RRB Group D Official Paper (Held On: 21 Dec, 2025 Shift 3) (Previous Year Paper)

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

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GENERAL SCIENCE

Q1. Rear-view mirrors of vehicles are usually _____.

(a) plane mirrors
(b) concave mirrors
(c) convex mirrors
(d) parabolic mirrors

Q2. According to Newton’s Third Law of Motion, which of the following statements is true?

(a) Action and reaction act on the same body and are equal in magnitude.
(b) Action and reaction are equal and opposite but act on two different bodies.
(c) Action and reaction are unequal and act on the same body.
(d) Action and reaction cancel each other out because they act on one body.

Q3. Which two physical properties allow metals to be drawn into thin wires and beaten into thin sheets, respectively?

(a) Lustre and hardness
(b) High melting point and solid state
(c) Sonorous and conductivity
(d) Ductility and malleability

Q4. Quickly pulling a hand back on touching a hot object is an example of _____.

(a) Thinking action
(b) Reflex action
(c) Conditioned action
(d) Hormonal action

Q5. Which of the following gives the correct relation between the work done (W) in terms of force (F) acting on the body and the displacement (S) of the body in the same direction as the force?

(a) W = F/S
(b) W = F + S
(c) W = F − S
(d) W = F × S

Q6. What gas is typically released when ethanoic acid reacts with sodium carbonate?

(a) Carbon dioxide gas
(b) Hydrogen gas
(c) Oxygen gas
(d) Methane gas

Q7. Name the scientist who defined elements as substances that CANNOT be broken down into simpler form by chemical reactions.

(a) Antoine Laurent Lavoisier
(b) Robert Hookie
(c) Robert boyle
(d) Charles Darwin

Q8. A force (F) of 60 N acts on a mass (m) of 6 kg. What will be the acceleration (a) produced by this force?

(a) 360.0 m/s2
(b) 0.10 m/s2
(c) 10.0 m/s2
(d) 6.0 m/s2

Q9. The symbol of an element represents which of the following?

(a) The full name of the element
(b) One mole of the element
(c) Atomic number and mass number
(d) One atom of the element only

Q10. Carbohydrates produced in photosynthesis but not immediately used are stored as _____ in plants.

(a) glucose
(b) protein
(c) starch
(d) cellulose

Q11. The magnetic field is strongest:

(a) far from the conductor
(b) near the conductor
(c) outside a solenoid
(d) equidistant from the conductor

Q12. The twinkling of stars is more pronounced when _____.

(a) the sky is cloudy
(b) the star is at the zenith
(c) the moon is bright
(d) the star is near the horizon

Q13. What is the primary function of the kidneys in human beings?

(a) To filter nitrogenous waste materials from the blood
(b) To regulate digestion and nutrient absorption
(c) To absorb oxygen and release carbon dioxide
(d) To transport glucose and hormones throughout the body

Q14. Which of the following contraceptive devices is placed in the uterus to prevent pregnancy?

(a) Copper-T
(b) Condom
(c) Hormonal patch
(d) Oral pills

Q15. What type of chemical bond is typically formed when a metal reacts with a non-metal?

(a) Hydrogen bond
(b) Metallic bond
(c) Ionic bond
(d) Covalent bond

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Q16. Which of the following is detected by gustatory receptors in our body?

(a) Smell
(b) Light
(c) Taste
(d) Sound

Q17. Which of the following is the correct sequence in extraction of metals from ore?

(a) Concentration → Reduction → Refining
(b) Reduction → Refining → Concentration
(c) Concentration → Electrolysis → Roasting
(d) Refining→Concentration→Reduction

Q18. Which of the following statements about sound propagation is true?

(a) Sound is the fastest in gases, slower in liquids and the slowest in solids.
(b) Sound is the fastest in solids, slower in liquids and the slowest in gases.
(c) Sound can travel in a vacuum.
(d) Sound travels at the same speed in all mediums.

Q19. Which of the following enzymes is present in saliva?

(a) Salivary Amylase
(b) Salivary Lipase
(c) No enzyme
(d) Salivary Protease

Q20. The gravitational force between the Earth and a body of mass ‘m’ kg is ‘F’ N. What will be the gravitational force between the body and the Earth if the mass of the body is increased to ‘4m’ kg? (Keep all the other parameters the same)

(a) F N
(b) 4F N
(c) F/2 N
(d) F/4 N

Q21. Consider the following statements and select the correct option.

Statement A: Washing soda is obtained by heating baking soda strongly.

Statement B: It is used in glass, soap and paper industries.

(a) Both statements A and B are correct.
(b) Statement A is incorrect but B is correct.
(c) Statement A is correct but B is incorrect.
(d) Both statements A and B are incorrect.

Q22. Which of the following is NOT a function of the stigma in the Hibiscus flower?

(a) Receiving pollen grains
(b) Producing male germ cells
(c) Providing a sticky surface
(d) Facilitating pollen tube growth

Q23. In a schematic electric circuit diagram, how is a voltmeter typically represented when connected to measure potential difference?

(a) A circle with a ‘V’ inside, connected in parallel
(b) A square with a ‘V’ inside, connected in parallel
(c) A circle with an ‘A’ inside, connected in series
(d) A rectangle with an ‘R’ inside, connected in series

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Q24. Which of the following is a colloidal solution?

(a) Salt Water
(b) Sand in Water
(c) Sugar Solution
(d) Milk

Q25. Testes are located outside the abdominal cavity, called _____.

(a) Scrotum
(b) Penis
(c) Bladder
(d) Ureter

MATHEMATICS

Q26. The expenditure of Sudha is 125% more than her savings. If her expenditure decreases by 14% and savings increase by 38%, then by what percentage does her income increase?

(a) 2%
(b) 6%
(c) 5%
(d) 3%

Q27. If $\tan\theta + \cot\theta = 4$, then $\sec^2\theta \times \operatorname{cosec}^2\theta$ is equal to:

(a) 12
(b) 8
(c) 16
(d) 24

Q28. If the mode of a data exceeds its mean by 77.7, then the mode exceeds the median by _____. (Use empirical formula to find the answer)

(a) 58.8
(b) 47.8
(c) 52.2
(d) 51.8

Q29. if 30% of 50% of 4over7 of a number is 303. Find the number.

(a) 5860
(b) 4650
(c) 6400
(d) 3535

Q30. The sides of a triangle are 105 cm, 137 cm, and 88 cm. What is its area (in cm^2)?

(a) 4573
(b) 4620
(c) 4634
(d) 4598

Q31. If the cost price of 60 guavas is equal to the selling price of 45 guavas, what is the profit percentage (rounded off to 2 decimal places)?

(a) 33.33%
(b) 34.33%
(c) 32.33%
(d) 31.33%

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Q32. Find the single equivalent discount (rounded off to two decimal places) for successive discounts of 16%, 29% and 4%.

(a) 41.18%
(b) 41.75%
(c) 44.77%
(d) 42.75%

Q33. A total profit of Rs. 25,000 is to be distributed amongst P, Q and R such that P : Q = 2 : 1 and Q : R = 11 : 7. The share (in Rs.) of R in the profit is:

(a) 4225
(b) 4375
(c) 4325
(d) 4275

Q34. Simplify: $(\sqrt{98} + \sqrt{200} - 2\sqrt{8})^2$

(a) $169\sqrt{2}$
(b) 338
(c) $13\sqrt{2}$
(d) 169

Q35. Walking at 3/4 of his normal speed from his home, Manish is 20 minutes late in reaching his office. The usual time taken by him to cover the distance between his home and his office is:

(a) 58 minutes
(b) 70 minutes
(c) 60 minutes
(d) 54 minutes

Q36. P and Q together can fill a cistern with water in 10 hours. If P alone can fill the cistern with water in 20 hours, then in how many hours will Q alone fill one-fourth of the same cistern with water?

(a) 6
(b) 5
(c) 10
(d) 11

Q37. What is the smallest natural number that should be added to 5023, such that a remainder of 5 is left when the resulting number is divided by each of the numbers 20, 98, 35 and 21?

(a) 846
(b) 862
(c) 855
(d) 850

Q38. Two trains, 297 m and 243 m, in length are running in opposite directions. The first runs at the rate of 42 km/hr and the second at the rate of 66 km/hr. How long will they take to cross each other?

(a) 9 seconds
(b) 8 seconds
(c) 13 seconds
(d) 18 seconds

Q39. In a quadrilateral ABCD, angle A = 88° and angle B = 81°. The bisectors of angle C and angle D meet at O. What is the measure of angle DOC ?

(a) 96°
(b) 99°
(c) 81.5°
(d) 84.5°

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Q40. The present ages of A and B are in the ratio of 7 : 6. Eight years hence, the ratio of their ages will be 8 : 7. Find the present age of B.

(a) 36 years
(b) 40 years
(c) 48 years
(d) 24 years

Q41. Amit and Rahul have a total of Rs. 50. If Amit has Rs. 16 more than Rahul, then find the amount with Rahul.

(a) Rs. 19
(b) Rs. 16
(c) Rs. 20
(d) Rs. 17

Q42. If the third proportional of 64 and Z is 4, then what is the value of Z?

(a) 17
(b) 16
(c) 14
(d) 18

Q43. If the marked price of a towel is 85% more than its cost price and a discount of 20% is announced on it, then find the profit percentage.

(a) 49%
(b) 45%
(c) 48%
(d) 47%

Q44. Three cubes of edges 3 cm, 4 cm, and 5 cm are melted and formed into a single cube. What is the percentage change in the total surface area after melting and recasting?

(a) 22% decrease
(b) 28% increase
(c) 22% increase
(d) 28% decrease

Q45. Pipe A can fill a tank in 12 minutes, while pipe B can empty the completely filled tank in 24 minutes. Initially, pipe A is opened and after 4 minutes, pipe B is also opened. In how much time (in minutes) will the remaining tank be filled completely?

(a) 35
(b) 16
(c) 18
(d) 28

Q46. How many numbers up to 200 are divisible by 4 and 3 both?

(a) 12
(b) 14
(c) 10
(d) 16

Q47. The arithmetic mean of the observations 64, 11, 66, 98, 25, 17, 50, 75 and 62 is:

(a) 45
(b) 56
(c) 44
(d) 52

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Q48. If $4A^2 + B^2 = 24$ and $AB = 4$, find the value of $2A+B$.

(a) $\pm 2\sqrt{10}$
(b) $\pm 2\sqrt{5}$
(c) $\pm 3\sqrt{5}$
(d) $\pm 3\sqrt{10}$

Q49. A man receives Rs. 7,420 per month as salary. He saves 35% of his salary every month. His expenditure per month is:

(a) Rs. 4,823
(b) Rs. 4,724
(c) Rs. 4,857
(d) Rs. 4,920

Q50. The amount on a sum of Rs. 1,000 at the rate of 10% per annum compound interest, compounded annually, in 2 years will be:

(a) Rs. 1,220
(b) Rs. 1,240
(c) Rs. 1,210
(d) Rs. 1,640

GENERAL INTELLIGENCE & REASONING

Q51. Select the triad which follows the same pattern as that followed by the two triads given below. Both triads follow the same pattern.

JS-LU-OQ

LU-NW-QS

(a) NW-PY-SU
(b) NW-PY-SV
(c) MW-PY-SV
(d) MW-PZ-SV

Q52. If 'A' stands for '÷', 'B' stands for '×', 'C' stands for '+' and 'D' stands for '−', then what will come in place of the question mark (?) in the following equation?

72 A 4 C 6 B 9 D 20 A 2 C 88 A 8 D 15 = ?

(a) 75
(b) 58
(c) 88
(d) 42

Q53. In a certain code language, 'what you have' is coded as 'nq jl mk' and 'have you been' is coded as 'rs nq jl'. How is 'been' coded in that language?

(a) nq
(b) rs
(c) mk
(d) jl

Q54. This question is based on the five, three-digit numbers given below.

(Left) 358 657 524 493 249 (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 second digit of the highest number is added to the third digit of lowest number?

