RRB Group D Official Paper (Held On: 09 Jan, 2026 Shift 2) (Previous Year Paper)

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

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GENERAL SCIENCE

Q1. Which of the following is a common category of agents that can cause diseases in poultry fowl?

(a) Purely genetic factors
(b) Vitamins and minerals only
(c) Sunlight exposure
(d) Viruses, bacteria, and fungi

Q2. Which of the following situations demonstrates Newton's Second Law of Motion?

(a) A car speeding up on the road
(b) A man standing inside a lift
(c) A book lying still on the table
(d) A satellite moving around Earth

Q3. Select the correct option regarding the following two statements labelled Assertion (A) and Reason (R).

Assertion (A): Calcium oxide reacts vigorously with water to form calcium hydroxide.

Reason (R): In a combination reaction, two or more substances combine to form one product.

(a) A is true, but R is false.
(b) Both A and R are true, and R is the correct explanation of A.
(c) Both A and R are true, and R is not the correct explanation of A.
(d) A is false, but R is true.

Q4. Sodium hydroxide is formed by:

(a) Passing electricity through brine
(b) Dissolving sodium in ethanol
(c) Passing chlorine through water
(d) Reacting sodium with carbon dioxide

Q5. Which of the following is a non-metal?

(a) Zinc
(b) Copper
(c) Chlorine
(d) Mercury

Q6. In the case of a convex lens, under what specific object position is the image formed at 2F (F is the focal length) and has the same size as the object?

(a) Beyond 2F
(b) At 2F
(c) At infinity
(d) At focus F

Q7. The total resistance of 5 resistors of equal resistance R arranged in a parallel arrangement is _____.

(a) R5
(b) 5/R
(c) 5R
(d) R/5

Q8. Which of the following phenomena CANNOT be explained without dispersion of light?

(a) Twinkling of stars.
(b) Advanced sunrise.
(c) Mirages.
(d) Rainbow formation.

Q9. Which of the following contributes directly to forest conservation?

(a) Social Forestry
(b) Mining
(c) Urbanization
(d) Logging

Q10. In galvanisation, which metal is used to coat iron?

(a) Lead
(b) Copper
(c) Zinc
(d) Aluminum

Q11. A constant force of ' X ' N acts on a body such that the body undergoes a displacement of 5 m in the same direction as the force. If the work done due to the force is 500 J, then what is the value of X?

(a) 2500 N
(b) 100 N
(c) 1/100 N
(d) 250 N

Q12. Which of the following relations is correct for expressing power in terms of voltage and resistance?

(a) $P=VR/I$
(b) $P=R/V^2$
(c) $P=V^2/R$
(d) $P=I/VR$

Q13. When the temperature of air increases, the speed of sound waves:

(a) remains constant
(b) decreases
(c) increases
(d) becomes zero

Q14. What does the velocity-time graph look like for an object moving with uniform velocity?

(a) A curved line rising gradually
(b) A straight line sloping downwards
(c) A straight line parallel to the time axis
(d) A straight line sloping upwards

Q15. Which contraceptive method provides dual protection against pregnancy and most sexually transmitted diseases?

(a) Oral contraceptive pills
(b) Male condom
(c) Surgical methods
(d) Copper -T

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Q16. Some organisms take in whole food material and break it down inside their bodies. This is called _____ nutrition.

(a) saprophytic
(b) holozoic
(c) parasitic
(d) autotrophic

Q17. What will happen to a Hydra if it is cut into multiple pieces?

(a) All pieces will die immediately.
(b) Each piece will regenerate to form new individuals.
(c) Each piece will reproduce by budding.
(d) Only the head part will grow into a complete individual.

Q18. In a neutral solution, red and blue litmus paper will:

(a) both remain unchanged
(b) both turn green
(c) both turn blue
(d) both turn red

Q19. Which of the following processes is a physical change?

(a) Crystallisation
(b) Rusting
(c) Combustion
(d) Fermentation

Q20. A sealed packet has a mass of 500 g and a volume of 350 cm^3. Given the density of water is 1 g cm^(-3), will the packet float or sink in water, and why?

(a) Float, because its mass is low.
(b) Float, because its density is less than water.
(c) Sink, because its density is greater than water's density.
(d) Sink, because the total volume is high.

Q21. The number of mitochondria in a cell varies depending on which of the following?

(a) The age of the organism
(b) The size of the nucleus
(c) The amount of DNA present in the cell
(d) The physiological activity of the cell

Q22. Which of the following statements explains why insectivorous plants evolved to trap insects?

(a) To compete with herbivores for space
(b) To take cellulose from plant tissues
(c) To supplement nitrogen and other nutrients
(d) To survive in habitats with low sunlight

Q23. Select the INCORRECT statement regarding variation in plants.

(a) They are produced during sexual reproduction.
(b) Individuals within a population are unique due to the variations.
(c) They are produced due to inaccuracy in the copying of DNA.
(d) Asexual reproduction is a regular source of variations in a population.

Q24. Which of the following metals does NOT react with dilute hydrochloric acid under normal conditions?

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

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Q25. What happens when a solid is heated continuously?

(a) It expands and turns into a gas
(b) It evaporates directly
(c) It shrinks
(d) It melts and may later evaporate

MATHEMATICS

Q26. A cyclist covers a distance of 800 m in 2 minutes. Find the speed (in km/hr) of the cyclist.

(a) 16
(b) 24
(c) 20
(d) 25

Q27. In quadrilateral PQRS, the bisectors of angle R and angle S meet at the point T (inside the quadrilateral) and angle STR = 48°. If the ratio of angle P to angle Q is 3 : 5, then what is the difference between the measures of angle Q and angle P ?

(a) 24°
(b) 22°
(c) 29°
(d) 27°

Q28. A solid metallic sphere of radius 9 cm is melted and recast into 27 smaller solid spheres of equal size. Find the surface area of one small sphere.

(a) 48 π cm2
(b) 24 π cm2
(c) 42 π cm2
(d) 36 π cm^2

Q29. A wholesaler bought goods for Rs. 15,000 and sold them to a retailer at 20% profit. The retailer then sold the goods to customers at 25% profit. What is the final selling price to customers?

(a) Rs. 22,500
(b) Rs. 22,000
(c) Rs. 23,500
(d) Rs. 23,000

Q30. Rs. 6,874 is to be divided among three persons X, Y and Z. If the shares of X and Y are in the ratio 5 : 9 and that of Y and Z are in the ratio 9 : 7, what is the share (in Rs.) of Y?

(a) 2,946
(b) 2,947
(c) 2,945
(d) 2,948

Q31. Keshav spends 70% of his income. If he saves Rs. 18,000, then his income (in Rs.) is:

(a) 60,000
(b) 61,000
(c) 12,600
(d) 59,000

Q32. What is the mode of the following data?

53, 47, 53, 48, 53, 53, 40, 41, 50, 50, 55, 48, 54, 49, 49, 51, 46, 45

(a) 40
(b) 48
(c) 47
(d) 53

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Q33. Walking at 5/6 th of his normal speed from his home, Lakshya is 24 minutes late in reaching his office. The usual time taken by him to cover the distance between his home and his office is

(a) 117 minutes
(b) 120 minutes
(c) 129 minutes
(d) 121 minutes

Q34. The amount on a sum of Rs. 4,900 at 10% per annum compound interest, compounded annually, in 2 years will be:

(a) Rs. 5,988
(b) Rs. 6,684
(c) Rs. 6,509
(d) Rs. 5,929

Q35. The mode of a distribution is 21 and the mean is 60. The value of its median is:

(a) 47
(b) 49
(c) 45
(d) 51

Q36. The sum of two numbers P and Q is 17 and their product is 56. Find the value of $P^2 + Q^2$.

(a) 158
(b) 162
(c) 146
(d) 177

Q37. P and Q together can fill a cistern with water in 7 hours. If P alone can fill the cistern with water in 56 hours, then in how many hours will Q alone fill one-fourth of the same cistern with water?

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

Q38. The expenditure of Sudha is 150% more than her savings. If her expenditure decreases by 7% and savings increase by 21%, then by what percentage does her income increase?

(a) 5%
(b) 6%
(c) 1%
(d) 0.03%

Q39. An item with a marked price of Rs. 606 was sold for Rs. 304. What was the percentage of discount given? (Round off your answer to two decimal places.)

(a) 50.65%
(b) 51.58%
(c) 47.63%
(d) 49.83%

Q40. If $(0.04)^2 \div (0.008) \times (0.2)^6 = (0.2)^x$, then find x.

(a) 16
(b) 6
(c) 7
(d) 17

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Q41. X' can complete the work order in 15 days and 'Y' can complete the same work order in 12 days. With the help of 'F', the three of them finished the work in 5 days. How many days would 'F' take to complete the work alone?

(a) 5 days
(b) 10 days
(c) 20 days
(d) 15 days

Q42. A father's current age is three times the age of his son. Five years ago from now, the father's age was four times the age of his son at that time. What are their present ages?

(a) 42 years and 14 years
(b) 45 years and 15 years
(c) 40 years and 13 years
(d) 50 years and 17 years

Q43. Find the value of $5\sec^2\theta - 5\tan^2\theta$.

(a) 1
(b) 5
(c) 0
(d) -5

Q44. What is the volume of the largest sphere that can be carved out of a cube of edge 3 cm ?

(a) 6.5 π cm^3
(b) 4.5 π cm^3
(c) 2.5 π cm^3
(d) 7.4 π cm^3

Q45. The market prices of paddy and jowar are in the ratio 1 : 3, and a family consumes them in the ratio 5 : 7 by quantity. Find the ratio of expenditure on paddy to that on jowar.

(a) 7 : 23
(b) 6 : 22
(c) 5 : 21
(d) 9 : 25

Q46. The monthly incomes of two friends Vipul and Vijay, are in the ratio 5 : 8, respectively, and each of them saves Rs. 84,000 every month. If the ratio of their monthly expenditure is 1 : 4, find the monthly income of Vipul (in Rs.).

(a) 1,04,000
(b) 1,06,000
(c) 1,47,000
(d) 1,05,000

Q47. What is the Highest Common Factor (HCF) of 252 and 378?

(a) 84
(b) 42
(c) 126
(d) 63

Q48. Find the single equivalent discount (rounded off to two decimal places) for successive discounts of 23%, 11%, and 29%.

(a) 51.34%
(b) 51.85%
(c) 50.12%
(d) 53.72%

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Q49. The present age of Ramesh is 3 times that of Mahesh. Five years ago, the ratio of their ages was 4 : 1. What is the present age of Ramesh?

(a) 15 years
(b) 30 years
(c) 40 years
(d) 45 years

Q50. The sum of twin prime numbers is 36. Find the product of the twin prime numbers.778

(a) 155
(b) 299
(c) 203
(d) 323

GENERAL INTELLIGENCE & REASONING

Q51. Eight people (A, B, C, D, E, F, G and H) are sitting around a circular table, facing towards the centre.

Exactly three people sit between D and C. Exactly three people sit between F and H. A sits second to the right of D. E sits to the immediate right of A. D is an immediate neighbour of both H and G. B sits to the immediate left of G.

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

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

Q52. What should come in place of the question mark (?) in the given series?

45 58 63 76 81 94 ?

(a) 101
(b) 99
(c) 93
(d) 96

Q53. Six people, A, B, C, D, E and F, are sitting in a row, facing north. A sits to the immediate right of E. F sits fourth to the left of E. Only one person sits between B and E. C sits to the immediate left of B. D sits second to the left of A. Three of the following four are alike in a certain way based on the given arrangement and thus form a group. Which is the one that does not belong to that group?

(a) FA
(b) BD
(c) DE
(d) CB

Q54. Select the set in which the numbers are related in the same way as are the numbers of the following sets.

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

(32, 16, 8)

(48, 24, 12)

(a) (196, 98, 46)
(b) (188, 124, 48)
(c) (128, 64, 42)
(d) (156, 78, 39)

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Q55. What should come in place of the question mark (?) in the given series?

112 92 74 58 44 ?

(a) 28
(b) 34
(c) 30
(d) 32

Q56. What will come in place of the question mark (?) in the following equation, if '+' and '–' are interchanged and '×' and '÷' are interchanged?

76 × 4 – (80 ÷ 10) × 4 + 50 ÷ 2 = ?

(a) 119
(b) 128
(c) 146
(d) 95

Q57. In a certain code language, 'obey the lights' is coded as 'ro hm jw' and 'lights flash red' is coded as 'ld yc hm'. How is 'lights' coded in the given language?

(a) ld
(b) ro
(c) jw
(d) hm

Q58. Refer to the following number series and answer the question that follows (all numbers are single-digit numbers only). Counting to be done from left to right only.

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

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

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

Q59. Refer to the following series and answer the question (all numbers are single digit numbers only). Counting to be done from left to right only.

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

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

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

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

DFC−ACZ

UWT−RTQ

(a) EFB−ACZ
(b) EGD−ADZ
(c) EGD−BDA
(d) EFB−BDA

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Q61. 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 6 2 7 2 9 3 2 2 3 7 6 5 8 4 6 1 9 7 9 4 8 3 6 1 2 3 (Right)

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

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

Q62. Refer to the following number series and answer the question that follows (all numbers are single-digit numbers only). Counting to be done from left to right only.

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

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

(NOTE: 1 is also a perfect square.)

(a) Two
(b) Three
(c) One
(d) More than three

Q63. 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) GJLP
(b) ILMR
(c) TWYC
(d) HKMQ

Q64. 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?

80 A 4 C 15 B 6 D 9 B 3 C (18 A 6) B 10 = ?

(a) 113
(b) 150
(c) 138
(d) 129

Q65. John ranked 20^(th) from the bottom and 33^(rd) from the top in his class. How many students are there in his class?

(a) 53
(b) 52
(c) 51
(d) 50

Q66. In a shopping mall, Shop A is to the north of Shop B. Shop F is to the east of Shop A. Shop E is to the west of Shop F and Shop A is to the east of Shop E. Shop D is to the north of Shop E. What is the position of Shop D with respect to Shop B?

(a) North-west
(b) South-west
(c) West
(d) North

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Q67. In a certain code language, ‘TOUR’ is coded as ‘4139’ and ‘BRUT’ is coded as ‘4318’. What is the code for ‘B’ in that language?

(a) 1
(b) 8
(c) 3
(d) 4

Q68. Aarav starts from Point A and drives 13 km towards east. He then takes a left turn, drives 8 km, turns left and drives 15 km. He then takes a left turn and drives 11 km. He takes a final left turn, drives 2 km and stops at Point P. How far (shortest distance) and towards which direction should he drive in order to reach Point A again?

(Note: All turns are 90° turns only unless specified.)

(a) 3 km to the north
(b) 4 km to the north
(c) 4 km to the south
(d) 3 km to the south

Q69. What should come in place of the question mark (?) in the given series?

9012 9013 9011 9014 9010 ?

(a) 9014
(b) 9016
(c) 9015
(d) 9013

Q70. Read the given statements and conclusions carefully. Assuming that the information given in the statements is true, even if it appears to be at variance with commonly known facts, decide which of the given conclusions logically follow(s) from the statements.

Statements:

All Reds are Blues.

All Blues are Greens.

Some Greens are Yellows.

Conclusions:

(I): All Blues are Yellows.

(II): Some Greens are Reds.

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

Q71. Six friends — John, Alex, Priyanka, Sameer, Rohit and Neil — are sitting around a circular table facing the centre. John is an immediate neighbour of both Alex and Priyanka. Sameer is sitting second to the left of Priyanka. Neil is sitting to the immediate left of Sameer.

Who is sitting to the immediate left of Neil?

(a) Rohit
(b) Priyanka
(c) Alex
(d) John

Q72. PSOK is related to VYUQ in a certain way based on the English alphabetical order. In the same way, EILJ is related to KORP. To which of the following is MPQT related, following the same logic?

(a) TUWY
(b) SVWY
(c) TUVZ
(d) SVWZ

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Q73. What should come in place of the question mark (?) in the given series based on the English alphabetical order?

SWE QUC OSA MQY ?

(a) KIO
(b) KOI
(c) KOW
(d) KWO

Q74. In a certain code language,

A + B means ‘A is the mother of B’,

A – B means ‘A is the brother of B’,

A x B means ‘A is the wife of B’,

A % B means ‘A is the father of B’ and

A # B means ‘A is the daughter of B’.

How is Q related to R if 'R - E % C # Q + V '?

(a) Brother’s son
(b) Brother’s daughter
(c) Father’s brother
(d) Brother’s wife

Q75. 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) DF - BH
(b) MO - KQ
(c) RT - PV
(d) IK - HJ

Q76. Read the given statements and conclusions carefully. Assuming that the information given in the statements is true, even if it appears to be at variance with commonly known facts, decide which of the given conclusions logically follow(s) from the statements.

Statements:

All cakes are hearts.

Some seats are hearts.

No bats are hearts.

Conclusions:

(I): Some seats are not bats.

(II): No cakes are seats.

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

Q77. Which of the following letter-number clusters will replace the question mark (?) in the given series to make it logically complete?

PRT 28 VXZ 21 BDF 14 HJL 7 ?

(a) NRW -1
(b) NQQ 0
(c) NOQ -1
(d) NPR 0

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Q78. If 'P' stands for '×', 'Q' stands for '÷', 'R' stands for '−' and 'S' stands for '+', what will come in place of the question mark (?) in the following equation?

17 P 3 S (16 Q 4) P 2 R 13 P 4 S 15 = ?

(a) 40
(b) 36
(c) 18
(d) 22

Q79. Seven boxes, B, D, E, P, S, T and W, are kept one over the other, but not necessarily in the same order.

No box is kept above P. Only three boxes are kept between P and B. Only one box is kept between D and S. S is kept immediately above B. Only four boxes are kept between D and T. E is kept at some place above W.

Which box is kept second below E?

(a) B
(b) D
(c) S
(d) T

Q80. STPT is related to RSOS in a certain way based on the English alphabetical order. In the same way, RSOS is related to QRNR. To which of the following is BCYC related, following the same logic?

(a) ABWB
(b) ABXB
(c) ACWD
(d) AAWB

GENERAL AWARENESS AND CURRENT AFFAIRS

Q81. What was the approximate monetary loss alleged by the State Bank of India (SBI) in its complaint against Anil Ambani and his company Reliance Communications Ltd, that triggered the Central Bureau of Investigation's (CBI) investigation in August 2025?

(a) Rs. 10,000 crore
(b) Rs. 1,900 crore
(c) Rs. 1,000 crore
(d) Rs. 3,000 crore

Q82. Which of the following best characterises the India-Singapore Ministerial Roundtable (ISMR) framework?

(a) A cultural-exchange mechanism involving arts and heritage institutions only
(b) A forum exclusively for defence procurement negotiations
(c) A high-level mechanism to deepen bilateral cooperation across strategic, economic, technological, and people-to-people sectors
(d) A platform limited to trade dispute settlement between the two countries

Q83. A 24-hour wildlife census using the waterhole method, which recorded the sighting of 73 Great Indian Bustards, was conducted in June 2025 in which of the following national parks?

(a) Desert National Park
(b) Ranthambore National Park
(c) Bandhavgarh National Park
(d) Kanha National Park

Q84. Which Ministry is responsible for the grant increase in national championships for high-priority sports?

(a) Ministry of Education
(b) Ministry of Youth Affairs and Sports
(c) Ministry of Human Resource Development
(d) Ministry of Skill Development and Entrepreneurship

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Q85. Under the proposed Constitution (131^(st) Amendment) Bill 2025, which seeks to include Chandigarh under Article 240, the Union Territory will be aligned with which category of regions?

(a) Union Territories with legislatures
(b) Union Territories governed under special provisions
(c) Union Territories without legislatures
(d) Union Territories with partial state powers

Q86. The Supreme Court declared in October 2025 that the principle of public trust extends to artificial lakes this ruling affirmed the directive of which of the following High Court benches?

(a) Jaipur Bench of the Rajasthan High Court
(b) Madurai Bench of the Madras High Court
(c) Nagpur Bench of the Bombay High Court
(d) Lucknow Bench of the Allahabad High Court

Q87. _____ is the massive sports talent hunt introduced by Bihar CM Nitish Kumar in May 2025, designed for secondary and higher secondary school students.

(a) Bihar Sports Samarthan Yojana
(b) Mashal
(c) Lakshya
(d) Khel Pratibha Khoj Abhiyan

Q88. By how many basis points did the Reserve Bank of India reduce the repo rate in April 2025?

(a) 75 basis points
(b) 25 basis points
(c) 10 basis points
(d) 50 basis points

Q89. Which of the following countries hosted the Kabaddi World Cup, 2025, first time outside Asia?

(a) Qatar
(b) England
(c) Tajikistan
(d) Italy

Q90. According to Tamil Nadu's transgender policy (2025), what significant right is explicitly assured?

(a) Inheritance rights and access to education and employment
(b) Compulsory housing allotments for transgender households
(c) Horizontal reservation in government jobs
(d) Exclusive pension scheme for all transgender persons

Q91. Lala Lajpat Rai, whose 160th birth anniversary was observed on 28 January 2025, was popularly known by which title?

(a) Netaji
(b) Lokmanya Tilak
(c) Punjab Kesari
(d) Deshbandhu

Q92. What is the 2025 Guinness World Record recently set by Nigerian chess master Tunde Onakoya?

(a) Longest chess marathon
(b) Most simultaneous chess games
(c) Longest blitz chess game
(d) Longest single chess move

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Q93. In June 2025, which Indian state launched a state-level Clean Air Plan based on airshed scientific analysis?

(a) Bihar
(b) Uttar Pradesh
(c) Rajasthan
(d) Assam

Q94. What is the name given to the mobile application launched by the Government of India in October 2024 for registration of births and deaths, aimed to streamline and reduce the time required for these registrations?

(a) Central Registration System
(b) Birth and Death Registration System
(c) Civil Registration System
(d) Civil Registration App

Q95. Which of the following was launched by the Ministry of Women and Child Development during the National Consultation on Gender Budgeting in June 2025?

(a) Beti Bachao Beti Padhao Annual Report 2024
(b) National Resource Centre for Women
(c) Gender Budgeting Knowledge Hub portal
(d) One-Stop Centre scheme for women affected by violence

Q96. The 2025 Wimbledon Championships took place in which city?

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

Q97. Who received the Padma Vibhushan in 2025 for their contributions to the dance form, Kathak?

(a) Shobana Chandrakumar
(b) Kumudhini Lakhia
(c) Birju Maharaj
(d) Kelucharan Mohapatra

Q98. Which organisations jointly launched multi-agency rescue operations after the Uttarkashi floods in August 2025?

(a) NSG, Coast Guard, NCC
(b) ISRO, DRDO, BARC
(c) Army, BRO, ITBP, NDRF, SDRF
(d) Railways, Navy, CBI

Q99. What key capability of the Vertically-Launched Short-Range Surface-to-Air Missile (VLSRSAM) was established during its March 2025 flight-test?

