical period of 2024, detailing the pressures that led to President Biden's decision to withdraw from the race and the subsequent endorsement of Vice President Kamala Harris. Hence, the statement regarding the authors is correct.

• Jake Tapper, a veteran journalist and CNN's lead Washington anchor, collaborated with Alex Thompson, a prominent national political correspondent for Axios, to synthesize deep-access reporting.

• The authors explore the "original sin" of the administration—the strategic and political miscalculations that the book argues ultimately paved the way for Donald Trump's return to power in the 2024 election.

Additional Information

• Profiles of the Authors:

• Jake Tapper: He is the anchor of The Lead with Jake Tapper and the co-anchor of State of the Union on CNN. He has previously authored several bestsellers, including "The Outpost: An Untold Story of American Valor" and political thrillers like "The Hellfire Club".

• Alex Thompson: Known for his "West Wing Playbook" at Politico before moving to Axios, he is widely regarded as one of the most well-sourced reporters covering the Biden White House and the Democratic establishment.

• Themes and Analysis:

• The book Original Sin analyzes the generational shift within American politics and the structural challenges facing the Democratic National Committee (DNC).

• It documents specific events from June 2024, such as the first presidential debate, which served as a catalyst for the party's leadership change.

• The publication offers insights into the Biden-Harris relationship and the friction between the White House staff and the broader Democratic campaign apparatus.

• Context of Other Options:

• Bob Woodward and Carl Bernstein: Famous for their coverage of the Watergate scandal in the 1970s. Woodward released his own book titled "War" in late 2024, but he did not co-author Original Sin.

• Michael Wolff: Known for the "Fire and Fury" trilogy regarding the Trump administration.

• Maggie Haberman: A New York Times correspondent and author of "Confidence Man", focused primarily on Donald Trump.

Important Points

• The book was published by Little, Brown and Company, a major American publishing house.

• It serves as a primary source for understanding the political climate of the mid-2020s, specifically the transition of power and the reorganization of political ideologies in the United States.

• The collaboration between a broadcast journalist (Tapper) and a digital-first reporter (Thompson) highlights the modern trend of multi-platform investigative journalism in Washington, D.C..

Q83. Answer: (d) Gout Gout

The correct answer is Gout Gout.

Key Points

• Gout Gout is a rising Australian sprinting sensation who has gained international attention for his incredible speed in the 200m and 100m events.

• The 16-year-old athlete recently made headlines by clocking a remarkable 20.02 seconds (and previously 20.29 seconds) in the 200m sprint, significantly breaking national junior records.

• His performance in Ostrava at the World Athletics Continental Tour or similar high-profile meets has solidified his reputation as one of the fastest teenagers in history.

• Born in Ipswich, Queensland, to South Sudanese parents, he is often compared to the legendary Usain Bolt due to his tall stature, late-race acceleration, and dominant running style.

• His record-breaking run at such a young age places him among the elite Under-20 (U20) sprinters globally, challenging times set by established world-class athletes.

Additional Information

• Reynier Mena:

• Reynier Mena is a prominent Cuban sprinter known for his explosive speed in the 100m and 200m.

• He made history in July 2022 at the Ostrava Golden Spike meet by running the 200m in 19.63 seconds, which is one of the fastest times ever recorded in the event.

• Lamine Yamal:

• Lamine Yamal is a world-renowned professional footballer who plays as a right-winger for FC Barcelona and the Spain national team.

• He is famous for breaking numerous "youngest player" records in football, including at UEFA Euro 2024, but he is not a track and field athlete.

• Victor Lopez:

• Victor Lopez is a respected figure in the world of athletics, serving as the President of the Association of Pan-American Athletics (APA).

• He is better known for his coaching and administrative contributions to the sport rather than being an active record-breaking sprinter.

• The 200m Sprint:

• The 200 meters is a classic sprint event in athletics that requires a combination of curved-track technique and straightaway speed.

• The World Record for the 200m is held by Usain Bolt, who clocked 19.19 seconds at the 2009 World Championships in Berlin.

• Major meets like the Ostrava Golden Spike (founded in 1961) serve as vital platforms for athletes to achieve Olympic and World Championship qualifying standards.

Important Points

• National and International Context:

• Gout Gout represented Australia at the 2024 World Athletics U20 Championships in Lima, Peru, where he won the silver medal in the 200m.

• His rapid progression suggests he will be a key contender for the 2028 Los Angeles Olympics and the 2032 Brisbane Olympics.

• The emergence of young talents like Gout Gout and Erriyon Knighton (USA) signals a highly competitive era for the 200m discipline.

Q84. Answer: (a) National Policy on Geothermal Energy

The correct answer is National Policy on Geothermal Energy.

Key Points

• The National Policy on Geothermal Energy was officially launched by the Ministry of New and Renewable Energy (MNRE) in September 2025. This policy marks a significant milestone in India's transition toward a diversified and sustainable energy portfolio. Hence, the correct answer is National Policy on Geothermal Energy.

• The primary objective of this policy is to harness geothermal energy, which is the heat stored beneath the Earth's surface, to provide a consistent and baseload power supply that complements intermittent sources like solar and wind.

• The policy aligns with India’s ambitious Net Zero target by the year 2070 and the intermediate goal of achieving 500 GW of non-fossil fuel based energy capacity by 2030.

• It introduces a structured framework for the exploration, assessment, and commercial exploitation of geothermal resources across various geothermal provinces in India.

• The framework encourages Public-Private Partnerships (PPP) and offers financial incentives and Single Window Clearance to attract domestic and international investments in deep-drilling technologies.

Additional Information

• Geothermal Energy Potential in India:

• India is estimated to have a geothermal potential of approximately 10,000 MW (10 GW).

• Major geothermal provinces include the Himalayas (Puga, Chhumathang), Sohna valley, Cambay basin, Son-Narmada-Tapti (SONATA) lineament belt, and the Godavari and Mahanadi basins.

• The Puga Valley in Ladakh is considered the most promising site, where the first pilot project was initiated by ONGC (Oil and Natural Gas Corporation).

• Ministry of New and Renewable Energy (MNRE):

• The MNRE is the nodal ministry of the Government of India for all matters relating to new and renewable energy.

• It aims to develop and deploy new and renewable energy for supplementing the energy requirements of the country.

