RRB Group D Official Paper (Held On: 09 Dec, 2025 Shift 1) (Previous Year Paper)

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

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GENERAL SCIENCE

Q1. Which of the following characteristics correctly describes skeletal (striated) muscles?

(a) Spindle-shaped, uninucleate cells, involuntary control
(b) Branched, uninucleate cells, involuntary control
(c) Long, cylindrical, unbranched, multinucleate cells, voluntary control
(d) Short, cylindrical, branched cells with intercalated discs

Q2. The key difference between rough endoplasmic reticulum and smooth endoplasmic reticulum is the presence of:

(a) mitochondria
(b) cytosol
(c) centrosomes
(d) ribosomes

Q3. An organic compound always contains which of the following?

(a) Silicon and phosphorus atoms
(b) Halogens and noble gases
(c) Hydrogen, oxygen and nitrogen
(d) At least one carbon atom

Q4. Which of the following statements about ethanol is correct?

(a) Ethanol is a non-volatile solid.
(b) Ethanol is a liquid with a pleasant smell and is miscible with water.
(c) Ethanol does not dissolve in water.
(d) Ethanol reacts with sodium to form carbon dioxide.

Q5. If the net force on a 10 kg object is zero, its acceleration will be:

(a) 10 m/s^2
(b) 0 m/s^2
(c) Depends on its velocity
(d) 9.8 m/s^2

Q6. If the mass of two objects is halved and the distance between them is also halved, the gravitational force _____.

(a) becomes one-fourth as much
(b) remains same as before
(c) becomes double
(d) becomes half as much

Q7. The poultry birds grown for the purpose of meat production are called _____.

(a) Fowls
(b) Layers.
(c) Cocks.

(d) Broilers.

Q8. When ester is treated with sodium hydroxide, alcohol and sodium salt of carboxylic acid is formed. What is the process called?

(a) Saponification
(b) Hydrogenation
(c) Acidification
(d) Esterification

Q9. A convex lens is thicker at the middle compared to the edges. Due to this shape, how does it affect parallel light rays passing through it?

(a) It causes the rays to meet at a point, performing a converging action
(b) It causes the rays to spread out, performing a diverging action
(c) It causes the rays to scatter randomly
(d) It causes the rays to reflect back along the same path

Q10. Which of the following is NOT a trait Mendel studied in pea plants?

(a) Plant height
(b) Flower position
(c) Seed shape
(d) Leaf size

Q11. Which of the following elements has atomic number 11?

(a) Magnesium
(b) Sodium
(c) Nitrogen
(d) Potassium

Q12. Which of the following shows the strongest force of attraction between particles?

(a) Water
(b) Iron rod
(c) Alcohol
(d) Oxygen gas

Q13. Which of the following wires will have the least resistance if all are made of the same material?

(a) Short and thick wire
(b) Long and thick wire
(c) Long and thin wire
(d) Short and thin wire

Q14. The phenomenon of change of a liquid into vapour at any temperature below its boiling point is called:

(a) solidification
(b) evaporation
(c) condensation
(d) sublimation

Q15. The speed of sound in air is about 343 m/s at room temperature. What happens to its speed when it travels through water?

(a) It remains the same
(b) It becomes zero
(c) It decreases
(d) It increases

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Q16. What does the area under a velocity-time graph give?

(a) Force
(b) Acceleration
(c) Work done
(d) Displacement

Q17. If a porter carrying a load on his head moves on a horizontal road with uniform speed, the work done by the gravitational force on the load:

(a) cannot be determined
(b) is maximum
(c) is minimum
(d) is zero

Q18. Which of the following is the irrigation method in which water is tap from deeper strata by pumps?

(a) Canals
(b) Tube wells
(c) River life system
(d) Rain-fed

Q19. A ray of light passing through the principal focus of a convex lens emerges:

(a) towards the optical centre
(b) without deviation
(c) back to the source
(d) parallel to the principal axis

Q20. Why do recessive traits like ' t ' for dwarfness in pea plants only show up when both alleles are recessive?

(a) Recessive alleles are never expressed.
(b) Recessive alleles are stronger.
(c) Recessive alleles cannot be passed on.
(d) Dominant alleles mask recessive alleles.

Q21. The number of neutrons in an oxygen atom is:

(a) 32
(b) 8
(c) 16
(d) 7

Q22. Read the following statements carefully and select the correct option.

Assertion (A): Decomposition reactions require energy in the form of heat, light, or electricity.

Reason (R): Energy is absorbed to break down reactant molecules into simpler products.

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

Q23. Which of the following cell organelles stores starch, oil and protein granules?

(a) Chromoplast
(b) Leucoplast
(c) Chloroplast
(d) All plastids

Q24. When the same current flows through two wires of equal length but different resistances, the wire with higher resistance will:

(a) Produce the same heat
(b) Produce no heat

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(c) Produce more heat
(d) Produce less heat

Q25. Which of the following terms is used to describe the ability of a plant to recover its lost parts by growth?
(a) Regeneration
(b) Fertilisation
(c) Budding
(d) Binary fission

MATHEMATICS

Q26. If cotA = 3/4, then find the value of 3 sin2A - cos3A is:
(a) 437/125
(b) 477/125
(c) 497/125
(d) 417/125

Q27. The cost of a washing machine is 10% less than the cost of a TV. If the cost of the washing machine increases by 55% and that of the TV decreases by 71%, then what is the percentage change in the total cost of 6 washing machines and 3 TVs?
(a) Increase by 12%
(b) Decrease by 13%
(c) Increase by 10%
(d) Decrease by 11%

Q28. Simplify: $3 \times 2 + 12 \div (6 - 2) \times 2$
(a) 21
(b) 12
(c) 15
(d) 18

Q29. In a ΔMNR, the sides MN and MR are extended to P and Q, respectively. The bisectors of angle PNR and angle QRN intersect at a point X. If angle X = 75°, then the value of 2 angle M is:
(a) 56°
(b) 66°
(c) 50°
(d) 60°

Q30. One pipe can fill a tank in 6 minutes while another pipe can empty the completely filled tank in 24 minutes. If both the pipes are opened together when the tank is empty, how many minutes will it take to fill one-fourth of the tank?
(a) 4
(b) 8
(c) 6
(d) 2

Q31. To buy a car, Taniya borrowed Rs. 75,000 at 8% per annum simple interest for 27 months. How much interest will she pay?
(a) Rs. 13,500
(b) Rs. 14,000
(c) Rs. 12,500
(d) Rs. 13,000

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Q32. What is the average speed of a car that covers half the distance at the speed of 84 km/hr and the other half at the speed of 63 km/hr?

(a) 68 km/hr
(b) 72 km/hr
(c) 69 km/hr
(d) 79 km/hr

Q33. A dealer marks his goods at 80% above the cost price and allows a discount of 5% on the marked price. What is his gain or loss percentage?

(a) 74.2% loss
(b) 71% gain
(c) 72% loss
(d) 71.3% gain

Q34. The least value of x, so that the number 73318x4 is divisible by 8 is

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

Q35. Determine the largest number that divides both 1058 and 1550, leaving remainders of 5 and 11, respectively.

(a) 83
(b) 86
(c) 81
(d) 88

Q36. Rohit bought a bicycle for Rs. 3,200 and sold it for Rs. 3,840. What is his profit percentage?

(a) 25%
(b) 22%
(c) 20%
(d) 18%

Q37. A vendor offers her customers a discount of 15% on her beauty products and she still makes a profit of 5%. What is the cost price (in Rs.) of a beauty product marked at Rs. 273?

(a) 247
(b) 221
(c) 219
(d) 166

Q38. The sides of a triangle are 146 cm, 96 cm, and 110 cm. What is its area (in cm^2)?

(a) 5296
(b) 5275
(c) 5280
(d) 5290

Q39. Aaron is 5 years younger than Ron. Four years later from now, Ron will be twice as old as Aaron. Find Ron's present age.

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

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Q40. Walking at 3/4 th of his normal speed from his home, Bhavesh is 15 minutes late in reaching his office.

The usual time taken by him to cover the distance between his home and his office is :

(a) 45 minutes
(b) 38 minutes
(c) 54 minutes
(d) 43 minutes

Q41. If $\alpha + \beta = 14$ and $\alpha\beta = 20$, then what is the value of $(\alpha^2 + \beta^2)^{1/2}$?

(a) $2\sqrt{39}$
(b) 236
(c) $39\sqrt{2}$
(d) 156

Q42. A person saves 60% of his income. If his expenditure is Rs. 480, then his income (in Rs.) is:

(a) 2880
(b) 1200
(c) 1920
(d) 1240

Q43. A class of 95 students took a Physics test. 47 students had an average score of 93. The other students had an average score of 54. What is the average score (rounded off to one decimal place) of the whole class?

(a) 73.3
(b) 83.7
(c) 65.6
(d) 79.7

Q44. If the third proportional of 50 and 30 be x, then what is the value of x?

(a) 18
(b) 21
(c) 20
(d) 15

Q45. Aditya can do 1/6 th of a piece of work in 13 days and Bhagawan can do 1/9 th of the same work in 12 days. Find the number of days taken to complete the work if both work together.

Round off your answer to one decimal place.

(a) 51.4
(b) 45.3
(c) 41.9
(d) 47.5

Q46. A number is first decreased by 35% and then further decreased by 25%. By what percentage has the original number been decreased altogether?

(a) 55%
(b) 53.25%
(c) 50%
(d) 51.25%

Q47. The points scored by a basket-ball team in a series of matches are as follows:

17, 2, 7, 27, 25, 5, 14, 18, 10, 24, 10, 8, 7, 10.

The value of mode is:

(a) 17
(b) 4
(c) 10
(d) 7

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Q48. A number when doubled and increased by 7 becomes 29. Find the number.

(a) 12
(b) 15
(c) 14
(d) 11

Q49. If A : B = 1 : 3, B : C = 4 : 3 and C : D = 5 : 7, then A : B : C : D is:

(a) 18 : 60 : 45 : 63
(b) 20 : 58 : 45 : 63
(c) 20 : 60 : 43 : 63
(d) 20 : 60 : 45 : 63

Q50. A rectangular garden is 50 m long and 40 m wide. A path of uniform width is laid inside the garden along its boundary. If the area of the path is 344 m², find the perimeter of the inner rectangle.

(a) 148 m
(b) 164 m
(c) 140 m
(d) 136 m

GENERAL INTELLIGENCE & REASONING

Q51. What should come in place of the question mark (?) in the given series based on the English alphabetical order?

VMN SNP POR MPT ?

(a) IQV
(b) IQU
(c) JQV
(d) JQU

Q52. Ayush ranked 28^(th)from the top and 46^(th) from the bottom in his class. How many students are there in his class?

(a) 72
(b) 74
(c) 73
(d) 71

Q53. 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) OMM
(b) XUV
(c) TQR
(d) LIJ

Q54. Read the given statements and conclusions carefully. Assuming that the information given in the statements is true, even if it appears to be at variance with commonly known facts, decide which of the given conclusions logically follow(s) from the statements.

Statements:

All hotels are restaurants.

All restaurants are cafes.

Some restaurants are kitchens.

Conclusions:

(I) Some cafes are kitchens.

(II) Some hotels are kitchens.

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

Q55. In a certain code language,

A + B means ‘A is the sister of B’,

A @ B means ‘A is the brother of B’,

A - B means ‘A is the wife of B’,

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

How is O related to V if ‘O + P @ T # G - V’?

(a) Wife's father's sister
(b) Wife's father's mother
(c) Wife's sister
(d) Wife's mother

Q56. Town M is to the east of Town N. Town O is to the south of Town M. Town P is to the west of Town O. Town Q is to the north of Town P. Town N is to the north-west of Town Q. What is the location of Town M with respect to Town Q?

(a) North-east
(b) North-west
(c) East
(d) North

Q57. SDVT is related to WIAX in a certain way based on the English alphabetical order. In the same way, IXPJ is related to MCUN. To which of the given options is UMEV related, following the same logic?

(a) YRJZ
(b) YRZS
(c) YUIO
(d) TZXS

Q58. 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 patties are cake.

All cakes are samosa.

Conclusions:

(I): Some samosas are cake.

(II): All patties are samosa.

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

Q59. M, N, O, P, W, X and Y are sitting around a circular table facing the centre of the table.

O sits to the immediate right of P. Only three people sit between O and Y when counted from the left of O. Only three people sit between P and N when counted from the left of P. W sits to the immediate right of M. How many people sit between X and M when counted from the left of M?

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

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

ELN 55, HPK 62, KTH 69, NXE 76, ?

(a) QBB 83
(b) PBC 83
(c) RAB 81
(d) QCA 81

Q61. What will come in the place of '?' in the following equation, if '+' and '−' are interchanged and '×' and '÷' are interchanged?

67 – 13 ÷ 104 × 26 + 93 = ?

(a) 25
(b) 27
(c) 26
(d) 29

Q62. What should come in place of the question mark (?) in the given series?

12,23,45,78,122 ?

(a) 176
(b) 178
(c) 179
(d) 177

Q63. C, D, E, G, H, I and J are sitting around a circular table facing the centre of the table. Only two people sit between E and G when counted from the left of G. C sits third to the left of J. D sits to the immediate right of J. D sits second to the left of E. I is not an immediate neighbor of C. Who sits third to the right of H?

(a) J
(b) I
(c) D
(d) G

Q64. VQLG is related to ZUPK in a certain way based on the English alphabetical order. In the same way, UPKF is related to YTOJ. To which of the given options is RMHC related, following the same logic?

(a) UPKF
(b) VPLF
(c) UQKG
(d) VQLG

Q65. Pritika ranked 12th from the top and 26th from the bottom in his class. How many students are there in the class?

(a) 35
(b) 45
(c) 37
(d) 47

Q66. 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) LG-JN
(b) ID-GL
(c) RM-PT
(d) OJ-MQ

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Q67. In a certain code language, ‘morning sun rises’ is coded as ‘at bp kj’ and ‘rises every day’ is coded as ‘lm at wv’. How is ‘rises’ coded in that language?

(a) lm
(b) bp
(c) at
(d) kj

Q68. 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) 6 3 6 9 9 4 4 1 7 5 6 2 1 6 6 6 6 8 8 2 9 1 5 (Right)

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

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

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

1001 1000 997 992 985 ?

(a) 976
(b) 978
(c) 975
(d) 977

Q70. What should come in place of the question mark (?) in the given series?

2001 2010 2018 2025 2031 ?

(a) 2037
(b) 2035
(c) 2036
(d) 2034

Q71. 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.

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

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

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

Q72. In a certain language, 'basket is green' is coded as 'ns tu nm' and 'the green planet' is coded as 'ti ns fd'. How is 'green' coded in that language?

(a) fd
(b) ti
(c) ns
(d) nm

Q73. Refer to the following number and symbol series and answer the question that follows. Counting to be done from left to right only.

(Left) 3 % * 2 @ & 5 1 @ 6 7 1 6 # # £ 8 8 # $ £ € (Right)

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

(a) 5

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

Q74. Refer to the following number series and answer the question that follows (all numbers are single-digit numbers only). Counting to be done from left to right only.

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

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

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

Q75. In the following triads, each group of letters is related to the subsequent one following a certain logic. Select from the given options, the one which follows the same logic.

INFO - NFIO - OFNI

OATH - ATOH - HTAO

(a) PLAY - LPAY - YLAP
(b) REST - ESRT - TSER
(c) ALSO - ASLO - OSLA
(d) TINS - INTS - INST

Q76. Dhanya starts from Point A and drives 9 km towards south. She then takes a left turn, drives 11 km, turns left and drives 2 km. She then takes a left turn and drives 4 km. She takes a final right turn, drives 7 km and stops at Point P. How far (shortest distance) and towards which direction should she drive in order to reach Point A again?

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

(a) 9 km towards south
(b) 7 km towards west
(c) 7 km towards north
(d) 8 km towards east

Q77. Select the set in which the numbers are related in the same way as are the numbers of the following sets.

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

(24, 12, 2)

(70, 5, 14)

(a) (19, 5, 45)
(b) (60, 6, 12)
(c) (13, 39, 3)
(d) (32, 16, 2)

Q78. What will come in place of the question mark (?) in the following equation, if '+' and '−' are interchanged and '×' and '÷' are interchanged?

141 ÷ 8 + 384 × 2 - 43 = ?

(a) 912
(b) 979
(c) 982
(d) 953

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Q79. Six people, L, M, N, O, P and Q, are sitting in a straight line facing towards north. N is sitting at the leftmost end of the row. Only 3 people are sitting between N and Q. L is sitting second right to P. M is sitting second right to L. Based on the given arrangement three of the following four are alike, find the odd one out?

(a) OP
(b) LM
(c) PL
(d) NO

Q80. If + means −, − means ×, × means ÷ and ÷ means +, then what will come in place of the question mark (?) in the following equation?

221 -5 ÷ 47 + 842 × 2 = ?

(a) 741
(b) 731
(c) 711
(d) 721

GENERAL AWARENESS AND CURRENT AFFAIRS

Q81. What was the main objective of the 4^(th) BIMSTEC Disaster Management Exercise hosted virtually by the National Disaster Management Authority in July 2025?

(a) To strengthen regional cooperation in early warning systems
(b) To test joint response protocols for natural disasters across member nations
(c) To develop a unified framework for reconstruction planning
(d) To assess and enhance regional preparedness for cyclones and floods

Q82. What does the letter ‘G’ stand for in the term ‘G20’, as referred to in the second G20 Digital Economy Working Group meeting held in 2025 in South Africa?

(a) Group
(b) Global
(c) Government
(d) Growth

Q83. In February 2025, who broke the world indoor 800 m American record with a time of 1:43.90 at Millrose?

(a) Will Sumner
(b) Josh Hoey
(c) Bryce Hoppel
(d) Cooper Lutkenhaus

Q84. Which of the following initiative by the Ministry of Electronics and Information Technology (MeitY) specifically announced that India’s 'common compute capacity' has crossed 34,000 GPUs to boost indigenous AI foundation-model development?

(a) Atmanirbhar Bharat Abhiyan
(b) Electronics Component Manufacturing Scheme
(c) India AI Mission
(d) Digital India AI Programme

Q85. As reported by Feeding India (an NGO) in June 2025, the big fat Indian wedding is quietly triggering a climate chaos by adding which of the following gases in the atmosphere?

(a) Nitrous Oxide
(b) Hydrofluorocarbons
(c) Methane
(d) Carbon Monoxide

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Q86. Which Indian naval asset participated in the defense exercise La Pérouse 2025?

(a) INS Mumbai
(b) INS Satpura
(c) INS Arihant
(d) INS Vikrant

Q87. What does the term 'Blue Washing' refer to as per the News reports in 2025?

(a) Using blue-coloured chemicals in industries
(b) The practice of portraying polluting industries as environmentally-friendly
(c) A new method for water purification
(d) Cleaning rivers to make them blue

Q88. Which new index, presented in March 2025 by the International Finance Forum, evaluates global AI competitiveness?

(a) AGILE Index
(b) Global AI Vibrancy Index
(c) AI Governance Index
(d) Global AI Competitiveness Index

Q89. In January 2025, the Reserve Bank of India (RBI) lifted restrictions on which two Non-Banking Financial Companies (NBFCs)?

(a) Asirvad Microfinance and DMI Finance
(b) DMI Finance and Muthoot Finance
(c) Arohan and Muthoot Finance
(d) Navi Finserv and Shriram Finance

Q90. Which Section of the Waqf (Amendment) Act, 2025, ensures that women are NOT excluded from Waqf property inheritance?

(a) Section 2C (2)
(b) Section 4B
(c) Section 9F
(d) Section 3A(2)

Q91. What is the primary function of Rajasthan's MadhuNetr DR-AI system launched by the state health department in 2025?

(a) A telemedicine platform for rural teleconsultations
(b) A blockchain system for managing patient records
(c) An AI tool for monitoring heart health remotely
(d) An AI system for diabetic retinopathy screening

Q92. What does PYKKA stand for in the context of sports?

(a) Panchayat Yojana Kendra for Kids Activities
(b) Public Youth Krida Kendra Abhiyan
(c) Primary Youth Khel Ka Abhiyan
(d) Panchayat Yuva Krida Aur Khel Abhiyan

Q93. Who received the Sporting Icon Award at the 2025 Laureus ceremony?

(a) Novak Djokovic
(b) Serena Williams
(c) Rafael Nadal
(d) Usain Bolt

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Q94. Which organisation planned a big safety drill called 'Operation Abhyaas' in May 2025 to help people prepare for emergencies?

(a) Defence Research and Development Organisation (DRDO)
(b) Department of Military Affairs (DMA)
(c) National Disaster Management Authority (NDMA)
(d) Defence Equipment Exporters Association (DEEA)

Q95. In which of the following places was the Round Table Discussion on improving female workforce participation in India, organised by the Ministry of Labour and Employment and the Lal Bahadur Shastri National Academy of Administration, held in March 2025?

(a) Nainital
(b) Dalhousie
(c) Mussoorie
(d) Shimla

Q96. The Indian Armed Forces participated in the multilateral Exercise ZAPAD 2025 in which country?

(a) United States
(b) China
(c) Russia
(d) United Kingdom

Q97. On 2 November 2025, the Indian Space Research Organisation (ISRO) deployed the advanced naval communication satellite GSAT-7R (CMS-03) into orbit from which launch site?

(a) Thumba Equatorial Rocket Launching Station, Thumba
(b) UR Rao Satellite Centre, Bengaluru
(c) Vikram Sarabhai Space Centre, Thiruvananthapuram
(d) Satish Dhawan Space Centre, Sriharikota

Q98. Who authored the book "Careless People: A Cautionary Tale of Power, Greed, and Lost Idealism" released in March 2025?

(a) Sheryl Sandberg
(b) Sarah Wynn-Williams
(c) Simon Sinek
(d) Boria Majumdar

Q99. Where was the All India Masters Ranking Badminton Tournament 2025 held from 22-29 January 2025?

(a) Mumbai, Maharashtra
(b) Bangalore, Karnataka
(c) Panchkula, Haryana
(d) Hyderabad, Telangana

Q100. In April 2025, under which campaign did the Reserve Bank of India launch its official WhatsApp channel to promote digital safety and literacy?

(a) RBI Kehta Hai
(b) RBI Secure
(c) RBI for All
(d) RBI Cares

ANSWER KEY

1	c	2	d	3	d	4	b	5	b	6	b	7	d	8	a	9	a	10	d
11	b	12	b	13	a	14	b	15	d	16	d	17	d	18	b	19	d	20	d
21	b	22	c	23	b	24	c	25	a	26	b	27	c	28	b	29	d	30	d
31	a	32	b	33	b	34	c	35	c	36	c	37	b	38	c	39	b	40	a

41	a	42	b	43	a	44	a	45	b	46	d	47	c	48	d	49	d	50	b
51	c	52	c	53	a	54	c	55	a	56	a	57	a	58	a	59	b	60	a
61	c	62	d	63	c	64	d	65	c	66	b	67	c	68	a	69	a	70	c
71	d	72	c	73	b	74	a	75	b	76	b	77	d	78	b	79	a	80	b
81	d	82	a	83	b	84	c	85	c	86	b	87	b	88	d	89	a	90	d
91	d	92	d	93	b	94	c	95	c	96	c	97	d	98	b	99	c	100	a

SOLUTIONS

Q1. Answer: (c) Long, cylindrical, unbranched, multinucleate cells, voluntary control

The correct answer is Long, cylindrical, unbranched, multinucleate cells, voluntary control.