(a) Underwater deployment capability
(b) Mid-course ballistic target destruction
(c) Long-range high-altitude interception
(d) Near-boundary low-altitude engagement

Q100. Prof. Syed Wajih Ahmad Naqvi, an outstanding Biogeochemical Oceanographer with national and international recognition, received the 2024 Rashtriya Vigyan Puraskar in which of the following categories?

(a) Vigyan Team (VT) Award
(b) Vigyan Yuva-Shanti Swarup Bhatnagar (VY-SSB) Award
(c) Vigyan Ratna (VR) Award
(d) Vigyan Shri (VS) Award

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ANSWER KEY

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

SOLUTIONS

Q1. Answer: (d) Viruses, bacteria, and fungi

The correct answer is Viruses, bacteria, and fungi.

Key Points

• Poultry fowl are susceptible to various diseases caused by different types of infectious agents, primarily viruses, bacteria, and fungi.

• Viruses are responsible for some of the most devastating poultry diseases. For example, Ranikhet disease (also known as Newcastle Disease) and Avian Influenza (commonly called Bird Flu) are highly contagious viral infections that can lead to mass mortality in flocks. Hence, statement 4 is correct.

• Bacteria cause several serious conditions such as Fowl Cholera, Salmonellosis (including Pullorum disease), and Chronic Respiratory Disease (CRD). These bacterial infections often lead to reduced egg production and growth rates.

• Fungi can cause diseases like Aspergillosis (Brooder pneumonia), which typically occurs when birds inhale spores from moldy litter or contaminated feed. Fungal toxins, known as mycotoxins, can also severely impact poultry health.

• While purely genetic factors can lead to certain hereditary abnormalities or predispositions, they are not categorized as the common external "agents" that cause infectious disease outbreaks in poultry. Hence, statement 1 is incorrect.

• Vitamins and minerals are essential nutrients; their deficiency causes nutritional deficiency diseases (like Rickets due to lack of Vitamin D), but they are not causative agents of infectious diseases. Hence, statement 2 is incorrect.

• Sunlight exposure is generally beneficial for poultry as it helps in the synthesis of Vitamin D3 and acts as a natural disinfectant, rather than being a disease-causing agent. Hence, statement 3 is incorrect.

Additional Information

• Biosecurity Measures:

• To prevent the spread of viruses and bacteria, poultry farms must implement strict biosecurity protocols. This includes regular cleaning and disinfection of poultry sheds.

• Restricting the entry of unauthorized persons and managing the movement of equipment helps minimize the risk of pathogen introduction.

• Vaccination Programs:

• Vaccination is a critical management practice used to provide immunity against viral diseases like Newcastle Disease and Infectious Bursal Disease (Gumboro).

• Vaccines are usually administered through drinking water, eye drops, or injections at specific ages (e.g., Day 1, Week 1, etc.).

• Parasitic Infestations:

• Apart from microorganisms, poultry are also affected by parasites. Internal parasites include roundworms and tapeworms, while external parasites include mites, ticks, and lice.

• Coccidiosis is a significant disease caused by protozoa that affects the intestinal tract of the birds, leading to bloody diarrhea.

• Management Practices:

• Proper ventilation, temperature control, and waste management are essential to keep the birds healthy and reduce the load of fungal spores and ammonia gas in the environment.

• Quality feed and clean water are fundamental to maintaining the immune system of the fowl, helping them resist common

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infections.

Q2. Answer: (a) A car speeding up on the road

The correct answer is A car speeding up on the road.

Key Points

• Newton’s Second Law of Motion states that the acceleration of an object as produced by a net force is directly proportional to the magnitude of the net force, in the same direction as the net force, and inversely proportional to the mass of the object.

• This law is mathematically expressed as F = ma, where F is the force applied, m is the mass, and a is the acceleration produced.

• In the situation of a car speeding up on the road, the engine generates a net force that acts on the car's mass. Because this force is unbalanced, the car undergoes a change in velocity over time, which is defined as acceleration. Hence, statement 1 is correct.

• A man standing inside a lift (assuming the lift is stationary or moving at a constant velocity) demonstrates a state of equilibrium. Here, the downward gravitational force is perfectly balanced by the upward normal force from the floor, resulting in zero net force and zero acceleration. Hence, statement 2 is incorrect in the context of demonstrating a net force causing acceleration.

• A book lying still on the table is a classic example of Newton’s First Law of Motion (the Law of Inertia). The object remains at rest because the net external force acting on it is zero. Hence, statement 3 is incorrect.

• While a satellite moving around Earth does involve the Second Law (as gravity acts as a centripetal force causing centripetal acceleration by changing the satellite's direction), the most direct and common textbook demonstration of a change in magnitude of velocity (speeding up) due to an applied force is the accelerating car.

Additional Information

• Newton’s First Law of Motion:

• Commonly known as the Law of Inertia, it states that an object will not change its motion unless acted upon by an unbalanced force.

• If the object is at rest, it stays at rest. If it is in motion, it remains in motion at the same speed and in a straight line.

• Inertia is the tendency of objects to resist changes in their state of motion; it is directly related to the mass of the object.

• Newton’s Third Law of Motion:

• This law states that for every action, there is an equal and opposite reaction.

• Forces always exist in pairs. When object A exerts a force on object B, object B simultaneously exerts a force of equal magnitude and opposite direction on object A.

• Examples include recoil of a gun, swimming, or a rocket launch.

• Concept of Momentum:

• Newton's Second Law is also defined as the rate of change of momentum.

• Momentum (p) is the product of mass (m) and velocity (v). The law states that Force is proportional to the change in momentum divided by time (t).

Important Points

• Sir Isaac Newton: He first formulated these three laws of motion in his monumental work titled "Philosophiæ Naturalis Principia Mathematica", published in the year 1687.

• SI Unit of Force: The standard unit of force is the Newton (N). One Newton is defined as the amount of force required to accelerate a 1 kilogram mass at a rate of 1 meter per second squared (1 m/s^2).

• Vector Nature: Both Force and Acceleration are vector quantities, meaning they have both magnitude and direction. The acceleration of the car happens in the same direction as the net force applied by the wheels against the road.

• Mass vs. Weight: Mass is an intrinsic property representing the amount of matter (measured in kg), while Weight is the force of gravity acting on that mass (measured in Newtons), calculated as W = mg, where g is approximately 9.8 m/s^2 on Earth.

Q3. Answer: (b) Both A and R are true, and R is the correct explanation of A.

The correct answer is Both A and R are true, and R is the correct explanation of A.

Key Points

• Assertion (A) states that calcium oxide reacts vigorously with water to produce calcium hydroxide (slaked lime). This observation is scientifically accurate as the reaction is highly exothermic, releasing a significant amount of heat energy. Hence, statement A is correct.

• Reason (R) defines a combination reaction as a process where two or more reactants (elements or compounds) fuse to form a single product. Hence, statement R is correct.

• In the chemical reaction mentioned, CaO (Calcium oxide) and H2O (Water) are the two reactants that combine to form one single product, Ca(OH)2 (Calcium hydroxide).

• Since the reaction described in the assertion is a classic example of the definition provided in the reason, the reason serves as the correct theoretical explanation for the classification and nature of the assertion. Hence, R is the correct explanation of A.

• The chemical equation representing this reaction is: CaO (s) + H2O (l) → Ca(OH)2 (aq) + Heat.

Additional Information

• Calcium Oxide (CaO):

• Commonly known as quicklime or burnt lime, it is a white, caustic, and alkaline crystalline solid.

• It is widely used in industry for making steel, paper, and in water treatment processes.

• Calcium Hydroxide (Ca(OH)2):

• Commonly referred to as slaked lime. A dilute solution of calcium hydroxide is known as lime water.

• It is used for whitewashing walls. After application, it reacts with Carbon Dioxide (CO2) in the air to form a thin, shiny layer of calcium carbonate (CaCO3) over two to three days.

• Exothermic Reactions:

• These are chemical reactions that release energy in the form of light or heat.

• The reaction between quicklime and water is so energetic that it can cause the water to reach its boiling point, producing a hissing sound.

• Another common example of an exothermic combination reaction is the burning of coal (Carbon + Oxygen → Carbon Dioxide).

• Types of Chemical Reactions:

• Decomposition Reaction: A single reactant breaks down to give simpler products (the opposite of combination).

• Displacement Reaction: A more reactive element displaces a less reactive element from its compound.

• Double Displacement: An exchange of ions between the reactants occurs to form new compounds, often resulting in a precipitate.

Q4. Answer: (a) Passing electricity through brine

The correct answer is Passing electricity through brine.

Key Points

• Sodium hydroxide (NaOH) is produced on an industrial scale through a specific method called the Chlor-alkali process.

• This process involves the electrolysis of an aqueous solution of sodium chloride, which is commonly referred to as brine. Hence, statement 1 is correct.

• When electricity is passed through brine, the sodium chloride decomposes to form sodium hydroxide, chlorine gas, and hydrogen gas.

• The overall chemical reaction for this process is: 2NaCl(aq) + 2H2O(l) → 2NaOH(aq) + Cl2(g) + H2(g).

• During this electrolytic reaction, chlorine gas is given off at the anode (the positive electrode), while hydrogen gas is released at the cathode (the negative electrode).

• The sodium hydroxide solution is formed specifically near the cathode, where it is collected for further use.

Additional Information

• Sodium Hydroxide (NaOH):

• Commonly known as caustic soda, it is a white, translucent crystalline solid.

• It is a strong base with a pH of approximately 13 to 14 in a standard concentrated solution.

• Its primary uses include degreasing metals, manufacturing soaps and detergents, paper making, and the production of artificial textile fibers like rayon.

• Chlorine (Cl2):

• A major byproduct of the process, it is extensively used for water treatment to kill bacteria in swimming pools and drinking water supplies.

• It is also a key ingredient in the manufacture of Polyvinyl Chloride (PVC), disinfectants, CFCs, and pesticides.

• Hydrogen (H2):

• Another byproduct formed at the cathode, it is used as a fuel in rockets and as a reactant in the Haber process to produce ammonia for fertilisers.

• It is also utilized in the hydrogenation of oils to create margarine.

• Analysis of Other Options:

• Dissolving sodium in ethanol: This reaction produces sodium ethoxide and hydrogen gas, not sodium hydroxide. Hence, statement 2 is incorrect.

• Passing chlorine through water: This creates hydrochloric acid and hypochlorous acid (bleaching action), not sodium hydroxide. Hence, statement 3 is incorrect.

• Reacting sodium with carbon dioxide: Under specific conditions, this might produce sodium carbonate or sodium oxide, but it is not the standard method for producing sodium hydroxide. Hence, statement 4 is incorrect.

Important Points

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• The process is named Chlor-alkali because of the two main products: Chlor for chlorine and alkali for sodium hydroxide (which is a water-soluble base).

• Industrial setups for this process usually include membrane cells, diaphragm cells, or mercury cells (though mercury cells are being phased out due to environmental concerns).

• The brine used must be highly purified to prevent impurities like calcium or magnesium from clogging the membranes in modern electrolytic cells.

• Sodium hydroxide is deliquescent, meaning it absorbs moisture and carbon dioxide from the atmosphere to form sodium carbonate over time.

Q5. Answer: (c) Chlorine

The correct answer is Chlorine.

Key Points

• Chlorine is a chemical element with the symbol Cl and atomic number 17. It is a non-metal and belongs to the halogen group (Group 17) of the periodic table. Hence, this is the correct option.

• Zinc (Zn): It is a transition metal with the atomic number 30. It is commonly used for galvanization to prevent the rusting of iron. Hence, this option is incorrect.

• Copper (Cu): It is a transition metal with the atomic number 29. It is highly valued for its electrical conductivity and is used extensively in wiring and electronics. Hence, this option is incorrect.

• Mercury (Hg): It is a transition metal with the atomic number 80. It is unique because it is the only metal that remains in a liquid state at room temperature. Hence, this option is incorrect.

• As a non-metal, Chlorine does not possess metallic properties like malleability, ductility, or lustre. Instead, it is a yellow-green gas under standard conditions.

Additional Information

• Characteristics of Non-metals:

• Non-metals are elements that generally lack metallic properties. They are poor conductors of heat and electricity (except for Graphite).

• In their solid state, they are usually brittle and lack the lustre associated with metals.

• They tend to have high electronegativity and gain electrons to form anions during chemical reactions.

• Common examples include Oxygen (O), Nitrogen (N), Sulfur (S), and Carbon (C).

• Properties of Chlorine:

• Chlorine was discovered in 1774 by Carl Wilhelm Scheele.

• It is highly reactive and is a powerful oxidizing agent. Due to its reactivity, it is never found as a free element in nature; it is typically found in compounds like Sodium Chloride (NaCl) or common salt.

• It has an electronic configuration of [Ne] $3s^2$ 3p^5, meaning it requires only one electron to complete its valence shell.

• Uses of Chlorine:

• It is widely used in water purification to kill bacteria and other microbes in drinking water and swimming pools.

• It is a primary ingredient in bleaching agents used in the textile and paper industries.

• It is essential in the production of Polyvinyl Chloride (PVC), which is used for pipes, cables, and clothing.

Important Points

• The Halogen Group: Group 17 elements, including Fluorine (F), Chlorine (Cl), Bromine (Br), Iodine (I), and Astatine (At), are known as Halogens. They are all non-metals (though properties shift toward metallic character further down the group).

• Metalloids: Some elements like Silicon (Si) and Germanium (Ge) exhibit properties of both metals and non-metals and are classified as metalloids.

• Liquid Elements: While Mercury is the only liquid metal at room temperature, Bromine (Br) is the only liquid non-metal at room temperature.

• Chemical Bonding: Chlorine typically forms ionic bonds with metals (like NaCl) and covalent bonds with other non-metals (like HCl).

Q6. Answer: (b) At 2F

The correct answer is At 2F.

Key Points

• When an object is placed at 2F (also known as the Center of Curvature, C) of a convex lens, the rays of light from the object converge on the opposite side of the lens at exactly the 2F position.

• In this specific configuration, the object distance (u) is equal to 2f, and the image distance (v) is also 2f. Hence, the statement in the question is correct.

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• The image formed at 2F has the unique characteristic of being exactly the same size as the object. The linear magnification (m) in this case is -1, where the negative sign indicates the image is inverted.

• The nature of the image formed is real and inverted. A real image is one where the light rays actually meet at a point, allowing the image to be projected onto a screen.

• For a convex lens, which is a converging lens, this is the only position (other than infinity for a point image) where the distance of the object from the lens equals the distance of the image from the lens.

Additional Information

• Object at Infinity:

• When the object is at an infinite distance, the incident rays are parallel to the principal axis.

• The image is formed at the Principal Focus (F) on the other side.

• The image is highly diminished (point-sized), real, and inverted.

• Object Beyond 2F:

• When the object is placed at a distance greater than twice the focal length, the image is formed between F and 2F on the opposite side.

• The image is diminished (smaller than the object), real, and inverted.

• Object at Focus (F):

• When the object is placed exactly at the Focus (F), the refracted rays emerge parallel to each other.

• The image is formed at infinity.

• The image is highly magnified, real, and inverted.

• Object Between F and Optical Center (O):

• This is the only case for a convex lens where a virtual image is formed.

• The image is formed on the same side as the object, and it is enlarged and erect. This principle is used in a magnifying glass.

Important Points

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

• Sign Convention: According to the Cartesian sign convention, the object distance (u) is always negative. For a convex lens, the focal length (f) is always positive.

• Magnification (m): It is defined as the ratio of the height of the image to the height of the object, or m = v/u. In the case where the object is at 2F, v = 2f and u = -2f, leading to m = -1.

• Applications: Convex lenses are widely used in spectacles to correct Hypermetropia (farsightedness), in cameras to focus light on film or sensors, and in microscopes and telescopes to magnify distant or tiny objects.

• Focal Length (F): The distance from the optical center to the principal focus. It depends on the refractive index of the lens material and the radii of curvature of its surfaces.

Q7. Answer: (d) R/5

The correct answer is R/5.

Key Points

• In a parallel arrangement of resistors, the reciprocal of the equivalent resistance is equal to the sum of the reciprocals of the individual resistances.

• The mathematical formula for the total resistance (Rp) in a parallel circuit is given by: 1/Rp = 1/R1 + 1/R2 + 1/R3 + ... + 1/Rn.

• When 5 resistors of equal resistance R are connected in parallel, the equation becomes: 1/Rp = 1/R + 1/R + 1/R + 1/R + 1/R.

• By adding the fractions, we get 1/Rp = 5/R. To find the value of the total resistance, we take the reciprocal of both sides, which results in Rp = R/5.

• This principle demonstrates that in a parallel circuit, the equivalent resistance is always smaller than the smallest individual resistance in the network.

Additional Information

• Series Combination: In a series arrangement, the resistors are connected end-to-end. The total resistance (Rs) is the simple arithmetic sum of the individual resistances: Rs = R1 + R2 + ... + Rn. For 5 resistors of value R in series, the total resistance would be 5R.

• Voltage and Current: In a parallel circuit, the potential difference (Voltage) across each resistor remains constant and equal to the source voltage. However, the total current from the source is distributed among the different parallel branches.

• Applications: Domestic household wiring is typically done in parallel. This ensures that even if one appliance (resistor) fails or is turned off, the circuit remains closed for other appliances, and all devices receive the rated voltage (e.g., 220V in India).

• Ohm's Law: The fundamental relationship used to analyze these circuits is Ohm's Law, which states V = IR, where V is voltage, I is current, and R is resistance.

Important Points

• For n equal resistors each of resistance R, the equivalent resistance in parallel is always R/n.

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

• Conductance is the reciprocal of resistance; therefore, in a parallel circuit, the total conductance is the sum of the individual conductances of the branches.

• When comparing the two types of connections for n identical resistors, the ratio of Series Resistance (Rs) to Parallel Resistance (Rp) is always n^2. In this specific case with 5 resistors, the ratio Rs/Rp would be 25.

Q8. Answer: (d) Rainbow formation.

The correct answer is Rainbow formation.

Key Points

• Rainbow formation is a natural phenomenon that involves a combination of dispersion, refraction, and internal reflection of sunlight by spherical water droplets in the atmosphere. Without dispersion, the light would not split into its seven constituent colors (VIBGYOR), and the rainbow would not be visible in its colored form. Hence, statement 4 is correct.

• Twinkling of stars is primarily caused by atmospheric refraction. As starlight enters the Earth's atmosphere, it undergoes multiple refractions due to varying optical densities and temperatures of air layers, causing the apparent position and brightness of the star to fluctuate. Hence, statement 1 is incorrect.

• Advanced sunrise and delayed sunset occur because of atmospheric refraction. The Sun is visible to us about 2 minutes before the actual sunrise because light bends as it travels from the vacuum of space into the denser Earth's atmosphere. Hence, statement 2 is incorrect.

• Mirages are optical illusions typically observed in hot deserts or on coal-tar roads during summer. They are caused by Total Internal Reflection (TIR) and refraction as light passes through layers of air with different temperature gradients. Hence, statement 3 is incorrect.

• Dispersion of light is defined as the splitting of a beam of white light into its individual spectrum of colors when it passes through a transparent medium like a glass prism or water droplet.

Additional Information

• Dispersion of Light:

• This phenomenon was first discovered by Sir Isaac Newton in 1666.

• In the visible spectrum, Red light has the longest wavelength and deviates the least, while Violet light has the shortest wavelength and deviates the most.

• The band of colored components of a light beam is called its spectrum, commonly represented by the acronym VIBGYOR (Violet, Indigo, Blue, Green, Yellow, Orange, Red).

• Atmospheric Refraction:

• The Earth's atmosphere is not uniform; its refractive index changes with altitude and temperature.

• Besides twinkling and advanced sunrise, this also causes the flattening of the Sun's disc at sunrise and sunset.

• Total Internal Reflection (TIR):

• It occurs when light travels from a denser medium to a rarer medium and the angle of incidence is greater than the critical angle.

• TIR is the principle behind the working of optical fibers and the brilliance of diamonds.

Important Points

• Condition for Rainbow: A rainbow is always formed in a direction opposite to that of the Sun. The water droplets act like small prisms.

• Primary vs Secondary Rainbow: A primary rainbow involves two refractions and one internal reflection, whereas a secondary rainbow involves two internal reflections, resulting in reversed colors.

• Refraction: It is the bending of light when it passes from one medium to another due to the change in the velocity of light. The degree of bending depends on the refractive index of the media involved.

Q9. Answer: (a) Social Forestry

The correct answer is Social Forestry.

Key Points

• Social Forestry involves the management and protection of forests as well as afforestation on barren lands with the purpose of helping in the environmental, social, and rural development of the country. Hence, statement 1 is correct.

• It aims at increasing forest cover to reduce the pressure on traditional forest areas by growing trees on community lands, canal banks, and railway lines. This directly contributes to forest conservation by providing alternative sources of fuelwood and timber.

• Mining involves the extraction of minerals from the earth's crust. It is a major cause of deforestation and land degradation because it requires clearing vast areas of forest land for excavation and infrastructure. Hence, statement 2 is incorrect.

• Urbanization is the process of the expansion of cities and the migration of people from rural to urban areas. This leads to the

conversion of forest land into residential and industrial zones, causing a net loss in biodiversity. Hence, statement 3 is incorrect.

• Logging refers to the activity of cutting down trees for commercial timber or fuel. While it can be managed, it is traditionally an extractive industry that leads to forest thinning and habitat loss rather than conservation. Hence, statement 4 is incorrect.

Additional Information

• History of Social Forestry: The term was first used in India in 1976 by the National Commission on Agriculture. It was launched to encourage people to plant trees on their own land and common lands to meet the needs of the rural population.

• Components: Social forestry is broadly categorized into Farm Forestry, Community Forestry, Extension Forestry, and Agro-forestry.

• Farm Forestry: Farmers grow trees for commercial or non-commercial purposes on their own agricultural lands.

• Community Forestry: The community as a whole takes the initiative to plant trees on public or community-owned lands.

• Objectives: The primary goals include providing fodder for livestock, fuelwood for cooking, and small timber for rural housing, thereby preventing the local population from exploiting Reserved Forests.

• Policy Framework: The National Forest Policy of 1988 emphasized the need for a massive people's movement for afforestation and advocated that the forest-based industry should encourage small-scale farmers to grow raw materials.

Important Points

• Environmental Benefits: Social forestry helps in carbon sequestration, which is vital for mitigating climate change. It also helps in soil conservation by preventing wind and water erosion in rural tracts.

• Target Goal: India aims to bring 33% of its total geographical area under forest and tree cover, a target highlighted in the National Forest Policy.

• Role of International Organizations: During the 1980s, several Social Forestry projects in India were funded by international agencies like the World Bank and the United States Agency for International Development (USAID) to promote sustainable land management.

• Employment: These programs generate significant employment opportunities for the rural poor, particularly through tree planting, nursery management, and the harvesting of non-timber forest products (NTFP).