• The ministry plays a pivotal role in implementing the National Green Hydrogen Mission and the PM-KUSUM scheme.

• India's Climate Commitments:

• At COP26 in Glasgow, India announced the Panchamrit strategy, which includes increasing non-fossil energy capacity and reducing the carbon intensity of the economy by 45% by 2030.

• Geothermal energy is vital as it provides 24/7 clean energy, unlike Solar Energy (dependent on daylight) or Wind Energy (dependent on weather conditions).

Important Points

• Advantages of Geothermal Power:

• It has a high capacity factor, often exceeding 80%, making it a reliable baseload alternative to coal-fired plants.

• It requires minimal land area compared to large-scale solar farms or wind parks.

• Applications include not just electricity generation but also direct heat use for space heating, greenhouses, and industrial processes.

• Technological Requirements:

• The policy emphasizes the use of Enhanced Geothermal Systems (EGS) and Binary Cycle Power Plants to extract energy from low-to-medium temperature reservoirs found in many parts of India.

Q85. Answer: (d) 2.3%

The correct answer is 2.3%.

Key Points

• According to the World Bank's Spring 2025 Poverty and Equity Brief, India has made significant strides in poverty reduction, with the extreme poverty rate falling to 2.3% in 2022-23.

• Extreme poverty is measured using the international poverty line of $2.15 per person per day based on 2017 Purchasing Power Parity (PPP).

• The latest estimates are derived from the Household Consumption Expenditure Survey (HCES) 2022-23, which was released by the National Sample Survey Office (NSSO) of India after a long gap since 2011-12.

• The report highlights that the extreme poverty rate was 22.5% in 2011-12, indicating a massive decline of approximately 20 percentage points over the span of 11 years.

• This decline suggests that nearly 250 million people have moved out of extreme poverty in India during this period, driven by consistent economic growth and targeted social welfare programs.

Additional Information

• International Poverty Lines:

• The World Bank uses different benchmarks to assess poverty across various income levels: the $2.15 line for extreme poverty, the $3.65 line for lower-middle-income countries, and the $6.85 line for upper-middle-income countries.

• In India, poverty at the $3.65 per day level also saw a decline, reaching approximately 12.1% in 2022-23.

• HCES 2022-23 Data:

• The Household Consumption Expenditure Survey (HCES) is a crucial dataset for India, as it forms the basis for calculating poverty ratios and updating the Consumer Price Index (CPI) basket.

• The 2022-23 survey adopted a new methodology, including multiple visits to households and a more detailed item list, to capture modern consumption patterns.

• Multidimensional Poverty:

• Apart from income/expenditure-based poverty, India also tracks the Multidimensional Poverty Index (MPI), which accounts for health, education, and living standards.

• The NITI Aayog's national MPI report recently noted that the share of multidimensionally poor people in India fell from 24.85% in 2015-16 to 14.96% in 2019-21.

Important Points

• Rural vs. Urban Trends:

• The poverty reduction has been more pronounced in rural India compared to urban areas, although rural poverty levels remain higher in absolute terms.

• In 2022-23, the rural extreme poverty rate was estimated at 2.5%, while the urban extreme poverty rate stood at 1.7%.

• Drivers of Reduction:

• Government initiatives such as the Pradhan Mantri Garib Kalyan Anna Yojana (PMGKAY), which provides free foodgrains, and the Jal Jeevan Mission for clean water, have played a vital role in improving the standard of living.

• Enhanced infrastructure development and digital financial inclusion through JAM (Jan Dhan-Aadhaar-Mobile) trinity have further accelerated the poverty exit process.

Q86. Answer: (c) World Health Organization

The correct answer is World Health Organization.

Key Points

• The National Polio Surveillance Network (NPSN) was established in 1997 as a collaborative effort between the Government of India and the World Health Organization (WHO) to provide technical assistance for polio eradication.

• In June 2025, the Government of India plans to complete the transition of the NPSN, effectively shutting down the WHO-managed framework to integrate its functions into the national public health system.

• The NPSN played a pivotal role in the Global Polio Eradication Initiative (GPEI), utilizing a vast network of Surveillance Medical Officers (SMOs) to monitor Acute Flaccid Paralysis (AFP) cases across the country.

• Through the rigorous monitoring and immunization strategies supported by the WHO, India reported its last case of wild poliovirus in January 2011 and was officially certified Polio-free in March 2014.

• The transition signifies India's capacity to independently manage large-scale Vaccine Preventable Diseases (VPDs) surveillance using its own institutional resources and manpower. Hence, the correct answer is World Health Organization.

Additional Information

• World Health Organization (WHO):

• Established on 7 April 1948, the WHO is a specialized agency of the United Nations responsible for international public health.

• Headquartered in Geneva, Switzerland, it works with 194 Member States to promote health, keep the world safe, and serve the vulnerable.

• It provides technical support and sets international health standards, such as those used in the NPSN for polio surveillance.

• Polio Eradication in India:

• The last case of wild poliovirus was detected on 13 January 2011, in a two-year-old girl in Howrah, West Bengal.

• India maintained a zero-case record for three consecutive years, meeting the WHO criteria for eradication.

• The Pulse Polio Programme, launched in 1995, was the primary vehicle for administering the Oral Polio Vaccine (OPV) to children under the age of 5.

• Transition and Repurposing:

• The infrastructure developed by the WHO for polio is now being repurposed to strengthen surveillance for other diseases like Measles, Rubella, and Neonatal Tetanus.

• This shift is part of the National Health Mission (NHM) strategy to achieve universal immunization coverage across all states and Union Territories.

• Global Polio Eradication Initiative (GPEI):

• It is a public-private partnership led by national governments and five partners: WHO, Rotary International, the US Centers for Disease Control and Prevention (CDC), UNICEF, and the Bill & Melinda Gates Foundation.

Important Points

• Surveillance Mechanism: The NPSN utilized nearly 40,000 reporting units and over 1,000 specialized staff members to ensure no case of paralysis went unnoticed.

• Polio Vaccines: India utilizes both Oral Polio Vaccine (OPV) for mass campaigns and Inactivated Polio Vaccine (IPV) as part of the Universal Immunization Programme (UIP).

• Current Status: While India is polio-free, the risk of importation remains from countries where the virus is still endemic, such as Pakistan and Afghanistan, necessitating continued vigilance.