(a) 13
(b) 12
(c) 14

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(d) 11

Q55. Refer to the following series and answer the question that follows (all numbers are single digit numbers only). Counting to be done from left to right only.

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

How many such odd numbers are there (from left to right) each of which is immediately preceded by an odd number and also immediately followed by an even number?

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

Q56. In the following number-pairs, the second number is obtained by applying certain mathematical operation(s) to the first number. Select the number-pair in which the numbers are related in the same way as are the numbers of the following pairs.

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

17, 33

13, 25

(a) 23, 35
(b) 54, 108
(c) 74, 146
(d) 31, 61

Q57. What should come in place of the question mark (?) in the given series based on the English alphabetical order?

ASE QIU GYK WOA ?

(a) MRW
(b) MEQ
(c) MOI
(d) MEO

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

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

How many such perfect squares are there, each of which is immediately preceded by an odd number and also immediately followed by an even number? (NOTE: 1 is also a perfect square.)

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

Q59. Six people, A, B, C, D, E and F, are sitting in a row, facing north. F sits to the immediate left of A. C sits third to the left of D. C is an immediate neighbour of A. B sits to the immediate left of E. How many people sit between E and C?

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

Q60. Six teachers — Judith, Anil, Myriam, Bina, Teresa and Jason — are sitting around a circular table, facing the centre. Judith is sitting second to the right of Anil. Anil is an immediate neighbour of both Myriam and Bina. Teresa is sitting second to the left of Myriam. Jason is sitting second to the left of Anil.

Who is sitting between Jason and Judith, when counted from the left of Jason?

(a) Teresa
(b) Myriam

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(c) Anil
(d) Bina

Q61. Which numbers should come in place of the question marks (?) in the same sequence to make the series logically complete?

789 779 769 ? 749 ? 729

(a) 759 and 729, respectively
(b) 769 and 739, respectively
(c) 749 and 739, respectively
(d) 759 and 739, respectively

Q62. Read the given statement(s) 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 atoms are protons.

Some protons are neutrons.

Conclusions:

(I) All atoms are neutrons.

(II) No neutron is a proton.

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

Q63. Each of the digits in the number 8325716 is arranged in ascending order from left to right. The position of how many digits will remain unchanged as compared to that in the original number?

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

Q64. Sunil starts from point A and drives 64 km towards the west. He then takes a left turn, drives 63 km, turns left and drives 67 km. He then takes a left turn and drives 78 km. He takes a final left turn, drives 3 km and stops at point P. How far (shortest distance) and towards which direction should he drive in order to reach point A again? (All turns are 90-degree turns only unless specified.)

(a) 16 km to the north
(b) 15 km to the south
(c) 17 km to the north
(d) 14 km to the south

Q65. MIDQ is related to CYTG in a certain way based on the English alphabetical order. In the same way, YUPC is related to OKFS. To which of the given options is UQLY related, following the same logic?

(a) KGBO
(b) KOLP
(c) KGHY
(d) KOBI

Q66. Based on the English alphabetical order, three of the following four letter-cluster pairs are alike in a certain way and thus form a group. Which letter-cluster pair DOES NOT belong to that group?

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

(a) CI - EL
(b) IO - KQ
(c) JP - LR

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(d) NT - PV

Q67. What should come in place of the question mark (?) in the given series?

382 392 400 406 410 ?4224

(a) 411
(b) 416
(c) 413
(d) 412

Q68. If 'A' stands for '÷', 'B' stands for '×', 'C' stands for '+' and 'D' stands for '−', then what will come in place of the question mark (?) in the following equation?

10 C 6 B 2 D 45 A 5 = ?

(a) 15
(b) 17
(c) 13
(d) 18

Q69. Varun starts from Point M and drives 8 km towards the south. He then takes a left turn, drives 10 km, turns left and drives 3 km. He then takes a right turn and drives 5 km. He then takes a right turn and drives 7 km. He takes a final right turn, drives 15 km and stops at Point Y. How far (shortest distance) and in which direction is Point Y with respect to Point M?

(All turns are 90 degrees turns only unless specified).

(a) 12 km towards east
(b) 12 km towards south
(c) 8 km towards south
(d) 8 km towards east

Q70. 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) 7 4 3 1 9 6 7 2 3 8 1 8 8 4 1 1 9 3 5 2 3 8 1 8 6 1 4 (Right)

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

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

Q71. In a certain code language,

' A ± B ' means 'A is the wife of B',

' A * B ' means 'A is the daughter of B',

' A Rs. B ' means 'A is the father of B' and

' A # B ' means 'A is the brother of B'.

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

(a) Wife's sister
(b) Sister
(c) Mother's sister
(d) Wife

Q72. Kartik ranked 19^(th) from the top and 54^(th) from the bottom in his class. How many students are there in his class?

(a) 70
(b) 72
(c) 71
(d) 73

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Q73. 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 hammers are anvils.

All anvils are metals.

All metals are plastics.

Conclusions:

(I) All hammers are plastics.

(II) Some plastics are anvils.

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

Q74. In a certain code language, ‘error mall bat’ is coded as ‘yr uh cl’ and ‘gap error unit’ is coded as ‘uh at nk’. How is ‘error’ coded in that language?

(a) yr
(b) uh
(c) cl
(d) at

Q75. Based on the English alphabetical order, three of the following four letter-cluster pairs are alike in a certain way and thus form a group. Which letter-cluster pair DOES NOT belong to that group?

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

(a) NO−ST
(b) MN−QU
(c) YZ−DE
(d) RS−WX

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

HIE 50 GHD 62 FGC 74 EFB 86 ?

(a) DFZ 98
(b) DEA 98
(c) DMW 97
(d) DDZ 97

Q77. Six people, L, M, N, O, P and Q, are sitting in a row, facing towards north. N is sitting at the leftmost end of the row. Only 3 people are sitting between N and Q. L is sitting second right to P. M is sitting second right to L. Based on the given arrangement, three of the following four are alike and hence form a group. Which is the one that does NOT belong to that group?

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

Q78. What should come in place of the question mark (?) in the given series?

3, 5, 9, 17, 33, ?

(a) 62
(b) 57
(c) 65
(d) 59

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Q79. Mr. Hepa ranked 22^(nd) from the bottom and 57^(th) from the top in his class. How many students are there in his class?

(a) 77
(b) 78
(c) 75
(d) 76

Q80. NMGT is related to THKQ in a certain way. In the same way, LSQR is related to RNUO. To which of the given options is GIUH related, following the same logic?

(a) NDXD
(b) MEXE
(c) MDYE
(d) NEYD

GENERAL AWARENESS AND CURRENT AFFAIRS

Q81. The AI Centre of Excellence for Education announced in Union Budget 2025 is intended to benefit which sector the most?

(a) Manufacturing
(b) Tourism
(c) Education
(d) Agriculture

Q82. Which award did Pakistani cricketer Sana Mir receive in June 2025?

(a) Asia Woman Cricketer of the Year
(b) ICC Best Bowler Award
(c) PCB Lifetime Achievement Award
(d) ICC Hall of Fame

Q83. Why was Acko General Insurance fined Rs. 1 crore by the Insurance Regulatory and Development Authority of India (IRDAI) in May 2025?

(a) Payments to an unregistered intermediary
(b) Denial of health insurance claims
(c) Mis-selling of ULIPs
(d) Failure to meet solvency ratios

Q84. Who among the following chaired the Parliamentary Consultative Committee meeting on ‘Disaster Management and Capacity Building’ in August 2025?

(a) Amit Shah
(b) Rajnath Singh
(c) Nirmala Sitharaman
(d) Narendra Modi

Q85. Which defence exercise involved the French carrier Charles de Gaulle in 2025?

(a) Tiger Triumph
(b) TROPEX
(c) Dharma Guardian
(d) Varuna

Q86. What is the name of the portal launched by the Government of India to support gender-responsive planning and budgeting?

(a) Women’s Finance Portal
(b) Gender Equality Resource Hub
(c) Gender Planning & Budget Portal
(d) Gender Budgeting Knowledge Hub

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Q87. Which countries are collaborating for the Chandrayaan-5 mission, as announced by ISRO in March 2025?

(a) India and Russia
(b) India and China
(c) India and Japan
(d) India and the United States

Q88. Which author won the Sahitya Akademi Yuva Puraskar for his novel, ‘Ram C/O Anandhi’, in June 2025?

(a) Kirtida Brahmbhatt
(b) Akhil P Dharmajan
(c) Vikas Swarup
(d) Parvati Tirkey

Q89. According to the October 2025 Monetary Policy Report of the Reserve Bank of India, the revised GDP growth forecast for India for FY 2025–26 is _____.

(a) 5.8%
(b) 6.5%
(c) 5.5%
(d) 6.8%

Q90. What was the theme of the first Global Conference on Manuscript Heritage held at Bharat Mandapam, New Delhi, in 2025?

(a) Preserving India’s Ancient Wisdom through Heritage Studies
(b) Digital Archives for Cultural Knowledge through Heritage Tools
(c) Reviving Asian Manuscript Traditions through Shared Heritage
(d) Reclaiming India’s Knowledge Legacy through Manuscript Heritage

Q91. Which of the following platforms are integrated under the National Cooperation Policy, 2025, to promote digital commerce for cooperatives?

(a) RuPay and UPI (Unified Payments Interface)
(b) e-NAM (National Agriculture Market) and e-Shram Portal
(c) GSTN and DigiLocker
(d) GeM (Government e-Marketplace) and ONDC (Open Network for Digital Commerce)

Q92. India’s first Cheetah Safari began in October 2025 at which national park?

(a) Satpura National Park
(b) Kanha National Park
(c) Kuno National Park
(d) Bandhavgarh National Park

Q93. In the 2025 Kho Kho World Cup, the Indian men’s team secured the first-ever championship title by defeating which opponent in the final match?

(a) Sri Lanka
(b) Pakistan
(c) Bangladesh
(d) Nepal

Q94. Which international badminton player became world No. 1 in 2025, marking a first in his country’s history?

(a) Lakshya Sen
(b) Kodai Naraoka
(c) Loh Kean Yew
(d) Kunlavut Vitidsarn

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Q95. Which among the following organisations launched the ‘Scheme for Promoting Registration of Employers and Employees’ (SPREE 2025)?

(a) Ministry of Finance
(b) Employees' Provident Fund Organisation
(c) National Institute for Transforming India
(d) Employees' State Insurance Corporation

Q96. Which of the following prestigious Indian cinema awards was conferred upon Mohanlal in September 2025 in recognition of his iconic contribution?

(a) Dadasaheb Phalke Award, 2023
(b) Filmfare Lifetime Achievement Award, 2024
(c) National Film Award for Best Actor, 2025
(d) Padma Shri, 2025

Q97. In the 56^(th) meeting of Monetary Policy Committee (MPC) held in August 2025, after assessing the current and evolving macroeconomic situation, the MPC voted to maintain the policy repo rate at:

(a) 8.50%
(b) 5.50%
(c) 6.40%
(d) 5.40%

Q98. What was the esteemed category of civilian honours conferred upon legendary Indian hockey player PR Sreejesh by President Droupadi Murmu at Rashtrapati Bhavan in April 2025?

(a) Gallantry Awards
(b) National Sports Awards
(c) Padma Awards
(d) Bharat Ratna

Q99. Which country's deaf cricket team won a historic 5-match series against Trinidad & Tobago in 2025?

(a) Australia
(b) India
(c) England
(d) Pakistan

Q100. India's SDG ranking in the 10th Sustainable Development Report was released by:

(a) World Economic Forum Report
(b) UN Sustainable Development Solutions Network
(c) World Bank Report
(d) International Monetary Fund Report

ANSWER KEY

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

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SOLUTIONS

Q1. Answer: (c) convex mirrors

The correct answer is convex mirrors.

Key Points

• Convex mirrors, also known as diverging mirrors, are the standard choice for rear-view mirrors (both side-view and interior mirrors) in automobiles.

