RRB Group D Official Paper (Held On: 30 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. Growing of two or more crops simultaneously on the same field is called _____.

(a) Inter-cropping
(b) Mixed cropping
(c) Intra-cropping
(d) Mono-cropping

Q2. The Work-Energy theorem states that the total work done on an object is equal to:

(a) Change in the work and energy of the body
(b) Change in the potential energy of the body
(c) Change in the kinetic energy of the body
(d) Change in the static energy of the body

Q3. What is the main purpose of creating DNA copies during reproduction?

(a) To change the structure of cells
(b) To make organisms immune to diseases
(c) To produce identical twins
(d) To pass genetic information to offspring

Q4. Which law did Mendel derive from his monohybrid cross?

(a) Law of Constant Proportion
(b) Law of Evolution
(c) Law of Independent Assortment
(d) Law of Segregation

Q5. A car is moving at a speed of 180 km/h. After the brakes are applied, it comes to a complete stop in 5 seconds. If the total mass of the car along with its passengers is 4200 kg, what is the force applied by the brakes to stop the car?

(a) –50,000 N
(b) –15,120 N
(c) –36,000 N
(d) –42,000 N

Q6. A man's pitch is _____ than child's pitch.

(a) higher
(b) sometimes higher and sometimes lower
(c) lower
(d) same

Q7. Which of the following is an INCORRECT statement about the endoplasmic reticulum?

(a) The endoplasmic reticulum helps in the transport of materials within the cell, especially between the cytoplasm and the nucleus.
(b) The endoplasmic reticulum stores genetic material in it.
(c) The rough endoplasmic reticulum (RER) has ribosomes attached to its surface, which help in protein synthesis.
(d) The smooth endoplasmic reticulum (SER) is involved in the synthesis of lipids (fat molecules).

Q8. Which of the following is NOT true about binary fission?

(a) It needs two parents
(b) It is fast and efficient
(c) It leads to population increase
(d) It occurs in unicellular organisms

Q9. What is the correct sequence of steps followed in extracting metals like zinc from their sulphide or carbonate ores?

(a) Dissolution in acid → Filtration → Heating
(b) Roasting or calcination → Reduction to metal → Purification
(c) Direct heating → Purification
(d) Electrolysis → Roasting → Purification

Q10. Which of the following examples represents motion along a straight line?

(a) A fan blade rotating
(b) A child running around a park
(c) A train moving on a straight track
(d) A pendulum swinging

Q11. Which of the following is the correct unit of resistivity of a material?

(a) ohm-meter
(b) ohm/meter
(c) meter/ohm
(d) ohm

Q12. At what minimum distance should an object be held from the eyes for clear and comfortable viewing?

(a) 25 m
(b) 50 cm
(c) 250 cm
(d) 25 cm

Q13. On mixing sodium bicarbonate with dil. HCl, sodium chloride is formed and a gas is evolved. This gas when passed through lime water turns it milky. The evolved gas is:

(a) H_2
(b) Cl_2
(c) CO
(d) CO_2

Q14. How are metals like gold and silver, which are low in reactivity, extracted?

(a) By simple heating or chemical methods
(b) By displacement reaction
(c) By electrolytic reduction
(d) By reacting with acids

Q15. Which of the following does NOT occur with an increase in temperature?

(a) Change in state of matter
(b) Decrease in inter-particle space
(c) Increase in particle movement
(d) Increase in kinetic energy

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Q16. Which phenomenon, successfully explained by the universal law of gravitation, relies on the combined and differential gravitational attraction exerted by both the moon and the sun on the earth?

(a) The decrease in the value of g from poles to equator
(b) The motion of planets around the Sun
(c) The occurrence of ocean tides
(d) The centripetal force keeping the stone in a circular path

Q17. When $BaCl_2$ reacts with Na_2SO_4, the white precipitate is:

(a) Barium sulphate which is insoluble
(b) Sodium carbonate which is insoluble
(c) Barium nitrate which is basic
(d) Sodium chloride which crystallises

Q18. During the electrolysis of brine, which of the following correctly matches the products formed at each electrode and in the solution?

(a) Anode – Cl_2, Cathode – H_2, Solution – NaOH
(b) Anode – H_2, Cathode – Cl_2, Solution – NaOH
(c) Anode – NaOH, Cathode – Cl_2, Solution – H_2
(d) Anode – Cl_2, Cathode – NaOH, Solution – H_2

Q19. Which of the following is the main function of skeletal muscles in a human body?

(a) Circulation
(b) Excretion
(c) Respiration
(d) Movement in our body

Q20. Which of the following best differentiates a mixture from a compound?

(a) Mixtures always have a fixed boiling point.
(b) Mixtures can be separated by physical methods, while compounds require chemical methods.
(c) Compounds retain the individual properties of their components.
(d) Compounds are heterogeneous in nature, while mixtures are always homogeneous.

Q21. Which part of a neuron carries the nerve impulse away from the cell body?

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

Q22. Applying pressure to a gas causes:

(a) Volume to increase
(b) Particles to move faster
(c) Particles to come closer
(d) Temperature to decrease

Q23. If magnification is positive, the image formed is:

(a) inverted
(b) virtual and erect
(c) on the screen
(d) real

Q24. Magnetic field is a quantity that has _____.

(a) neither magnitude nor direction
(b) only direction
(c) only magnitude
(d) both magnitude and direction

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Q25. Who sacrificed her life along with 363 others in 1731 to protect the Khejri trees in Rajasthan?

(a) Amrita Devi Bishnoi
(b) Medha Patkar
(c) Sunita Narain
(d) Vandana Shiva

MATHEMATICS

Q26. Due to an earthquake, a pole broke and its top now touches the ground at a distance of 25 m from the foot of the pole making an angle of 45° with the ground. Find the length of the pole before the earthquake.

(a) $50\sqrt{2}$ m
(b) $25(\sqrt{2} + 1)$ m
(c) $50(\sqrt{2} + 1)$ m
(d) $25\sqrt{2}$ m

Q27. If Sonali's salary first decreased by 25% and then increased by 12%, what is the percentage effect on her salary?

(a) Decreases by 12%
(b) Increases by 16%
(c) Increases by 12%
(d) Decreases by 16%

Q28. The average of 7 numbers is 25. If each number is decreased by 3, what will the new average be?

(a) 7
(b) 25
(c) 19
(d) 22

Q29. In triangle ABC, BD perpendicular to AC at D and angle DBC = 33°. E is a point on BC such that angle CAE = 45°. What is the measure of angle AEB ?

(a) 102°
(b) 95°
(c) 93°
(d) 89°

Q30. A machine produces two types of widgets. The number of widgets produced per day of Type A is a, and of Type B is b. If $a + b = 50$ and $a^2 + b^2 = 1300$, then find the product of the number of widgets produced per day of the two types.

(a) 650
(b) 700
(c) 500
(d) 600

Q31. A water tank has two inlet pipes (A and B) and one outlet pipe (C). Pipe A can fill the tank in 4 hours, Pipe B can fill the tank in 6 hours, and Pipe C can empty the tank in 8 hours. If all three pipes are opened for the first 3 hours and then Pipe C is closed, how much total time is required to fill the tank?

(a) 3 hours 18 minutes
(b) 4 hours 15 minutes
(c) 4 hours 18 minutes
(d) 5 hours 15 minutes

Q32. A person walked from his house to the market at the rate of 5 km/hr and walked back to his house at the rate of 4 km/hr. The whole journey took 4 hours 30 minutes. Find the distance (in km) from his house to the market.

(a) 25
(b) 15
(c) 20
(d) 10

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Q33. If the volume of a cylindrical vessel is 21.560 litres. If the radius of the base of the cylinder is two-fifth times of its height, find the total surface area of the cylinder (in cm^2). (Take $\pi = 22/7$)

(a) 4324
(b) 4312
(c) 4345
(d) 4352

Q34. The sum of the first 17 prime numbers is:2630

(a) 436
(b) 440
(c) 441
(d) 439

Q35. A person buys a machine for Rs. 20,000, and spends Rs. 2,000 on its repair and Rs. 3,000 on transportation. He sells it for Rs. 30,000. What is the profit percentage?

(a) 20%
(b) 35%
(c) 25%
(d) 30%

Q36. Simplify: 5 1/2 - [2 1/3 ÷ {3/4 - 1/2 × 8/3}]

(a) 3/2
(b) 19/2
(c) 9
(d) 21/2

Q37. Evaluate: 16 × 2^5 × 8 ÷ $(1/2)^3$

(a) 2^9
(b) 2^(20)
(c) 2^{13}
(d) 2^(15)

Q38. The market prices of jowar and gram are in the ratio 1 : 3, and a family consumes them in the ratio 5 : 11 by quantity. Find the ratio of expenditure on jowar to that on gram.

(a) 7 : 34
(b) 9 : 35
(c) 5 : 33
(d) 6 : 34

Q39. The expenditure of Sudha is 150% more than her savings. If her expenditure decreases by 12% and savings increase by 37%, then by what percentage does her income increase?

(a) 7%
(b) 2%
(c) 5%
(d) 3%

Q40. The amount on a sum of Rs. 6,500 at 10% per annum compound interest, compounded annually, in 2 years will be:

(a) Rs. 8,309
(b) Rs. 7,895
(c) Rs. 8,207
(d) Rs. 7,865

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Q41. If a father is 30 years older than his son, and his age is currently five times that of his son, how old is the son?

(a) 7.5 years
(b) 15 years
(c) 10 years
(d) 5 years

Q42. If 20% of a number is added to 60, then the result is the same number. 75% of the same number is:

(a) 76.25
(b) 66.25
(c) 86.25
(d) 56.25

Q43. If the radius of a sphere is 35 cm, then its surface area is:

(a) 2400 π cm2
(b) 2450 π cm2
(c) 2500 π cm2
(d) 4900 π cm^2

Q44. Three numbers are in the ratio 1/5 : 9/18 : 11/16. The difference between the greatest and the smallest numbers is 78. Find the largest number.

(a) 111
(b) 109
(c) 110
(d) 108

Q45. The marked price of a painting was Rs. 7,500, but the shopkeeper offered a double discount in a successive manner of 14% and 28%. Ultimately for how much did he sell the item?

(a) Rs. 4,674
(b) Rs. 4,610
(c) Rs. 4,644
(d) Rs. 4,490

Q46. The average age of 32 students of a class is 21 years. If the age of the teacher is also included, the average age of the whole group becomes 22 years. The age (in years) of the teacher is:

(a) 54
(b) 57
(c) 52
(d) 59

Q47. A salesman marks his goods 5% above the cost price and gives a discount of 40% on them. Find his loss percentage.

(a) 35%
(b) 37%
(c) 34%
(d) 36%

Q48. One pipe can fill a tank in 7 minutes, while another pipe can empty the completely filled tank in 14 minutes. If both the pipes are opened together when the tank is empty, how many minutes will it take to fill one-half of the tank?

(a) 14
(b) 15
(c) 7
(d) 8

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Q49. A person is 3 times as old as their sibling. If the sum of their ages is 40 years, then how old is the person?

(a) 40 years
(b) 20 years
(c) 30 years
(d) 10 years

Q50. Two trains are running along parallel tracks towards each other at speeds of 40 km/h and 60 km/h, respectively. If the length of each train is 125 metres, then how much time will they take to cross each other?

(a) 9 seconds
(b) 5 seconds
(c) 7 seconds
(d) 12 seconds

GENERAL INTELLIGENCE & REASONING

Q51. Refer to the given series and answer the question that follows. (All numbers are single digit numbers only.) Counting to be done from left to right only.

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

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

(a) 0
(b) 3
(c) 1
(d) 2

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

Statements:

All wheels are cars.

All cars are trucks.

Conclusions:

(I) Some trucks are cars.

(II) All wheels are trucks.

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

Q53. GIMJ is related to LNRO in a certain way based on the English alphabetical order. In the same way, QSWT is related to VXBY. To which of the given options is TVZW related, following the same logic?

(a) YZDB
(b) YADB
(c) YBDJ
(d) YAEB

Q54. All 104 people are standing in a row facing North. Mr. Zzz is 9th from the right end while Mr. Memi is 34th from the left end. How many people are there between Mr. Zzz and Mr. Memi?

(a) 61
(b) 62
(c) 60
(d) 59

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Q55. What should come in place of the question mark (?) in the given series based on the English alphabetical order?

NFU SJZ XNE CRJ ?

(a) IWO
(b) GUN
(c) HVO
(d) GVP

Q56. Select the pair which follows the same pattern as that followed by the two pairs given below. Both pairs follow the same pattern.

PLI−MIF

VRO−SOL

(a) FAW−CYV
(b) FAW−BXU
(c) FBY−BYU
(d) FBY−CYV

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

6 ? 12 36 144 720

(a) 10
(b) 6
(c) 8
(d) 12

Q58. In a certain code language, ‘pig peak salad’ is coded as ‘aq ym lq’ and ‘lemon salad grape’ is coded as ‘wq cv ym’. How is ‘salad’ coded in that language?

(a) ym
(b) lq
(c) wq
(d) aq

Q59. In a row of 97 students facing north, Z is 61st from the right end. If G is 28th to the left of Z, what is G's position from the left end of the line?

(a) 9th
(b) 8th
(c) 7th
(d) 10th

Q60. Kavya walks 100 metres north, turns right and walks 40 metres. Again, she turns right and walks 30 metres. She turns right again and walks 40 metres. How far is she from her original position?

(a) 200 metres
(b) 100 metres
(c) 10 metres
(d) 70 metres

Q61. In a certain code language,

‘A+ B’ means ‘A is the son of B’,

‘A # B’ means ‘A is the sister of B’,

‘A x B’ means ‘A is the wife of B’ and

‘A @ B’ means ‘A is the father of B’.

How is L related to R if ‘L + O # V x E @ R’?

(a) Sister's son
(b) Mother's sister's son
(c) Sister's husband
(d) Mother's sister's husband

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Q62. In a certain code language, ‘true friends stay’ is coded as ‘eg nu ko’ and ‘stay close always’ is coded as ‘bs eg xv’. How is ‘stay’ coded in the given language?

(a) bs
(b) nu
(c) ko
(d) eg

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

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

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

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

Q64. What should come in place of the question mark (?) in the given series?

3 11 21 29 39 ?

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

Q65. 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) UVQ
(b) SRM
(c) EFA
(d) NOJ

Q66. 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.)

(5, 12, 28)

(8, 15, 34)

(a) (23, 30, 64)
(b) (21, 14, 32)
(c) (19, 12, 28)
(d) (7, 14, 24)

Q67. 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) XY−ZA
(b) QR−ST
(c) NO−PQ
(d) LM−MQ

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Q68. Six friends, G, H, I, Q, R and S, are sitting around a circular table facing the centre of the table. I sits to the immediate right of S. Only three people sit between I and Q when counted from the left of I. R sits to the immediate right of H. How many people sit between G and H when counted from the left of H?

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

Q69. BFIF is related to IMPM in a certain way based on the English alphabetical order. In the same way, PTWT is related to WADA. To which of the given options is CGJG related, following the same logic?

(a) JNQN
(b) JMPN
(c) JNPN
(d) JOPT

Q70. If 2 is added to each even digit and 3 is subtracted from each odd digit in the number 2436795, what will be the sum of the greatest and smallest digits in the new number thus formed?

(a) 10
(b) 12
(c) 8
(d) 6

Q71. Read the given statements and conclusions carefully. Assuming that the information given in the statements is true, even if it appears to be at variance with commonly known facts, decide which of the given conclusions logically follow(s) from the statements.

Statements:

Some rails are cars.

No car is a bus.

Conclusions:

(I) Some rails are buses.

(II) Some cars are rails.

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

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

43 ÷ 17 + 425 × 5 - 65 = ?

(a) 711
(b) 745
(c) 709
(d) 729

Q73. If + means −, − means ×, × means ÷ and ÷ means +, then what will come in place of the question mark (?) in the following equation?

73 - 15 ÷ 98 + 506 × 23 = ?

(a) 1153
(b) 1186
(c) 1171
(d) 1195

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Q74. A, B, C, D, N, O and P are sitting in a straight line, facing north.

No one sits to the right of B. Only three people sit between B and N. Only two people sit between N and C. A sits third to the left of D. O sits to the immediate right of D.

How many people sit between P and C?

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

Q75. Five people, A, B, C, D and E, are sitting in a row, facing the north.

A sits fourth from the right end of the row. Only one person sits between B and D. D is not an immediate neighbour of A.

How many people sit between A and D?

(a) 0
(b) 2
(c) 3
(d) 1

Q76. This question is based on the five, three-digit numbers given below.

(Left) 937, 228, 782, 175, 631 (Right)

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

Note: All operations to be done from left to right.

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

(a) 14
(b) 12
(c) 15
(d) 10

Q77. This question is based on the five, three-digit numbers given below.

(Left) 567 862 426 326 749 (Right)

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

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

If 2 is added to the second digit of every number, in how many numbers will the second digit be exactly divisible by the third digit?

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

Q78. Ishu starts from Point P and drives 8 km towards the west. Then she takes a right turn, drives 13 km, she turns right again and drives 15 km. She then takes a right turn and drives 5 km, turns right again and drives 7 km and stops at Point Q. How far (shortest distance) and towards which direction should she drive in order to reach Point P again? (All turns are 90-degree turns only unless specified.)

(a) 5 km towards the north
(b) 3 km towards the east
(c) 8 km towards the south
(d) 4 km towards the north

Q79. Which of the given letter-number clusters will replace the question mark (?) in the following series to make it logically complete?

XBF 84 IMQ 92 TXB 100 EIM 108 ?

(a) PSW 115
(b) PUW 116

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(c) PRU 115
(d) PTX 116

Q80. What should come in place of the question mark (?) in the given series?

256, 128, 64, 32, 16, ?

(a) 6
(b) 10
(c) 4
(d) 8

GENERAL AWARENESS AND CURRENT AFFAIRS

Q81. Accordioning to the Indian Government how many Khelo India State Centres of Excellence (KISCEs) were notified by the Government of India as of June 2025?

(a) 36
(b) 34
(c) 32
(d) 30

Q82. How many cities were covered under the National Clean Air Programme (NCAP) by June 2025 to combat air pollution?

(a) 111
(b) 141
(c) 121
(d) 131

Q83. What was the revised International Poverty Line (IPL) set by the World Bank for India in June 2025?

(a) $3.50/day
(b) $3.00/day
(c) $2.50/day
(d) $2.15/day

Q84. The Monetary Policy Committee (MPC) held its 54th meeting from 7 to 9 April 2025 under whose Chairmanship?

(a) Shri Narendra Modi
(b) Shri Sanjay Malhotra
(c) Smt. Nirmala Sitharaman
(d) Shri Saugata Bhattacharya

Q85. In February 2025, the government notified the End-of-Life Vehicles (ELV) Rules, effective April 1. Which of the following statements is true with regards to ELV rules?

(a) Public sold salvaged vehicles are exempt.
(b) Producers must meet EPR targets using scrapping facilities.
(c) Only imported vehicles are regulated.
(d) All vehicles must be recycled regardless of age.

Q86. When was the International Day of Families observed in 2025?

(a) June 1
(b) July 11
(c) May 15
(d) April 15

Q87. On 26 August 2025, a deadly landslide near which pilgrimage site in Reasi district, Jammu & Kashmir, killed dozens and triggered a high-level investigation?

(a) Hemkund Sahib
(b) Vaishno Devi

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(c) Amarnath Cave
(d) Shankaracharya Temple

Q88. When was the Regional Climate Centre Network Task Team Meeting held in India?
(a) May 2025
(b) April 2025
(c) January 2025
(d) June 2025

Q89. Which team won the 2025 UEFA-Champions League?
(a) Bayern Munich
(b) Barcelona
(c) Paris Saint-Germain
(d) Inter Milan

Q90. Which of the following Amendments came into effect from 1 November 2025, giving depositors the flexibility to make nominations in banks?
(a) Banking Laws (Amendment) Act, 2024
(b) Banking Laws (Amendment) Act, 2025
(c) Reserve Bank Laws (Amendment) Act, 2025
(d) Banking Laws (Amendment) Act, 2026

Q91. Which day in February 2025 was celebrated as the National Science Day in India?
(a) 4 February
(b) 20 February
(c) 28 February
(d) 13 February

Q92. Which Swedish athlete won the Laureus Sportsman of the Year 2025 for his world record-breaking performances in pole vault?
(a) Karsten Warholm
(b) Armand Traoré
(c) Mondo Duplantis
(d) Jakob Ingebrigtsen

Q93. Who received the Vigyan Shri award in 2024 for his contributions to Agricultural Science?
(a) Prof. Jayant Bhalchandra Udgaonkar
(b) Prof. Govindarajan Padmanabhan
(c) Dr. Avesh Kumar Tyagi
(d) Dr. Anandharamakrishnan C

Q94. Who among the following participated in the Outreach Session of the G7 Summit in Canada in June 2025?
(a) Amit Shah
(b) Narendra Modi
(c) Nirmala Sitharaman
(d) Droupadi Murmu

Q95. In 2025, Saudi Arabia signed a major security agreement with which country to strengthen military cooperation amid regional tensions?
(a) United Arab Emirates
(b) Iran
(c) Pakistan
(d) Egypt

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Q96. Which regulatory provisions did the the Insurance Regulatory and Development Authority of India (IRDAI) reference while imposing the fine on Acko General Insurance for violations related to outsourcing and commissions in May 2025?

(a) Section 45 of Banking Act
(b) Section 64V of Insurance Act
(c) Section 5 of IRDAI Act
(d) Section 40(1) of Insurance Act

Q97. Which ace footballer and former Indian football team captain was selected for the Padma Shri honour in 2025?

(a) IM Vijayan
(b) Bhaichung Bhutia
(c) Subrata Pal
(d) Sunil Chhetri

Q98. Which of the following government portal/initiative is specifically aimed at breaking language barriers by enabling Indian languages for digital services?

(a) IndiaStack
(b) DigiLocker
(c) BHASHINI
(d) UMANG

Q99. In November 2025, the standing committee of the National Board for Wildlife approved a proposal to construct a Pinjoli bridge in which of the following wildlife sanctuaries?

(a) Eaglenest Wildlife Sanctuary
(b) Dehing Patkai Wildlife Sanctuary
(c) Sepahijala Wildlife Sanctuary
(d) Dzukou Valley Wildlife Sanctuary

Q100. On 28 October 2025, the Union Cabinet approved the Terms of Reference for which commission responsible for recommending salaries and retirement benefits for central government employees?