Q87. Answer: (c) London Summit on Ukraine

The correct answer is London Summit on Ukraine.

Key Points

• The London Summit on Ukraine was a high-level diplomatic event held in early March 2025 in London, United Kingdom.

• This summit saw the active participation of 16 sovereign states, including major global powers and regional allies committed to the stability of Eastern Europe.

• Crucially, the summit included the European Union (EU) and the North Atlantic Treaty Organization (NATO), represented by their respective leadership, highlighting a unified multilateral approach.

• The primary objective of the summit was to coordinate long-term security commitments and provide a structured framework for Ukraine's defensive capabilities and future reconstruction. Hence, the statement regarding the participation of 16 states, the EU, and NATO is correct.

• The meeting served as a follow-up to previous international conferences, focusing on the economic recovery and infrastructure rebuilding of the nation amidst ongoing geopolitical tensions.

Additional Information

• Strategic Importance of London: The United Kingdom has consistently acted as a lead coordinator for international aid. By hosting the summit in March 2025, the UK government aimed to solidify bilateral security pacts that go beyond immediate military hardware assistance.

• Role of NATO and EU:

• NATO's involvement centered on the Interoperability of defense systems and the transition of Ukraine toward Alliance standards.

• The EU focused on the Ukraine Facility, a multi-year financial package designed to support governance reforms and economic integration into the Single Market.

• Defense Industry Collaboration: A significant portion of the 2025 summit was dedicated to joint ventures between 16 states and Ukrainian defense firms to boost ammunition production and drone technology.

• Participant Demographics: The 16 states involved primarily consisted of G7 members and key Eastern European and

Nordic-Baltic nations, emphasizing a coalition of "willing and capable" partners.

• Comparison with other Summits:

• The Munich Security Conference (typically held in February) serves as an informal platform for global security policy but lacks the specific legislative or financial mandate of the London Summit.

• The Shangri-La Dialogue is primarily focused on Asia-Pacific security and takes place in Singapore, usually in May or June.

• The UN General Assembly meets in September in New York and covers a much broader range of global humanitarian and developmental issues.

Important Points

• The London Summit on Ukraine is part of a series of Recovery Conferences; previous iterations were held in Lugano (2022), London (2023), and Berlin (2024).

• By 2025, the focus shifted significantly from "emergency survival aid" to "sustainable investment" and private sector engagement.

• The participation of NATO and the EU at this specific summit in March 2025 underscored the institutionalization of support, ensuring that aid remains independent of individual national election cycles.

• Specific outcomes included the London Declaration 2025, which outlined a 10-year roadmap for energy security and de-mining operations across Ukraine.

Q88. Answer: (d) Justice Surya Kant

p>The correct answer is Justice Surya Kant.

Key Points

• Justice Surya Kant was officially designated as the 53rd Chief Justice of India (CJI) on 30 October 2025 and formally assumed office on 24 November 2025.

• He succeeded Justice B.R. Gavai (the 52nd CJI), continuing the established line of succession in the Supreme Court of India based on the principle of seniority.

• Born in Hisar, Haryana, in 1962, Justice Surya Kant has had a distinguished legal career, previously serving as the Chief Justice of the Himachal Pradesh High Court before his elevation to the Supreme Court on 24 May 2019.

• His tenure as the Chief Justice of India is slated to last until 9 February 2027, when he will reach the mandatory retirement age of 65 years.

• During his career, he has been part of several landmark judgments involving constitutional law, fundamental rights, and administrative reforms, contributing significantly to Indian jurisprudence.

Additional Information

• Justice B.V. Nagarathna: A sitting judge of the Supreme Court of India, she is widely recognized for the historic possibility of becoming the first woman Chief Justice of India. Her projected tenure as CJI is expected to begin in September 2027, though it will be for a relatively short duration of 36 days.

• Justice P.S. Narasimha: He was elevated directly from the Bar to the Supreme Court bench in August 2021. He is also in the line of succession to become the Chief Justice of India in the year 2027-28.

• Justice Vikram Nath: Formerly the Chief Justice of the Gujarat High Court, he was among the nine judges appointed to the Supreme Court in 2021 and is another key figure in the seniority-based succession for the top judicial post.

• Appointment Process: Under Article 124 of the Constitution of India, the President of India appoints the Chief Justice. By convention, the outgoing CJI recommends the name of the most senior judge of the Supreme Court as their successor.

Important Points

• The Collegium System: This is the system by which judges are appointed and transferred in the Supreme Court and High Courts. It consists of the Chief Justice of India and the four most senior judges of the Supreme Court.

• Retirement and Qualifications: A judge of the Supreme Court must be a citizen of India and must have been a judge of a High Court for at least 5 years or an advocate of a High Court for 10 years. The retirement age is fixed at 65 years.

• Constitutional Oath: Every person appointed to be a judge of the Supreme Court shall, before entering upon office, make and subscribe an oath or affirmation before the President of India according to the form set out in the Third Schedule of the Constitution.

• Removal: A judge can only be removed from office by an order of the President passed after an address by each House of Parliament (supported by a special majority) on the grounds of proved misbehaviour or incapacity.

Q89. Answer: (d) Meghalaya

The correct answer is Meghalaya.

Key Points

• The boundary dispute between Assam and Meghalaya is a long-standing issue that traces back to 1972, when Meghalaya was carved out of Assam under the North-Eastern Areas (Reorganisation) Act, 1971.

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• The two states share a border of approximately 884.9 km. The conflict primarily stems from Meghalaya's challenge to the Assam Reorganisation (Meghalaya) Act, 1969, which defined the boundaries of the new state.

• There are 12 areas of dispute along the border, including Upper Tarabari, Gazang reserve forest, Hahim, Langpih, Borduar, Boklapara, Nongwah, Matamur, Khanapara-Pilangkata, Deshdemoreah, Block I and Block II, and Khanduli-Psyar.

• In March 2022, a historic Memorandum of Understanding (MoU) was signed between Assam Chief Minister Himanta Biswa Sarma and Meghalaya Chief Minister Conrad Sangma in the presence of Union Home Minister Amit Shah to resolve 6 out of the 12 points of dispute.

• The dispute reached significant legal and administrative milestones in 2024 and 2025 as both state governments intensified the second phase of border talks to address the remaining six complex sectors, involving regional committees and joint field visits. Hence, the correct answer is Meghalaya.