• The primary reason for using a convex mirror is that it provides a much wider field of view compared to a plane mirror or a concave mirror because it is curved outwards.

• A convex mirror always forms a virtual, erect, and diminished image of the objects behind the vehicle, regardless of the distance of the object from the mirror.

• Because the images are diminished (smaller in size), it allows the driver to see a large area of the traffic behind them within a relatively small mirror surface.

• The focal point and the center of curvature of a convex mirror are imaginary points located behind the mirror, which cannot be reached.

Additional Information

• Plane Mirrors:

• In a plane mirror, the image is virtual, erect, and exactly the same size as the object.

• While it provides an accurate representation of distance, its field of view is quite narrow, making it less effective for monitoring multiple lanes of traffic.

• Concave Mirrors:

• A concave mirror is curved inwards (like a spoon). It can form both real and virtual images depending on the position of the object.

• If used as a rear-view mirror, the image would appear inverted (upside down) once the following vehicle moves beyond the focal length, which would be dangerous for a driver.

• Common uses of concave mirrors include shaving mirrors, dentist mirrors, and solar furnaces.

• Parabolic Mirrors:

• These are specialized spherical mirrors used to focus light into a single point or to produce a parallel beam of light.

• They are typically used in car headlights, torches, and telescopes rather than as rear-view monitors.

Important Points

• Magnification: For a convex mirror, the magnification (m) is always positive and less than 1. This indicates that the image is erect and smaller than the object.

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

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

• Safety Warning: Many passenger-side convex mirrors carry the warning "Objects in the mirror are closer than they appear" because the diminished size of the image can trick the driver's perception of distance.

• Uses: Apart from vehicles, convex mirrors are used in ATM security, hallways of hospitals, and stores to prevent theft by providing a broad view of the surroundings.

Q2. Answer: (b) Action and reaction are equal and opposite but act on two different bodies.

The correct answer is Action and reaction are equal and opposite but act on two different bodies.

Key Points

• Newton’s Third Law of Motion states that whenever one object exerts a force on a second object, the second object exerts an equal and opposite force on the first object.

• According to the law, action and reaction are equal in magnitude but opposite in direction. They must act on two different bodies rather than a single body. Hence, statement 2 is correct.

• If the action and reaction acted on the same body, the net force would always be zero, and acceleration would be impossible. Hence, statement 1 is incorrect.

• The law emphasizes that forces always occur in pairs; there is no such thing as an isolated single force in nature. These forces act simultaneously and do not result in a time lag. Hence, statement 3 is incorrect.

• Since action and reaction act on different objects, they do not cancel each other out. A force can only be canceled by another force acting on the same object. Hence, statement 4 is incorrect.

Additional Information

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• Historical Context: Sir Isaac Newton formulated the laws of motion and published them in his monumental work, "Philosophiæ Naturalis Principia Mathematica," in the year 1687.

• Examples of the Third Law:

• Recoil of a Gun: When a bullet is fired from a gun, it exerts a forward force (action) on the bullet, and the bullet exerts an equal and opposite force (reaction) on the gun, causing it to recoil.

• Walking: When a person walks, they push the ground backward with their feet (action), and the ground pushes the person forward with an equal force (reaction).

• Rocket Propulsion: A rocket accelerates forward by expelling exhaust gases backward at high velocity; the gases exert a reaction force (thrust) on the rocket.

• Law of Conservation of Momentum: Newton's Third Law is the fundamental basis for the Law of Conservation of Momentum, which states that the total linear momentum of a closed system remains constant if no external force acts on it.

• Force Definition: In physics, a force is an interaction that, when unopposed, will change the motion of an object. It is a vector quantity measured in Newtons (N).

Important Points

• Internal vs. External Forces: While action-reaction pairs are equal and opposite, they are internal to the system of two interacting bodies. To change the acceleration of the system as a whole, an external force is required.

• Mass and Acceleration: Although the magnitude of the force is the same on both bodies, the resulting acceleration may differ significantly if the bodies have different masses, as per Newton's Second Law (F = ma). For example, the Earth exerts the same gravitational force on a falling apple as the apple exerts on the Earth, but the Earth's massive size makes its acceleration negligible.

Q3. Answer: (d) Ductility and malleability

The correct answer is Ductility and malleability.

Key Points

• Ductility is the physical property of a material, specifically metals, that allows it to be stretched or drawn into thin wires without breaking or snapping. This property is essential for making electrical wiring.

• Malleability is the ability of a material to be deformed under compressive stress, which allows it to be beaten into thin sheets or foils using a hammer or by rolling, without cracking.

• Among all known elements, Gold is considered the most malleable and ductile metal. For instance, a wire of about 2 km length can be drawn from just 1 gram of Gold. Hence, the combination of these two properties is the correct answer.

• These properties arise because the atoms in a metallic lattice are arranged in layers that can slide over one another when force is applied, while the metallic bonds hold the structure together.

Additional Information

• Lustre and Hardness:

• Metallic Lustre refers to the shining surface of metals in their pure state. This is due to the reflection of light by free electrons.

• Hardness varies from metal to metal. While Iron and Copper are hard, alkali metals like Sodium and Potassium are so soft that they can be cut with a knife.

• Sonorous and Conductivity:

• Sonorous metals produce a ringing sound when they strike a hard object. This property is used in the manufacturing of school bells and musical instruments.

• Conductivity refers to the ability to transmit heat and electricity. Silver is the best conductor of electricity, followed by Copper and Aluminium.

• Melting Point and State:

• Most metals are solids at room temperature, with the notable exception of Mercury, which is a liquid.

• Metals generally have high melting points. Tungsten has the highest melting point (about 3422°C), making it ideal for bulb filaments. In contrast, Gallium and Cesium have very low melting points and can melt on a human palm.

• Chemical Nature:

• Metals are electropositive elements because they lose electrons to form positive ions. When metals burn in oxygen, they produce basic oxides (like Magnesium oxide), whereas non-metals produce acidic or neutral oxides.

Q4. Answer: (b) Reflex action

The correct answer is Reflex action.

Key Points

• A reflex action is an automatic, spontaneous, and involuntary response of the body to a specific stimulus without the involvement of conscious thought.

• When a person touches a hot object, the heat acts as a stimulus that is detected by thermoreceptors (heat receptors) in the skin.

• The neural pathway that controls a reflex action is called a reflex arc. It involves sensory neurons carrying the signal to the spinal cord, and motor neurons carrying the response back to the effector muscles.

• In this process, the spinal cord processes the signal instead of the brain to ensure an extremely rapid response, which helps in protecting the body from immediate physical harm or injury. Hence, pulling a hand back on touching a hot object is a reflex action.

• Common examples of reflex actions include the knee-jerk reflex, blinking of eyes when an object approaches quickly, and pupil constriction in bright light.

Additional Information

• Thinking Action (Voluntary Action):

• These actions are performed consciously and are controlled by the forebrain (specifically the cerebrum).

• They involve deliberation, memory, and decision-making. Examples include writing a letter, riding a bicycle, or solving a mathematical problem.

• Unlike reflex actions, thinking actions are slower because the signal must travel to the brain for processing.

• Conditioned Action (Acquired Reflex):

• A conditioned reflex is a response that is learned through experience or repetitive training rather than being inborn.

• The most famous example is Ivan Pavlov's experiment with dogs, where the dogs began to salivate at the sound of a bell.

• Other examples include typing on a keyboard or playing a musical instrument, where the body responds automatically due to long-term habituation.

• Hormonal Action:

• This refers to the chemical coordination in the body mediated by hormones secreted by endocrine glands.

• Hormonal responses are generally slower than nervous responses but have long-lasting effects.

• Examples include the release of Adrenaline during a "fight or flight" situation, or the regulation of blood sugar levels by Insulin.

Important Points

• Components of a Reflex Arc:

• Receptor: Organ like skin that receives the stimulus.

• Sensory Neuron: Conducts the nerve impulse from the receptor to the Central Nervous System (CNS).

• Relay Neuron (Interneuron): Located in the spinal cord, it connects the sensory neuron to the motor neuron.

• Motor Neuron: Conducts the response signal from the spinal cord to the effector.

• Effector: The muscle or gland that executes the final action, such as muscle contraction.

• Significance: Reflex actions are essential for survival as they allow the body to react to dangerous stimuli in milliseconds, often before the brain even perceives pain.

Q5. Answer: (d) W = F × S

The correct answer is W = F x S.

Key Points

• Work Done (W) is defined in physics as the product of the Force (F) applied to an object and the Displacement (S) caused by that force in the direction of the force.

• The general mathematical expression for work is W = F S cos(theta), where theta represents the angle between the Force vector and the Displacement vector.

• In this specific case, the body moves in the same direction as the force, which means the angle theta is 0 degrees. Since the value of cos(0) is 1, the formula simplifies directly to W = F x S. Hence, the relation W = F x S is correct.

• The relation W = F/S suggests that work is inversely proportional to displacement for a constant force, which contradicts the physical definition of work. Hence, statement 1 is incorrect.

• The relations W = F + S and W = F - S are physically inconsistent because Force (measured in Newtons) and Displacement (measured in meters) have different dimensions and cannot be added or subtracted. Hence, statements 2 and 3 are incorrect.

Additional Information

• Nature of Work: Work is a scalar quantity, meaning it has only magnitude and no direction, even though it is derived from two vector quantities (Force and Displacement).

• SI Unit: The Standard International (SI) unit of work is the Joule (J). 1 Joule is defined as the work performed by a force of 1 Newton acting over a distance of 1 meter (1 J = 1 N-m).

• Types of Work:

• Positive Work: Occurs when the force and displacement are in the same direction (angle between 0 and 90 degrees), such as an object falling under gravity.

• Negative Work: Occurs when the force acts opposite to the direction of motion (angle between 90 and 180 degrees), such as the frictional force acting on a sliding box.

• Zero Work: Occurs when the force is perpendicular to the displacement (angle is 90 degrees), such as a person carrying a box

horizontally, where gravity acts downwards.

• CGS Unit: In the Centimetre-Gram-Second system, the unit of work is the erg. One Joule is equal to 10^7 ergs.

Important Points

• Dimensional Formula: The dimensions of work are represented as [ML^2T^-2]. This is identical to the dimensions of Energy and Torque.

• Work-Energy Theorem: This principle states that the net work done by all forces acting on a particle is equal to the change in the Kinetic Energy of that particle.

• Prerequisites for Work: For work to be non-zero, two conditions must be met: a Force must be exerted, and there must be a Displacement of the object. If a person pushes against a stationary wall, the displacement is zero; therefore, the work done is zero.

• Power Correlation: Power is defined as the rate of doing work. It is calculated by dividing the Work Done by the Time (t) taken, expressed as P = W / t. The SI unit for power is the Watt (W).

Q6. Answer: (a) Carbon dioxide gas

The correct answer is Carbon dioxide gas.

Key Points

• When Ethanoic acid (commonly known as Acetic acid) reacts with Sodium carbonate (also known as Washing soda), a chemical reaction occurs that releases Carbon dioxide gas.

• The chemical equation for this reaction is 2CH3COOH + Na2CO3 → 2CH3COONa + H2O + CO2. In this process, Ethanoic acid reacts with the metal carbonate to produce Sodium ethanoate (a salt), Water, and Carbon dioxide.

• The evolution of Carbon dioxide gas is observed as brisk effervescence, which refers to the rapid formation of bubbles in the liquid as the gas escapes.

• This reaction is a characteristic property of carboxylic acids, where they react with carbonates and bicarbonates to evolve CO2, serving as a common laboratory test to identify the presence of a carboxyl group.

• The gas evolved can be identified by passing it through lime water (calcium hydroxide), which will turn milky due to the formation of Calcium carbonate.

Additional Information

• Ethanoic Acid (CH3COOH):

• It is a weak organic acid and the second simplest carboxylic acid after formic acid.

• In its concentrated form, it is called Glacial Acetic Acid because it freezes at 16.6 degrees Celsius, forming ice-like crystals.

• It is widely used in the food industry as Vinegar, which typically contains 5% to 8% ethanoic acid by volume.