Key Points

• Skeletal muscles, often referred to as striated muscles, are primarily attached to the bones and are responsible for the movement of the skeleton.

• The muscle fibers in skeletal muscles are long, cylindrical, and unbranched in structure. They are arranged in parallel bundles wrapped by connective tissue. Hence, the statement regarding their cylindrical and unbranched nature is correct.

• These muscle fibers are multinucleate, meaning they contain multiple nuclei located at the periphery of the cell, just beneath the sarcolemma (plasma membrane). This occurs because the muscle fiber is a syncytium formed by the fusion of multiple myoblasts during development. Hence, the statement describing them as multinucleate is correct.

• Skeletal muscles are under voluntary control, which means they are regulated by the Somatic Nervous System. An individual can consciously decide when to move these muscles. Hence, the statement regarding voluntary control is correct.

• When viewed under a microscope, these muscles exhibit distinct light and dark bands known as striations. These striations are caused by the highly organized arrangement of contractile proteins like actin and myosin.

Additional Information

• Smooth Muscles:

• These are non-striated muscles found in the walls of hollow internal organs like the alimentary canal, bladder, and blood vessels.

• The cells are spindle-shaped (fusiform) and contain a single central nucleus (uninucleate).

• They are under involuntary control, meaning their contraction is managed by the Autonomic Nervous System.

• Cardiac Muscles:

• These muscles are found exclusively in the heart (myocardium).

• The cells are cylindrical and branched, typically containing only one or two nuclei.

• A unique feature of cardiac muscle is the presence of intercalated discs, which act as communication junctions to synchronize heart contractions. They are involuntary in function.

• Muscle Functions:

• Skeletal muscles are vital for locomotion, maintaining body posture, and heat production (thermogenesis) through shivering.

• In humans, skeletal muscles make up approximately 40% to 50% of the total body weight.

Important Points

• The structural and functional unit of skeletal muscle contraction is the sarcomere, which is the segment between two Z-lines.

• The Sarcoplasmic Reticulum in skeletal muscles serves as a major storehouse for Calcium ions (Ca++), which are essential for muscle contraction.

• The red color of some skeletal muscles (Red Fibers) is due to a high content of myoglobin (an oxygen-storing pigment) and mitochondria, making them resistant to fatigue. Conversely, White Fibers have less myoglobin and depend on anaerobic respiration, causing them to fatigue quickly.

• Muscle fatigue is often caused by the accumulation of lactic acid due to the repeated activation of muscles under anaerobic conditions.

Q2. Answer: (d) ribosomes

The correct answer is ribosomes.

Key Points

• The Endoplasmic Reticulum (ER) is a large, dynamic structure that serves many roles in the cell, including protein synthesis, lipid metabolism, and calcium storage. It consists of a network of membranous tubules and flattened sacs called cisternae.

• The key difference between the two types of ER lies in the presence or absence of ribosomes. The Rough Endoplasmic Reticulum (RER) is studded with ribosomes on its outer cytoplasmic surface, which gives it a "rough" or granular appearance

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under an electron microscope. Hence, the presence of ribosomes is the correct distinguishing factor.

• In contrast, the Smooth Endoplasmic Reticulum (SER) lacks these ribosomes, resulting in a smooth, tubular appearance. Because it lacks ribosomes, it is not involved in protein synthesis but focuses on other metabolic processes.

• The ribosomes attached to the RER are responsible for translating mRNA into polypeptide chains, which are then folded and modified within the RER lumen. These proteins are typically destined for secretion, the cell membrane, or lysosomes.

• While mitochondria, cytosol, and centrosomes are all essential components of a eukaryotic cell, they are not the defining structural difference between the two regions of the Endoplasmic Reticulum.

Additional Information

• Rough Endoplasmic Reticulum (RER):

• Structure: It is mainly composed of flattened sacs known as cisternae. It is physically continuous with the outer nuclear membrane.

• Functions: Its primary function is the synthesis of secretory proteins (like enzymes and hormones), membrane proteins, and lysosomal proteins. It also plays a role in glycosylation, where carbohydrate groups are added to proteins.

• Location & Examples: RER is highly abundant in cells that specialize in protein secretion, such as the pancreatic acinar cells (which secrete digestive enzymes) and plasma cells (which secrete antibodies).

• Smooth Endoplasmic Reticulum (SER):

• Structure: It consists of a branching network of tubules rather than flattened sacs.

• Functions: It is the site for lipid synthesis, including phospholipids and cholesterol, and the production of steroid hormones (like testosterone and estrogen). It also performs detoxification of drugs and metabolic wastes.

• Location & Examples: SER is prominent in liver cells (hepatocytes) for detoxification and in endocrine glands for hormone production. In muscle cells, it is specialized into the sarcoplasmic reticulum for calcium ion storage.

• Ribosomes:

• These are small, dense structures made of ribosomal RNA (rRNA) and proteins. They can exist as "free" ribosomes in the cytosol or "bound" ribosomes attached to the RER.

• In eukaryotes, ribosomes are of the 80S type (composed of 60S and 40S subunits), whereas in prokaryotes, they are 70S.

Important Points

• Discovery: The ER was first observed in 1945 by Keith Porter, Albert Claude, and Ernest Fullam using electron microscopy. The term "Endoplasmic Reticulum" was coined by Porter in 1953.

• Interconnectivity: The ER membrane is part of the endomembrane system, which also includes the nuclear envelope, Golgi apparatus, lysosomes, and vesicles.

• Protein Quality Control: The RER acts as a quality control center. If proteins are misfolded, they are retained in the RER and targeted for degradation, a process known as ER-associated degradation (ERAD).

• Metabolic Variation: The ratio of RER to SER in a cell varies depending on the cell's function. For example, a cell manufacturing large amounts of fats will have more SER, while a cell producing enzymes will have more RER.

Q3. Answer: (d) At least one carbon atom

The correct answer is At least one carbon atom.

Key Points

• Organic compounds are defined as chemical substances that primarily consist of Carbon atoms covalently bonded to other elements. The presence of at least one Carbon atom is the fundamental requirement for a compound to be classified as organic.

• Statement A suggests that an organic compound always contains Silicon and Phosphorus atoms. This is inaccurate because while these elements can be present in some organic molecules (like phospholipids), they are not mandatory components for all organic substances. Hence, statement A is incorrect.

• Statement B claims that organic compounds contain Halogens and Noble Gases. This is incorrect because Noble Gases like Helium and Neon are chemically inert and do not typically form organic structures, while Halogens (Chlorine, Bromine, etc.) are only found in specific substituted compounds like Chloroform. Hence, statement B is incorrect.

• Statement C posits that Hydrogen, Oxygen, and Nitrogen are always present. While extremely common in biological molecules like Proteins and DNA, they are not universally present in every single organic molecule; for instance, Carbon Tetrachloride (CCl_4) is an organic solvent that contains no hydrogen. Hence, statement C is incorrect.

• Statement D states that an organic compound always contains at least one Carbon atom. This aligns with the chemical definition of organic chemistry as the study of Carbon-based compounds, utilizing carbon's unique ability to form stable bonds. Hence, statement D is correct.

• The versatility of Carbon allows it to form chains, rings, and complex three-dimensional structures, which serves as the basis for all known life on Earth.

Additional Information

• History of Organic Chemistry: In the early 19th century, scientists like Jöns Jacob Berzelius believed in the Vital Force Theory,

suggesting organic compounds could only be produced by living organisms.

• The Turning Point: This theory was disproved in 1828 when Friedrich Wöhler synthesized Urea (an organic compound) from Ammonium Cyanate (an inorganic precursor) in a laboratory setting.

• Diversity of Compounds: There are millions of known organic compounds, ranging from simple molecules like Methane (CH4) to complex polymers like Starch and Cellulose.

• Applications: Organic compounds are essential in various industries, including Pharmaceuticals (medicines like Aspirin), Petrochemicals (fuels like Gasoline), and Agriculture (pesticides and Urea fertilizers).

• Functional Groups: The properties of organic molecules are often determined by Functional Groups such as Hydroxyl (-OH), Carboxyl (-COOH), and Amino (-NH2) groups, which dictate their chemical reactivity.

Important Points

• Catenation: This is the unique property of Carbon (Atomic Number 6) to form long covalent bonds with other carbon atoms, leading to a vast array of structures.

• Tetravalency: Carbon has 4 valence electrons, allowing it to form four bonds with other atoms, providing the structural complexity needed for biological macromolecules like Lipids and Carbohydrates.

• Inorganic Carbon Exceptions: Not all carbon-containing molecules are organic. Common exceptions include Carbon Dioxide (CO2), Carbon Monoxide (CO), Carbonates (CO3), and Cyanides, which are classified as Inorganic Compounds due to their properties and historical classification.

• Bonding Types: Organic compounds primarily feature Covalent Bonding, where electrons are shared between atoms, unlike the Ionic Bonding typically found in many inorganic salts.

Q4. Answer: (b) Ethanol is a liquid with a pleasant smell and is miscible with water.

The correct answer is Ethanol is a liquid with a pleasant smell and is miscible with water.

Key Points

• Ethanol is a volatile liquid at room temperature with a distinct, pleasant odor and a burning taste. It is not a non-volatile solid. Hence, statement A is incorrect.

• It is completely miscible with water in all proportions due to the presence of the hydroxyl (-OH) group, which allows it to form hydrogen bonds with water molecules. Hence, statement B is correct.

• Because of its polar nature and ability to form hydrogen bonds, ethanol dissolves easily in water, making it a highly effective solvent. Hence, statement C is incorrect.

• When ethanol reacts with sodium metal, it produces sodium ethoxide and evolves hydrogen gas (H2), which can be tested with a burning splinter (pop sound). It does not produce carbon dioxide in this reaction. Hence, statement D is incorrect.

Additional Information

• Chemical Identity: Ethanol is also known as ethyl alcohol or grain alcohol. Its chemical formula is C2H5OH or CH3CH2OH. It is the second member of the homologous series of alcohols.

• Physical Properties: It has a melting point of 156 K and a boiling point of 351 K (approximately 78 degrees Celsius). It is a flammable and colorless liquid.

• Industrial Uses: It is widely used as a solvent in the manufacture of paints, varnishes, perfumes, and medicines like tincture of iodine, cough syrups, and various tonics.

• Fuel and Energy: Ethanol is used as a biofuel. In India, the Ethanol Blended Petrol (EBP) Programme aims to achieve 20% blending of ethanol in petrol (known as E20) by the year 2025-26 to reduce carbon emissions and import dependency.

• Biological Effects: While it is the active ingredient in alcoholic drinks, consumption of absolute alcohol (100% pure ethanol) can be lethal. It acts as a depressant on the central nervous system.

Important Points

• Dehydration Reaction: Heating ethanol at 443 K with an excess of concentrated sulphuric acid (H2SO4) results in the dehydration of ethanol to form ethene (C2H4). Here, the acid acts as a dehydrating agent.

• Denatured Alcohol: To prevent the misuse of industrial alcohol for drinking, it is made unfit for human consumption by adding poisonous substances like methanol or pyridine. Dyes like copper sulphate are often added to give it a blue color so that it can be identified easily; this is called denatured alcohol.

• Production Process: Large-scale production of ethanol occurs through the fermentation of sugars found in molasses (a byproduct of the sugar industry), sugarcane juice, maize, and broken rice. This process is catalyzed by enzymes like invertase and zymase found in yeast.

• Combustion: Ethanol burns in oxygen with a clear blue flame to give carbon dioxide and water, releasing a significant amount of heat and light energy.

Q5. Answer: (b) 0 m/s²

The correct answer is 0 m/s².

Key Points

• According to Newton's Second Law of Motion, the acceleration of an object is directly proportional to the net force acting upon it and inversely proportional to its mass.

• The mathematical formula for this law is F = ma, where F represents the net force in Newtons, m is the mass in kilograms, and a is the acceleration in m/s².

• In the given problem, the mass of the object is 10 kg and the net force is 0. Substituting these values into the equation: 0 = 10 kg × a.

• Solving for a gives a = 0 / 10, resulting in an acceleration of 0 m/s². Hence, the statement that the acceleration is zero is correct.

• This indicates that when the resultant force is zero, there is no change in the velocity of the object; it remains in a state of equilibrium.

Additional Information

• Newton's First Law of Motion: Often called the Law of Inertia, it was published by Sir Isaac Newton in 1687. It states that an object will remain at rest or continue to move at a constant velocity unless acted upon by an external net force.

• Inertia: This is a fundamental property of matter. The mass of an object is a quantitative measure of its inertia; a 10 kg object has more inertia than a 2 kg object and thus requires more force to achieve the same acceleration.

• Types of Equilibrium:

• Static Equilibrium: When an object is at rest and the net force is zero.

• Dynamic Equilibrium: When an object is moving at a constant speed in a straight line (constant velocity) and the net force is zero.

• Units and Measurements: In the International System of Units (SI), force is measured in Newtons (N), where 1 N = 1 kg·m/s². Acceleration is always measured in distance per time squared, commonly meters per second squared.

Important Points

• It is a common misconception that zero net force means the object is not moving. It only means the acceleration is zero; the object could be moving at a very high constant velocity.

• If the net force were 98 N (the weight of the 10 kg object on Earth), the acceleration would be 9.8 m/s², which is the acceleration due to gravity.

• The mass of 10 kg is a scalar quantity and does not change regardless of location, whereas weight is a force that changes depending on the gravitational field.

• For any object with a non-zero mass, the only way to achieve zero acceleration is to ensure the vector sum of all applied forces equals zero.

Q6. Answer: (b) remains same as before

The correct answer is remains same as before.

Key Points

• Newton's Law of Universal Gravitation states that the force of attraction between two bodies is directly proportional to the product of their masses and inversely proportional to the square of the distance between their centers.

• The mathematical formula for this force is F = G (m1 × m2) / r², where F is the gravitational force, G is the Universal Gravitational Constant, m1 and m2 are the masses, and r is the distance.

• In the given scenario, the mass of both objects is halved. Therefore, the new masses are m1/2 and m2/2. The product of the masses becomes (m1/2) × (m2/2) = (m1 × m2) / 4. This reduction tends to decrease the force by a factor of 4.

• Simultaneously, the distance (r) between the objects is also halved, making the new distance r/2. Since the force is inversely proportional to the square of the distance, the denominator becomes (r/2)² = r²/4. This reduction in distance tends to increase the force by a factor of 4.

• When we combine these changes into the formula: F' = G × [(m1 × m2) / 4] / [r²/4]. The factor of 4 in the numerator and the denominator cancels out perfectly.

• As a result, the magnitude of the gravitational force remains unchanged and stays the same as before.

Additional Information

• Universal Gravitational Constant (G): The value of G is 6.674 × 10^-11 N m²/kg². This value was experimentally determined by Henry Cavendish in 1798. It is a scalar quantity and its value remains constant throughout the universe, regardless of the medium between the masses.

• Inverse Square Law: This is a fundamental feature of gravity where the intensity of the force drops off rapidly as distance increases. For example, if the distance is tripled, the force becomes 1/9th of its original value. If the distance is doubled, the force becomes 1/4th.

• Mass vs. Weight: While mass is an intrinsic property of an object measured in kilograms (kg), weight is the gravitational force acting on that mass, measured in Newtons (N). Weight changes depending on the location (e.g., weight on the Moon is about 1/6th of that on Earth), but mass remains the same.

• Sir Isaac Newton: He formulated the laws of motion and universal gravitation in his work "Philosophiæ Naturalis Principia

Mathematica", published in 1687. These laws explained both the falling of an apple on Earth and the orbiting of planets in the solar system.

Important Points

• Acceleration due to Gravity (g): On the surface of the Earth, the average value of g is 9.8 m/s^2. This value varies with altitude (decreases as you go up), depth (decreases as you go toward the center), and latitude (maximum at the poles and minimum at the equator).

• Weak Force: Gravitational force is the weakest of the four fundamental forces of nature (the others being Electromagnetic, Strong Nuclear, and Weak Nuclear forces), but it has an infinite range and is always attractive.

• Tides: The gravitational pull of the Moon and the Sun on the Earth's oceans is the primary cause of oceanic tides. Because the Moon is much closer to Earth than the Sun, its tidal effect is about twice as strong.

• Planetary Motion: The gravitational force acts as the centripetal force required to keep planets in their elliptical orbits around the Sun, as described by Kepler's Laws.

Q7. Answer: (d) Broilers.

The correct answer is Broilers.

Key Points

• Broilers are domesticated poultry birds specifically bred and raised for meat production. They are known for their fast growth rates compared to birds kept for eggs. Hence, the statement is correct.

• These birds are usually ready for slaughter at a very young age, typically between 6 to 8 weeks, by which time they reach a weight of 1.5 to 2.5 kg.

• The nutritional requirements for broilers are distinct, requiring feed that is rich in proteins and fats to support rapid muscle development.

• High levels of Vitamin A and Vitamin K are maintained in their diet to ensure healthy growth and prevent deficiency diseases.

• Common examples of broiler breeds include the Cornish Cross, Plymouth Rock, and New Hampshire chickens.

Additional Information

• Layers: These are poultry birds raised primarily for the production of eggs. They reach sexual maturity and start laying eggs at the age of approximately 18 to 20 weeks. Their diet requires a high amount of calcium and phosphorus to ensure the formation of strong eggshells. Hence, this option is incorrect for meat production.

• Cocks: A cock or rooster is an adult male chicken. While they can be consumed for meat, in commercial poultry farming, they are predominantly used for breeding purposes to fertilize eggs. Hence, this option is incorrect as the primary term for meat-purpose birds.

• Fowls: This is a general term that refers to birds belonging to the order Galliformes, such as chickens, turkeys, and pheasants. It is a broad category encompassing both meat and egg-producing birds rather than a specific commercial type. Hence, this option is incorrect.

• Poultry Farming: This agribusiness involves the commercial rearing of domesticated birds. It serves as a vital source of animal protein and contributes significantly to the economy of countries like India, USA, and China.

Important Points

• Management Practices: Broilers require specialized housing management. During the brooding stage (the first 14 days), the temperature must be strictly controlled between 33°C to 35°C for the chicks to survive.

• Health and Hygiene: Broiler flocks are susceptible to diseases such as Ranikhet (Newcastle Disease), Coccidiosis, and Bird Flu. Regular vaccination and sanitation of the poultry farm are mandatory to prevent mass mortality.

• Economic Data: In India, the poultry sector is one of the fastest-growing segments of the agricultural sector, with a growth rate of nearly 8% to 10% per year.

• Feeding Efficiency: Modern broilers have a Feed Conversion Ratio (FCR) of approximately 1.5 to 1.9, meaning they convert 1.5 kg of feed into roughly 1 kg of body weight.

Q8. Answer: (a) Saponification

The correct answer is Saponification.

Key Points

• Saponification is a specific chemical reaction in which an ester is heated with an alkali (such as sodium hydroxide or potassium hydroxide) to produce alcohol and the sodium salt (or potassium salt) of a carboxylic acid.

• This process is effectively the alkaline hydrolysis of esters. While esters are typically formed by the reaction of an acid and an alcohol, saponification breaks them back down into these components under basic conditions.

• The resulting sodium or potassium salts of long-chain fatty acids are commonly known as soap. This is the primary function of this reaction in the industrial manufacturing of cleaning agents.

• In this reaction, sodium hydroxide (NaOH) acts as the base. For example, when ethyl ethanoate reacts with sodium hydroxide, it yields ethanol (an alcohol) and sodium ethanoate (a sodium salt of ethanoic acid).

• The general chemical formula for this process is: RCOOR' + NaOH → RCOONa + R'OH. Here, RCOOR' represents the ester, RCOONa represents the soap, and R'OH represents the alcohol.

Additional Information

• Esterification: This is the chemical process of forming an ester from the reaction between an alcohol and an organic acid (carboxylic acid) in the presence of a catalyst like concentrated sulfuric acid. It is essentially the reverse process of hydrolysis.

• Hydrogenation: This process involves the addition of hydrogen (H2) to unsaturated compounds (like alkenes or alkynes) to make them saturated. In the food industry, it is used to convert liquid vegetable oils into solid fats (like vanaspati ghee) using Nickel (Ni) or Palladium (Pd) as a catalyst.

• Acidification: This refers to the process of increasing the acid concentration in a solution or the addition of an acid to a substance to lower its pH value. It is often used in chemical analysis to precipitate certain compounds or to neutralize basic solutions.

• Esters: These are organic compounds characterized by a sweet, fruity smell. Because of this feature, they are widely used in the perfume industry, cosmetics, and as artificial flavoring agents in the food industry (e.g., isoamyl acetate has a banana scent).

Important Points

• Types of Soaps: The type of alkali used determines the property of the soap. Sodium hydroxide (NaOH) produces hard soaps (typically used in laundry), while potassium hydroxide (KOH) produces soft soaps (used in bathing and shaving creams).

• Glycerol Production: In the saponification of triglycerides (fats and oils), the alcohol produced is glycerol (glycerin), which is a valuable by-product used in pharmaceuticals and skin-care products.

• Historical Context: The process of saponification has been known since ancient times, where animal fats were boiled with wood ash (which contains potassium carbonate) to create crude cleaning substances.

• Cleansing Action: Soaps work because they have a hydrophilic (water-loving) head and a hydrophobic (water-fearing/oil-loving) tail. This unique structure allows them to emulsify oils and grease, making them easy to wash away with water.

Q9. Answer: (a) It causes the rays to meet at a point, performing a converging action

The correct answer is It causes the rays to meet at a point, performing a converging action.

Key Points

• A convex lens is also known as a converging lens because of its ability to bring parallel light rays together. It is physically characterized by being thicker at the middle and tapering towards the edges.

• When parallel rays of light (usually from an object at infinity) strike the surface of a convex lens, they undergo refraction as they pass through the medium of the lens.

• Due to the curvature of the lens surfaces, the rays are bent inward toward the principal axis. This action causes the light rays to intersect or meet at a specific point on the opposite side of the lens.

• The point where these parallel rays converge after passing through the lens is called the Principal Focus (F). The distance from the optical center of the lens to this focus point is the Focal Length (f).

• The converging nature of the lens allows it to form real images (images that can be caught on a screen) when the object is placed beyond the focal point. Hence, the statement regarding the converging action is correct.

Additional Information

• Applications and Uses: Convex lenses are widely used in optical instruments such as microscopes, telescopes, and camera lenses to focus light. In the field of medicine, they are used in spectacles to correct Hypermetropia (long-sightedness), as they help focus images correctly onto the retina.

• Image Characteristics: Depending on the position of the object, a convex lens can produce real and inverted images or virtual and erect images. A virtual image is formed only when the object is placed between the optical center (O) and the principal focus (F1).

• Power of a Lens: The degree of convergence or divergence of light rays achieved by a lens is expressed as its Power (P). The SI unit of power is Dioptre (D). For a convex lens, the power is always a positive numerical value.

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

• Comparison with Concave Lens: A concave lens is thinner at the center than at the edges. It causes parallel light rays to diverge or spread out, making them appear as if they are coming from a focal point on the same side as the object.

Important Points

• Optical Center: This is the geometric center of the lens. Any ray of light passing through the optical center does so without any deviation or displacement.

• Principal Axis: An imaginary straight line passing through the centers of curvature of the two surfaces of the lens and its optical center is called the principal axis.

• Focal Length and Curvature: The focal length of a convex lens depends on the refractive index of the material (like glass or plastic) and the radii of curvature of its surfaces. A more "bulging" lens (thicker middle) typically has a shorter focal length and greater converging power.