Additional Information

• Constitutional Provisions: Under Article 3 of the Constitution of India, the Parliament has the power to form new states and alter the areas, boundaries, or names of existing states. This power is often exercised to address administrative needs or settle historical territorial claims.

• The North-Eastern Areas (Reorganisation) Act, 1971: This was a landmark Act of the Indian Parliament that led to the creation of the states of Manipur and Tripura, and the conversion of the Union Territories of Mizoram and Arunachal Pradesh. It also formally established Meghalaya as a full-fledged state, having previously been an autonomous state within Assam.

• Other Border Disputes in Northeast India:

• Assam-Mizoram: A major dispute involving the Inner Line Reserve Forest, which saw a violent clash in July 2021 resulting in the death of six Assam Police personnel.

• Assam-Arunachal Pradesh: A dispute involving over 1,200 villages. A significant Namsai Declaration was signed in 2022 to minimize the number of contested areas.

• Assam-Nagaland: The longest-running border dispute in the region, which began immediately after Nagaland achieved statehood in 1963, involving tracts in the Brahmaputra Valley.

• Role of the Ministry of Home Affairs (MHA): The MHA acts as a facilitator in inter-state boundary disputes. While the Supreme Court has jurisdiction under Article 131 of the Constitution to decide on such disputes, the Union Government prefers settlements through mutual dialogue and regional committees.

Important Points

• Survey of India: This is the national survey and mapping organization of the country under the Department of Science & Technology. It plays a critical role in demarcating boundaries and providing geospatial data to resolve state-level territorial conflicts.

• Criteria for Settlement: The recent Assam-Meghalaya resolution process used five principles: historical facts, ethnicity, administrative convenience, contiguity, and the willingness of the local population residing in the disputed areas.

• Status of Other Options:

• Himachal Pradesh: While it has minor territorial discussions with Ladakh (Sarchu) and Haryana (Parwanoo), it was not a primary party in the 2025 high-profile Assam border context.

• Sikkim: Shares international borders with China, Nepal, and Bhutan, but does not share a land border with Assam.

• Bihar: Primarily involved in flood management or occasional transit issues with Nepal or Uttar Pradesh, but not a border disputant with Assam.

Q90. Answer: (c) Sonbhadra, Uttar Pradesh

The correct answer is Sonbhadra, Uttar Pradesh.

Key Points

• The NAVYA programme is a strategic initiative launched by the Government of India to empower adolescent girls by providing them with specialized vocational training.

• The programme was first inaugurated in June 2025 in the Sonbhadra district of Uttar Pradesh, marking a significant step toward regional development and gender parity in the workforce.

• The core objective of NAVYA is to facilitate the entry of young women into non-traditional job roles, which includes sectors like manufacturing, renewable energy, electronics, and information technology.

• By focusing on non-traditional roles, the scheme aims to break long-standing gender stereotypes that often confine women to specific service-oriented or domestic-adjacent occupations.

• The training curriculum is designed to make the participants industry-ready, ensuring they possess the technical skills required for high-growth sectors in the modern Indian economy.

Additional Information

• Significance of Sonbhadra:

• Sonbhadra is the second-largest district of Uttar Pradesh and is often referred to as the "Energy Capital of India" due to its high concentration of power plants.

• Being an Aspirational District, it was selected for the pilot launch of NAVYA to boost socio-economic indicators among the marginalized sections of the population.

• The district is unique as it borders four different states: Madhya Pradesh, Chhattisgarh, Jharkhand, and Bihar, making it a critical hub for regional integration.

• Target Demographic and Scope:

• The programme primarily targets girls in the age group of 14 to 18 years, ensuring they receive skill development alongside or after their formal schooling.

• Roles included under the training umbrella involve Electric Vehicle (EV) technicians, drone pilots, solar panel installers, and industrial automation experts.

• It aligns with the broader goals of the National Skill Development Corporation (NSDC) and the Skill India Mission.

• Policy Alignment:

• NAVYA complements existing schemes like Beti Bachao Beti Padhao by moving beyond education to economic self-reliance.

• It follows the guidelines of the National Education Policy (NEP) 2020, which emphasizes the vocationalization of education from an early stage.

• The Ministry of Women and Child Development, in collaboration with the Ministry of Skill Development and Entrepreneurship, monitors the implementation to ensure quality and placement support.

Important Points

• Economic Impact: By integrating women into the industrial workforce, the NAVYA programme is expected to contribute to an increase in the Female Labour Force Participation Rate (FLFPR) in India.

• Social Transformation: Training in non-traditional trades provides girls with higher bargaining power within their families and communities, delaying early marriage and promoting financial independence.

• Technological Integration: The 2025 launch highlights the government's focus on Industry 4.0, where skills in coding, robotics, and AI-driven logistics are becoming essential.

Q91. Answer: (b) 4.0%

The correct answer is 4.0%.

Key Points

• The Reserve Bank of India (RBI), in its bi-monthly monetary policy review announced in December 2024, decided to reduce the Cash Reserve Ratio (CRR).

• The CRR was reduced by 50 basis points (bps), moving it from the previous level of 4.50% to the new level of 4.00%.

• This decision was announced by the RBI Governor Shaktikanta Das to address the prevailing liquidity conditions in the banking system.

• The reduction in the ratio is estimated to release primary liquidity worth approximately Rs 1.16 lakh crore into the Indian banking system, providing banks with more funds for lending.

• This was a significant move as the CRR had remained unchanged at 4.50% since May 2022.

Additional Information

• Definition of CRR: The Cash Reserve Ratio is the share of a bank's Net Demand and Time Liabilities (NDTL) that it must maintain with the Reserve Bank of India in the form of liquid cash.

• Purpose of CRR: It acts as a monetary policy tool used by the central bank to regulate the money supply, control inflation, and ensure the solvency of the banking sector. When the RBI lowers the CRR, it increases the loanable funds available to banks.

• Interest Earnings: Banks do not earn any interest or profit on the money kept with the RBI under the CRR requirements.

• Monetary Policy Committee (MPC): While the CRR is determined by the RBI under the RBI Act, 1934, other key rates like the Repo Rate are decided by the MPC. In the same December 2024 meeting, the Repo Rate was kept unchanged at 6.50%.