• Sodium Carbonate (Na2CO3):

• Commonly known as Washing Soda, it is a basic salt derived from a strong base and a weak acid.

• It is used in glass manufacturing, water softening, and as a laboratory reagent.

• When it reacts with acids, it consistently produces Carbon dioxide, making it useful in fire extinguishers and effervescent salts.

• Hydrogen Gas (H2):

• Unlike carbonates, when metals like Zinc or Magnesium react with acids, they typically release Hydrogen gas.

• Hydrogen is a colorless, odorless gas that burns with a pop sound when a burning splinter is brought near it.

• Oxygen Gas (O2):

• Oxygen is not typically released in simple acid-base neutralization or acid-carbonate reactions.

• It is usually produced during the decomposition of certain oxides or electrolysis of water.

Important Points

• Reaction with Sodium Bicarbonate: Ethanoic acid also reacts with Sodium bicarbonate (NaHCO3, or baking soda) to produce the same gas, Carbon dioxide. The equation is CH3COOH + NaHCO3 → CH3COONa + H2O + CO2.

• Test for Carbon Dioxide: To confirm the identity of the gas, it is passed through Lime Water [Ca(OH)2]. The lime water turns milky because of the formation of insoluble Calcium Carbonate (CaCO3). If the gas is passed in excess, the milkiness disappears due to the formation of soluble Calcium Hydrogen Carbonate [Ca(HCO3)2].

• Functional Group Identification: The reaction with Sodium Carbonate is a standard analytical test to distinguish carboxylic acids from phenols and alcohols, as the latter do not typically release CO2 with carbonates.

• Salt Formation: The salt formed in this specific reaction, Sodium ethanoate (CH3COONa), is used in the textile industry and as a buffering agent in various chemical applications.

Q7. Answer: (a) Antoine Laurent Lavoisier

The correct answer is Antoine Laurent Lavoisier.

Key Points

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• Antoine Laurent Lavoisier (1743–1794) was a prominent French chemist who is widely regarded as the "Father of Modern Chemistry" for his revolutionary contributions to the field.

• He was the first scientist to establish a strictly functional and modern definition of a chemical element.

• Lavoisier defined an element as a basic form of matter that cannot be broken down into simpler substances by any known chemical reaction. Hence, option 1 is correct.

• His findings and this specific definition were published in his landmark book, Traité Élémentaire de Chimie (Elementary Treatise on Chemistry), in the year 1789.

• In this work, he listed 33 substances that he considered elements based on this definition, including oxygen, nitrogen, hydrogen, phosphorus, mercury, zinc, and sulfur.

Additional Information

• Robert Boyle:

• Robert Boyle was an Anglo-Irish natural philosopher and chemist.

• In 1661, in his book The Sceptical Chymist, he was the first to use the term "element" in a scientific context to challenge the ancient Greek idea of four elements (earth, air, fire, water).

• While he laid the conceptual groundwork, he did not provide the experimental definition that Lavoisier later perfected.

• Robert Hooke:

• Robert Hooke (often misspelled as Hookie) was an English polymath and architect.

• He is most famous for discovering the law of elasticity, known as Hooke's Law, and for his work in microscopy.

• In 1665, he published Micrographia, where he used a microscope to observe cork and coined the biological term "cell."

• Charles Darwin:

• Charles Darwin was an English naturalist, geologist, and biologist.

• He is best known for his contributions to the science of evolution.

• His theory of natural selection was detailed in his 1859 book, On the Origin of Species, which transformed the biological sciences.

Important Points

• Law of Conservation of Mass: Lavoisier formulated this fundamental law, which states that in a chemical reaction, the mass of the products is always equal to the mass of the reactants; matter is neither created nor destroyed.

• Oxygen and Combustion: He played a vital role in naming oxygen in 1778 and hydrogen in 1783. He effectively debunked the phlogiston theory by proving that oxygen is necessary for combustion to occur.

• Chemical Nomenclature: Along with other colleagues, Lavoisier helped devise the first systematic method of chemical nomenclature, ensuring that the name of a chemical compound reflects its elemental composition.

• Metric System: As a member of various French academies, he was instrumental in the development of the metric system to standardize weights and measures across France.

Q8. Answer: (c) 10.0 m/s2

The correct answer is 10.0 m/s2.

Key Points

• The relationship between the applied force, the mass of an object, and the resulting acceleration is defined by Newton’s Second Law of Motion.

• According to this law, the acceleration of an object is directly proportional to the net force acting on it and inversely proportional to its mass. The mathematical formula is expressed as F = m × a, or a = F / m.

• In the given problem, the Force (F) acting on the object is 60 N and the Mass (m) of the object is 6 kg.

• By substituting these values into the acceleration formula: a = 60 N / 6 kg.

• The calculation results in an acceleration (a) of 10.0 m/s2. Hence, the calculated value matches the correct option.

Additional Information

• Newton (N): It is the SI unit of force. One Newton is defined as the amount of force required to give a mass of 1 kilogram an acceleration of 1 meter per second squared (1 kg·m/s2).

• Mass (m): This is a fundamental property of matter that represents an object's resistance to acceleration when a force is applied. It is a scalar quantity and is measured in kilograms (kg) in the SI system.

• Acceleration (a): This is a vector quantity that describes the rate at which an object changes its velocity. Its standard unit is meters per second squared (m/s2).

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

Important Points

• Vector Nature: Since Force is a vector, the acceleration produced will always occur in the same direction as the applied net

force.

• Inertia: Mass is a measure of inertia; therefore, a larger mass requires a greater force to achieve the same acceleration as a smaller mass.

• Dimensional Consistency: When performing physics calculations, it is vital to ensure units are consistent. If the force is in Newtons and mass is in kilograms, the acceleration will naturally result in m/s2.

• Zero Acceleration: If the net force acting on a mass is zero, the acceleration will also be zero, meaning the object will either remain at rest or continue to move at a constant velocity, as per Newton's First Law.

Q9. Answer: (d) One atom of the element only

The correct answer is One atom of the element only.

Key Points

• The symbol of an element is a shorthand notation or abbreviation used in chemistry to represent a specific chemical element. Primarily, it represents one atom of that element in a chemical reaction or formula. Hence, statement 4 is correct.

• A chemical symbol provides a qualitative and quantitative representation. Qualitatively, it identifies the name of the element; quantitatively, it represents one atom or a definite mass (atomic mass) of that element.

• While the symbol is derived from the name, it is not the full name itself but a standardized abbreviation consisting of one or two letters. Hence, statement 1 is incorrect.

• The concept of one mole of an element refers to 6.022×10^{23} atoms (Avogadro's number). While a symbol in a balanced chemical equation can represent a molar ratio, fundamentally, the symbol itself stands for a single atomic unit. Hence, statement 2 is incorrect.

• The atomic number (number of protons) and mass number (protons plus neutrons) are numerical properties of an atom. Although they are often written alongside a symbol (as subscript and superscript), the symbol itself does not inherently "represent" these numbers; it represents the identity of the element. Hence, statement 3 is incorrect.

• For example, the symbol "C" represents one atom of Carbon. Similarly, "He" represents one atom of Helium.

Additional Information

• Origin of Chemical Symbols: The modern system of using letters to represent elements was proposed by the Swedish chemist J.J. Berzelius in the early 19th century (specifically around 1813). Before this, alchemists used complex pictorial symbols.

• Naming Conventions: The first letter of a symbol is always capitalized, while the second letter (if present) is always lowercase. For instance, Co represents Cobalt, whereas CO represents Carbon Monoxide (a compound).

• Latin and Greek Roots: Many symbols are derived from the Latin or Greek names of elements. For example, Fe comes from Ferrum (Iron), Au from Aurum (Gold), Cu from Cuprum (Copper), and Na from Natrium (Sodium).

• IUPAC Standardization: The International Union of Pure and Applied Chemistry (IUPAC) is the global authority that approves the official names and symbols for newly discovered elements to ensure consistency in scientific communication across all countries.

• Significance in Formulas: When a subscript is added to a symbol, it indicates the number of atoms in a molecule. For example, H represents one atom of Hydrogen, but H2 represents one molecule of Hydrogen consisting of two atoms.

Important Points

• Atomic Mass Unit (amu): The symbol of an element also represents a mass equal to its atomic mass expressed in atomic mass units. For example, the symbol O represents 16 amu of Oxygen.

• Gram Atomic Mass: In laboratory calculations, the symbol can represent the gram atomic mass of an element, which is the mass of one mole of atoms in grams.

• Valency: The symbol is used to determine the valency or combining capacity of an element when writing chemical formulas using the criss-cross method.

• Isotopes: Symbols are also used to distinguish between isotopes of the same element by adding the mass number, such as ^{12}C and ^(14)C, though the base symbol remains the same as the number of protons (atomic number) does not change.

Q10. Answer: (c) starch

The correct answer is starch.

Key Points

• During the process of photosynthesis, plants utilize sunlight, water, and carbon dioxide to produce glucose, which serves as their primary source of energy.

• Glucose is a simple sugar (monosaccharide) that is highly soluble in water; if stored directly, it would increase the osmotic pressure within the plant cells, potentially causing them to burst or lose water balance.

• To prevent this, plants convert the surplus glucose into starch, a complex polysaccharide. Starch is insoluble in water and chemically inert, making it the most efficient form for long-term energy storage.

• This starch is stored in various parts of the plant, including the chloroplasts of leaves and specialized organelles called amyloplasts located in roots, seeds, and tubers.

• When the plant requires energy during periods without sunlight, such as at night or during dormancy, it breaks down the stored starch back into glucose to fuel its metabolic activities.

Additional Information

• Glucose: It is the immediate product of photosynthesis. It provides the energy needed for cellular respiration and acts as a building block for other organic molecules. However, it is not the primary storage molecule.

• Cellulose: While also a polymer of glucose, cellulose is a structural carbohydrate. It is the main component of the plant cell wall, providing rigidity and mechanical strength. Unlike starch, it is not used as a reserve food source.

• Proteins: These are macromolecules made of amino acids. Plants synthesize proteins by combining the carbohydrates produced in photosynthesis with nitrogen, phosphorus, and sulfur absorbed from the soil. They are essential for growth and enzymatic functions.

• Sucrose: This is a disaccharide (composed of glucose and fructose). Sucrose is the form in which carbohydrates are transported or translocated through the phloem from the leaves to other parts of the plant like the roots and fruits.

Important Points

• Composition of Starch: Starch is composed of two types of glucose polymers: amylose (a linear chain) and amylopectin (a highly branched chain).

• Iodine Test: The presence of starch in a plant leaf can be confirmed using the Iodine Test. When iodine solution is added to a leaf containing starch, it turns blue-black in color.

• Animal Storage: It is important to note that while plants store carbohydrates as starch, animals (including humans) store their excess glucose as glycogen in the liver and muscles.

• Economic Importance: Many staple foods consumed by humans, such as potatoes, rice, wheat, and maize, are rich in starch because these plants store significant reserves in their tubers or grains.

• Conversion Process: The conversion of glucose to starch involves a series of enzymatic reactions, specifically during the Calvin cycle and subsequent metabolic pathways in the stroma of the chloroplast.

Q11. Answer: (b) near the conductor

The correct answer is near the conductor.

Key Points

• The magnetic field strength (magnetic flux density) produced by a straight current-carrying conductor is directly proportional to the magnitude of the current and inversely proportional to the distance from the conductor.

• According to Ampere's Circuital Law and the Biot-Savart Law, the magnetic field (B) at a point is given by the relation B prop. to 1/r, where r is the radial distance from the wire.

• Near the conductor: As the distance r decreases, the value of the magnetic field B increases significantly. Therefore, the field is at its maximum intensity in the immediate proximity of the wire. Hence, statement 2 is correct.

• Far from the conductor: As the distance r increases, the magnetic field strength weakens rapidly. At very large distances, the field becomes negligible. Hence, statement 1 is incorrect.