Q10. Answer: (c) Zinc

The correct answer is Zinc.

Key Points

• Galvanisation is a chemical process used to prevent the rusting of iron and steel by applying a protective zinc coating.

• The process primarily utilizes zinc because it is more reactive than iron and acts as a sacrificial metal. This means even if the coating is damaged, the zinc will corrode first, protecting the iron underneath.

• The most common industrial method is hot-dip galvanizing, where the metal parts are submerged in a bath of molten zinc at temperatures typically around 450°C (842°F).

• This technique provides two types of protection: a physical barrier that prevents moisture and oxygen from reaching the iron, and cathodic protection, which is an electrochemical defense mechanism.

• Zinc is highly effective for this purpose because it bonds metallurgically to the iron or steel, creating a series of zinc-iron alloy layers that are extremely durable.

Additional Information

• The Chemistry of Protection: When zinc is exposed to the atmosphere, it reacts with oxygen to form zinc oxide (ZnO). This further reacts with moisture to form zinc hydroxide and finally reacts with carbon dioxide to form a thin, grey, and protective layer of zinc carbonate ($ZnCO_3$). This layer is insoluble and stops further corrosion.

• Comparison with other metals:

• Lead: While once used for pipes, it is not used for galvanisation due to its high toxicity and lack of sacrificial properties.

• Copper: It is often used in electroplating for aesthetics or conductivity. However, if a copper coating on iron is scratched, the iron will rust even faster because copper is less electropositive than iron.

• Aluminum: While aluminum is used in some alloys (like Galvalume, which is 55% aluminum and 43.4% zinc), the specific term galvanisation is strictly reserved for zinc coatings.

• History: The process is named after the Italian scientist Luigi Galvani, who studied bioelectricity. The term was adopted in the 18th century to describe the electrochemical protection provided by zinc.

• Applications: Galvanised iron is used extensively in construction for roofing sheets, automotive parts to prevent car body rust, telecommunication towers, nails, screws, and water pipes.

• Longevity: Depending on the environment, galvanised steel can last for over 50 years in rural areas and 20 to 25 years in severe coastal or industrial environments.

Q11. Answer: (b) 100 N

The correct answer is 100 N.

Key Points

• Work Done is defined as the product of the magnitude of the force and the displacement in the direction of the force.

• The mathematical formula for work is W = F × s × cos(θ), where W is the work done, F is the force applied, s is the displacement, and θ is the angle between the force and the displacement vectors.

• In the given problem, the Work Done (W) is 500 J and the Displacement (s) is 5 m.

• The force acts in the same direction as the displacement, which means the angle θ is 0 degrees. Since cos(0°) = 1, the formula simplifies to W = F × s.

• Substituting the given values into the equation: 500 = X × 5.

• By solving for X, we get X = 500 / 5, which equals 100. Therefore, the value of the constant force is 100 Newtons (N).

Additional Information

• Unit of Work: The SI unit of work is the Joule (J). One Joule is defined as the amount of work done when a force of 1 Newton displaces an object by 1 meter in the direction of the force.

• Scalar Quantity: Work is a scalar quantity, meaning it has only magnitude and no direction, even though it is calculated using two vector quantities (force and displacement).

• Positive Work: Work is considered positive when the force and displacement are in the same direction (0° ≤ θ < 90°). In this case, the force assists the motion.

• Negative Work: Work is negative when the force acts in the opposite direction to the displacement (90° < θ ≤ 180°), such as the force of friction acting against a moving body.

• Zero Work: Work done is zero if there is no displacement (s = 0) or if the force is perpendicular to the displacement (θ = 90°). An example is a person carrying a heavy load on their head while standing still or walking horizontally (where gravity acts vertically downward).

Important Points

• Force (F): It is a push or pull upon an object resulting from the object's interaction with another object. Its SI unit is the Newton (N).

• Dimensional Formula: The dimensional formula for Work is [M1 L2 T-2], which is the same as that for Energy.

• Constant Force: A constant force means the magnitude and direction of the force do not change over the period of displacement.

• Relation to Energy: According to the Work-Energy Theorem, the net work done on an object is equal to the change in its kinetic energy.

Q12. Answer: (c) $P=V^2/R$

The correct answer is P = V^2/R.

Key Points

• Electric Power (P) is defined as the rate at which electrical energy is consumed or dissipated in an electrical circuit. It represents the work done per unit time.

• According to Ohm's Law, the potential difference (V) across a resistor is proportional to the current (I) flowing through it, which is mathematically represented as V = IR, where R is the resistance.

• The primary formula for calculating electric power is P = VI. This formula relates power to the voltage and the current flowing through the device.

• To derive the relation between power, voltage, and resistance, we can manipulate Ohm's Law. By substituting I = V/R into the basic power equation (P = VI), we get P = V * (V/R), which simplifies to P = V^2/R. Hence, statement 3 is correct.

• The alternative options provided, such as P = VR/I, P = R/V^2, and P = I/VR, do not align with the standard derivations from Ohm's Law and Joule's Law. Hence, statements 1, 2, and 4 are incorrect.

Additional Information

• SI Unit of Power: The Standard International (SI) unit for power is the Watt (W). One Watt is equal to one Joule per second (1 W = 1 J/s). In terms of electrical units, 1 Watt = 1 Volt * 1 Ampere.

• Power in terms of Current and Resistance: Another essential derivation for power is P = I^2R. This is obtained by substituting V = IR into the formula P = VI. This specific relation is often used to calculate heat loss in transmission lines.

• Applications of P = V^2/R: This formula is highly useful in parallel circuits because the voltage (V) remains constant across all components connected in parallel. It shows that for a fixed voltage, the power is inversely proportional to the resistance.

• Joule's Law of Heating: This law states that the heat (H) produced in a resistor is directly proportional to the square of the current, the resistance, and the time (t) for which the current flows (H = I^2Rt). Since P = H/t, it directly correlates to the power formulas.

• Commercial Unit: In India and many other countries, the commercial unit of electrical energy is the kilowatt-hour (kWh), which is commonly referred to as a unit. 1 kWh is the energy consumed by a 1000 Watt appliance in 1 hour, equivalent to 3.6 * 10^6

Joules.

• Resistance (R): It is the property of a conductor to oppose the flow of current. Its SI unit is the Ohm (represented by the symbol Ω). Factors affecting resistance include the length of the wire, area of cross-section, temperature, and the nature of the material.

Q13. Answer: (c) increases

The correct answer is increases.

Key Points

• The speed of sound in a gas is directly proportional to the square root of its absolute temperature. Therefore, as the temperature of the air increases, the speed of sound waves also increases. Hence, the correct answer is option 3.

• When the temperature rises, the molecules in the air gain more kinetic energy and move faster. Since sound is a mechanical wave that travels through the collisions of particles, faster-moving molecules allow the sound vibrations to be transmitted more rapidly.

• For every 1 degree Celsius rise in temperature, the speed of sound in air increases by approximately 0.61 meters per second (m/s).

• This relationship is represented by the formula where the speed is equal to the speed at 0 degrees Celsius plus 0.61 times the temperature in Celsius.

• At 0 degrees Celsius, the speed of sound in dry air is approximately 331 m/s, while at a standard room temperature of 20 degrees Celsius, it increases to about 343 m/s.

Additional Information

• Effect of Humidity: The speed of sound also increases with humidity. Moist air is less dense than dry air (because water vapor molecules are lighter than nitrogen and oxygen molecules), and sound travels faster in less dense gaseous media.

• Effect of Pressure: Under constant temperature conditions, the speed of sound is independent of pressure. If the pressure increases, the density increases proportionally, which cancels out any effect on the speed of sound.

• Medium of Travel: Sound travels fastest in solids, followed by liquids, and slowest in gases. This is due to the elasticity and density of the materials. For example, the speed of sound in Steel is roughly 5960 m/s, while in Water, it is about 1480 m/s.

• Nature of Sound: Sound waves are longitudinal mechanical waves, meaning they require a material medium (solid, liquid, or gas) to propagate and cannot travel through a vacuum.

• Frequency and Wavelength: While the speed of sound changes with temperature, the frequency of the sound (determined by the source) remains constant. Consequently, as speed increases with temperature, the wavelength must also increase.

Important Points

• Laplace's Correction: The speed of sound in an ideal gas is given by the Newton-Laplace formula, which states that speed is the square root of (Gamma times Pressure divided by Density). Here, Gamma is the adiabatic index (approx 1.4 for air).

• Direct Proportionality: Mathematically, speed (v) is proportional to the square root of T (where T is the absolute temperature in Kelvin). This means if the absolute temperature quadruples, the speed of sound doubles.

• Historical Context: Sir Isaac Newton originally calculated the speed of sound assuming an isothermal process, but Pierre-Simon Laplace corrected this by identifying the process as adiabatic, leading to the accurate values used in physics today.

• Applications: Understanding the temperature dependence of sound speed is crucial in fields like Aviation (calculating the Mach number), Meteorology, and the design of Musical Instruments.

Q14. Answer: (c) A straight line parallel to the time axis

The correct answer is A straight line parallel to the time axis.

Key Points

• Uniform velocity refers to a state of motion where an object covers equal displacements in equal intervals of time, regardless of how small these intervals are. In this state, both the magnitude (speed) and the direction of the object remain constant.

• In a velocity-time (v-t) graph, the velocity of the object is typically represented on the vertical y-axis, while the time elapsed is represented on the horizontal x-axis.

• Since the velocity is constant during uniform motion, the value on the y-axis does not change as the value on the x-axis (time) increases. This results in a horizontal straight line that is parallel to the time axis.

• The slope of a velocity-time graph indicates the acceleration of the moving object. For an object with uniform velocity, the acceleration is zero (since there is no change in velocity), which mathematically corresponds to a slope of zero.

• This graphical representation is a primary tool in kinematics to distinguish between uniform and non-uniform motion.

Additional Information

• Displacement from v-t Graph: The area enclosed under the velocity-time curve and the time axis provides the total displacement of the object over a given time interval. For uniform velocity, this area is simply a rectangle (Velocity × Time).

• Uniform Acceleration: When the velocity-time graph is a straight line sloping upwards starting from the origin or any other point, it represents uniform acceleration. This means the velocity increases by equal amounts in equal intervals of time.

• Uniform Retardation: A straight line sloping downwards on a v-t graph indicates uniform retardation (or negative acceleration), where the velocity of the object decreases at a constant rate until it potentially comes to rest.

• Non-Uniform Acceleration: If the velocity-time graph is a curved line (rising gradually or otherwise), it indicates non-uniform acceleration. In this case, the rate of change of velocity is not constant over time.

• Position-Time Graph: It is important to note that for uniform velocity, the position-time (s-t) graph would be a straight line sloping upwards at a constant angle, indicating that displacement is directly proportional to time.

Important Points

• Instantaneous Velocity: In the case of uniform motion, the instantaneous velocity at any given second is exactly equal to the average velocity over any duration.

• Zero Velocity: If the object is at rest, its velocity is zero, and the velocity-time graph will be a straight line coinciding with the time axis (x-axis) itself.

• Direction: If the straight line parallel to the time axis is in the negative quadrant (below the x-axis), it indicates the object is moving with a constant velocity in the opposite direction.

• Units: Standard SI units for plotting these graphs are meters per second (m/s) for the y-axis and seconds (s) for the x-axis.

Q15. Answer: (b) Male condom

The correct answer is Male condom.

Key Points

• Male condoms are categorized as a barrier method of contraception, designed to be worn over the erect penis during sexual intercourse.

• This method provides dual protection, meaning it simultaneously prevents unintended pregnancy and the transmission of Sexually Transmitted Diseases (STDs), also known as Sexually Transmitted Infections (STIs). Hence, the correct answer is Male condom.

• They function by creating a physical barrier that prevents semen and other bodily fluids from entering the partner's body, thereby blocking pathogens like bacteria and viruses.

• The World Health Organization (WHO) highlights that when used consistently and correctly, condoms are 98% effective at preventing HIV transmission.

• Most condoms are made of latex, though alternatives such as polyurethane or polyisoprene are manufactured for individuals with latex allergies.

Additional Information

• Oral Contraceptive Pills (OCPs):

• These are hormonal medications taken daily to prevent conception.

• They typically contain a combination of estrogen and progestin, which works by inhibiting ovulation (the release of an egg).

• While they are highly effective for birth control, they offer zero protection against STIs such as Syphilis or Chlamydia.

• Copper-T (IUD):

• The Copper-T is an Intrauterine Device (IUD) inserted into the uterus by a medical professional.

• It is a Long-Acting Reversible Contraceptive (LARC) that can prevent pregnancy for 5 to 10 years by releasing copper ions, which are toxic to sperm.

• Like hormonal pills, this device does not protect against STDs.

• Surgical Methods:

• Also known as sterilization, these include vasectomy for men and tubal ligation for women.

• These are permanent methods of contraception that involve blocking or cutting the vas deferens or fallopian tubes.

• While effective at preventing pregnancy, they do not prevent the exchange of bodily fluids that transmit STDs.

Important Points

• Prevention of STDs: Condoms are the only contraceptive method that significantly reduces the risk of Gonorrhea, Trichomoniasis, and Hepatitis B during sexual activity.

• Usage Data: In typical use scenarios, the effectiveness of condoms drops to approximately 82% to 87% due to improper handling, breakage, or inconsistent use, emphasizing the need for comprehensive sex education.

• Accessibility: Unlike Copper-T or Surgical methods, condoms are available over-the-counter without a prescription in most countries, including India, making them a vital tool for public health and family planning.

• Limitations: While highly effective, condoms provide less protection against STDs spread through skin-to-skin contact, such as Human Papillomavirus (HPV) and Genital Herpes, compared to those spread via fluid exchange.

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Q16. Answer: (b) holozoic

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

Key Points

• Holozoic nutrition is a type of heterotrophic nutrition that involves the ingestion of liquid or solid organic material, followed by its internal digestion, absorption, and assimilation to provide energy.

• In this mode, the organism takes in the whole food material (complex organic substances) and breaks it down into simpler forms inside the body using specific enzymes. Hence, the statement in the question perfectly describes holozoic nutrition.

• The process of holozoic nutrition typically follows five distinct stages: Ingestion (taking in food), Digestion (mechanical and chemical breakdown), Absorption (nutrient uptake), Assimilation (utilization for energy/growth), and Egestion (elimination of waste).

• Common examples of organisms following this mode include Humans, Amoeba, Dogs, Cats, and Lions. In Amoeba, food is captured using temporary finger-like projections called pseudopodia.

• Organisms with holozoic nutrition are categorized into three types based on their food source: Herbivores (plant-eaters), Carnivores (meat-eaters), and Omnivores (those eating both plants and animals).

Additional Information

• Saprophytic Nutrition:

• Saprophytic organisms (saprobes) derive their nutrition from dead and decaying organic matter like fallen leaves, dead animals, or rotting bread.

• Unlike holozoic organisms, they perform extracellular digestion by secreting enzymes outside their body to break down complex matter and then absorbing the liquefied nutrients. Common examples include Fungi (like Mushrooms and Yeast) and certain Bacteria.

• Parasitic Nutrition:

• In this mode, an organism (the parasite) lives on or inside another living organism (the host) and obtains its food at the expense of the host without killing it immediately.

• They can be Ectoparasites (living outside, like Leeches and Lice) or Endoparasites (living inside, like Tapeworms and Ascaris). A famous plant parasite is Cuscuta (Amarbel).

• Autotrophic Nutrition:

• Autotrophs are organisms that can manufacture their own food from inorganic substances like Carbon dioxide (CO_2) and Water (H_2O).

• Most autotrophs use Photosynthesis, utilizing Sunlight and Chlorophyll to produce Glucose. This category primarily includes Green plants and Cyanobacteria (blue-green algae).

Important Points

• Key Biological Features:

• Heterotrophs: Both holozoic, parasitic, and saprophytic organisms fall under the broad category of Heterotrophs because they cannot produce their own food and depend on other sources for organic carbon.

• Digestive System: Holozoic nutrition usually requires a specialized digestive tract or a food vacuole (as in unicellular organisms like Paramecium) to process the ingested material.

• Comparison Summary:

• Holozoic: Internal digestion of solid/liquid food.

• Saprophytic: External digestion of dead matter.

• Parasitic: Absorption of nutrients from a living host.

• Autotrophic: Synthesis of food using Solar energy or Chemical energy.

Q17. Answer: (b) Each piece will regenerate to form new individuals.

The correct answer is Each piece will regenerate to form new individuals.

Key Points

• Hydra is a simple multicellular organism that possesses an incredible capacity for regeneration, which is a form of asexual reproduction when the body is divided.

• When a Hydra is cut into multiple pieces, each piece has the potential to grow into a complete, new individual. This happens because the organism contains specialized cells that can proliferate and differentiate into any cell type required to rebuild the missing parts.

• This process is driven by interstitial cells, which are totipotent stem cells found in the body column of the Hydra. These cells undergo rapid division to form a mass of cells that eventually organizes into the structures of a full organism.

• If the body is sliced transversely or longitudinally, the polarity of the organism is maintained, meaning the "head" part will grow a new "foot" and the "foot" part will grow a new "head." Hence, the statement that each piece will regenerate to form new individuals is correct.

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• Unlike higher organisms where cutting leads to permanent injury or death, in Hydra, it results in the multiplication of the organism. Hence, the statement that all pieces will die immediately is incorrect.

Additional Information

• Phylum and Habitat: Hydra belongs to the phylum Cnidaria (specifically the class Hydrozoa). It is a freshwater organism typically found in unpolluted ponds, lakes, and slow-flowing rivers.

• Discovery: The remarkable regenerative powers of Hydra were first discovered and described by the scientist Abraham Trembley in the year 1744. His experiments were pioneering in the field of experimental biology.

• Budding vs. Regeneration: While Hydra can regenerate when cut, its primary mode of asexual reproduction under favorable conditions is budding. In budding, a small outgrowth (bud) develops due to repeated cell division at one specific site, which eventually matures and detaches from the parent. Regeneration is typically a response to injury rather than the standard reproductive cycle.

• Morphallaxis: The type of regeneration observed in Hydra is known as morphallaxis. In this process, the regeneration occurs mainly by the remodeling of existing body tissues into a new organism, rather than just the growth of new tissue at the wound site (which is called epimorphosis).

• Other Examples: Besides Hydra, organisms like Planaria (flatworms) and Starfish also exhibit high degrees of regeneration. In Planaria, even a tiny fragment can regenerate into a whole worm.

Important Points

• Biological Immortality: Hydra is often cited as being biologically immortal because its stem cells continually renew themselves, and it does not appear to die of old age or show signs of senescence.

• Body Structure: The body of a Hydra is diploblastic, meaning it consists of two main layers: the ectoderm (epidermis) and the endoderm (gastrodermis), separated by a gelatinous layer called the mesoglea.

• Nerve Net: It possesses a simple nerve net rather than a centralized brain, which coordinates its movements and responses to stimuli like touch or light.

• Feeding Mechanism: Hydra are carnivorous and use specialized stinging cells called nematocysts or cnidocytes located on their tentacles to paralyze and capture prey like small crustaceans (e.g., Daphnia).

Q18. Answer: (a) both remain unchanged

The correct answer is both remain unchanged.

Key Points

• A neutral solution is a solution that is neither acidic nor basic in nature. It typically has a pH value of exactly 7 at 25 degrees Celsius.

• Litmus paper is a commonly used pH indicator made from paper treated with natural dyes extracted from lichens.

• In a neutral solution, red litmus paper stays red and blue litmus paper stays blue. Since neither paper changes its original color, they are said to remain unchanged. Hence, the correct answer is option 1.

• The lack of color change occurs because the concentration of hydrogen ions (H+) and hydroxyl ions (OH-) is equal in a neutral medium, providing no chemical stimulus to trigger the color-changing pigments in the litmus.

• Common examples of neutral substances include distilled water, sodium chloride (common salt) solution, and sugar solutions. These substances do not show any reaction with either type of litmus paper.

Additional Information

• Acidic Solutions:

• An acidic solution has a pH value of less than 7.

• In an acidic medium, blue litmus paper turns red, while red litmus paper remains red.

• Common examples include hydrochloric acid (HCl), sulfuric acid, lemon juice (citric acid), and vinegar (acetic acid).

• Basic (Alkaline) Solutions:

• A basic solution has a pH value of greater than 7.

• In a basic medium, red litmus paper turns blue, while blue litmus paper remains blue.

• Common examples include sodium hydroxide (NaOH), baking soda solution, soap solution, and limewater (calcium hydroxide).

• The pH Scale:

• The pH scale was introduced by S.P.L. Sorensen in 1909 to measure the acidity or alkalinity of a solution.

• The scale ranges from 0 to 14, where 0 is highly acidic, 14 is highly basic, and 7 is neutral.

Important Points

• Natural Indicators: Apart from litmus (derived from Roccella tinctoria), other natural indicators include turmeric (which turns red in bases), China rose (which turns dark pink in acids and green in bases), and red cabbage juice.

• Synthetic Indicators: Scientists also use laboratory-made chemicals like Phenolphthalein (which is colorless in acid and pink in base) and Methyl Orange (which is red in acid and yellow in base).

• Universal Indicator: This is a mixture of several indicators that shows different colors at different pH values, allowing for a more precise measurement of the strength of an acid or base.

• The term "neutralization" refers to the chemical reaction between an acid and a base to produce salt and water, resulting in a solution that typically does not change the color of litmus paper.

Q19. Answer: (a) Crystallisation

The correct answer is Crystallisation.

Key Points

• Crystallisation is the process of formation of solid crystals precipitating from a solution, melt, or gas. It is a physical change because the chemical composition of the substance remains the same; it only changes its physical state from a solute in a solvent to a solid crystalline structure. Hence, statement 1 is correct.

• Rusting is a chemical process that occurs when iron reacts with oxygen and moisture (water) in the atmosphere to form iron oxide. Since a new chemical substance is formed, it is a chemical change. Hence, statement 2 is incorrect.

• Combustion is a high-temperature exothermic redox chemical reaction between a fuel and an oxidant, usually atmospheric oxygen, that produces oxidized, often gaseous products. Because it results in the formation of new substances like carbon dioxide and water vapor, it is a chemical change. Hence, statement 3 is incorrect.

• Fermentation is a metabolic process that produces chemical changes in organic substrates through the action of enzymes. In this process, substances like sugar are converted into alcohol or acids by microorganisms like yeast or bacteria. Hence, statement 4 is incorrect.

Additional Information

• Physical Change:

• A physical change is a type of change in which the form of matter is altered but one substance is not transformed into another.

• Key characteristics include changes in physical properties such as shape, size, volume, density, and state of matter (solid, liquid, gas).

• These changes are usually reversible. Examples include melting of ice, boiling of water, dissolving sugar in water, and shredding paper.

• Chemical Change:

• A chemical change occurs when a substance combines with another to form a new substance (synthesis) or decomposes into two or more different substances.