• Impact on Economy: A cut in CRR is typically seen as a dovish move that helps ease liquidity crunches and can lead to a decrease in interest rates for retail and corporate loans.

Important Points

• Implementation Date: The reduction to 4.00% was scheduled to be implemented in two tranches, with the first 25 bps cut effective from the fortnight beginning December 14, 2024, and the next 25 bps cut from the fortnight beginning December 28, 2024.

• Liquidity Management: The RBI uses CRR alongside the Statutory Liquidity Ratio (SLR) to manage the liquidity in the economy. Unlike CRR, SLR can be maintained in gold or government-approved securities.

• Historical Context: The CRR has seen various fluctuations over the decades, reaching as high as 15% in the early 1990s before the liberalization era led to more moderate levels.

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Q92. Answer: (d) Udaipur and Indore

The correct answer is Udaipur and Indore.

Key Points

• The Ministry of Environment, Forest and Climate Change (MoEF&CC) officially submitted nominations for Indore (Madhya Pradesh), Udaipur (Rajasthan), and Bhopal (Madhya Pradesh) for the Wetland City Accreditation (WCA) under the Ramsar Convention.

• Udaipur, popularly known as the City of Lakes, is famous for its sophisticated lake system, including Lake Pichola, Fateh Sagar, and Swaroop Sagar, which are vital for the city's microclimate and tourism. Hence, the inclusion of Udaipur is correct.

• Indore has been recognized for its environmental initiatives, particularly the restoration and protection of Sirpur Wetland and Yashwant Sagar, both of which are Ramsar Sites. Hence, the inclusion of Indore is correct.

• The Wetland City Accreditation scheme was established to recognize cities that have taken exceptional steps to safeguard their urban wetlands and promote sustainable use.

• These nominations represent India's first-ever attempt to get its cities recognized on the global stage as Wetland Cities, highlighting the country's commitment to the Amrit Dharohar initiative. Hence, option 4 is the correct answer.

Additional Information

• Wetland City Accreditation (WCA):

• This voluntary accreditation system was introduced during the COP12 of the Ramsar Convention in 2015.

• It aims to promote the conservation and wise use of urban and peri-urban wetlands, as well as sustainable socio-economic benefits for local populations.

• To be eligible, a city must have one or more Ramsar Sites or significant wetlands within its jurisdiction that provide various ecosystem services.

• The Ramsar Convention:

• Signed in 1971 in the Iranian city of Ramsar, it is one of the oldest inter-governmental accords for preserving the ecological character of wetlands.

• India currently has 85 Ramsar Sites (as of 2024 updates), covering a significant area of the country's total geographical surface.

• Specific City Highlights:

• Udaipur: The lakes here are managed by the Rajasthan Government and local communities, ensuring a balance between urban development and ecological preservation.

• Indore: Known as India’s cleanest city, it has integrated waste management with wetland conservation, significantly improving the biodiversity of Sirpur Lake.

• Bhopal: Although not paired in the chosen option, it was also nominated due to the Bhoj Wetland, which consists of the Upper Lake and Lower Lake.

Important Points

• Significance of Accreditation: Gaining Wetland City status provides international prestige and helps cities attract funding for conservation projects and sustainable eco-tourism.

• Conservation Laws: In India, wetlands are protected under the Wetlands (Conservation and Management) Rules, 2017, which prohibit activities like encroachment, dumping of solid waste, and discharge of untreated effluents.

• Global Context: There are currently very few accredited Wetland Cities globally (mostly in China, France, and South Korea), and India's inclusion would mark a significant milestone for South Asia.

• Year of Recognition: While the nomination process gained momentum in 2024, the official recognition status for the cycle is often finalized by the Ramsar Secretariat in the following year, matching the 2025 timeframe mentioned in the query.

Q93. Answer: (c) Rs. 13,416 crore

The correct answer is Rs. 13,416 crore.

Key Points

• The Union Budget 2025–26, presented by Finance Minister Nirmala Sitharaman on February 1, 2025, has allocated a total of Rs. 13,416 crore to the Department of Space (DoS).

• This allocation represents a significant increase of approximately 26% compared to the Revised Estimate (RE) of Rs. 10,638 crore for the previous financial year 2024–25. Hence, the correct answer is Rs. 13,416 crore.

• The bulk of this budget is directed toward Space Technology, which received Rs. 10,131.63 crore, primarily to fund ambitious missions like Gaganyaan and Chandrayaan-4.

• The Gaganyaan mission, India's first human spaceflight program, is a major priority, with funds earmarked for unmanned test flights and the development of heavy-lift launch vehicles.

• Other major allocations within the budget include Rs. 1,532.70 crore for Space Applications and Rs. 588.63 crore for the INSAT satellite system, which supports communication and weather monitoring.

Additional Information

• Department of Space (DoS):

• The Department of Space is the nodal agency for India's space program and reports directly to the Prime Minister of India.

• It oversees the Indian Space Research Organisation (ISRO), which is headquartered in Bengaluru and was established in 1969.

• The DoS also manages NewSpace India Limited (NSIL) and the Indian National Space Promotion and Authorization Centre (IN-SPACe) to foster commercial and private participation.

• Long-term Vision (Amrit Kaal):

• India aims to establish the Bharatiya Antariksh Station (Indian Space Station) by the year 2035.

• The government has set a target to land the first Indian astronaut on the Moon by 2040.

• The Indian Space Policy 2023 serves as the guiding document for these milestones, encouraging end-to-end participation of the private sector in space activities.

• Space Sector Reforms:

• In 2024, the government amended the Foreign Direct Investment (FDI) policy, allowing 100% FDI in certain sub-sectors of the space industry to attract global investment.

• A Rs. 1,000 crore Venture Capital Fund was also announced to support space-tech startups, aiming to expand India's share in the global space economy from 2% to 10% by 2033.

Important Points

• Mission-Specific Highlights:

• Chandrayaan-4: A sample-return mission to the Moon that will demonstrate docking and undocking capabilities in lunar orbit.

• Shukrayaan: A planned mission to explore the planet Venus, focusing on its atmosphere and surface chemistry.

• NGLV (Next Generation Launch Vehicle): Development of a reusable, heavy-lift rocket capable of carrying larger payloads for future space station modules.