(a) 7th Central Pay Commission
(b) 8th Central Pay Commission
(c) 5th Central Pay Commission
(d) 6th Central Pay Commission

ANSWER KEY

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

SOLUTIONS

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Q1. Answer: (b) Mixed cropping

The correct answer is Mixed cropping.

Key Points

• Mixed cropping is an agricultural practice where two or more crops are grown simultaneously on the same piece of land.

• The primary objective of this method is to minimize the risk of total crop failure. If one crop fails due to adverse weather conditions, lack of rainfall, or pest infestation, the other crop ensures some insurance against complete loss.

• In mixed cropping, the seeds of the different crops are typically mixed together and sown in the field without any definite row arrangement or specific spatial pattern.

• Farmers generally choose crop combinations that have different nutrient requirements or different root depths to ensure that they do not compete intensely for the same resources.

• Common examples of mixed cropping in India include combinations such as Wheat + Gram, Wheat + Mustard, or Groundnut + Sunflower.

Additional Information

• Inter-cropping:

• Similar to mixed cropping, it involves growing two or more crops simultaneously, but in a definite row pattern.

• For example, a few rows of one crop may alternate with a few rows of another crop (e.g., Soybean + Maize).

• This method allows for better management of fertilizers and pesticides for individual crops compared to mixed cropping.

• Mono-cropping:

• This refers to the practice of growing only one type of crop on the same piece of land year after year.

• While it allows for specialization and mechanization, it often leads to the depletion of specific soil nutrients and increases the risk of pest outbreaks.

• Crop Rotation:

• It is the practice of growing different types of crops in the same area in sequential seasons.

• For instance, planting a leguminous crop (like pulses) after a cereal crop (like wheat) helps in nitrogen fixation and replenishes soil fertility naturally.

• Benefits of Diverse Cropping Systems:

• These systems improve soil health, increase biodiversity, and provide a varied diet and income source for farmers.

• They are essential components of sustainable agriculture and help in weed control and efficient utilization of solar energy.

Q2. Answer: (c) Change in the kinetic energy of the body

The correct answer is Change in the kinetic energy of the body.

Key Points

• The Work-Energy Theorem states that the net work done by the sum of all forces acting on an object is equal to the change in the kinetic energy of that object.

• This principle is derived from Newton's Second Law of Motion and is applicable to both constant and variable forces. Hence, statement 3 is correct.

• Mathematically, the theorem can be expressed as W = ΔK, where W is the total work done and ΔK is the change in kinetic energy (Final KE - Initial KE).

• The formula for Kinetic Energy (KE) is 1/2 mv^2, where m represents the mass of the body and v represents its velocity.

• If the net work done on an object is positive, its kinetic energy increases, meaning the object speeds up. If the net work is negative, the kinetic energy decreases, and the object slows down.

Additional Information

• Work Done:

• In physics, work is done when a force acts upon an object to cause a displacement. It is a scalar quantity.

• The SI unit of work is the Joule (J), which is equivalent to 1 Newton-meter (N·m).

• The formula for work is W = Fd cosθ, where F is force, d is displacement, and θ is the angle between the force and displacement vectors.

• Potential Energy (PE):

• Potential Energy is the energy held by an object because of its position relative to other objects, stresses within itself, or its electric charge.

• The most common form is Gravitational Potential Energy, calculated as PE = mgh, where g is the acceleration due to gravity (approximately 9.8 m/s^2 on Earth) and h is the height.

• Kinetic Energy (KE):

• It is the energy that a body possesses by virtue of being in motion.

• Since it depends on the square of the velocity, kinetic energy is always a non-negative value.

• Law of Conservation of Energy:

• This law states that energy can neither be created nor destroyed; it can only be transformed from one form to another.

• In a closed system where only conservative forces act, the sum of Kinetic Energy and Potential Energy remains constant.

Important Points

• Scalar Nature: Both Work and Energy are scalar quantities, meaning they have magnitude but no direction.

• Power: The rate at which work is done or energy is transferred is called Power. Its SI unit is the Watt (W), where 1 Watt = 1 Joule per second.

• Static Energy: This usually refers to Electrostatic Energy (energy stored in an electric field) or potential energy in a stationary state, but it is not the primary component defined by the Work-Energy Theorem.

• Applications: The Work-Energy Theorem is widely used in engineering and mechanics to solve problems where force and displacement are known, avoiding the need to calculate acceleration via Newton's Second Law.

Q3. Answer: (d) To pass genetic information to offspring

The correct answer is To pass genetic information to offspring.

Key Points

• DNA (Deoxyribonucleic Acid) replication is the fundamental process during reproduction that ensures the genetic blueprint is transferred from one generation to the next.

• In a dividing cell, the nucleus contains information for the inheritance of features from parents to offspring in the form of DNA molecules.

• The process of DNA copying creates two copies of the genetic material; these copies need to be separated from each other, with each going to a new daughter cell.

• Simply creating a DNA copy is not enough; it must be accompanied by the creation of an additional cellular apparatus (like mitochondria, ribosomes, etc.) so that the DNA copies have a functioning environment to survive. Hence, the primary purpose is to pass genetic information, making this statement the correct answer.

• The consistency of DNA copying during reproduction is important for maintaining the body design features that allow an organism to use a particular niche.

Additional Information

• Structure of DNA:

• DNA is a double-stranded helical structure first described by James Watson and Francis Crick in 1953.

• It is composed of nucleotides, which consist of a phosphate group, a deoxyribose sugar, and four types of nitrogenous bases: Adenine (A), Thymine (T), Guanine (G), and Cytosine (C).

• The Role of Variations:

• No biochemical process, including DNA copying, is 100% accurate. Small alterations occur during the process, leading to variations in the offspring.

• These variations are the source of evolution and allow species to survive in changing environments or ecological niches over long periods of time.

• While drastic changes in DNA can lead to the death of a cell, subtle variations provide a competitive advantage in the struggle for survival.

• Heredity and Genes:

• A gene is a specific segment of DNA that provides information for making a particular protein.

• If the information in the DNA changes, different proteins will be made, eventually leading to altered body designs or traits.

• Heredity is the process by which traits and characteristics are transmitted from parents to progeny through these genetic codes.

• Modes of Reproduction:

• In asexual reproduction, a single parent produces DNA copies that are almost identical, resulting in clones with very little variation.

• In sexual reproduction, DNA from two different individuals combines, leading to a greater degree of variation and genetic diversity.

Important Points

• Location: In eukaryotic cells, the majority of DNA is located in the cell nucleus, organized into structures called chromosomes. A small amount of DNA can also be found in mitochondria (mtDNA) and chloroplasts.

• Cell Division: Before mitosis or meiosis begins, the cell enters the S-phase (Synthesis phase) of the cell cycle, where DNA replication occurs.

• Biological Significance: Without DNA copying, the continuity of life would cease because new cells would lack the instructions necessary to perform metabolic functions or maintain biological structures.

Q4. Answer: (d) Law of Segregation

The correct answer is Law of Segregation.

Key Points

• The Law of Segregation is Mendel's first law of inheritance, which he derived from his experiments with monohybrid crosses.

• A monohybrid cross is a genetic cross between two individuals that differ in only one specific trait, such as plant height (Tall vs. Dwarf).

• According to this law, every individual possesses two alleles for any particular trait, and these alleles segregate (separate) during the formation of gametes.

• During meiosis, each gamete receives only one of the two alleles, ensuring that the offspring receives one allele from each parent. Hence, the statement regarding the Law of Segregation is correct.

• Mendel observed that in the F2 generation of a monohybrid cross, the recessive trait reappeared in a phenotypic ratio of 3:1, proving that the alleles did not blend but remained distinct.

Additional Information

• Law of Independent Assortment:

• This is Mendel's second law, derived from dihybrid crosses (crosses involving two traits, such as seed color and seed shape).

• It states that the alleles of two (or more) different genes get sorted into gametes independently of one another.

• Law of Dominance:

• Also observed in monohybrid crosses, it states that in a heterozygous pair, the dominant allele will mask the expression of the recessive allele.

• The trait that appears in the F1 generation is the dominant trait.

• Gregor Johann Mendel:

• Known as the Father of Genetics, he performed his experiments on Pisum sativum (garden pea) between 1856 and 1863.

• He presented his findings in 1865 at the Natural History Society of Brunn, providing the foundation for modern genetics.

• Other Options:

• The Law of Constant Proportion is a law of Chemistry formulated by Joseph Proust, stating that a chemical compound always contains its component elements in a fixed ratio by mass.

• The Law of Evolution refers to the broader biological theory of natural selection and descent with modification, primarily associated with Charles Darwin.

Important Points

• Purity of Gametes: The Law of Segregation is also referred to as the Law of Purity of Gametes because a gamete is always pure for a particular trait, carrying only one allele.

• Ratios: In a standard Mendelian monohybrid cross:

• The Phenotypic ratio is 3:1 (3 dominant, 1 recessive).

• The Genotypic ratio is 1:2:1 (1 Homozygous Dominant, 2 Heterozygous, 1 Homozygous Recessive).

• Mechanism: The physical basis of segregation is the separation of homologous chromosomes during Anaphase I of meiosis.

Q5. Answer: (d) –42,000 N

The correct answer is –42,000 N.

Key Points

• The calculation of force is based on Newton's Second Law of Motion, which states that Force (F) = mass (m) × acceleration (a).

• First, we must convert the initial velocity (u) of the car from km/h to m/s to maintain SI unit consistency. Given the speed is 180 km/h, we multiply by 5/18. Therefore, u = 180 × (5/18) = 50 m/s.

• The car comes to a complete stop, which means the final velocity (v) is 0 m/s. The time (t) taken for this change is 5 seconds.

• We calculate the acceleration (a) using the first equation of motion: v = u + at. Rearranging for a, we get a = (v - u) / t. Plugging in the values: a = (0 - 50) / 5 = -10 m/s². Hence, the acceleration is –10 m/s².

• The total mass (m) of the system (car + passengers) is 4200 kg. Using the force formula: F = 4200 kg × (-10 m/s²) = -42,000 N.

• The negative sign in the result –42,000 N signifies that the force is acting in the opposite direction to the motion of the car, which is characteristic of a braking or retarding force. Hence, the correct answer is –42,000 N.

Additional Information

• Newton's Second Law of Motion: This law provides a quantitative measure of force. It establishes that the net force acting on an object is equal to the rate of change of its linear momentum. For an object with a constant mass, it simplifies to the product of mass and acceleration.

• Unit Conversion: In physics problems, it is crucial to use the International System of Units (SI). Velocity should be in meters per second (m/s), mass in kilograms (kg), and time in seconds (s). The conversion factor 5/18 is derived from 1000 meters / 3600

seconds.

• Concept of Retardation: When the velocity of an object decreases over time, the acceleration is negative. This is specifically referred to as retardation or deceleration. In this context, the brakes provide the necessary frictional force to cause this retardation.

• The Newton (N): The SI unit of force is the Newton, named after Sir Isaac Newton. 1 Newton is defined as the amount of force required to accelerate a 1 kg mass at a rate of 1 m/s^2.

• Applications: Understanding braking force is essential in automotive engineering and road safety. It helps in determining stopping distances and designing efficient braking systems like ABS (Anti-lock Braking System) to handle large inertial loads.

Important Points

• Momentum: The initial momentum of the car was 4200 kg × 50 m/s = 210,000 kg·m/s. The final momentum is 0. The impulse provided by the brakes is equal to this change in momentum.

• Force Direction: Since force is a vector quantity, the sign is vital. A positive force would imply the car is speeding up, while the negative force confirms the application of brakes to reduce speed.

• Mass Sensitivity: If the mass of the car were lower, the same braking force would stop the car in less time or a shorter distance, demonstrating the role of inertia in motion.

Q6. Answer: (c) lower

The correct answer is lower.

Key Points

• Pitch is a characteristic of sound that allows the brain to distinguish between a shrill sound and a grave (deep) sound; it is directly dependent on the frequency of the vibration.

• A man's voice is generally characterized by a lower pitch because his vocal cords are longer and thicker compared to those of a child or a woman.

• In adult men, the vocal cords are approximately 17 mm to 25 mm in length, whereas in children, the vocal cords are much shorter, leading to different vibrational properties.

• Because the vocal cords in men are larger, they vibrate at a lower frequency. A lower frequency of vibration results in a sound that is perceived as having a lower pitch.

• Conversely, a child's vocal cords are short and thin, which causes them to vibrate with a higher frequency, producing a higher pitch or a shriller voice. Hence, the correct answer is lower.

Additional Information

• The Larynx (Voice Box):

• The larynx is the organ in the throat of mammals that contains the vocal cords and produces sound.

• During puberty, the larynx in males grows significantly larger than in females, often becoming visible as the Adam's apple. This growth is driven by testosterone and results in the deepening of the voice.

• Frequency and Hertz:

• Frequency is defined as the number of vibrations per second and is measured in Hertz (Hz).

• The typical fundamental frequency for an adult male ranges from 85 to 155 Hz, while for an adult female, it ranges from 165 to 255 Hz. A child's frequency is even higher, often exceeding 250-300 Hz.

• Vocal Cord Composition:

• Vocal cords are composed of twin infoldings of mucous membrane stretched horizontally across the larynx.

• The tension, mass, and length of these cords determine the pitch of the sound produced. Higher tension and lower mass/length result in higher frequency.

Important Points

• Shrillness vs. Loudness:

• It is important to distinguish pitch from loudness. While pitch depends on frequency, loudness depends on the amplitude of the sound wave.

• A bird produces a high-pitched sound (high frequency), whereas a lion’s roar has a low pitch (low frequency) but high loudness (high amplitude).

• Gender Differences:

• Women's vocal cords are approximately 12.5 mm to 17.5 mm long, which is intermediate between men and children, explaining why their pitch is generally higher than men's but often lower than very young children's.

Q7. Answer: (b) The endoplasmic reticulum stores genetic material in it.

The correct answer is The endoplasmic reticulum stores genetic material in it.

Key Points

• The Endoplasmic Reticulum (ER) serves as a channel for the transport of materials, especially proteins, between various regions of the cytoplasm or between the cytoplasm and the nucleus. Hence, statement 1 is correct.

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• Genetic material, specifically Deoxyribonucleic Acid (DNA), is stored within the Nucleus of the cell, not the Endoplasmic Reticulum. The ER is primarily involved in the synthesis and transport of molecules, while the nucleus acts as the control center containing hereditary information. Hence, statement 2 is incorrect.

• The Rough Endoplasmic Reticulum (RER) is characterized by the presence of ribosomes attached to its outer surface. These ribosomes are the primary sites for protein synthesis within the cell. Hence, statement 3 is correct.

• The Smooth Endoplasmic Reticulum (SER) lacks ribosomes and is responsible for the synthesis of lipids, including fats, steroids, and phospholipids. It also plays a role in carbohydrate metabolism. Hence, statement 4 is correct.

• Hence, the incorrect statement (and the correct answer) is that the endoplasmic reticulum stores genetic material.

Additional Information

• Structure of ER: The Endoplasmic Reticulum was first observed by Keith Porter, Albert Claude, and Ernest Fullam in 1945. It is a large network of membrane-bound tubules and sheets called cisternae.

• Detoxification: One of the crucial functions of the Smooth ER (SER) in the liver cells of vertebrates is detoxifying many poisons and drugs, making them water-soluble so they can be excreted from the body.

• Membrane Biogenesis: Some of the proteins and lipids synthesized by the ER help in building the cell membrane. This biological process is known as membrane biogenesis.

• Calcium Storage: In muscle cells, a specialized type of smooth ER called the sarcoplasmic reticulum stores calcium ions, which are essential for muscle contraction.

• Protein Folding: The Rough ER (RER) provides a surface where proteins are folded into their three-dimensional structures. Proteins that are improperly folded are usually retained or degraded.

Important Points

• The Endoplasmic Reticulum is absent in prokaryotic cells (like bacteria) and mature mammalian red blood cells (RBCs).

• It accounts for more than half of the total membrane in many eukaryotic cells.

• The lumen of the ER is the internal space enclosed by the ER membrane, which is distinct from the surrounding cytosol.

Q8. Answer: (a) It needs two parents

p data-end="57" data-start="0">The correct answer is It needs two parents.

Key Points

• Binary fission is a primary method of asexual reproduction where a single parent body divides into two nearly equal parts, each of which grows into an independent organism. Since it does not involve the fusion of gametes, it does not require two parents. Hence, statement 1 is incorrect (making it the correct answer).

• The process is remarkably fast and efficient, especially in prokaryotic organisms. Under ideal environmental conditions, some bacteria can undergo this process every 20 minutes, allowing for rapid colonization. Hence, statement 2 is correct.

• Because each division results in the doubling of the individuals, binary fission leads to an exponential population increase. This is a survival strategy that ensures the species can thrive quickly when resources are abundant. Hence, statement 3 is correct.

• Binary fission typically occurs in unicellular organisms belonging to the domains of Bacteria and Archaea, as well as some eukaryotic protists like Amoeba, Paramecium, and Euglena. Hence, statement 4 is correct.

• Hence, the correct answer is It needs two parents.

Additional Information

• The Process of Binary Fission:

• The process begins with DNA replication, where the genetic material of the single parent is copied. Following this, the cell undergoes elongation to separate the two copies of DNA.

• The final stage is cytokinesis, where the cytoplasm divides and a new cell wall or membrane forms down the middle, creating two daughter cells that are genetically identical clones of the parent.

• Types of Binary Fission:

• Irregular Binary Fission: Occurs in organisms like Amoeba where the plane of division can happen through any axis.

• Longitudinal Binary Fission: Observed in Euglena, where the division occurs along the longitudinal axis.

• Transverse Binary Fission: Seen in Paramecium and Planaria, where the division plane is perpendicular to the long axis of the organism.

• Advantages and Disadvantages:

• The main advantage is the speed of reproduction and the fact that no mate is required, which is energy-efficient for the organism.

• The primary disadvantage is the lack of genetic diversity. Since the offspring are clones, the entire population is equally susceptible to the same diseases or environmental changes.

Important Points

• Comparison with Mitosis:

• While binary fission in eukaryotes involves mitosis (division of the nucleus), prokaryotic binary fission is much simpler because bacteria lack a defined nucleus and spindle fibers.

• Biological Examples:

• Leishmania: This parasite causes Kala-azar and undergoes binary fission in a definite orientation in relation to its whip-like structures.

• Vibrio cholerae: The causative agent of cholera, which uses rapid fission to increase its bacterial load within the human gut.

Q9. Answer: (b) Roasting or calcination → Reduction to metal → Purification

The correct answer is Roasting or calcination → Reduction to metal → Purification.

Key Points

• The extraction of metals like Zinc from their concentrated ores is a multi-step metallurgical process that depends on the reactivity of the metal. Zinc is a metal of medium reactivity, usually found as sulphides or carbonates in nature.

• Roasting is the first step for sulphide ores (such as Zinc Blende, ZnS). The ore is heated strongly in the presence of excess air to convert it into Zinc Oxide (ZnO). Hence, the first part of the sequence is correct.

• Calcination is used for carbonate ores (such as Calamine, ZnCO3). The ore is heated strongly in limited air or the absence of air to convert it into Zinc Oxide (ZnO). Hence, this alternative first step is also correct.

• The Reduction of the metal oxide is the next step. It is easier to obtain a metal from its oxide than from its sulphides or carbonates. Zinc Oxide is reduced to metallic zinc by heating it with a reducing agent like Carbon (Coke). The reaction is ZnO + C -> Zn + CO. Hence, the second part of the sequence is correct.

• The metal obtained after reduction is often crude and contains impurities. The final step is Purification (or Refining), such as electrolytic refining or distillation, to obtain pure Zinc metal. Hence, the final part of the sequence is correct.

• Hence, the correct answer is Roasting or calcination → Reduction to metal → Purification.

Additional Information

• Roasting: This process is specifically used for sulphide ores. For example, 2ZnS + 3O2 -> 2ZnO + 2SO2. A significant byproduct of this process is Sulphur Dioxide, which is often used to manufacture Sulphuric Acid.

• Calcination: This process involves the thermal decomposition of carbonate ores. For example, ZnCO3 -> ZnO + CO2. This is typically performed in a reverberatory furnace where the air supply can be controlled.

• Reducing Agents: While Carbon (in the form of Coke) is the most common reducing agent for Zinc, other highly reactive metals like Sodium, Calcium, or Aluminium can also be used as reducing agents to displace metals of lower reactivity from their oxides.

• Electrolytic Refining: In this purification process, the impure metal is made the anode, and a thin strip of pure metal is made the cathode. A solution of the metal salt is used as an electrolyte. When current passes, pure metal from the anode deposits onto the cathode.

• Occurrence of Zinc: The major ores of Zinc include Zinc Blende (ZnS), Calamine (ZnCO3), and Zincite (ZnO). India has significant zinc resources, primarily located in Rajasthan (Zawar mines).

Important Points

• Reactivity Series: Zinc sits in the middle of the reactivity series. Metals at the top (like Potassium, Sodium) are extracted by electrolysis of their molten chlorides, while metals at the bottom (like Gold, Silver) often occur in a native state.

• Thermodynamics of Reduction: The reduction of ZnO with Carbon occurs at a temperature of approximately 1673 K. Since the boiling point of Zinc is 1180 K, the metal is collected as vapour and then condensed.

• Froth Flotation: Before roasting or calcination, sulphide ores like ZnS are usually concentrated using the Froth Flotation process to remove gangue (earthy impurities).

Q10. Answer: (c) A train moving on a straight track

The correct answer is A train moving on a straight track.

Key Points

• Motion is defined as the change in the position of an object with respect to time and its surrounding environment. Depending on the path taken by the object, motion is classified into various types.

• Rectilinear Motion: This refers to the movement of an object along a straight line. In this type of motion, the direction of the object remains constant throughout its path.

• A fan blade rotating: This represents rotational motion or circular motion. The particles of the fan blades move in a circular path around a fixed axis. Hence, this option is incorrect.

• A child running around a park: Since a park usually involves a curved or circular boundary, the path is not a single straight line. This is typically an example of curvilinear motion or circular motion. Hence, this option is incorrect.

• A train moving on a straight track: When a train travels on tracks that do not curve, every part of the train moves the same distance in a straight path. This is a classic example of rectilinear motion. Hence, this option is correct.

• A pendulum swinging: This is an example of periodic motion or oscillatory motion. The bob of the pendulum moves to and fro

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about a central mean position at regular intervals of time. Hence, this option is incorrect.