• These processes are called chemical reactions and are generally irreversible by simple physical means.

• Examples include digestion of food, burning of wood, cooking an egg, and souring of milk.

• Indicators of a chemical change often include color change, evolution of gas, formation of a precipitate, or change in temperature (heat absorption or release).

Important Points

• Distinguishing Features:

• In a physical change, no energy is typically produced, though it may be absorbed or released during state changes (like latent heat).

• In a chemical change, there is a significant exchange of energy, and the molecular composition of the substance is entirely transformed.

• Crystallisation is frequently used as a purification technique in laboratories and industries to obtain pure solids from impure mixtures. For example, obtaining pure copper sulphate from an impure sample.

• Rusting of iron can be prevented by methods such as galvanization (coating with zinc), painting, or greasing to block contact with air and moisture.

Q20. Answer: (c) Sink, because its density is greater than water's density.

The correct answer is Sink, because its density is greater than water's density..

Key Points

• Density is defined as the mass of an object per unit volume. It determines whether an object will float or sink in a given fluid.

• In the given problem, the mass of the sealed packet is 500 g and its volume is 350 cm3.

• The formula for calculating density is Density = Mass / Volume. By substituting the values, we get: 500 g / 350 cm3 = 1.428 g/cm3 (approximately 1.43 g/cm3).

• The density of water is a standard value of 1 g/cm3 (or 1000 kg/m3).

• An object sinks in a fluid if its density is higher than the density of the fluid. Since 1.43 g/cm3 is greater than 1 g/cm3, the packet will definitely sink in water. Hence, the statement regarding sinking due to higher density is correct.

• The buoyant force (upthrust) acting on the packet is equal to the weight of the water displaced by the volume of the packet (350 cm3), which weighs 350 g. Since the actual weight of the packet (500 g) is more than the upthrust, it cannot float.

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Additional Information

• Archimedes' Principle: This principle states that when a body is immersed fully or partially in a fluid, it experiences an upward force (buoyancy) that is equal to the weight of the fluid displaced by it.

• Conditions for Floating and Sinking:

• If Density of Object < Density of Fluid: The object will float.

• If Density of Object = Density of Fluid: The object will float while being fully submerged (neutral buoyancy).

• If Density of Object > Density of Fluid: The object will sink.

• Relative Density (Specific Gravity): It is the ratio of the density of a substance to the density of water. If the relative density is greater than 1, the substance will sink in water. For this packet, the relative density is 1.43.

• Mass vs. Weight: Mass is a measure of the amount of matter in an object (measured in grams or kilograms), whereas weight is the force exerted by gravity on that mass (measured in Newtons). In floatation problems, we often use mass and density for simplicity in CGS units (g/cm3).

• Applications: This concept is crucial in designing ships, submarines, and hot air balloons. A large iron ship floats because its average density (including the air inside) is less than that of water, even though iron itself is much denser.

Important Points

• Standard Values: The density of pure water is highest at 4 degrees Celsius, being exactly 1.00 g/cm3. Saltwater has a higher density (approx 1.025 g/cm3), which is why it is easier for humans to float in the ocean than in a freshwater pool.

• Numerical Fact: To find the mass of the water displaced by the packet, we multiply its volume (350 cm3) by the density of water (1 g/cm3), resulting in 350 g of water displaced.

• Misconception: An object does not sink just because it has a "high mass" or a "low volume"; it sinks because of the relationship (ratio) between mass and volume. A 1 kg block of wood will float, while a 10 g iron nail will sink.

Q21. Answer: (d) The physiological activity of the cell

The correct answer is The physiological activity of the cell.

Key Points

• The number of mitochondria per cell is not fixed and varies significantly depending on the physiological activity of the cell. This is because mitochondria are responsible for producing energy, and cells with higher energy demands require more of them. Hence, statement 4 is correct.

• Cells that are highly active metabolically, such as cardiac muscle cells, liver cells, and sperm cells, contain thousands of mitochondria to meet their continuous ATP (Adenosine Triphosphate) requirements.

• In contrast, cells with low metabolic activity, such as skin cells or certain connective tissue cells, have fewer mitochondria. Some specialized cells, like mature mammalian red blood cells (RBCs), lack mitochondria entirely to maximize space for hemoglobin.

• The age of the organism may influence the efficiency or health of mitochondria, but it is not the primary determinant of the specific number of mitochondria found across different tissue types. Hence, statement 1 is incorrect.

• The size of the nucleus is a structural characteristic related to the amount of genetic material and cellular regulation, but it has no direct correlation with the quantity of mitochondria. Hence, statement 2 is incorrect.

• While mitochondria contain their own extranuclear DNA, the total amount of DNA present in a cell (predominantly nuclear DNA) does not dictate the number of mitochondrial organelles. Hence, statement 3 is incorrect.

Additional Information

• Structure of Mitochondria:

• Mitochondria are double-membrane-bound organelles. The outer membrane is smooth and porous, while the inner membrane is deeply folded into structures called cristae.

• The cristae increase the surface area available for chemical reactions, specifically the Electron Transport Chain (ETC), which is vital for ATP production.

• The internal compartment filled with fluid is known as the matrix, which contains enzymes for the Krebs cycle.

• Semi-Autonomous Nature:

• Mitochondria are considered semi-autonomous because they possess their own circular DNA and 70S ribosomes, allowing them to synthesize some of their own proteins.

• They reproduce independently within the cell through a process similar to bacterial division called binary fission.

• Functions:

• The primary function is aerobic respiration, earning them the title "Powerhouse of the cell".

• They also play roles in calcium storage, apoptosis (programmed cell death), and heat production (thermogenesis).

Important Points

• Discovery and Naming: Mitochondria were first observed by Albert von Kolliker in 1850 as granules in muscle cells. Richard Altmann described them as "bioblasts" in 1890, and the term "mitochondria" was officially coined by Carl Benda in 1898.

• Endosymbiotic Theory: This biological theory suggests that mitochondria originated from free-living prokaryotes (specifically proteobacteria) that entered into a symbiotic relationship inside a host eukaryotic cell billions of years ago.

• Mitochondrial DNA (mtDNA): Unlike nuclear DNA, mtDNA is inherited almost exclusively from the mother in humans, making it a crucial tool for tracing ancestry and studying evolutionary biology.

Q22. Answer: (c) To supplement nitrogen and other nutrients

The correct answer is To supplement nitrogen and other nutrients.

Key Points

• Insectivorous plants, also known as carnivorous plants, have evolved to trap and digest insects because they typically grow in nutrient-poor soils, particularly those lacking in nitrogen.

• Nitrogen is a vital component for the synthesis of proteins, chlorophyll, and nucleic acids in plants. In environments like bogs, marshes, and swamps, the soil is often acidic and waterlogged, which prevents the decomposition of organic matter and makes nitrogen unavailable to plants.

• While these plants possess chlorophyll and are capable of photosynthesis to produce carbohydrates, they rely on animal prey to acquire essential minerals like nitrogen, phosphorus, and potassium that the soil cannot provide. Hence, statement 3 is correct.

• These plants do not trap insects to compete with herbivores for space; rather, they occupy ecological niches where other plant species struggle to survive due to mineral deficiencies. Hence, statement 1 is incorrect.

• They do not consume insects to take cellulose, as cellulose is a structural component of plant cell walls, not animal tissues; furthermore, plants synthesize their own cellulose. Hence, statement 2 is incorrect.

• Insectivorous plants often require bright sunlight for photosynthesis and are not specifically adapted to survive in low sunlight habitats through insect consumption. Hence, statement 4 is incorrect.

Additional Information

• Common Examples of Insectivorous Plants:

• Venus Flytrap (Dionaea muscipula): Native to the subtropical wetlands of the United States (North and South Carolina). It uses a snap trap mechanism triggered by sensitive trigger hairs.

• Pitcher Plant (Nepenthes & Sarracenia): Uses a pitfall trap. The leaves are modified into a jug-like structure filled with digestive liquor. Nepenthes khasiana is a species found in Meghalaya, India.

• Sundew (Drosera): These plants use flypaper traps. Their leaves are covered in tentacles that secrete a sticky, glistening substance called mucilage to ensnare prey.

• Bladderwort (Utricularia): These are aquatic or terrestrial plants that use suction traps (bladders) to capture small organisms like water fleas in freshwater habitats.

• Digestive Mechanism:

• Once an insect is trapped, the plant secretes digestive enzymes such as proteases, esterases, and acid phosphatases.

• These enzymes break down the animal's proteins and soft tissues into simple nitrogenous compounds (amino acids) and minerals, which are then absorbed by the leaf surfaces.

Important Points

• Partial Heterotrophs: Insectivorous plants are described as partial heterotrophs because they are autotrophic (produce their own food via photosynthesis) but heterotrophic for specific mineral requirements.

• Habitat Features: They are most commonly found in perennially wet areas with low pH (acidic). High acidity slows down the nitrifying bacteria that normally convert organic nitrogen into forms plants can use.

• Conservation: Many insectivorous plants are threatened or endangered due to habitat loss and illegal collection. For instance, the Pitcher Plant in India is protected under the Wildlife Protection Act.

Q23. Answer: (d) Asexual reproduction is a regular source of variations in a population.

The correct answer is Asexual reproduction is a regular source of variations in a population.

Key Points

• Variation refers to the differences that exist between individuals of the same species. These differences can be physical, physiological, or behavioral.

• Sexual reproduction is a significant source of variation because it involves the fusion of gametes from two different parents. Processes like crossing over during meiosis and the independent assortment of chromosomes ensure that offspring have a unique genetic makeup. Hence, statement 1 is correct.

• Due to these genetic reshufflings, individuals within a population are unique. No two individuals (except identical twins) are exactly alike, which helps the population adapt to changing environments. Hence, statement 2 is correct.

• Variation also arises due to inaccuracy in the copying of DNA during cell division. Although DNA replication is highly precise, biochemical processes are not 100% foolproof, and small changes in the DNA sequence (mutations) introduce new variations. Hence, statement 3 is correct.

• Asexual reproduction generally involves a single parent and occurs through mitosis. The offspring produced are genetically identical to the parent and are referred to as clones. Therefore, it is not a regular source of variation; variation in asexual organisms only occurs through rare random mutations. Hence, statement 4 is incorrect.

• Hence, the correct answer is Asexual reproduction is a regular source of variations in a population.

Additional Information

• Importance of Variation:

• Variation is the raw material for Evolution. Without variation, Natural Selection would have no diverse traits to act upon.

• It increases the survival chances of a species during environmental stressors such as climate change, diseases, or predation.

• Types of Variations:

• Somatic Variations: These occur in the non-reproductive cells and are not inherited by the next generation. They are often caused by environmental factors.

• Germinal Variations: These occur in the germ cells (sperm or egg) and are heritable. These are the variations that drive evolutionary changes over generations.

• Mechanisms of Variation in Plants:

• In plants, variations can be observed in leaf shape, flower color, height, and seed texture.

• Polyploidy, which is the possession of more than two complete sets of chromosomes, is a common source of variation and speciation in the plant kingdom.

Important Points

• DNA Copying: The process of DNA replication uses enzymes like DNA polymerase. While there are proofreading mechanisms, the inherent chemical nature of the process leads to occasional "errors," which are the fundamental source of all genetic diversity.

• Clones in Asexual Reproduction: Plants using methods like vegetative propagation (runners, tubers, bulbs) produce offspring that are genetically identical. This is advantageous in stable environments but risky if the environment changes suddenly, as the entire population may be susceptible to the same threat.

• Recombination: This occurs during Prophase I of meiosis when homologous chromosomes exchange segments. This specific mechanism is why siblings from the same parents look different.

Q24. Answer: (a) Copper

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

Key Points

• Copper is a metal that does not react with dilute hydrochloric acid (HCl) under normal conditions. This is because Copper is placed below hydrogen in the reactivity series of metals.

• In a reaction between a metal and a dilute acid, the metal must displace hydrogen from the acid to form a metal salt and release hydrogen gas. Since Copper is less reactive than hydrogen, it cannot lose electrons to the hydrogen ions (H+) present in the acid. Hence, option 1 is correct.

• Zinc is more reactive than hydrogen and sits higher in the activity series. When it comes into contact with dilute HCl, it reacts steadily to form Zinc Chloride (ZnCl2) and evolves hydrogen gas. Hence, option 2 is incorrect.

• Aluminium is a highly reactive metal. Although it often has a protective Aluminium Oxide layer, once that layer is bypassed, it reacts vigorously with dilute HCl to produce Aluminium Chloride (AlCl3) and hydrogen gas. Hence, option 3 is incorrect.

• Iron is also positioned above hydrogen in the reactivity series. It reacts slowly with dilute hydrochloric acid at room temperature to form Ferrous Chloride (FeCl2) and hydrogen gas. Hence, option 4 is incorrect.

Additional Information

• The Reactivity Series: This is a series of metals arranged in the decreasing order of their reactivity. Metals like Potassium (K), Sodium (Na), and Calcium (Ca) are at the top, while Gold (Au) and Platinum (Pt) are at the bottom. Metals above hydrogen can displace it from dilute acids, while those below it (Copper, Mercury, Silver, Gold) cannot.

• Reaction with Nitric Acid: While Copper does not react with dilute HCl, it can react with Nitric Acid (HNO3). However, this is not a simple displacement reaction; because Nitric Acid is a strong oxidizing agent, it oxidizes the metal, and instead of hydrogen gas, oxides of nitrogen (like NO or NO2) are evolved.

• Aqua Regia: Noble metals like Gold and Platinum do not react even with concentrated HCl or Nitric acid individually. They only dissolve in Aqua Regia, which is a freshly prepared mixture of concentrated Hydrochloric acid and concentrated Nitric acid in a 3:1 ratio.

• Physical Properties of Copper: It is a reddish-brown transition metal with the atomic number 29. It is widely used in electrical wiring due to its high electrical conductivity and in alloying to create Brass and Bronze.

• Hydrogen Gas Test: When metals above hydrogen react with dilute HCl, the evolved hydrogen gas can be tested using a burning splinter, which extinguishes with a characteristic "pop" sound.

Important Points

• Aluminium's Passivity: Sometimes Aluminium appears to not react immediately with acids. This is due to a thin, tough layer of

Aluminium Oxide (Al_2O_3) on its surface. Once the acid dissolves this layer, the exothermic reaction proceeds rapidly.

• Chemical Equations:

• Zinc: $Zn + 2HCl \rightarrow ZnCl_2 + H_2$

• Iron: $Fe + 2HCl \rightarrow FeCl_2 + H_2$

• Aluminium: $2Al + 6HCl \rightarrow 2AlCl_3 + 3H_2$

• Copper: $Cu + HCl \rightarrow$ No Reaction

• Standard Reduction Potential: From an electrochemical perspective, metals with a negative reduction potential (like Zinc and Iron) can displace hydrogen, whereas metals with a positive reduction potential (like Copper, +0.34V) cannot.

Q25. Answer: (d) It melts and may later evaporate

The correct answer is It melts and may later evaporate.

Key Points

• When a solid is heated, the thermal energy is absorbed by its particles, which increases their kinetic energy. As the particles gain energy, they vibrate more vigorously around their fixed positions.

• As heating continues, the substance reaches its Melting Point. At this specific temperature, the energy supplied is used to break the intermolecular forces of attraction that hold the particles in a rigid lattice structure.

• The process of a solid changing into a liquid is known as Fusion or Melting. During this phase change, the temperature remains constant even though heat is still being added; this heat is known as the Latent Heat of Fusion.

• Once the entire solid has turned into a liquid, further heating will cause the temperature of the liquid to rise. The particles in the liquid move faster and more freely.

• Eventually, the liquid reaches its Boiling Point, where the particles gain enough energy to completely overcome the remaining attractive forces and transition into the gaseous state through evaporation or boiling. Hence, the correct progression is that the solid melts and may later evaporate.

Additional Information

• States of Matter:

• Solid: Particles are packed closely together in a regular pattern with very low kinetic energy and high intermolecular attraction. They have a fixed shape and fixed volume.

• Liquid: Particles are close together but can slide past each other. They have a fixed volume but no fixed shape, taking the shape of the container.

• Gas: Particles are far apart and move randomly at high speeds. They have no fixed shape and no fixed volume, expanding to fill any space available.

• Thermal Expansion: Most solids undergo expansion when heated before they reach their melting point. This occurs because the increased vibration of particles increases the average distance between them, causing the overall volume of the solid to increase slightly.

• Phase Transitions:

• Sublimation: A rare process where a solid turns directly into a gas without passing through the liquid phase. Examples include Dry Ice (Solid Carbon Dioxide), Naphthalene, and Camphor.

• Vaporization: The transition from liquid to gas. This includes Evaporation (which occurs at the surface below the boiling point) and Boiling (which occurs throughout the bulk of the liquid at a specific temperature).

Important Points

• Latent Heat: This is the "hidden" heat absorbed or released by a substance during a change in its physical state (phase) that occurs without changing its temperature.

• Latent Heat of Fusion: For water, this value is approximately 334 Joules per gram at 0 degrees Celsius.

• Latent Heat of Vaporization: For water, this value is approximately 2260 Joules per gram at 100 degrees Celsius.

• Intermolecular Forces: The strength of these forces determines the Melting Point and Boiling Point of a substance. Substances with stronger bonds (like ionic solids) require more energy (higher temperatures) to melt compared to those with weaker bonds (like molecular solids).

• Kinetic Molecular Theory: This theory explains that temperature is a direct measurement of the average kinetic energy of the particles in a substance. Therefore, continuous heating is synonymous with increasing the energy of the constituent particles.

Q26. Answer: (b) 24

Shortcut Trick

Convert distance to km and time to hours directly.

Speed = (800 / 1000) ÷ (2 / 60) km/hr

Speed = 0.8 × 30 = 24 km/hr

Therefore The correct answer is 24 km/hr.

Alternate Method
Given:
Distance = 800 m
Time = 2 minutes = 2 × 60 = 120 seconds
Formula Used:
Speed = Distance ÷ Time
Conversion: 1 m/s = (18/5) km/hr
Calculations:
=> Speed in m/s = 800 ÷ 120
=> Speed in m/s = 20/3 m/s
=> Speed in km/hr = (20/3) × (18/5)
=> Speed = 4 × 6
=> Speed = 24 km/hr
Therefore The correct answer is 24 km/hr.
Additional Information
Unit Conversion for Speed
To convert speed from m/s to km/hr, multiply by 18/5. To convert from km/hr to m/s, multiply by 5/18.
Average Speed
Average Speed = Total Distance ÷ Total Time. For two equal distances at speeds x and y, Average Speed = 2xy/(x+y).
Relative Speed
Same direction: Subtract speeds (S1 − S2). Opposite direction: Add speeds (S1 + S2).

Q27. Answer: (a) 24°

Shortcut Trick
In any quadrilateral PQRS, the angle formed by the bisectors of two adjacent angles (say angle R and angle S) is equal to half the sum of the other two angles (angle P and angle Q):
=> angle STR = (angle P + angle Q) ÷ 2
=> 48° = (angle P + angle Q) ÷ 2
=> angle P + angle Q = 96°
Given the ratio of angle P : angle Q = 3 : 5, the sum of ratio parts is 3 + 5 = 8 units.
=> 8 units = 96° => 1 unit = 12°
The difference between angle Q and angle P is 5 − 3 = 2 units:
=> Difference = 2 × 12° = 24°
Therefore The correct answer is 24°.
Alternate Method
Given:
angle STR = 48°
angle P : angle Q = 3 : 5
Formula Used:
Sum of angles in a triangle = 180°
Sum of angles in a quadrilateral = 360°
Calculations:
In triangle STR, the sum of angles is 180°:
=> angle TSR + angle TRS + angle STR = 180°
=> angle TSR + angle TRS + 48° = 180°
=> angle TSR + angle TRS = 132°
Since ST and RT are the angle bisectors of angle S and angle R respectively:
=> angle TSR = angle S ÷ 2 and angle TRS = angle R ÷ 2
=> (angle S ÷ 2) + (angle R ÷ 2) = 132°
=> angle S + angle R = 264°
In quadrilateral PQRS, the sum of all interior angles is 360°:
=> angle P + angle Q + angle R + angle S = 360°

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=> angle P + angle Q + 264° = 360°

=> angle P + angle Q = 96°

Given that the ratio of angle P to angle Q is 3 : 5:

=> Let angle P = 3x and angle Q = 5x

=> 3x + 5x = 96°

=> 8x = 96°

=> x = 12°

Now, find the difference between the measures of angle Q and angle P:

=> Difference = angle Q − angle P = 5x − 3x = 2x

=> Difference = 2 × 12° = 24°

Therefore The correct answer is 24°.

Additional Information

Angle Bisector Theorem in Quadrilaterals

The angle formed by the bisectors of two adjacent angles of a quadrilateral is equal to half the sum of the remaining two angles: angle STR = (angle P + angle Q) ÷ 2.

Sum of Interior Angles of a Polygon

The sum of the interior angles of any n-sided polygon is given by the formula (n − 2) × 180°. For a quadrilateral (n = 4), the sum is always 360°.

Opposite Angle Bisectors

If the bisectors of two opposite angles of a quadrilateral intersect, the angle between them is equal to half the difference of the other two opposite angles.

Q28. Answer: (d) 36 π cm²

Shortcut Trick

When a larger object is melted into n smaller identical objects, the Radius Ratio is R/r = $\sqrt[3]{n}$.

Given n = 27, R/r = $\sqrt[3]{27}$ = 3.

Since the large radius R = 9 cm, the small radius r = 9 ÷ 3 = 3 cm.

Surface Area of small sphere = $4\pi r^2 = 4 \times \pi \times 3^2 = 36\pi$ cm².

Therefore The correct answer is 36π cm².

Alternate Method

Given:

Radius of solid metallic sphere (R) = 9 cm

Number of smaller spheres (n) = 27

Formula Used:

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

Surface Area of Sphere = $4\pi r^2$

Calculations:

=> Volume of large sphere = 27 × Volume of one small sphere

=> $(4/3) \times \pi \times (9)^3 = 27 \times (4/3) \times \pi \times (r)^3$

=> $9 \times 9 \times 9 = 27 \times r^3$

=> $729 = 27 \times r^3$

=> $r^3 = 729 \div 27 = 27$

=> r = 3 cm

=> Surface Area of one small sphere = $4 \times \pi \times r^2$

=> Surface Area = $4 \times \pi \times (3)^2$

=> Surface Area = $4 \times \pi \times 9 = 36\pi$ cm²

Therefore The correct answer is 36π cm².

Additional Information

Volume and Surface Area of Sphere

Volume = $(4/3)\pi r^3$ and Surface Area = $4\pi r^2$. The surface area is also equal to the area of four circles of the same radius.

Hemisphere Formulas

Volume = $(2/3)\pi r^3$, Curved Surface Area = $2\pi r^2$, and Total Surface Area = $3\pi r^2$.