• Economic Impact:

• The increased funding is expected to boost high-tech manufacturing and generate employment in the STEM (Science, Technology, Engineering, and Mathematics) sectors.

• India’s Space Economy is currently valued at approximately $8.4 billion and is projected to reach $44 billion within the next decade.

Q94. Answer: (a) Kerala

The correct answer is Kerala.

Key Points

The Management Effectiveness Evaluation (MEE) is a global framework used to assess how well National Parks and Wildlife Sanctuaries are being managed. In the 2022–23 cycle (the 5th cycle relevant to the 2020–2025 period), Kerala emerged as the top-performing state.

The Periyar Tiger Reserve in Kerala was ranked as the best-managed protected area in the country, securing an exceptional MEE score of 94.38%. Hence, the statement regarding Kerala being the best performer is correct.

This evaluation was conducted by the Ministry of Environment, Forest and Climate Change (MoEFCC) in collaboration with the Wildlife Institute of India (WII) and the National Tiger Conservation Authority (NTCA).

The evaluation process involves 30 parameters categorized under planning, inputs, process, outputs, and outcomes to ensure a comprehensive assessment of biodiversity conservation and administrative efficiency.

The MEE 2022–2023 report highlighted that Kerala has consistently maintained high standards in habitat management, anti-poaching measures, and community participation in conservation.

Additional Information

Periyar Tiger Reserve (Kerala):

Located in the Idukki and Pathanamthitta districts within the Western Ghats.

It was declared a National Park in 1982 and is famous for its Asian Elephant and Bengal Tiger populations.

The reserve is notable for the Periyar Lake, an artificial reservoir formed by the Mullaperiyar Dam across the Periyar River.

Management Effectiveness Evaluation (MEE) Framework:

The framework was originally developed by the IUCN World Commission on Protected Areas (WCPA).

India adopted this system in 2006 to bring transparency and scientific rigor to the management of its Protected Area (PA) network.

Protected areas are categorized into four groups: Very Good (score > 75%), Good (60-74%), Satisfactory (50-59%), and Poor (< 50%).

Other High Performing States and Reserves:

Following Kerala, states like Madhya Pradesh and Karnataka also showed strong performance.

Satpura Tiger Reserve (Madhya Pradesh) and Bandipur Tiger Reserve (Karnataka) were among the other top-ranked sites in recent MEE cycles.

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In Tamil Nadu, the Anamalai Tiger Reserve and Mudumalai Tiger Reserve also featured in the "Very Good" category.

Conservation Significance:

As of 2023, India has over 990 Protected Areas, including 106 National Parks and 567 Wildlife Sanctuaries.

These evaluations are critical for the Project Tiger and Project Elephant initiatives to identify gaps in corridor management and man-animal conflict mitigation.

Important Points

Year of Report Release: The 5th cycle report was released in April 2023 by the Prime Minister during the celebration of 50 years of Project Tiger in Mysuru.

Statistical Data: Out of the tiger reserves evaluated, 12 were ranked in the 'Excellent' category, while Kerala's Periyar remained at the absolute pinnacle.

Legal Framework: All protected areas in India are governed under the Wildlife (Protection) Act, 1972, which provides the legal basis for the establishment and management of these zones.

Q95. Answer: (b) India

The correct answer is India.

Key Points

• India emerged as the champion of the Women's Kabaddi World Cup 2025, reinforcing its global dominance in the sport.

• The 2025 edition of the World Cup was a landmark event, as India was chosen by the International Kabaddi Federation (IKF) to host the tournament, marking the first time the country hosted the women's world event since 2012.

• The Indian women's team maintained an exceptional record throughout the tournament, showcasing superior tactical skills, agility, and teamwork to secure the title.

• This victory adds to India's trophy cabinet, as the nation has historically won all previous editions of the Women's World Cup (Standard Style) held in 2012, 2013, 2014, and 2016.

• The success of the 2025 World Cup in India is seen as a significant boost for the promotion of women's sports and the professionalization of Kabaddi through leagues and international exposure.

Additional Information

• History and Origin: Kabaddi is an ancient Indian sport that dates back over 4,000 years. It is rooted in Indian mythology and was traditionally played to build physical strength and defensive skills.

• International Kabaddi Federation (IKF): Founded in 2004, the IKF is the global governing body for the sport. It currently oversees more than 30 national associations and organizes major events like the World Cup and Asia Cup.

• Standard Style vs. Circle Style:

• Standard Style: Played on a rectangular court (13m x 10m for men and 12m x 8m for women). This is the version played in the Asian Games and Pro Kabaddi League.

• Circle Style: Played on a circular pitch, primarily popular in Punjab (India and Pakistan).

• Asian Games Presence: Kabaddi was introduced as a competitive sport in the Asian Games in 1990 (Beijing) for men. The women's category was introduced later in the 2010 Guangzhou Asian Games, where India won the inaugural gold medal.

• Amateur Kabaddi Federation of India (AKFI): The AKFI was founded in 1973 and is the primary body responsible for the development and regulation of the sport within India.

Important Points

• Match Duration: A standard women's kabaddi match consists of two halves of 15 to 20 minutes each, with a 5-minute break in between.

• Player Composition: Each team consists of 12 players, out of which only 7 players are on the court at any given time. The remaining 5 players act as substitutes.

• Raiding Rules: A Raider must enter the opponent's half and touch one or more defenders (known as Antis) and return to their own half within 30 seconds while continuously chanting the word "Kabaddi" (the "cant").

• Scoring System: Points are awarded for every opponent touched and safely returning home. Bonus points are awarded if the raider crosses the bonus line when there are 6 or 7 defenders on the court. An Lona (2 extra points) is awarded if the entire opposing team is declared out.

• Pro Kabaddi League (PKL) Influence: While PKL primarily boosted the men's game since 2014, initiatives like the Women's Kabaddi Challenge have been launched to provide a professional platform for female athletes.

Q96. Answer: (b) Padma Shri

The correct answer is Padma Shri.

Key Points

• Indian cricketer Ravichandran Ashwin (R Ashwin) was conferred with the Padma Shri, India's fourth-highest civilian award, by President Droupadi Murmu.

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• The ceremony took place at the Rashtrapati Bhavan in New Delhi during the Civil Investiture Ceremony held in April 2025.

• R Ashwin was recognized for his exceptional contribution to the field of Sports, particularly for his career as one of the most successful off-spinners in the history of Test cricket.