• Nature of Light: The refraction occurs because the speed of light changes when it moves from a rarer medium (air) to a denser

medium (glass). The specific shape of the convex lens ensures that this change in speed results in convergence.

Q10. Answer: (d) Leaf size

The correct answer is Leaf size.

Key Points

• Gregor Johann Mendel, the Father of Genetics, conducted hybridization experiments on garden pea plants (Pisum sativum) for seven years between 1856 and 1863.

• He specifically chose seven pairs of contrasting traits to study the laws of inheritance. These traits were distinct and easily observable.

• The seven traits studied by Mendel were:

• Stem height: Tall or Dwarf. Hence, Statement A is a trait Mendel studied.

• Flower position: Axial or Terminal. Hence, Statement B is a trait Mendel studied.

• Seed shape: Round or Wrinkled. Hence, Statement C is a trait Mendel studied.

• Flower color: Violet or White.

• Pod shape: Inflated or Constricted.

• Pod color: Green or Yellow.

• Seed color: Yellow or Green.

• Leaf size was not one of the characters selected by Mendel for his genetic experiments. He focused on traits that showed clear, binary differences without intermediate forms. Hence, Statement D is the correct answer as it was NOT studied.

Additional Information

• Reasons for Selecting Pea Plants: Mendel chose Pisum sativum because it is easy to grow, has a short life cycle, produces many offspring, and possesses bisexual flowers which allow for both self-pollination and cross-pollination.

• Mendel's Laws of Inheritance: Based on his observations, he proposed three fundamental laws:

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

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

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

• Terminology:

• Phenotype: The observable physical properties of an organism (e.g., Tall or Dwarf).

• Genotype: The genetic makeup of an organism (e.g., TT, Tt, or tt).

• Homozygous: Having two identical alleles for a particular gene.

• Heterozygous: Having two different alleles for a particular gene.

Important Points

• Mendel published his work, titled "Experiments on Plant Hybridization", in 1865 in the Proceedings of the Natural History Society of Brunn.

• His work remained unrecognized until 1900, when it was independently rediscovered by three scientists: Hugo de Vries (Holland), Carl Correns (Germany), and Erich von Tschermak (Austria).

• The true-breeding lines used by Mendel were those that, through continuous self-pollination, showed stable trait inheritance and expression for several generations.

• Mendel's success was largely due to his mathematical and statistical approach to biological problems, which was revolutionary for the 19th century.

Q11. Answer: (b) Sodium

The correct answer is Sodium.

Key Points

• Sodium is a chemical element with the symbol Na and the atomic number 11. Hence, this is the correct option.

• It belongs to Group 1 of the periodic table, categorized as an alkali metal, and is located in Period 3.

• As an alkali metal, Sodium has only one electron in its outermost shell (valence shell), making it highly reactive.

• Due to its extreme reactivity, especially with water and oxygen, it is never found as a free element in nature; instead, it is stored under kerosene or mineral oil to prevent accidental combustion.

• Physically, Sodium is a soft, silvery-white metal that can be easily cut with a knife at room temperature.

• The electronic configuration of Sodium is [Ne] $3s^1$ or 2, 8, 1.

Additional Information

• Magnesium:

• The atomic number of Magnesium is 12. Hence, this statement is incorrect.
• It is an alkaline earth metal located in Group 2 and Period 3 of the periodic table.
• It is a shiny grey solid and is the ninth most abundant element in the universe.
• Magnesium is widely used in structural alloys, die-casting, and as an essential mineral for human biological functions.
• Nitrogen:
• The atomic number of Nitrogen is 7. Hence, this statement is incorrect.
• It is a non-metal located in Group 15 (Pnictogens) and Period 2.
• At standard temperature and pressure, it exists as a colorless, odorless diatomic gas (N2).
• Nitrogen constitutes about 78% of Earth's atmosphere by volume and is a critical component of amino acids and DNA.
• Potassium:
• The atomic number of Potassium is 19. Hence, this statement is incorrect.
• It is an alkali metal (Group 1) located in Period 4.
• Like Sodium, it is highly reactive and stored in oil. It is essential for nerve function and muscle contraction in the human body.
• It was first isolated in 1807 by Humphry Davy through the electrolysis of caustic potash (KOH).

Important Points

• The Modern Periodic Table was organized based on atomic numbers rather than atomic masses, a breakthrough attributed to Henry Moseley in 1913.
• The atomic number represents the number of protons found in the nucleus of every atom of that element.
• Sodium (Atomic Number 11) is the sixth most abundant element in the Earth's crust and occurs in many minerals such as feldspars, sodalite, and rock salt (NaCl).
• In industrial applications, Sodium is used in the production of titanium, sodamide, and sodium cyanide.
• Sodium lamps are commonly used for street lighting because they produce an efficient yellow-orange light.
• The mass number of the most common stable isotope of Sodium is 23.

Q12. Answer: (b) Iron rod

The correct answer is Iron rod.

Key Points

• The strength of the force of attraction between particles is primarily determined by the physical state of the substance, which is categorized into solids, liquids, and gases.
• In solids, such as an Iron rod, the particles are tightly packed in a regular pattern with very minimum space between them. This proximity allows the intermolecular forces to be at their maximum strength, providing the substance with a definite shape and fixed volume.
• In liquids like Water and Alcohol, the intermolecular force of attraction is moderate. The particles have more kinetic energy and space than solids, allowing them to move past each other, which gives liquids the ability to flow and take the shape of their container.
• In gases like Oxygen gas, the particles are very far apart and possess the highest kinetic energy. The force of attraction between these particles is negligible or weakest, allowing them to expand and fill any available volume.
• Therefore, when comparing the options, the Iron rod (solid) has the strongest force, followed by Water and Alcohol (liquids), while Oxygen gas has the weakest force.

Additional Information

• Iron Rod (Solid State):
• Iron is a metallic element with the chemical symbol Fe and atomic number 26.
• The particles in Iron are held together by metallic bonds, where a "sea" of delocalized electrons surrounds positive metal ions, creating an immensely strong attraction.
• It has a very high melting point of approximately 1538°C and a boiling point of 2862°C, which reflects the significant energy required to break these strong attractive forces.
• Water and Alcohol (Liquid State):
• Water (H2O) molecules are held together by hydrogen bonding, a specific and strong type of dipole-dipole attraction, yet it is much weaker than the metallic bonds in iron.
• Alcohol (such as Ethanol, C2H5OH) also uses hydrogen bonding, but typically has a lower boiling point (around 78.37°C) compared to water (100°C), indicating slightly weaker intermolecular forces.
• Liquids are generally incompressible but do not maintain a rigid structure.
• Oxygen Gas (Gaseous State):
• Oxygen (O2) consists of diatomic molecules held together by very weak Van der Waals forces or London dispersion forces.

• It remains a gas at room temperature because the thermal energy at this temperature is much greater than the attractive forces between the molecules.

• Oxygen has a extremely low boiling point of -183°C.

Important Points

• Kinetic Theory of Matter: This theory states that all matter is made of small particles that are in constant motion. The force of attraction acts as a "glue" that keeps these particles together against the kinetic energy that tries to separate them.

• Diffusion: The rate of diffusion is inversely proportional to the force of attraction. Thus, diffusion is slowest in solids (like the Iron rod) and fastest in gases (like Oxygen).

• Cohesion: The force of attraction between particles of the same substance is called cohesion. The cohesive force in solids is much higher than in liquids and gases.

• Density: Usually, substances with stronger forces of attraction have higher density because the particles are pulled closer together into a smaller volume. Iron has a density of about 7.87 g/cm³, while liquid water is 1.0 g/cm³.

Q13. Answer: (a) Short and thick wire

The correct answer is Short and thick wire.

Key Points

• The Resistance of a conductor depends on its physical dimensions and the nature of the material. According to the laws of resistance, the resistance (R) of a wire is directly proportional to its length (L). This means a short wire will offer less resistance compared to a long wire of the same material.

• Resistance is inversely proportional to the cross-sectional area (A) of the conductor. A thick wire has a larger cross-sectional area, which allows electrons to flow more easily, thereby resulting in lower resistance.

• Combining these factors, the formula for resistance is R = ρ (L/A), where ρ (rho) is the electrical resistivity of the material. To achieve the least resistance, the numerator (L) should be as small as possible and the denominator (A) should be as large as possible.

• Therefore, a short and thick wire satisfies both conditions for minimum resistance. Hence, statement A is correct.

• Conversely, a long and thin wire would have the highest resistance because it has a greater length and a smaller area. Hence, statement C is incorrect.

Additional Information

• Electrical Resistivity (ρ):

• It is a fundamental property of a material that quantifies how strongly it resists or conducts electric current.

• The SI unit of resistivity is the Ohm-metre (Ω?m).

• Materials like Silver, Copper, and Aluminium have very low resistivity, making them excellent conductors for electrical wiring.

• Ohm's Law:

• Proposed by Georg Simon Ohm in 1827, it states that the current (I) through a conductor between two points is directly proportional to the voltage (V) across the two points, provided temperature remains constant.

• The relationship is expressed as V = IR, where R is the Resistance.

• The SI unit of resistance is the Ohm (Ω).

• Factors Affecting Resistance:

• Nature of Material: Different materials have different densities of free electrons. For example, Nichrome has higher resistance than Copper and is used in heating elements.

• Temperature: For pure metals, resistance increases with an increase in temperature because the thermal vibrations of atoms interfere with the flow of electrons.

• Dimensions: As discussed, length and thickness (diameter) are primary physical factors.

Important Points

• Applications of Low Resistance Wires: Thick copper wires are used in power transmission lines and heavy-duty appliances like air conditioners to minimize energy loss due to Joule heating (H = I²Rt).

• Applications of High Resistance Wires: Thin wires made of alloys like Tungsten are used in incandescent bulbs because their high resistance generates enough heat to produce light.

• Numerical Value Context: If the length of a wire is doubled, its resistance doubles. If the radius of a wire is doubled, the area increases fourfold, which causes the resistance to decrease to one-fourth of its original value.

• In the context of India, the Bureau of Indian Standards (BIS) sets guidelines for the gauge (thickness) and quality of wiring used in residential and industrial buildings to ensure safety and efficiency.

Q14. Answer: (b) evaporation

The correct answer is evaporation.

Key Points

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• Evaporation is defined as the phenomenon of change of a liquid into vapour at any temperature below its boiling point. Hence, option B is correct.

• Solidification is a phase transition in which a liquid turns into a solid when its temperature is lowered below its freezing point. Hence, option A is incorrect.

• Condensation is the process by which water vapour (gas) in the air is changed into liquid water; it is the crucial process that forms clouds. Hence, option C is incorrect.

• Sublimation is the transition of a substance directly from the solid state to the gas state without passing through the intermediate liquid phase. Hence, option D is incorrect.

• Evaporation is a surface phenomenon where particles from the surface of the liquid gain enough kinetic energy to break away from the forces of attraction of other particles and escape into the air as vapour.

Additional Information

• Factors Affecting Evaporation:

• Surface Area: Since evaporation is a surface phenomenon, an increase in the surface area increases the rate of evaporation. For example, spreading out wet clothes to dry.

• Temperature: With an increase in temperature, more particles get enough kinetic energy to go into the vapour state, thereby increasing the rate.

• Humidity: It is the amount of water vapour present in the air. If the humidity is high, the rate of evaporation decreases because the air can only hold a certain amount of vapour.

• Wind Speed: An increase in wind speed leads to water vapour particles moving away with the wind, which increases the rate of evaporation.

• Characteristics of Sublimation: This process is observed in substances like Naphthalene, Camphor, Ammonium Chloride, and Dry Ice (Solid Carbon Dioxide). It occurs when the vapour pressure of the solid exceeds the surrounding atmospheric pressure.

• Freezing Point and Solidification: For pure water, the freezing point is 0°C or 273.15 Kelvin at standard atmospheric pressure. During this process, heat energy is released into the surroundings.

• Condensation in Nature: It is responsible for the formation of dew, fog, and mist. It happens when the air temperature drops to its dew point.

Important Points

• Evaporation vs. Boiling: While both involve a phase change from liquid to gas, boiling is a bulk phenomenon that occurs throughout the liquid at a fixed temperature (e.g., 100°C for water), whereas evaporation occurs only at the surface and at all temperatures.

• Cooling Effect: Evaporation causes cooling. This is because the liquid particles absorb latent heat of vaporization from the surroundings to change into vapour, leaving the surroundings cooler.

• Practical Examples: We use cotton clothes in summer because cotton is a good absorber of sweat, which then evaporates and provides a cooling effect. Similarly, water kept in earthen pots (matkas) stays cool due to evaporation through small pores.

• Latent Heat: During the change of state from liquid to gas, the temperature remains constant because the heat supplied is used as latent heat to overcome the intermolecular forces.

Q15. Answer: (d) It increases

The correct answer is It increases.

Key Points

• Sound is a mechanical longitudinal wave that requires a material medium (solid, liquid, or gas) for its propagation. It cannot travel through a vacuum.

• The speed of sound depends on the density and elasticity (specifically the Bulk Modulus in fluids) of the medium through which it travels.

• In air at 20°C (room temperature), the speed of sound is approximately 343 m/s. When sound moves from air into water, its speed increases significantly to approximately 1480 m/s to 1500 m/s. Hence, the statement that the speed increases is correct.

• The primary reason for this increase is that water is much less compressible than air. While water is denser than air, its elastic properties (resistance to compression) are so much greater that the wave energy is transferred much more rapidly between molecules.

• Sound waves travel fastest in solids, followed by liquids, and slowest in gases. For example, in steel, sound can travel at speeds exceeding 5000 m/s.

Additional Information

• Factors Affecting Speed in Fluids: The speed of sound in a fluid is given by the formula $v = \sqrt{(B/\rho)}$, where B is the Bulk Modulus and ρ (rho) is the density. Since the Bulk Modulus of water is much higher than that of air, the numerator dominates, leading to a higher velocity.

• Temperature Sensitivity: In air, the speed of sound increases by about 0.6 m/s for every 1 degree Celsius increase in temperature. In seawater, factors like salinity and pressure (depth) also play a critical role in determining the exact speed.

• Applications of Sound in Water: Because sound travels so efficiently and quickly in water, it is used in SONAR (Sound Navigation and Ranging) technology to map the ocean floor and detect underwater objects like submarines or shipwrecks.

• Biological Use: Marine mammals such as whales and dolphins rely on the high speed of sound in water for echolocation and long-distance communication, which can span hundreds of kilometers across the ocean.

Important Points

• Frequency and Wavelength: When sound transitions from air to water, its frequency remains constant (as frequency depends on the source). However, because the speed increases, the wavelength must also increase to satisfy the equation $v = f\lambda$ (velocity = frequency × wavelength).

• Acoustic Impedance: The density and speed difference between air and water creates a high acoustic impedance mismatch. This is why most sound originating in the air is reflected off the surface of the water rather than entering it.

• Comparison Data:

• Speed in Air (0°C): 331 m/s

• Speed in Distilled Water (25°C): 1497 m/s

• Speed in Sea Water: 1531 m/s

• Speed in Iron/Steel: 5960 m/s

• History: The first accurate measurement of the speed of sound in water was conducted in 1826 by Jean-Daniel Colladon and Charles-François Sturm on Lake Geneva, Switzerland.

Q16. Answer: (d) Displacement

The correct answer is Displacement.

Key Points

• The area under a velocity-time (v-t) graph represents the total displacement of an object over a specific time interval. Since velocity is the rate of change of displacement, the integral of velocity with respect to time yields the net change in position.

• For an object moving with uniform velocity, the velocity-time graph is a horizontal straight line parallel to the time-axis. The area formed under this line is a rectangle, where the product of velocity (height) and time (width) gives the displacement.

• In the case of uniformly accelerated motion, the velocity-time graph is a straight line with a constant slope. The area under this curve (often a triangle or trapezium) represents the displacement during that period.

• If the velocity of the object becomes negative (moving in the opposite direction), the area falls below the time-axis. To find the net displacement, the area below the axis is subtracted from the area above the axis.

• The SI unit for the area under this graph is meters (m). This is derived because the unit of the y-axis is meters per second (m/s) and the x-axis is seconds (s); multiplying them (m/s × s) results in meters.

Additional Information

• Acceleration: The slope or gradient of a velocity-time graph represents the acceleration of the object. A steeper slope indicates a higher rate of change in velocity.

• Distance vs. Displacement: While the algebraic sum of the areas under a v-t graph gives displacement (a vector quantity), the total area (taking the absolute value of all areas) represents the total distance traveled (a scalar quantity).

• Position-Time Graph: In a position-time (s-t) graph, the slope at any given point represents the instantaneous velocity of the object. A horizontal line in this graph indicates the object is at rest (velocity is 0).

• Acceleration-Time Graph: The area under an acceleration-time (a-t) graph represents the change in velocity of the object over a specific duration.

• Equations of Motion: The relationships derived from these graphs are fundamental to Classical Mechanics and were famously organized into the three equations of motion by Sir Isaac Newton in the 17th century (specifically around 1687 in his work Principia).

Important Points

• Uniform Motion: In uniform motion, the acceleration is 0, meaning the velocity remains constant, and the displacement increases linearly with time.

• Non-Uniform Acceleration: If the acceleration is not constant, the velocity-time graph will be a curve. The area under such a curve is typically calculated using calculus (integration) to find the exact displacement value.

• Sign Convention: In physics problems, displacement is positive if the area is above the t-axis and negative if it is below. If an object returns to its starting point, the total area sum will be exactly 0.

• Visualizing Motion: Graphs are essential tools used by engineers and scientists to visualize kinematics data without needing complex numerical tables.

Q17. Answer: (d) is zero

The correct answer is is zero.

Key Points

• In physics, work is defined as the product of the force applied and the displacement of the object in the direction of that force. The mathematical formula for work done is W = F × d × cos θ, where F is the magnitude of the force, d is the magnitude of the displacement, and θ is the angle between the force vector and the displacement vector.

• When a porter carries a load on his head and moves on a horizontal road, the gravitational force on the load acts vertically downwards towards the center of the Earth.

• As the porter moves forward on the road, the displacement of the load occurs in the horizontal direction.

• The angle (θ) between the vertical gravitational force (downward) and the horizontal displacement (forward) is 90 degrees.

• Since the value of cos 90° is zero, the calculation for work done becomes W = F × d × 0 = 0. Therefore, the work done by the gravitational force on the load is zero.

Additional Information

• Work Done: It is a scalar quantity. Its SI unit is the Joule (J), which is equal to 1 Newton-meter (N·m). One Joule of work is done when a force of 1 Newton displaces an object by 1 meter.

• Positive Work: Work is considered positive when the angle (θ) between the force and displacement is between 0 and 90 degrees. For example, when an object is falling freely under gravity, the work done by gravity is positive because both force and displacement are in the same direction (θ = 0°).

• Negative Work: Work is considered negative when the angle (θ) is between 90 and 180 degrees. A common example is the frictional force, which acts in the direction opposite to the displacement (θ = 180°), resulting in negative work.

• Zero Work Conditions: Work done is zero under three specific conditions:

• When the displacement is zero (e.g., pushing a stationary wall).

• When the force applied is zero.

• When the force and displacement are perpendicular to each other (θ = 90°).

• Force Components: If the force is applied at an angle, only the component of force acting along the direction of displacement contributes to the work done. The perpendicular component does no work.

Important Points

• Work vs. Effort: In daily life, a porter might feel tired and claim to have done a lot of "work," but in scientific terms, if the force and displacement are perpendicular, the mechanical work done is zero. This distinction is crucial in Classical Mechanics.

• Centripetal Force: Another classic example of zero work is the work done by centripetal force on an object moving in a circular path. Since the force is always directed towards the center and the displacement is tangential, the angle remains 90 degrees, making the work done zero.

• Uniform Speed: In the given question, moving with uniform speed on a horizontal surface implies there is no acceleration in the horizontal direction. If we ignore friction, the net force in the horizontal direction is also zero.

• Potential Energy: Since the height of the load does not change while moving horizontally, the gravitational potential energy of the load remains constant (mgh). No work is done against gravity to increase this energy.

Q18. Answer: (b) Tube wells

The correct answer is Tube wells.

Key Points

• Tube wells are a type of water well in which a long, 100 to 200 millimeter wide, stainless steel tube or pipe is bored into an underground aquifer.

• In this method, water is tapped from deeper strata (layers) of the earth where groundwater is available in abundance. Hence, the description in the question refers to tube wells.

• To lift water from these depths, centrifugal or submersible pumps operated by electricity or diesel engines are used.

• Unlike surface wells (dug wells) which tap water from shallow strata, tube wells can reach depths of several hundred feet to ensure a continuous water supply even during dry seasons.

• This system is highly prevalent in the Indo-Gangetic plains of India, including states like Uttar Pradesh, Punjab, and Haryana, where the geological structure allows for easy boring and high groundwater discharge.

Additional Information

• Canals:

• Canals are human-made channels or artificial waterways constructed to convey water from a river or reservoir to agricultural fields.

• They usually operate on gravity flow, meaning the water moves from a higher elevation to a lower one without the need for heavy pumping from deep underground.

• In India, canal irrigation is the second most important source of irrigation, particularly effective in the North Indian plains and coastal deltas.

• River Lift System:

• The River Lift System is employed in areas where canal flow is insufficient or unavailable due to inadequate reservoir release or

irregular terrain.

• In this system, water is directly drawn from rivers using pumps to irrigate land located near the river banks.

• This method is particularly useful for small-scale irrigation and in regions where the land is higher than the river level, making gravity-based canals unfeasible.

• Rain-fed Irrigation:

• Rain-fed farming refers to agricultural practices that rely entirely on natural precipitation (rainfall) for soil moisture.

• It does not involve any artificial tapping of groundwater or diversion of surface water through pipes or pumps.

• Approximately 60% of the net sown area in India is still rain-fed, making agriculture highly vulnerable to the vagaries of the Monsoon.

Important Points

• India is the largest user of groundwater in the world, extracting more than China and the USA combined.

• The Central Ground Water Board (CGWB), established in 1970, is the apex National Organization for managing groundwater resources in India under the Ministry of Jal Shakti.

• While tube wells provide reliable irrigation, over-extraction has led to a significant decline in the water table in several states. To monitor this, the Government of India launched the Atal Bhujal Yojana in 2019 to improve groundwater management through community participation.

• The National Aquifer Mapping and Management Program (NAQUIM) aims to identify and map the aquifers at a 1:50,000 scale to help in the sustainable extraction of water via wells and tube wells.

Q19. Answer: (d) parallel to the principal axis

The correct answer is parallel to the principal axis.

Key Points

• A convex lens is also known as a converging lens because it converges the rays of light incident on it. When a ray of light passes through the principal focus of a convex lens, it undergoes refraction at both surfaces of the lens.

• According to the rules of image formation for spherical lenses, any ray of light that passes through the first principal focus (F1) will emerge parallel to the principal axis after passing through the lens. Hence, the statement is correct.

• This behavior is based on the Principle of Reversibility of light. Since a ray of light coming parallel to the principal axis passes through the principal focus after refraction, the reverse path must also be true.

• The convex lens is thicker at the middle than at the edges. This specific geometrical shape ensures that rays diverging from a single point (the focus) are bent such that they become equidistant from the principal axis.

Additional Information

• Optical Centre: The central point of a lens is called its optical centre. A ray of light passing through this point emerges without any deviation.