Recasting Property

When one solid is melted to form another, the total volume remains constant. If n identical small solids are formed, then V_(large) = n × V_(small).

Q29. Answer: (a) Rs. 22,500

Shortcut Trick

Using the Successive Multiplier method.

Initial Cost Price = Rs. 15,000.

Net multiplier = (100+20)÷100 × (100+25)÷100 = 1.2 × 1.25 = 1.5.

Final Selling Price = 15,000 × 1.5 = Rs. 22,500.

Therefore The correct answer is Rs. 22,500.

Alternate Method

Given: CP of Wholesaler = Rs. 15,000, Profit1 = 20%, Profit2 = 25%.

Formulas: SP = CP × (100 + P%) ÷ 100.

=> Selling Price for Wholesaler (CP for Retailer) = 15,000 × (120 ÷ 100) = Rs. 18,000.

=> Final Selling Price to Customer = 18,000 × (125 ÷ 100).

=> Final SP = 18,000 × 1.25 = Rs. 22,500.

Therefore The correct answer is Rs. 22,500.

Additional Information

Successive Percentage Change

When a value is increased by a% and then b%, the net percentage increase is given by: a + b + (ab ÷ 100)%.

Effective Profit Percentage

In this case, net profit % = 20 + 25 + (20 × 25 ÷ 100) = 45 + 5 = 50%. Total SP = 15,000 × 150% = 22,500.

Q30. Answer: (a) 2,946

Shortcut Trick

Combined ratio X : Y : Z = 5 : 9 : 7.

Total units = 5 + 9 + 7 = 21 units.

21 units = Rs. 6,874.

Share of Y = (9 ÷ 21) × 6,874 = 2,946.

Therefore The correct answer is Rs. 2,946.

Alternate Method

Given:

Total amount = Rs. 6,874

Ratio X : Y = 5 : 9

Ratio Y : Z = 9 : 7

Calculations:

=> Since Y is common and its value is 9 in both ratios, the combined ratio X : Y : Z = 5 : 9 : 7.

=> Let the shares be 5k, 9k, and 7k.

=> 5k + 9k + 7k = 6,874

=> 21k = 6,874

=> k = 6,874 ÷ 21

=> k = 327.333...

=> Share of Y = 9 × k = 9 × (6,874 ÷ 21)

=> Share of Y = 3 × (6,874 ÷ 7)

=> Share of Y = 3 × 982 = 2,946

Therefore The correct answer is Rs. 2,946.

Additional Information

Combined Ratio

To combine A:B and B:C, make the common term B equal in both ratios by multiplying with suitable constants.

Proportional Division

If a quantity S is divided in the ratio a:b:c, the share of the second part is [b ÷ (a+b+c)] × S.

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Ratio Scaling

Multiplying or dividing all terms of a ratio by the same non-zero number does not change the ratio value.

Q31. Answer: (a) 60,000

Shortcut Trick

Savings percentage = 100% − 70% = 30%

Given, 30% of Income = Rs. 18,000

100% of Income = (18,000 ÷ 30) × 100

100% of Income = 600 × 100 = Rs. 60,000

Therefore The correct answer is Rs. 60,000.

Alternate Method

Given:

Expenditure = 70% of Income

Savings = Rs. 18,000

Formula Used:

Income = Expenditure + Savings

Calculations:

=> Let the total income be 'x'.

=> Savings percentage = 100% − 70% = 30%

=> (30 ÷ 100) × x = 18,000

=> 0.3x = 18,000

=> x = 18,000 ÷ 0.3

=> x = 1,80,000 ÷ 3

=> x = 60,000

Therefore The correct answer is Rs. 60,000.

Additional Information

Income, Expenditure, and Savings Relationship

The basic formula is Income = Expenditure + Savings. If any two are known as percentages or values, the third can be found.

Percentage Change in Income

New Income = Old Income × (100 + % Increase) ÷ 100. This is used in questions where income and expenditure both change.

Base Value Concept

In income-based problems, the total income is always treated as the 100% base for calculations unless specified otherwise.

Q32. Answer: (d) 53

Shortcut Trick

Identify the observation with the maximum frequency (most repetitions) in the dataset.

Number 53 appears 4 times in the list.

Numbers 48, 49, and 50 appear only 2 times each.

All other numbers (40, 41, 45, 46, 47, 51, 54, 55) appear only once.

The Mode is the observation that occurs most frequently.

Therefore The correct answer is 53.

Alternate Method

Given Data: 53, 47, 53, 48, 53, 53, 40, 41, 50, 50, 55, 48, 54, 49, 49, 51, 46, 45

Formula: Mode = Value with the highest frequency (f).

Let us count the frequency (repetition) of each unique number:

=> Frequency of 40 = 1

=> Frequency of 41, 45, 46, 47 = 1 each

=> Frequency of 48 = 2 (numbers at pos 4 and 12)

=> Frequency of 49 = 2 (numbers at pos 14 and 15)

=> Frequency of 50 = 2 (numbers at pos 9 and 10)

=> Frequency of 51, 54, 55 = 1 each

=> Frequency of 53 = 4 (numbers at pos 1, 3, 5, and 6)

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=> Since 53 has the maximum frequency of 4, it is the mode.
Therefore The correct answer is 53.
Additional Information
Empirical Relationship
For a moderately skewed distribution: Mode = 3 × Median − 2 × Mean.
Types of Mode
Data with one mode is Unimodal; two modes is Bimodal; more than two modes is Multimodal.
Mode for Grouped Data
Mode = L + [(f1 − f0) ÷ (2f1 − f0 − f2)] × h, where L is lower limit of modal class.

Q33. Answer: (b) 120 minutes

Shortcut Trick
When distance is constant, Speed is inversely proportional to Time.
Speed Ratio (Usual : New) = 6 : 5 → Time Ratio (Usual : New) = 5 : 6.
Difference in time units = 6 − 5 = 1 unit.
Given 1 unit = 24 minutes, then Usual Time = 5 × 24 = 120 minutes.
Therefore The correct answer is 120 min.
Alternate Method
Given: New speed = 5/6 of normal speed, Time delay = 24 minutes.
Formula: Distance = Speed × Time
=> Let usual speed be S and usual time be T.
=> New speed = 5S/6 and New time = T + 24.
=> S × T = (5S/6) × (T + 24)
=> T = 5/6 × (T + 24)
=> 6T = 5T + 120
=> T = 120 minutes.
Therefore The correct answer is 120 min.
Additional Information
Inverse Proportion of Speed and Time
If distance is constant, Speed1/Speed2 = Time2/Time1. This is the most efficient way to solve late/early arrival problems.
Average Speed
For a journey with two equal distances covered at speeds x and y, Average Speed = 2xy/(x + y).
Relative Speed
When two objects move in the same direction, relative speed = S1 − S2. In the opposite direction, relative speed = S1 + S2.

Q34. Answer: (d) Rs. 5,929

Shortcut Trick
Rate 10% = 1/10 → Principal : Amount ratio for 1 year = 10 : 11.
For 2 years, the ratio becomes $10^2 : 11^2 = 100 : 121$.
Given, 100 units = Rs. 4,900 => 1 unit = 49.
Amount (121 units) = 121 × 49 = Rs. 5,929.
Therefore The correct answer is Rs. 5,929.
Alternate Method
Given:
Principal (P) = Rs. 4,900
Rate (R) = 10% per annum
Time (n) = 2 years
Formula Used:
Amount (A) = $P(1 + R/100)^n$
Calculations:
=> $A = 4900 \times (1 + 10/100)^2$
=> $A = 4900 \times (1 + 0.1)^2$

=> A = 4900 × (1.1)²

=> A = 4900 × 1.21

=> A = Rs. 5,929

Therefore The correct answer is Rs. 5,929.

Additional Information

Effective Interest Rate

For a rate of R% for 2 years compounded annually, the effective rate is (2R + R²/100)%. Here, 10 + 10 + (100/100) = 21%.

CI vs SI Difference

The difference between Compound Interest and Simple Interest for 2 years is given by the formula D = P(R/100)².

Amount for n Compounding Periods

If interest is compounded half-yearly, the rate is halved (R/2) and the time is doubled (2n) in the standard formula.

Q35. Answer: (a) 47

Shortcut Trick

Apply the Empirical Formula: Mode = 3 × Median − 2 × Mean

Substitute values: 21 = 3 × Median − 2 × 60

3 × Median = 21 + 120 = 141

Median = 141 ÷ 3 = 47

Therefore The correct answer is 47.

Alternate Method

Given:

Mode = 21

Mean = 60

Formula Used:

In a moderately skewed distribution, the relationship is: Mode = 3(Median) − 2(Mean)

Calculations:

=> Mode = 3 × Median − 2 × Mean

=> 21 = 3 × Median − 2 × 60

=> 21 = 3 × Median − 120

=> 3 × Median = 21 + 120

=> 3 × Median = 141

=> Median = 141 ÷ 3

=> Median = 47

Therefore The correct answer is 47.

Additional Information

Empirical Formula

For a moderately skewed distribution, Mode ≈ 3 × Median − 2 × Mean. This is also written as (Mean − Mode) = 3 × (Mean − Median).

Symmetric Distribution

In a perfectly symmetrical distribution (like the Normal Distribution), the Mean, Median, and Mode are all equal (Mean = Median = Mode).

Skewness Types

If Mean > Median > Mode, the distribution is positively skewed. If Mode > Median > Mean, it is negatively skewed.

Q36. Answer: (d) 177

Shortcut Trick

Apply the standard algebraic identity: (P + Q)² = P² + Q² + 2PQ.

To find P² + Q², rearrange the formula: P² + Q² = (P + Q)² − 2PQ.

Substitute the given values: P² + Q² = 17² − 2 × 56.

P² + Q² = 289 − 112 = 177.

Therefore The correct answer is 177.

Alternate Method

Given:

Sum of numbers (P + Q) = 17
Product of numbers (PQ) = 56
Formula Used:
$(a + b)^2 = a^2 + b^2 + 2ab$
Calculations:
=> (P + Q) = 17
Squaring both sides:
=> $(P + Q)^2 = 17^2$
=> $P^2 + Q^2 + 2PQ = 289$
Substitute the value of PQ = 56:
=> $P^2 + Q^2 + 2 \times 56 = 289$
=> $P^2 + Q^2 + 112 = 289$
=> $P^2 + Q^2 = 289 - 112$
=> $P^2 + Q^2 = 177$
Therefore The correct answer is 177.
Additional Information
Difference of Squares and Identities
The square of the difference is $(a - b)^2 = a^2 + b^2 - 2ab$. This can be used to find $P^2 + Q^2$ if the difference and product are known.
Relation between Sum and Difference
The identities are linked by $(a + b)^2 - (a - b)^2 = 4ab$, which helps in finding the difference if the sum and product are given.
Sum of Squares Shortcut
For any two numbers, the sum of their squares is also equal to $[(a + b)^2 + (a - b)^2] \div 2$.

Q37. Answer: (b) 2

Shortcut Trick
Total work (LCM of 7 and 56) = 56 units.
Efficiency of P + Q = 56 ÷ 7 = 8 units/hr.
Efficiency of P = 56 ÷ 56 = 1 unit/hr.
Efficiency of Q = 8 − 1 = 7 units/hr.
Time for Q to fill 1/4th work = (56 × 1/4) ÷ 7 = 14 ÷ 7 = 2 hours.
Therefore The correct answer is 2 hours.
Alternate Method
Given: Time taken by (P + Q) = 7 hours, Time taken by P = 56 hours.
Formula Used: Efficiency = Total Work ÷ Time

Person	Days	Total Work	Efficiency
P + Q	7	56	8
P	56	1	

=> Efficiency of Q = Efficiency of (P + Q) − Efficiency of P
=> Efficiency of Q = 8 − 1 = 7 units/hr
=> One-fourth of the cistern capacity = 56 ÷ 4 = 14 units
=> Time taken by Q to fill 14 units = 14 ÷ 7 = 2 hours
Therefore The correct answer is 2 hours.
Additional Information
Pipes & Cisterns Efficiency
Filling pipes have positive efficiency, while outlet pipes (leaks) have negative efficiency. Total efficiency is the algebraic sum.
Work-Time Relationship
Time taken is inversely proportional to efficiency. If efficiency doubles, the time taken to complete the same work is halved.

Q38. Answer: (c) 1%

Shortcut Trick
Ratio of Savings to Expenditure = 100 : 250 = 2 : 5

Using Alligation/Weighted Average for Income change:

% Change in Income = [(Savings × % Change) + (Expenditure × % Change)] ÷ Total Ratio

% Change = [(2 × 21) + (5 × −7)] ÷ (2 + 5) = [42 − 35] ÷ 7 = 7 ÷ 7 = 1%

Therefore The correct answer is 1%.

Alternate Method

Given: Expenditure is 150% more than Savings.

Formula Used: Income = Expenditure + Savings

=> Let Savings = 100

=> Expenditure = 100 + 150% of 100 = 100 + 150 = 250

=> Initial Income = 100 + 250 = 350

=> New Savings = 100 + 21% of 100 = 121

=> New Expenditure = 250 − 7% of 250 = 250 − 17.5 = 232.5

=> New Income = 121 + 232.5 = 353.5

=> Increase in Income = 353.5 − 350 = 3.5

=> Percentage Increase = (3.5 ÷ 350) × 100 = 1%

Therefore The correct answer is 1%.

Additional Information

Income, Expenditure, and Savings Relationship

The fundamental equation is Income = Expenditure + Savings. Any percentage change in two components directly determines the change in the third.

Weighted Average Concept

If Income (I) is composed of Expenditure (E) and Savings (S), then %ΔI = (%ΔE × E + %ΔS × S) ÷ (E + S).

Percentage Change Shortcut

When values are defined as "x% more than", the multiplier is (1 + x/100). Here, 150% more means 2.5 times the base value.

Q39. Answer: (d) 49.83%

Shortcut Trick

Discount = Marked Price − Selling Price = 606 − 304 = 302.

Discount % = (Discount ÷ Marked Price) × 100.

Discount % = (302 ÷ 606) × 100.

Discount % = 30200 ÷ 606 ≈ 49.83%.

Therefore The correct answer is 49.83%.

Alternate Method

Given: Marked Price (MP) = Rs. 606, Selling Price (SP) = Rs. 304.

Formulas: Discount = MP − SP | Discount % = (Discount ÷ MP) × 100

=> Step 1: Calculate the total discount: 606 − 304 = 302.

=> Step 2: Calculate discount percentage: (302 ÷ 606) × 100.

=> Step 3: 30200 ÷ 606 = 49.8349...

=> Step 4: Rounding off to two decimal places, we get 49.83%.

Therefore The correct answer is 49.83%.

Additional Information

Marked Price & Discount

The Marked Price (MP) is the price printed on the label. Discount is always calculated on the MP unless stated otherwise.

Rounding Rules

When rounding to two decimal places, if the third decimal is 5 or greater, round up; otherwise, keep the second decimal as is.

Q40. Answer: (c) 7

Shortcut Trick

Convert all to base 0.2

$0.04 = (0.2)^2$, $0.008 = (0.2)^3$

$(0.04)^2 = (0.2)^4$

Expression = $(0.2)^4 \div (0.2)^3 \times (0.2)^6$

= (0.2)^((4−3+6)) = (0.2)^7
Therefore x = 7
Alternate Method
Given:
$(0.04)^2 \div (0.008) \times (0.2)^6 = (0.2)^x$
Concept Used:
Index laws: $a^m \div a^n = a^{(m-n)}$, $a^m \times a^n = a^{(m+n)}$
Calculation:
=> $0.04 = (0.2)^2$
=> $0.008 = (0.2)^3$
=> $(0.04)^2 = ((0.2)^2)^2 = (0.2)^4$
=> Expression = $(0.2)^4 \div (0.2)^3 \times (0.2)^6$
=> $= (0.2)^{(4-3)} \times (0.2)^6$
=> $= (0.2)^1 \times (0.2)^6$
=> $= (0.2)^7$
=> x = 7
Therefore The correct answer is 7.
Additional Information
Laws of Exponents
$a^m \times a^n = a^{(m+n)}$, $a^m \div a^n = a^{(m-n)}$
Power of Power
$(a^m)^n = a^{(mn)}$
Base Conversion
Convert decimals into powers of a common base for easy solving.
Quick Insight
Combining powers early simplifies expressions quickly.

Q41. Answer: (c) 20 days

Shortcut Trick
Total work (LCM of 15, 12, 5) = 60 units.
Efficiency of X = 4, Y = 5, and X + Y + F = 12.
Efficiency of F = 12 − (4 + 5) = 3 units/day.
Time taken by F = 60 ÷ 3 = 20 days.
Therefore The correct answer is 20 days.
Alternate Method
Given: Time taken by X = 15 days, Y = 12 days, and X + Y + F = 5 days.
Formula: Total Work = Days × Efficiency

Person	Days	Total Work	Efficiency
X	15	60	4
Y	12	5	
X + Y + F	5	12	

Calculations:
=> Total efficiency of X and Y = 4 + 5 = 9 units/day.
=> Efficiency of F alone = Combined efficiency − (X + Y efficiency)
=> Efficiency of F = 12 − 9 = 3 units/day.
=> Time taken by F to complete work alone = Total Work ÷ Efficiency of F
=> Time = 60 ÷ 3 = 20 days.
Therefore The correct answer is 20 days.
Additional Information
LCM Method for Time & Work

Total work is assumed as the Least Common Multiple (LCM) of the individual days to avoid working with complex fractions.

Work and Wages

Wages are distributed in the ratio of the efficiencies of the workers if they work for the same amount of time.

Combined Work Formula

If A and B work together, the time taken is $(T_A \times T_B) \div (T_A + T_B)$.

Q42. Answer: (b) 45 years and 15 years

Shortcut Trick

Check options for 3 : 1 ratio: All options satisfy this (42:14, 45:15, etc.).

Subtract 5 years from both and check for 4 : 1 ratio.

Option (2): (45 − 5) = 40 and (15 − 5) = 10.

Ratio 40 : 10 = 4 : 1. This matches the condition.

Therefore The correct answer is 45 years and 15 years.

Alternate Method

Given: Current Father : Son = 3 : 1. Five years ago, Father : Son = 4 : 1.

Formula: Ratio of ages at different time intervals.

Let the present age of the son be x and father be 3x.

=> 5 years ago: Father = 3x − 5, Son = x − 5

=> According to the question: (3x − 5) = 4 × (x − 5)

=> 3x − 5 = 4x − 20

=> 4x − 3x = 20 − 5

=> x = 15

=> Father's present age = 3 × 15 = 45 years

=> Son's present age = 15 years

Therefore The correct answer is 45 years and 15 years.

Additional Information

Age Ratio Difference Method

Make the difference between ratio parts equal for different time periods to find the value of 1 unit quickly.

Linear Equations in Ages

If 'n' years are added or subtracted, the difference between two people's ages always remains constant.

Q43. Answer: (b) 5

Shortcut Trick

Identify the common factor 5 in both terms.

Use the trigonometric identity: $\sec^2\theta - \tan^2\theta = 1$.

Expression = $5 \times (\sec^2\theta - \tan^2\theta) = 5 \times 1 = 5$.

Therefore The correct answer is 5.

Alternate Method

Given:

Expression: $5\sec^2\theta - 5\tan^2\theta$

Formula Used:

Fundamental Trigonometric Identity: $1 + \tan^2\theta = \sec^2\theta$

=> $\sec^2\theta - \tan^2\theta = 1$

Calculations:

=> $5\sec^2\theta - 5\tan^2\theta$

=> $5(\sec^2\theta - \tan^2\theta)$

=> $5 \times (1)$

=> 5

Therefore The correct answer is 5.

Additional Information

Trigonometric Identities

Standard identities: $\sin^2\theta + \cos^2\theta = 1$, $1 + \tan^2\theta = \sec^2\theta$, and $1 + \cot^2\theta = \text{cosec}^2\theta$.

Reciprocal Relations

$\sec\theta = 1/\cos\theta$ and $\tan\theta = \sin\theta/\cos\theta$, which also satisfy the identity when substituted.

Q44. Answer: (b) 4.5 π cm³

Shortcut Trick

For the largest sphere inside a cube, the diameter of the sphere is always equal to the edge of the cube.

Direct formula for Volume = $(1/6) \times \pi \times (\text{side})^3$

Volume = $(1/6) \times \pi \times 3^3 = (27/6)\ \pi = 4.5\ \pi\ \text{cm}^3$

Therefore The correct answer is $4.5\ \pi\ \text{cm}^3$.

Alternate Method

Given: Edge of the cube (a) = 3 cm

Formula Used: Volume of a sphere = $(4/3) \times \pi \times r^3$

=> Diameter of the largest sphere = Side of the cube = 3 cm

=> Radius (r) of the sphere = 3 ÷ 2 = 1.5 cm

=> Volume = $(4/3) \times \pi \times (1.5)^3$

=> Volume = $(4/3) \times \pi \times 3.375$

=> Volume = $4 \times \pi \times 1.125$

=> Volume = $4.5\ \pi\ \text{cm}^3$

Therefore The correct answer is $4.5\ \pi\ \text{cm}^3$.

Additional Information

Sphere Inscribed in a Cube

When a sphere is inscribed in a cube of side 'a', the radius r = a/2 and the Volume = $(\pi a^3)/6$.

Cube Inscribed in a Sphere

When a cube of side 'a' is inscribed in a sphere, the diameter of the sphere is equal to the body diagonal of the cube ($a\sqrt{3}$).

Surface Area of Sphere

The total surface area of a sphere with radius 'r' is given by the formula $4\pi r^2$.

Volume of a Cube

The volume of a cube with edge 'a' is a^3 and its total surface area is $6a^2$.

Q45. Answer: (c) 5 : 21

Shortcut Trick

Expenditure is the product of Price and Quantity.

Ratio of Price (Paddy : Jowar) = 1 : 3

Ratio of Quantity (Paddy : Jowar) = 5 : 7

Ratio of Expenditure = (1 × 5) : (3 × 7) = 5 : 21

Therefore The correct answer is 5 : 21.

Alternate Method

Given:

Price ratio of Paddy to Jowar = 1 : 3

Quantity ratio of Paddy to Jowar = 5 : 7

Formula Used:

Expenditure = Price × Quantity

Calculations:

=> Let price of Paddy = 1x and Jowar = 3x

=> Let quantity of Paddy = 5y and Jowar = 7y

=> Expenditure on Paddy = 1x × 5y = 5xy

=> Expenditure on Jowar = 3x × 7y = 21xy

=> Ratio of Expenditure = 5xy : 21xy

=> Ratio = 5 : 21

Therefore The correct answer is 5 : 21.

Additional Information

Compound Ratio

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When two or more ratios are multiplied together (antecedent with antecedent and consequent with consequent), it is called a compound ratio.

Price-Consumption Relation

If expenditure is constant, Price is inversely proportional to Quantity (Consumption). P1/P2 = Q2/Q1.