• Ashwin is widely regarded for his tactical intelligence and has achieved significant milestones, including becoming the second Indian bowler to surpass 500 Test wickets.

• The award acknowledges his long-standing dedication to Indian Cricket and his role in numerous victories for the Indian National Team on the international stage.

Additional Information

• The Padma Awards:

• These are among the highest civilian honors of India, announced annually on the eve of Republic Day (January 26).

• The awards are given in three categories: Padma Vibhushan (for exceptional and distinguished service), Padma Bhushan (distinguished service of high order), and Padma Shri (distinguished service in any field).

• The awards are conferred by the President of India at ceremonial functions held at Rashtrapati Bhavan usually around March or April.

• R Ashwin's Cricketing Profile:

• Born in Chennai, Tamil Nadu, Ashwin made his international debut in 2010.

• He was a vital member of the Indian squad that won the 2011 ICC Cricket World Cup and the 2013 ICC Champions Trophy.

• He is the fastest bowler to reach several wicket milestones in Test cricket, including 250, 300, and 350 wickets.

• Apart from his bowling, he is known for his batting capabilities, having scored multiple Test centuries.

Important Points

• Previous Accolades: Before receiving the Padma Shri, R Ashwin was honored with the Arjuna Award in 2014 for his outstanding performance in sports.

• Major Dhyan Chand Khel Ratna: He also received the Major Dhyan Chand Khel Ratna Award (formerly Rajiv Gandhi Khel Ratna) in 2021, which is the highest sporting honor in India.

• ICC Rankings: Ashwin has frequently occupied the Number 1 spot in the ICC Men's Test Player Rankings for both bowlers and all-rounders.

• Selection Process: The recommendations for Padma Awards are made by the Padma Awards Committee, which is constituted by the Prime Minister every year. The committee is headed by the Cabinet Secretary.

• Other Options:

• Padma Vibhushan: The second-highest civilian award; usually reserved for exceptional national service.

• Padma Bhushan: The third-highest civilian award.

• Arjuna Award: A dedicated sports award for consistent performance over four years, which Ashwin received earlier in his career (2014).

Q97. Answer: (b) Uttara Bwiswmuthiary

The correct answer is Uttara Bwiswmuthiary.

Key Points

• Uttara Bwiswmuthiary has been honored with the Sahitya Akademi Translation Prize 2024 for her translation of the novel Kanchan into the Bodo language.

• The original novel, Kanchan, is a highly acclaimed work written in Assamese by the renowned author and journalist Anuradha Sharma Pujari.

• The award was officially conferred in March 2025 by the Sahitya Akademi, which is India's National Academy of Letters.

• This recognition highlights the importance of literary exchange between Assamese and Bodo, two major languages of Northeast India.

• The selection for the prize is made based on the recommendations of a three-member jury in each language, which is later approved by the Executive Board of the Sahitya Akademi. Hence, the correct answer is Uttara Bwiswmuthiary.

Additional Information

• Sahitya Akademi Translation Prize:

• The prize was established in 1989 to encourage the translation of literary works between the 24 languages recognized by the Akademi.

• The award carries a cash prize of Rs. 50,000 along with an engraved copper plaque and a citation.

• The Akademi recognizes 22 languages listed in the Eighth Schedule of the Indian Constitution, plus English and Rajasthani.

• Anuradha Sharma Pujari:

• She is a distinguished Assamese novelist and editor of the popular weekly magazine Sadin and Satsori.

• Her novel Kanchan is considered a modern classic that explores socio-economic struggles and the psychological depth of its

protagonist.

• She previously won the Sahitya Akademi Award in 2021 for her novel Iyat Ekhan Aranya Asil.

• Bodo Language:

• Bodo is a Sino-Tibetan language spoken primarily by the Bodo people of Assam.

• It was included in the Eighth Schedule of the Indian Constitution by the 92nd Constitutional Amendment Act in 2003.

• It is written using the Devanagari script, although it has historically used other scripts as well.

Important Points

• Significance of the Award: The translation prize serves to bridge the cultural gap between different linguistic communities in India, fostering a national identity through shared literature.

• Bodo Literature Growth: In recent years, Bodo literature has seen significant growth, with many young and veteran writers translating classics from Bengali, Hindi, and Assamese to enrich the local literary landscape.

• Selection Process: The Sahitya Akademi follows a rigorous peer-review and jury-based selection process to ensure that only the highest quality translations that preserve the spirit and nuances of the original text are rewarded.

• Other Options: While Basudeb Das, Suvash Satpathy, and Anjan Sarma are names associated with regional literature or translations, they were not the recipients of the Bodo translation award for Kanchan in the March 2025 ceremony.

Q98. Answer: (a) Odisha

The correct answer is Odisha.

Key Points

• The Defence Research and Development Organisation (DRDO) conducted the successful inaugural flight trial of the Integrated Air Defence Weapon System (IADWS) on 23 August 2025.

• The test was carried out off the shoreline of Odisha, which serves as a primary hub for testing advanced missile systems and aerospace technologies in India.

• The IADWS is designed to provide a comprehensive, multi-layered aerial defense cover, integrating various sensors, weapon systems, and command-and-control architectures.

• The flight trial was conducted from the Integrated Test Range (ITR), ensuring the system met its initial performance parameters and functional requirements.

• This successful test marks a significant milestone in the development of indigenous defense systems, showcasing the DRDO's capability to build sophisticated network-centric warfare solutions.

Additional Information

• Defence Research and Development Organisation (DRDO):

• It was established in 1958 and functions under the Ministry of Defence, Government of India.

• Headquartered in New Delhi, it aims to empower India with cutting-edge defense technologies and achieve self-reliance in critical military systems.

• DRDO operates a network of more than 50 laboratories across the country, working on various disciplines like aeronautics, armaments, electronics, and land combat engineering.

• Integrated Test Range (ITR), Chandipur:

• Located in the Balasore district of Odisha, it is the premier missile testing facility in India.

• The range provides a safe and technically advanced environment for the flight evaluation of rockets, missiles, and airborne weapon systems.

• It is strategically located to allow for long-range tracking over the Bay of Bengal.

• Atmanirbhar Bharat in Defence:

• The development of the IADWS aligns with the national goal of Atmanirbhar Bharat (Self-Reliant India) to reduce dependence on foreign military imports.