• Outside a solenoid: In an ideal solenoid, the magnetic field lines are nearly parallel and very close together inside, but they spread out extensively in the exterior space. The magnetic field outside a solenoid is considered to be zero or extremely weak. Hence, statement 3 is incorrect.

• Equidistant from the conductor: Points that are equidistant from the conductor lie on a concentric circle. While the magnetic field strength is uniform (the same) at all these points, this phrase does not describe where the field is "strongest" relative to other locations. Hence, statement 4 is incorrect.

Additional Information

• Right-Hand Thumb Rule:

• This rule is used to determine the direction of the magnetic field around a straight conductor.

• If you hold the conductor in your right hand such that the thumb points in the direction of the electric current, then your fingers will curl around the conductor in the direction of the magnetic field lines.

• Characteristics of Magnetic Field Lines:

• For a straight wire, the field lines form concentric circles centered on the wire.

• The density of these field lines indicates the strength; they are crowded near the conductor and become spaced out as we move away.

• Magnetic field lines never intersect each other.

• Magnetic Field in a Solenoid:

• A solenoid is a long coil containing a large number of close turns of insulated copper wire.

• The magnetic field inside a solenoid is uniform and strong, represented by parallel straight lines. This property is used to magnetize materials like soft iron to create electromagnets.

• Units and Discovery:

• The SI unit of magnetic field strength is the Tesla (T), named after the physicist Nikola Tesla.

• In 1820, Hans Christian Oersted discovered that an electric current creates a magnetic field, marking the birth of electromagnetism.

Important Points

• Factors affecting the Magnetic Field:

• Current (I): Increasing the current increases the magnetic field strength (B prop. to I).

• Number of Turns (N): In a coil or solenoid, the field is proportional to the number of turns (B prop. to N).

• Medium: The presence of a ferromagnetic core (like soft iron) inside a coil increases the magnetic field intensity by thousands of times due to high magnetic permeability.

• Mathematical Representation: For an infinitely long straight wire, the formula is B = (μ0I) / (2πr), where μ0 is the permeability of free space (approximately 4π × 10^-^7 T·m/A).

Q12. Answer: (d) the star is near the horizon

The correct answer is the star is near the horizon.

Key Points

• The twinkling of stars, scientifically known as stellar scintillation, is caused by the atmospheric refraction of starlight as it passes through the Earth's atmosphere.

• When a star is near the horizon, the light coming from it has to travel through a much thicker layer of the atmosphere compared to when it is directly overhead (at the zenith).

• Because the light travels through more atmospheric layers with varying densities and temperatures, it undergoes multiple refractions. These layers are constantly moving due to thermal turbulence and wind, causing the light to bend in different directions rapidly.

• This continuous change in the refractive index of the air causes the apparent position and brightness of the star to fluctuate, making the twinkling effect more visible and pronounced. Hence, the correct answer is the star is near the horizon.

• In contrast, when a star is at the zenith, the starlight enters the atmosphere perpendicularly and travels the shortest distance, resulting in minimal refraction and less twinkling. Hence, statement 2 is incorrect.

Additional Information

• Atmospheric Refraction: This phenomenon occurs because the Earth's atmosphere is not uniform. It consists of several layers with different optical densities. As starlight enters the atmosphere, it gradually bends towards the normal because the air becomes denser closer to the Earth's surface.

• Planets do not twinkle: Unlike stars, which act as point sources of light due to their immense distance, planets are much closer to Earth and are seen as extended sources (a collection of many point sources). While the individual points of light from a planet may twinkle, the average brightness remains constant as the fluctuations cancel each other out.

• Apparent Position: Due to refraction, a star appears slightly higher in the sky than its actual position. This effect is most significant when the star is near the horizon.

• Sky conditions: While a cloudy sky might block starlight entirely or scatter it, it does not specifically make the "twinkling" more pronounced in a scientific sense; rather, it often obscures the star. Hence, statement 1 is incorrect.

• Moonlight: A bright moon increases the background luminance of the sky, which can actually make it harder to observe the subtle intensity changes of twinkling stars. Hence, statement 3 is incorrect.

Important Points

• Refractive Index: The refractive index of air depends on its temperature. Hot air is less dense and has a lower refractive index than cold air. The mixing of these air masses creates turbulent cells that act like tiny moving lenses.

• Vacuum: If there were no atmosphere (such as on the Moon or in outer space), stars would appear as steady, non-twinkling points of light because there would be no medium to refract the light.

• Color Flashing: Very bright stars near the horizon (like Sirius) often appear to flash different colors. This is because the atmosphere acts as a prism, dispersing the white starlight into its component colors through chromatic refraction.

• Observation: Astronomers often place telescopes on high mountains or in space (like the Hubble Space Telescope) to avoid the "blurring" and "twinkling" caused by the Earth's turbulent atmosphere, allowing for clearer images.

Q13. Answer: (a) To filter nitrogenous waste materials from the blood

The correct answer is To filter nitrogenous waste materials from the blood.

Key Points

• The kidneys are the primary organs of the human excretory system, responsible for maintaining the chemical balance of the body by processing blood.

• Their most critical function is to filter out metabolic waste products, specifically nitrogenous wastes such as urea, uric acid, and creatinine, from the bloodstream. Hence, option 1 is correct.

• Each kidney contains approximately 1 million structural and functional units called nephrons, which perform the actual filtration process.

• The filtration process in the nephron involves glomerular filtration (ultrafiltration), tubular reabsorption, and tubular secretion to ensure essential nutrients are retained while wastes are removed.

• The waste product formed after this filtration process is urine, which is then excreted from the body through the ureters, urinary bladder, and urethra.

Additional Information

• Homeostasis and Osmoregulation: The kidneys play a vital role in maintaining homeostasis by regulating the osmolarity of body fluids. They control the levels of water and electrolytes like sodium, potassium, and calcium.

• Regulation of Blood Pressure: Through the Renin-Angiotensin-Aldosterone System (RAAS), the kidneys help regulate long-term blood pressure by adjusting blood volume and vascular resistance.

• Endocrine Functions: The kidneys act as endocrine organs by secreting hormones such as Erythropoietin, which stimulates the production of red blood cells in the bone marrow, and Renin.

• Vitamin D Activation: They are responsible for converting calcifediol into calcitriol, the active form of Vitamin D, which is essential for calcium absorption in the intestines.

• pH Balance: The kidneys help maintain the acid-base balance (pH) of the blood by excreting hydrogen ions and reabsorbing bicarbonate from the urine.

Important Points

• Anatomy: In a healthy adult, each kidney is about 10-12 cm long, 5-7 cm wide, and weighs approximately 120-170 grams. They are located in the retroperitoneal space at the level of T12 to L3 vertebrae.

• Filtration Rate: The kidneys filter about 180 liters of fluid daily; however, nearly 99% of this is reabsorbed into the blood, resulting in only about 1.5 liters of urine production per day.

• Comparison with Other Functions:

• Digestion and nutrient absorption (Option 2) are primarily the functions of the stomach and small intestine.

• Oxygen absorption and carbon dioxide release (Option 3) are the primary functions of the lungs in the respiratory system.

• Transport of glucose and hormones (Option 4) is handled by the circulatory system (heart and blood vessels).

• Renal Failure: When kidneys lose their ability to filter, it leads to a condition called uremia, which may require medical interventions like dialysis or a kidney transplant.

Q14. Answer: (a) Copper-T

The correct answer is Copper-T.

Key Points

• Copper-T (CuT) is a type of Intrauterine Device (IUD) that is inserted by medical professionals or expert nurses into the uterus through the vagina.

• It is a non-hormonal contraceptive device made of plastic and copper. It is T-shaped to fit the anatomy of the uterine cavity.

• The primary mechanism of action involves the release of copper ions, which increase the phagocytosis of sperm within the uterus.

• The released copper ions also suppress sperm motility and reduce the fertilizing capacity of the sperm, thereby preventing the sperm from reaching and fertilizing the egg.

• It is considered one of the most effective long-term reversible contraceptive methods, with specific models like CuT-380A providing protection for up to 10 years.

• In India, IUDs like Copper-T are widely accepted as a primary method of contraception for women who wish to space children or delay pregnancy.

Additional Information

• Condom:

• It is a barrier method of contraception made of thin rubber or latex sheath.

• It is used to cover the penis in the male or the vagina and cervix in the female just before coitus.

• Unlike IUDs, condoms prevent the physical meeting of the sperm and the ovum and offer the added benefit of protecting against Sexually Transmitted Infections (STIs) and AIDS.

• Oral Pills:

• These are hormonal contraceptives taken in the form of tablets. They contain small doses of either progestogens or a progestogen-estrogen combination.

• They work by inhibiting ovulation and implantation, as well as altering the quality of cervical mucus to prevent/retard the entry of sperm.

• Saheli is a well-known non-steroidal oral pill developed by the Central Drug Research Institute (CDRI) in Lucknow, India.

• Hormonal Patch:

• This is a transdermal patch applied to the skin that releases synthetic estrogen and progestogen hormones into the bloodstream.

• Similar to oral pills, the patch prevents ovulation (the release of an egg from the ovary) and thickens the cervical mucus.

• Categories of IUDs:

• Non-medicated IUDs: Example includes the Lippes Loop.

• Copper releasing IUDs: Examples include CuT, Cu7, and Multiload 375.

• Hormone releasing IUDs: Examples include Progestasert and LNG-20, which make the uterus unsuitable for implantation and the cervix hostile to sperm.

Important Points

• The effectiveness of Copper-T starts immediately upon insertion by a healthcare provider.

• While Copper-T is highly effective at preventing pregnancy, it does not provide any protection against HIV/AIDS or other sexually transmitted diseases.

• It is a reversible method; fertility returns to normal as soon as the device is removed from the uterus.

• Common side effects may include heavier menstrual bleeding or cramping, especially in the first few months after insertion.

Q15. Answer: (c) Ionic bond

The correct answer is Ionic bond.

Key Points

• An Ionic bond is a type of chemical linkage formed through the electrostatic attraction between two oppositely charged ions. This bond typically forms when a metal reacts with a non-metal.

• During the formation of an ionic bond, the metal atom loses one or more valence electrons to become a positively charged ion, known as a cation.

• The non-metal atom accepts these electrons to complete its outer shell, becoming a negatively charged ion, known as an anion.

• This complete transfer of electrons happens because metals generally have low ionization energy (they lose electrons easily), while non-metals have high electron affinity (they gain electrons easily).

• A common example is Sodium Chloride (NaCl), where a Sodium (Na) atom (metal) transfers its single valence electron to a Chlorine (Cl) atom (non-metal). Hence, the correct answer is Ionic bond.

Additional Information

• Covalent Bond:

• This bond involves the sharing of electron pairs between atoms. It typically occurs between two non-metals.

• Examples include Water (H_2O), Methane (CH_4), and Carbon Dioxide (CO_2).

• Unlike ionic bonds, there is no complete transfer of electrons; instead, the atoms reach stability by sharing.

• Metallic Bond:

• This bond occurs specifically between metal atoms. It is characterized by a "sea of delocalized electrons" that move freely around a lattice of positive metal nuclei.

• This structure accounts for properties like electrical conductivity, malleability, and ductility in metals like Copper (Cu) and Iron (Fe).

• Hydrogen Bond:

• This is a relatively weak intermolecular force rather than a primary chemical bond.

• It occurs when a hydrogen atom is covalently bonded to a highly electronegative atom (such as Nitrogen, Oxygen, or Fluorine) and experiences attraction to another electronegative atom nearby.

Important Points

• Electronegativity Difference: The nature of a bond is often determined by the electronegativity difference between the two elements. If the difference is greater than 1.7 on the Pauling scale, the bond is usually Ionic; if it is lower, it is Covalent.

• Physical State: Ionic compounds are typically crystalline solids at room temperature and have very high melting and boiling points due to the strong attraction between ions.

• Conductivity: Ionic compounds do not conduct electricity in solid form because the ions are fixed in place. However, they are excellent conductors when molten or dissolved in water (aqueous state) because the ions are free to move.