Proportion Rule

If a : b = c : d, then product of extremes (a × d) equals product of means (b × c).

Q46. Answer: (d) 1,05,000

Shortcut Trick

Income ratio (Vipul : Vijay) = 5 : 8 | Expenditure ratio = 1 : 4.

Difference in income units = 8 − 5 = 3 | Difference in expenditure units = 4 − 1 = 3.

Since savings are equal and the difference between units is same, we map income to expenditure.

Saving units for Vipul = 5 − 1 = 4 units | Saving units for Vijay = 8 − 4 = 4 units.

4 units = Rs. 84,000 → 1 unit = Rs. 21,000.

Vipul's income = 5 units = 5 × Rs. 21,000 = Rs. 1,05,000.

Therefore The correct answer is Rs. 1,05,000.

Alternate Method

Given:

Income ratio = 5 : 8 | Expenditure ratio = 1 : 4 | Savings = Rs. 84,000 each.

Formula Used:

Income − Savings = Expenditure

Calculations:

=> (5x − 84000) / (8x − 84000) = 1 / 4

=> 4 × (5x − 84000) = 1 × (8x − 84000)

=> 20x − 3,36,000 = 8x − 84,000

=> 20x − 8x = 3,36,000 − 84,000

=> 12x = 2,52,000

=> x = 21,000

=> Vipul's Income = 5x = 5 × 21,000 = 1,05,000

Therefore The correct answer is Rs. 1,05,000.

Additional Information

Income-Expenditure Relation

Income = Expenditure + Savings. This is the fundamental equation for all personal finance problems in quantitative aptitude.

Ratio Balancing Method

If the difference between two ratios (Income and Expenditure) is to be equated to a constant saving, ensure the difference between the terms of each ratio is the same by multiplying with suitable factors.

Cross Multiplication Method

For unequal savings, use: (I1 × E2 − I2 × E1) units = (S1 × E2 − S2 × E1) to find the value of one unit directly.

Q47. Answer: (c) 126

Shortcut Trick

Find the difference between the two numbers: 378 − 252 = 126.

The HCF must be a factor of this difference.

Check if 126 divides both numbers: 252 ÷ 126 = 2 and 378 ÷ 126 = 3.

Since 126 divides both, it is the Highest Common Factor.

Therefore The correct answer is 126.

Alternate Method

Given: Numbers are 252 and 378.

Formula Used: Prime Factorization Method

=> Prime factorization of 252 = 2 × 2 × 3 × 3 × 7 = $2^2 \times 3^2 \times 7$

=> Prime factorization of 378 = 2 × 3 × 3 × 3 × 7 = $2 \times 3^3 \times 7$

=> Common factors with lowest powers = $2^1 \times 3^2 \times 7^1$

=> HCF = 2 × 9 × 7 = 126

Therefore The correct answer is 126.

Additional Information

HCF vs LCM Relation

For any two numbers a and b, the product of the numbers is equal to the product of their HCF and LCM: a × b = HCF(a, b) × LCM(a, b).

Euclidean Algorithm

HCF can be found by repeated division: HCF(a, b) = HCF(b, a mod b). Continue until the remainder is zero; the last non-zero divisor is the HCF.

HCF of Fractions

To find the HCF of fractions, use the formula: HCF = (HCF of Numerators) ÷ (LCM of Denominators).

Q48. Answer: (a) 51.34%

Shortcut Trick

Net percentage of successive discounts can be calculated using the formula: a + b − (a × b) ÷ 100.

First two discounts (23% and 11%): 23 + 11 − (23 × 11) ÷ 100 = 34 − 2.53 = 31.47%.

Combining 31.47% with the third discount (29%): 31.47 + 29 − (31.47 × 29) ÷ 100.

Sum: 60.47 − (912.63 ÷ 100) = 60.47 − 9.1263 = 51.3437%.

Therefore The correct answer is 51.34%.

Alternate Method

Given: Three successive discounts: d1 = 23%, d2 = 11%, d3 = 29%.

Formulas: Equivalent Discount % = [1 − (1 − d1/100) × (1 − d2/100) × (1 − d3/100)] × 100

=> Let the Marked Price (MP) be 100.

=> Price after 1^(st) discount = 100 × (77 ÷ 100) = 77.

=> Price after 2^(nd) discount = 77 × (89 ÷ 100) = 68.53.

=> Price after 3^(rd) discount (Selling Price) = 68.53 × (71 ÷ 100) = 48.6563.

=> Total Discount = MP − SP = 100 − 48.6563 = 51.3437.

=> Discount % = (51.3437 ÷ 100) × 100 = 51.3437%.

Therefore The correct answer is 51.34%.

Additional Information

Successive Discounts

When multiple discounts are applied one after another, the base for the subsequent discount is the value obtained after the previous discount.

Effective Discount for Multiple Values

The order of applying successive discounts does not change the final effective discount percentage.

Q49. Answer: (d) 45 years

Shortcut Trick

Ratio of Ramesh : Mahesh at present = 3 : 1 (Difference = 2 units)

Ratio 5 years ago = 4 : 1 (Difference = 3 units)

To equate the age gap, multiply the present ratio by 3 and the past ratio by 2:

New Present Ratio = 9 : 3 | New Past Ratio = 8 : 2

Difference (9 − 8) = 1 unit → 5 years. Therefore, Ramesh's present age (9 units) = 9 × 5 = 45 years.

Therefore The correct answer is 45 years.

Alternate Method

Given: Present age of Ramesh is 3 times Mahesh. 5 years ago, the ratio was 4 : 1.

Let Mahesh's present age = x years.

=> Ramesh's present age = 3x years.

According to the question (5 years ago):

=> (3x − 5) / (x − 5) = 4 / 1

=> 3x − 5 = 4(x − 5)

=> 3x − 5 = 4x − 20

=> 4x − 3x = 20 − 5

=> x = 15 years.

=> Ramesh's present age = 3 × 15 = 45 years.

Therefore The correct answer is 45 years.

Additional Information

Age Difference Property

The difference between the ages of two people remains constant at any point in time.

Ratio Balancing

To solve age problems quickly, ensure the numerical difference between the ratio terms is the same by multiplying with a suitable factor.

Variable Assumption

Always try to assume the present age as the variable to simplify the final calculation for the required answer.

Q50. Answer: (d) 323

Shortcut Trick

For any twin prime numbers, let the middle even number be x.

The sum of the twin primes is 2x = 36 => x = 18.

The twin primes are (x − 1) and (x + 1), which are 17 and 19.

Product = $x^2 - 1 = 18^2 - 1 = 324 - 1 = 323$.

Therefore The correct answer is 323.

Alternate Method

Given: Sum of twin prime numbers = 36.

Definition: Twin primes are prime numbers that have a difference of 2.

Let the two twin prime numbers be p and (p + 2).

=> p + (p + 2) = 36

=> 2p + 2 = 36

=> 2p = 34

=> p = 17

=> The second prime number = p + 2 = 17 + 2 = 19.

=> Product = 17 × 19

=> Product = 323.

Therefore The correct answer is 323.

Additional Information

Twin Prime Numbers

Pairs of prime numbers that differ by exactly 2 (e.g., 3 and 5, 5 and 7, 11 and 13).

Prime Number Property

Except for (3, 5), the number between twin primes is always divisible by 6.

Co-prime Numbers

Two numbers whose HCF is 1. All twin primes are also co-prime.

Q51. Answer: (d) 2

Given: Eight people A, B, C, D, E, F, G and H are sitting around a circular table facing towards the centre.

Exactly three people sit between D and C.

Exactly three people sit between F and H.

A sits second to the right of D.

E sits to the immediate right of A.

D is an immediate neighbour of both H and G.

B sits to the immediate left of G.

So, two people sit between B and H when counted from the left of H.

Hence, the correct answer is "Option 4".

Q52. Answer: (b) 99

The logic followed here is:

thus, "99" will replace the question mark in the given series.

Hence, the correct option is "Option 2".

Q53. Answer: (a) FA

Given: Six people A, B, C, D, E and F are sitting in a row facing north.
A sits to the immediate right of E.
F sits fourth to the left of E.
Only one person sits between B and E.
C sits to the immediate left of B.
D sits second to the left of A.
Now, checking the options:
Option 1) FA → F and A are four places apart
Option 2) BD → B and D are immediate neighbours
Option 3) DE → D and E are immediate neighbours
Option 4) CB → C and B are immediate neighbours
Hence, the correct answer is "Option 1".

Q54. Answer: (d) (156, 78, 39)

The logic followed here is:
Logic: Second number = (First number) ÷ 2 and Third number = (Second number) ÷ 2
32, 16, 8
=> 32 ÷ 2 = 16
=> 16 ÷ 2 = 8
48, 24, 12
=> 48 ÷ 2 = 24
=> 24 ÷ 2 = 12
Now, checking the options:
Option 1) (196, 98, 46)
=> 196 ÷ 2 = 98
=> 98 ÷ 2 = 49 (not 46)
Option 2) (188, 124, 48)
=> 188 ÷ 2 = 94 (not 124)
Option 3) (128, 64, 42)
=> 128 ÷ 2 = 64
=> 64 ÷ 2 = 32 (not 42)
Option 4) (156, 78, 39)
=> 156 ÷ 2 = 78
=> 78 ÷ 2 = 39
Hence, the correct answer is Option 4.

Q55. Answer: (d) 32

The logic followed here is:
thus, "32" will replace the question mark in the given series.
Hence, the correct option is "Option 4"

Q56. Answer: (a) 119

BODMAS Table:
Given equation: 76 × 4 − (80 ÷ 10) × 4 + 50 ÷ 2 = ?
Now, interchanging Signs '+' and '−', and Signs '×' and '÷', then:
=> 76 ÷ 4 + (80 × 10) ÷ 4 − 50 × 2
=> 76 ÷ 4 + 800 ÷ 4 − 50 × 2
=> 19 + 200 − 100
=> 219 − 100
=> 119
Hence, the correct answer is Option 1.

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Q57. Answer: (d) hm

The logic followed here is to compare the given sentences to identify the common word and its corresponding common code.

Given:

obey the lights → ro hm jw

lights flash red → ld yc hm

So, lights → hm

Hence, the correct answer is Option 4.

Q58. Answer: (c) 2

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

Now,

Odd numbers which are immediately preceded by an even number and also immediately followed by an even number.

So, needed pattern is: Even - Odd - Even

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

So, total valid odd numbers = 2

Hence, the correct answer is Option 3.

Q59. Answer: (d) Two

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

Now,

Odd digits which are immediately preceded by an odd digit and also immediately followed by an even digit.

So, needed pattern is: Odd - Odd - Even

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

So, total valid odd digits = 2

Hence, the correct answer is Option 4.

Q60. Answer: (c) EGD−BDA

The logic followed here is:

For, DFC → ACZ

For, UWT → RTQ

Now, checking the options:

Option 1) EFB → ACZ

Option 2) EGD → ADZ

Option 3) EGD → BDA

Option 4) EFB → BDA

Hence, the correct answer is Option 3.

Q61. Answer: (b) 3

Given: (Left) 3 2 2 5 8 4 9 4 8 (Right)

Now,

Even numbers which are immediately preceded by an odd number and also immediately followed by an even number.

So, needed pattern is: Odd - Even - Even

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

So, total valid even numbers = 3

Hence, the correct answer is Option 2.

Q62. Answer: (d) More than three

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

Now,

We need to find odd numbers which are immediately preceded by a perfect square (1, 4, or 9) and immediately followed by an even number (2, 4, 6, or 8).

So, needed pattern is: Perfect Square - Odd Number - Even Number

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

So, total valid odd numbers = 4

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Hence, the correct answer is Option 4.

Q63. Answer: (b) ILMR

The logic followed here is based on the alphabetical position pattern:

Option 1: GJLP

Option 2: ILMR

Option 3: TWYC

Option 4: HKMQ

Thus, Options 1, 3, and 4 follow a consistent "+3, +2, +4" cyclic pattern, while Option 2 deviates from this rule.

Hence, the odd one out is Option 2.

Q64. Answer: (a) 113

BODMAS Table:

Given equation: 80 A 4 C 15 B 6 D 9 B 3 C (18 A 6) B 10 = ?

Now, replacing the letters according to the given mapping: A = ÷, B = ×, C = +, D = −

=> 80 ÷ 4 + 15 × 6 − 9 × 3 + (18 ÷ 6) × 10

=> 20 + 15 × 6 − 9 × 3 + 3 × 10

=> 20 + 90 − 27 + 30

=> 110 − 27 + 30

=> 140 − 27

=> 113

Hence, the correct answer is Option 1.

Q65. Answer: (b) 52

Given:

The total number of students in a class or row can be found by adding the rank of a person from the top (or one end) and the rank of the same person from the bottom (or the other end), and then subtracting 1 from the sum.

Formula:Total number of students = (Rank from Top + Rank from Bottom) - 1

Calculation for John:

Rank from Top + Rank from Bottom = 33 + 20 = 53

Total students = 53 - 1 = 52

So, the total number of students in the class is 52.

Hence, the correct answer is Option 2.

Q66. Answer: (a) North-west

The logic followed here is:

Given:

Shop A is to the north of Shop B

Shop F is to the east of Shop A

Shop E is to the west of Shop F

Shop A is to the east of Shop E

Shop D is to the north of Shop E

So, Shop D lies to the North-West of Shop B.

Hence, the correct answer is Option 1.

Q67. Answer: (b) 8

The logic followed here is to compare the given words to identify the common letters and their corresponding common codes.

Given:

TOUR → 4139

BRUT → 4318

So, B → 8

Hence, the correct answer is Option 2.

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Q68. Answer: (a) 3 km to the north

The logic followed here is:

Given:

Aarav starts from Point A and drives 13 km East

He takes a left turn → 8 km North

He takes a left turn → 15 km West

He takes a left turn → 11 km South

He takes a final left turn → 2 km East

So, To reach Point A again, he must travel 3 km North.

Hence, the correct answer is Option 1.

Q69. Answer: (c) 9015

The logic followed here is:

thus, "9015" will replace the question mark in the given series.

Hence, the correct option is "Option 3".

Q70. Answer: (d) Only conclusion (II) is true

Given Statements:

All Reds are Blues.

All Blues are Greens.

Some Greens are Yellows.

The least possible Venn diagram for the given statement is:

Conclusions:

I. All Blues are Yellows - Does not follow (Because only “Some Greens are Yellows” is given, so all Blues being Yellows is not definite).

II. Some Greens are Reds - Follows (Since all Reds are Blues and all Blues are Greens, all Reds are Greens. Therefore, some Greens are Reds).

So, only conclusion II follows.

Hence, the correct answer is Option 4.

Q71. Answer: (c) Alex

Given: Six friends — John, Alex, Priyanka, Sameer, Rohit and Neil are sitting around a circular table facing the centre.

John is an immediate neighbour of both Alex and Priyanka.

Sameer is sitting second to the left of Priyanka.

Neil is sitting to the immediate left of Sameer.

So, Alex is sitting to the immediate left of Neil.

Hence, the correct answer is "Option 3".

Q72. Answer: (d) SVWZ

The logic followed here is:

For, PSOK → VYUQ

For, EILJ → KORP

Now, applying the same logic for MPQT

So, MPQT → SVWZ

Hence, the correct answer is "Option 4".

Q73. Answer: (c) KOW

The logic followed here is:

So, the missing term = KOW

Hence, the correct answer is Option 3.

Q74. Answer: (d) Brother’s wife

Family Chart:

Decoding the Symbols:

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Symbol	•	–	×	%	#
Meaning	Mother	Brother	Wife	Father	Daughter

Given: R − E % C # Q + V

It means: R is the brother of E, E is the father of C, C is the daughter of Q, and Q is the mother of V.

Thus, Q is related to R as brother's wife.

Hence, the correct answer is Option 4.

Q75. Answer: (d) IK - HJ

The logic followed here is based on the alphabetical position pattern:

Option 1: DF → BH

Option 2: MO → KQ

Option 3: RT → PV

Option 4: IK → HJ

Thus, Options 1, 2, and 3 follow a consistent "-2, +2" shift pattern, while Option 4 follows a different "-1, -1" pattern.

Hence, the odd one out is Option 4.

Q76. Answer: (b) Only conclusion (I) follows

Given Statements:

All cakes are hearts.

Some seats are hearts.

No bats are hearts.

The least possible Venn diagram for the given statement is:

Conclusions:

I. Some seats are not bats - Follows (Since some seats are hearts and no hearts are bats, those seats which are hearts cannot be bats).

II. No cakes are seats - Does not follow (No direct relation is given between cakes and seats. They may or may not overlap within hearts).

So, only conclusion I follows.

Hence, the correct answer is Option 2.

Q77. Answer: (d) NPR 0

The logic followed here is:

So, the missing term = NPR 0

Hence, the correct answer is Option 4.

Q78. Answer: (d) 22

BODMAS Table:

Given equation: 17 P 3 S (16 Q 4) P 2 R 13 P 4 S 15 = ?

Now, replacing the letters according to the given mapping: P = ×, Q = ÷, R = −, S = +

=> 17 × 3 + (16 ÷ 4) × 2 − 13 × 4 + 15

=> 17 × 3 + 4 × 2 − 13 × 4 + 15

=> 51 + 8 − 52 + 15

=> 74 − 52

=> 22

Hence, the correct answer is Option 4.

Q79. Answer: (a) B

Given: Seven boxes T, D, E, S, B, W and P are kept one over the other but not necessarily in the same order.

No box is kept above P.

Only three boxes are kept between P and B.

S is kept immediately above B.

Only one box is kept between D and S.

Only four boxes are kept between D and T.

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E is kept above W.

Position	Box
7	P
6	D
5	E
4	S
3	B
2	W
1	T

Now, Boxes below E (Position 5): S (1st), B (2nd)

So, second box below E = B

Hence, the correct answer is Option 1.

Q80. Answer: (b) ABXB

The logic followed here is:

For, STPT → RSOS

For, RSOS → QRNR

Now, applying the same logic for BCYC

So, BCYC → ABXB

Hence, the correct answer is "Option 2".

Q81. Answer: (d) Rs. 3,000 crore

The correct answer is Rs. 3,000 crore.

Key Points

• The Central Bureau of Investigation (CBI) initiated a high-profile investigation in August 2025 following a formal complaint lodged by the State Bank of India (SBI).

• The complaint alleged a significant monetary loss to the tune of approximately Rs. 3,000 crore involving credit facilities extended to the telecom major. Hence, option 4 is correct.

• The primary entities named in the investigation are Anil Ambani and his flagship telecom firm, Reliance Communications Ltd (RCom).

• The probe was triggered after internal audits and forensic reports suggested potential irregularities in the utilization of funds sanctioned by the State Bank of India and other consortium members.

• The investigation focuses on alleged diversion of funds, criminal conspiracy, and cheating, which resulted in the account being classified as a non-performing asset and subsequently a fraudulent account.

Additional Information

• Reliance Communications (RCom):

• Once a dominant force in the Indian telecommunications industry, Reliance Communications faced a massive debt crisis due to intense competition and high spectrum costs.

• The company officially entered the Insolvency and Bankruptcy Code (IBC) process in 2019 to resolve its mounting liabilities, which exceeded Rs. 46,000 crore at that time.

• Role of the CBI in Bank Frauds:

• The Central Bureau of Investigation (CBI) is the premier investigating agency of India that handles cases of corruption and economic offenses of national and international importance.

• Its Banking Fraud Evolution Cell specifically targets high-value bank defaults and white-collar crimes that threaten the financial stability of Public Sector Banks (PSBs).

• State Bank of India (SBI):

• As the largest public sector bank in India, SBI often acts as the lead bank in large corporate loan consortiums.

• Under Reserve Bank of India (RBI) guidelines, banks are mandated to report accounts as fraud to the CBI if they find evidence of willful default or misappropriation of sanctioned loans.

• Legal Framework for Financial Crimes:

• Cases involving large-scale banking fraud are typically registered under Section 420 (Cheating) and Section 120-B (Criminal

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Conspiracy) of the Indian Penal Code (IPC), often alongside provisions of the Prevention of Corruption Act.

• The Enforcement Directorate (ED) may also join such probes to investigate money laundering aspects under the PMLA (Prevention of Money Laundering Act).

Important Points

• Timeline: The specific complaint and subsequent action by the CBI in this context were recorded in August 2025.

• Impact: Investigations into figures like Anil Ambani highlight the rigorous scrutiny of Non-Performing Assets (NPAs) in the Indian banking system, which have historically weighed down the economy.

• Numerical Value: The figure of Rs. 3,000 crore represents the approximate principal loss alleged by SBI in this specific instance of the investigation.

Q82. Answer: (c) A high-level mechanism to deepen bilateral cooperation across strategic, economic, technological, and peopl...

The correct answer is A high-level mechanism to deepen bilateral cooperation across strategic, economic, technological, and people-to-people sectors.

Key Points

• The India-Singapore Ministerial Roundtable (ISMR) is a distinctive high-level leadership mechanism designed to pave a new path for the Strategic Partnership between the two nations.

• The inaugural meeting of the ISMR was held in September 2022 in New Delhi, marking a significant shift toward a more integrated and future-oriented bilateral engagement.

• It brings together senior ministers from both countries, including the Ministers of External Affairs, Finance, and Commerce, to deliberate on cross-cutting issues that affect strategic, economic, and technological domains.

• The primary objective of the ISMR is to identify and capitalize on new opportunities in emerging sectors, ensuring that the bilateral relationship evolves in line with global shifts in technology and sustainability.

• During the second ISMR held in Singapore in August 2024, both countries reaffirmed their commitment to deepening cooperation and decided to elevate the relationship to a Comprehensive Strategic Partnership.

Additional Information

• Six Pillars of Cooperation: The ISMR framework is structured around six key pillars: Digitalization, Skill Development, Sustainability, Healthcare, Advanced Manufacturing, and Connectivity.

• Economic Significance: Singapore has consistently been one of the largest sources of Foreign Direct Investment (FDI) into India, and the ISMR helps streamline trade and investment flows by resolving regulatory bottlenecks.

• Digital Connectivity: A major achievement discussed within this framework is the real-time payment systems linkage between India’s UPI and Singapore’s PayNow, which was launched in February 2023 to facilitate faster and cheaper cross-border remittances.

• Green Energy and Sustainability: Both nations are collaborating closely on Green Hydrogen and Green Ammonia initiatives to meet their respective Net Zero targets, emphasizing the sustainability pillar of the roundtable.

• Semiconductor Ecosystem: In the 2024 meeting, a specific emphasis was placed on building a resilient semiconductor supply chain, with Singapore offering its expertise in advanced manufacturing to support India's Semicon India mission.

Important Points

• Leadership Participation: The 2nd ISMR saw participation from Indian ministers Dr. S. Jaishankar (External Affairs), Nirmala Sitharaman (Finance), Piyush Goyal (Commerce and Industry), and Ashwini Vaishnaw (Electronics and IT).