• Principal Axis: It is an imaginary straight line passing through the two centres of curvature of the lens. It serves as the reference line for all optical measurements.

• Focal Length: The distance between the optical centre and the principal focus is called the focal length (f). For a convex lens, the focal length is traditionally taken as positive.

• Applications: Convex lenses are widely used in optical instruments such as microscopes, telescopes, and cameras. They are also used in spectacles to correct Hypermetropia (long-sightedness), a condition where a person cannot see nearby objects clearly.

• Image Nature: Depending on the position of the object, a convex lens can form both real and inverted images or virtual and erect images (when the object is between the focus and the optical centre).

Important Points

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

• Power of Lens: The reciprocal of the focal length (in metres) is called the power (P) of the lens. The SI unit of power is Dioptre (D). For a convex lens, the power is always positive.

• Magnification: The ratio of the height of the image to the height of the object is called magnification (m). It is also expressed as m = v/u.

• Comparison with Concave Lens: Unlike a convex lens, a concave lens (diverging lens) causes a ray of light appearing to meet at the focus to emerge parallel to the principal axis, but it always forms virtual, erect, and diminished images.

Q20. Answer: (d) Dominant alleles mask recessive alleles.

The correct answer is Dominant alleles mask recessive alleles.

Key Points

• Mendel's Law of Dominance: This law states that in a heterozygous individual, one allele will conceal or mask the presence of

another allele for the same characteristic. Rather than both alleles contributing to a phenotype, the dominant allele will be expressed exclusively.

• Dominant Allele (T): A dominant allele is an allele that expresses its phenotypic effect even when inherited with a different allele (heterozygous state). In Gregor Mendel's experiments with pea plants (Pisum sativum), the allele for tallness (T) is dominant over the allele for dwarfness (t).

• Recessive Allele (t): A recessive allele is one whose expression is masked in the presence of a dominant allele. The recessive trait of dwarfness only manifests when the organism is homozygous recessive, meaning it possesses two copies of the recessive allele (tt).

• Masking Effect: When a plant has the genotype Tt, it will appear tall because the dominant allele (T) produces enough functional protein or hormone (like gibberellin) to result in a tall plant, effectively masking the dwarf (t) trait. Hence, statement D is correct.

• Expression of Traits: Recessive alleles are not "weaker" in a physical sense, nor are they "never expressed" (Option A is incorrect as they are expressed in tt). They are passed on to offspring just as frequently as dominant alleles (Option C is incorrect).

Additional Information

• Genotype vs. Phenotype: The genotype refers to the specific genetic makeup of an organism (e.g., TT, Tt, or tt), while the phenotype refers to the observable physical characteristics (e.g., Tall or Dwarf).

• Homozygous and Heterozygous: An organism is homozygous when it has two identical alleles for a gene (TT or tt). It is heterozygous when it has two different alleles (Tt).

• Monohybrid Cross: In a monohybrid cross between a pure-breeding tall plant (TT) and a pure-breeding dwarf plant (tt), the F1 generation (first filial) results in 100% tall plants with the genotype Tt.

• F2 Generation Ratio: When F1 plants (Tt) are self-pollinated, the F2 generation shows a phenotypic ratio of 3:1 (three tall plants for every one dwarf plant) and a genotypic ratio of 1:2:1 (1 TT, 2 Tt, 1 tt).

• Gregor Mendel: Known as the Father of Genetics, he conducted his landmark research on pea plants between 1856 and 1863, establishing the fundamental laws of inheritance.

Important Points

• Biological Basis: The dominant allele usually codes for a functional enzyme or protein. In the case of pea plants, the Le gene (for height) produces an enzyme that converts an inactive precursor into the active growth hormone gibberellin (GA1). The recessive allele (t) is often a mutation that results in a non-functional enzyme.

• Punnett Square: Developed by Reginald Punnett in 1905, this diagram is used to predict the probability of an offspring having a particular genotype based on the parental alleles.

• Exceptions to Dominance: While Mendelian inheritance describes complete dominance, other patterns exist, such as Incomplete Dominance (e.g., pink flowers in Mirabilis jalapa) and Codominance (e.g., ABO blood groups in humans where both A and B alleles are expressed).

• Location of Genes: Alleles are located at specific positions called loci (singular: locus) on homologous chromosomes. During meiosis, these alleles segregate, ensuring each gamete carries only one allele for each gene (Law of Segregation).

Q21. Answer: (b) 8

The correct answer is 8.

Key Points

• The Atomic Number of Oxygen is 8, which indicates that a neutral atom of oxygen contains 8 protons in its nucleus and 8 electrons orbiting the nucleus.

• The Mass Number (atomic mass) of the most common and stable isotope of Oxygen (Oxygen-16) is approximately 16.

• To find the number of neutrons, the formula used is: Number of Neutrons = Mass Number (A) - Atomic Number (Z). For Oxygen-16, this calculation is 16 - 8 = 8. Hence, the statement that oxygen has 8 neutrons is correct.

• While Oxygen has three stable isotopes, Oxygen-16 is the most abundant, making up about 99.76% of natural oxygen found on Earth.

• The electronic configuration of an Oxygen atom is $1s^2\ 2s^2\ 2p^4$, showing that it has 6 valence electrons in its outermost shell.

Additional Information

• Chemical Properties of Oxygen:

• Oxygen is a highly reactive non-metal and an oxidizing agent that readily forms oxides with most elements.

• It belongs to Group 16 (the chalcogens) and Period 2 of the Periodic Table.

• In its standard form, it is a diatomic gas with the formula O_2, which is colorless, odorless, and tasteless.

• Isotopes of Oxygen:

• Oxygen-17: Contains 8 protons and 9 neutrons, with a natural abundance of 0.038%.

• Oxygen-18: Contains 8 protons and 10 neutrons, with a natural abundance of 0.205%.

• These isotopes are often used in paleoclimatology to determine historical global temperatures and ice volume.

• Biological and Environmental Importance:

• Oxygen constitutes approximately 21% of the Earth's atmosphere by volume.

• It is essential for aerobic respiration in almost all living organisms and is produced during photosynthesis by plants and algae.

• Ozone (O_3) is an allotrope of oxygen located in the stratosphere that protects the Earth from harmful ultraviolet (UV) radiation.

Important Points

• Discovery: Oxygen was first discovered by Carl Wilhelm Scheele in 1772, but Joseph Priestley is often credited with the discovery as he published his findings first in 1774. The name "Oxygen" was coined by Antoine Lavoisier in 1777.

• Abundance: It is the third most abundant element in the universe by mass, after hydrogen and helium, and the most abundant element by mass in the Earth's crust (making up about 46.6%).

• Valency: Oxygen typically has a valency of 2, as it requires two electrons to complete its octet in the outer shell, leading to its characteristic -2 oxidation state in most compounds.

• Liquid Oxygen: At very low temperatures (below -183°C or 90 K), oxygen condenses into a pale blue liquid which is strongly paramagnetic.

Q22. Answer: (c) 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

• A Decomposition Reaction is a fundamental type of chemical reaction where a single reactant breaks down into two or more simpler products. These reactions are generally the opposite of combination reactions.

• Assertion (A) states that decomposition reactions require energy in the form of heat, light, or electricity. This is because these reactions are typically endothermic in nature, meaning they cannot proceed without an external supply of energy to initiate the process. Hence, statement A is correct.

• Reason (R) explains that energy is absorbed to break down reactant molecules into simpler products. In any chemical reaction, chemical bonds in the reactants must be broken before new bonds can form in the products. Breaking bonds always requires an input of energy (bond enthalpy). Hence, statement R is correct.

• The relationship between the two statements is direct: the reason (energy needed for bond cleavage) provides the scientific basis for why the assertion (requirement of heat, light, or electricity) is true. Without the absorption of energy, the stable molecular structure of the reactant would not dismantle into simpler forms.

• Depending on the source of energy, these reactions are categorized into Thermal Decomposition (Heat), Electrolytic Decomposition (Electricity), and Photolytic Decomposition (Light).

Additional Information

• Thermal Decomposition: This process uses heat energy to decompose substances. A classic example is the heating of Calcium Carbonate (limestone), which decomposes into Calcium Oxide (quick lime) and Carbon Dioxide gas. This reaction is widely used in the cement industry and usually requires temperatures around 1200 K.

• Electrolytic Decomposition (Electrolysis): This occurs when an electric current is passed through an aqueous solution or a molten state of a compound. For instance, the electrolysis of water (H_2O) yields Hydrogen and Oxygen gases in a volume ratio of 2:1. This is a primary industrial method for producing high-purity hydrogen.

• Photolytic Decomposition (Photolysis): This reaction is triggered by photons from solar energy or artificial light. Compounds like Silver Chloride (AgCl) turn grey in sunlight because they decompose into Silver metal and Chlorine gas. Silver Bromide (AgBr) behaves similarly and was historically essential in Black and White Photography.

• Digestion as Decomposition: In the human body, the process of digestion is a natural decomposition reaction. Complex molecules like carbohydrates, fats, and proteins are broken down into simpler substances like glucose and amino acids with the help of enzymes (biological catalysts).

• Endothermic Nature: Most decomposition reactions are endothermic because the energy required to break the bonds of the single reactant is greater than the energy released when the smaller product bonds are formed.

Important Points

• Extraction of Metals: Decomposition reactions are vital in metallurgy. Metals high in the reactivity series, such as Sodium, Aluminum, and Magnesium, are extracted from their molten chlorides or oxides through electrolytic decomposition.

• Stability of Compounds: The amount of energy required for decomposition indicates the chemical stability of a compound. Highly stable compounds require significant thermal energy or high voltage to decompose.

• Environmental Impact: The decomposition of Organic Matter by microorganisms (decomposers) is a natural recycling process that returns nutrients to the soil and releases Carbon Dioxide and Methane into the atmosphere.

• Safety and Storage: Certain chemicals, like Hydrogen Peroxide (H_2O_2), undergo spontaneous decomposition over time into Water and Oxygen. To slow this down, they are often stored in dark-colored bottles to prevent photolysis.

Q23. Answer: (b) Leucoplast

The correct answer is Leucoplast.

Key Points

• Leucoplasts are a group of plastids that are colorless because they lack pigments like chlorophyll or carotenoids.

• The primary function of leucoplasts is the storage of organic compounds such as starch, lipids (oils), and proteins. Hence, the statement regarding leucoplasts storing these granules is correct.

• They are typically found in non-photosynthetic tissues of plants, such as roots, bulbs, seeds, and tubers, where light does not reach.

• Based on the type of substance they store, leucoplasts are classified into three specialized types:

• Amyloplasts: These are responsible for the synthesis and storage of starch granules. They are abundant in storage organs like potato tubers and cereal grains.

• Elaioplasts (also known as Oleoplasts): These organelles store fats and oils. They are commonly found in seeds (like castor or sunflower) where lipids are required for germination.

• Aleuroplasts (also known as Proteinoplasts): These are specialized for the storage of proteins and are frequently found in seeds like maize or pulses.

• Unlike chloroplasts, leucoplasts do not have a complex thylakoid system, although they are enclosed by a double membrane.

Additional Information

• Chloroplasts: These are green-colored plastids containing chlorophyll. Their primary function is photosynthesis, where they convert light energy into chemical energy (glucose). They are found in the mesophyll cells of leaves and green stems. Hence, the statement that chloroplasts primarily store starch/oil granules is incorrect compared to leucoplasts.

• Chromoplasts: These are pigmented plastids that contain carotenoids (carotene and xanthophylls), giving flowers and fruits their characteristic yellow, orange, or red colors. Their function is to attract pollinators and seed dispersers. Hence, the statement that chromoplasts are the primary storage site for starch and oils is incorrect.

• Plastids: These are double-membrane bound organelles found in the cells of plants and algae. They were first discovered and named by Ernst Haeckel, but the term was later refined by A.F.W. Schimper in 1883.

• All types of plastids (chloroplasts, chromoplasts, and leucoplasts) develop from undifferentiated organelles called proplastids. Interestingly, leucoplasts can differentiate into chloroplasts if exposed to light.

• Location: While chloroplasts are in aerial parts, leucoplasts are mostly in underground parts or embryonic tissues.

Important Points

• Genetic Material: Like mitochondria, plastids are semi-autonomous organelles because they contain their own DNA and ribosomes (70S type). This allows them to replicate independently within the cell.

• Applications: Understanding Amyloplasts is crucial in agriculture and food science as they determine the starch content in staple crops. Similarly, Elaioplasts are significant in the oilseed industry for vegetable oil production.

• Starch types: The starch stored in leucoplasts consists of amylose and amylopectin. Potatoes are one of the most well-known examples of tissues packed with amyloplasts.

• Age and Development: As a fruit ripens, chloroplasts often transform into chromoplasts (e.g., a green tomato turning red), showing the dynamic nature of these organelles.

Q24. Answer: (c) Produce more heat

The correct answer is Produce more heat.

Key Points

• According to Joule’s Law of Heating, the heat produced in a conductor is directly proportional to the resistance of the conductor when the current and time of flow are constant.

• The mathematical expression for heat generated is $H = I^2Rt$, where H is the heat produced, I is the electric current, R is the electrical resistance, and t is the time duration for which the current flows.

• In the given scenario, the current (I) and length (which implies similar conditions for time or setup) are equal for both wires. Since H prop. to R, the wire with the higher resistance will generate a greater amount of thermal energy. Hence, the correct answer is Produce more heat.

• Statement A suggests the wires produce the same heat; this is incorrect because heat production depends on resistance, and the resistances are stated to be different. Hence, statement A is incorrect.

• Statement B suggests no heat is produced; this is impossible as whenever current flows through a resistor, energy is dissipated as heat due to collisions between electrons and atoms. Hence, statement B is incorrect.

• Statement D suggests the wire with higher resistance produces less heat; this contradicts Joule's Law where H is directly proportional to R. Hence, statement D is incorrect.

Additional Information

• Factors Affecting Resistance: The resistance (R) of a wire depends on its length (L), cross-sectional area (A), and the resistivity

(ρ) of the material, represented by the formula R = ρ(L/A). Even if lengths are equal, differences in material or thickness result in different resistances.

• Applications of Heating Effect: The heating effect of electric current is utilized in various household appliances such as electric irons, electric heaters, geysers, and toasters. These devices use heating elements made of materials with high resistivity and high melting points, such as Nichrome (an alloy of Nickel and Chromium).

• Electric Fuse: A safety device called an electric fuse works on the heating effect of current. It consists of a wire with a low melting point; when excessive current flows, the heat produced (I^2Rt) melts the fuse wire, breaking the circuit to prevent fire or damage.

• Energy Conversion: This phenomenon represents the conversion of electrical energy into heat energy. The standard SI unit of heat is the Joule (J), but it is often measured in calories (1 calorie = 4.184 Joules).

Important Points

• Series vs Parallel Circuits: In a series circuit, the current (I) is the same through all components, so the component with higher resistance produces more heat. However, in a parallel circuit, the voltage (V) is the same, and heat is calculated using $H = (V^2/R)t$, meaning the lower resistance wire would produce more heat.

• Tungsten in Bulbs: The filament of an incandescent light bulb is made of Tungsten because of its high resistance and an extremely high melting point of approximately 3422°C, allowing it to glow and emit light without melting.

• Power Dissipation: The rate at which heat is produced is called Electric Power (P). It is measured in Watts (W) and calculated as $P = I^2R$ or $P = VI$. In 1841, James Prescott Joule first quantified this relationship, which is why it bears his name.

Q25. Answer: (a) Regeneration

The correct answer is Regeneration.

Key Points

• Regeneration is defined as the biological process by which an organism replaces or restores lost or damaged cells, tissues, organs, and even entire body parts to full functionality. Hence, option A is correct.

• In the plant kingdom, this ability is highly developed due to totipotency, a unique characteristic where a single plant cell has the genetic potential to divide and produce all the differentiated cells of the entire organism.

• This process often involves the formation of a callus, which is an unorganized mass of parenchyma cells. These cells eventually undergo differentiation to form new roots, stems, or leaves.

• Regeneration serves as a vital survival strategy for plants, allowing them to recover from herbivory, environmental damage, or physical fragmentation.

• It is distinctly different from regular growth, as it specifically refers to the repair or replacement of structures that were previously present but subsequently removed or destroyed.

Additional Information

• Fertilisation:

• This is the process of the fusion of male gametes (sperm/pollen) with female gametes (egg/ovule) to form a diploid zygote.

• It is the fundamental step in sexual reproduction, ensuring genetic diversity through the combination of DNA from two parents.

• It does not involve the recovery of lost somatic parts but rather the creation of a new generation. Hence, option B is incorrect.

• Budding:

• A form of asexual reproduction where a new individual develops from a small anatomical projection or bud on the parent organism.

• Commonly observed in organisms like Yeast and Hydra. In plants, this is utilized in horticulture as a method of grafting.

• While it involves growth, it is a reproductive mechanism to produce offspring rather than a repair mechanism for the parent. Hence, option C is incorrect.

• Binary Fission:

• A primary method of asexual reproduction in prokaryotic organisms like bacteria and certain protozoa such as Amoeba.

• The parent cell divides into two approximately equal-sized daughter cells, each receiving a copy of the genetic material.

• This process is related to population increase in single-celled organisms and not the regrowth of specialized organs in multicellular plants. Hence, option D is incorrect.

Important Points

• Hormonal Control: The regeneration of plant parts is strictly regulated by phytohormones. Auxins are typically responsible for root initiation, while Cytokinins promote shoot formation. The balance between these two hormones determines the type of tissue regenerated.

• Historical Context: The study of regeneration was significantly advanced in 1740 by Abraham Trembley, who demonstrated that Hydra could grow back into complete individuals even after being cut into pieces.

• Types of Regeneration:

• Morphallaxis: The tissue is reorganized into a smaller but complete version of the organism without significant new growth.

• Epimorphosis: The lost part is replaced through active cell proliferation and the formation of new tissue, common in salamander limbs and plant shoots.

• Commercial Use: In agriculture and biotechnology, plant regeneration is the backbone of Tissue Culture. This allows for the production of thousands of disease-free clones from a single explant in a laboratory setting, a technique that has revolutionized food security in the 21st century.

Q26. Answer: (b) 477/125

Shortcut Trick

cot A = 3/4 => tan A = 4/3 => triangle: opposite = 4, adjacent = 3, hypotenuse = 5

sin A = 4/5, cos A = 3/5

$\sin 2A = 2 \times \sin A \times \cos A = 2 \times 4/5 \times 3/5 = 24/25$

$\cos 3A = 4\cos^3 A - 3\cos A = 4 \times (3/5)^3 - 3 \times 3/5 = 108/125 - 9/5 = -117/125$

=> 3(24/25) - (- 117/125)

=> 477/125

Therefore Answer = 477/125

Alternate Method

Given:

cot A = 3/4

Formula used:

$\sin 2A = 2\sin A \cos A$

$\cos 3A = 4\cos^3 A - 3\cos A$

A B C 3 4 5

Calculations:

=> cot A = adjacent/opposite = 3/4

=> sin A = 4/5, cos A = 3/5

=> $\sin 2A = 2 \times 4/5 \times 3/5 = 24/25$

=> $\cos 3A = 4 \times (3/5)^3 - 3 \times 3/5$

=> $= 108/125 - 9/5 = 108/125 - 225/125 = -117/125$

=> $3\sin 2A - \cos 3A = 3 \times 24/25 - (-117/125)$

=> $= 72/25 + 117/125 = 360/125 + 117/125 = 477/125$

Therefore The correct answer is 477/125.

Additional Information

sin2A Formula

$\sin 2A = 2\sin A \cos A$, useful when sinA and cosA are known.

cos3A Identity

$\cos 3A = 4\cos^3 A - 3\cos A$, commonly used in higher trig expressions.

Right Triangle Approach

Convert ratios like cot into triangle sides to easily get sin and cos.

Alternative Identity

$\cos 3A$ can also be written as $4\cos^3 A - 3\cos A$ or $1 - 4\sin^2 A \cos A$ depending on need.

Q27. Answer: (c) Increase by 10%

Shortcut Trick

Ratio of TV cost to WM cost = 100 : 90 = 10 : 9

Initial weighted value = (6 × 9) + (3 × 10) = 54 + 30 = 84 parts

Net change in parts = (54 × 55%) − (30 × 71%) = 29.7 − 21.3 = 8.4 parts

% Change = (Net change ÷ Initial value) × 100 = (8.4 ÷ 84) × 100 = 10%

Since the result is positive, it is an increase.

Therefore Answer = Increase by 10%

Alternate Method

Given:

WM cost = 10% less than TV cost. WM count = 6, TV count = 3. WM increase = 55%, TV decrease = 71%.

Formula used:

Total Cost = (Quantity1 × Price1) + (Quantity2 × Price2)

Percentage Change = [(Final Cost − Initial Cost) ÷ Initial Cost] × 100

Initial 6 WM: 540 Initial 3 TV: 300 Total: 840 New 6 WM: 837 New 3 TV: 87 New Total: 924 (Change: +84) +55% -71%

Calculations:

Let the cost of one TV = 100 units

=> Cost of one WM = 100 − 10 = 90 units

=> Initial Total Cost = (6 × 90) + (3 × 100) = 540 + 300 = 840 units

=> New WM cost = 90 + (55% of 90) = 90 + 49.5 = 139.5 units

=> New TV cost = 100 − (71% of 100) = 100 − 71 = 29 units

=> New Total Cost = (6 × 139.5) + (3 × 29) = 837 + 87 = 924 units

=> Net change in cost = 924 − 840 = 84 units

=> Percentage Change = (84 ÷ 840) × 100 = 10%

Therefore The correct answer is Increase by 10%, which is option (3).

Q28. Answer: (b) 12

Shortcut Trick

Apply BODMAS rule hierarchy: (Bracket) → (Division & Multiplication left-to-right) → (Addition).

Part 1: 3 × 2 = 6.

Part 2: 12 ÷ (6 − 2) × 2 = 12 ÷ 4 × 2 = 3 × 2 = 6.

Final Addition: 6 + 6 = 12.

Therefore Answer = 12

Alternate Method

Given:

Expression: 3 × 2 + 12 ÷ (6 − 2) × 2

Formula used:

BODMAS Rule: B (Brackets), O (Of), D (Division), M (Multiplication), A (Addition), S (Subtraction). Division and Multiplication are performed from left to right based on their appearance.

Term 1: 3 × 2 = 6 Term 2: 12 ÷ 4 × 2 = 6 Final Result: 6 + 6 = 12

Calculations:

=> 3 × 2 + 12 ÷ (6 − 2) × 2

=> 3 × 2 + 12 ÷ 4 × 2 (Solving Bracket)

=> 6 + 3 × 2 (Solving Division and first Multiplication)

=> 6 + 6 (Solving second Multiplication)

=> 12

Therefore The correct answer is 12 (Option 2).

Q29. Answer: (d) 60°

Angle formed by external bisectors intersection: angle X = 90° − angle M / 2

=> 75° = 90° − angle M / 2

=> angle M / 2 = 90° − 75° = 15°

=> angle M = 30° => 2 × angle M = 60°

Therefore Answer = 60°

Given:

In triangle MNR, sides MN and MR are extended to P and Q. Bisectors of exterior angles angle PNR and angle QRN meet at X. Angle angle X = 75°.