• Lattice Energy: The stability of an ionic compound is derived from its lattice energy, which is the energy released when gaseous ions combine to form a solid ionic crystal.

• Octet Rule: The primary driving force for forming ionic bonds is the Octet Rule, where atoms lose or gain electrons to achieve a stable electronic configuration similar to Noble Gases (usually 8 electrons in the outermost shell).

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Q16. Answer: (c) Taste

The correct answer is Taste.

Key Points

• Gustatory receptors are specialized sensory cells responsible for the perception of taste. These receptors are primarily located on the tongue, though they are also found on the soft palate, epiglottis, and pharynx.

• These receptors are clustered into structures known as taste buds, which are embedded within papillae (small bumps on the tongue surface). Each taste bud contains 50 to 100 taste receptor cells.

• The primary function of gustatory receptors is to detect chemical substances dissolved in saliva. These chemicals (tastants) bind to the receptors, triggering nerve impulses that are sent to the brain for processing.

• Human gustatory receptors can distinguish between five primary tastes: Sweet, Sour, Salty, Bitter, and Umami (savory).

• While gustatory receptors detect taste, the overall perception of flavor is a combination of signals from both taste buds and olfactory (smell) receptors. Hence, the correct answer is Taste.

Additional Information

• Smell (Olfaction):

• The detection of smell is performed by olfactory receptors located in the olfactory epithelium at the top of the nasal cavity.

• These are chemoreceptors that detect volatile chemical molecules in the air. Hence, statement 1 is incorrect regarding gustatory receptors.

• Light (Vision):

• Light is detected by photoreceptors located in the retina of the eye.

• There are two main types of photoreceptors: Rods (responsible for vision in low light) and Cones (responsible for color vision and detail). Hence, statement 2 is incorrect.

• Sound (Hearing):

• Sound waves are detected by phonoreceptors (also called auditory receptors), which are a type of mechanoreceptor.

• These are found in the Organ of Corti within the cochlea of the inner ear. They convert mechanical vibrations into electrical signals. Hence, statement 4 is incorrect.

• Touch (Somatosensation):

• The skin contains various receptors such as mechanoreceptors (for pressure and texture), thermoreceptors (for temperature), and nociceptors (for pain).

Important Points

• Cranial Nerves: Taste information from the gustatory receptors is carried to the brainstem (specifically the medulla oblongata) by three main cranial nerves: the Facial Nerve (VII) for the front two-thirds of the tongue, the Glossopharyngeal Nerve (IX) for the back one-third, and the Vagus Nerve (X) for the throat area.

• The Umami Taste: This was officially recognized as the fifth basic taste in the year 1985, though it was first identified by Japanese chemist Kikunae Ikeda in 1908. It detects the presence of glutamate, often found in protein-rich foods.

• Adaptation: Gustatory receptors exhibit rapid adaptation, meaning the sensitivity to a constant taste stimulus decreases quickly over time (e.g., the first bite of food often tastes more intense than the last).

• Age and Taste: The number of taste buds typically decreases with age, often starting after age 50, which can lead to a reduced ability to detect flavors.

Q17. Answer: (a) Concentration → Reduction → Refining

The correct answer is Concentration → Reduction → Refining.

Key Points

• The extraction of metals from their ores involves several physical and chemical processes collectively known as Metallurgy. The standard sequence followed is Concentration, followed by Reduction, and finally Refining.

• Concentration of Ore: Also known as ore-dressing or beneficiation, this is the initial step where impurities such as sand, clay, and rocks (collectively called gangue) are removed from the mined ore. Methods used include hydraulic washing, magnetic separation, or froth flotation. Hence, the first stage in the sequence is Concentration.

• Reduction: Once the ore is concentrated and usually converted into a metal oxide (via roasting or calcination), it undergoes reduction. In this stage, the metal oxide is reduced to the crude metal by removing oxygen. This is often done using reducing agents like carbon (coke), carbon monoxide, or through electrolysis for highly reactive metals. Hence, the second stage in the sequence is Reduction.

• Refining: The metal obtained after reduction is usually impure and contains other metals or non-metals. Refining is the final treatment to obtain pure metal of high grade. Common techniques include distillation, liquation, and electrolytic refining. Hence, the third stage in the sequence is Refining.

• Therefore, the correct operational sequence in metallurgical extraction is Concentration → Reduction → Refining. Hence, option 1 is correct.

Additional Information

• Gangue and Flux: Gangue refers to the earthy impurities associated with the ore. A substance called Flux is added during the extraction process to remove gangue by forming a fusible material known as Slag.

• Roasting and Calcination:

• Roasting: The process of heating sulphide ores strongly in the presence of excess air to convert them into oxides.

• Calcination: The process of heating carbonate or hydrated ores strongly in the absence or limited supply of air to remove volatile impurities and convert them into oxides.

• Reactivity Series and Extraction:

• High Reactivity Metals (e.g., Sodium, Magnesium, Aluminium): These are extracted by electrolytic reduction of their molten chlorides or oxides because they cannot be reduced by carbon.

• Medium Reactivity Metals (e.g., Zinc, Iron, Lead): Usually found as sulphides or carbonates, converted to oxides, and then reduced using carbon.

• Low Reactivity Metals (e.g., Mercury, Copper): These can often be reduced to metal by simply heating their ores in air.

• Electrolytic Refining: This is the most widely used method for refining metals like Copper (Cu), Zinc (Zn), and Nickel (Ni). In this process, the impure metal acts as the anode, and a thin strip of pure metal acts as the cathode. On passing electricity, pure metal from the anode dissolves into the electrolyte and deposits onto the cathode.

Important Points

• Froth Flotation: This specific concentration method is primarily used for sulphide ores. It relies on the principle that ore particles are wetted by oil while gangue particles are wetted by water.

• Thermite Process: A reduction method where a highly reactive metal like Aluminium is used as a reducing agent to displace a metal from its oxide, often used for joining railway tracks (Iron oxide reduction).

• Purity Levels: While concentration increases the percentage of the metal in the ore, and reduction yields the metal, only Refining ensures a purity level often exceeding 99.9%.

Q18. Answer: (b) Sound is the fastest in solids, slower in liquids and the slowest in gases.

The correct answer is Sound is the fastest in solids, slower in liquids and the slowest in gases..

Key Points

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

• The speed of sound depends on the elasticity and density of the medium. In solids, the molecules are tightly packed and held together by strong intermolecular forces, allowing vibrations to transfer very rapidly. Hence, statement 2 is correct.

• In liquids, the molecules are less tightly packed than in solids but more so than in gases. Consequently, sound travels slower in liquids than in solids but faster than in gases. For example, the speed of sound in water is approximately 1480 m/s.

• In gases, molecules are far apart, meaning the collisions between them occur less frequently, which results in the slowest speed of propagation. For instance, in air at 20°C, sound travels at approximately 343 m/s. Hence, statement 1 is incorrect.

• Sound cannot travel through a vacuum because there are no particles to carry the vibrations. Hence, statement 3 is incorrect.

• The speed of sound is not the same in all mediums; it varies significantly based on the physical state and temperature of the substance. Hence, statement 4 is incorrect.

Additional Information

• Nature of Sound Waves:

• Sound waves are longitudinal waves, meaning the particles of the medium vibrate parallel to the direction of the wave's propagation.

• In solids, sound can also travel as transverse waves, but in fluids (liquids and gases), they are primarily longitudinal.

• Effect of Temperature:

• The speed of sound increases with an increase in temperature. For example, in air, the speed increases by approximately 0.6 meters per second for every 1 degree Celsius rise in temperature.

• This happens because higher temperatures increase the kinetic energy of the molecules, leading to more frequent collisions.

• Elasticity vs. Density:

• While higher density usually tends to slow down sound, the significantly higher elasticity (bulk modulus) of solids more than compensates for their density, resulting in the highest speeds in materials like steel (approx 5960 m/s) or aluminum (approx 6420 m/s).

• Historical Context and Applications:

• The Bell Jar Experiment is a classic scientific demonstration used to prove that sound cannot travel in a vacuum.

• Understanding sound propagation is essential in fields like SONAR (Sound Navigation and Ranging) used by submarines, medical ultrasonography, and seismology to study Earth's interior.

Important Points

• Human Hearing Range: The human ear can typically hear frequencies between 20 Hz and 20,000 Hz (20 kHz).

• Infrasonic and Ultrasonic: Sounds with frequencies below 20 Hz are called infrasonic (often produced by elephants or whales), while frequencies above 20,000 Hz are ultrasonic (used by bats for navigation).

• Mach Number: This is the ratio of the speed of an object to the speed of sound in the surrounding medium. If an aircraft travels faster than sound, it is called supersonic, which produces a sonic boom.

Q19. Answer: (a) Salivary Amylase

The correct answer is Salivary Amylase.

Key Points

• Salivary amylase, also referred to as ptyalin, is the primary enzyme present in the saliva of humans and several other mammals.

• It is synthesized and secreted by the salivary glands, which include the parotid, submandibular, and sublingual glands.

• The main function of this enzyme is to initiate the chemical digestion of carbohydrates (specifically starch) in the buccal cavity (mouth).

• Salivary amylase works by breaking down the long chains of starch (polysaccharides) into simpler disaccharides like maltose and smaller polymers called dextrins.

• The enzyme operates most efficiently at an optimum pH of 6.8, which is slightly acidic, and requires chloride ions (Cl-) for its activation.

• It is estimated that nearly 30 percent of the total dietary starch is hydrolyzed in the oral cavity before the food reaches the stomach. Hence, the correct answer is Salivary Amylase.

Additional Information

• Composition of Saliva:

• Saliva is a watery fluid containing 99.5% water and 0.5% solutes, including electrolytes like Sodium (Na+), Potassium (K+), Chloride (Cl-), and Bicarbonate (HCO3-).

• Apart from amylase, it contains Lysozyme, an antibacterial agent that prevents infections by attacking the cell walls of certain bacteria.

• Other Digestive Enzymes:

• Proteases: These are enzymes that digest proteins. While Salivary Protease is not a standard component of human saliva, protein digestion mainly begins in the stomach with pepsin.

• Lipases: While a very small amount of lingual lipase is secreted by glands on the tongue, its activity is minimal in the mouth and becomes more significant in the acidic environment of the stomach.

• Pancreatic Amylase: Once food reaches the small intestine, the digestion of remaining starch is completed by amylase secreted by the pancreas.

• The Salivary Glands:

• Parotid Glands: Located near the ears; these are the largest salivary glands.

• Submandibular Glands: Located along the inner side of the lower jaw.

• Sublingual Glands: Located beneath the tongue.

Important Points

• Bolus Formation: The mechanical action of teeth (mastication) combined with the lubricating effect of mucus in saliva turns food into a soft mass called a bolus, which is then swallowed (deglutition).

• Inactivation in Stomach: When the bolus reaches the stomach, the highly acidic gastric juice (pH 1.5 to 2.5) denatures and inactivates the salivary amylase, halting carbohydrate digestion until it reaches the duodenum.

• Taste Perception: Saliva acts as a solvent, dissolving food chemicals so they can be detected by taste buds located on the papillae of the tongue.

• Dental Health: The Bicarbonate ions in saliva act as a buffer, neutralizing acids produced by bacteria, thereby protecting the tooth enamel from decay.

Q20. Answer: (b) 4F N

The correct answer is 4F N.

Key Points

• According to Newton’s Law of Universal Gravitation, every particle attracts every other particle in the universe with a force that is directly proportional to the product of their masses and inversely proportional to the square of the distance between their centers.

• The mathematical expression for this force is $F = G (M \times m) / r^2$, where G is the Gravitational Constant, M is the mass of the Earth, m is the mass of the body, and r is the distance between them.

• In the initial scenario, the force is given as F. If the mass of the body m is increased to 4m while keeping the mass of the Earth M and the distance r constant, the new force F' is calculated as: $F' = G (M \times 4m) / r^2$.