Additional Information

• Translatory Motion:

• It occurs when all parts of an object move the same distance in the same interval of time.

• It is divided into two categories: Rectilinear motion (motion in a straight line, e.g., a falling stone) and Curvilinear motion (motion along a curved path, e.g., a thrown ball).

• Circular and Rotational Motion:

• Circular motion is when an object moves along the circumference of a circle (e.g., a satellite orbiting the Earth).

• Rotational motion occurs when an object turns around an internal axis (e.g., the spinning of the Earth or a spinning top).

• Periodic and Oscillatory Motion:

• Periodic motion repeats itself after a fixed period of time (e.g., hands of a clock).

• Oscillatory motion is a specific type of periodic motion where the object moves back and forth (e.g., vibrating strings of a guitar or a child on a swing).

• Random Motion:

• This occurs when an object moves in a disorderly manner with no fixed path or direction (e.g., the motion of a honeybee or gas molecules).

Important Points

• Distance vs. Displacement: In rectilinear motion, if an object moves in a single direction without turning back, the magnitude of distance is equal to the magnitude of displacement.

• Uniform Rectilinear Motion: When an object covers equal distances in equal intervals of time along a straight line, it is said to be in uniform motion, meaning its velocity is constant.

• Non-Uniform Rectilinear Motion: If the speed of the object changes while moving in a straight line, it is called accelerated motion or non-uniform linear motion (e.g., a car starting from rest on a straight road).

• Newton's First Law: It states that an object will remain in its state of rest or uniform motion in a straight line unless acted upon by an external unbalanced force.

Q11. Answer: (a) ohm-meter

The correct answer is ohm-meter.

Key Points

• Resistivity, often represented by the Greek letter rho (ρ), is a fundamental property of a material that measures how strongly it resists the flow of electric current.

• The relationship between resistance (R) and resistivity (ρ) is given by the formula: $R = \rho (L / A)$, where L is the length of the conductor and A is the cross-sectional area.

• To find the unit of resistivity, we rearrange the formula to $\rho = (R \times A) / L$.

• The SI unit of resistance is the ohm (Ω), the unit of area is square meters (m^2), and the unit of length is meters (m).

• Substituting these into the formula: (ohm × m^2) / m = ohm-meter (Ω·m). Hence, the correct unit is ohm-meter.

• The option ohm/meter represents resistance per unit length, which is not resistivity. Hence, statement 2 is incorrect.

• The option ohm is the SI unit for electrical resistance, which depends on the dimensions of the object, unlike resistivity. Hence, statement 4 is incorrect.

Additional Information

• Nature of Materials:

• Conductors: Materials like silver, copper, and aluminum have very low resistivity (in the range of 10^-^8 Ω·m), making them ideal for electrical wiring.

• Insulators: Materials like rubber, glass, and fused quartz have very high resistivity (ranging from 10^{12} to 10^1^7 Ω·m), preventing current flow.

• Semiconductors: Materials like silicon and germanium have resistivity levels between conductors and insulators.

• Temperature Dependence:

• For metallic conductors, resistivity increases as the temperature rises because atomic vibrations interfere with electron flow.

• For semiconductors, resistivity typically decreases with an increase in temperature as more charge carriers become available.

• Conductivity (σ): It is the reciprocal of resistivity ($\sigma = 1/\rho$). Its SI unit is siemens per meter (S/m) or mho/meter. It indicates how easily a material allows electricity to pass through.

Important Points

• Intrinsic vs. Extrinsic: While resistance is an extrinsic property (depends on size and shape), resistivity is an intrinsic property. This means the resistivity of copper is the same whether you have a one-meter wire or a ten-meter wire.

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• Dimensional Formula: The dimensional formula for resistivity is [$M^1 L^3 T^{-3} A^{-2}$].

• Historical Context: Georg Simon Ohm, a German physicist, published his findings in 1827, which led to the definition of Ohm's Law and the subsequent naming of the unit for resistance after him.

• Specific Resistance: Resistivity is also frequently referred to as specific electrical resistance in many engineering and physics contexts.

Q12. Answer: (d) 25 cm

The correct answer is 25 cm.

Key Points

• The minimum distance at which an object can be seen most distinctly without any strain on the eyes is known as the least distance of distinct vision (LDDV).

• For a normal human eye of a young adult, this distance is standardly measured to be 25 cm.

• This specific distance is also referred to as the near point of the eye, which represents the closest limit of clear focus.

• To see objects at this distance, the ciliary muscles of the eye contract to increase the curvature of the crystalline lens, making it thicker and decreasing its focal length.

• If an object is placed closer than 25 cm, the eye lens cannot become sufficiently curved to focus the light rays onto the retina, resulting in a blurred and uncomfortable image.

Additional Information

• Far Point of the Eye:

• The farthest distance up to which the eye can see objects clearly is called the far point. For a normal human eye, the far point is at infinity.

• The region between the near point (25 cm) and the far point (infinity) is known as the range of vision.

• Power of Accommodation:

• This is the ability of the eye lens to adjust its focal length to see objects at varying distances.

• When viewing distant objects, ciliary muscles are relaxed, the lens is thin, and the focal length is maximum.

• When viewing nearby objects, ciliary muscles contract, the lens becomes thick, and the focal length decreases.

• Defects of Vision:

• Myopia (Near-sightedness): A condition where a person can see nearby objects clearly but cannot see distant objects distinctly because the image forms in front of the retina.

• Hypermetropia (Far-sightedness): A condition where a person can see distant objects clearly but cannot see nearby objects distinctly because the near point is further than 25 cm.

• Presbyopia: A common condition associated with aging where the power of accommodation decreases, often requiring bifocal lenses.

Important Points

• Structure and Function: The human eye functions like a camera, where the cornea and lens system focus light onto the retina, which acts as a light-sensitive screen containing photoreceptors.

• Persistence of Vision: The impression of an image does not vanish immediately from the retina; it persists for about 1/16th of a second, allowing for the perception of continuous motion in films.

• Age Factors: The near point of the eye changes with age. In infants, it can be as close as 5 to 8 cm, but as a person grows older, the ciliary muscles weaken and the lens loses flexibility, pushing the near point further away.

Q13. Answer: (d) CO2

The correct answer is CO2.

Key Points

• When Sodium Bicarbonate (NaHCO3), commonly known as baking soda, is mixed with dilute Hydrochloric Acid (HCl), a chemical reaction occurs that produces Sodium Chloride (NaCl), water (H2O), and Carbon Dioxide (CO2) gas.

• The balanced chemical equation for this reaction is: NaHCO3 + HCl → NaCl + H2O + CO2.

• The CO2 gas is released with brisk effervescence, which is a visible bubbling effect in the solution. Hence, the evolved gas is Carbon Dioxide.

• The identification of this gas is confirmed using the lime water test. When Carbon Dioxide is passed through lime water (an aqueous solution of Calcium Hydroxide), it turns the solution milky or turbid.

• The milkiness is caused by the formation of Calcium Carbonate (CaCO3), which is an insoluble white precipitate. The reaction is: Ca(OH)2 + CO2 → CaCO3 + H2O.

Additional Information

• Reaction of Acids with Metal Carbonates: In general, when acids react with metal carbonates or metal hydrogen carbonates

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(bicarbonates), the resulting products are always a salt, water, and carbon dioxide gas.

• Properties of Sodium Bicarbonate: It is a mild non-corrosive basic salt. It is widely used in the food industry as a leavening agent in baking and as an antacid to neutralize excess stomach acid.

• Excess CO2 Passage: If excess Carbon Dioxide is passed through the milky lime water, the milkiness eventually disappears. This is because the insoluble Calcium Carbonate converts into soluble Calcium Bicarbonate [Ca(HCO3)2].

• Uses of CO2: Apart from being a product in chemical tests, Carbon Dioxide is essential for photosynthesis in plants and is used in fire extinguishers because it does not support combustion and is denser than air.

Important Points

• Hydrogen Gas (H2): This gas is usually evolved when a reactive metal (like Zinc or Magnesium) reacts with a dilute acid. It is identified by the pop sound it makes when a burning splinter is brought near it.

• Chlorine Gas (Cl2): This is a greenish-yellow gas with a suffocating odor. It is typically produced during the electrolysis of brine (chlor-alkali process) or the reaction of metal oxides with concentrated HCl.

• Carbon Monoxide (CO): This is a colorless, odorless, and highly toxic gas produced during the incomplete combustion of carbon or hydrocarbons. It does not turn lime water milky.

• Lime Water Composition: Lime water is a clear, colorless solution of Calcium Hydroxide [Ca(OH)2]. It should not be confused with lime juice, which is citric acid.

Q14. Answer: (a) By simple heating or chemical methods

The correct answer is By simple heating or chemical methods.

Key Points

• Metals that are low in the reactivity series, such as Gold (Au), Silver (Ag), Platinum (Pt), and Mercury (Hg), are very unreactive and often found in their native state or as easily reducible oxides.

• Because of their low affinity for oxygen, the oxides of these metals can be reduced to the metallic state by simple heating alone. Hence, option 1 is correct.

• For example, Mercury is extracted from its sulphide ore, Cinnabar (HgS). When heated in air, it is first converted into mercuric oxide (HgO), and upon further heating, it is reduced to mercury metal.

• Displacement reactions are typically used for metals of medium reactivity (like Iron or Zinc) where a more reactive metal is used to displace them from their ores. Hence, option 2 is incorrect.

• Electrolytic reduction is a method reserved for highly reactive metals like Sodium (Na), Magnesium (Mg), and Aluminium (Al), which cannot be reduced by carbon or heat. Hence, option 3 is incorrect.

• Reacting with acids is generally a method to study the properties of metals or to form salts, but it is not a standard industrial process for the extraction of low-reactivity metals from their ores. Hence, option 4 is incorrect.

Additional Information

• Reactivity Series:

• The reactivity series is a list of metals arranged in descending order of their chemical reactivity.

• Metals at the top (Potassium, Sodium) are so reactive that they are never found as free elements in nature.

• Metals at the bottom (Gold, Silver) are the least reactive and are often called noble metals because they do not easily react with air, water, or acids.

• Extraction of Silver and Gold:

• While they occur in a free state, they are also extracted through chemical methods such as leaching.

• In the MacArthur-Forrest process, the ore is treated with a dilute solution of Sodium Cyanide (NaCN) or Potassium Cyanide (KCN) in the presence of air to form a soluble complex.

• The metal is then recovered from the solution by displacement using a more reactive metal like Zinc (Zn).

• Refining of Metals:

• Even after extraction, metals like Gold and Silver contain impurities and must be purified using electrolytic refining.

• In this process, the impure metal is made the anode, and a thin strip of pure metal is made the cathode in a solution of the metal's salt.

Important Points

• Native State: Metals like Gold and Platinum are found in the Earth's crust in their pure form because they have very low electrode potential and do not oxidize easily.

• Cinnabar Ore: It is the primary ore of Mercury. The process of heating it in excess air is known as roasting, which is the first step in extracting the metal.

• Environmental Impact: Extraction processes for Gold involving cyanide are strictly regulated globally due to the high toxicity of cyanide compounds to the ecosystem.

• Industrial Use: Silver and Gold are highly valued not just for jewelry but also in electronics due to their excellent electrical

conductivity and resistance to corrosion.

Q15. Answer: (b) Decrease in inter-particle space

The correct answer is Decrease in inter-particle space.

Key Points

• According to the Kinetic Molecular Theory, the temperature of a substance is a direct measurement of the average kinetic energy of its particles. When the temperature increases, the particles absorb thermal energy, which significantly increases their kinetic energy. Hence, statement 4 is correct.

• As the kinetic energy of the particles rises, they begin to move more rapidly and vigorously. In solids, this manifests as stronger vibrations, while in liquids and gases, it results in faster random motion. Hence, statement 3 is correct.

• When temperature increases, the particles move faster and collide more forcefully, causing them to move further away from each other to overcome inter-molecular forces of attraction. This leads to an increase in inter-particle space, a phenomenon commonly known as thermal expansion. A decrease in space only occurs when temperature drops or pressure increases. Hence, statement 2 is incorrect (the correct answer).

• If the temperature continues to rise, the particles gain enough energy to completely overcome the attractive forces holding them in a specific state of matter. This results in a phase transition, such as melting (solid to liquid) or boiling (liquid to gas). Hence, statement 1 is correct.

• Therefore, among the given options, a decrease in inter-particle space is the only process that does not occur with an increase in temperature.

Additional Information

• Kinetic Energy and Temperature: The relationship is mathematically defined where Kinetic Energy is proportional to the Absolute Temperature (measured in Kelvin). At 0 Kelvin (Absolute Zero), particle motion is theoretically considered to be at its minimum.

• Inter-particle Forces: These are the forces of attraction or repulsion which act between neighboring particles (atoms, molecules, or ions). In solids, these forces are strongest, keeping inter-particle spaces minimal. In gases, these forces are weakest, resulting in maximum inter-particle spaces.

• States of Matter:

• Solid: Defined shape and volume; particles are closely packed with minimal inter-particle space.

• Liquid: Defined volume but no defined shape; particles have moderate inter-particle space.

• Gas: Neither defined shape nor volume; particles have maximum inter-particle space and move freely.

• Thermal Expansion: This is the tendency of matter to change its shape, area, and volume in response to a change in temperature. For example, railway tracks are laid with small gaps to allow for expansion during summer.

Important Points

• Anomalous Expansion of Water: While most substances expand on heating, water behaves differently between 0 degrees Celsius and 4 degrees Celsius. In this specific range, its density increases and volume decreases (inter-particle space effectively decreases) as it is heated. However, above 4 degrees Celsius, it follows the standard rule of expansion.

• Diffusion: The rate of diffusion (mixing of particles) also increases with an increase in temperature because particles move faster and occupy the inter-particle spaces of other substances more quickly.

• Evaporation: This is a surface phenomenon where particles gain enough energy to leave the liquid state and enter the vapor state. The rate of evaporation increases with temperature as more particles acquire the necessary kinetic energy to break free.

Q16. Answer: (c) The occurrence of ocean tides

The correct answer is The occurrence of ocean tides.

Key Points

• The Universal Law of Gravitation, formulated by Sir Isaac Newton in 1687, states that every object in the universe attracts every other object with a force that is directly proportional to the product of their masses and inversely proportional to the square of the distance between them.

• Ocean tides are the periodic rise and fall of the sea level. This phenomenon is a direct consequence of the gravitational pull exerted by both the Moon and the Sun on the Earth. Hence, the occurrence of ocean tides is the correct answer.

• The Moon, being much closer to Earth than the Sun, exerts a stronger tidal force. This force is "differential" because the gravitational attraction is stronger on the side of the Earth facing the Moon than on the center or the far side, causing the water to bulge.

• The Sun also exerts gravitational attraction. When the Sun, Moon, and Earth are aligned (during New Moon and Full Moon), their combined forces create Spring Tides, which are exceptionally high.

• When the Sun and Moon are at right angles to each other relative to Earth, their gravitational forces partially counteract each other, resulting in Neap Tides, which have a lower tidal range.

Additional Information

• Variation of 'g' (Option 1):

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• The acceleration due to gravity (g) is not constant everywhere on Earth. It is maximum at the poles and minimum at the equator.

• This variation occurs because the Earth is an oblate spheroid (bulged at the equator) and due to the centrifugal force generated by Earth's rotation. It does not rely on the Sun or Moon's combined attraction. Hence, statement 1 is incorrect.

• Motion of Planets (Option 2):

• The motion of planets around the Sun is explained by the gravitational force providing the necessary centripetal force for orbital motion.

• While this is a triumph of the universal law of gravitation, it describes the attraction between two bodies (Sun and a planet) rather than the combined differential attraction of two external bodies on a third. Hence, statement 2 is incorrect.

• Centripetal Force (Option 4):

• The centripetal force keeping a stone in a circular path when tied to a string is provided by tension in the string, not the gravitational attraction of the Sun or Moon.

• In a broader sense, gravity acts as a centripetal force for celestial bodies, but in the context of a "stone," it is a mechanical tension. Hence, statement 4 is incorrect.

Important Points

• Gravitational Constant (G): The value of the universal gravitational constant is 6.674 x 10^-11 Nm^2/kg^2. It remains the same throughout the universe.

• Tidal Cycle: Most coastal areas experience two high tides and two low tides every 24 hours and 50 minutes. This is known as a lunar day.

• Barycenter: The Earth and Moon actually orbit around their common center of mass, called the barycenter, which is located inside the Earth but off-center. This orbital motion also contributes to the centrifugal force that creates the tide on the far side of the Earth.

• Mass vs. Distance: Although the Sun is about 27 million times more massive than the Moon, it is 400 times further away. Since the tidal force decreases with the cube of the distance, the Moon's effect on tides is about 2.2 times stronger than the Sun's.

Q17. Answer: (a) Barium sulphate which is insoluble

The correct answer is Barium sulphate which is insoluble.

Key Points

• When an aqueous solution of Barium chloride ($BaCl_2$) is mixed with an aqueous solution of Sodium sulphate (Na_2SO_4), a chemical reaction occurs that results in the formation of Barium sulphate ($BaSO_4$) and Sodium chloride (NaCl).

• The Barium sulphate formed in this reaction is a white solid that does not dissolve in water. This solid is known as a precipitate. Hence, the statement regarding Barium sulphate being insoluble is correct.

• This specific type of chemical reaction is classified as a Double Displacement Reaction. In such reactions, the cations and anions of two different compounds switch places to form two entirely new compounds.

• The chemical equation for this process is: $BaCl_2 (aq) + Na_2SO_4 (aq) \rightarrow BaSO_4 (s) + 2NaCl (aq)$. Here, the (s) denotes the solid state of the precipitate, while (aq) denotes the aqueous state of the other substances.

• The formation of the white precipitate is a primary observation in this experiment, serving as a qualitative test for the presence of sulphate ions in a solution.

Additional Information

• Precipitation Reaction: This is a sub-category of chemical reactions where two soluble salts in aqueous solution combine to form one or more insoluble products (precipitates). These reactions are vital in analytical chemistry for identifying various ions.

• Barium Sulphate ($BaSO_4$):

• It is a naturally occurring mineral known as barite.

• Due to its high density and insolubility in water and acids, it is widely used in the medical field as a radiopaque contrast medium (often called a Barium meal) for X-ray imaging of the digestive system.

• It is also used as a pigment in paints and as a filler in plastics and rubber products.

• Sodium Chloride (NaCl): Common salt remains in the aqueous phase during this reaction because it is highly soluble in water. It does not contribute to the visible precipitate.

• Solubility Rules: In chemistry, solubility rules help predict which compounds will form a precipitate. Generally, most sulphates are soluble, but those of Barium, Lead, Calcium, and Strontium are notable exceptions as they are insoluble or sparingly soluble.

Important Points

• Safety Considerations: While Barium sulphate is non-toxic because it is insoluble and cannot be absorbed by the body, Barium chloride is highly toxic and water-soluble. Careful handling is required in laboratory environments.

• Ion Exchange: During the reaction, the Barium ions (Ba^{2+}) from the barium chloride solution react with the Sulphate ions (SO_4^{2-}) from the sodium sulphate solution to form the ionic lattice of the solid precipitate.

• Reaction Observation: The white color is characteristic of the barium sulphate solid. If the reaction resulted in Sodium chloride crystallizing (as mentioned in option 4), it would only happen if the water was evaporated, not upon the immediate mixing of the

two aqueous solutions.

Q18. Answer: (a) Anode – Cl2, Cathode – H2, Solution – NaOH

The correct answer is Anode – Cl2, Cathode – H2, Solution – NaOH.

Key Points

• The process of electrolysis of an aqueous solution of sodium chloride (commonly known as brine) is industrially termed the Chlor-alkali process.

• When electricity is passed through brine, it decomposes to form sodium hydroxide, chlorine, and hydrogen. The name "Chlor-alkali" is derived from the products: "chlor" for chlorine and "alkali" for sodium hydroxide.

• At the Anode (the positive electrode), chlorine gas (Cl2) is produced as chloride ions lose electrons (oxidation).

• At the Cathode (the negative electrode), hydrogen gas (H2) is produced as hydrogen ions from the water gain electrons (reduction).

• The Sodium hydroxide (NaOH) solution is formed in the remaining liquid, typically near the cathode compartment.

• The overall chemical reaction representing this process is: $2NaCl(aq) + 2H2O(l) \rightarrow 2NaOH(aq) + Cl2(g) + H2(g)$.

Additional Information

• Chlorine (Cl2): It is a versatile gas used primarily for water treatment, disinfecting swimming pools, and the manufacture of PVC (Polyvinyl Chloride), disinfectants, CFCs, and pesticides.

• Hydrogen (H2): This byproduct is highly valuable as a fuel, for the hydrogenation of oils to produce margarine, and in the synthesis of ammonia for agricultural fertilizers.

• Sodium Hydroxide (NaOH): Commonly known as caustic soda, it is used for de-greasing metals, manufacturing soaps and detergents, in paper making, and for creating artificial fibers like rayon.

• Brine: It refers to a saturated or highly concentrated solution of salt (NaCl) in water. In a typical industrial setup, the concentration of salt is approximately 26%.

Important Points

• In the electrolytic cell, the migration of ions is specific: the negatively charged chloride ions (Cl^-) migrate toward the positive anode, and the hydrogen ions (H^+) (from water) migrate toward the negative cathode.

• The membrane cell and diaphragm cell are the modern technologies used to ensure that the chlorine gas produced does not react with the sodium hydroxide, as they would otherwise form sodium hypochlorite (bleach).

• The Chlor-alkali industry is one of the largest segments of the chemical industry, providing raw materials for thousands of downstream products including medicines and plastics.

Q19. Answer: (d) Movement in our body

The correct answer is Movement in our body.

Key Points

• Skeletal muscles are a specialized type of muscle tissue that is primarily attached to the bones of the skeleton, and their primary function is to facilitate locomotion and movement of various body parts. Hence, statement 4 is correct.

• These muscles are under voluntary control, meaning an individual can consciously decide when to contract or relax them through signals sent by the somatic nervous system.

• Physically, skeletal muscles appear striated (striped) under a microscope due to the highly organized arrangement of actin and myosin filaments within the muscle cells.

• They are connected to the bones via tough, fibrous connective tissues known as tendons, which act as levers to pull the bones during muscle contraction.

• While Circulation is primarily managed by the cardiac muscle of the heart and Excretion involves smooth muscles in the urinary system, skeletal muscles are uniquely designed for physical mobility and force generation. Hence, statements 1, 2, and 3 are incorrect.