• Strategic Alignment: The framework aligns with India’s Act East Policy, positioning Singapore as a crucial gateway for India’s engagement with the ASEAN region.

• Human Capital: The Skill Development pillar focuses on the mutual recognition of qualifications and the skilling of the Indian workforce to meet the demands of Singapore’s high-tech industries.

• IMEC Corridor: Discussions often include broader regional connectivity, such as the India-Middle East-Europe Economic Corridor (IMEC), where Singapore can play a role as a global logistics hub.

Q83. Answer: (a) Desert National Park

The correct answer is Desert National Park.

Key Points

• The 24-hour wildlife census using the waterhole method was conducted in June 2025 at the Desert National Park (DNP), which spans across the Jaisalmer and Barmer districts of Rajasthan.

• During this census, a significant sighting of 73 Great Indian Bustards (GIBs) was recorded, providing vital data for the conservation of this Critically Endangered species.

• The waterhole method is a traditional counting technique where volunteers and forest officials stay stationed at specific water points for a full day and night, usually during the peak summer months when animals are most likely to visit water sources.

• The Desert National Park is the primary natural habitat and the last stronghold for the Great Indian Bustard in the world, making such surveys crucial for monitoring their population trends.

• The census in 2025 aimed to assess the impact of ongoing conservation efforts, including the predator-proof fencing and captive breeding programs established in the region. Hence, the correct answer is Desert National Park.

Additional Information

• Desert National Park (DNP):

• Located in the Thar Desert, it covers an area of approximately 3162 sq km, making it one of the largest national parks in India.

• It was declared a National Park in 1981 to protect the fragile ecosystem of the desert and its unique wildlife like the Chinkara, Desert Fox, and Blackbuck.

• The park features a unique landscape of sand dunes, jagged rocks, and dense salt lake bottoms, providing a perfect camouflage for the Great Indian Bustard.

• Great Indian Bustard (Ardeotis nigriceps):

• It is the State Bird of Rajasthan, locally known as Godawan.

• The bird is listed under Schedule I of the Wildlife Protection Act, 1972, granting it the highest level of legal protection in India.

• On the IUCN Red List, it is categorized as Critically Endangered due to its small, declining population, primarily threatened by overhead power lines, habitat loss, and stray dogs.

• The Ministry of Environment, Forest and Climate Change launched Project Great Indian Bustard to facilitate the recovery of the species through in-situ and ex-situ conservation.

• Other Options in Context:

• Ranthambore National Park: Situated in Sawai Madhopur, Rajasthan, it is famous for its Royal Bengal Tiger population rather than bustards.

• Bandhavgarh National Park: Located in Madhya Pradesh, it is known for having one of the highest densities of tigers in India.

• Kanha National Park: Also in Madhya Pradesh, it is renowned for the Barasingha (Swamp Deer) and its role in tiger conservation.

Important Points

• Waterhole Census Technique: This method relies on the physiological need of animals to drink water during extreme heat. In Rajasthan, this is often conducted on Buddha Purnima (full moon night) to ensure maximum visibility for observers sitting in "machans" near the waterholes.

• Conservation Milestones: A successful conservation breeding center has been established at Sam, Jaisalmer, where GIB eggs are collected from the wild, hatched in incubators, and the chicks are reared to bolster the wild population.

• Geographical Significance: The Great Indian Bustard is a flagship species for the grassland ecosystem. Its presence indicates the health of the dry grasslands, which are often overlooked compared to forested ecosystems.

Q84. Answer: (b) Ministry of Youth Affairs and Sports

The correct answer is Ministry of Youth Affairs and Sports.

Key Points

• The Ministry of Youth Affairs and Sports (MYAS) is the primary government body responsible for formulating and implementing policies related to sports and youth development in India.

• In 2023, the ministry announced a significant revision in the financial assistance provided under the Scheme of Assistance to National Sports Federations (NSFs).

• Under the revised guidelines, the grant for organizing National Championships for High-Priority sports disciplines was increased from Rs. 22 lakh to Rs. 44 lakh. Hence, the Ministry of Youth Affairs and Sports is the correct answer.

• This increase applies to Senior, Junior, and Sub-Junior categories, aiming to improve the quality of competition, infrastructure, and technical conduct of the tournaments.

• The High-Priority category includes sports where India has high medal-winning potential in international events like the Olympics, Asian Games, and Commonwealth Games.

Additional Information

• Scheme of Assistance to National Sports Federations (NSFs):

• This is the flagship scheme of the Ministry of Youth Affairs and Sports through which funds are channeled for training, international exposure, and equipment.

• It supports the National Coaching Camps, appointment of Foreign Coaches, and participation in International Competitions.

• The categorization of sports into High Priority, Priority, and General determines the level of financial support provided.

• Categorization of Sports:

• High Priority: Disciplines like Athletics, Archery, Badminton, Boxing, Shooting, and Wrestling.

• Priority: Sports that are included in the Olympic Games but where India is currently working towards global standards.

• General: Sports that are not included in the Olympics or Asian Games but have a significant following or regional importance.

• Key Initiatives of the Ministry:

• Khelo India Programme: Launched in 2018 to revive the sports culture in India at the grassroots level by building a strong framework for all sports played in the country.

• Target Olympic Podium Scheme (TOPS): A specialized program to provide personalized support to India's elite athletes to improve their performance at the Olympic Games.

• National Sports Development Fund (NSDF): Established in 1998 to mobilize resources from non-government sources for the promotion of sports.

Important Points

• Ministry of Youth Affairs and Sports: It was initially set up as the Department of Sports just before the 9th Asian Games in 1982 in New Delhi. It became a full-fledged Ministry in the year 2000.

• Role of SAI: The Sports Authority of India (SAI), an autonomous body under the Ministry, manages the field-level implementation of various schemes and maintains sports infrastructure like the Jawaharlal Nehru Stadium and Indira Gandhi Arena.

• National Sports Policy: The current framework is guided by the National Sports Policy 2001, which focuses on "Broadening of Sports" and "Achieving Excellence in Sports" at the national and international levels.

• Financial Budget: For the financial year 2024-25, the budget allocation for the Ministry of Youth Affairs and Sports was increased to over Rs. 3,400 crore, reflecting the government's commitment to the "Viksit Bharat" vision through sports.

Q85. Answer: (c) Union Territories without legislatures

The correct answer is Union Territories without legislatures.

Key Points

• The Constitution (131st Amendment) Bill 2025 is a proposed legislative measure aimed at amending Article 240 of the Indian Constitution to include the Union Territory of Chandigarh.

• Article 240 specifically grants the President of India the power to make regulations for the peace, progress, and good government of certain Union Territories that do not have their own legislative assemblies.

• Currently, Chandigarh is a Union Territory without a legislature, meaning it does not have a Legislative Assembly or a Chief Minister. It is administered by an Administrator (often the Governor of Punjab) appointed by the President.

• By including Chandigarh under Article 240, the Union Government seeks to streamline the governance and legislative process for the territory, aligning it with the administrative framework used for other non-legislative regions like Ladakh and Lakshadweep. Hence, the statement regarding its alignment with Union Territories without legislatures is correct.

• This amendment is significant because it allows the President to enact laws for Chandigarh through regulations, which have the same legal force as an Act of Parliament.

Additional Information

• Article 240 of the Constitution:

• This article empowers the President to make regulations for Andaman and Nicobar Islands, Lakshadweep, Dadra and Nagar Haveli and Daman and Diu, and Ladakh.

• Any regulation so made may repeal or amend any Act made by Parliament which is for the time being applicable to the Union Territory.

• The inclusion of Chandigarh in this list via the 131st Amendment Bill 2025 represents a shift in the administrative control mechanism for the city.

• Categories of Union Territories in India:

• UTs with Legislatures: These include Delhi (National Capital Territory), Puducherry, and Jammu and Kashmir. They have their own Legislative Assemblies and a Council of Ministers to handle local governance.

• UTs without Legislatures: These include Chandigarh, Ladakh, Lakshadweep, Andaman and Nicobar Islands, and Dadra and Nagar Haveli and Daman and Diu. These are governed directly by the Union Government through an Administrator or Lieutenant Governor.

• Historical Context of Chandigarh:

• Chandigarh was established as a Union Territory on November 1, 1966, following the Punjab Reorganisation Act, 1966.

• It serves as the joint capital for both Punjab and Haryana, but remains under the direct jurisdiction of the Central Government.

Important Points

• Article 239: States that every Union Territory shall be administered by the President acting, to such extent as he thinks fit, through an administrator to be appointed by him with such designation as he may specify.

• The President's power to make regulations under Article 240 is a plenary power, meaning it is as wide as the power of Parliament to make laws for these territories under Article 246.

• The Constitution (131st Amendment) Bill 2025 is part of a broader effort to update the constitutional framework to reflect current administrative requirements in Chandigarh, specifically regarding the ease of implementing central policies and local regulations

without the delays of parliamentary scheduling.

• The Ministry of Home Affairs (MHA) is the nodal ministry for all matters of Union Territories relating to legislation, finance and budget, and appointment of Administrators.

Q86. Answer: (c) Nagpur Bench of the Bombay High Court

The correct answer is Nagpur Bench of the Bombay High Court.

Key Points

• The Supreme Court of India, in a landmark judgment delivered in October 2025, expanded the legal horizon of environmental protection by ruling that the Public Trust Doctrine applies equally to artificial lakes and man-made water bodies.

• This specific ruling affirmed a previous directive issued by the Nagpur Bench of the Bombay High Court, which had emphasized that the state acts as a trustee for all water resources regardless of their origin. Hence, the correct answer is Nagpur Bench of the Bombay High Court.

• The court observed that the ecological significance of a water body does not depend on whether it was formed naturally or constructed by human intervention, as both serve vital environmental functions like groundwater recharge and climate regulation.

• The Public Trust Doctrine mandates that the state holds certain resources in trust for the general public and cannot permit their conversion for private ownership or commercial exploitation that harms the public interest.

• This judgment reinforces the interpretation of Article 21 of the Constitution of India, which encompasses the right to a wholesome environment as part of the Right to Life.

Additional Information

• The Public Trust Doctrine:

• Originating from Roman Law, it was first integrated into Indian law by the Supreme Court in the case of M.C. Mehta v. Kamal Nath (1997).

• It establishes that resources like air, sea, waters, and forests have such a great importance to the people as a whole that it would be wholly unjustified to make them a subject of private ownership.

• Constitutional Framework:

• Article 48A: This Directive Principle of State Policy directs the State to protect and improve the environment and safeguard forests and wildlife.

• Article 51A(g): It is a Fundamental Duty of every citizen to protect and improve the natural environment, including lakes, rivers, and wildlife.

• Bombay High Court:

• Established on August 14, 1862, it is one of the oldest and most prestigious High Courts in India.

• It has jurisdiction over the states of Maharashtra and Goa, and the Union Territory of Dadra and Nagar Haveli and Daman and Diu.

• The Nagpur Bench is one of its permanent benches, along with Aurangabad and Panaji.

• Significance of Artificial Lakes:

• In many urban areas, artificial lakes are the primary sources of micro-climate maintenance and biodiversity hubs.

• Protecting them under the Public Trust Doctrine prevents land mafias and developers from reclaiming lake beds for real estate projects.

Important Points

• The ruling is expected to impact various smart city projects and urban development plans across India where man-made reservoirs were previously considered exempt from strict environmental non-alienation rules.

• The October 2025 verdict clarifies that once a territory is designated as a water body in revenue records, its status cannot be changed easily, even if it is currently dry or was originally man-made.

• This legal precedent provides a powerful tool for environmental activists to challenge the encroachment of historic tanks and reservoirs constructed during various eras of Indian history.

Q87. Answer: (b) Mashal

The correct answer is Mashal.

Key Points

• Mashal is a massive sports talent hunt initiative introduced by the Government of Bihar to identify and nurture athletic potential at the grassroots level.

• The program was officially launched by Chief Minister Nitish Kumar in May 2025, specifically targeting students enrolled in secondary and higher secondary schools across the state.

• The primary objective of Mashal is to create a structured pathway for young athletes to move from school-level competitions to national and international sporting events.

• The talent hunt covers a wide range of disciplines, ensuring that students with diverse physical strengths—from sprinting and

long-distance running to team sports like football and kabaddi—are identified.

• Under this scheme, the state government aims to provide scientific training, nutritional support, and modern equipment to the selected candidates to hone their skills effectively.

Additional Information

• Bihar Sports Authority (BSA):

• The BSA serves as the nodal agency for implementing Mashal. It coordinates with district education officers and physical education teachers to conduct trials at the block and district levels.

• The authority is also responsible for managing the State Sports Academy and ensuring that the infrastructure meets the standards required for professional athlete development.

• Infrastructure and Facilities:

• To support initiatives like Mashal, the Bihar Government has been investing in the construction of stadiums in every subdivision and improving existing sports complexes in cities like Patna and Rajgir.

• The Rajgir Sports University, the first of its kind in the state, plays a pivotal role in providing higher education and research facilities in the field of sports science.

• Student Enrollment and Participation:

• The target group includes students from Class 9 to Class 12, generally falling within the age group of 14 to 18 years.

• By focusing on secondary schools, the program ensures that talent is captured at a critical developmental stage before athletes transition to university-level sports.

Important Points

• Incentives for Athletes:

• The Government of Bihar has implemented a "Medal Lao, Naukri Pao" policy, which guarantees government jobs to athletes who win medals in recognized national and international championships.

• Successful participants of the Mashal talent hunt may receive stipends or scholarships to cover their educational and training expenses, reducing the financial burden on their families.

• Socio-Economic Impact:

• The program is designed to promote social inclusivity by reaching out to students in rural and marginalized areas who previously lacked access to formal sports scouting.

• By integrating sports into the academic calendar, the state aims to promote a culture of physical fitness and discipline among the youth of Bihar.

• Selection Process:

• The selection involves multiple rounds, including physical efficiency tests (PET), skill-specific drills, and medical evaluations to ensure that the most promising talents are shortlisted for long-term training camps.

Q88. Answer: (b) 25 basis points

The correct answer is 25 basis points.

Key Points

• In the April 2025 monetary policy review, the Reserve Bank of India (RBI) announced a reduction in the Repo Rate by 25 basis points (bps) to stimulate economic activity.

• The decision was finalized by the Monetary Policy Committee (MPC) after evaluating the prevailing inflation trends and the need to support GDP growth in the new financial year.

• A reduction of 25 basis points translates to a 0.25% decrease in the interest rate at which the RBI lends to commercial banks. Hence, the correct answer is 25 basis points.

• The MPC opted for a calibrated 25 bps cut rather than a more aggressive 50 basis points or 75 basis points reduction to ensure that liquidity remains balanced without stoking consumer price index (CPI) inflation. Hence, options 1 and 4 are incorrect.

• Small adjustments like 10 basis points are generally not standard practice for the RBI, which typically moves in multiples of 25 to provide a clear signal to the financial markets. Hence, option 3 is incorrect.

Additional Information

• Repo Rate:

• The Repo Rate (Repurchase Option) is the key policy rate used by the Central Bank to control the money supply and inflation in the economy.

• When the Repo Rate is reduced, it becomes cheaper for commercial banks to borrow from the RBI, which usually leads to lower interest rates for home loans, auto loans, and business credits.

• Basis Points (bps):

• In finance, a basis point is a unit equal to one-hundredth of one percent (0.01%).

• It is primarily used to denote changes in interest rates, equity indices, and the yield of a fixed-income security to avoid ambiguity

in percentage discussions.

• Monetary Policy Committee (MPC):

• The MPC is a six-member committee constituted by the Central Government under Section 45ZB of the amended RBI Act, 1934.

• It is headed by the Governor of the RBI and meets at least four times a year to determine the policy interest rate required to achieve the inflation target.

Important Points

• Impact on the Economy: A 25 basis point cut in April 2025 signals a "dovish" stance, indicating that the RBI is prioritizing economic expansion over strict monetary tightening.

• Reverse Repo Rate: While the Repo Rate is the rate at which banks borrow, the Reverse Repo Rate is the rate at which the RBI borrows money from banks. The gap between these two rates is known as the corridor.

• Transmission of Rates: For a repo rate cut to benefit the public, commercial banks must transmit the benefit by lowering their MCLR (Marginal Cost of Funds Based Lending Rate) or External Benchmark Lending Rate (EBLR).

• Inflation Targeting: The primary mandate of the RBI is to maintain price stability, with a target inflation rate of 4% with a tolerance band of +/- 2% (i.e., between 2% and 6%).

Q89. Answer: (b) England

The correct answer is England.

Key Points

• The 2025 Kabaddi World Cup is scheduled to be hosted by England, specifically in the West Midlands region.

• This marks a historic milestone for the sport as it is the first time the Kabaddi World Cup is being held outside of Asia.

• The event is organized by the World Kabaddi Federation (WKF) and is expected to feature approximately 16 teams from across the globe, including men's and women's categories.

• The tournament is slated to take place in April 2025, with matches distributed across various venues in cities like Wolverhampton, Birmingham, and Coventry.

• The decision to host the event in England reflects the growing international footprint of the sport and the significant diaspora population in the United Kingdom that follows the game.

Additional Information

• History of Kabaddi World Cup:

• The first Standard Style Kabaddi World Cup was held in 2004 in Mumbai, India.

• Historically, India has been the most dominant nation in the sport, winning nearly all major international trophies in both Standard and Circle styles.

• Prior to the 2025 edition, all major iterations of the World Cup were hosted within Asian countries, predominantly in India.

• Styles of Kabaddi:

• Standard Style: Played on a rectangular mat, this version is featured in the Asian Games and the Pro Kabaddi League (PKL).

• Circle Style: Played on a circular pitch, this version is popular in Punjab (both in India and Pakistan) and has its own separate World Cup circuit.

• International Status:

• Kabaddi is the National Sport of Bangladesh.

• The sport has seen massive growth in countries like Iran, South Korea, and Kenya, challenging the traditional dominance of South Asian teams.

Important Points

• Strategic Selection: The West Midlands was chosen as the host because of its rich sporting heritage and the presence of a large, vibrant South Asian community, ensuring a high level of local engagement and viewership.

• Economic Impact: The 2025 event is expected to boost the local economy of England by attracting tourists, promoting international broadcasting rights, and fostering sports infrastructure development.

• Governance: While the International Kabaddi Federation (IKF) often oversees the Standard Style used in major games, the World Kabaddi Federation (WKF) is the lead body for the 2025 global event in the United Kingdom.

• Year of Event: The formal announcement for the 2025 host was made in 2022, giving the England Kabaddi Federation sufficient time to prepare for the high-profile influx of athletes.

Q90. Answer: (a) Inheritance rights and access to education and employment

The correct answer is Inheritance rights and access to education and employment.

Key Points

• The Government of Tamil Nadu released the Tamil Nadu Transgender Policy 2025 to provide a comprehensive legal framework for the rights and welfare of transgender persons.

• A landmark provision of this policy is the explicit assurance of inheritance rights, allowing transgender individuals to inherit ancestral and parental property, addressing a long-standing legal gap. Hence, statement 1 is correct.

• The policy emphasizes inclusive education by ensuring non-discriminatory access to schools and colleges, alongside creating specialized employment opportunities in both public and private sectors.

• It streamlines the process for obtaining Transgender Identity Certificates and Identity Cards, facilitating easier access to various government welfare schemes and legal documentation.

• The policy was developed following directives and observations from the Madras High Court to ensure the dignity and social integration of the community.

Additional Information

• Historical Context: Tamil Nadu has been a pioneer in transgender welfare, being the first state in India to establish a Transgender Welfare Board in the year 2008.

• Nodal Agency: The Social Welfare and Women Empowerment Department is responsible for the implementation and monitoring of the 2025 Policy guidelines across the state.

• Healthcare Provisions: The state provides Gender Reassignment Surgery (GRS) free of cost in Government General Hospitals and includes transgender persons under the Chief Minister's Comprehensive Health Insurance Scheme.

• Housing and Social Security: While the state provides free housing site pattas and a monthly pension of Rs. 1,500 for destitute transgender persons over the age of 40, the 2025 policy specifically strengthens the legal standing regarding property inheritance.

• Education Incentives: The government provides tuition fee waivers and scholarships for transgender students pursuing higher education to improve the literacy rate and economic independence within the community.

Important Points

• Legal Rights: The policy aligns with the Transgender Persons (Protection of Rights) Act, 2019, but goes further by addressing succession laws which are usually governed by personal laws.

• Reservation Status: In Tamil Nadu, transgender persons are currently categorized under the Most Backward Classes (MBC) for the purpose of reservation in education and government jobs.

• Sensitization: The 2025 policy mandates sensitization programs for police personnel, healthcare workers, and judicial officers to prevent harassment and stigma.

• Self-Identification: It upholds the right to self-identified gender, in accordance with the Supreme Court's NALSA judgement (2014), ensuring that individuals do not face medical coercion for legal recognition.

Q91. Answer: (c) Punjab Kesari

The correct answer is Punjab Kesari.

Key Points

• Lala Lajpat Rai was a prominent Indian independence activist and a revolutionary leader, widely celebrated by the title Punjab Kesari, which means the 'Lion of Punjab'.

• He was born on 28 January 1865 in the village of Dhudike, located in the Ferozepur district of Punjab. His 160th birth anniversary was observed across India on 28 January 2025.

• He was a vital part of the Indian National Congress and formed the legendary Lal-Bal-Pal trio, representing the assertive nationalist wing alongside Bal Gangadhar Tilak and Bipin Chandra Pal.

• In 1894, he was instrumental in founding the Punjab National Bank (PNB), which was the first swadeshi bank started with Indian capital. He also founded the Lakshmi Insurance Company.

• During a protest against the Simon Commission in Lahore on 30 October 1928, he was severely injured in a lathi charge ordered by the British police. He succumbed to his injuries on 17 November 1928.

Additional Information

• Netaji:

• This title is synonymous with Subhash Chandra Bose, one of the most influential leaders of the Indian independence movement who led the Indian National Army (INA).

• The title Netaji was reportedly first used by Indian soldiers of the Indische Legion in Germany in 1942.

• Lokmanya Tilak:

• Bal Gangadhar Tilak was conferred with the title Lokmanya, which means "accepted by the people".

• He was a scholar, mathematician, and philosopher who famously declared, "Swaraj is my birthright and I shall have it!"

• Deshbandhu:

• Chittaranjan Das (C.R. Das) was popularly known as Deshbandhu, which translates to "Friend of the Nation".

• He was a distinguished lawyer, a leader of the Swaraj Party, and a political mentor to Subhash Chandra Bose.

• Literary Contributions of Lala Lajpat Rai:

• He was a prolific writer and authored several influential books, including Unhappy India, Young India, History of My Deportation,

and The Arya Samaj.

• He founded the Servants of the People Society in 1921, dedicated to the service of the country and its marginalized communities.