• By rearranging the equation, we get $F' = 4 \times [G (M \times m) / r^2]$. Since the term in the bracket is the original force F, the new force

becomes 4F. Hence, the gravitational force increases by four times.

Additional Information

• Universal Gravitational Constant (G): It is a scalar quantity and its value is 6.674 × 10^-11 N·m²/kg². This value was first experimentally determined by Henry Cavendish in 1798 and remains constant everywhere in the universe.

• Mass vs. Weight: While mass is the amount of matter in a body and remains constant (m), weight is the gravitational force exerted by the Earth on that body (W = mg). If the mass of an object increases, its weight increases proportionally.

• Inverse Square Law: The gravitational force is highly sensitive to distance. If the distance between the Earth and the body were doubled, the force would decrease to one-fourth (F/4) of its original value.

• Acceleration due to Gravity (g): On the surface of the Earth, the value of g is approximately 9.8 m/s². It is derived from the formula g = GM / r², showing that the acceleration of a falling object does not depend on the mass of the object itself, but the force acting on it does.

• Earth's Characteristics: The Earth has a mass of approximately 5.97 × 10²^4 kg and a mean radius of about 6,371 km. These parameters define the strength of the gravitational field we experience daily.

Q21. Answer: (b) Statement A is incorrect but B is correct.

The correct answer is Statement A is incorrect but B is correct.

Key Points

• Statement A: Heating Sodium Hydrogen Carbonate (commonly known as Baking Soda) results in its thermal decomposition to produce Sodium Carbonate, water, and carbon dioxide. While Sodium Carbonate is the base of washing soda, Washing Soda specifically refers to the crystalline form, Sodium Carbonate Decahydrate (Na2CO3.10H2O). To obtain washing soda, recrystallization of the anhydrous sodium carbonate with ten molecules of water is necessary. Simple heating alone produces soda ash (anhydrous sodium carbonate), not the hydrated washing soda. Hence, statement A is incorrect.

• Statement B: Sodium carbonate (washing soda) is a highly versatile chemical used in various industrial processes. It is a primary raw material in the Glass industry for manufacturing bottles and window glass. It is also a key ingredient in the Soap and detergent industry due to its ability to act as a builder and surfactant booster. Furthermore, it is used in the Paper industry for the pulping and bleaching processes. Hence, statement B is correct.

• The chemical formula for Baking Soda is NaHCO3, and the reaction for its decomposition upon heating is: 2NaHCO3 → Na2CO3 + H2O + CO2.

• The transition from Sodium Carbonate to Washing Soda involves the addition of 10 molecules of water of crystallization, represented by the formula Na2CO3 + 10H2O → Na2CO3.10H2O.

• Hence, the correct answer is Statement A is incorrect but B is correct.

Additional Information

• Washing Soda (Sodium Carbonate Decahydrate):

• It is a basic salt that turns red litmus solution to blue, indicating its alkaline nature.

• One of its most important functions is the removal of permanent hardness of water by precipitating magnesium and calcium ions as carbonates.

• It is manufactured commercially using the Solvay Process (also known as the ammonia-soda process) which uses Brine, Ammonia, and Limestone as raw materials.

• Apart from glass and soap, it is used in the production of sodium compounds like Borax and as a cleaning agent for domestic purposes.

• Baking Soda (Sodium Hydrogen Carbonate):

• It is produced using the Solvay process where Carbon dioxide is passed through a concentrated solution of Sodium Chloride and Ammonia.

• It is used as an Antacid in medicine to neutralize excess Hydrochloric acid in the stomach, providing relief from acidity.

• In the culinary world, it is used to make Baking Powder, which is a mixture of baking soda and a mild edible acid like Tartaric acid. When heated, it releases CO2 gas, which makes bread or cakes rise and become soft and spongy.

• It is also a key component in Soda-acid fire extinguishers because it releases carbon dioxide when reacting with acids, which helps smother flames.

Important Points

• Water of Crystallization: This refers to the fixed number of water molecules present in one formula unit of a salt. For washing soda, this number is 10, making it a decahydrate.

• Efflorescence: When Washing Soda crystals are exposed to air, they lose nine molecules of water to form a monohydrate (Na2CO3.H2O), a process known as efflorescence.

• Chemical Nature: Both baking soda and washing soda are sodium salts of carbonic acid, but they differ in their pH levels and solubility, with washing soda being more strongly alkaline.

Q22. Answer: (b) Producing male germ cells

The correct answer is Producing male germ cells.

Key Points

• The stigma is the uppermost part of the carpel (female reproductive organ) of a flower like Hibiscus, and its primary role is receiving pollen grains during the process of pollination. Hence, statement 1 is a correct function of the stigma.

• To effectively capture pollen from various pollinators or the wind, the stigma provides a sticky surface. This stickiness ensures that the pollen grains adhere firmly to the flower. Hence, statement 3 is a correct function of the stigma.

• Once the pollen grain lands, the stigma plays a vital role in facilitating pollen tube growth by providing the necessary chemical signals and nutrients for the pollen to germinate. Hence, statement 4 is a correct function of the stigma.

• The production of male germ cells (male gametes) does not happen in the stigma. Instead, these cells are produced within the pollen grains, which are generated in the anther (the male part of the flower). Hence, statement 2 is NOT a function of the stigma.

• In a Hibiscus flower, the stigma is typically pentafid, meaning it is divided into five distinct lobes, each corresponding to a locule in the ovary.

Additional Information

• Structure of the Hibiscus Flower:

• The Hibiscus rosa-sinensis is a bisexual or hermaphrodite flower, meaning it contains both male (androecium) and female (gynoecium) reproductive parts.

• The stamen (male part) consists of the anther and filament. In Hibiscus, the filaments are fused to form a staminal tube, a condition known as monadelphous.

• The pistil or carpel (female part) consists of the stigma, style, and ovary. The style passes through the staminal tube.

• The Process of Fertilization:

• After pollination, the pollen tube grows down through the style to reach the ovary.

• The ovary contains ovules, which house the female gamete (egg cell).

• The male germ cells travel through the pollen tube to fuse with the egg cell, a process called syngamy or fertilization, resulting in a zygote.

Important Points

• Hibiscus is often used as a model organism in botany to study floral morphology because its reproductive parts are large and easily identifiable.

• The anthers of the Hibiscus are reniform (kidney-shaped) and monothecous (having one lobe).

• The stigma acts as a gatekeeper, often performing pollen rejection to prevent self-pollination or the growth of pollen from different species, thereby ensuring genetic diversity.

• The male germ cells are specifically formed when the generative cell inside the pollen grain divides by mitosis.

Q23. Answer: (a) A circle with a ‘V’ inside, connected in parallel

The correct answer is A circle with a ‘V’ inside, connected in parallel.

Key Points

• In a schematic electric circuit diagram, a voltmeter is represented by a circle with the letter ‘V’ inscribed inside it. This device is specifically designed to measure the electric potential difference between two points in a circuit.

• A voltmeter must always be connected in parallel with the component or part of the circuit across which the voltage is to be measured. This is because the potential difference remains the same across all branches in a parallel connection. Hence, statement 1 is correct.

• The standard symbol for a voltmeter is a circle; using a square with a ‘V’ is not a standard practice in conventional electrical schematics. Hence, statement 2 is incorrect.

• A circle with an ‘A’ inside represents an ammeter, which is used to measure electric current. Unlike a voltmeter, an ammeter is connected in series because current remains constant in a series circuit. Hence, statement 3 is incorrect.

• A rectangle with an ‘R’ (or more commonly a zig-zag line) represents a resistor, which is a passive component that provides resistance to the flow of current, rather than a measuring instrument. Hence, statement 4 is incorrect.

• An ideal voltmeter is considered to have infinite resistance. This characteristic ensures that it does not draw any significant current from the main circuit, thereby providing an accurate reading of the potential difference without altering the circuit's behavior.

Additional Information

• Potential Difference (Voltage):

• It is defined as the work done to move a unit positive charge from one point to another in an electric field. The SI unit of potential difference is the Volt (V), named after the physicist Alessandro Volta.

• Mathematically, Voltage (V) = Work Done (W) / Charge (Q).

• Ammeter vs. Voltmeter:

• An ammeter measures current in Amperes (A) and has very low resistance to minimize its impact on the total circuit resistance. It is always placed in series.

• A voltmeter measures voltage in Volts (V) and has very high resistance. It is always placed in parallel.

• Ohm's Law:

• Proposed by Georg Simon Ohm in 1827, it states that the current passing through a conductor between two points is directly proportional to the voltage across the two points, provided physical conditions like temperature remain constant (V = IR).

• Galvanometer:

• A galvanometer is an instrument used for detecting and measuring small electric currents. It can be converted into a voltmeter by connecting a high resistance (multiplier) in series with it.

Important Points

• Circuit Safety: Connecting a voltmeter in series can stop the flow of current in a circuit due to its exceptionally high resistance, rendering the circuit non-functional. Conversely, connecting an ammeter in parallel can lead to a short circuit and damage the meter because of its low resistance.

• Measurement Units:

• 1 Volt is the potential difference between two points when 1 Joule of work is done to move a charge of 1 Coulomb.

• Instruments like the Multimeter are versatile tools that can function as a voltmeter, ammeter, or ohmmeter depending on the setting chosen by the user.

• Schematic Symbols: Standard symbols facilitate global communication among engineers. A battery is shown as a series of long and short parallel lines, while a switch is shown as a break in the line that can be "opened" or "closed."

Q24. Answer: (d) Milk

The correct answer is Milk.

Key Points

• Milk is considered a colloidal solution because it consists of liquid fat globules dispersed throughout an aqueous (water-based) solution.

• A colloid is a heterogeneous mixture in which the particle size of the substance is intermediate between a true solution and a suspension. The diameter of the particles typically ranges from 1 nanometer to 1000 nanometers.

• In milk, the dispersed phase is fat (lipids) and the dispersion medium is water. Because both the dispersed phase and the medium are liquids, it is specifically categorized as an emulsion.

• Colloids like milk exhibit the Tyndall effect, which is the scattering of a beam of light as it passes through the mixture, making the path of light visible.

• Unlike suspensions, the particles in a colloidal solution do not settle down at the bottom when left undisturbed for a long period, showing that milk is relatively stable.

Additional Information

• Salt Water:

• It is a True Solution. In this mixture, the sodium chloride (NaCl) particles are completely dissolved in water.

• The particle size is less than 1 nanometer, making it impossible to see them even with a powerful microscope. It does not scatter light.

• Sugar Solution:

• Like salt water, a sugar solution is also a True Solution. It is a homogeneous mixture where the solute (sugar) is uniformly distributed in the solvent (water).

• The particles are molecular in size and do not settle over time, nor can they be separated by filtration.

• Sand in Water:

• This is a Suspension. It is a heterogeneous mixture containing large solid particles (greater than 1000 nanometers) that are visible to the naked eye.

• If left undisturbed, the sand particles will settle at the bottom due to gravity. This mixture can be easily separated using a filter paper.

Important Points

• Types of Colloids: Colloids are classified based on the state of the dispersed phase and dispersion medium. Common examples include Fog (Aerosol), Whipped Cream (Foam), Jelly (Gel), and Muddy Water (Sol).

• Separation Techniques: While true solutions cannot be separated by physical means like filtration, colloids like milk can be separated into their components (like cream/fat) using centrifugation.

• Brownian Motion: The particles in a colloidal solution move in a zig-zag path, known as Brownian motion, which helps in keeping the particles in suspension and prevents them from settling.

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Q25. Answer: (a) Scrotum

The correct answer is Scrotum.

Key Points

• The scrotum is a pouch-like anatomical structure located outside the abdominal cavity in male mammals, specifically situated behind the penis.

• Its primary function is to house and protect the testes (testicles), which are the primary male reproductive organs. Hence, the statement regarding the location of testes is correct.

• The location of the scrotum outside the body is vital for thermoregulation. The process of spermatogenesis (production of sperm) requires a temperature that is 2 to 2.5°C lower than the standard internal body temperature (which is approximately 37°C or 98.6°F).