Additional Information

• Types of Muscle Tissues:

• Smooth Muscle: These are non-striated and involuntary muscles found in the walls of internal organs like the stomach, intestines, and blood vessels. They assist in functions like peristalsis and regulating blood pressure.

• Cardiac Muscle: Found exclusively in the heart, these muscles are striated but involuntary. They are responsible for the rhythmic pumping of blood throughout the circulatory system.

• Functional Unit: The basic functional unit of a muscle fiber is the sarcomere. It contains the proteins necessary for contraction, allowing the muscle to shorten and exert force.

• Thermoregulation: Skeletal muscles play a vital role in maintaining body temperature. When they contract, they release heat as a byproduct, which is why the body shivers in cold conditions to generate warmth.

• Posture and Stability: Beyond active movement, these muscles provide postural support by resisting the pull of gravity, allowing

humans to stand upright and maintain joint stability.

Important Points

• Antagonistic Pairs: Skeletal muscles typically work in pairs. For example, to flex the arm, the biceps contract (agonist) while the triceps relax (antagonist). Since muscles can only pull and not push, this pairing is essential for back-and-forth movement.

• Energy Source: Muscle contraction requires a significant amount of Adenosine Triphosphate (ATP). This energy is derived from glucose and fatty acids through aerobic respiration or anaerobic glycolysis during intense exercise.

• Muscle Mass: In an average healthy adult male, skeletal muscle accounts for approximately 40% to 50% of the total body weight, whereas in females, it accounts for about 30% to 40%.

• Hypertrophy vs. Atrophy: Regular physical exercise leads to hypertrophy (increase in muscle size and strength), while lack of use or aging can lead to atrophy (wasting away of muscle tissue).

Q20. Answer: (b) Mixtures can be separated by physical methods, while compounds require chemical methods.

The correct answer is Mixtures can be separated by physical methods, while compounds require chemical methods.

Key Points

• Mixtures consist of two or more substances that are physically combined but not chemically bonded. Because there are no chemical bonds between the components, they can be separated using physical methods such as filtration, distillation, crystallization, or magnetization. In contrast, compounds are substances formed by the chemical combination of elements in a fixed proportion. To separate a compound into its constituent elements, chemical methods or electrochemical reactions like electrolysis are required. Hence, statement 2 is correct.

• A mixture does not have a fixed melting or boiling point. Instead, it typically exhibits a range of temperatures during phase changes because the composition can vary. Conversely, compounds are pure substances and possess sharp, fixed boiling and melting points. Hence, statement 1 is incorrect.

• In a mixture, each constituent substance retains its original properties. For example, in a mixture of iron filings and sulfur, the iron can still be attracted by a magnet. However, when a compound is formed (like Iron Sulfide), the individual properties of the elements are lost, and the new substance has entirely different chemical and physical characteristics. Hence, statement 3 is incorrect.

• Compounds are always homogeneous in nature, meaning they have a uniform composition and appearance throughout. Mixtures can be homogeneous (like solutions) or heterogeneous (like suspensions or soil), where the different components are visible to the naked eye or under a microscope. Hence, statement 4 is incorrect.

Additional Information

• Homogeneous vs Heterogeneous Mixtures:

• Homogeneous mixtures have a uniform composition throughout their mass. Examples include air, alloys (like brass), and salt dissolved in water.

• Heterogeneous mixtures do not have a uniform composition. Examples include a mixture of sand and sugar, chalk powder in water, or oil and water.

• Characteristics of Compounds:

• Compounds follow the Law of Definite Proportions, which states that a chemical compound always contains exactly the same proportion of elements by mass. For example, Water (H_2O) always contains hydrogen and oxygen in a 1:8 mass ratio.

• The formation of a compound involves a chemical change accompanied by the absorption or evolution of energy in the form of heat, light, or electricity.

• Separation Techniques:

• Physical methods: Used for mixtures. Chromatography is used to separate colors, and centrifugation is used to separate cream from milk.

• Chemical methods: Used for compounds. Thermal decomposition uses heat to break down a compound into simpler substances (e.g., Calcium Carbonate breaking into Calcium Oxide and Carbon Dioxide).

Important Points

• Energy Changes: During the preparation of a mixture, energy (heat, light, etc.) is usually neither given out nor absorbed. However, the preparation of a compound is always accompanied by a significant energy change.

• Composition: The components of a mixture can be present in any ratio, whereas the elements in a compound are always present in a fixed, definite ratio by weight.

• Purity: Compounds are considered pure substances because they consist of only one type of molecule, while mixtures are considered impure substances.

Q21. Answer: (b) Axon

The correct answer is Axon.

Key Points

• The Axon is a long, slender projection of a nerve cell or neuron that typically conducts electrical impulses known as action

potentials away from the cell body (also known as the soma). Hence, option 2 is correct.

• It serves as the primary transmission line of the nervous system, and as a bundle, axons help make up nerves.

• The axon originates from a specialized region of the cell body called the axon hillock, which acts as a junction where signals are integrated before being sent down the axon.

• Most large axons are wrapped in a fatty insulating layer called the myelin sheath, which is formed by glial cells. This sheath allows the nerve impulse to travel rapidly through a process called saltatory conduction.

• At its far end, the axon divides into several branches called axon terminals. these terminals are responsible for releasing neurotransmitters into the synapse to communicate with other neurons, muscles, or glands.

Additional Information

• Nucleus:

• The nucleus is located within the cell body (soma) of the neuron.

• It contains the genetic material (DNA) and controls the biosynthetic activities of the cell, such as growth and repair. It does not play a direct role in carrying the electrical impulse. Hence, option 1 is incorrect.

• Dendrites:

• Dendrites are branch-like structures that extend from the cell body.

• Their primary function is to receive incoming signals from other neurons and transmit those impulses toward the cell body. Hence, option 3 is incorrect.

• Synapse:

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

• It is the site where chemical or electrical signals are passed between cells via neurotransmitters. Hence, option 4 is incorrect.

Important Points

• Direction of Impulse: In a healthy neuron, the flow of information is unidirectional. It is received by the dendrites, processed in the cell body, and then transmitted away via the axon.

• Nodes of Ranvier: These are the periodic gaps in the myelin sheath where the axonal membrane is exposed to the extracellular space. These nodes are essential for the rapid regeneration of the action potential.

• Length of Axons: Axons vary greatly in length. In the human body, the longest axon is part of the sciatic nerve, which can extend over one meter from the spinal cord to the big toe.

• Myelination Cells: In the Central Nervous System (CNS), myelin is produced by oligodendrocytes, while in the Peripheral Nervous System (PNS), it is produced by Schwann cells.

Q22. Answer: (c) Particles to come closer

The correct answer is Particles to come closer.

Key Points

• Applying pressure to a gas results in the reduction of the space between its constituent particles. Because gases have large intermolecular spaces, increasing external pressure forces these particles into a smaller total volume, which effectively makes the particles come closer to each other. Hence, statement 3 is correct.

• According to Boyle's Law, at a constant temperature, the pressure of a given mass of an ideal gas is inversely proportional to its volume. This means that when pressure is increased, the volume must decrease, not increase. Hence, statement 1 is incorrect.

• The speed at which particles move is a function of their kinetic energy, which is directly proportional to the absolute temperature of the gas. While increasing pressure through compression can sometimes increase temperature (and thus speed) in an adiabatic process, pressure itself is a measure of force per unit area and does not fundamentally define the speed of particles in the same way temperature does. Hence, statement 2 is incorrect.

• When a gas is compressed (pressure is increased), work is done on the system. In most real-world scenarios, such as adiabatic compression, this causes the temperature to increase rather than decrease. A decrease in temperature usually requires the gas to expand or for heat to be removed from the system. Hence, statement 4 is incorrect.

• The high compressibility of gases is one of their most significant physical properties, distinguishing them from liquids and solids, where particles are already very close together.

Additional Information

• Boyle's Law: Discovered by Robert Boyle in 1662, it states that P1V1 = P2V2. This principle is fundamental in understanding how pneumatic systems and respiratory mechanisms function.

• Kinetic Molecular Theory: This theory explains that gas consists of a large number of submicroscopic particles (atoms or molecules), all of which are in constant, random motion. The distance between these particles is much larger than the size of the particles themselves.

• Liquefaction of Gases: By applying high pressure and reducing temperature, gases can be converted into liquids. This is the principle used in the production of LPG (Liquefied Petroleum Gas) and Liquid Oxygen used in hospitals.

• Compressibility Factor: In thermodynamics, the deviation of a real gas from ideal gas behavior is measured by the compressibility factor (Z). For an ideal gas, Z = 1, but for real gases, this value changes depending on the pressure and temperature.

• Diffusion and Effusion: Because particles in a gas are far apart and move rapidly, they can easily mix with other gases (diffusion) or escape through tiny openings (effusion). Increasing pressure can influence the rate at which these processes occur.

Important Points

• Industrial Applications: Compressed gases like CNG (Compressed Natural Gas) are used as fuel in vehicles because large volumes of gas can be squeezed into small cylinders by applying high pressure.

• Ideal Gas Equation: The relationship between pressure, volume, and temperature is summarized by the equation PV = nRT, where P is pressure, V is volume, n is the number of moles, R is the universal gas constant, and T is the temperature.

• Mean Free Path: When pressure increases and particles come closer, the mean free path (the average distance a particle travels between collisions) decreases. This leads to an increase in the frequency of collisions against the walls of the container.

Q23. Answer: (b) virtual and erect

The correct answer is virtual and erect.

Key Points

• Magnification (m) produced by a spherical mirror or lens is defined as the ratio of the height of the image (h') to the height of the object (h).

• A positive sign in the value of magnification indicates that the image is virtual and erect. This is because both the object and the image are situated above the principal axis, and according to the Cartesian sign convention, heights measured upwards are taken as positive. Hence, the correct answer is virtual and erect.

• If the magnification has a negative sign, it implies that the image is real and inverted. In this case, the image is formed below the principal axis, and heights measured downwards are taken as negative. Hence, statement 1 and statement 4 are incorrect.

• A virtual image cannot be obtained on a screen as the light rays do not actually meet but only appear to diverge from a point. Only real images can be caught on a screen. Hence, statement 3 is incorrect.

• The numerical value of magnification represents the size of the image relative to the object. If m = 1, the image is the same size as the object; if m > 1, the image is magnified; and if m < 1, the image is diminished.

Additional Information

• Magnification for Mirrors:

• In the case of spherical mirrors, magnification is also related to the object distance (u) and image distance (v). It is expressed as m = -v/u.

• For a plane mirror, the magnification is always +1, indicating the image is virtual, erect, and of the same size as the object.

• Convex mirrors always produce a magnification that is positive and less than 1 because they always form virtual, erect, and diminished images.

• Magnification for Lenses:

• For lenses, the magnification is given by the ratio m = v/u.

• A concave lens always gives a positive magnification less than 1, as it always forms a virtual, erect, and diminished image regardless of the object position.

• A convex lens can produce both positive and negative magnification depending on where the object is placed relative to the focus (F) and optical center (O).

Important Points

• Sign Convention: According to the New Cartesian Sign Convention, the object is always placed to the left of the mirror/lens. All distances measured to the right of the origin (pole/optical center) are positive, and those to the left are negative.

• Real Image: Formed when light rays actually intersect after reflection or refraction. These are always inverted and have a negative magnification.

• Virtual Image: Formed when light rays appear to meet when produced backwards. These are always erect and have a positive magnification.

• Applications: Understanding magnification is crucial in designing microscopes, telescopes, and corrective eyeglasses where specific image sizes and orientations are required.

Q24. Answer: (d) both magnitude and direction

The correct answer is both magnitude and direction.

Key Points

• A magnetic field is defined as a vector quantity, which by definition means it possesses both magnitude (strength) and direction.

• The magnitude of a magnetic field refers to the intensity of the magnetic force at a specific point. In the International System of Units (SI), the magnitude is measured in Tesla (T). Another common unit used is the Gauss (G), where 1 Tesla is equal to 10,000

Gauss.

• The direction of the magnetic field at any point is the direction in which the north pole of a compass needle points when placed at that location. Outside a magnet, the field lines emerge from the North Pole and enter the South Pole.

• It can be visualized using magnetic field lines. The density of these lines indicates the magnitude (stronger where lines are closer), and the tangent to the line at any point indicates the direction. Hence, the statement that it has both magnitude and direction is correct.

Additional Information

• Vector vs. Scalar Quantities:

• Vectors: Quantities like force, velocity, acceleration, and magnetic field require both a numerical value and a spatial orientation to be fully described.

• Scalars: Quantities like mass, time, temperature, and electric potential only have magnitude and no direction.

• Magnetic Flux Density: The magnetic field is often referred to as magnetic flux density (represented by the symbol B). It represents the amount of magnetic flux through a unit area taken perpendicular to the direction of the magnetic field.

• Sources of Magnetic Fields: Magnetic fields are produced by moving electric charges (electric currents) and the intrinsic magnetic moments of elementary particles associated with a fundamental quantum property known as spin.

• Lorentz Force: When a charge q moves with a velocity v in a magnetic field B, it experiences a force $F = q(v \times B)$. This cross-product mathematical relationship confirms that the magnetic field must have a direction to determine the resulting force.

Important Points

• Properties of Magnetic Field Lines:

• Field lines never intersect each other because, at a single point, the field cannot have two different directions.

• They form continuous closed loops, unlike electric field lines which begin on positive charges and end on negative charges.

• The strength of the field is proportional to the closeness of the lines; they are crowded near the poles where the magnetic field is strongest.

• Right-Hand Thumb Rule: To find the direction of a magnetic field produced by a straight current-carrying wire, point the thumb of the right hand in the direction of the current; the curled fingers then give the direction of the magnetic field lines.

• Historical Context: Hans Christian Ørsted discovered the relationship between electricity and magnetism in 1820, proving that an electric current creates a circular magnetic field around the wire.

Q25. Answer: (a) Amrita Devi Bishnoi

The correct answer is Amrita Devi Bishnoi.

Key Points

• The historic sacrifice for environmental conservation took place in September 1731 in the village of Khejarli, located in the Jodhpur district of Rajasthan.

• Amrita Devi Bishnoi, along with her three daughters, stood against the soldiers of Maharaja Abhai Singh of Marwar, who were sent to cut Khejri trees to fuel lime kilns for the construction of a new palace.

• During this protest, Amrita Devi famously declared that if a tree could be saved at the cost of one's head, it was still a cheap price to pay. She was the first to be martyred while hugging a tree to protect it.

• Following her example, a total of 363 members of the Bishnoi community from 84 villages sacrificed their lives to save the sacred trees. Hence, the statement regarding Amrita Devi Bishnoi is correct.

• This event is recognized as a pioneering movement in environmentalism and served as a major inspiration for the modern Chipko Movement led by Sunderlal Bahuguna in the 1970s.

Additional Information

• Medha Patkar:

• She is a prominent Indian social activist known for her leading role in the Narmada Bachao Andolan (NBA).

• The movement was started in 1985 to protest against the construction of large dams across the Narmada River, particularly the Sardar Sarovar Dam, due to the displacement of local tribal communities and environmental damage.

• Vandana Shiva:

• She is an world-renowned environmentalist and eco-feminist based in Delhi.

• She founded Navdanya in 1987, an organization dedicated to biodiversity conservation, organic farming, and the rights of farmers to save and share seeds.

• Sunita Narain:

• She is a distinguished Indian environmentalist who serves as the Director General of the Centre for Science and Environment (CSE).

• She has been a vocal advocate for sustainable development and was named in Time Magazine’s list of 100 Most Influential People in 2016.

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Important Points

• The Khejri Tree (Prosopis cineraria):

• It was declared the State Tree of Rajasthan in 1983.

• Known as the "Golden Tree of the Desert" or "Ghaf," it plays a vital role in the ecosystem of the Thar Desert by preventing soil erosion and providing fodder (Loom) and food (Sangri).

• Bishnoi Community:

• The sect was founded by Guru Jambheshwar (also known as Jambhoji) in 1485.

• The community follows 29 tenets (Bish-noi), which include a strict prohibition against cutting green trees and killing animals, making them some of the world's first organized environmentalists.

• Amrita Devi Bishnoi Wildlife Protection Award:

• The Government of India and the Rajasthan Government instituted this national award to honor individuals and communities for their extraordinary courage and dedication to protecting wildlife and forests.

• A commemorative fair (Mela) is held every year on Bhadrapad Shukla Dashmi at Khejarli village to pay tribute to the martyrs.

Q26. Answer: (b) 25(√2 + 1) m

Shortcut Trick

In a 45°−45°−90° triangle, the ratio of sides is 1 : 1 : √2.

Base (distance) = 1 unit = 25 m.

Height of standing part = 1 unit = 25 m.

Hypotenuse (broken part) = √2 units = 25√2 m.

Total height of pole = Standing part + Broken part = 25 + 25√2 = 25(√2 + 1) m.

Therefore The correct answer is 25(√2 + 1) m.

Alternate Method

Given:

Distance from foot to top (BC) = 25 m.

Angle of elevation (θ) = 45°.

Formula Used:

tan θ = Perpendicular / Base

cos θ = Base / Hypotenuse

Calculations:

=> In ΔABC, tan 45° = AB / BC

=> 1 = AB / 25

=> Standing part (AB) = 25 m

=> cos 45° = BC / AC

=> 1 / √2 = 25 / AC

=> Broken part (AC) = 25√2 m

=> Total length of pole = AB + AC

=> Total length = 25 + 25√2 = 25(√2 + 1) m

Therefore The correct answer is 25(√2 + 1) m.

Additional Information

Trigonometric Ratios for 45°

For a 45° angle, sin 45° = 1/√2, cos 45° = 1/√2, and tan 45° = 1.

Pythagoras Theorem

In a right-angled triangle, Hypotenuse² = Base² + Perpendicular².

Height and Distance Logic

The total height of a broken object is always the sum of the vertical part still standing and the hypotenuse formed by the broken part.

Q27. Answer: (d) Decreases by 16%

Shortcut Trick

Net percentage change formula = a + b + (a × b)/100

Here, a = −25 (decrease) and b = +12 (increase)

Net change = −25 + 12 + (−25 × 12)/100

Net change = −13 − 3 = −16%

Therefore The correct answer is Decreases by 16%.

Alternate Method

Given:

First decrease = 25%

Second increase = 12%

Calculations:

=> Let the initial salary of Sonali be 100 units.

=> Salary after 25% decrease = 100 − (25% of 100) = 75 units.

=> Salary after 12% increase = 75 + (12% of 75)

=> 75 + (12 × 75)/100 = 75 + 9 = 84 units.

=> Net change = Final salary − Initial salary = 84 − 100 = −16 units.

=> Net percentage effect = (−16 / 100) × 100 = −16%.

Therefore The correct answer is Decreases by 16%.

Additional Information

Successive Percentage Change

When a value is changed by x% and then by y%, the net effective change is given by [x + y + (xy/100)]%.

Base Value Concept

Percentage change is always calculated on the preceding value in a series of successive changes, not the original base unless specified.

Ratio Method

For 25% decrease, ratio is 4:3. For 12% increase, ratio is 25:28. Multiplying ratios (4×25):(3×28) = 100:84, which shows a 16% decrease.

Q28. Answer: (d) 22

Shortcut Trick

If each number in a data set is decreased by a constant value k, the average of the set is also decreased by k.

Given: Old Average = 25 and Decrease (k) = 3.

New Average = Old Average − k

New Average = 25 − 3 = 22.

Therefore The correct answer is 22.

Alternate Method

Given:

Total numbers (n) = 7

Initial Average = 25

Decrease in each number = 3

Formula Used:

Average = Sum of observations ÷ Total number of observations

Calculations:

=> Total Sum of 7 numbers = 7 × 25 = 175

=> Total decrease across all numbers = 7 × 3 = 21

=> New Total Sum = 175 − 21 = 154

=> New Average = 154 ÷ 7

=> New Average = 22

Therefore The correct answer is 22.

Additional Information

Properties of Averages

If every term in a set is increased by k, the average increases by k. If every term is multiplied or divided by k, the average is also multiplied or divided by k respectively.

Sum of Observations

Total Sum = Average × Total number of observations. This is the fundamental relation used for most average-based problems.

Average of Consecutive Numbers

For a set of consecutive numbers (AP), the average is always the middle term or (First term + Last term) ÷ 2.

Q29. Answer: (a) 102°

Shortcut Trick

In right-angled triangle BDC, angle C = 90° − angle DBC = 90° − 33° = 57°.

In triangle AEC, angle AEB is the exterior angle at vertex E.

By the Exterior Angle Theorem, angle AEB = angle CAE + angle C.

=> angle AEB = 45° + 57° = 102°.

Therefore The correct answer is 102°.

Alternate Method

Given:

In triangle ABC, BD perpendicular to AC at D, angle DBC = 33°, and angle CAE = 45° where E is on BC.

Formula Used:

1. Angle Sum Property of a triangle: Sum of angles = 180°.

2. Linear Pair: Sum of angles on a straight line = 180°.

Calculations:

=> In right-angled triangle BDC, angle BDC = 90°.

=> angle BCD + angle DBC + angle BDC = 180°

=> angle BCD + 33° + 90° = 180°

=> angle BCD = 180° − 123° = 57°

=> Now, consider triangle AEC. The sum of interior angles is 180°.

=> angle CAE + angle ACE + angle AEC = 180°

=> 45° + 57° + angle AEC = 180°

=> 102° + angle AEC = 180°

=> angle AEC = 180° − 102° = 78°

=> Since B, E, and C are collinear, angle AEB and angle AEC form a linear pair.

=> angle AEB + angle AEC = 180°

=> angle AEB + 78° = 180°

=> angle AEB = 180° − 78° = 102°

Therefore The correct answer is 102°.

Additional Information

Exterior Angle Theorem

The measure of an exterior angle of a triangle is equal to the sum of the measures of its two remote interior angles.

Angle Sum Property

The sum of the interior angles of any triangle is always 180°.

Linear Pair Postulate

If two angles form a linear pair, then the measures of the angles add up to 180°.

Q30. Answer: (d) 600

Shortcut Trick

Use the direct algebraic identity: $2ab = (a + b)^2 − (a^2 + b^2)$

Substitute the given values: $2ab = 50^2 − 1300$

$2ab = 2500 − 1300 = 1200$

$ab = 1200 ÷ 2 = 600$

Therefore The correct answer is 600.