• This involves the indigenous design and manufacturing of complex systems like Radars, Missiles, and Electronic Warfare (EW) suites.

Important Points

• Dr. APJ Abdul Kalam Island: Formerly known as Wheeler Island, this site located off the Odisha coast is another critical facility used for testing long-range ballistic missiles like the Agni series.

• Role of Odisha in Defence: The state's geographical features and the presence of the ITR make it the most vital location for India's Integrated Guided Missile Development Programme (IGMDP).

• Integrated Air Defence Weapon System Features: The system is built to intercept a variety of threats including drones, combat aircraft, and cruise missiles, providing a protective shield over high-value strategic assets.

• Collaboration: Such trials often involve the participation of the Indian Air Force and the Indian Army to ensure the systems meet operational requirements for final deployment.

Q99. Answer: (d) Dr. Jitendra Singh

The correct answer is Dr. Jitendra Singh.

Key Points

• Dr. Jitendra Singh, the Union Minister of State (Independent Charge) for Science and Technology and the Department of Space, addressed the Global Space Exploration Conference (GLEX 2025) on behalf of India in May 2025. Hence, this option is correct.

• During the conference, the Minister highlighted India's rapid progress in the space sector, emphasizing the transition from being a space-capable nation to a global leader in cost-effective and innovative space technology.

• He spoke extensively about the Gaganyaan Mission, which is India's first human spaceflight mission, and provided updates on the Bhartiya Antariksh Station (India's own space station) project slated for completion by 2035.

• The Minister underscored the importance of the Indian Space Policy 2023, which has significantly opened up the sector to Private Start-ups and Non-Government Entities (NGEs), fostering a robust Space Economy.

• His address also touched upon International Collaboration, reinforcing India's commitment to the Artemis Accords and global partnerships for Lunar and Martian exploration.

Additional Information

• Global Space Exploration Conference (GLEX):

• The GLEX is a high-profile international event organized by the International Astronautical Federation (IAF).

• It serves as a platform for space agencies, industries, and academic institutions to discuss the latest developments in Robotic Exploration and Human Spaceflight.

• The conference aims to foster global cooperation to solve technical and political challenges associated with exploring the Moon, Mars, and Deep Space.

• ISRO and the Department of Space:

• The Indian Space Research Organisation (ISRO), founded on August 15, 1969, operates under the Department of Space (DoS), which is directly overseen by the Prime Minister's Office (PMO).

• S Somanath serves as the Chairman of ISRO and Secretary of the Department of Space, providing technical leadership for missions like Chandrayaan and Aditya-L1.

• India successfully landed Chandrayaan-3 on the Lunar South Pole in August 2023, making it the first country to achieve this specific feat.

• Key Missions and Objectives:

• Gaganyaan: Aims to demonstrate human spaceflight capability by launching a crew of 3 members to an orbit of 400 km for a 3-day mission.

• Space Economy: India aims to increase its share in the Global Space Economy from the current 2% to approximately 10% by the year 2030.

• IN-SPACe: The Indian National Space Promotion and Authorization Centre acts as a single-window autonomous agency to promote and authorize private sector participation in space activities.

Important Points

• Dr. Jitendra Singh often represents India at international science and space forums as he holds the portfolio for the Department of Space as a Minister of State.

• The May 2025 address at GLEX is part of India's broader Space Diplomacy efforts to lead the Global South in space technology applications for disaster management and communication.

• In June 2023, India signed the Artemis Accords during Prime Minister Narendra Modi's visit to the United States, which provided a framework for cooperation in civil space exploration and use of the Moon and Mars.

Q100. Answer: (b) Nurturing young talent and infrastructure

The correct answer is Nurturing young talent and infrastructure.

Key Points

• The Union Budget 2025-26 continues to prioritize the Khelo India - National Programme for Development of Sports, which aims to identify talented players at the grassroots level and provide them with a platform to excel.

• A significant portion of the sports budget is allocated to the Sports Authority of India (SAI), which is responsible for managing National Centres of Excellence (NCOE) and providing high-performance coaching to young athletes across the country.

• The government focuses on the development of sports infrastructure, including the construction of synthetic tracks, multi-purpose indoor halls, and swimming pools in both urban and rural areas to bridge the accessibility gap. Hence, the statement regarding nurturing young talent and infrastructure is correct.

• The budget includes dedicated funds for the Target Olympic Podium Scheme (TOPS), which provides customized training, international exposure, and medical support to elite athletes preparing for the 2028 Los Angeles Olympics.

• The core philosophy of the 2025-26 allocation is to transform India into a multi-sport nation and support the long-term vision of hosting the 2036 Olympic Games.

Additional Information

• Khelo India Scheme:

• Launched in 2018 by the Ministry of Youth Affairs and Sports, this scheme aims to revive the sports culture in India by integrating sports with education.

• It covers various components such as Play Field Development, Community Coaching Development, and State Level Khelo India Centres.

• Target Olympic Podium Scheme (TOPS):

• Established in September 2014, it is a flagship program to provide financial assistance and world-class facilities to potential medal winners.

• The scheme is managed by the Mission Olympic Cell (MOC), which evaluates the performance data and training requirements of athletes.

• National Sports Development Fund (NSDF):

• The NSDF was established in 1998 under the Charitable Endowments Act, 1890, to mobilize resources from government and non-government sources for sports promotion.

• It supports athletes with stipends and funds specialized equipment for National Sports Federations (NSFs).

• Digital Initiatives in Sports:

• The Government of India is increasingly using Sports Science and data analytics to monitor athlete health and performance metrics, ensuring scientific training methods are implemented.

Important Points

• National Sports Federations (NSFs): These bodies receive grants-in-aid for conducting national championships and managing international tours. The 2025-26 budget ensures steady funding to maintain transparency and efficiency in sports governance.

• Women's Participation: Schemes like the Asmita Women's League are highlighted to encourage female athletes from remote locations to participate in competitive sports.

• Infrastructure Goals: The government aims to establish at least one Khelo India State Centre of Excellence (KISCE) in every state and union territory to provide standardized training environments.

• Para-Sports Support: Increased focus is placed on para-athletes through the Khelo India Para Games, providing specialized infrastructure and adaptive equipment for differently-abled sports persons.

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