Formula used:

Angle at intersection of external bisectors = 90° − (Internal opposite angle / 2)

M N R P Q X = 75° angle X = 90° − angle M/2

Calculations:

angle X = 90° − angle M/2

=> 75° = 90° − angle M/2

=> angle M/2 = 90° − 75°

=> angle M/2 = 15°

=> angle M = 15° × 2 = 30°

=> 2angle M = 2 × 30° = 60°

Therefore The correct answer is 60°. (Option 4)

Q30. Answer: (d) 2

Shortcut Trick

Filling rate = 1/6, Emptying rate = 1/24

Net rate = 1/6 − 1/24 = 1/8

Time for full tank = 8 min

Time for 1/4 tank = 8 × 1/4 = 2 min

Therefore Answer = 2 minutes

Alternate Method

Given:

Pipe A fills tank in 6 min

Pipe B empties tank in 24 min

Formula used:

Total Work = LCM of 6 and 24 = 24 units

Efficiency = Work ÷ Time

Fill Empty Tank 3/4 1/4 filled Time = 2 min

Calculations:

=> Total work = 24 units

=> Pipe A = 4 units/min, Pipe B = 1 unit/min (emptying)

=> Net work = 4 − 1 = 3 units/min

=> Work for 1/4 tank = 6 units

=> Time = 6 ÷ 3 = 2 minutes

Therefore The correct answer is 2 minutes.

Additional Information

Pipes and Cisterns Rule

Filling is positive work, emptying is negative work.

Net Efficiency

Net rate = Sum of filling rates − emptying rates.

LCM Trick

Take LCM to avoid fractions and simplify calculations.

Fraction Work

Time = (Required work) ÷ (Net efficiency).

Q31. Answer: (a) Rs. 13,500

Shortcut Trick

Total Interest Rate % = Rate × Time (in years)

Total Interest Rate % = 8% × (27/12) = 18%

Simple Interest = 18% of 75,000

Simple Interest = 18 × 750 = 13,500

Therefore Answer = Rs. 13,500

Alternate Method

Given:

Principal (P) = Rs. 75,000

Rate (R) = 8% per annum

Time (T) = 27 months

Formula used:

Simple Interest (SI) = (P × R × T) / 100

Simple Interest Timeline Month 0 Month 27 P = Rs. 75,000 R = 8% p.a. Total Interest = Rs. 13,500

Calculations:

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=> Time (T) = 27 / 12 years
=> T = 9 / 4 = 2.25 years
=> SI = (75,000 × 8 × 2.25) / 100
=> SI = 750 × 8 × 2.25
=> SI = 750 × 18
=> SI = 13,500
Therefore The correct answer is (1).

Q32. Answer: (b) 72 km/hr

Shortcut Trick
Average speed for two equal halves = 2v1v2 / (v1 + v2)
Average Speed = (2 × 84 × 63) / (84 + 63)
Average Speed = 10584 / 147 = 72 km/hr
Therefore Answer = 72 km/hr
Alternate Method
Given:
Speed of the first half (v1) = 84 km/hr
Speed of the second half (v2) = 63 km/hr
Distance 1 = Distance 2 = Half of total distance
Formula used:
Average Speed = Total Distance ÷ Total Time
Point A Mid-Point B Point C 84 km/hr 63 km/hr Distance = d Distance = d Total Distance = 2d
Calculations:
=> Let each half of the distance be the LCM of 84 and 63 = 252 km
=> Total Distance = 252 × 2 = 504 km
=> Time for the first half = 252 ÷ 84 = 3 hours
=> Time for the second half = 252 ÷ 63 = 4 hours
=> Total Time taken = 3 + 4 = 7 hours
=> Average Speed = 504 ÷ 7 = 72 km/hr
Therefore The correct answer is 72 km/hr (2).

Q33. Answer: (b) 71% gain

Shortcut Trick
Net Profit % = x + y + (xy / 100)
Here, Markup (x) = +80 and Discount (y) = −5
Net Profit % = 80 − 5 + [80 × (−5) / 100]
Net Profit % = 75 − 400/100 = 75 − 4 = 71%
Therefore Answer = 71% gain
Alternate Method
Given:
Markup % = 80%, Discount % = 5%
Formula used:
MP = CP × (100 + Markup %)/100; SP = MP × (100 − Discount %)/100; Profit % = (SP − CP)/CP × 100
CP = 100 MP = 180 SP = 171 Markup +80% −5% Discount Net Profit = 71%
Calculations:
=> Let Cost Price (CP) = 100 units
=> Marked Price (MP) = 100 + 80% of 100 = 180 units
=> Discount = 5% of 180 = (5 × 180) / 100 = 9 units
=> Selling Price (SP) = MP − Discount = 180 − 9 = 171 units
=> Profit = SP − CP = 171 − 100 = 71 units
=> Profit % = (71 / 100) × 100 = 71%
Therefore The correct answer is (2).

Q34. Answer: (c) 2

Shortcut Trick

Divisibility rule for 8: Last three digits of the number must be divisible by 8.

In 73318x4, the last three digits are 8x4.

Test digits for x: 804 ÷ 8 (Rem = 4), 814 ÷ 8 (Rem = 6), 824 ÷ 8 (Rem = 0).

Smallest value of x that satisfies the condition is 2.

Therefore Answer = 2

Alternate Method

Given:

Number = 73318x4

Condition = Divisible by 8

Formula used:

A number is divisible by 2^n if its last n digits are divisible by 2^n. For 8 (2^3), the last 3 digits must be divisible by 8.

7 3 3 1 8 x 4 Check Divisibility by 8 Number: 73318x4

Calculations:

To be divisible by 8, last three digits 8x4 must be divisible by 8.

=> 8x4 = 800 + 10x + 4

=> Since 800 is already divisible by 8, we only need to check (10x + 4).

=> If x = 0, 10(0) + 4 = 4 (Not divisible by 8)

=> If x = 1, 10(1) + 4 = 14 (Not divisible by 8)

=> If x = 2, 10(2) + 4 = 24 (Divisible by 8, as 24 = 8 × 3)

Therefore The correct answer is (3) 2.

Q35. Answer: (c) 81

Shortcut Trick

Required Number = HCF of (1058 − 5) and (1550 − 11) = HCF(1053, 1539).

Both numbers are odd, so eliminate even options 86 and 88.

Calculate difference: 1539 − 1053 = 486.

The HCF must be a factor of the difference; 81 × 6 = 486.

Testing 81: 1053 ÷ 81 = 13 and 1539 ÷ 81 = 19 (both integers).

Therefore Answer = 81

Alternate Method

Given:

First number = 1058, Remainder1 = 5

Second number = 1550, Remainder2 = 11

Formula used:

Largest number dividing N1 and N2 leaving remainders R1 and R2 = HCF(N1 − R1, N2 − R2)

1053 (Multiple of 81) 81 81 ... 13 times 1539 (Multiple of 81) 81 81 ... 19 times Common Divisor (HCF) = 81

Calculations:

=> First number for HCF = 1058 − 5 = 1053

=> Second number for HCF = 1550 − 11 = 1539

=> Applying Long Division for HCF:

=> 1539 = 1 × 1053 + 486

=> 1053 = 2 × 486 + 81

=> 486 = 6 × 81 + 0

=> The last divisor that gives remainder 0 is the HCF.

=> HCF(1053, 1539) = 81

Therefore The correct answer is 81.

Q36. Answer: (c) 20%

Ratio CP : SP = 3200 : 3840

Simplified ratio = 320 : 384 = 5 : 6

Profit = 6 − 5 = 1 unit on base 5
Profit Fraction = 1 ÷ 5 = 0.2
in percentage 20%
Therefore Answer = 20%
Given:
Cost Price (CP) = Rs. 3,200
Selling Price (SP) = Rs. 3,840
Formula used:
Profit = SP − CP
Profit % = (Profit ÷ CP) × 100
CP = Rs. 3,200 Profit = Rs. 640 Total SP = Rs. 3,840 Profit % = (640/3200) = 0.2
Calculations:
Profit = 3840 − 3200
=> Profit = 640
=> Profit % = (640 ÷ 3200) × 100
=> Profit % = (1 ÷ 5) × 100 = 20%
Therefore The correct answer is 20% (Option 3).

Q37. Answer: (b) 221

Shortcut Trick
Ratio CP : MP = (100 − Discount%) : (100 + Profit%)
CP : MP = (100 − 15) : (100 + 5) = 85 : 105
Simplifying the ratio: CP : MP = 17 : 21
Given MP = 21 units = 273 → 1 unit = 273 ÷ 21 = 13
CP = 17 units = 17 × 13 = 221
Therefore Answer = 221
Alternate Method
Given:
Marked Price (MP) = Rs. 273, Discount = 15%, Profit = 5%
Formula used:
CP/MP = (100 − Discount%) / (100 + Profit%)
CP SP MP Profit +5% Discount −15% Rs. 273 CP = Rs. 221
Calculations:
=> CP / 273 = (100 − 15) / (100 + 5)
=> CP / 273 = 85 / 105
=> CP = 273 × (85 / 105)
=> CP = 273 × (17 / 21)
=> CP = 13 × 17
=> CP = 221
Therefore The correct answer is 221. (Option 2)

Q38. Answer: (c) 5280

Shortcut Trick
Divide sides by 2 to check for triplets: 146/2 = 73, 96/2 = 48, 110/2 = 55.
Since $48^2 + 55^2 = 2304 + 3025 = 5329 = 73^2$, it is a right-angled triangle.
Area = 1/2 × base × height = 1/2 × 96 × 110.
Area = 48 × 110 = 5280 cm^2.
Therefore Answer = 5280
Given:
Sides of the triangle: a = 146 cm, b = 96 cm, c = 110 cm
Formula used:
Heron's Formula: Area = √[s(s − a)(s − b)(s − c)], where s = (a + b + c) / 2

Base (b) = 96 cm Height (c) = 110 cm Hypotenuse (a) = 146 cm Area = 1/2 × 96 × 110

Calculations:

Calculate semi-perimeter (s):

=> s = (146 + 96 + 110) / 2 = 352 / 2 = 176 cm

Apply Heron's formula:

=> Area = √[176 × (176 − 146) × (176 − 96) × (176 − 110)]

=> Area = √[176 × 30 × 80 × 66]

=> Area = √[(11 × 16) × (3 × 10) × (8 × 10) × (6 × 11)]

=> Area = √[$11^2 \times 10^2 \times 16 \times (3 \times 8 \times 6)$]

=> Area = √[$11^2 \times 10^2 \times 16 \times 144$]

=> Area = 11 × 10 × 4 × 12

=> Area = 110 × 48 = 5280 cm^2

Therefore The correct answer is 5280, which is option (3).

Q39. Answer: (b) 6 years

Shortcut Trick

The age difference (5 years) remains constant forever.

Ratio after 4 years (Ron : Aaron) = 2 : 1.

Difference in ratio = 2 − 1 = 1 unit = 5 years.

Ron age in 4 years = 2 units = 2 × 5 = 10 years.

Ron present age = 10 − 4 = 6 years.

Therefore Answer = 6 years

Alternate Method

Given:

Age difference between Ron and Aaron = 5 years

Age relation 4 years later: Ron = 2 × Aaron

Formula used:

Age after n years = Present Age + n

Ron Present: R Aaron Present: R−5 +4 years Ron Future: R+4 Aaron: R−1 Equation: (R+4) = 2 × (R−1)

Calculations:

Let the present age of Ron be R.

Since Aaron is 5 years younger, Aaron present age = R − 5.

Age after 4 years:

=> Ron = R + 4

=> Aaron = (R − 5) + 4 = R − 1

According to the problem, Ron will be twice Aaron age after 4 years:

=> R + 4 = 2 × (R − 1)

=> R + 4 = 2R − 2

=> 4 + 2 = 2R − R

=> R = 6

Therefore The correct answer is 6 years, which is option (2).

Q40. Answer: (a) 45 minutes

Shortcut Trick

Speed ratio (Usual : New) = 4 : 3

Time ratio (Usual : New) = 3 : 4 [Since Time prop. to 1/Speed]

Difference in time ratio = 4 − 3 = 1 unit

Given 1 unit = 15 minutes, then Usual time = 3 units = 3 × 15 = 45 minutes

Therefore Answer = 45 minutes

Alternate Method

Given:

New Speed = 3/4 of Usual Speed

Time Delay = 15 minutes
Formula used:
Distance = Speed × Time (For constant Distance, Speed1 × Time1 = Speed2 × Time2)
Home Office Usual Case: Speed S, Time T Late Case: Speed 3/4S, Time T + 15
Calculations:
Let the usual speed be S and usual time be T.
=> New Speed = 3/4 S and New Time = T + 15
=> S × T = (3/4)S × (T + 15)
=> T = 3/4 (T + 15)
=> 4T = 3T + 45
=> 4T − 3T = 45
=> T = 45 minutes
Therefore The correct answer is 45 minutes (Option 1).

Q41. Answer: (a) 2√39

Shortcut Trick
Given α + β = 14 and αβ = 20.
Use Algebraic identity: $\alpha^2 + \beta^2 = (\alpha + \beta)^2 - 2\alpha\beta$.
Substitute values: $\alpha^2 + \beta^2 = 14^2 - 2(20) = 196 - 40 = 156$.
Required value = (156)^(1/2) = √156 = √(4 × 39) = 2√39.
Therefore Answer = 2√39
Alternate Method
Given:
Sum of terms (α + β) = 14
Product of terms (αβ) = 20
Formula used:
$(a + b)^2 = a^2 + b^2 + 2ab$
2αβ $\alpha^2 + \beta^2$ 40 156 Total Area = $(\alpha + \beta)^2$ = 196 Result: $(\alpha^2 + \beta^2)^{(1/2)}$ = √156 = 2√39
Calculations:
=> $(\alpha + \beta)^2 = \alpha^2 + \beta^2 + 2\alpha\beta$
=> $14^2 = \alpha^2 + \beta^2 + 2(20)$
=> $196 = \alpha^2 + \beta^2 + 40$
=> $\alpha^2 + \beta^2 = 196 - 40$
=> $\alpha^2 + \beta^2 = 156$
=> $(\alpha^2 + \beta^2)^{(1/2)} = (156)^{(1/2)} = \sqrt{156}$
=> √(4 × 39) = 2√39
Therefore The correct answer is 2√39 (Option 1).

Q42. Answer: (b) 1200

Shortcut Trick
Savings = 60% → Expenditure = 100% − 60% = 40%
Unitary Method: 40% → 480
1% → 480 ÷ 40 = 12
Income (100%) → 12 × 100 = 1200
Therefore Answer = 1200
Alternate Method
Given:
Savings percentage = 60%
Expenditure amount = Rs. 480
Formula used:
Income = Expenditure + Savings
Expenditure % = 100% − Savings %

Total Income (100%) Expenditure (40%) = Rs. 480 Savings (60%) Income = 480 ÷ 0.4 = Rs. 1200
Calculations:
Let the total income be Rs. I.
=> Expenditure % = 100% − 60% = 40%
=> 40% of I = 480
=> (40 ÷ 100) × I = 480
=> I = (480 × 100) ÷ 40
=> I = 12 × 100 = 1200
Therefore The correct answer is 1200 (Option 2).

Q43. Answer: (a) 73.3

Shortcut Trick
Assume base average = 54.
Deviation for 47 students = 93 − 54 = +39.
Total deviation = 47 × 39 = 1833.
Net average increase = 1833 ÷ 95 ≈ 19.3.
Total Average = 54 + 19.3 = 73.3.
Therefore Answer = 73.3
Alternate Method
Given:
Total students in class = 95
Number of students in first group (n1) = 47, Average score (A1) = 93
Number of students in second group (n2) = 95 − 47 = 48, Average score (A2) = 54
Formula used:
Weighted Average = (n1 × A1 + n2 × A2) ÷ (n1 + n2)
48 Students (n2) 47 Students (n1) Avg: 54 Avg: 93 Total Average = 73.3
Calculations:
Sum of scores of 47 students = 47 × 93 = 4371
=> Sum of scores of 48 students = 48 × 54 = 2592
=> Total sum of scores = 4371 + 2592 = 6963
=> Average score of whole class = 6963 ÷ 95
=> Average score ≈ 73.2947
=> Average score (rounded to 1 decimal place) = 73.3
Therefore The correct answer is 73.3 (Option 1).

Q44. Answer: (a) 18

Shortcut Trick
Third proportional (x) = $b^2 \div a$
Here a = 50 and b = 30
x = (30 × 30) ÷ 50
x = 900 ÷ 50
x = 18
Therefore Answer = 18
Alternate Method
Given:
First term (a) = 50
Second term (b) = 30
Third proportional = x
Formula used:
If a, b, and x are in continued proportion, then a : b = b : x
50 Term a 30 Term b x Third Prop Ratio Relationship: 50 : 30 = 30 : x
Calculations:

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The numbers 50, 30, and x are in continued proportion.
=> 50 ÷ 30 = 30 ÷ x
=> 5 ÷ 3 = 30 ÷ x
=> 5 × x = 30 × 3
=> 5x = 90
=> x = 90 ÷ 5
=> x = 18
Therefore The correct answer is 18 (Option 1).

Q45. Answer: (b) 45.3

Shortcut Trick
Aditya full work time = 13 × 6 = 78 days
Bhagawan full work time = 12 × 9 = 108 days
Combined time = (A × B) / (A + B) = (78 × 108) / (78 + 108)
Combined time = 8424 / 186 = 45.2903...
Therefore Answer = 45.3
Alternate Method
Given:
Aditya completes 1/6 work in 13 days.
Bhagawan completes 1/9 work in 12 days.
Formula used:
Total days to complete work = Total work / Combined efficiency
Aditya (A): 78 days Bhagawan (B): 108 days Combined Work (A + B) Total Work = LCM(78, 108) = 1404
Calculations:
Total time for Aditya = 13 × 6 = 78 days
=> Total time for Bhagawan = 12 × 9 = 108 days
=> Let Total Work = LCM(78, 108) = 1404 units
=> Efficiency of Aditya = 1404 ÷ 78 = 18 units/day
=> Efficiency of Bhagawan = 1404 ÷ 108 = 13 units/day
=> Total Efficiency = 18 + 13 = 31 units/day
=> Combined Time = 1404 ÷ 31 = 45.2903... days
=> Rounded to one decimal place = 45.3 days
Therefore The correct answer is 45.3 (Option 2).

Q46. Answer: (d) 51.25%

Shortcut Trick
Net percentage change formula = a + b + (a × b / 100)
For two successive decreases, a = −35 and b = −25
Net change = −35 − 25 + (−35 × −25 / 100)
Net change = −60 + 8.75 = −51.25%
Overall decrease = 51.25%
Therefore Answer = 51.25
Alternate Method
Given:
First decrease = 35%
Second decrease = 25%
Formula used:
Final Value = Initial Value × (1 − d1/100) × (1 − d2/100)
Original Value (100%) −35% −16.25% Final Value = 48.75% Total Decrease = 35% + 16.25% = 51.25% Net Change = 0.5125
Calculations:
Assume the original number is 100.
=> After 1^(st) decrease of 35%: 100 − (35% of 100) = 65

=> After 2^(nd) decrease of 25%: 65 − (25% of 65) = 65 − 16.25
=> Final remaining number = 48.75
=> Total decrease amount = 100 − 48.75 = 51.25
=> Percentage decrease = (51.25 / 100) × 100 = 51.25%
Therefore The correct answer is option (4).

Q47. Answer: (c) 10

Shortcut Trick
Identify the value that appears the maximum number of times in the data.
Scores: 17, 2, 7, 27, 25, 5, 14, 18, 10, 24, 10, 8, 7, 10
Number 10 repeats 3 times (Highest frequency).
Number 7 repeats 2 times.
All other numbers appear only once.
Therefore Answer = 10
Alternate Method
Given:
Data set: 17, 2, 7, 27, 25, 5, 14, 18, 10, 24, 10, 8, 7, 10
Formula used:
Mode = Value with the highest frequency in the distribution.
2 5 7 8 10 14+ Freq: 3 Freq: 2 Frequency Distribution
Calculations:
Arrange the scores in ascending order to count frequencies easily:
=> 2, 5, 7, 7, 8, 10, 10, 10, 14, 17, 18, 24, 25, 27
=> Frequency of 2 = 1
=> Frequency of 5 = 1
=> Frequency of 7 = 2
=> Frequency of 8 = 1
=> Frequency of 10 = 3
=> Frequency of 14, 17, 18, 24, 25, 27 = 1 each
=> Since 10 appears the most number of times (3 times), the mode is 10.
Therefore The correct answer is 10 (Option 3).

Q48. Answer: (d) 11

Shortcut Trick
Perform the reverse operations on the result in reverse order.
Step 1: Subtract the increase (29 − 7 = 22)
Step 2: Divide by the doubling factor (22 ÷ 2 = 11)
Therefore Answer = 11
Alternate Method
Given:
Final result = 29
Operations: Number is doubled (2 × x) and increased by 7 (+7)
Formula used:
Equation: (2 × x) + 7 = 29
Initial (x) 2x + 7 29 ×2 then +7 Value: x = 11
Calculations:
Let the required number be x.
=> 2x + 7 = 29
=> 2x = 29 − 7
=> 2x = 22
=> x = 22 ÷ 2
=> x = 11

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Therefore The correct answer is 11. Option (4).

Q49. Answer: (d) 20 : 60 : 45 : 63

Shortcut Trick

Use the column multiplication method for compound ratios:

A = 1 × 4 × 5 = 20

B = 3 × 4 × 5 = 60

C = 3 × 3 × 5 = 45

D = 3 × 3 × 7 = 63

Therefore Answer = 20 : 60 : 45 : 63

Alternate Method

Given:

A : B = 1 : 3, B : C = 4 : 3, C : D = 5 : 7

Formula used:

To combine ratios X : Y and Y : Z, multiply terms to make the common variable Y equal.

A 20 B 60 C 45 D 63 Combined Ratio = 20 : 60 : 45 : 63

Calculations:

=> A : B = 1 : 3 and B : C = 4 : 3

=> Equating B: Multiply (A : B) by 4 and (B : C) by 3

=> A : B = 4 : 12, B : C = 12 : 9 → A : B : C = 4 : 12 : 9

=> Now, A : B : C = 4 : 12 : 9 and C : D = 5 : 7

=> Equating C: Multiply (A : B : C) by 5 and (C : D) by 9

=> A : B : C = 20 : 60 : 45, C : D = 45 : 63

=> A : B : C : D = 20 : 60 : 45 : 63

Therefore The correct answer is Option (4).

Q50. Answer: (b) 164 m

Shortcut Trick

Shortcut formula for path area inside: 2w(L + B − 2w) = Area

2w(50 + 40 − 2w) = 344 => w(90 − 2w) = 172

By inspection, w = 2 satisfies the equation: 2 × (90 − 4) = 172

Inner perimeter = 2 × (L + B − 4w) = 2 × (50 + 40 − 8)

Inner perimeter = 2 × 82 = 164 m

Therefore Answer = 164 m

Alternate Method

Given:

Outer length (L) = 50 m, Outer width (W) = 40 m, Area of path = 344 m²

Formula used:

Area of rectangle = Length × Width

Perimeter of rectangle = 2 × (Length + Width)

Outer Length = 50 m Outer Width = 40 m Inner Garden w Path Area = 344 m²

Calculations:

=> Area of outer garden = 50 × 40 = 2000 m²

=> Area of inner garden = Total Area − Path Area = 2000 − 344 = 1656 m²

=> Let uniform width of path be x. Inner length = (50 − 2x) and Inner width = (40 − 2x)

=> Area of inner garden = (50 − 2x)(40 − 2x) = 1656

=> 2000 − 100x − 80x + 4x² = 1656 => 4x² − 180x + 344 = 0

=> Dividing by 4: x² − 45x + 86 = 0 => (x − 2)(x − 43) = 0

=> Width x = 2 m (since width x < 20 m)

=> Inner dimensions: Length = 50 − 2(2) = 46 m; Width = 40 − 2(2) = 36 m

=> Perimeter of inner rectangle = 2 × (46 + 36) = 2 × 82 = 164 m

Therefore The correct answer is 164 m. (Option 2)

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Q51. Answer: (c) JQV

The position and positional values or English Alphabets are:

Given: VMN SNP POR MPT ?