Alternate Method

Given:

Total number of widgets produced (a + b) = 50

Sum of squares of widgets produced ($a^2 + b^2$) = 1300

Formula Used:

$(a + b)^2 = a^2 + b^2 + 2ab$

Calculations:

=> $(50)^2 = 1300 + 2ab$ => $2500 = 1300 + 2ab$ => $2ab = 2500 - 1300$ => $2ab = 1200$ => $ab = 1200 \div 2$ => $ab = 600$

Therefore The correct answer is 600.

Additional Information

Square of Difference Identity

$(a - b)^2 = a^2 + b^2 - 2ab$. This can be used to find the difference between two quantities when their sum of squares and product are known.

Sum and Product Relation

The relationship $(a + b)^2 - (a - b)^2 = 4ab$ is frequently used in quantitative aptitude to solve problems involving two variables without finding individual values.

Alternate Expression for Sum of Squares

$a^2 + b^2 = (a + b)^2 - 2ab$ or $a^2 + b^2 = (a - b)^2 + 2ab$. These are fundamental algebraic identities for competitive exams.

Q31. Answer: (a) 3 hours 18 minutes

Shortcut Trick

Let Total Capacity of the tank be LCM of 4, 6, and 8 = 24 units.

Net efficiency of (A + B − C) = 6 + 4 − 3 = 7 units/hr.

Work done in first 3 hours = 7 × 3 = 21 units.

Remaining work = 24 − 21 = 3 units, to be filled by (A + B) with efficiency 10.

Additional time = 3/10 hours = 18 minutes.

Total time = 3 hours + 18 minutes = 3 hr 18 min.

Therefore The correct answer is 3 hr 18 min.

Alternate Method

Given: Filling time for Pipe A = 4 hr, Pipe B = 6 hr, and Emptying time for Pipe C = 8 hr.

Pipe	Time (hr)	Total Work (units)	Efficiency
Pipe A	4	24	+6
Pipe B	6	+4	
Pipe C	8	−3	

Step-by-step Calculations:

=> Total efficiency when all pipes are open = (6 + 4 − 3) = 7 units/hr

=> Tank filled in first 3 hours = 7 × 3 = 21 units

=> Remaining tank capacity to be filled = 24 − 21 = 3 units

=> Efficiency of (A + B) only = 6 + 4 = 10 units/hr

=> Time taken by A and B to fill remaining part = 3 ÷ 10 = 0.3 hr

=> Converting to minutes: 0.3 × 60 = 18 min

=> Total time required = 3 hr + 18 min = 3 hr 18 min

Therefore The correct answer is 3 hr 18 min.

Additional Information

Net Efficiency Concept

In pipes and cisterns, efficiency of an inlet pipe is positive (+) and efficiency of an outlet/leak pipe is negative (−).

Time and Work Relation

Total Work = Time taken × Efficiency. To find total time, add the durations of different operational stages separately.

Unit Conversion

To convert hours into minutes, multiply the fractional or decimal part of the hour by 60.

Q32. Answer: (d) 10

Shortcut Trick

Average Speed = (2 × s1 × s2) ÷ (s1 + s2) = (2 × 5 × 4) ÷ (5 + 4) = 40 ÷ 9 km/hr.

Total Time = 4 hours 30 minutes = 4.5 hours = 9/2 hours.

Total Distance (both ways) = Average Speed × Total Time = (40 ÷ 9) × (9 ÷ 2) = 20 km.

One-way Distance = 20 ÷ 2 = 10 km.

Therefore The correct answer is 10 km.

Alternate Method

Given: Speed while going (s1) = 5 km/hr, Speed while returning (s2) = 4 km/hr, Total time (T) = 4.5 hours.

Formula Used: Distance (D) = [(s1 × s2) ÷ (s1 + s2)] × Total Time

=> Total Time (T) = 4 + 30/60 = 4.5 = 9/2 hours

=> D = [(5 × 4) ÷ (5 + 4)] × (9 ÷ 2)

=> D = (20 ÷ 9) × (9 ÷ 2)

=> D = 10 km

Therefore The correct answer is 10 km.

Additional Information

Average Speed Formula

When a person travels equal distances at speeds x and y, the average speed for the whole journey is (2xy) ÷ (x + y).

Time, Speed, and Distance Relationship

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

Conversion of Time

To convert minutes to hours, divide the value by 60 (e.g., 30 mins = 30/60 = 0.5 hours).

Q33. Answer: (b) 4312

Shortcut Trick

Convert Volume: 21.560 litres × 1000 = 21560 cm^3.

Let Radius (r) = 2x and Height (h) = 5x => Volume = (22/7) × $(2x)^2$ × 5x = 21560.

Solving: (22/7) × $4x^2$ × 5x = 21560 => 110/7 × $4x^3$ = 21560 => x^3 = 343 => x = 7.

Dimensions: r = 14 cm, h = 35 cm => Total Surface Area = 2πr(r + h) = 88 × 49 = 4312 cm^2.

Therefore The correct answer is 4312 cm^2.

Alternate Method

Given:

Volume (V) = 21.560 litres

Radius (r) = 2/5 × Height (h)

Formula Used:

1 litre = 1000 cm^3

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

Total Surface Area (TSA) = 2πr(r + h)

Calculations:

=> Volume = 21.560 × 1000 = 21560 cm^3

=> r = (2/5)h → h = (5/2)r

=> 21560 = (22/7) × r^2 × (5/2)r

=> 21560 = (110/14) × r^3

=> r^3 = (21560 × 14) ÷ 110

=> r^3 = 196 × 14 = 2744

=> r = $\sqrt[3]{2744}$ = 14 cm

=> h = (5 × 14) ÷ 2 = 35 cm

=> TSA = 2 × (22/7) × 14 × (14 + 35)

=> TSA = 2 × 22 × 2 × 49

=> TSA = 88 × 49 = 4312 cm^2

Therefore The correct answer is 4312 cm^2.

Additional Information

Cylinder Surface Areas

The Curved Surface Area (CSA) of a cylinder is 2πrh. The Total Surface Area (TSA) includes the area of two circular bases: TSA = 2πrh + $2\pi r^2$ = 2πr(r + h).

Unit Conversions

Capacity and Volume relationship: 1 Litre = 1000 cm^3 = 1 dm^3; 1 m^3 = 1000 Litres.

Volume of Cylinder

The amount of space occupied by a 3D cylinder is given by the base area times the height: V = $\pi r^2 h$.

Q34. Answer: (b) 440

Shortcut Trick

List the first 17 prime numbers and sum them manually as there is no arithmetic progression formula for primes.

Primes: 2, 3, 5, 7, 11, 13, 17, 19, 23, 29, 31, 37, 41, 43, 47, 53, 59.

Sum = (2+3+5+7) + (11+13+17+19) + (23+29+31+37) + (41+43+47) + (53+59)

Sum = 17 + 60 + 120 + 131 + 112 = 440.

Therefore The correct answer is 440.

Alternate Method

Given: The first 17 prime numbers.

Formula: Sum = p1 + p2 + ... + p17

=> Prime numbers are natural numbers greater than 1 with exactly two factors: 1 and itself.

=> Sequence: 2, 3, 5, 7, 11, 13, 17, 19, 23, 29, 31, 37, 41, 43, 47, 53, 59.

=> Sum = 2 + 3 + 5 + 7 + 11 + 13 + 17 + 19 + 23 + 29 + 31 + 37 + 41 + 43 + 47 + 53 + 59

=> Sum = (2+3+5+7+11+13+17+19+23+29) + (31+37+41+43+47+53+59)

=> Sum = 129 + 311

=> Sum = 440

Therefore The correct answer is 440.

Additional Information

Definition of Prime Numbers

A prime number is a whole number greater than 1 whose only factors are 1 and itself. 2 is the only even prime number.

Sum of Primes Property

There is no general algebraic formula to find the sum of the first n prime numbers; it requires direct addition of the specific terms.

Composite Numbers

Numbers that have more than two factors are composite numbers. Note that 1 is neither prime nor composite.

Q35. Answer: (a) 20%

Shortcut Trick

Total Effective Cost Price (CP) = 20,000 + 2,000 + 3,000 = Rs. 25,000.

Selling Price (SP) = Rs. 30,000.

Ratio of CP : SP = 25,000 : 30,000 = 5 : 6.

Profit = 6 − 5 = 1 unit.

Profit % = (1 ÷ 5) × 100 = 20%.

Therefore The correct answer is 20%.

Alternate Method

Given: Purchase Price = Rs. 20,000, Repair = Rs. 2,000, Transportation = Rs. 3,000, Selling Price (SP) = Rs. 30,000.

Formulas: Total CP = Purchase Price + Overheads | Profit = SP − CP | Profit % = (Profit ÷ CP) × 100

=> Total Cost Price (CP) = 20,000 + 2,000 + 3,000 = Rs. 25,000.

=> Profit = SP − CP = 30,000 − 25,000 = Rs. 5,000.

=> Profit % = (5,000 ÷ 25,000) × 100

=> Profit % = (1 ÷ 5) × 100 = 20%.

Therefore The correct answer is 20%.

Additional Information

Effective Cost Price

Any overhead expenses like repairs, labor, or freight are always added to the original purchase price to calculate the actual CP.

Profit and Loss Calculation

Both Profit Percentage and Loss Percentage are always calculated on the Cost Price (CP) unless otherwise stated.

Q36. Answer: (b) 19/2

Shortcut Trick

Apply BODMAS: First solve the innermost product, then the brackets, and finally the subtraction.

Inner curly bracket: 3/4 − (1/2 × 8/3) = 3/4 − 4/3 = −7/12.

Outer square bracket: 7/3 ÷ (−7/12) = 7/3 × (−12/7) = −4.

Final calculation: 11/2 − (−4) = 11/2 + 4 = 19/2.
Therefore The correct answer is 19/2.
Alternate Method
Given: 5 1/2 − [2 1/3 ÷ { 3/4 − 1/2 × 8/3 }]
Method: BODMAS Rule (Brackets, Of, Division, Multiplication, Addition, Subtraction)
=> Convert mixed fractions: 5 1/2 = 11/2 and 2 1/3 = 7/3
=> 11/2 − [7/3 ÷ { 3/4 − (1/2 × 8/3) }]
=> 11/2 − [7/3 ÷ { 3/4 − 4/3 }]
=> 11/2 − [7/3 ÷ { (9 − 16) / 12 }]
=> 11/2 − [7/3 ÷ { −7/12 }]
=> 11/2 − [7/3 × (−12/7)]
=> 11/2 − [−4]
=> 11/2 + 4
=> (11 + 8) / 2 = 19/2
Therefore The correct answer is 19/2.
Additional Information
BODMAS / VBODMAS Rule
Operations must be performed in the order: Vinculum, Brackets ((), {}, []), Of, Division, Multiplication, Addition, and Subtraction.
Mixed Fraction Conversion
A mixed fraction A b/c is converted to an improper fraction using the formula: (A × c + b) / c.
Division of Fractions
To divide one fraction by another, multiply the first fraction by the reciprocal of the second: (a/b) ÷ (c/d) = (a/b) × (d/c).

Q37. Answer: (d) 2^(15)

Shortcut Trick
Convert all numbers to base 2.
16 = 2^4, 8 = 2^3, and $(1/2)^3$ = 2^(−3).
For multiplication add powers, and for division subtract powers.
Resulting power = 4 + 5 + 3 − (−3) = 15.
Therefore The correct answer is 2^(15).
Alternate Method
Given:
Expression: 16 × 2^5 × 8 ÷ $(1/2)^3$
Formula Used:
a^m × a^n = a^(m+n)
a^m ÷ a^n = a^(m−n)
$(1/a)^n$ = a^(−n)
Calculation:
=> First, express each term as a power of 2.
=> 16 = 2^4
=> 8 = 2^3
=> $(1/2)^3$ = 2^(−3)
=> Substitute these values into the given expression:
=> 2^4 × 2^5 × 2^3 ÷ 2^(−3)
=> Using the multiplication rule (add exponents):
=> 2^((4 + 5 + 3)) ÷ 2^(−3)
=> 2^{12} ÷ 2^(−3)
=> Using the division rule (subtract exponents):
=> 2^(12 − (−3))
=> 2^(12 + 3) = 2^(15)
Therefore The correct answer is 2^(15).
Additional Information

BODMAS Rule

Simplification follows the BODMAS order: Brackets, Orders (powers/roots), Division, Multiplication, Addition, and Subtraction.

Laws of Exponents (Multiplication & Division)

When multiplying terms with the same base, add their exponents: a^m × aⁿ = a^(m+n). When dividing, subtract their exponents: a^m ÷ aⁿ = a^(m−n).

Negative Exponents

A negative exponent indicates the reciprocal of the base raised to the corresponding positive exponent: a^(−n) = 1 ÷ aⁿ.

Q38. Answer: (c) 5 : 33

Shortcut Trick

Expenditure Ratio = (Price Ratio) × (Quantity Ratio)

Expenditure on Jowar : Gram = (1 × 5) : (3 × 11)

Expenditure ratio = 5 : 33

Therefore The correct answer is 5 : 33.

Alternate Method

Given:

Ratio of Market Price (Jowar : Gram) = 1 : 3

Ratio of Quantity Consumed (Jowar : Gram) = 5 : 11

Formula Used:

Expenditure = Price per unit × Quantity

Calculations:

=> Let the prices be 1x and 3x respectively.

=> Let the quantities consumed be 5y and 11y respectively.

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

=> Expenditure on Gram = 3x × 11y = 33xy

=> Ratio of Expenditure = 5xy : 33xy

=> Ratio = 5 : 33

Therefore The correct answer is 5 : 33.

Additional Information

Product of Ratios

When a value depends on the product of two independent variables, its ratio is the product of the individual ratios of those variables.

Compound Ratio

The compound ratio of (a : b) and (c : d) is (ac : bd). This is used in calculating total Expenditure, Revenue, or Work.

Inverse Relation

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

Q39. Answer: (b) 2%

Shortcut Trick

Assume Savings = 100 units.

Expenditure = 100 + 150% of 100 = 250 units.

Net change in Income = (Change in Expenditure + Change in Savings) ÷ Initial Income.

Net change = (−12% × 250 + 37% × 100) ÷ 350 = (−30 + 37) ÷ 350 = 7 ÷ 350 = 1/50 = 2%.

Therefore The correct answer is 2%.

Alternate Method

Given:

Expenditure = 150% more than Savings.

Decrease in Expenditure = 12%.

Increase in Savings = 37%.

Formula Used:

Income = Expenditure + Savings

Let Savings = 100

=> Expenditure = 100 + (150/100) × 100 = 250

=> Initial Income = 250 + 100 = 350

=> New Expenditure = 250 − 12% of 250 = 250 − 30 = 220

=> New Savings = 100 + 37% of 100 = 100 + 37 = 137

=> New Income = 220 + 137 = 357

=> Increase in Income = 357 − 350 = 7

=> Percentage Increase = (7 ÷ 350) × 100 = 2%

Therefore The correct answer is 2%.

Additional Information

Income and Expenditure Relationship

The fundamental equation is Income = Expenditure + Savings. Any percentage change in components affects the total income proportionally.

Percentage Change

Percentage Increase/Decrease = (Final Value − Initial Value) ÷ Initial Value × 100.

Weighted Average in Income

Income change % = (E % × E_ratio + S % × S_ratio) ÷ (Total ratio). Here (250 × −12 + 100 × 37) ÷ 350 = 2%.

Q40. Answer: (d) Rs. 7,865

Shortcut Trick

Effective Compound Interest rate for 2 years at 10% = 10 + 10 + (10 × 10)/100 = 21%.

Total Amount percentage = 100% (Principal) + 21% (Interest) = 121%.

Amount = 121% of Rs. 6,500 = 1.21 × 6,500.

Amount = Rs. 7,865.

Therefore The correct answer is Rs. 7,865.

Alternate Method

Given:

Principal (P) = Rs. 6,500

Rate (R) = 10% per annum

Time (n) = 2 years

Formula Used:

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

Calculations:

=> $A = 6,500 \times (1 + 10/100)^2$

=> $A = 6,500 \times (1 + 0.1)^2$

=> $A = 6,500 \times (1.1)^2$

=> A = 6,500 × 1.21

=> A = 65 × 121

=> A = Rs. 7,865

Therefore The correct answer is Rs. 7,865.

Additional Information

CI vs SI Difference for 2 Years

The difference between Compound Interest and Simple Interest for 2 years is given by the formula: Difference = $P \times (R/100)^2$.

Half-Yearly Compounding

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

Compound Interest Formula

Compound Interest (CI) alone can be calculated as CI = A − P = $P[(1 + R/100)^n - 1]$.

Q41. Answer: (a) 7.5 years

Shortcut Trick

Age ratio of Father : Son = 5 : 1

Difference in ratio parts = 5 − 1 = 4 units

Given age difference = 30 years

4 units = 30 years → 1 unit = 30 ÷ 4 = 7.5 years

Therefore The correct answer is 7.5 years.

Alternate Method

Let the current age of the son be x years.

The father's age is 5× that of the son => 5x years.

Given that the father is 30 years older than the son.

=> 5x − x = 30

=> 4x = 30

=> x = 30 ÷ 4

=> x = 7.5

Therefore The correct answer is 7.5 years.

Additional Information

Age Difference Constant

The difference between the ages of two persons remains constant at any point in time.

Ratio Method

If the ratio of ages is a:b and the difference is D, then 1 unit = D ÷ (a−b).

Linear Equations in Ages

Problems involving 'n' years ago or 'n' years hence require adding or subtracting 'n' from the current age variables.

Q42. Answer: (d) 56.25

Shortcut Trick

20% of number + 60 = number

=> 80% of number = 60

=> Number = 60 ÷ 0.8 = 75

75% of number = 0.75 × 75 = 56.25

Therefore The correct answer = 56.25

Alternate Method

Given:

20% of a number + 60 = number

Formula Used:

Percentage = (Value ÷ 100) × Number

Expression	Value
Number	x
20% of x	0.2x

Calculations:

=> 0.2x + 60 = x

=> x − 0.2x = 60

=> 0.8x = 60

=> x = 75

=> 75% of x = 0.75 × 75 = 56.25

Therefore The correct answer is 56.25.

Additional Information

Percentage Basics

20% = 1/5 and 75% = 3/4

Equation Formation

Translate statements into algebraic equations

Shortcut Logic

If x − 20% of x = constant, then remaining % = constant

Q43. Answer: (d) 4900 π cm²

Shortcut Trick

The Surface Area of a sphere is 4 × π × (radius)².

Given Radius = 35 cm.
Surface Area = $4 \times \pi \times (35)^2 = 4 \times \pi \times 1225 = 4900\pi$ cm².
Therefore The correct answer is 4900π cm².
Alternate Method
Given:
Radius (r) of the Sphere = 35 cm.
Formula Used:
Surface Area (A) of a sphere = $4\pi r^2$
Calculations:
=> Surface Area = $4 \times \pi \times (35)^2$
=> Surface Area = $4 \times \pi \times (35 \times 35)$
=> Surface Area = $4 \times \pi \times 1225$
=> Surface Area = 4900π cm²
Therefore The correct answer is 4900π cm².
Additional Information
Volume of a Sphere
The amount of space inside a sphere is given by the formula $V = (4/3)\pi r^3$.
Curved Surface Area of Hemisphere
For a hemisphere (half-sphere), the curved surface area is exactly half of a full sphere: $CSA = 2\pi r^2$.
Total Surface Area of Hemisphere
A solid hemisphere includes the base circle (πr^2), making the total area: $TSA = 2\pi r^2 + \pi r^2 = 3\pi r^2$.

Q44. Answer: (c) 110

Shortcut Trick
Simplified ratio: 1/5 : 1/2 : 11/16
Multiply by LCM (80): 16 : 40 : 55
Difference (Greatest − Smallest): 55 − 16 = 39 units
39 units = 78 => 1 unit = 2
Largest number (55 units) = 55 × 2 = 110
Therefore The correct answer is 110.
Alternate Method
Given: Ratio of three numbers = 1/5 : 9/18 : 11/16
Formula: To convert fractional ratios to integers, multiply each term by the LCM of denominators.
=> First, simplify 9/18 = 1/2
=> Ratio = 1/5 : 1/2 : 11/16
=> LCM of 5, 2, 16 = 80
=> Simplified Ratio = (1/5 × 80) : (1/2 × 80) : (11/16 × 80) = 16 : 40 : 55
=> Let numbers be 16x, 40x, and 55x
=> Difference = 55x − 16x = 39x
=> Given 39x = 78 => x = 2
=> Largest number = 55x = 55 × 2 = 110
Therefore The correct answer is 110.
Additional Information
Ratio Simplification
To simplify a ratio of fractions a/b : c/d, multiply both terms by the LCM of b and d to obtain a ratio of whole numbers.
Proportional Constant
The 'x' in ratios like ax : bx represents the highest common factor (HCF) of the original numbers being compared.
Compound Ratio
The compound ratio of a:b and c:d is (a × c) : (b × d). This is useful when combining multiple relationships.

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Q45. Answer: (c) Rs. 4,644

Shortcut Trick

Net Selling Price (SP) = Marked Price (MP) × (100 − d1)% × (100 − d2)%

SP = 7500 × (100 − 14)% × (100 − 28)%

SP = 7500 × 86% × 72%

SP = 7500 × (86 ÷ 100) × (72 ÷ 100) = 75 × 0.86 × 72

SP = 5400 × 0.86 = 4644

Therefore The correct answer is Rs. 4,644.

Alternate Method

Given: Marked Price (MP) = Rs. 7,500, First Discount (d1) = 14%, Second Discount (d2) = 28%.

Formulas: Successive Discount = a + b − (a × b ÷ 100) | SP = MP × (100 − Total Discount%) ÷ 100

=> Price after first discount = 7500 × (100 − 14) ÷ 100 = 7500 × 0.86 = Rs. 6,450

=> Final Selling Price (SP) = 6450 × (100 − 28) ÷ 100 = 6450 × 0.72

=> SP = Rs. 4,644

Therefore The correct answer is Rs. 4,644.

Additional Information

Marked Price & Discount

Discount is always calculated on the Marked Price (MP). Selling Price = MP − Discount.

Successive Discount Calculation

Two successive discounts of x% and y% are equivalent to a single discount of [x + y − (xy ÷ 100)]%.

Q46. Answer: (a) 54

Shortcut Trick

New person age = New Average + (Previous Total Members × Increase in Average)

Here, Previous Members = 32, New Average = 22, Increase = 22 − 21 = 1

=> Teacher age = 22 + (32 × 1)

=> 22 + 32 = 54 years

Therefore The correct answer is 54 years.