Important Points

• Political Ideology: Lala Lajpat Rai was deeply influenced by the Arya Samaj and played a significant role in the Swadeshi Movement of 1905 following the Partition of Bengal.

• International Impact: He traveled to the United States in 1917 and founded the Indian Home Rule League of America in New York to seek international support for India's freedom.

• Education: He was a pillar of the DAV (Dayanand Anglo-Vedic) College Trust and Management Society and helped establish several educational institutions in Punjab.

• Legacy: His death sparked a wave of revolutionary activities; Bhagat Singh, Rajguru, and Sukhdev vowed to avenge his death, which eventually led to the Saunders' murder case in 1928.

Q92. Answer: (a) Longest chess marathon

The correct answer is Longest chess marathon.

Key Points

• Tunde Onakoya, a renowned Nigerian chess master and child education advocate, officially broke the Guinness World Record for the longest chess marathon in April 2024.

• The record-breaking event took place at the iconic Times Square in New York City, beginning on April 17 and concluding on April 20, 2024.

• Onakoya played for a continuous duration of 60 hours, significantly surpassing the previous record of 56 hours, 9 minutes, and 37 seconds, which was set by Norwegian players Hallvard Haug Flatebø and Sjur Ferkingstad in 2018.

• The marathon was not just a feat of endurance but a fundraising campaign aimed at raising $1 million for his non-profit organization, Chess in Slums Africa, to support education and chess training for underprivileged children across the continent.

• Throughout the attempt, he was joined by American chess player Shawn Martinez, who acted as his opponent for the entire 60-hour duration to satisfy the Guinness World Record requirements. Hence, the correct answer is Longest chess marathon.

Additional Information

• Chess in Slums Africa:

• This is a social intervention initiative founded by Tunde Onakoya in 2018.

• The organization uses chess as a framework to help children in impoverished communities (like Oshodi in Lagos, Nigeria) develop critical thinking, problem-solving skills, and access to scholarships.

• The foundation has successfully reached thousands of children, providing them with a path away from street life and child labor.

• Global Recognition:

• The event drew global attention, receiving public support from Bill Gates, the President of Nigeria (Bola Ahmed Tinubu), and various United Nations representatives.

• Onakoya’s achievement has been hailed as a symbol of resilience and a testament to the potential of African youth on the global stage.

Important Points

• Technical Rules of the Record:

• According to Guinness World Record guidelines for the longest marathon, the participant is permitted only 5 minutes of break for every hour of continuous activity.

• These breaks can be accumulated, which Tunde Onakoya used for brief periods of rest and medical check-ups during his 60-hour stint.

• Despite battling physical exhaustion and intense fatigue, he remained undefeated in the games played during the marathon.

• Impact and Legacy:

• By the end of the marathon, the campaign had successfully raised hundreds of thousands of dollars, contributing significantly toward the construction of educational facilities in Nigeria.

• The record solidified the year 2024 as a milestone for Nigerian sports and humanitarian efforts globally.

Q93. Answer: (b) Uttar Pradesh

The correct answer is Uttar Pradesh.

Key Points

• In June 2025, the state of Uttar Pradesh became the first in India to launch a comprehensive state-level Clean Air Plan formulated using airshed-based scientific analysis.

• The plan was developed by the Uttar Pradesh Pollution Control Board (UPPCB) in technical collaboration with IIT Kanpur and supported by international organizations like the World Bank.

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• Unlike traditional city-specific plans, this airshed approach recognizes that air pollution does not respect administrative boundaries and moves across regions due to meteorological factors and topographical features.

• The initiative aims to address trans-boundary pollution, focusing on clusters of districts that share the same air quality profile, rather than treating cities as isolated units. Hence, the correct answer is Uttar Pradesh.

Additional Information

• Concept of Airshed Management:

• An airshed is defined as a geographical area where local topography and meteorology limit the dispersion of pollutants, leading to similar air quality levels throughout the zone.

• In India, the Indo-Gangetic Plain (IGP) is considered a massive multi-state airshed where pollution from one state significantly impacts the air quality of neighboring states.

• Managing air quality through an airshed lens allows for synchronized action against biomass burning, industrial emissions, and vehicular exhaust across a larger territory.

• National Clean Air Programme (NCAP):

• Launched in January 2019 by the Ministry of Environment, Forest and Climate Change (MoEFCC), it is a long-term, time-bound national strategy.

• The original goal was a 20% to 30% reduction in PM2.5 and PM10 concentrations by 2024, with 2017 as the base year; this was later updated to a 40% reduction target by 2026.

• The program covers 131 non-attainment cities across the country, where air quality consistently fails to meet National Ambient Air Quality Standards (NAAQS).

Important Points

• Targeted Pollutants: The plan specifically targets Particulate Matter (PM2.5 and PM10), Nitrogen Oxides (NOx), and Sulfur Dioxide (SO2), which are primary contributors to respiratory illnesses.

• Geographic Focus: In Uttar Pradesh, major non-attainment cities including Lucknow, Kanpur, Varanasi, Agra, and Noida are integrated into this regional management framework.

• Sectoral Interventions: Key strategies include the promotion of Electric Vehicles (EVs), strict enforcement of Grades Response Action Plan (GRAP), and the installation of Continuous Ambient Air Quality Monitoring Systems (CAAQMS).

• Financial Support: The implementation is supported by grants from the XV Finance Commission specifically earmarked for improving air quality in million-plus population cities.

Q94. Answer: (c) Civil Registration System

The correct answer is Civil Registration System.

Key Points

• The Union Home Minister Amit Shah launched the Civil Registration System (CRS) mobile application on October 29, 2024, to modernize the process of recording vital events in India.

• The application is designed to allow citizens to register births and deaths at any time and from any location, significantly reducing the dependency on physical visits to government offices.

• It aims to streamline and automate the registration process, ensuring that certificates are issued in a much shorter time frame compared to the traditional manual method.

• The app was developed under the aegis of the Registrar General and Census Commissioner of India to promote the Digital India initiative and enhance administrative efficiency.

• This digital transition is part of the implementation of the Registration of Births and Deaths (Amendment) Act, 2023, which seeks to create a national-level database of vital statistics.

• Hence, the correct answer is Civil Registration System.

Additional Information

• Legal Framework:

• The Registration of Births and Deaths (RBD) Act, 1969, provides the statutory framework for the compulsory registration of these events in India.

• The 2023 Amendment to this Act authorized the use of digital technology and the creation of centralized databases to improve data integrity and accessibility.

• Significance of CRS:

• The Civil Registration System is a continuous, permanent, and compulsory recording of the occurrence and characteristics of vital events.

• Accurate data from the CRS is crucial for health planning, socio-economic development, and population monitoring by the government.

• Digital Governance:

• The mobile app integrates with various API-based services to ensure that the data can be verified and updated in real-time

across different government platforms.

• It facilitates the issuance of digitally signed certificates, which are legally valid and harder to forge than traditional paper documents.

Important Points

• Single Document Utility: Under the new rules, the birth certificate will serve as a single document for multiple purposes, including admission to educational institutions, issuance of driving licenses, preparation of voter lists, and applying for a passport or Aadhaar.

• Mandatory Timeline: While the app eases the process, the standard requirement to report births and deaths within 21 days of the occurrence remains a key administrative guideline for citizens.

• Integration: The national database created through this system will eventually be linked with the National Population Register (NPR), Electoral Rolls, and Ration Card databases to ensure seamless governance and benefit delivery.

• User Interface: The CRS App is designed to be user-friendly, supporting multiple languages to cater to the diverse population of India across different states and union territories.

Q95. Answer: (c) Gender Budgeting Knowledge Hub portal

The correct answer is Gender Budgeting Knowledge Hub portal.

Key Points

• The Gender Budgeting Knowledge Hub (GBKH) portal was launched by the Ministry of Women and Child Development (MWCD) to act as a centralized digital repository for all resources related to Gender Responsive Budgeting (GRB) in India.

• It was officially unveiled during the National Consultation on Gender Budgeting held in June 2025 (referring to the event timeline specified), aimed at strengthening the institutionalization of gender-sensitive planning across Government departments.

• The portal serves as a platform for sharing best practices, training modules, research papers, and Gender Budgeting Statements from various Union Ministries and State Governments. Hence, the correct answer is the Gender Budgeting Knowledge Hub portal.

• The primary objective of this hub is to facilitate capacity building for officials and stakeholders, ensuring that financial allocations effectively address the specific needs and disparities faced by women and girls.

• By providing real-time access to data and guidelines, the GBKH portal streamlines the process of monitoring gender-related expenditures and evaluating the impact of welfare schemes.

Additional Information

• Gender Budgeting in India:

• India formally adopted Gender Budgeting in 2005-06. It is not a separate budget for women but an analytical tool to ensure gender mainstreaming in the macroeconomic policy framework.

• The Ministry of Women and Child Development serves as the nodal agency for coordinating these efforts across the Government of India.

• Beti Bachao Beti Padhao (BBBP):

• Launched in January 2015 at Panipat, Haryana, this scheme aims to address the declining Child Sex Ratio (CSR) and promote female education and empowerment.

• While an Annual Report might be released periodically, it was not the specific portal launched during the June 2025 consultation focused on budgeting.

• One-Stop Centre (OSC) Scheme:

• Also known as Sakhi Centres, this scheme was implemented to provide integrated support (medical, legal, and psychological) to women affected by violence under one roof.

• It is funded through the Nirbhaya Fund and is a critical component of the Sambal sub-scheme of Mission Shakti.

• National Resource Centre for Women (NRCW):

• This was an initiative intended to provide technical support to the Ministry and other agencies; however, the specific Knowledge Hub portal is the contemporary digital evolution designed for Gender Budgeting specifically.

Important Points

• Mission Shakti: This is an integrated women empowerment programme launched as an umbrella scheme for the safety, security, and empowerment of women. It has two sub-schemes: 'Sambal' (safety) and 'Samarthya' (empowerment).

• Gender Budgeting Statement (Statement 20): This is a crucial document presented along with the Union Budget in Parliament, highlighting the quantum of funds allocated for schemes that benefit women.

• Article 15(3) of the Indian Constitution empowers the State to make special provisions for women and children, providing the legal foundation for Gender Budgeting.

• The June 2025 consultation focused on the sustainable development goals (SDG 5), which targets gender equality and the empowerment of all women and girls by 2030.

Q96. Answer: (d) London, UK

The correct answer is London, UK.

Key Points

• The Wimbledon Championships is the oldest and most prestigious tennis tournament in the world, and the 2025 edition was held in London, United Kingdom.

• The tournament takes place annually at the All England Lawn Tennis and Croquet Club (AELTC), which is situated in the Wimbledon district of southwest London.

• The 2025 Wimbledon Championships represents the 138th edition of the event, maintaining its long-standing tradition since its inception in 1877.

• It is historically significant as the only Grand Slam tournament that continues to be played on Grass courts, which is the original surface of the sport.

• The event is part of the Grand Slam calendar, typically scheduled to occur over a fortnight starting in late June and concluding in early July.

• The 2025 tournament features various categories, including Gentlemen's Singles, Ladies' Singles, doubles, and junior championships, attracting top-tier athletes from the ATP and WTA tours.

Additional Information

• Grand Slam Venues and Locations:

• Australian Open: Held annually in January at Melbourne Park in Melbourne, Australia, played on Hard courts.

• French Open (Roland-Garros): Held in May and June at Stade Roland-Garros in Paris, France, played on Red Clay.

• US Open: Held in August and September at the USTA Billie Jean King National Tennis Center in New York City, USA, played on Hard courts.

• Wimbledon Traditions:

The tournament is famous for its strict all-white dress code for players and the tradition of spectators consuming strawberries and cream. It is also known for the absence of sponsor advertising around the courts.

• Court Maintenance:

The grass courts at Wimbledon are composed of 100% Perennial Ryegrass, which is mown to a height of exactly 8mm during the playing season to ensure optimal performance.

Important Points

• Centre Court: This is the premier court at the AELTC and features a retractable roof, which was installed in 2009 to allow play to continue during rain and low-light conditions.

• The Royal Box: Located at the south end of Centre Court, it is reserved for use by the British Royal Family and other invited dignitaries.

• Prize Money: The Wimbledon organizers announce a significant prize fund each year, which is distributed equally between the Gentlemen's and Ladies' champions, a practice that has been in place since 2007.

• Qualifying Rounds: Before the main draw in London, qualifying matches are usually held at the Bank of England Sports Centre in Roehampton.

Q97. Answer: (b) Kumudhini Lakhia

The correct answer is Kumudhini Lakhia.

Key Points

• Kumudhini Lakhia, a legendary Kathak dancer and choreographer, was honored with the Padma Vibhushan in the year 2025 for her exceptional contribution to the field of Art.

• Born in 1930, she is widely credited with revolutionizing the traditional Kathak dance form by moving away from solo narratives toward innovative group choreographies and contemporary themes.

• She founded the Kadamb Centre for Dance in Ahmedabad, Gujarat, in 1964, which has since become a premier institute for training and research in Kathak.

• Her work is characterized by a focus on spatial design, lighting, and costumes, which transformed the visual aesthetics of the dance while maintaining the integrity of the Lucknow Gharana techniques.

• Before receiving the Padma Vibhushan, she was previously decorated with the Padma Shri in 1987 and the Padma Bhushan in 2010, making her one of the most decorated classical dancers in India.

Additional Information

• Padma Vibhushan:

• It is the second-highest civilian award in India, preceded by the Bharat Ratna.

• The award was instituted on January 2, 1954, and is given for "exceptional and distinguished service" without distinction of race, occupation, position, or sex.

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• The awards are announced annually on the eve of Republic Day (January 26) by the Ministry of Home Affairs.

• Kathak Dance Form:

• Kathak is one of the eight classical dances of India recognized by the Sangeet Natak Akademi.

• It originated in North India, specifically in the states of Uttar Pradesh and Rajasthan.

• The name is derived from the Sanskrit word 'Katha', meaning story, and practitioners are known as Kathakars (storytellers).

• Key features include Chakkars (spins), intricate footwork (Tatkar), and expressive gestures (Abhinaya).

• Other Distinguished Personalities:

• Birju Maharaj: A doyen of the Lucknow Kalka-Bindadin Gharana of Kathak. He received the Padma Vibhushan in 1986 and passed away in 2022.

• Kelucharan Mohapatra: A legendary exponent of Odissi dance. He was the first person from Odisha to receive the Padma Vibhushan in the year 2000.

• Shobana Chandrakumar: A renowned Bharatanatyam dancer and two-time National Film Award winning actress from Kerala. She was awarded the Padma Shri in 2006.

Important Points

• The Padma Awards are conferred by the President of India at ceremonial functions held at Rashtrapati Bhawan usually around March or April.

• In 2025, the selection committee emphasized pioneers who bridged the gap between traditional heritage and modern sensibilities, fitting the profile of Kumudhini Lakhia perfectly.

• She has been a mentor to several prominent dancers, including Aditi Mangaldas and Daksha Sheth, who have further expanded the boundaries of Indian classical dance.

• The recognition of a Kathak exponent with the Padma Vibhushan highlights the continued cultural significance of the Gharana system in the 21st century.

Q98. Answer: (c) Army, BRO, ITBP, NDRF, SDRF

The correct answer is Army, BRO, ITBP, NDRF, SDRF.

Key Points

• The multi-agency rescue operation in Uttarkashi during August 2025 was necessitated by extreme weather conditions leading to flash floods and landslides across the Himalayan region.

• The Indian Army deployed specialized columns for humanitarian assistance and disaster relief (HADR), focusing on bridging collapsed road sections and airlifting stranded individuals.

• The Border Roads Organization (BRO) was instrumental in restoring critical infrastructure, specifically clearing the National Highways and Chardham Yatra routes that were blocked by heavy debris.

• The Indo-Tibetan Border Police (ITBP), being the primary force stationed along the Sino-Indian border, acted as the first responder due to their deep familiarity with the high-altitude terrain of Uttarakhand.

• The National Disaster Response Force (NDRF) and the State Disaster Response Force (SDRF) worked in tandem to conduct technical search and rescue operations, providing emergency medical services and managing relief camps for the displaced population.

Additional Information

• National Disaster Response Force (NDRF):

• It was constituted under the Disaster Management Act, 2005, to provide a specialist response to natural and man-made disasters.

• The Prime Minister of India serves as the Chairperson of the National Disaster Management Authority (NDMA), which oversees the NDRF.

• Border Roads Organization (BRO):

• Established on 7 May 1960, the BRO functions under the Ministry of Defence.

• It plays a strategic role in maintaining the socio-economic development of the North and North-Eastern border states by ensuring all-weather connectivity.

• Indo-Tibetan Border Police (ITBP):

• The ITBP is one of the Central Armed Police Forces (CAPFs) of India, raised on 24 October 1962.

• It is specifically trained for mountain warfare and high-altitude rescue operations, making it vital for emergencies in the Himalayas.

• Uttarkashi Geography:

• Uttarkashi is a district in Uttarakhand that houses the sources of the Ganges (Gangotri) and Yamuna (Yamunotri) rivers.

• The region is geologically unstable and prone to cloudbursts, which often result in catastrophic flash floods like those seen in 2013 and 2025.

Important Points

• Multi-Agency Coordination: The success of such operations depends on the Integrated Command and Control Center, which synchronizes the efforts of military, paramilitary, and civil forces.

• SDRF Evolution: Following the 2013 Kedarnath tragedy, the Uttarakhand SDRF was significantly strengthened and is now considered one of the most efficient state-level response forces in India.

• Air Support: During the August 2025 floods, the Indian Air Force (IAF) often supports these agencies through Operation Rahat-style sorties, using Chinook and Mi-17 helicopters for heavy-lift requirements.

Q99. Answer: (d) Near-boundary low-altitude engagement

The correct answer is Near-boundary low-altitude engagement.

Key Points

• On March 14, 2025, the Defence Research and Development Organisation (DRDO) and the Indian Navy successfully conducted a flight test of the Vertically Launched Short Range Surface to Air Missile (VLSRSAM).

• The test was carried out from the Integrated Test Range (ITR), Chandipur, located off the coast of Odisha, using a land-based vertical launcher.

• The primary objective of the mission was to establish and validate the near-boundary low-altitude engagement capability of the missile system, which is crucial for defending against sea-skimming threats.

• The missile successfully intercepted a high-speed aerial target flying at a very low altitude and at a near-range boundary, demonstrating the system's precision and rapid reaction time.

• This flight test confirmed the integration of various subsystems, including the missile, the vertical launcher with canister, and the weapon control system.

Additional Information

• VLSRSAM System Overview:

• The VLSRSAM is a next-generation, ship-borne weapon system designed to provide a point-defense shield for Indian Navy warships against a variety of aerial threats.

• It is intended to replace the older Barak-1 surface-to-air missile systems currently in service on several Indian naval vessels.

• The missile has an operational range of approximately 40 to 50 kilometers and can reach altitudes of up to 15 kilometers.

• Design and Technology:

• It features cruciform wings that provide aerodynamic stability and Thrust Vector Control (TVC), allowing the missile to perform high-maneuverability turns immediately after a vertical launch.

• The vertical launch capability ensures a 360-degree coverage, enabling the ship to engage targets coming from any direction without maneuvering the vessel or the launcher.

• The system is equipped with an active radar seeker for terminal guidance, ensuring high kill probability against agile targets.

• Strategic Significance:

• The development of VLSRSAM is a significant step toward Aatmanirbhar Bharat (Self-reliant India) in the defense sector, as it is designed and developed indigenously by DRDO laboratories like RCI Hyderabad and DRDL.

• It is specifically optimized to counter supersonic sea-skimming missiles, which fly very close to the water surface to avoid radar detection, making low-altitude engagement a critical requirement.

Important Points

• Comparison with other options:

• Underwater deployment: This capability is associated with Submarine-Launched Ballistic Missiles (SLBMs) or torpedoes, not the VLSRSAM, which is surface-launched.

• Mid-course ballistic target destruction: This is the domain of Ballistic Missile Defence (BMD) systems like the Prithvi Air Defence (PAD) or Advanced Air Defence (AAD), rather than short-range tactical missiles.

• Long-range high-altitude interception: Systems like the S-400 or Long Range Surface-to-Air Missile (LRSAM/Barak-8) handle long-range threats, whereas VLSRSAM is specialized for short-range protection.

Q100. Answer: (d) Vigyan Shri (VS) Award

The correct answer is Vigyan Shri (VS) Award.

Key Points

• Prof. Syed Wajih Ahmad Naqvi, a distinguished Biogeochemical Oceanographer, was honored with the Vigyan Shri (VS) Award in 2024.

• He received this prestigious recognition in the domain of Earth Science for his pioneering contributions to marine science and biogeochemistry. Hence, option 4 is correct.

• The Rashtriya Vigyan Puraskar (RVP) is the highest national award in the field of science, technology, and innovation in India, established to recognize outstanding contributions by scientists and technologists.

• The Vigyan Shri (VS) Award specifically recognizes distinguished contributions to any field of science and technology.

• Prof. Naqvi has significantly enhanced the understanding of oceanic nitrogen cycles, particularly in the Arabian Sea and the Indian Ocean, gaining both national and international acclaim.

• He previously served as the Director of the CSIR-National Institute of Oceanography (NIO), based in Goa, where he led numerous research expeditions and institutional developments.

Additional Information

• Rashtriya Vigyan Puraskar (RVP) Categories:

• Vigyan Ratna (VR): Awarded for lifetime achievements and contributions in any field of science and technology.

• Vigyan Shri (VS): Awarded for distinguished contributions in any field of science and technology.

• Vigyan Yuva-Shanti Swarup Bhatnagar (VY-SSB): Designed to recognize young scientists up to the age of 45 years who have made exceptional contributions.

• Vigyan Team (VT): Awarded to a team consisting of three or more scientists/researchers for collaborative work.

• Eligibility and Domains:

• The awards are given in 13 specific domains, including Physics, Chemistry, Biological Sciences, Mathematics & Computer Science, Earth Science, Medicine, Engineering Sciences, Agricultural Science, Environmental Science, Technology & Innovation, Atomic Energy, Space Science and Technology, and Others.

• The selection is made by the Rashtriya Vigyan Puraskar Committee (RVPC), which is headed by the Principal Scientific Adviser to the Government of India.

• Significance of 2024:

• The year 2024 marked the inaugural edition of the Rashtriya Vigyan Puraskar, consolidating various previous science awards under one umbrella.

• A total of 33 awards were announced in the first edition across the four categories.

Important Points

• The awards were presented by the President of India, Droupadi Murmu, at a ceremony held at Rashtrapati Bhavan.

• The announcement of the awards coincided with National Space Day, celebrated on August 23, to commemorate the success of the Chandrayaan-3 mission.

• Prof. Naqvi's research is crucial for understanding marine hypoxia (low oxygen zones) and how climate change affects ocean chemistry and marine life.

• The award comprises a Sanad (Certificate) and a Medal, emphasizing the recipient's dedication to advancing the scientific landscape of India.

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