The logic followed here is:

Thus, JQV should come in place of the question mark (?) in the given series based on the English alphabetical order.

Hence, the correct answer is "Option 3".

Q52. Answer: (c) 73

The logic followed here is:

Position of Ayush from the top = 28th

Position of Ayush from the bottom = 46th

So,

Total number of students = (Position from the top + Position from the bottom) - 1

= 28 + 46 - 1

= 74 - 1 = 73.

Hence, the correct answer is "Option 3".

Q53. Answer: (a) OMM

The position and positional values or English Alphabets are:

The pattern followed here is:

Each letter-cluster follows the pattern -3, +1.

Let's check each option:

1. OMM

This letter-cluster does not follows the pattern -3, +1.

2. XUV

This letter-cluster follows the pattern -3, +1.

3. TQR

This letter-cluster follows the pattern -3, +1.

4. LIJ

This letter-cluster follows the pattern -3, +1.

Thus, OMM is the odd one out.

Hence, the correct answer is "Option 1".

Q54. Answer: (c) Only conclusion (I) follows.

Statements:

All hotels are restaurants.

All restaurants are cafes.

Some restaurants are kitchens.

The least possible Venn diagram for the given statement is:

Conclusions:

(I) Some cafes are kitchens. - Follow (Because, All restaurants are cafes and Some restaurants are kitchens, which means Some cafes are kitchens.)

(II) Some hotels are kitchens. - Does not follow (There is no definite relation between hotels and kitchens, it can be possible but it is not definite.)

Thus, Only conclusion (I) follows.

Hence, the correct answer is "Option 3".

Q55. Answer: (a) Wife's father's sister

Family Chart:

Decoding the Symbols:

A is				
Symbol	•	@	•	#

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Meaning	sister	brother	wife	father
to B				

Given: O + P @ T # G - V

It means: O is the sister of P, P is the brother of T, T is the father of G, G is the wife of V.

Thus, O is V's Wife's father's sister.

Hence, the correct answer is "Option 1".

Q56. Answer: (a) North-east

Given:

Town M is to the east of Town N.

Town O is to the south of Town M.

Town P is to the west of Town O.

Town Q is to the north of Town P.

Town N is to the north-west of Town Q

North South West East Town N Town M Town O Town P Town Q North-East

So, the location of Town M with respect to Town Q is North-east.

Hence, the correct answer is "Option 1".

Q57. Answer: (a) YRJZ

The position and positional values or English Alphabets are:

Given: SDVT is related to WIAX in a certain way based on the English alphabetical order. In the same way, IXPJ is related to MCUN.

The logic followed here is:

Similarly,

Thus, UMEV is related to YRJZ, following the same logic.

Hence, the correct answer is "Option 1".

Q58. Answer: (a) Both conclusions (I) and (II) follow

Statements:

All patties are cake.

All cakes are samosa.

The least possible Venn diagram for the given statement is:

Conclusions:

(I): Some samosas are cake. - Follow (Because, All cakes are samosa, which means Some samosas are cake.)

(II): All patties are samosa. Follow (Because, All patties are cake and All cakes are samosa, which means all patties being cakes are samosas too.)

Thus, Both conclusions (I) and (II) follow.

Hence, the correct answer is "Option 1".

Q59. Answer: (b) Two

Given: M, N, O, P, W, X and Y are sitting around a circular table facing the centre of the table.

1. O sits to the immediate right of P.

2. Only three people sit between O and Y when counted from the left of O.

3. Only three people sit between P and N when counted from the left of P.

4. W sits to the immediate right of M.

X, the only person left will occupy the vacant position.

Thus, two people sit between X and M when counted from the left of M.

Hence, the correct answer is "Option 3".

Q60. Answer: (a) QBB 83

The position and positional values or English Alphabets are:

Given: ELN 55, HPK 62, KTH 69, NXE 76, ?

The logic followed here is:

Thus, QBB83 will replace the question mark (?) in the given series to make it logically complete.

Hence, the correct answer is "Option 1".

Q61. Answer: (c) 26

BODMAS Rule:

Given equation: 67 – 13 ÷ 104 × 26 + 93 = ?

Now, if '+' and '−' are interchanged and '×' and '÷' are interchanged, then the equation becomes:

=> 67 + 13 × 104 ÷ 26 − 93 = ?

=> 67 + 13 × 4 − 93 = ?

=> 67 + 52 − 93 = ?

=> 119 − 93 = ?

=> 26 = ?

Hence, the correct answer is "Option 3".

Q62. Answer: (d) 177

The logic followed here is:

Thus, the missing term in the series is 177.

Hence, the correct answer is "Option 4".

Q63. Answer: (c) D

Given: C, D, E, G, H, I and J are sitting around a circular table facing the centre of the table.

1. C sits third to the left of J.
2. D sits to the immediate right of J.
3. D sits second to the left of E.
4. I is not an immediate neighbor of C.
5. Only two people sit between E and G when counted from the left of G.

Thus, I sits between D and E.

H, the only person left will occupy the vacant position.

Thus, D sits third to the right of H.

Hence, the correct answer is "Option 3".

Q64. Answer: (d) VQLG

The position and positional values or English Alphabets are:

Given: VQLG is related to ZUPK in a certain way based on the English alphabetical order. In the same way, UPKF is related to YTOJ.

The logic followed here is:

Similarly,

Thus, RMHC is related to VQLG, following the same logic.

Hence, the correct answer is "Option 4".

Q65. Answer: (c) 37

The logic followed here is:

Position of Pritika from the top = 12th

Position of Pritika from the bottom = 26th

So,

Total number of students = (Position from the top + Position from the bottom) - 1

= 12 + 26 - 1

= 38 - 1 = 37.

Hence, the correct answer is "Option 3".

Q66. Answer: (b) ID-GL

The position and positional values or English Alphabets are:

The pattern followed here is:

Each letter-cluster pair follows the pattern -2, +7.

Let's check each option:

1. LG-JN

This letter-cluster pair follows the pattern -2, +7.

2. ID -GL

This letter-cluster pair does not follow the pattern -2, +7.

3. RM-PT

This letter-cluster pair follows the pattern -2, +7.

4. OJ-MQ

This letter-cluster pair follows the pattern -2, +7.

Thus, ID-GL is the odd one out.

Hence, the correct answer is "Option 2".

Q67. Answer: (c) at

Given: In a certain code language, ‘morning sun rises’ is coded as ‘at bp kj’ and ‘rises every day’ is coded as ‘lm at wv’.

Thus, ‘rises’ is coded as 'at' in that language.

Hence, the correct answer is "Option 3".

Q68. Answer: (a) Two

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

Now,

Odd numbers, each of which is immediately preceded by an odd number and also immediately followed by an even number.

So, the needed pattern is: Odd — Odd — Even

Thus, there are two odd numbers, each of which is immediately preceded by an odd number and also immediately followed by an even number.

Hence, the correct answer is "Option 1".

Q69. Answer: (a) 976

The logic followed here is:

Thus, the missing term in the series is 976.

Hence, the correct answer is "Option 1".

Q70. Answer: (c) 2036

The logic followed here is:

Thus, the missing term in the series is 2036.

Hence, the correct answer is "Option 3".

Q71. Answer: (d) 3

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

Now,

Even numbers, each of which is immediately preceded by an odd number and also immediately followed by an odd number.

So, the needed pattern is: Odd — Even — Odd

Thus, there are 3 even numbers, each of which is immediately preceded by an odd number and also immediately followed by an odd number.

Hence, the correct answer is "Option 4".

Q72. Answer: (c) ns

Given: In a certain language, 'basket is green' is coded as 'ns tu nm' and 'the green planet' is coded as 'ti ns fd'.

Thus, 'green' is coded as 'ns' in that language.

Hence, the correct answer is "Option 3".

Q73. Answer: (b) 3

Given: (Left) 3 % * 2 @ & 5 1 @ 6 7 1 6 # # £ 8 8 # $ £ € (Right)

Now,

Numbers, each of which is immediately preceded by a number and also immediately followed by a symbol.

So, the needed pattern is: Number — Number — Symbol

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Thus, there are 3 such numbers, each of which is immediately preceded by a number and also immediately followed by a symbol.

Hence, the correct answer is "Option 2".

Q74. Answer: (a) Three

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

Now,

Even digits, each of which is immediately preceded by an even digit and also immediately followed by an even digit.

So, the needed pattern is: Even — Even — Even

Thus, there are three even digits, each of which is immediately preceded by an even digit and also immediately followed by an even digit.

Hence, the correct answer is "Option 1".

Q75. Answer: (b) REST - ESRT - TSER

The logic followed here is:

INFO - NFIO - OFNI

OATH - ATOH - HTAO

Now, let's check each option:

1. PLAY - LPAY - YLAP

This group of triads does not follow the same logic.

2. REST - ESRT - TSER

This group of triads follows the same logic.

3. ALSO - ASLO - OSLA

This group of triads does not follow the same logic.

4. TINS - INTS - INST

This group of triads does not follow the same logic.

Thus, REST - ESRT - TSER is the one which follows the same logic.

Hence, the correct answer is "Option 2".

Q76. Answer: (b) 7 km towards west

Given:

Dhanya starts from Point A and drives 9 km South.

Turns left and drives 11 km (East), then turns left and drives 2 km (North).

Turns left and drives 4 km (West), then takes a final right turn and drives 7 km (North) to reach Point P.

North South West East Point A 9 km 11 km 2 km 4 km 7 km Point P (7 km to reach A)

Calculating vertical position: Total South = 9 km. Total North = 2 km + 7 km = 9 km. Therefore, Point P is on the same horizontal level as Point A.

Calculating horizontal position: East = 11 km. West = 4 km. Net distance from A = $11 - 4 = 7$ km East.

To reach Point A from Point P, she must drive 7 km towards the West.

Hence, the correct answer is "Option 2".

Q77. Answer: (d) (32, 16, 2)

The logic followed here is:

Logic: (a, b, c) → b × c = a

(24, 12, 2) → 12 × 2 = 24

(70, 5, 14) → 5 × 14 = 70

Let's check each option:

1. (19, 5, 45) → 5 × 45 = 225 ≠ 19

2. (60, 6, 12) → 6 × 12 = 72 ≠ 60

3. (13, 39, 3) → 39 × 3 = 117 ≠ 13

4. (32, 16, 2) → 16 × 2 = 32

Thus, (32, 16, 2) is the set in which the numbers are related in the same way as the given sets.

Hence, the correct answer is "Option 4".

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Q78. Answer: (b) 979

BODMAS Rule:

Given equation: 141 ÷ 8 + 384 × 2 − 43 = ?

Now, if '+' and '−' are interchanged and '×' and '÷' are interchanged, then the equation becomes:

=> 141 × 8 − 384 ÷ 2 + 43 = ?

=> 141 × 8 − 192 + 43 = ?

=> 1128 − 192 + 43 = ?

=> 1171 - 192 = ?

=> 979 = ?

Hence, the correct answer is "Option 2".

Q79. Answer: (a) OP

Given: Six people, L, M, N, O, P and Q, are sitting in a straight line facing towards north.

1. N is sitting at the leftmost end of the row.
2. Only 3 people are sitting between N and Q.
3. L is sitting second right to P.
4. M is sitting second right to L.

O, the only person left will occupy the vacant position.

Let's check each option:

1. OP → No one is sitting between O and P.
2. LM → One person is sitting between L and M.
3. PL → One person is sitting between P and L.
4. NO → One person is sitting between N and O.

Thus, OP is the odd one out.

Hence, the correct answer is "Option 1".

Q80. Answer: (b) 731

BODMAS Rule:

Decoding the given information:

Symbol	•	•	×	÷
Meaning	•	×	÷	•

Given equation: 221 − 5 ÷ 47 + 842 × 2 = ?

Now replacing the sign from left to right using BODMAS Rule, we get:

=> 221 × 5 + 47 − 842 ÷ 2 = ?

=> 221 × 5 + 47 − 421 = ?

=> 1105 + 47 − 421 = ?

=> 1152 − 421 = ?

=> 731 = ?

Hence, the correct answer is "Option 2".

Q81. Answer: (d) To assess and enhance regional preparedness for cyclones and floods

The correct answer is A - 2, B - 1, C - 4, D - 3.

Key Points

• National Nutrition Plan (National Nutrition Mission): This scheme was launched during the financial year 2001-02. It was designed to provide free foodgrains to under-nourished groups, specifically targeting pregnant women, lactating mothers, and adolescent girls who belong to the Below Poverty Line (BPL) category. The primary objective was to address the high prevalence of malnutrition and anemia in India. Hence, the match A - 2 is correct.

• Swajal Dhara Yojana: Launched on December 25, 2002 (falling in the 2002-03 cycle), by the then Prime Minister Atal Bihari Vajpayee, this scheme aimed to provide clean drinking water to all rural areas. It followed a demand-driven and community-led approach where the villagers were responsible for the operation and maintenance of the water systems. Hence, the match B - 1 is correct.

• Hariyali Project: This watershed development project was officially launched in January 2003. The function of this project was to enable Panchayati Raj Institutions (PRIs) to execute watershed development programmes effectively. It consolidated existing

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initiatives like the Desert Development Programme (DDP) and Drought Prone Areas Programme (DPAP) to promote rainwater harvesting and irrigation. Hence, the match C - 4 is correct.

• Universal Health Insurance Plan (UHIS): This scheme was introduced in the Union Budget of 2003-04 to cater to the health security needs of BPL families. It provided reimbursement of medical expenses up to Rs. 30,000 for hospitalization and even included a personal accident cover. It was implemented through four public sector general insurance companies to improve healthcare accessibility. Hence, the match D - 3 is correct.

Additional Information

• Watershed Management in India: The Hariyali Project emphasized water conservation and sustainable land use. By involving Gram Panchayats, the government aimed to decentralize the management of natural resources. This project laid the foundation for the later Integrated Watershed Management Programme (IWMP), which eventually became a part of the Pradhan Mantri Krishi Sinchayee Yojana (PMKSY).

• Evolution of Nutrition Schemes: The National Nutrition Plan of 2001 has evolved significantly over the years. In 2018, the government launched POSHAN Abhiyaan (Prime Minister's Overarching Scheme for Holistic Nourishment) with a target to reduce stunting, under-nutrition, and low birth weight by 2% per annum.

• Rural Water Supply Transformation: Swajal Dhara Yojana marked a shift from the government acting as a service provider to becoming a facilitator. This philosophy is now reflected in the Jal Jeevan Mission (JJM), launched in 2019, which aims to provide Functional Household Tap Connections (FHTC) to every rural home by 2024.

• Social Security Nets: The Universal Health Insurance Scheme was one of the early attempts to create a social safety net for the unorganized sector. It paved the way for more comprehensive schemes like the Rashtriya Swasthya Bima Yojana (RSBY) and the current Ayushman Bharat - PMJAY, which provides a cover of Rs. 5 lakh per family per year.

Important Points

• Financial Contribution of Swajaldhara: Under this policy, the Union Government bore 90% of the total capital cost, while the local community or the villagers had to contribute the remaining 10%. This was intended to instill a sense of ownership and accountability among the users.

• Administrative Framework of Hariyali: The Gram Sabha was empowered to monitor the progress of the watershed works, while the Zila Parishads and Panchayat Samitis acted as the nodal agencies for fund disbursement and technical guidance.

• Beneficiary Coverage of UHIS: The Universal Health Insurance Scheme offered a premium subsidy to BPL families. For an individual, the subsidy was Rs. 200, for a family of five members, it was Rs. 300, and for a family of seven members, it was Rs. 400 per annum.

• Implementation Agencies: While Hariyali and Swajal Dhara were managed by the Ministry of Rural Development, the National Nutrition Plan was under the Ministry of Women and Child Development, showing a multi-sectoral approach to poverty alleviation in the early 2000s.

Q82. Answer: (a) Group

The correct answer is Group.

Key Points

• The letter ‘G’ in the term G20 stands for Group. Therefore, G20 refers to the Group of Twenty, which is a premier forum for international economic cooperation.

• The G20 is composed of 19 sovereign countries, the European Union (EU), and the African Union (AU). It plays a critical role in shaping and strengthening global architecture and governance on all major international economic issues.

• The Digital Economy Working Group (DEWG) is one of the specialized tracks under the Sherpa Track of the G20. The second meeting of this group in 2025 was hosted by South Africa, focusing on digital public infrastructure, artificial intelligence, and digital inclusion.

• South Africa officially assumed the G20 Presidency on December 1, 2024, succeeding Brazil. It is the first African nation to hold the presidency of this elite Group.

• The G20 members represent around 85% of the global GDP, over 75% of the global trade, and about two-thirds of the world population.

Additional Information

• History and Evolution: The G20 was founded in 1999 after the Asian financial crisis as a forum for Finance Ministers and Central Bank Governors to discuss global economic and financial issues. It was upgraded to the level of Heads of State/Government in the wake of the 2008 global financial crisis.

• Member Countries: The members include Argentina, Australia, Brazil, Canada, China, France, Germany, India, Indonesia, Italy, Japan, Republic of Korea, Mexico, Russia, Saudi Arabia, South Africa, Türkiye, the United Kingdom, and the United States.

• The African Union (AU): In a historic move during the 18th G20 Summit held in New Delhi, India, in September 2023, the African Union was admitted as a permanent member of the Group, significantly enhancing the representation of developing economies.

• Working Structure: The G20 operates through two parallel tracks: the Finance Track and the Sherpa Track. The Sherpa Track focuses on non-financial issues such as agriculture, culture, digital economy, and health, while the Finance Track is led by Finance Ministers and Central Bank Governors.

• Presidency and Troika: The G20 Presidency rotates annually. The Troika consists of the previous, current, and incoming presidencies to ensure continuity. For the year 2025, the Troika included Brazil, South Africa, and the United States.

Important Points

• 2025 Theme: Under South Africa's leadership, the theme for the 2025 G20 Summit was "Fostering Solidarity, Equality and Sustainable Development," emphasizing the need to address global inequality and promote inclusive growth.

• Location and Dates: The second Digital Economy Working Group meeting took place in South Africa during the first half of 2025, serving as a preparatory step for the final Leaders' Summit held in Johannesburg/Pretoria.

• Functions of DEWG: The Digital Economy Working Group (formerly the Digital Economy Task Force) was established in 2017 under the German Presidency to address the challenges and opportunities of digitalization for economic growth.

• Global Impact: Because the G20 is a Group of the world's largest economies, its decisions on taxation, climate change, and trade have a profound impact on global policy and international law.

Q83. Answer: (b) Josh Hoey

The correct answer is Will Sumner.

Key Points

• Will Sumner delivered a historic performance in February 2025 at the Millrose Games, which is held annually at the Armory in New York City.

• He set a new American indoor record in the 800 meters by clocking a remarkable time of 1:43.90. Hence, statement A is correct.

• This feat broke the previous American record of 1:44.42, which was established by Bryce Hoppel in February 2024 at the same venue. Hence, statement C refers to the former record holder.

• Sumner's time of 1:43.90 makes him the first American to dip under the 1:44 barrier in an indoor 800m race, solidifying his position as a world-class middle-distance athlete.

• During the race, he maintained a high pace throughout the four laps of the 200-meter banked track, showcasing exceptional aerobic capacity and sprint finish.

• He represents Georgia Elite and previously gained fame as a standout collegiate athlete at the University of Georgia, where he won NCAA titles.

Additional Information

• Millrose Games:

• The Millrose Games is the world's most prestigious indoor track and field meet, first held in 1908.

• It moved from Madison Square Garden to The Armory in Upper Manhattan in 2012 to utilize the faster mondo track surface.

• It is a featured stop on the World Athletics Indoor Tour Gold, attracting Olympic and World Champions.

• 800 Meters Discipline:

• The 800m is a middle-distance running event that consists of two laps on a standard 400m outdoor track or four laps on a 200m indoor track.

• It is often described as a "controlled sprint" because it requires a combination of speed, endurance, and tactical awareness.

• Bryce Hoppel:

• He is a veteran American runner and the 2024 World Indoor Champion in the 800m.

• Before Will Sumner's run in 2025, Hoppel held the national record and remains one of the most decorated 800m runners in U.S. history.

• Josh Hoey and Cooper Lutkenhaus:

• Josh Hoey is another elite American middle-distance runner who has consistently competed at the highest domestic level.

• Cooper Lutkenhaus is a rising high school star who broke the National High School indoor 800m record with a time of 1:46.67 in 2025, showing the depth of American talent.

Important Points

• World Indoor Record: The overall World Indoor Record for the men's 800m is 1:42.67, set by Wilson Kipketer of Denmark in March 1997 in Paris.

• Significance of 1:43.90: In the context of indoor athletics, running sub-1:44 is extremely rare due to the tighter turns of the 200m track compared to an outdoor track.

• Location: The New York City Armory is known as "The Fastest Track in the World" due to the numerous national and world records broken on its surface.

• Date: The 117th Millrose Games took place on February 8, 2025, serving as a key qualifying event for the World Indoor Championships.

Q84. Answer: (c) India AI Mission

The correct answer is IndiaAI Mission.

Key Points

• The IndiaAI Mission was approved by the Union Cabinet in March 2024 with a comprehensive financial outlay of Rs. 10,371.92 crore. This mission is a landmark initiative designed to catalyze India's AI ecosystem by providing critical infrastructure and support for innovation.

• One of the primary pillars of this mission is the IndiaAI Compute Capacity, which aims to establish a high-end GPU (Graphics Processing Unit) based compute infrastructure. The Ministry of Electronics and Information Technology (MeitY) recently highlighted that the 'common compute capacity' in India has crossed the threshold of 34,000 GPUs, which is a significant milestone for indigenous AI foundation-model development.

• The mission operates on a Public-Private Partnership (PPP) model. It seeks to provide AI startups, researchers, and government agencies with subsidized access to high-performance computing resources, reducing the cost of training large AI models.

• The initiative is aimed at building Sovereign AI capabilities for India. This ensures that the nation has control over its data and the underlying technology used for critical sectors like healthcare, agriculture, and governance.

• Under the IndiaAI Mission, the government intends to procure or facilitate the availability of at least 10,000 GPUs specifically for the public segment, while the broader ecosystem (including private players) is expected to scale significantly beyond that, as reflected in the 34,000 GPUs milestone.

Additional Information

• Components of IndiaAI Mission:

• IndiaAI Innovation Centre: This focuses on the development and deployment of indigenous Large Multimodal Models (LMMs) and domain-specific foundational models.

• IndiaAI Datasets Platform: It aims to streamline access to non-personal data for India-based AI researchers and startups, ensuring high-quality data is available for model training.

• IndiaAI FutureSkills: This component focuses on human capital by increasing AI literacy and advanced skills among the youth, targeting the creation of a specialized workforce in the AI domain.

• Sovereign AI and GPU Significance:

• Sovereign AI refers to a country's ability to produce AI using its own infrastructure, data, workforce, and business networks.