Alternate Method

Given:

Number of students = 32

Average age of students = 21 years

Total members after teacher is included = 32 + 1 = 33

New average age = 22 years

Formula Used:

Sum of observations = Average × Number of observations

Calculations:

=> Total age of 32 students = 32 × 21 = 672 years

=> Total age of 33 persons (including teacher) = 33 × 22 = 726 years

=> Age of the teacher = Total age (33 persons) − Total age (32 students)

=> Age of the teacher = 726 − 672

=> Age of the teacher = 54 years

Therefore The correct answer is 54 years.

Additional Information

Weighted Average Formula

Used to find the average of combined groups: Avg_(combined) = (n1x1 + n2x2) ÷ (n1 + n2).

Net Deviation Method

The sum of deviations from the average is always zero. Addition of a person with age higher than average increases the overall average.

Arithmetic Mean Properties

If every value in a set is increased by a constant 'k', the average also increases by 'k'.

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Q47. Answer: (b) 37%

Shortcut Trick

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

Here, markup percentage (a) = +5% and discount percentage (b) = −40%.

Net change = 5 − 40 + (5 × −40) ÷ 100 = −35 − 2 = −37%.

Negative sign indicates a loss of 37%.

Therefore The correct answer is 37%.

Alternate Method

Given: Markup = 5%, Discount = 40%.

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

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

=> Marked Price (MP) = 100 + 5% of 100 = 105.

=> Selling Price (SP) = 105 − 40% of 105 = 105 − 42 = 63.

=> Loss = CP − SP = 100 − 63 = 37.

=> Loss percentage = (37 ÷ 100) × 100 = 37%.

Therefore The correct answer is 37%.

Additional Information

Marked Price & Discount

Discount is always calculated on the Marked Price. SP = MP × (100 − Discount%) ÷ 100.

Successive Percentage Change

When a value is increased by x% and then decreased by y%, the net effect is [x − y − (xy ÷ 100)]%.

Q48. Answer: (c) 7

Shortcut Trick

Net filling efficiency = (1/7 − 1/14) of tank per minute.

Net efficiency = (2 − 1)/14 = 1/14 of tank per minute.

Time to fill full tank = 14 minutes.

Time to fill one-half of the tank = 14 ÷ 2 = 7 minutes.

Therefore The correct answer is 7 minutes.

Alternate Method

Given: Filling Pipe (A) = 7 minutes, Emptying Pipe (B) = 14 minutes.

Formula Used: Total Work = LCM of time taken; Efficiency = Work ÷ Time.

Pipe	Time (min)	Total Capacity	Efficiency
Pipe A (Fill)	7	14 units	+2
Pipe B (Empty)	14	−1	

=> Combined Efficiency (A + B) = +2 − 1 = 1 unit/min.

=> Target Work = 1/2 × Total Capacity = 1/2 × 14 = 7 units.

=> Time required = Target Work ÷ Combined Efficiency = 7 ÷ 1 = 7 minutes.

Therefore The correct answer is 7 minutes.

Additional Information

Pipes and Cisterns Rule

If an inlet pipe fills in x hours and an outlet pipe empties in y hours, net work done in 1 hour = (1/x − 1/y) when both are open.

Efficiency Concept

Filling efficiency is taken as positive (+), while emptying efficiency is always taken as negative (−).

Q49. Answer: (c) 30 years

Shortcut Trick

Ratio of Person to Sibling = 3 : 1

Sum of ratio parts = 3 + 1 = 4 units

4 units = 40 years → 1 unit = 10 years

Age of the person = 3 units = 3 × 10 = 30 years

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Therefore The correct answer is 30 years.
Alternate Method
Given:
Sum of ages = 40 years
Person age = 3 × Sibling age
Calculations:
=> Let the age of the sibling be x years.
=> Age of the person = 3x years.
=> x + 3x = 40
=> 4x = 40
=> x = 40 ÷ 4 = 10 years
=> Person age = 3 × 10 = 30 years.
Therefore The correct answer is 30 years.
Additional Information
Ratio and Proportion in Ages
When ages are given in a ratio a:b and their sum is S, the ages are [a/(a+b)] × S and [b/(a+b)] × S.
Age Difference Constant
The difference between the ages of two people remains constant throughout their lives, regardless of how many years pass.
Future and Past Ages
If current age is x, then age 'n' years ago was (x − n) and age 'n' years later will be (x + n).

Q50. Answer: (a) 9 seconds

Shortcut Trick
Relative Speed (opposite direction) = 40 + 60 = 100 km/h.
Convert Speed to m/s: 100 × (5/18) = 250/9 m/s.
Total Distance to cover = Length of Train 1 + Length of Train 2 = 125 + 125 = 250 m.
Time = Distance ÷ Speed = 250 ÷ (250/9) = 9 seconds.
Therefore The correct answer is 9 sec.
Alternate Method
Given: Speed of Train A (S1) = 40 km/h, Speed of Train B (S2) = 60 km/h, Length of each train (L) = 125 m.
Formula Used: Time = (L1 + L2) ÷ (S1 + S2)
=> Total Distance = 125 + 125 = 250 m
=> Relative Speed = 40 + 60 = 100 km/h
=> Relative Speed in m/s = 100 × (5/18) = 500/18 = 250/9 m/s
=> Time taken = 250 ÷ (250/9)
=> Time taken = 250 × (9/250) = 9 seconds
Therefore The correct answer is 9 sec.
Additional Information
Relative Speed Concept
When two objects move in opposite directions, relative speed is the sum of individual speeds (S1 + S2). If moving in the same direction, it is the difference (S1 − S2).
Unit Conversion
To convert speed from km/h to m/s, multiply by 5/18. To convert from m/s to km/h, multiply by 18/5.
Crossing Distance
When a train crosses another train, platform, or bridge, the total distance is always the sum of their lengths.

Q51. Answer: (c) 1

Shortcut Trick
Condition to check: Odd Number → Even Number → Even Number
Instead of checking every single number, directly scan the series for two consecutive even numbers.
The only consecutive even numbers in the entire series are 4 and 6 near the end.
Check the number before 4: It is 3 (an Odd number).

Thus, the triplet 3, 4, 6 is the only one that perfectly satisfies the required condition.

Therefore The correct answer is 1.

Alternate Method

Given Series:

9 6 9 4 7 8 9 9 1 6 7 3 6 5 9 7 4 7 1 7 7 8 3 4 6 9 3

Condition to be fulfilled:

=> Odd Number → Even Number → Even Number

Let us identify all the even numbers in the series from left to right and check their adjacent numbers:

=> 9, 6, 9 → Preceded by Odd, Followed by Odd ×

=> 9, 4, 7 → Preceded by Odd, Followed by Odd ×

=> 7, 8, 9 → Preceded by Odd, Followed by Odd ×

=> 1, 6, 7 → Preceded by Odd, Followed by Odd ×

=> 3, 6, 5 → Preceded by Odd, Followed by Odd ×

=> 7, 4, 7 → Preceded by Odd, Followed by Odd ×

=> 7, 8, 3 → Preceded by Odd, Followed by Odd ×

=> 3, 4, 6 → Preceded by Odd, Followed by Even Yes

=> 4, 6, 9 → Preceded by Even, Followed by Odd ×

=> Clearly, there is only one such even number (4) which is immediately preceded by an odd number and immediately followed by an even number.

Therefore The correct answer is 1.

Additional Information

Preceded By

In any reasoning sequence, if an element X is 'preceded by' Y, it means Y comes immediately before X in the series (i.e., Y → X).

Followed By

If an element X is 'followed by' Z, it means Z comes immediately after X in the sequence (i.e., X → Z).

Odd and Even Numbers

An even number is an integer perfectly divisible by 2 (e.g., 2, 4, 6, 8), while an odd number leaves a remainder of 1 when divided by 2 (e.g., 1, 3, 5, 7, 9).

Q52. Answer: (a) Both conclusions (I) and (II) follow

Given Statements:

All wheels are cars.

All cars are trucks.

The least possible Venn diagram for the given statement is:

Conclusions:

I. Some trucks are cars - Follows (Since all cars are inside trucks, at least some trucks are cars).

II. All wheels are trucks - Follows (All wheels are cars and all cars are trucks, therefore all wheels are trucks).

So, both conclusions I and II follow.

Hence, the correct answer is Option 1.

Q53. Answer: (d) YAEB

The logic followed here is:

For, GIMJ is related to LNRO

For, QSWT is related to VXBY

Now, applying the same logic for TVZW

So, TVZW → YAEB

Hence, the correct answer is "Option 4".

Q54. Answer: (a) 61

Given: Mr. Memi is 34th from the left and Mr. Zzz is 9th from the right.

Total number of persons = 104

Convert Mr. Zzz's position from right into left:

Position from left = (Total + 1) − Position from right

= (104 + 1) − 9
= 96th
Now, positions:
Mr. Memi = 34th from left
Mr. Zzz = 96th from left
Number of persons between them = (96 − 34) − 1
= 62 − 1
= 61
Hence, the correct answer is Option 1.

Q55. Answer: (c) HVO

The logic followed here is:
So, the next term = HVO
Hence, the correct answer is Option 3.

Q56. Answer: (d) FBY−CYV

The logic followed here is:
For, PLI − MIF
For, VRO − SOL
Now, applying the same logic for FBY − CYV
So, FBY − CYV follows the same pattern correctly.
Hence, the correct answer is "Option 4".

Q57. Answer: (b) 6

The logic followed here is:
thus, "6" will replace the question mark in the given series.
Hence, the correct option is "Option 2"

Q58. Answer: (a) ym

The logic followed here is:
Given:
‘pig peak salad’ is coded as ‘aq ym lq’
‘lemon salad grape’ is coded as ‘wq cv ym’
So, salad → ym
Hence, the correct answer is Option 1.

Q59. Answer: (a) 9th

Given: Z is 61st from the right end, and total number of students is 97.
Z’s position from left = (97 − 61) + 1 = 37th
G is 28th to the left of Z, so:
G’s position from left = 37 − 28 = 9th
Therefore, G’s position from the left end is 9th.
Hence, the correct answer is Option 1.

Q60. Answer: (d) 70 metres

Given:
Kavya walks 100 metres North.
She turns right → 40 metres East.
She turns right → 30 metres South.
She turns right → 40 metres West.
So, she is 70 metres away from her original position.
Hence, the correct answer is Option 4.

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Q61. Answer: (b) Mother's sister's son

Family Chart:

Decoding the Symbols:

Symbol	•	#	x	@
Meaning	Son	Sister	Wife	Father

Given: L + O # V x E @ R

It means: L is the son of O, O is the sister of V, V is the wife of E, and E is the father of R.

So, L is the son of R's mother's sister.

Hence, the correct answer is Option 2.

Q62. Answer: (d) eg

The logic followed here is:

Given:

'true friends stay' is coded as 'eg nu ko'

'stay close always' is coded as 'bs eg xv'

So, stay → eg

Hence, the correct answer is Option 4.

Q63. Answer: (c) 4

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

Now,

Odd numbers, which are immediately preceded by an even number and also immediately followed by an even number.

So, Needed pattern is: Even Number - Odd Number - Even Number

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

So, total valid odd numbers = 4

Hence, the correct answer is Option 3.

Q64. Answer: (a) 47

The logic followed here is:

thus, "47" will replace the question mark in the given series.

Hence, the correct option is "Option 1".

Q65. Answer: (b) SRM

The logic followed here is based on the alphabetical position pattern:

Option 1: UVQ

Option 2: SRM

Option 3: EFA

Option 4: NOJ

Thus, SRM does not follow the pattern.

Hence, the correct answer is Option 4.

Q66. Answer: (a) (23, 30, 64)

The logic followed here is:

Logic: (1st number + 2nd number) + 11 = 3rd number

For, (5, 12, 28)

=> 5 + 12 = 17

=> 17 + 11 = 28

For, (8, 15, 34)

=> 8 + 15 = 23

=> 23 + 11 = 34

Now, checking the options using the same pattern:

Option 1) (23, 30, 64)

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=> 23 + 30 = 53
=> 53 + 11 = 64
Option 2) (21, 14, 32)
=> 21 + 14 = 35
=> 35 + 11 = 46 ≠ 32
Option 3) (19, 12, 28)
=> 19 + 12 = 31
=> 31 + 11 = 42 ≠ 28
Option 4) (7, 14, 24)
=> 7 + 14 = 21
=> 21 + 11 = 32 ≠ 24
Hence, the correct answer is Option 1.

Q67. Answer: (d) LM−MQ

The logic followed here is based on the alphabetical sequence pattern:
Option 1: XY – ZA
Option 2: QR – ST
Option 3: NO – PQ
Option 4: LM – MQ
Thus, LM – MQ does not follow the continuous alphabetical sequence pattern.
Hence, the odd one out is Option 4.

Q68. Answer: (c) One

Given: S, I, Q, H, R and G are sitting around a circular table facing the centre.
I sits to the immediate right of S.
Only three people sit between I and Q when counted from the left of I.
R sits to the immediate right of H.
So, there is 1 person between G and H from the left of H.
Hence, the correct answer is "Option 3".

Q69. Answer: (a) JNQN

The logic followed here is:
For, BFIF is related to IMPM
For, PTWT is related to WADA
Now, applying the same logic for CGJG
So, CGJG → JNQN
Hence, the correct answer is "Option 1".

Q70. Answer: (c) 8

Given number: 2436795
Logic:
Add 2 to each even digit
Subtract 3 from each odd digit
Original number: 2 4 3 6 7 9 5

Digit	Type	Operation	New Digit
2	Even	2 + 2	4
4	Even	4 + 2	6
3	Odd	3 − 3	0
6	Even	6 + 2	8
7	Odd	7 − 3	4
9	Odd	9 − 3	6

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5	Odd	5 − 3	2

New number: 4 6 0 8 4 6 2

Greatest digit = 8

Smallest digit = 0

Sum = 8 + 0 = 8

Hence, the correct answer is Option 3.

Q71. Answer: (b) Only conclusion (II) follows

Given Statements:

Some rails are cars.

No car is a bus.

The least possible Venn diagram for the given statement is:

Conclusions:

I. Some rails are buses - Does not follow (No definite relation is given between rails and buses).

II. Some cars are rails - Follows (From “Some rails are cars”, it follows that some cars are rails).

So, only conclusion II follows.

Hence, the correct answer is Option 2.

Q72. Answer: (a) 711

BODMAS Table:

Given equation: 43 ÷ 17 + 425 × 5 − 65 = ?

Now, replacing the symbols as:

Symbol	•	−	×	÷
Replaced by	−	•	÷	×

=> 43 × 17 − 425 ÷ 5 + 65 = ?

=> 731 − 425 ÷ 5 + 65 = ?

=> 731 − 85 + 65 = ?

=> 646 + 65 = ?

=> 711

Hence, the correct answer is Option 1.

Q73. Answer: (c) 1171

BODMAS Table:

Given equation: 73 − 15 ÷ 98 + 506 × 23 = ?

Now, replacing the symbols as:

Symbol	•	−	×	÷
Replaced by	−	•	÷	×

=> 73 × 15 + 98 − 506 ÷ 23 = ?

=> 1095 + 98 − 506 ÷ 23 = ?

=> 1095 + 98 − 22 = ?

=> 1193 − 22 = ?

=> 1171

Hence, the correct answer is Option 3.

Q74. Answer: (d) Three

Given: Seven people C, A, P, N, D, O and B are sitting in a row facing north.

No one sits to the right of B.

Only three people sit between B and N.

Only two people sit between N and C.

A sits third to the left of D.

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O sits to the immediate right of D.
Now, people between C and P = 3 people.
Hence, the correct answer is "Option 4".

Q75. Answer: (b) 2

Given: Five people A, B, C, D and E are sitting in a row facing north.
A sits fourth from the right end of the row.
Only one person sits between B and D.
D is not an immediate neighbour of A.
Now, number of people between A and D = 2.
Hence, the correct answer is "Option 2".

Q76. Answer: (a) 14

The logic followed here is:
Given numbers: 937, 782, 631,228, 175
Now, Arranging in descending order: 937, 175
Highest number = 937
→ Third digit = 7
Lowest number = 175
→ Second digit = 7
Result = 7 + 7 = 14
Hence, the correct answer is Option 1.

Q77. Answer: (d) One

The logic followed here is:
Given numbers: 567, 862, 426, 326, 749
Logic: Add 2 to the second digit of each number and check whether the resultant digit is exactly divisible by the third digit.
For, 567
→ Second digit = 6
→ 6 + 2 = 8
→ 8 ÷ 7 = Not divisible
For, 862
→ Second digit = 6
→ 6 + 2 = 8
→ 8 ÷ 2 = 4 (Exactly divisible)
For, 426
→ Second digit = 2
→ 2 + 2 = 4
→ 4 ÷ 6 = Not divisible
For, 326
→ Second digit = 2
→ 2 + 2 = 4
→ 4 ÷ 6 = Not divisible
For, 749
→ Second digit = 4
→ 4 + 2 = 6
→ 6 ÷ 9 = Not divisible
Only 862 satisfies the condition.
Hence, the correct answer is Option 4.

Q78. Answer: (c) 8 km towards the south

Given:
Ishu starts from P and drives 8 km West.

She turns right → 13 km North.

She turns right → 15 km East.

She turns right → 5 km South.

She turns right → 7 km West and stops at Q.

So, To reach P from Q → move 8 km South.

Hence, the correct answer is Option 3.

Q79. Answer: (d) PTX 116

The logic followed here is:

So, the next term = PTX 116

Hence, the correct answer is Option 4.

Q80. Answer: (d) 8

The logic followed here is:

thus, "8" will replace the question mark in the given series.

Hence, the correct option is "Option 4".

Q81. Answer: (b) 34

The correct answer is 34.

Key Points

• As of June 2025, the Ministry of Youth Affairs and Sports has notified a total of 34 Khelo India State Centres of Excellence (KISCEs) across 31 States and Union Territories in India.

• The KISCE initiative is a flagship program under the Khelo India Scheme, aimed at upgrading existing sports infrastructure in States and Union Territories to a world-class standard.

• Each center is tasked with focusing on specific Olympic sport disciplines to ensure concentrated development of talent and resources, helping India improve its standing in the Olympic Games.

• The selection of these 34 centers is based on the quality of existing infrastructure, coaching facilities, and the performance history of the State in particular sports.

• Financial assistance is provided by the Central Government to these centers to cover recurring and non-recurring costs, including sports science support, high-performance coaches, and technical equipment.

Additional Information

• The Khelo India Scheme:

• Launched in the financial year 2017-18, this umbrella scheme was introduced by the Government of India to revive the sports culture at the grassroots level.

• The scheme is divided into 12 verticals, ranging from infrastructure development to talent identification and community coaching.

• Strategic Objectives:

• The primary goal of KISCE is to create a robust ecosystem for athletes who have moved past the introductory stage and are ready for high-performance training.

• By June 2025, the integration of sports science (including nutrition, physiotherapy, and psychology) has become a mandatory component of these centers to ensure the holistic development of athletes.

• Identification of Talent:

• Athletes for these centers are often identified through national competitions such as the Khelo India Youth Games and Khelo India University Games.

• Selected athletes receive a scholarship and access to residential training facilities, aiming for peak performance in the 2028 and 2032 Olympic Games.

• Role of States and UTs:

• While the Central Government provides the funding and technical guidelines, the day-to-day management of these 34 centers remains with the respective State Governments or UT Administrations.

• This collaborative model ensures that the development of sports is not centralized but spread across the diverse geography of India.

Important Points

• The number of KISCEs has seen a steady increase since the first batch was announced, reflecting the government's commitment to reaching a target of at least one center of excellence in every State and UT.

• The Sports Authority of India (SAI) acts as the monitoring agency for these centers, ensuring that the quality of training meets international benchmarks.

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• Prominent sports included in the KISCE focus list are Archery, Athletics, Boxing, Hockey, Shooting, and Weightlifting.

Q82. Answer: (d) 131

The correct answer is 131.

Key Points

• The National Clean Air Programme (NCAP) is a long-term, time-bound, national-level strategy to tackle the air pollution problem across India in a comprehensive manner.

• By June 2025, the total number of cities covered under this flagship program is 131.

• These cities are primarily identified as non-attainment cities, which means they did not meet the National Ambient Air Quality Standards (NAAQS) for five consecutive years.

• The program initially started with 102 cities in 2019, which was later expanded to 122, and eventually to 131 cities to include those receiving grants under the XV Finance Commission for million-plus population cities.

• The primary objective of covering these 131 cities is to implement city-specific action plans to reduce the levels of Particulate Matter (PM10 and PM2.5) significantly.

Additional Information

• Launch and Governance:

• The NCAP was launched in January 2019 by the Ministry of Environment, Forest and Climate Change (MoEFCC).

• It represents the first such effort in India to frame a national framework for air quality management with a time-bound reduction target.

• Revised Targets:

• Initially, the goal was to achieve a 20% to 30% reduction in particulate matter concentration by 2024 (with 2017 as the base year).

• In September 2022, the Government of India updated the goal to a 40% reduction in particulate matter levels or achieving the National Ambient Air Quality Standards by 2025-26.

• PRANA Portal:

• To monitor the progress of the program in these 131 cities, the government launched PRANA (Portal for Regulation of Air-pollution in Non-Attainment cities).

• This portal tracks the physical and financial status of city action plan implementation and disseminates information on air quality to the public.

• Funding Mechanisms:

• Funding for the program is funneled through the Control of Pollution scheme for 82 cities with a population below one million.

• For the remaining 49 cities (million-plus cities), funding is provided through the XV Finance Commission air quality grants.

Important Points

• Multi-Sectoral Approach: The NCAP focuses on various sources of pollution, including industrial emissions, vehicular exhaust, biomass burning, and construction dust.

• Institutional Framework: It involves collaboration between the Central Pollution Control Board (CPCB), State Pollution Control Boards (SPCBs), and Urban Local Bodies (ULBs) to ensure ground-level execution of clean air plans.

• Monitoring Stations: As part of the program, there has been a significant increase in the number of Manual Monitoring Stations and Continuous Ambient Air Quality Monitoring Stations (CAAQMS) across the 131 identified cities to provide real-time data.

• Base Year: The base year for measuring the concentration of pollutants and calculating the percentage of reduction is 2017.

Q83. Answer: (b) $3.00/day

The correct answer is $3.00/day.

Key Points

• In June 2025, the World Bank officially updated the International Poverty Line (IPL) to $3.00 per day, a significant increase from the previous standard of $2.15 per day established in 2022.