• GPUs are specialized electronic circuits designed to accelerate the creation of images and are now the gold standard for processing AI algorithms due to their parallel processing capabilities. High GPU counts directly correlate with a nation's ability to train complex AI models rapidly.

• AIRAWAT Supercomputer:

• India's AI supercomputer, AIRAWAT, is located at C-DAC, Pune. In 2023, it was ranked 75th in the world on the TOP500 Global Supercomputing list, showcasing India's existing prowess in high-performance computing.

Important Points

• Implementation Agency: The IndiaAI Mission is implemented through the IndiaAI Independent Business Division (IBD) under the Digital India Corporation (DIC).

• Strategic Goal: By achieving a capacity of over 34,000 GPUs, India aims to become a "Global Hub for AI," ensuring that AI technology is developed and deployed ethically and inclusively.

• Funding Allocation: The Rs. 10,372 crore budget is spread across several years, with a significant portion dedicated to compute infrastructure, followed by startup financing through the IndiaAI Startup Bridge.

• Ecosystem Growth: As of 2024, India has one of the fastest-growing AI talent pools globally, and the IndiaAI Mission provides the necessary hardware backbone to prevent "brain drain" and keep innovation within the country.

Q85. Answer: (c) Methane

The correct answer is Methane.

Key Points

• According to the report released by Feeding India in June 2025, the "big fat Indian wedding" industry is a significant contributor to environmental degradation through massive food waste. When large quantities of unconsumed food are discarded, they eventually reach landfills.

• In these landfills, the food waste undergoes anaerobic decomposition (breaking down without oxygen), which leads to the significant emission of Methane (CH_4). This gas is a highly potent greenhouse gas that traps heat in the atmosphere. Hence, the statement regarding Methane is correct.

• The data suggests that approximately 10% to 20% of the food prepared for large weddings in India goes to waste. This translates to thousands of tonnes of organic waste being generated during the peak wedding months of November, December, and January.

• Feeding India, a non-profit organization initiated by Zomato, highlighted that this "climate chaos" is often overlooked compared to industrial emissions, yet the Methane released from such events significantly accelerates global warming.

• The report emphasizes that Methane has a Global Warming Potential (GWP) that is significantly higher than Carbon Dioxide over a short-term period, making wedding waste a critical climate issue.

Additional Information

• Feeding India:

• It was founded in 2014 and later became a part of Zomato to tackle the dual problem of hunger and food waste in India.

• The organization operates in over 100 cities and utilizes a network of volunteers to collect surplus food from weddings and corporate events to feed the underprivileged.

• Characteristics of Methane (CH4):

• Methane is a colorless, odorless gas and is the primary component of natural gas.

• It is 25 to 28 times more effective at trapping heat than Carbon Dioxide (CO2) over a 100-year period, according to the Intergovernmental Panel on Climate Change (IPCC).

• Major sources include agriculture (enteric fermentation in livestock), landfills, and fossil fuel extraction.

• Waste Management Rules in India:

• The Solid Waste Management Rules, 2016 mandate the segregation of waste at source into dry, wet, and hazardous categories.

• Under these rules, bulk waste generators like wedding halls and hotels are responsible for processing their biodegradable waste on-site through composting or biomethanation.

• Environmental Impact of Other Gases:

• Nitrous Oxide (N2O): Primarily released from agricultural soil management and synthetic fertilizers; it is 300 times more potent than CO2.

• Hydrofluorocarbons (HFCs): Used in air conditioning and refrigeration systems often found in wedding venues; they have a very high global warming potential.

• Carbon Monoxide (CO): A byproduct of incomplete combustion, often found in vehicular emissions around crowded event locations.

Important Points

• Scale of the Problem: India hosts approximately 10 million weddings every year. The cumulative impact of food waste from these events creates a substantial ecological footprint.

• Global Commitments: India is a signatory to various international climate agreements. Managing short-lived climate pollutants like Methane is crucial for meeting the targets set under the Paris Agreement.

• Technological Solutions: The use of Bio-digesters in large venues can convert organic waste into biogas, which can be used as a clean fuel, thereby preventing the release of Methane into the atmosphere.

• Social Awareness: Campaigns like "Stop Food Waste" and initiatives by the FSSAI (Food Safety and Standards Authority of India) aim to sensitize citizens about the environmental and economic costs of food wastage.

Q86. Answer: (b) INS Satpura

The correct answer is INS Satpura.

Key Points

• INS Satpura is an indigenously designed and built Shivalik-class guided-missile stealth frigate of the Indian Navy. It is known for its frequent participation in high-profile international maritime exercises, including La Pérouse.

• The exercise La Pérouse is a multilateral maritime drill led by the French Navy (Marine Nationale). It typically involves the participation of the QUAD nations, which includes India, the United States of America, Japan, and Australia.

• The participation of INS Satpura in the 2025 edition (projected in strategic maritime calendars) and previous editions like 2021 aims to enhance interoperability, maritime domain awareness, and tactical coordination among friendly foreign navies in the Indo-Pacific region.

• This naval asset was constructed at the Mazagon Dock Shipbuilders Limited (MDL) located in Mumbai and was officially commissioned into the Indian Navy on 20 August 2011.

• As a multi-role frigate, INS Satpura is equipped with a versatile array of weapons and sensors, enabling it to perform anti-air, anti-surface, and anti-submarine warfare operations effectively during complex naval drills.

Additional Information

• Exercise La Pérouse Origins: The exercise is named after the 18th-century French naval explorer Jean-François de Galaup, comte de Lapérouse. It serves as a platform for partner navies to demonstrate shared values in maintaining a Free and Open Indo-Pacific.

• Technical Specifications: INS Satpura has a displacement of approximately 6,200 tonnes and a length of 143 meters. It features advanced stealth technology that reduces its radar, infra-red, and magnetic signatures, making it difficult for enemy sensors to detect.

• Weapon Systems: The ship is armed with BrahMos supersonic cruise missiles, Shtil-1 medium-range surface-to-air missiles, and Club-N anti-ship missiles. It also features a 76mm Super Rapid Gun Mount (SRGM) for surface and aerial threats.

• Aviation Capabilities: To extend its surveillance and strike range, INS Satpura can carry two HAL Dhruv or Westland Sea King helicopters. These are utilized for Search and Rescue (SAR) and Anti-Submarine Warfare (ASW).

• Operational Base: The ship is a part of the Eastern Fleet of the Indian Navy and is based at Visakhapatnam, Andhra Pradesh. This strategic location allows it to maintain a persistent presence in the Bay of Bengal and the wider Indian Ocean Region (IOR).

Important Points

• Multilateral Diplomacy: Participation in La Pérouse 2025 highlights India's growing role as a Net Security Provider in the region. It showcases the capability of the Indian Navy to operate seamlessly with technologically advanced navies like the US Navy and the French Navy.

• Evolution of Participation: While INS Satpura participated in 2021, other Indian vessels such as INS Sahyadri and the fleet tanker INS Jyoti took part in the 2023 edition, demonstrating the Indian Navy's diverse asset deployment strategy.

• Focus Areas: The exercise focuses on advanced maritime maneuvers including surface warfare, anti-air warfare, visit board search and seizure (VBSS) operations, and cross-deck helicopter flights.

• Strategic Impact: Such exercises strengthen the Security and Growth for All in the Region (SAGAR) initiative promoted by the Government of India, fostering a rules-based international maritime order.

Q87. Answer: (b) The practice of portraying polluting industries as environmentally-friendly

The correct answer is The practice of portraying polluting industries as environmentally-friendly.

Key Points

• Bluewashing is a deceptive marketing practice where companies overstate their commitment to social responsibility or water sustainability to distract from their actual impact. Hence, Option B is correct.

• The term originates from the blue color of the United Nations (UN) flag, specifically referring to companies that join the UN Global Compact to use its reputation as a shield for poor practices.

• In recent 2024-2025 news reports, the term has expanded to include "Blue Economy" claims, where industries like deep-sea mining or industrial fishing falsely portray themselves as ocean-friendly.

• The primary feature of Bluewashing is the use of humanitarian or marine conservation rhetoric to mask labor violations, water pollution, or lack of ethical governance.

• Unlike Greenwashing, which focuses on overall climate and carbon emissions, Bluewashing specifically targets social justice and aquatic ecosystems.

Additional Information

• The United Nations Global Compact:

• Launched in the year 2000, it is the world's largest voluntary corporate citizenship initiative.

• It encourages businesses to adopt ten principles covering human rights, labor standards, and anti-corruption.

• Bluewashing occurs when a member organization signs these principles for publicity but fails to implement substantive changes.

• Related Terminology:

• Greenwashing: The practice of making misleading claims about the environmental benefits of a product, service, or technology.

• Pinkwashing: Using LGBTQ+ rights or breast cancer awareness branding to promote a company without meaningful financial or systemic support.

• Social Washing: A broader category where companies hide their poor social records behind charitable donations or marketing campaigns.

• Regulatory Landscape in 2025:

• Global bodies such as the European Union and the US SEC are implementing stricter ESG disclosure norms to curb Bluewashing.

• In India, the Securities and Exchange Board of India (SEBI) introduced the Business Responsibility and Sustainability Report (BRSR) to ensure transparency in corporate claims.

Important Points

• Significance of "Blue": The term "Blue" signifies two major pillars: the United Nations Global Compact (social) and Sustainable Development Goal 14 (SDG 14), which focuses on Life Below Water.

• Common Applications: Bluewashing is frequently observed in the shipping industry, textile manufacturing (due to water waste), and offshore oil drilling companies.

• Consequences: Companies found guilty of misleading consumers face legal penalties, loss of investor trust, and significant reputational damage.

• Distinction from Option A, C, and D: Bluewashing is a socio-economic concept rather than a chemical process (Option A), a purification method (Option C), or a physical cleaning task (Option D). These options are incorrect as they interpret the term literally rather than in its corporate ethics context.

Q88. Answer: (d) Global AI Competitiveness Index

The correct answer is Pradhan Mantri Shram Yogi Maan-Dhan Yojana.

Key Points

• The Pradhan Mantri Shram Yogi Maan-Dhan (PM-SYM) is a central sector scheme designed to provide social security and old age protection specifically for unorganized workers.

• The scheme was officially launched on 5 March 2019 by Prime Minister Narendra Modi at Vastral, Gujarat. It targets the massive workforce in the informal sector, which accounts for nearly 42 crore workers in India.

• It was first announced during the Interim Budget 2019-20, which was presented in the Parliament by the then Union Minister for Finance, Shri Piyush Goyal, on 1 February 2019.

• The eligibility criteria for the scheme mandate that the beneficiary must be an unorganized worker within the entry age group of 18 to 40 years.

• Subscribers must have a monthly income of Rs. 15,000 or less and should not be covered under other social security frameworks like EPFO, ESIC, or the National Pension System (NPS), nor should they be income taxpayers.

• The scheme is implemented through the Life Insurance Corporation (LIC) of India, which acts as the Fund Manager and is responsible for the pension pay-out.

Additional Information

• Ayushman Bharat - Pradhan Mantri Jan Arogya Yojana (AB-PMJAY):

• This is the world's largest health assurance scheme, launched in September 2018 to provide a health cover of Rs. 5 lakhs per family per year.

• It focuses on secondary and tertiary care hospitalization for the bottom 40% of the Indian population, covering over 12 crore vulnerable families.

• Pradhan Mantri Suraksha Bima Yojana (PMSBY):

• Launched on 9 May 2015, this is an accident insurance scheme available to people in the age group of 18 to 70 years.

• It provides a cover of Rs. 2 lakh for accidental death or total disability and Rs. 1 lakh for partial disability at a very low annual premium, which was recently revised to Rs. 20.

• Pradhan Mantri Jeevan Jyoti Bima Yojana (PMJJBY):

• This is a one-year life insurance scheme, renewable from year to year, offering coverage for death due to any reason.

• It is available to individuals in the age group of 18 to 50 years having a bank account. The annual premium is Rs. 436 for a life cover of Rs. 2 lakh.

• Atal Pension Yojana (APY):

• Another pension scheme launched in 2015, primarily targeting the unorganized sector, where the pension amount varies from Rs. 1,000 to Rs. 5,000 based on the contribution and age of joining.

Important Points

• Pension Benefit: Under PM-SYM, after attaining the age of 60 years, the beneficiary is entitled to receive a minimum assured monthly pension of Rs. 3,000.

• Matching Contribution: It is a voluntary and contributory scheme where the Government of India makes a 50% matching contribution. For instance, if a worker contributes Rs. 100, the Central Government also deposits Rs. 100 into the pension account.

• Family Pension: During the receipt of the pension, if the subscriber dies, the spouse of the beneficiary shall be entitled to receive 50% of the pension received by such beneficiary as family pension.

• Contribution Amount: The monthly contribution ranges from Rs. 55 to Rs. 200, depending on the entry age of the subscriber. A person joining at 18 years pays the minimum, while one joining at 40 years pays the maximum.

• Enrollment: The registration is facilitated through Common Service Centers (CSCs) located across the country, making it accessible to rural and urban unorganized laborers alike.

Q89. Answer: (a) Asirvad Microfinance and DMI Finance

The correct answer is Arohan and Muthoot Finance.

Key Points

• The Reserve Bank of India (RBI), on January 1, 2025, announced the lifting of business restrictions on two prominent Non-Banking Financial Companies (NBFCs).

• The curbs were removed for Arohan Financial Services Limited and Asirvad Microfinance Limited, which is a key subsidiary of Muthoot Finance. Hence, the statement regarding Arohan and Muthoot Finance is correct.

• These restrictions were originally imposed in October 2024 due to concerns regarding usurious interest rates and non-compliance with the regulatory framework for microfinance loans.

• The RBI had issued a "cease and desist" order, which prevented these companies from sanctioning and disbursing new loans, although they were allowed to continue servicing existing accounts.

• The lifting of the ban followed significant corrective actions taken by the companies, including restructuring their pricing policies and interest rate models to align with RBI guidelines.

Additional Information

• Asirvad Microfinance Limited: Headquartered in Chennai, it is one of India's largest NBFC-MFIs. It was acquired by Muthoot Finance in 2015 and serves millions of women entrepreneurs in rural and semi-urban areas.

• Arohan Financial Services Limited: Based in Kolkata, it is a leading microfinance institution in Eastern India. It provides credit, insurance, and pension products to the underbanked population.

• October 2024 RBI Action: The RBI had taken action against four entities: Asirvad Microfinance, Arohan Financial Services, Navi Finserv, and DMI Finance. The central bank cited high interest rates that were not in proportion to the cost of funds and risk profiles.

• Fair Practices Code: The RBI mandates that all NBFCs follow a code that ensures transparency in loan pricing and prohibits predatory lending practices.

• Impact on Sector: The lifting of restrictions in January 2025 is seen as a positive signal for the microfinance sector, indicating that regulatory compliance can lead to the restoration of business operations.

Important Points

• The Reserve Bank of India Act, 1934, specifically Section 45L, empowers the RBI to issue directions to NBFCs to ensure the financial system's stability.

• In 2024, the RBI intensified its supervision of NBFC-MFIs due to reports of high household indebtedness and aggressive recovery methods.

• The Weighted Average Lending Rate (WALR) is a critical metric monitored by the RBI to ensure that the benefits of lower interest rates are passed on to end-consumers.

• The Microfinance Institutions Network (MFIN), a self-regulatory organization, has also introduced a Code of Conduct to prevent over-leveraging of borrowers in the unorganized sector.

Q90. Answer: (d) Section 3A(2)

The correct answer is Section 3A(2).

Key Points

• Section 3A(2) is a pivotal provision introduced in the Waqf (Amendment) Bill, 2024 (referred to as the 2025 Act contextually following its legislative timeline), which explicitly prohibits the creation of a Waqf that results in the denial of inheritance rights to legal heirs, specifically emphasizing that women must not be excluded.

• This section mandates that a person can only dedicate property to a Waqf if it does not infringe upon the Succession Rights of their family members. Under traditional practices, sometimes property was dedicated to Waqf-alal-aulad (Waqf for descendants) in a manner that bypassed female heirs; this amendment directly addresses such Gender Discrimination.

• The amendment clarifies that the Right to Inheritance is paramount, and any Waqf deed found to be depriving heirs of their rightful share, especially women who are often vulnerable in property disputes, will be considered void to that extent.

• This move is part of a broader reform to the Waqf Act, 1995, aimed at ensuring Social Justice and aligning religious property management with the Constitutional Principles of equality and non-discrimination.

• The provision ensures that the legal heirs under personal law retain their claims, preventing the misuse of Waqf as a tool to disinherit daughters or widows.

Additional Information

• Definition of Waqf: A Waqf is the permanent dedication of movable or immovable property by a person professing Islam for any purpose recognized by Muslim Law as pious, religious, or charitable. The Waqf (Amendment) Bill, 2024, seeks to rename the original act to the United Waqf Management, Empowerment, Efficiency and Development Act, 1995.

• Gender Representation in Boards: Apart from inheritance rights, the new amendments mandate the inclusion of at least two women members in both the Central Waqf Council and the State Waqf Boards. This ensures that women have a direct say in the administration of Waqf properties.

• Waqf-alal-aulad: This specific type of Waqf is created for the maintenance and support of the donor's own family and descendants. The new Section 3A(2) ensures that this practice cannot be used to selectively provide for male descendants while excluding female descendants.

• Inclusion of Non-Muslims: The amendment bill also proposes that a person must have been practicing Islam for at least five years to create a Waqf, and it allows for non-Muslim representation in the administrative bodies to increase transparency and diversity.

• Role of the Collector: The bill proposes to give the District Collector the power to determine whether a property is Waqf property or Government land. This shifts some adjudicatory power away from Waqf Tribunals to the civil administration to resolve long-standing land disputes.

Important Points

• Abolition of "Waqf by User": The 2024/2025 Amendment seeks to eliminate the concept of Waqf by User, where a property was

deemed Waqf simply because it had been used for religious purposes for a long time. Now, a formal Waqf-nama (deed) and registration are mandatory.

• Centralized Portal: The government is introducing a Centralized Registration Portal for the Registration of Waqf properties, ensuring that all Mutawallis (managers) upload details of their assets to prevent Encroachments and illegal sales.

• Tribunal Reforms: While Waqf Tribunals previously had final authority, the new amendments propose that their decisions can be appealed in High Courts within a specific timeframe, usually ninety days, ensuring a check on judicial power within the Waqf framework.

• Impact on Minority Rights: Proponents of the bill argue it empowers Muslim women and Pasmanda Muslims, while critics argue it may interfere with Article 26 of the Constitution of India, which grants religious denominations the right to manage their own affairs.

Q91. Answer: (d) An AI system for diabetic retinopathy screening

The correct answer is An AI system for diabetic retinopathy screening.

Key Points

• The MadhuNetr DR-AI system is a specialized artificial intelligence software tool launched by the Government of Rajasthan's Medical and Health Department in early 2025 to combat blindness caused by diabetes.

• Its primary function is the automated screening of Diabetic Retinopathy (DR), a complication of diabetes that affects the retina of the eye. Hence, Option D is correct.

• The system utilizes Deep Learning algorithms to analyze fundus images (back of the eye) captured by specialized cameras, identifying microaneurysms and hemorrhages that indicate early-stage damage.

• The deployment of this AI technology aims to provide mass screening in District Hospitals and Community Health Centers (CHCs) across Rajasthan, particularly in areas where Ophthalmologists are not readily available.

• By using automated interpretation, the system provides real-time reports, allowing for immediate referral to tertiary eye care centers for patients identified with "referable DR," thus preventing irreversible vision loss.

Additional Information

• Understanding Diabetic Retinopathy (DR):

• It is a microvascular complication of Type 1 and Type 2 diabetes. High blood sugar levels damage the tiny blood vessels in the retina, leading to swelling, leaking, or the growth of abnormal new vessels.

• In India, nearly 1 in 5 people with diabetes may suffer from some form of DR, and it remains a leading cause of preventable blindness among the working-age population.

• Role of Artificial Intelligence in Healthcare:

• AI in diagnostics helps in bridging the gap between high patient volumes and the shortage of medical specialists. In the context of MadhuNetr, the AI engine acts as a triage tool that can process thousands of images with high sensitivity and specificity (often exceeding 90%).

• The use of Cloud-based AI allows health workers at the village or block level to upload images and receive instant feedback, a process known as Point-of-Care (PoC) screening.

• Other Health Initiatives in Rajasthan:

• Rajasthan has been a pioneer in health schemes such as the Chiranjeevi Health Insurance Scheme (now integrated with Ayushman Bharat) and the Nirogi Rajasthan campaign.

• The state health department also utilizes e-Sanjeevani for telemedicine and tele-consultations, which is different from the specific diagnostic focus of MadhuNetr. Hence, Option A is incorrect.

Important Points

• Technical Features: The MadhuNetr system is designed to work with both mydriatic (dilated) and non-mydriatic (non-dilated) fundus cameras, making the screening process more comfortable for the patient.

• Significance of the Name: The name 'MadhuNetr' is derived from 'Madhumeha' (Diabetes) and 'Netra' (Eye), clearly indicating its application in diabetic eye care.

• Data Security: The system follows the National Digital Health Mission (NDHM) guidelines, ensuring that patient data privacy and electronic health records (EHR) are managed securely through the Integrated Health Management System (IHMS).

• Global Context: India is often cited as the "Diabetes Capital of the World" with over 100 million diabetic individuals as per the ICMR-INDIAB study (2023). Systems like MadhuNetr are essential to achieve the Sustainable Development Goal (SDG) 3, which focuses on Good Health and Well-being.

• While Blockchain (Option B) is used for secure data and Heart Health AI (Option C) exists in tools like AI-enabled ECGs, MadhuNetr is exclusively dedicated to Ophthalmology.

Q92. Answer: (d) Panchayat Yuva Krida Aur Khel Abhiyan

The correct answer is Panchayat Yuva Krida Aur Khel Abhiyan.

Key Points

• PYKKA stands for Panchayat Yuva Krida Aur Khel Abhiyan, which was a Centrally Sponsored Scheme launched by the Ministry of Youth Affairs and Sports, Government of India. Hence, option D is correct.

• The scheme was formally launched in the year 2008 with the primary objective of promoting sports and games in rural areas of the country. Hence, the option naming Kids Activities or Public Youth Krida is incorrect.

• It aimed at the development and maintenance of basic sports infrastructure at the Village and Block Panchayat levels. This was designed to provide youth in villages with opportunities to participate in organized sports competitions.

• The scheme intended to cover all 2.5 lakh Village Panchayats and 6,373 Block Panchayats across India over a period of 10 years. It provided one-time capital grants and annual operational grants for the upkeep of playfields.

• By encouraging sports culture at the grassroots level, PYKKA sought to tap into rural talent and integrate it with the mainstream national sports framework.

Additional Information

• Evolution of the Scheme:

• In April 2014, the PYKKA scheme was revamped and renamed as the Rajiv Gandhi Khel Abhiyan (RGKA). This change was aimed at addressing gaps in infrastructure and providing more structured training facilities.

• Later, in 2016, the RGKA was merged along with other schemes like the Urban Sports Infrastructure Scheme (USIS) and the National Sports Talent Search Scheme (NSTSS) into the unified Khelo India: National Programme for Development of Sports.

• Implementation Strategy:

• The scheme utilized Panchayati Raj Institutions (PRIs) for implementation, ensuring local governance and community participation.

• The central government provided 75% of the funding for infrastructure development, while the remaining 25% was contributed by the State Governments (for North-Eastern States, the ratio was 90:10).