• This revision is based on the latest Purchasing Power Parity (PPP) data, which accounts for changes in the global cost of living and inflation rates across different nations.

• For India, this update is particularly relevant as it serves as a benchmark for international organizations to assess the progress of poverty alleviation programs and economic growth.

• The $3.00/day threshold is used to define extreme poverty globally, ensuring that the metric reflects the minimum cost for basic food, clothing, and shelter in the current economic climate of 2025.

• The adjustment ensures that the poverty line remains consistent with the real value of the original "dollar-a-day" line introduced in the 1990s, updated periodically to maintain its relevance.

Additional Information

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• Purchasing Power Parity (PPP): This is a fundamental economic theory used by the World Bank and IMF to compare the purchasing power of different currencies. It calculates how much of a specific "basket of goods" a currency can buy in its domestic market compared to another country, usually the United States.

• Evolution of the Poverty Line: The International Poverty Line has evolved over decades, moving from $1.00 (1985 prices) to $1.08 (1993 prices), then $1.25 (2005 prices), $1.90 (2011 prices), and $2.15 (2017 prices) before the June 2025 adjustment.

• Sustainable Development Goals (SDGs): The United Nations has set SDG 1 with the target to "End poverty in all its forms everywhere" by the year 2030. The $3.00/day metric is the primary tool used to track the progress of Target 1.1 (eradicating extreme poverty).

• Income Classifications: The World Bank also maintains higher poverty lines for different economic tiers: $3.65/day for Lower-Middle-Income countries (like India) and $6.85/day for Upper-Middle-Income countries, though the extreme poverty line is the universal base.

• Data Sourcing: Poverty estimates are derived from household surveys conducted by national statistical agencies, such as India's National Sample Survey Office (NSSO), which are then harmonized by the World Bank.

Important Points

• Impact of Inflation: The shift to $3.00 was necessitated by global price increases following the pandemic recovery and geopolitical shifts, which reduced the real purchasing power of the previous $2.15 limit.

• Policy Implications: For the Government of India, while the National Poverty Line is used for domestic subsidies (like Antyodaya Anna Yojana), the World Bank line is a critical indicator for Foreign Direct Investment (FDI) and international credit ratings.

• Extreme vs. Relative Poverty: The IPL measures absolute poverty (survival needs), whereas many developed nations use relative poverty (income relative to the national median) to define their social safety nets.

Q84. Answer: (b) Shri Sanjay Malhotra

The correct answer is Shri Sanjay Malhotra.

Key Points

• The 54th meeting of the Monetary Policy Committee (MPC) was conducted over three days, specifically from 7 to 9 April 2025.

• The meeting was held under the Chairmanship of Shri Sanjay Malhotra, who serves as the Governor of the Reserve Bank of India (RBI) during this period.

• The primary objective of this MPC meeting was to deliberate on the prevailing macroeconomic situation and determine the Policy Repo Rate required to maintain price stability.

• The MPC is a statutory body responsible for fixing the benchmark interest rates in India, ensuring that inflation remains within the target range while supporting economic growth.

• Decisions within the committee are made through a majority vote among its six members, and the Governor holds the casting vote in the event of a tie.

Additional Information

• Monetary Policy Committee (MPC) Framework:

• The MPC was established following an amendment to the Reserve Bank of India Act, 1934, specifically under Section 45ZB, in the year 2016.

• It consists of six members: the Governor of the RBI (Chairperson, ex-officio), the Deputy Governor in charge of monetary policy, one officer of the RBI, and three external members appointed by the Central Government.

• The three external members are appointed for a non-renewable term of four years.

• Inflation Targeting:

• The Government of India, in consultation with the RBI, sets a Flexible Inflation Target (FIT) every five years.

• The current target for Consumer Price Index (CPI) inflation is 4%, with an upper tolerance limit of 6% and a lower tolerance limit of 2% (i.e., 4% +/- 2%).

• Frequency of Meetings:

• The MPC is legally required to meet at least four times a year.

• The quorum for a meeting is four members. After each meeting, the RBI publishes the resolution adopted by the committee.

• Monetary Policy Instruments:

• Repo Rate: The interest rate at which the RBI lends to commercial banks.

• Reverse Repo Rate: The rate at which the RBI borrows money from commercial banks.

• MSF (Marginal Standing Facility): A window for banks to borrow from the RBI in an emergency when inter-bank liquidity dries up.

Important Points

• Transparency and Accountability: The RBI must publish the minutes of every MPC meeting on the 14th day after the meeting concludes. This document includes the voting pattern and the individual statements of each member explaining their stance.

• Failure to Meet Target: If the inflation remains outside the 2-6% range for three consecutive quarters, it is considered a failure. In

such a case, the RBI must submit a report to the Central Government explaining the reasons and the proposed remedial actions.

• Monetary Policy Report: Every six months, the RBI publishes a report to explain the sources of inflation and the forecast for the next six to eighteen months.

Q85. Answer: (b) Producers must meet EPR targets using scrapping facilities.

The correct answer is Producers must meet EPR targets using scrapping facilities.

Key Points

• The Government of India, through the Ministry of Environment, Forest and Climate Change (MoEFCC), notified the End-of-Life Vehicles (ELV) Rules in February 2025, which are set to become effective from April 1, 2025.

• Under these rules, Producers (including manufacturers and importers) are required to fulfill Extended Producer Responsibility (EPR) targets. This means they must ensure that a certain percentage of the vehicles they sell are eventually recycled or scrapped through authorized Registered Vehicle Scrapping Facilities (RVSF). Hence, statement 2 is correct.

• The rules apply to all vehicles that have reached the end of their life, including those sold through public auctions or salvaged. There is no broad exemption for public sold salvaged vehicles as the goal is to prevent unorganized scrapping. Hence, statement 1 is incorrect.

• The ELV Rules cover all categories of vehicles produced or used within the country, including domestic production. It is not limited to imported vehicles alone. Hence, statement 3 is incorrect.

• Vehicles are generally classified as End-of-Life based on specific criteria such as the expiry of the fitness certificate, damage beyond repair, or voluntary scrapping by the owner, rather than a mandatory recycling rule for every vehicle regardless of its age or condition. Hence, statement 4 is incorrect.

• Hence, the correct answer is Producers must meet EPR targets using scrapping facilities.

Additional Information

• Extended Producer Responsibility (EPR):

• EPR is a policy approach under which producers are given a significant responsibility—financial and/or physical—for the treatment or disposal of post-consumer products.

• In the context of the ELV Rules 2025, this ensures that the automotive industry takes an active role in the circular economy by promoting recycling and resource recovery.

• Registered Vehicle Scrapping Facilities (RVSF):

• These are authorized centers that must follow strict environmental guidelines for dismantling and scrapping vehicles.

• The RVSF units are responsible for issuing a Certificate of Deposit to the vehicle owner, which may provide incentives for purchasing new vehicles.

• The use of these facilities ensures that hazardous materials like lead-acid batteries, fluids, and refrigerants are handled safely.

Important Points

• Regulatory Framework: The Central Pollution Control Board (CPCB) is expected to play a major role in monitoring the EPR certificates and ensuring compliance by producers.

• Objectives: The primary objective of the February 2025 notification is to reduce the carbon footprint of the transport sector and minimize soil and water pollution caused by old, leaking vehicles in the informal sector.

• Targets: The EPR targets are typically phased, increasing over the years to allow the automotive ecosystem to adapt to the new recycling infrastructure requirements.

Q86. Answer: (c) May 15

The correct answer is May 15.

Key Points

• The International Day of Families is observed annually on May 15. In the year 2025, this observance continues its tradition of highlighting the importance of the family unit in the global community.

• The day was officially proclaimed by the United Nations General Assembly in 1993 under resolution A/RES/47/237. It reflects the significance that the international community attaches to families as basic units of society.

• The first official observance took place in 1994, which was also designated as the International Year of the Family. This initiative aims to promote awareness of issues relating to families and to increase knowledge of the social, economic, and demographic processes affecting them.

• Each year, the United Nations selects a specific theme for the day. These themes often focus on education, poverty alleviation, work-family balance, and social integration to strengthen family-centered policies.

• The 2025 observance serves as a platform for policy-makers and non-governmental organizations to discuss demographic trends, such as aging populations and migration, and their specific impacts on family structures worldwide.

Additional Information

• Global Day of Parents (June 1):

• Proclaimed by the UN General Assembly in 2012, this day is observed on June 1 to honor parents throughout the world for their selfless commitment to children. Hence, option 1 is incorrect.

• World Population Day (July 11):

• Observed on July 11, this day seeks to focus attention on the urgency and importance of population issues. It was established by the Governing Council of the United Nations Development Programme in 1989. Hence, option 2 is incorrect.

• Sustainable Development Goals (SDGs):

• Families play a crucial role in achieving the 2030 Agenda for Sustainable Development. Objectives such as Goal 1 (No Poverty), Goal 3 (Good Health and Well-being), and Goal 4 (Quality Education) are heavily dependent on stable family environments and supportive government policies.

• Demographic Shifts:

• Recent data from the United Nations suggests that family sizes are shrinking globally, and the number of single-parent households is rising. The International Day of Families encourages member states to adapt their legal and social frameworks to these evolving dynamics.

Important Points

• The May 15 date remains constant every year, regardless of the day of the week. In 2025, the International Day of Families falls on a Thursday.

• The Division for Inclusive Social Development (DISD), part of the UN Department of Economic and Social Affairs (UN DESA), is the primary body responsible for organizing activities and research related to this day.

• Governments often use this day to launch social security schemes, parental leave benefits, and childcare initiatives to support the well-being of their citizens.

Q87. Answer: (b) Vaishno Devi

The correct answer is Vaishno Devi.

Key Points

• The tragic landslide occurred on 26 August 2025 near the world-famous Vaishno Devi shrine, which is located in the Reasi district of the Union Territory of Jammu & Kashmir.

• The incident took place on the track leading to the holy cave, specifically affecting the Himkoti route or the traditional Bhavan-Sanjichhat stretch, causing several casualties and leading to a high-level investigation ordered by the administration.

• The Shri Mata Vaishno Devi Shrine Board (SMVDSB), which manages the pilgrimage, immediately suspended the Yatra for safety reasons and launched a massive rescue operation involving the NDRF, SDRF, and local police.

• Preliminary reports suggested that the landslide was triggered by heavy rainfall in the Trikuta Hills, highlighting the geological vulnerability of the Himalayan region during the monsoon and post-monsoon periods.

• The Lieutenant Governor of Jammu & Kashmir, who serves as the Chairman of the Shrine Board, announced a committee to probe the causes of the slide and to review the disaster management protocols in place.

Additional Information

• Vaishno Devi Temple:

• Located at an altitude of approximately 5,200 feet, the shrine is situated in the Trikuta Mountains near Katra.

• It is one of the most visited pilgrimage sites in India, attracting millions of devotees annually. The base camp for the trek is Katra, located in the Reasi district.

• Geographical Context of Reasi:

• The Reasi district is home to significant landmarks including the Chenab Bridge, the world's highest railway bridge, and the Shiv Khori cave.

• The region is characterized by steep slopes and sedimentary rock formations, making it susceptible to landslides and soil erosion during intense weather events.

• Other Pilgrimage Sites Mentioned:

• Amarnath Cave: Located in the Anantnag district of Jammu & Kashmir at a much higher altitude of 12,756 feet. It is famous for the natural Ice Lingam.

• Hemkund Sahib: A prominent Sikh pilgrimage site located in the Chamoli district of Uttarakhand, dedicated to Guru Gobind Singh.

• Shankaracharya Temple: An ancient temple dedicated to Lord Shiva located on the Gopadari Hill in Srinagar, Jammu & Kashmir.

• Safety and Mitigation Measures:

• The SMVDSB has previously installed wire mesh and retaining walls along the track to prevent falling stones.

• Advanced Weather Forecasting systems and CCTV monitoring are used to track real-time conditions on the 13 km trek from Katra to the Bhavan.

Important Points

• Disaster Response: The National Disaster Response Force (NDRF) is the specialized body constituted under the Disaster Management Act, 2005, to deal with such emergencies in India.

• Investigation Scope: The high-level investigation typically involves geologists from the Geological Survey of India (GSI) to study the stability of the slopes and recommend long-term safety measures like slope stabilization and tunneling.

• Impact on Pilgrimage: The Vaishno Devi Yatra is a major economic driver for the Union Territory, supporting thousands of livelihoods in Katra and surrounding areas; hence, safety is a top priority for the Ministry of Home Affairs.

Q88. Answer: (d) June 2025

The correct answer is June 2025.

Key Points

• The Regional Climate Centre (RCC) Network Task Team Meeting is a significant international gathering scheduled to be hosted in India in June 2025.

• This meeting serves as a technical platform under the World Meteorological Organization (WMO) to streamline the operations of various climate centers across the globe.

• The primary objective of the meeting is to review the current status of the RCC Network and ensure that climate services are delivered efficiently to the National Meteorological and Hydrological Services (NMHSs) of member nations.

• Hosting this meeting in India underscores the nation's pivotal role in South Asian meteorology and its commitment to global climate monitoring and disaster preparedness.

• The task team will focus on enhancing the accuracy of long-range forecasts, seasonal climate outlooks, and the standardization of climate data products to help countries mitigate the impacts of climate change.

Additional Information

• Regional Climate Centres (RCCs):

• These are specialized centers designated by the WMO to create regional climate products.

• They provide support to national weather agencies by generating high-quality climatological data, which is essential for sectors like agriculture, water management, and energy.

• India operates a prominent RCC in Pune under the India Meteorological Department (IMD), which provides seasonal outlooks for the South Asian region.

• World Meteorological Organization (WMO):

• Established on 23 March 1950, the WMO is a specialized agency of the United Nations headquartered in Geneva, Switzerland.

• It coordinates international efforts regarding the state and behavior of the Earth’s atmosphere, its interaction with the land and oceans, and the resulting weather and climate.

• Significance of the Meeting:

• The June 2025 meeting is crucial for updating the technical criteria for RCC operations and exploring the integration of Artificial Intelligence (AI) and Machine Learning in climate modeling.

• It aligns with the Global Framework for Climate Services (GFCS), which aims to improve the quality and quantity of climate services available to vulnerable populations.

• India Meteorological Department (IMD):

• Established in 1875, the IMD is the principal agency responsible for meteorological observations, weather forecasting, and seismology in India.

• The IMD has been a lead player in the WMO Regional Association II (Asia), providing crucial data for cyclone warnings and monsoon predictions.

Important Points

• Climate Data Exchange: One of the key agendas of such meetings is the promotion of open and free data exchange between nations to enhance global weather predictive capabilities.

• Disaster Risk Reduction: By improving regional climate networks, the WMO aims to achieve the goal of protecting every person on Earth with Early Warning Systems by 2027, a target emphasized during recent UN climate summits.

• Technical Standards: The Task Team ensures that all Regional Climate Centres adhere to the strict technical and operational standards set by the Commission for Weather, Climate, Water and Related Environmental Services and Applications (SERCOM).

Q89. Answer: (c) Paris Saint-Germain

The correct answer is Paris Saint-Germain.

Key Points

• Paris Saint-Germain (PSG) emerged as the champions of the 2024-25 UEFA Champions League, marking a historic achievement for the club.

• The final match was held on May 31, 2025, at the iconic Allianz Arena in Munich, Germany.

• This victory represents PSG's first-ever European Cup/UEFA Champions League title, fulfilling a long-standing ambition for the

Paris-based side.

• By winning this title, PSG became the second French club in history to win the prestigious trophy, following Olympique de Marseille's victory in 1993.

• The 2025 final was the grand finale of the 70th season of Europe's premier club football tournament and the 33rd season since it was renamed the UEFA Champions League.

Additional Information

• New Tournament Format:

• The 2024–25 season introduced a revolutionary "Swiss-style" format, expanding the number of participating teams from 32 to 36.

• In this new League Phase, each team played eight matches against eight different opponents (four at home and four away) instead of the traditional group stage.

• This format change aimed to increase the number of high-profile matches early in the competition and provided more revenue opportunities for the UEFA member associations.

• Venue Details:

• The Allianz Arena, home to Bayern Munich, hosted its second Champions League final in 2025; the first was the famous 2012 "Finale dahoam."

• The stadium has a seating capacity of approximately 75,000 for domestic matches and around 67,000 for international UEFA events.

• Managerial Success:

• The team was led by head coach Luis Enrique, who had previously won the tournament with Barcelona in 2015.

• His tactical approach emphasized possession-based football and high-intensity pressing, which proved decisive throughout the knockout stages.

Important Points

• Qualification and Rewards:

• As the winners of the 2025 UEFA Champions League, PSG automatically qualified for the 2025–26 UEFA Champions League league stage.

• They also earned the right to play against the winners of the 2024–25 UEFA Europa League in the 2025 UEFA Super Cup.

• Furthermore, the victory ensured their participation in the expanded 2025 FIFA Club World Cup scheduled to be held in the United States.

• Financial Impact:

• The winner of the tournament received a base prize of €20 million for the final victory, in addition to accumulated bonuses from earlier rounds, totaling over €100 million in overall revenue.

• The UEFA Champions League remains the most lucrative club competition in world sports, with total distributions exceeding €2.4 billion for the 2024-25 cycle.

• Historical Context:

• The 2025 season marked a shift in European football hierarchy, as PSG overcame perennial giants like Real Madrid and Manchester City during their path to the trophy.

• Key players such as Ousmane Dembélé, Vitinha, and Bradley Barcola played pivotal roles in the club's successful campaign.

Q90. Answer: (b) Banking Laws (Amendment) Act, 2025

The correct answer is Banking Laws (Amendment) Act, 2025.

Key Points

• The Banking Laws (Amendment) Act, 2025 is a landmark piece of legislation aimed at strengthening governance in the Indian banking sector and enhancing depositor protection.

• One of the most significant changes introduced by this Act, effective from 1 November 2025, is the increased flexibility in nominations for bank deposits and locker facilities.

• Under the new provisions, depositors are now permitted to have up to four nominees for their accounts, whereas the previous limit was restricted to only one nominee. Hence, the statement regarding nomination flexibility is correct.

• The Act allows for both simultaneous and successive nominations, providing depositors with the choice to allocate percentages of their deposits to different individuals or establish a priority list of beneficiaries.

• This amendment primarily modifies the Banking Regulation Act, 1949, along with other related statutes like the Banking Companies (Acquisition and Transfer of Undertakings) Act, 1970 and 1980.

Additional Information

• Revision of "Substantial Interest":

• The Act has redefined the term substantial interest for bank directors. The threshold for defining such interest has been

increased from the earlier limit of Rs 5 lakhs to Rs 2 crores, reflecting modern economic realities.

• Change in Reporting Frequency:

• The statutory reporting requirements for banks to the Reserve Bank of India (RBI) have been synchronized. Banks are now required to report their credit and deposit data as of the 15th and the last day of every month, replacing the older system of fortnightly reporting Fridays.

• Statutory Auditors and Tenure:

• The amendment provides more autonomy and clarity regarding the tenure of statutory auditors and the appointment of directors in cooperative banks, ensuring better professional management.

• Unclaimed Dividends and DEAF:

• The Act introduces provisions for the transfer of unclaimed dividends and shares to the Depositor Education and Awareness Fund (DEAF) after a period of 10 years, allowing individuals to claim these funds from the RBI at a later stage.

Important Points

• The Banking Regulation Act, 1949: This is the parent act that regulates all banking firms in India. The 2025 Amendment ensures this act stays relevant in a digital-first banking environment.

• Impact on Cooperative Banks: The new law specifically empowers the Reserve Bank of India to exercise better oversight over Primary Agricultural Credit Societies (PACS) and Cooperative Banks, aligning their governance standards with Commercial Banks.

• Ease of Doing Business: By streamlining reporting dates and increasing the nomination count, the government aims to reduce administrative friction for both the banking institutions and the general public.

• Implementation: The Union Ministry of Finance and the Reserve Bank of India are the primary bodies responsible for the rollout and enforcement of these new rules starting November 2025.

Q91. Answer: (c) 28 February

The correct answer is 28 February.

Key Points

• National Science Day is celebrated in India every year on 28 February to commemorate the discovery of the Raman Effect.

• On this day in 1928, the renowned Indian physicist Sir Chandrasekhara Venkata Raman (C.V. Raman) announced the discovery of the scattering of light, which was later named after him as the Raman Effect.

• For his revolutionary work in the field of physics, Sir C.V. Raman was honored with the Nobel Prize in Physics in 1930. He was the first Indian and first Asian to receive a Nobel Prize in any branch of science.

• In 1986, the National Council for Science and Technology Communication (NCSTC) requested the Government of India to designate February 28 as National Science Day.

• The first National Science Day was celebrated on February 28, 1987, with the aim of spreading the message of the importance of scientific applications in the daily lives of the people.

Additional Information

• Sir C.V. Raman:

• He was born on 7 November 1888 in Tiruchirapalli, Tamil Nadu.

• Apart from the Nobel Prize, he was also awarded India's highest civilian honor, the Bharat Ratna, in 1954.

• He was also a recipient of the Lenin Peace Prize in 1957.

• The Raman Effect:

• It is a phenomenon in spectroscopy where a photon of light interacts with a molecule, leading to a change in the wavelength and energy of the light.

• This discovery is widely used in chemical laboratories to identify the structure of molecules and in medical diagnostics.

• Objectives of the Day:

• To display all the activities, efforts, and achievements in the field of science for human welfare.

• To give an opportunity to the scientific-minded citizens in the country and encourage them to popularize science and technology.

• To foster a scientific temper among the youth of India.

Important Points

• The Department of Science and Technology (DST) acts as a nodal agency to support and coordinate the celebration of National Science Day throughout the country.

• The government announces a specific theme for National Science Day every year. For example, the theme for 2024 was "Indigenous Technologies for Viksit Bharat", focusing on homegrown innovation.

• Various awards, such as the National Awards for Science Popularization, are conferred on this day to individuals and organizations for their outstanding contribution to science communication.

• Developing a scientific temper, humanism, and the spirit of inquiry and reform is a Fundamental Duty of Indian citizens under

Article 51A of the Constitution of India.

Q92. Answer: (c) Mondo Duplantis

The correct answer is Mondo Duplantis.

Key Points

• Armand "Mondo" Duplantis is a Swedish-American athlete who competes for Sweden and is widely considered the greatest pole vaulter in the history of the sport.

• He is recognized for his extraordinary world record-breaking performances, having broken the world record multiple times throughout his career. In April 2024, he set a new world record of 6.24 meters at the Diamond League meeting in Xiamen, China.

• The Laureus World Sportsman of the Year award is a prestigious global honor given to the male athlete who has demonstrated supreme athletic achievement. Duplantis has been a frequent nominee and winner in various categories due to his dominance in track and field.

• His accolades include winning the Gold Medal at the Tokyo 2020 Olympics and securing titles at the World Athletics Championships in 2022 (Eugene) and 2023 (Budapest).

• His ability to consistently improve his own records by small increments (the "Bubka" method) has made him a standout figure in global sports, leading to his selection for the 2025 cycle honors based on his 2024 season performance.

Additional Information

• Laureus World Sports Awards:

• Established in 1999 by founding patrons Daimler and Richemont, these awards celebrate the highest sporting achievements of the year.

• The first ceremony was held in 2000 in Monte Carlo, with Tiger Woods winning the first Sportsman of the Year award.

• The winners are selected by the Laureus World Sports Academy, which consists of over 70 sporting legends.

• Other Notable Athletes:

• Karsten Warholm: A Norwegian athlete who holds the world record in the 400-meter hurdles (45.94 seconds). He is a multiple-time World Champion and Olympic Gold medalist.

• Jakob Ingebrigtsen: A Norwegian middle-distance runner who won Olympic Gold in the 1500 meters at the Tokyo Games and holds several world and European records in the 1500m, 2000m, and 5000m.

• Armand Traoré: A former professional footballer who played as a defender for clubs such as Arsenal, Juventus, and Queens Park Rangers. He represented Senegal at the international level and is not associated with pole vaulting.

Important Points

• World Records: Mondo Duplantis has broken the world record eight times (as of early 2024). He first broke the record in February 2020 in Torun, Poland, with a jump of 6.17 meters, surpassing Renaud Lavillenie.

• Nationality: Although born and raised in the United States (Louisiana), Duplantis chose to represent his mother's home country, Sweden, in international competitions starting in 2015.

• Technique: His success is attributed to a combination of elite sprinting speed (learned from his father, a former vaulter) and exceptional gymnastic control.

• Consistency: In the 2024 season, his performance in Xiamen was particularly notable as it was his first outdoor competition of the year, where he cleared 6.24 meters on his first attempt.

Q93. Answer: (d) Dr. Anandharamakrishnan C

The correct answer is Dr. Anandharamakrishnan C.

Key Points

• Dr. Anandharamakrishnan C was honored with the Vigyan Shri award in 2024 for his outstanding contributions to the field of Agricultural Science.

• He currently serves as the Director of the CSIR-National Institute for Interdisciplinary Science and Technology (NIIST), located in Thiruvananthapuram, Kerala.

• His research work primarily focuses on food processing, food engineering, and the application of nanotechnology in the agricultural and food sectors.

• He is widely recognized for his pioneering work in 3D food printing, spray drying, and electrospraying of food bioactive compounds to improve their bioavailability.

• The Vigyan Shri is one of the four categories of the Rashtriya Vigyan Puraskar, newly instituted by the Government of India to recognize distinguished contributions to Science and Technology.

Additional Information

• Rashtriya Vigyan Puraskar (2024):

• The Government of India announced the first-ever Rashtriya Vigyan Puraskar in 2024, replacing various previous science awards with a unified national framework.

• A total of 33 awards were announced in August 2024, comprising 1 Vigyan Ratna, 13 Vigyan Shri, 18 Vigyan Yuva-Shanti Swarup Bhatnagar, and 1 Vigyan Team award.

• The awards were presented by the President of India, Droupadi Murmu, at Rashtrapati Bhavan.

• Award Categories:

• Vigyan Ratna: Awarded for lifetime achievements and contributions in any field of science and technology. In 2024, it was awarded to Prof. Govindarajan Padmanabhan for his work in Biological Sciences.

• Vigyan Shri: Conferred for distinguished contributions to a specific field. Recipients in 2024 included Prof. Jayant Bhalchandra Udgaonkar (Biological Sciences) and Dr. Avesh Kumar Tyagi (Atomic Energy).

• Vigyan Yuva–Shanti Swarup Bhatnagar: Recognizes young scientists (up to 45 years of age) for exceptional contributions.

• Vigyan Team: Given to a team of 3 or more scientists for collaborative research work. In 2024, this was awarded to the ISRO Chandrayaan-3 Team.

• Significance of Agricultural Science in RVP:

• The inclusion of Agricultural Science as a dedicated category highlights the government's focus on food security, sustainable farming, and agri-tech innovations.

• Dr. Anandharamakrishnan's recognition emphasizes the importance of value addition in agricultural produce and the reduction of post-harvest losses through engineering interventions.

Important Points

• The Rashtriya Vigyan Puraskar is organized across 13 domains, including Physics, Chemistry, Biological Sciences, Mathematics & Computer Science, Earth Sciences, Medicine, Engineering Sciences, Agricultural Science, Environmental Science, Technology & Innovation, Atomic Energy, Space Science & Technology, and others.

• The selection process is governed by the Rashtriya Vigyan Puraskar Committee (RVPC), headed by the Principal Scientific Adviser to the Government of India.

• Recipients of the Vigyan Shri award receive a Sanad (certificate) and a Medallion, but no monetary cash prize is associated with these specific national honors, focusing instead on the prestige of the recognition.

Q94. Answer: (b) Narendra Modi

The correct answer is Narendra Modi.

Key Points

• Prime Minister Narendra Modi participated in the Outreach Session of the 51st G7 Summit, which was held in Canada in June 2025.

• India was invited as an Outreach Country, continuing its streak of participation in the G7 meetings as a key global partner and a representative of the Global South.

• During the summit, the Indian Prime Minister engaged in discussions regarding global governance, artificial intelligence, energy security, and sustainable development. Hence, statement 2 is correct.

• The 51st G7 Summit saw the participation of leaders from the seven member nations and invited heads from various international organizations and partner countries to address geopolitical tensions and economic stability.

• The invitation to Narendra Modi reflects India's growing influence in the international arena and its strategic partnership with G7 nations like the United States, France, and Canada.

Additional Information

• The Group of Seven (G7):

• The G7 is an intergovernmental political forum consisting of seven of the world's advanced economies: Canada, France, Germany, Italy, Japan, the United Kingdom, and the United States.

• The European Union (EU) is also represented at the G7, though it is not a formal member.

• The group was established in 1975 (initially as the G6) to provide a platform for industrialized nations to coordinate economic policies and tackle global crises.

• G7 Presidency and Hosting:

• The presidency of the G7 rotates annually among its members. Canada held the presidency for the year 2025 and hosted the summit.

• The previous summit, the 50th G7 Summit, was hosted by Italy in June 2024 at Borgo Egnazia (Puglia).

• India has been a regular invitee to the G7 summits since 2019, when it was invited by France for the Biarritz Summit.

• Significance of the Outreach Session:

• The Outreach Session is a special segment of the G7 summit where leaders from non-member nations and international organizations are invited to discuss specific global issues like climate change, health, and digital transformation.

• It serves as a bridge between the G7 and the rest of the world, particularly the developing nations.

Important Points

• India's Role: India often uses the G7 platform to advocate for the concerns of the Global South, emphasizing inclusive growth and technological equity.

• Other Options: While Amit Shah (Union Home Minister), Nirmala Sitharaman (Finance Minister), and Droupadi Murmu (President of India) hold high constitutional and cabinet positions, it is traditionally the Prime Minister who represents India at G7 Outreach summits.

• Historical Context: India's first participation in a G7 (then G8) summit was in 2003 under the leadership of then PM Atal Bihari Vajpayee.

• Key Themes: The 2025 Summit in Canada emphasized clean energy transitions and supply chain resilience in the face of shifting global dynamics.

Q95. Answer: (c) Pakistan

The correct answer is Pakistan.

Key Points

• In 2025, Saudi Arabia and Pakistan signed a significant security agreement aimed at deepening their bilateral military cooperation and strategic partnership.

• The agreement focuses on enhancing joint military exercises, sharing intelligence, and collaborating on counter-terrorism operations to address evolving regional security challenges.

• A major component of this pact involves Defense Industrial Cooperation, where both nations agreed to explore joint ventures in defense production and the transfer of military technology.

• The security pact also emphasizes maritime security in the Arabian Sea and the Indian Ocean, ensuring the safety of vital international sea lanes and trade routes.

• This collaboration is seen as a move to stabilize the Middle East and South Asia regions, reflecting the high level of trust between the Saudi Armed Forces and the Pakistan Armed Forces.

Additional Information

• Historical Defense Ties: The security relationship between Saudi Arabia and Pakistan dates back several decades, formally strengthened by a defense protocol signed in 1982. Under this framework, Pakistan has historically provided military training and advisory services to the Saudi military.

• Islamic Military Counter Terrorism Coalition (IMCTC): Both nations are prominent members of the IMCTC, a 41-nation alliance headquartered in Riyadh. The coalition, often led by retired high-ranking officers from Pakistan, focuses on counter-terrorism through four domains: ideology, communications, counter-terrorist financing, and military.

• Strategic Location: Saudi Arabia views Pakistan as a key strategic ally due to its location at the crossroads of Central Asia, China, and the Middle East. Conversely, Saudi Arabia is the "Heart of the Islamic World" and a major energy supplier for Pakistan.

• Joint Exercises: The two countries regularly conduct high-intensity military drills such as Al-Samsaam (army), Al-Kassah (anti-explosive/mine), and Naseem Al-Bahr (navy) to improve interoperability between their respective forces.

• Economic and Security Synergy: The security agreement often runs parallel to economic initiatives like the Special Investment Facilitation Council (SIFC) in Pakistan, which encourages Saudi investment in sectors like mining, agriculture, and information technology.

Important Points

• Regional Stability: The 2025 agreement is particularly relevant given the shifting geopolitical dynamics in the Gulf region and the need for a unified approach toward non-state actors and maritime piracy.

• Humanitarian and Peacekeeping: Beyond combat operations, the pact includes provisions for disaster management and cooperation in United Nations Peacekeeping missions where both countries are active contributors.

• Cybersecurity: Modern security challenges including cyber warfare and digital surveillance were also integrated into the 2025 framework, marking an evolution from traditional kinetic warfare to modern hybrid security needs.

Q96. Answer: (a) Section 45 of Banking Act

The correct answer is Section 40(1) of Insurance Act.

Key Points

• The Insurance Regulatory and Development Authority of India (IRDAI) took regulatory action against Acko General Insurance in May 2025 for violations concerning outsourcing and commission payments.

• Section 40(1) of the Insurance Act, 1938 serves as a critical provision that prohibits the payment of remuneration or reward by way of commission to any person for soliciting or procuring insurance business in India, unless that person is an authorized insurance agent or an insurance intermediary.

• The investigation by IRDAI revealed that the insurer had entered into arrangements that resulted in payments exceeding the permissible commission caps or were directed toward entities not eligible under the regulatory framework.

• The fine was imposed because the outsourcing expenses were found to be a means of circumventing the statutory limits on acquisition costs and expenses of management. Hence, the statement regarding Section 40(1) is correct.

• This regulatory intervention emphasizes the necessity for general insurance companies to adhere strictly to the Insurance Act and IRDAI regulations to maintain market integrity and protect policyholders' interests.

Additional Information

• Insurance Regulatory and Development Authority of India (IRDAI):

• It is a statutory body formed under the IRDAI Act, 1999.

• The headquarters of the authority are located in Hyderabad, having moved from New Delhi in 2001.

• Its primary mission is to regulate and promote the insurance and reinsurance industries in India while ensuring the financial security of the sector.

• The Insurance Act, 1938:

• This is the foundational legislation governing the insurance sector in India.

• It provides the legal framework for the registration of insurance companies, investment of assets, and the prohibition of rebates and unauthorized commissions.

• Section 64V of this Act specifically deals with the assets and liabilities of an insurer and the determination of the solvency margin.

• Outsourcing Regulations:

• Under the IRDAI (Outsourcing of Activities by Indian Insurers) Regulations, 2017, insurers are strictly prohibited from outsourcing core functions such as underwriting, claims settlement, and compliance functions.

• The regulations aim to ensure that insurers retain effective control over their operations and do not utilize outsourcing as a loophole to pay extra commissions.

Important Points

• Section 40(1) Enforcement: The enforcement of this section ensures that the cost of insurance does not escalate due to unregulated payouts to intermediaries, which ultimately benefits the end consumer.

• Compliance Framework: Every insurer must submit an annual certificate signed by the CEO and Compliance Officer, affirming that all outsourcing arrangements and commission payments are in line with the statutory provisions.

• Penalties: IRDAI has the power to impose monetary penalties ranging from 1 lakh to 1 crore rupees per day of continuing violation or cancel the certificate of registration under extreme circumstances.

Q97. Answer: (a) IM Vijayan

The correct answer is IM Vijayan.

Key Points

• The legendary Indian footballer Inovivalappil Mani Vijayan, popularly known as IM Vijayan, has been selected for the prestigious Padma Shri award in the year 2025.

• He served as the former captain of the Indian National Football Team and is celebrated as one of the most gifted strikers to ever represent the country, often referred to as the "Black Pearl of Indian Football".

• IM Vijayan holds the distinction of being the first player to be honored as the AIFF Player of the Year on three separate occasions, specifically in the years 1993, 1997, and 1999.

• His illustrious international career spanned from 1989 to 2003, during which he formed a lethal attacking partnership with Bhaichung Bhutia and scored approximately 40 international goals for India.

• His contribution to the sport extends beyond the field, as he has been instrumental in mentoring young athletes and currently serves as the Chairman of the Technical Committee of the All India Football Federation (AIFF).

Additional Information

• The Padma Shri Award:

• The Padma Shri is the fourth-highest civilian award in the Republic of India, after the Bharat Ratna, the Padma Vibhushan, and the Padma Bhushan.

• It is awarded by the Government of India every year on the occasion of Republic Day to recognize distinguished contributions in various spheres like Art, Education, Literature, Science, Sports, Medicine, and Social Service.

• Career Highlights of IM Vijayan:

• Before his 2025 Padma Shri recognition, he was conferred with the Arjuna Award in 2003 for his excellence in Football.

• He was famous for scoring one of the fastest international goals in history, netting a goal against Bhutan in the 1999 SAF Games in just 12 seconds.

• Apart from his sporting career, he is a well-known actor in the Malayalam film industry, having debuted in the film Shantham, which won the National Film Award for Best Feature Film.

• Other Football Recipients:

• The Padma Shri has been previously awarded to other iconic Indian footballers, including Bhaichung Bhutia in 2008 and Sunil Chhetri in 2019.

• In the 2025 awards list, the government emphasized the recognition of sporting veterans who have dedicated their lives to raising the profile of Indian Sports globally.

Important Points

• IM Vijayan started his professional journey with the Kerala Police football team and went on to play for major clubs like Mohun Bagan, East Bengal, and JCT Mills.

• His selection in 2025 is seen as a long-overdue recognition for a player who dominated South Asian football throughout the 1990s.

• The Padma Awards 2025 ceremony is typically held at the Rashtrapati Bhavan, where the President of India confers the honors upon the recipients.

Q98. Answer: (c) BHASHINI

The correct answer is BHASHINI.

Key Points

• BHASHINI, which stands for Bharat Interface for Smart Indian Languages, is the National Language Translation Mission launched by the Government of India.

• It was officially launched by Prime Minister Narendra Modi in July 2022 during the Digital India Week held in Gandhinagar, Gujarat.

• The primary objective of the initiative is to break language barriers by utilizing Artificial Intelligence (AI) and Machine Learning (ML) technologies to provide digital content and services in Indian languages. Hence, the correct answer is BHASHINI.

• The platform aims to enable citizens to access the internet and digital government services in their native languages, thereby promoting digital inclusion for those who are not proficient in English.

• It focuses on all 22 scheduled languages of India, seeking to create a massive open-source ecosystem for datasets and models that can be used by startups and developers to build innovative language-based solutions.

Additional Information

• IndiaStack:

• IndiaStack is a set of open APIs (Application Programming Interfaces) and digital public goods that allow governments, businesses, and developers to utilize a unique digital infrastructure.

• It is built on four distinct layers: Presence-less (Aadhar), Paperless (DigiLocker), Cashless (UPI), and Consent Layer.

• While it provides the foundation for digital identity and payments, it is not primarily a language translation portal.

• DigiLocker:

• Launched in July 2015 under the Digital India program, DigiLocker is a flagship initiative by the Ministry of Electronics and Information Technology (MeitY).

• It provides cloud-based storage for citizens to store, share, and verify authentic digital documents such as driving licenses, marksheet, and Aadhar cards.

• Its main purpose is paperless governance and documentation, not solving language barriers.

• UMANG (Unified Mobile Application for New-age Governance):

• UMANG was launched in November 2017 by Prime Minister Narendra Modi to provide a single platform for all Indian citizens to access pan-India e-Gov services.

• The app integrates services from Central and State government departments, such as EPFO, PAN, Aadhar, and Gas cylinder booking.

• It is available in 13 languages to enhance accessibility, but unlike BHASHINI, its core function is service aggregation rather than language translation technology.

Important Points

• Bhasha Daan: This is a crucial component of the BHASHINI mission where citizens can contribute to the enrichment of Indian language datasets by transcribing, translating, or validating text and speech.

• The Digital Divide: Statistics show that a large percentage of the Indian population cannot access the internet effectively due to language constraints; BHASHINI aims to bridge this gap to reach the next billion users.

• Universal Product/Service Interface (UPHI): The mission also works on creating a seamless interface for voice-based digital interactions, allowing users to perform tasks like digital payments through voice commands in their mother tongue.

Q99. Answer: (a) Eaglenest Wildlife Sanctuary

The correct answer is Eaglenest Wildlife Sanctuary.

Key Points

• The Standing Committee of the National Board for Wildlife (NBWL), in its meeting held in November 2025, cleared the proposal for the construction of the Pinjoli bridge.

• The bridge is located within the Eaglenest Wildlife Sanctuary, situated in the West Kameng district of Arunachal Pradesh.

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• This infrastructure project is a critical component of the Bhalukpong-Charduar-Tawang (BCT) road, which is of strategic importance for the movement of defense forces and logistics toward the Line of Actual Control (LAC).

• The Pinjoli bridge construction involves the diversion of forest land, and the approval was granted with specific mitigation measures to ensure the protection of the local flora and fauna.

• The NBWL is the apex body in India for all wildlife-related matters and its approval is mandatory for any project passing through protected areas like national parks and sanctuaries. Hence, the correct answer is Eaglenest Wildlife Sanctuary.

Additional Information

• Eaglenest Wildlife Sanctuary:

• Located in Arunachal Pradesh, it covers an area of approximately 218 square kilometers.

• It gained international fame in 2006 following the discovery of a rare bird species named Bugun Liocichla.

• The sanctuary is part of the Kameng Elephant Reserve and is known for its incredible altitudinal range, varying from 500 meters to 3,250 meters.

• Dehing Patkai Wildlife Sanctuary:

• Located in the Dibrugarh and Tinsukia districts of Assam, it is often referred to as the "Amazon of the East".

• It was officially declared a National Park in June 2021. It is the only sanctuary in India that is home to seven different species of wild cats.

• Sepahijala Wildlife Sanctuary:

• This sanctuary is located in Tripura and is famous for its Clouded Leopard National Park.

• It is a prominent site for the conservation of the Phayre's leaf monkey (also known as the Spectacled Monkey), which is the state animal of Tripura.

• Dzukou Valley Wildlife Sanctuary:

• Situated at the border of Nagaland and Manipur, it is renowned for its natural beauty and seasonal blooms of the Dzukou Lily.

• The valley is a popular trekking destination and faces ecological threats from forest fires and unregulated tourism.

Important Points

• National Board for Wildlife (NBWL): It is a statutory body constituted under the Wildlife (Protection) Act, 1972. The Prime Minister serves as the ex-officio chairman of the board.

• Border Roads Organization (BRO): Most strategic bridges in this region, including those near Eaglenest, are executed by the BRO under Project Vartak to enhance national security infrastructure.

• Wildlife Clearances: Any non-forestry activity within a protected area requires a recommendation from the Standing Committee of the NBWL after initial scrutiny by the State Board for Wildlife.

Q100. Answer: (b) 8th Central Pay Commission

The correct answer is 8th Central Pay Commission.

Key Points

• The Union Cabinet of India officially approved the Terms of Reference (ToR) for the 8th Central Pay Commission on 28 October 2025.

• The primary mandate of the 8th Central Pay Commission is to review, examine, and recommend changes to the existing salary structure, allowances, and retirement benefits for all Central Government employees, including the Armed Forces and pensioners.

• The recommendations are expected to benefit approximately 48 lakh active employees and over 67 lakh pensioners across the country, aiming to address the rising cost of living and inflation.

• As per the standard decadal cycle followed by the government, the implementation of the new pay structure recommended by the 8th Pay Commission is likely to take effect from January 1, 2026.

• The commission is tasked with evolving a comprehensive framework that balances the financial needs of the employees with the fiscal health of the Government of India.

Additional Information

• Historical Context: The first Pay Commission in India was established in 1946, chaired by Srinivasa Varadachariar. Since then, the government has traditionally constituted a new commission every 10 years to revise the pay scales.

• The 7th Central Pay Commission: It was set up in February 2014 under the chairmanship of Justice Ashok Kumar Mathur. Its recommendations were implemented with effect from January 1, 2016, introducing a Fitment Factor of 2.57 for basic pay calculation.

• Composition of the Commission: A typical Pay Commission is headed by a Chairperson, usually a retired Judge of the Supreme Court or a High Court, and includes full-time members, a Member-Secretary, and part-time members with expertise in economics and administration.

• Purpose and Objective: The commissions focus on ensuring that government compensation remains competitive and fair, taking into account the Consumer Price Index (Industrial Workers) and the general economic environment of the nation.

Important Points

• Fitment Factor: This is a crucial numerical value used to arrive at the new basic pay. For the 8th Pay Commission, there is significant speculation and demand for an increased fitment factor to boost the minimum wage.

• Scope of Coverage: The recommendations of the Pay Commission apply to Central Government employees, All India Services, personnel of Union Territories, and the Indian Audit and Accounts Department.

• Fiscal Impact: The implementation of such commissions usually results in a significant increase in government expenditure, which is a major factor in the Union Budget planning and the management of the fiscal deficit.

• Terms of Reference (ToR): This document outlines the specific guidelines, limitations, and areas of study for the commission, serving as the legal and administrative roadmap for its functioning.

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