• Competitions and Awards:

• Under PYKKA, annual competitions were organized at the Block, District, State, and National levels. These competitions specifically targeted rural youth to ensure talent identification.

• The scheme also focused on Women's Sports through special National Sports Festivals for Women and North-East Sports Festivals to promote inclusive participation.

• Key Features of Current Successor (Khelo India):

• The Khelo India scheme, which succeeded PYKKA, now provides a financial assistance of INR 5 lakh per annum for 8 years to talented athletes identified in priority sports disciplines.

• It has expanded the scope from simple rural playfields to high-performance centers and State Centers of Excellence.

Important Points

• Target Demographic: The scheme primarily focused on the age group of adolescents and young adults living in rural sectors who lacked access to modern gymnasiums or stadiums.

• Administrative Body: The Sports Authority of India (SAI) played a crucial role in providing technical support and conducting coaching camps during the active years of the PYKKA program.

• Geographical Reach: It was implemented across all States and Union Territories of India, with special emphasis on LWE (Left Wing Extremism) affected districts to engage youth constructively.

Q93. Answer: (b) Serena Williams

The correct answer is Serena Williams.

Key Points

• The legendary tennis player Serena Williams was honored with the Sporting Icon Award at the Laureus World Sports Awards held in 2024 (marking her status for the 2024-25 sporting cycle).

• The award ceremony took place at the Palacio de Cibeles in Madrid, Spain, on April 22, 2024. Hence, the option Serena Williams is correct.

• This special recognition was given to Serena Williams for her extraordinary career and her profound impact on the world of Tennis and global sports.

• She is a 23-time Grand Slam singles champion, holding the record for the most titles in the Open Era.

• The Sporting Icon Award is not given every year; it is reserved for individuals whose influence transcends the boundaries of their sport, advocating for gender equality and social justice.

Additional Information

• Novak Djokovic (Option A):

• The Serbian tennis star Novak Djokovic was named the 2024 Laureus World Sportsman of the Year.

• This was his fifth time winning this specific category, equaling the all-time record held by Roger Federer.

• Djokovic was recognized for his dominant 2023 season where he won three out of four Grand Slams (Australian Open, French

Open, and US Open).

• Aitana Bonmatí:

• The Spanish footballer Aitana Bonmatí won the Laureus World Sportswoman of the Year award.

• She made history as the first footballer to win this prestigious individual honor, following her success in the 2023 FIFA Women's World Cup.

• Jude Bellingham:

• The Real Madrid and England midfielder received the Laureus World Breakthrough of the Year Award.

• He was recognized for his phenomenal debut season in La Liga and his leadership on the pitch at a young age.

• Simone Biles:

• The American gymnast Simone Biles was awarded the Laureus World Comeback of the Year.

• She returned to professional gymnastics after a hiatus focusing on mental health, winning four gold medals at the 2023 World Championships.

Important Points

• Laureus World Sports Academy: The winners are selected by a jury consisting of 69 members of the Laureus World Sports Academy, who are all living sporting legends.

• Founding: The awards were established in 1999 by founding patrons Daimler and Richemont and supported by global partners like Mercedes-Benz and IWC Schaffhausen.

• Retirement: Serena Williams officially evolved away from tennis (retired) after the 2022 US Open, finishing a career that included four Olympic gold medals and 319 weeks as world number one.

• Significance: The Laureus Awards are often referred to as the "Oscars of Sports," celebrating the most remarkable sporting achievements of the calendar year.

Q94. Answer: (c) National Disaster Management Authority (NDMA)

The correct answer is National Disaster Management Authority (NDMA).

Key Points

• Operation Abhyaas is a comprehensive safety and disaster preparedness drill scheduled to be conducted in May 2025.

• The initiative is spearheaded by the National Disaster Management Authority (NDMA), which serves as the apex body for disaster management in India.

• The primary objective of this exercise is to enhance the response capabilities of various agencies, including the National Disaster Response Force (NDRF), and to test the effectiveness of existing emergency protocols.

• The drill focuses on creating realistic simulations of natural and man-made disasters, such as earthquakes, floods, and industrial accidents, to ensure that the State Disaster Management Authorities (SDMAs) and District Disaster Management Authorities (DDMAs) are fully prepared for any exigency.

• The exercise is designed to identify gaps in communication, resource allocation, and evacuation strategies before actual emergencies occur. Hence, the option identifying NDMA as the planning organization is correct.

Additional Information

• National Disaster Management Authority (NDMA):

• The NDMA was formally constituted on 27th September 2006, under the Disaster Management Act, 2005.

• It is chaired by the Prime Minister of India and has a vice-chairman and nine other members.

• Its primary mandate is to lay down policies, plans, and guidelines for disaster management to ensure a timely and effective response to disasters.

• National Disaster Response Force (NDRF):

• The NDRF is a specialized force constituted "for the purpose of specialist response to a threatening disaster situation or disaster" under the Act of 2005.

• It currently consists of 16 battalions organized on paramilitary lines and equipped to handle CBRN (Chemical, Biological, Radiological, and Nuclear) emergencies as well.

• Other Organizations Mentioned:

• Defence Research and Development Organisation (DRDO): Established in 1958, it focuses on developing defense technologies and hardware for the Indian Armed Forces.

• Department of Military Affairs (DMA): Created in December 2019, it is headed by the Chief of Defence Staff (CDS) and deals with the integration of the three services.

• Defence Equipment Exporters Association (DEEA): Primarily focuses on the promotion and export of Indian-made military hardware to other countries.

Important Points

• Institutional Framework: The Disaster Management Act, 2005, envisages a three-tier structure consisting of the NDMA at the

national level, SDMAs at the state level, and DDMAs at the district level.

• Vulnerability Profile: Approximately 58.6% of the Indian landmass is prone to earthquakes of moderate to very high intensity, making drills like Operation Abhyaas critical for public safety.

• International Collaboration: NDMA aligns its strategies with the Sendai Framework for Disaster Risk Reduction (2015–2030), which aims for a substantial reduction of disaster risk and losses in lives, livelihoods, and health.

• Early Warning Systems: NDMA works closely with the India Meteorological Department (IMD) and the Indian National Centre for Ocean Information Services (INCOIS) to disseminate real-time alerts to the population.

Q95. Answer: (c) Mussoorie

The correct answer is A - 2, B - 1, C - 4, D - 3.

Key Points

• National Nutrition Plan (2001-02): This plan, often referred to under the National Nutrition Mission, was initiated in 2001-02. It was designed to provide free foodgrains to pregnant and lactating women, under-nourished children, and adolescent girls belonging to families below the poverty line (BPL). The mission aimed to tackle malnutrition and anemia at the grassroots level. Hence, statement A - 2 is correct.

• Swajal Dhara Yojana (2002-03): Launched by the then Prime Minister Atal Bihari Vajpayee in December 2002 (effective in the 2002-03 fiscal year), this scheme aimed to provide clean drinking water to rural areas through community participation. It shifted the focus from a government-led supply model to a demand-driven model. Hence, statement B - 1 is correct.

• Universal Health Insurance Plan (2003-04): The Universal Health Insurance Scheme (UHIS) was launched in 2003-04 to improve access to healthcare for the poor. It provided subsidized premiums for individuals and families below the poverty line, covering hospitalization expenses, accidental death, and loss of wages. Hence, statement C - 4 is correct.

• Hariyali Project (2003): Launched in January 2003, the Hariyali Project was a massive watershed development program. It was implemented through Panchayati Raj Institutions (PRIs) to empower local communities in rainwater harvesting, afforestation, and soil conservation. Hence, statement D - 3 is correct.

Additional Information

• Watershed Management in India: The Hariyali Project integrated several existing programs like the Drought Prone Areas Programme (DPAP), the Desert Development Programme (DDP), and the Integrated Wastelands Development Programme (IWDP). Its primary objective was to ensure ecological balance and sustainable livelihoods for the rural population by managing land, water, and biomass.

• Rural Water Supply Evolution: Swajal Dhara was a landmark because it required the beneficiary community to contribute 10% of the capital cost of the project, while the Central Government provided the remaining 90%. This ensured that the local community took ownership and responsibility for the operation and maintenance of the water assets.

• Health Security for the Vulnerable: The Universal Health Insurance Scheme originally offered a subsidy of Rs. 200 for an individual, Rs. 300 for a family of five, and Rs. 400 for a family of seven. It served as a precursor to more expansive schemes like Rashtriya Swasthya Bima Yojana (RSBY) and the current Ayushman Bharat (PM-JAY).

• Nutrition Interventions: The National Nutrition Plan targeted 51 nutritionally deficient districts in its pilot phase. It focused specifically on adolescent girls weighing less than 35 kg to ensure they received 6 kg of free foodgrains per month through the Public Distribution System (PDS).

Important Points

• Institutional Framework: Most of these schemes during the early 2000s emphasized decentralization. For instance, the Hariyali guidelines made the Gram Panchayat the implementation agency, while the Zilla Parishad or District Rural Development Agency (DRDA) acted as the nodal authority at the district level.

• Linguistic and Regional Reach: These schemes were implemented across all States and Union Territories of India, catering to diverse climatic zones (in the case of Hariyali) and socio-economic strata (in the case of UHIS and Nutrition Plan).

• Yearly Significance: The period between 2001 and 2004 marked a significant era in Indian social policy, moving towards participatory governance and targeted subsidies for BPL families.

Q96. Answer: (c) Russia

The correct answer is Russia.

Key Points

• Exercise ZAPAD is one of the largest multilateral strategic command exercises conducted by the Russian Armed Forces, typically held every four years to test the readiness of their military districts.

• The Indian Armed Forces, particularly the Indian Army, have been a regular participant in these drills to enhance military-to-military cooperation and exchange tactical expertise with other participating nations. Hence, the participation of India in Russia is correct.

• The primary focus of Exercise ZAPAD is on counter-terrorism operations, urban warfare, and conventional combat scenarios, providing a platform for the Indian contingent to operate in diverse climatic and geographical conditions.

• In previous iterations, such as ZAPAD 2021, the exercise was conducted at the Mulino training ground in Nizhny, Russia,

involving nearly 200,000 personnel, 80 aircraft, and over 700 units of military equipment.

• Participating in such high-level multilateral exercises allows India to refine its interoperability standards and validate its operational doctrines alongside global military powers.

Additional Information

• Exercise Indra: This is a major bilateral military exercise between India and Russia that commenced in 2003. It has evolved into a tri-services exercise involving the Army, Navy, and Air Force of both nations.

• Geopolitical Significance: India's involvement in Russian hosted exercises like ZAPAD and VOSTOK highlights its strategic autonomy and commitment to the Shanghai Cooperation Organisation (SCO) framework for regional security.

• Equipment and Technology: These exercises often showcase advanced weapon systems, including T-90 tanks, Su-30MKI fighter jets, and sophisticated electronic warfare suites, much of which are shared between the two countries.

• Scope of Operations: The drills involve complex maneuvers such as heliborne operations, artillery barrages, and cyber-defense simulations, aimed at tackling modern-day security threats like insurgency and cross-border terrorism.

• Location Diversity: While ZAPAD (meaning "West") focuses on Russia's western borders, other exercises like VOSTOK (meaning "East") are conducted in the Eastern Military District of Russia, reflecting the vast geographical reach of their defense strategy.

Important Points

• Training and Simulation: The Indian Army personnel often undergo pre-induction training in India before departing for Russia to ensure they are familiar with the Russian protocols and the specific counter-terrorism drills planned for the year.

• International Observers: These exercises are closely monitored by international observers and often include participants from countries like Belarus, Kazakhstan, Armenia, and other members of the Collective Security Treaty Organization (CSTO).

• Diplomatic Relations: Military diplomacy remains a cornerstone of the India-Russia relationship, which was elevated to a Special and Privileged Strategic Partnership in 2010.

• Fact Check: The ZAPAD series is renowned for its sheer scale, often serving as a deterrent and a demonstration of technological prowess in the Eurasian region.

Q97. Answer: (d) Satish Dhawan Space Centre, Sriharikota

The correct answer is Satish Dhawan Space Centre, Sriharikota.

Key Points

• The Indian Space Research Organisation (ISRO) successfully deployed the GSAT-7R satellite, also known by its commercial designation CMS-03, on 2 November 2025. This satellite is a dedicated naval communication satellite designed to provide a significant boost to the Indian Navy's maritime communication capabilities.

• The launch was conducted from the Satish Dhawan Space Centre (SDSC), which is located in Sriharikota, Andhra Pradesh. This site serves as India's primary spaceport due to its proximity to the equator and its location on the east coast, which provides a velocity boost for eastward launches over the Bay of Bengal.

• The GSAT-7R is a replacement for the aging GSAT-7 satellite, which was launched in 2013. It is equipped with advanced UHF, S-band, C-band, and Ku-band payloads to facilitate secure, real-time communication between Indian Navy warships, submarines, aircraft, and land-based command centers. Hence, the statement regarding Satish Dhawan Space Centre being the launch site is correct.

• The satellite was launched using the Geosynchronous Satellite Launch Vehicle (GSLV) or LVM3 (Launch Vehicle Mark 3), which is ISRO's heaviest launch vehicle, capable of carrying large payloads into Geostationary Transfer Orbit (GTO).

• The deployment of CMS-03 ensures maritime domain awareness over the Indian Ocean Region (IOR), supporting the country's strategic interests and ensuring national security.

Additional Information

• Satish Dhawan Space Centre (SDSC), SHAR: Established in 1971, it is the sole satellite launch station of India. It is situated on the Sriharikota island in the Nellore district of Andhra Pradesh. It features two active launch pads that facilitate the launch of PSLV, GSLV, and LVM3 rockets.

• Thumba Equatorial Rocket Launching Station (TERLS): Located in Thiruvananthapuram, Kerala, this station was established in 1963. It is primarily used for launching sounding rockets for upper atmospheric research due to its proximity to the magnetic equator. It does not possess the infrastructure to launch heavy communication satellites like GSAT-7R.

• UR Rao Satellite Centre (URSC): Formerly known as the ISRO Satellite Centre (ISAC), it is located in Bengaluru, Karnataka. This is the lead center for the design, development, and construction of all Indian satellites. While GSAT-7R was built here, it was transported to Sriharikota for the actual launch.

• Vikram Sarabhai Space Centre (VSSC): Situated in Thiruvananthapuram, VSSC is the main center for design and development of satellite launch vehicles (rockets). It is named after the father of the Indian space program, Dr. Vikram Sarabhai.

Important Points

• GSAT-7 Series (Rukmini): The GSAT-7 satellite was India's first dedicated multi-band military satellite. It significantly improved the Indian Navy's ability to operate far from the coastline by providing a footprint that covers the entire Indian Ocean.

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• CMS Nomenclature: ISRO recently started using the CMS (Communication Satellite) prefix for its communication satellites. For instance, CMS-01 was launched in December 2020 to replace GSAT-12. GSAT-7R falling under the CMS-03 designation follows this administrative rebranding strategy.

• Strategic Impact: The GSAT-7R (CMS-03) provides network-centric warfare capabilities, allowing for the seamless integration of various naval assets. It plays a vital role in the Security and Growth for All in the Region (SAGAR) initiative led by the Government of India.

• Launch Date and Year: The specific mission on 2 November 2025 represents ISRO's continued commitment to indigenous satellite technology under the Aatmanirbhar Bharat mission.

Q98. Answer: (b) Sarah Wynn-Williams

The correct answer is Sarah Wynn-Williams.

Key Points

• The book titled "Careless People: A Cautionary Tale of Power, Greed, and Lost Idealism" is authored by Sarah Wynn-Williams, a former high-ranking executive at Meta Platforms Inc. (formerly Facebook). Hence, the correct answer is Sarah Wynn-Williams.

• Released in March 2025, the book serves as a memoir and a critical analysis of the inner workings of one of the world's most powerful Big Tech companies during a period of extreme global controversy.

• Sarah Wynn-Williams served as the Director of Global Public Policy at Meta, where she managed the company's relationships with governments and international organizations across various continents.

• The narrative focuses on the corporate culture of Silicon Valley, highlighting how the original mission of "connecting the world" was allegedly overshadowed by a pursuit of growth, market dominance, and profit.

• The book provides an insider's account of the company's response to the Cambridge Analytica scandal, the spread of misinformation, and the ethical dilemmas faced by those within the policy and communications departments.

Additional Information

• Sheryl Sandberg (Option A): She is the former Chief Operating Officer (COO) of Meta and the author of the influential books "Lean In" (2013) and "Option B". While she is a central figure in the history of Facebook, she did not author this 2025 title. Hence, Option A is incorrect.

• Simon Sinek (Option C): He is a renowned author and motivational speaker known for books such as "Start with Why" and "The Infinite Game". His work generally focuses on leadership and organizational psychology rather than specific corporate exposés. Hence, Option C is incorrect.

• Boria Majumdar (Option D): He is a well-known Indian sports journalist and author who has written extensively on the history of Indian cricket and Olympics. His literary contributions are unrelated to the American tech industry. Hence, Option D is incorrect.

• The title "Careless People" is a literary reference to F. Scott Fitzgerald's classic novel "The Great Gatsby", symbolizing a class of people who use their power and wealth to cause damage without taking responsibility for the consequences.

• The book is expected to be a significant resource for policymakers, tech ethics researchers, and students of corporate governance globally.

Important Points

• The book explores the regulatory challenges faced by social media companies, including the implementation of the General Data Protection Regulation (GDPR) in the European Union and the Digital Services Act (DSA).

• It provides data and anecdotes regarding the lobbying efforts of Big Tech in Washington D.C. and Brussels, illustrating the functions of a Global Public Policy team.

• The release coincides with a period of intense antitrust investigations into Meta, Google, and Amazon by the Federal Trade Commission (FTC) and various Attorney Generals in the USA.

• Sarah Wynn-Williams previously worked in government relations and diplomacy, bringing a unique international relations perspective to the technological landscape.

Q99. Answer: (c) Panchkula, Haryana

The correct answer is Panchkula, Haryana.

Key Points

• The All India Masters Ranking Badminton Tournament 2025 was successfully organized in Panchkula, Haryana, from 22nd to 29th January 2025. This event is a premier competition for veteran badminton players across the country.

• The tournament took place at the prestigious Tau Devi Lal Sports Complex, which is a multi-sport facility known for hosting high-profile national and international events.

• This ranking tournament serves as a critical selection ground for Indian athletes aiming to represent the nation at the BWF World Senior (Masters) Championships. Hence, the statement regarding its location in Haryana is correct.

• The event witnessed participation from over 1,500 athletes, showcasing the growing popularity of masters sports in India. The competition was held across various age brackets, starting from 35+ years up to 75+ years.

• The Badminton Association of India (BAI), in collaboration with the Haryana Badminton Association, oversaw the technical and

administrative aspects of the tournament to ensure it met international standards.

Additional Information

• Badminton Association of India (BAI):

• The BAI is the governing body for badminton in India. It is registered under the Societies Registration Act.

• The current President of BAI is Dr. Himanta Biswa Sarma. The organization is headquartered in New Delhi.

• It is responsible for organizing national championships, managing the national team, and promoting the sport at the grassroots level.

• Masters Badminton Classification:

• Masters or "Senior" badminton is specifically designed for players who have retired from professional circuits but continue to compete.

• The categories are divided into 5-year intervals: 35+, 40+, 45+, 50+, 55+, 60+, 65+, 70+, and 75+.

• Events included in this tournament are Men's Singles, Women's Singles, Men's Doubles, Women's Doubles, and Mixed Doubles.

• Sports Infrastructure in Haryana:

• Haryana is often referred to as the "Sports Hub" of India due to its high density of elite athletes and world-class facilities.

• The Tau Devi Lal Sports Complex in Sector 3, Panchkula, has previously hosted the Khelo India Youth Games 2021 (held in 2022) and several Pro Kabaddi League matches.

Important Points

• Significance of Ranking: The points earned in this tournament contribute to the National Ranking of the players. High-ranking players receive preference for international entries in tournaments sanctioned by the Badminton World Federation (BWF).

• BWF World Senior Championships: These are held biennially. The 2025 edition of the BWF World Senior Championships is a major target for the winners of the Panchkula ranking tournament.

• Health and Fitness: The tournament highlights the importance of lifelong fitness, encouraging individuals in their 40s, 50s, and beyond to maintain an active lifestyle through competitive sports.

• Year 2025 Calendar: The January 2025 slot is strategically placed at the beginning of the sporting calendar to allow players enough time to prepare for international summer and autumn circuits.

Q100. Answer: (a) RBI Kehta Hai

The correct answer is RBI Kehta Hai.

Key Points

• The Reserve Bank of India (RBI) launched its official WhatsApp channel in April 2025 as part of its flagship public awareness initiative, RBI Kehta Hai, to bolster digital safety and financial literacy.

• The primary objective of the WhatsApp channel is to provide real-time updates, safety tips, and information regarding banking regulations directly to the users' mobile phones, ensuring a wider reach across urban and rural India.

• The RBI Kehta Hai campaign is a multi-media and multi-lingual initiative, delivering messages in 14 Indian languages to ensure that financial education is accessible to diverse linguistic groups.

• This digital expansion targets the prevention of cyber-frauds, such as identity theft, vishing, and phishing, by educating customers on the importance of never sharing their OTP, PIN, or CVV with anyone. Hence, the statement regarding the campaign name is correct.

• By utilizing the WhatsApp Business Platform, the RBI aims to simplify complex financial concepts for common citizens, senior citizens, and students, making the central bank more accessible to the general public.

Additional Information

• Historical Context: The RBI Kehta Hai campaign was originally conceptualized around 2016-17 to address the rising need for customer protection and financial inclusion following the growth of digital payments in India.

• The Integrated Ombudsman Scheme (RB-IOS), 2021: This scheme was launched to provide a single point of reference for customers to file complaints against RBI-regulated entities. The WhatsApp channel often integrates information on how to reach the Ombudsman for grievance redressal.

• National Strategy for Financial Education (NSFE): 2020-2025: The launch of the WhatsApp channel aligns with the NSFE's goal of creating a "financially aware and empowered India." The strategy emphasizes capacity building and community-led financial literacy models.

• Collaboration with NPCI: The Reserve Bank works closely with the National Payments Corporation of India (NPCI) to secure UPI (Unified Payments Interface) transactions. RBI often uses its campaigns to highlight features like UPI Lite and UPI 123Pay for feature phone users.

• Cyber Crime Helpline: The campaign frequently promotes the National Cyber Crime Helpline Number 1930 and the Sanchar Saathi portal, which are critical tools for reporting financial frauds within the "Golden Hour" to recover stolen funds.

Important Points

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• Legal Framework: The RBI derives its authority for public interest interventions from the Reserve Bank of India Act, 1934 and the Banking Regulation Act, 1949. These acts empower the bank to issue directions to banks regarding customer service standards.

• Safe Digital Practices: Key safety features highlighted by RBI include the Two-Factor Authentication (2FA) and the "Limited Liability" circular, which protects customers from losses in unauthorized electronic transactions if reported to the bank within 3 working days.

• Financial Inclusion Data: As per recent reports, India has seen a massive surge in digital transactions, with UPI processing over 10 billion transactions per month. This scale necessitates scalable communication tools like WhatsApp to manage consumer risks effectively.

• Target Demographics: Special focus is given to Micro, Small, and Medium Enterprises (MSMEs) and Self-Help Groups (SHGs) through this campaign to ensure they are not exploited by unregulated digital lending apps.

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