• The testes descend from the abdominal cavity into the scrotum through the inguinal canal during the seventh month of fetal development.

• The scrotum contains the dartos muscle and the cremaster muscle, which contract or relax to move the testes closer to or further from the body to maintain the optimal temperature for sperm survival.

Additional Information

• Penis:

• This is the male external genitalia and serves as the copulatory organ.

• It is composed of specialized erectile tissue that facilitates erection to assist in insemination.

• The tip of the penis, known as the glans penis, is covered by a retractable fold of skin called the prepuce or foreskin.

• Urinary Bladder:

• The bladder is a muscular, hollow organ located in the pelvic cavity.

• Its primary function is the storage of urine before it is expelled from the body via the urethra.

• In males, the bladder sits above the prostate gland and in front of the rectum.

• Ureter:

• These are narrow, muscular tubes (typically two) that measure about 25 to 30 cm in length.

• Their function is to transport urine from the kidneys to the urinary bladder using peristaltic movements.

• They are part of the urinary system and do not play a direct role in the reproductive system.

Important Points

• Testicular Lobules: Each testis is divided into approximately 250 compartments called testicular lobules, each containing seminiferous tubules where sperm is produced.

• Hormonal Function: The Leydig cells (interstitial cells) found in the testes secrete androgens, mainly testosterone, which is responsible for male secondary sexual characteristics and the regulation of spermatogenesis.

• Cryptorchidism: This is a medical condition where one or both of the testes fail to descend into the scrotum before birth. If left untreated, it can lead to infertility due to the high internal body temperature affecting sperm production.

• Sperm Pathway: Once produced in the seminiferous tubules, sperm travels through the rete testis, vasa efferentia, and the epididymis (where it matures) before entering the vas deferens.

Q26. Answer: (a) 2%

Shortcut Trick

Ratio of Expenditure to Savings = 225 : 100 = 9 : 4.

Net change in Income = (9 × −14% + 4 × 38%) ÷ (9 + 4)

Net change = (−126 + 152) ÷ 13 = 26 ÷ 13 = 2%.

Therefore The correct answer is 2%.

Alternate Method

Given: Expenditure is 125% more than Savings.

=> Let Savings = 100

=> Expenditure = 100 + 125% of 100 = 225

=> Income = Expenditure + Savings = 225 + 100 = 325

=> New Expenditure = 225 × (100 − 14)/100 = 225 × 0.86 = 193.5

=> New Savings = 100 × (100 + 38)/100 = 138

=> New Income = 193.5 + 138 = 331.5

=> Increase in Income = 331.5 − 325 = 6.5

=> Percentage Increase = (6.5 ÷ 325) × 100 = 2%

Therefore The correct answer is 2%.

Additional Information

Income-Expenditure Relationship

The fundamental accounting equation used in these problems is Income = Expenditure + Savings.

Weighted Average Application

Percentage change in Income is the weighted average of percentage changes in Expenditure and Savings based on their initial values.

Successive Percentage Change

For two successive changes a% and b%, the net effect is given by [a + b + (a×b)/100]%, though not directly applicable to additions like Income.

Q27. Answer: (c) 16

Shortcut Trick

Given: $\tan\theta + \cot\theta = 4$

Convert to sin and cos: $(\sin\theta/\cos\theta) + (\cos\theta/\sin\theta) = 4 \Rightarrow (\sin^2\theta + \cos^2\theta) / (\sin\theta \cos\theta) = 4$

Using identity $\sin^2\theta + \cos^2\theta = 1$: $1 / (\sin\theta \cos\theta) = 4$

Squaring both sides: $1 / (\sin^2\theta \cos^2\theta) = 16$

Since $\sec^2\theta = 1/\cos^2\theta$ and $\csc^2\theta = 1/\sin^2\theta$, the expression is equal to 16.

Therefore The correct answer is 16.

Alternate Method

Given: $\tan\theta + \cot\theta = 4$

Formula Used: $\tan\theta + \cot\theta = \sec\theta \times \csc\theta$

$\Rightarrow (\sin\theta/\cos\theta) + (\cos\theta/\sin\theta) = 4$

$\Rightarrow (\sin^2\theta + \cos^2\theta) / (\sin\theta \cos\theta) = 4$

$\Rightarrow 1 / (\sin\theta \cos\theta) = 4$

$\Rightarrow \sec\theta \times \csc\theta = 4$

$\Rightarrow (\sec\theta \times \csc\theta)^2 = 4^2$

$\Rightarrow \sec^2\theta \times \csc^2\theta = 16$

Therefore The correct answer is 16.

Additional Information

Trigonometric Identity Relation

The expression $\tan\theta + \cot\theta$ is always equal to $\sec\theta \times \csc\theta$ or $1/(\sin\theta\cos\theta)$.

Pythagorean Identities

$\sin^2\theta + \cos^2\theta = 1$; $1 + \tan^2\theta = \sec^2\theta$; $1 + \cot^2\theta = \csc^2\theta$.

Sum of Squares Identity

$\sec^2\theta + \csc^2\theta = \sec^2\theta \times \csc^2\theta$. This unique property allows switching between sum and product.

Q28. Answer: (d) 51.8

Shortcut Trick

The Empirical Relationship between averages is: (Mode − Mean) = 3 × (Median − Mean).

From this, the ratio of differences is: (Mode − Median) : (Mode − Mean) = 2 : 3.

Given: (Mode − Mean) = 77.7, which corresponds to 3 units.

Value of 1 unit = 77.7 ÷ 3 = 25.9.

Required: (Mode − Median) = 2 units = 2 × 25.9 = 51.8.

Therefore The correct answer is 51.8.

Alternate Method

Given:

Difference between Mode and Mean (Mode − Mean) = 77.7

Formula Used:

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

Calculations:

$\Rightarrow$ Mode = 3 × Median − 2 × Mean

$\Rightarrow$ Mode + 2 × Mean = 3 × Median

$\Rightarrow$ To find the difference between Mode and Median, subtract 3 × Mode from both sides:

=> Mode + 2 × Mean − 3 × Mode = 3 × Median − 3 × Mode
=> 2 × Mean − 2 × Mode = 3 × (Median − Mode)
=> −2 × (Mode − Mean) = −3 × (Mode − Median)
=> 2 × 77.7 = 3 × (Mode − Median)
=> Mode − Median = (2 × 77.7) ÷ 3
=> Mode − Median = 155.4 ÷ 3
=> Mode − Median = 51.8
Therefore The correct answer is 51.8.
Additional Information
Empirical Relationship
For a moderately skewed distribution, the relationship is Mode = 3 × Median − 2 × Mean.
Symmetric Distribution
In a perfectly symmetrical distribution, the Mean, Median, and Mode are all equal (Mean = Median = Mode).
Positively Skewed Distribution
In a positively skewed (right-skewed) distribution, the relation is usually Mean > Median > Mode.
Negatively Skewed Distribution
In a negatively skewed (left-skewed) distribution, the relation is usually Mode > Median > Mean.

Q29. Answer: (d) 3535

Shortcut Trick
Convert percentages and fractions into a single multiplying factor.
Number = 303 ÷ (0.30 × 0.50 × 4/7)
Number = 303 × (100/30) × (100/50) × (7/4)
Number = 303 × (10/3) × 2 × (7/4) = 101 × 10 × 3.5 = 3535.
Therefore The correct answer is 3535.
Alternate Method
Given: 30% of 50% of 4/7 of x = 303
Formula Used: Percentage = Value/100
=> (30/100) × (50/100) × (4/7) × x = 303
=> (3/10) × (1/2) × (4/7) × x = 303
=> (3 × 1 × 4) / (10 × 2 × 7) × x = 303
=> (12 / 140) × x = 303
=> (3 / 35) × x = 303
=> x = (303 × 35) / 3
=> x = 101 × 35 = 3535
Therefore The correct answer is 3535.
Additional Information
Percentage to Fraction Conversion
To simplify calculations, convert common percentages: 50% = 1/2, 25% = 1/4, 20% = 1/5, and 10% = 1/10.
Successive Percentage Rule
A% of B% of C is equivalent to (A × B / 100)% of C. This is useful for multi-step discount or growth problems.
Reciprocal Property
When solving for a number, multiply the result by the reciprocal of the total fraction: x = Result × (Denominator / Numerator).

Q30. Answer: (b) 4620

Shortcut Trick
Calculate the semi-perimeter (s): (105 + 137 + 88) ÷ 2 = 165 cm.
Note that s = 165 (multiple of 11) and (s − c) = 165 − 88 = 77 (multiple of 7 and 11).
By Heron's Formula, the Area must be a multiple of 11 and 7.
Checking options for divisibility by 11 and 7: Only 4620 satisfies both conditions.
Therefore The correct answer is 4620 cm².
Alternate Method

Given: Sides of the triangle are a = 105 cm, b = 137 cm, and c = 88 cm.

Formula Used: Area of a triangle = √[s(s − a)(s − b)(s − c)], where s is the semi-perimeter.

=> s = (a + b + c) ÷ 2

=> s = (105 + 137 + 88) ÷ 2 = 330 ÷ 2 = 165 cm

=> Area = √[165 × (165 − 105) × (165 − 137) × (165 − 88)]

=> Area = √[165 × 60 × 28 × 77]

=> Area = √[(11 × 15) × (4 × 15) × (4 × 7) × (11 × 7)]

=> Area = √[$11^2 \times 15^2 \times 4^2 \times 7^2$]

=> Area = 11 × 15 × 4 × 7 = 165 × 28

=> Area = 4620 cm^2

Therefore The correct answer is 4620 cm^2.

Additional Information

Heron's Formula

Used for finding the area of any triangle when all three sides are known: Area = √[s(s − a)(s − b)(s − c)].

Equilateral Triangle Area

If all sides are equal to 'a', the area is given by (√3 ÷ 4) × a^2.

Right-Angled Triangle Area

The area of a triangle with base 'b' and height 'h' is 1/2 × b × h.

Inradius of a Triangle

The radius of the incircle (r) is related to the area (A) and semi-perimeter (s) by the formula: r = A ÷ s.

Q31. Answer: (a) 33.33%

Shortcut Trick

If CP of x articles = SP of y articles, then Profit% = [(x − y) ÷ y] × 100.

Given: x = 60 and y = 45.

Profit% = [(60 − 45) ÷ 45] × 100 = [15 ÷ 45] × 100.

Profit% = (1 ÷ 3) × 100 = 33.33%.

Therefore The correct answer is 33.33%.

Alternate Method

Given → CP of 60 guavas = SP of 45 guavas.

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

=> 60 × CP = 45 × SP

=> SP ÷ CP = 60 ÷ 45 = 4 ÷ 3

=> Let CP = 3 units and SP = 4 units.

=> Profit = 4 − 3 = 1 unit.

=> Profit% = (1 ÷ 3) × 100 = 33.333...%

=> Rounded to 2 decimal places = 33.33%.

Therefore The correct answer is 33.33%.

Additional Information

Profit and Loss on Article Quantity

When the cost price of a certain number of items equals the selling price of another number, the base for percentage calculation is always the number of items sold (SP quantity).

Rounding Off Rules

To round to 2 decimal places, look at the third decimal digit; if it is 5 or greater, round up the second digit, otherwise keep it as is.

Q32. Answer: (d) 42.75%

Shortcut Trick

Total Successive Discount for 16%, 29% and 4% can be calculated using the Effective Discount formula.

Step 1: Discount for 16% and 29% => 16 + 29 − (16 × 29) ÷ 100 = 45 − 4.64 = 40.36%.

Step 2: Discount for 40.36% and 4% => 40.36 + 4 − (40.36 × 4) ÷ 100 = 44.36 − 1.6144 = 42.7456%.

Rounding off to two decimal places, we get 42.75%.

Therefore The correct answer is 42.75%.

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Alternate Method

Given → Successive Discounts: d1 = 16%, d2 = 29%, d3 = 4%.

Formulas: Equivalent Discount = [1 − (1 − d1/100) × (1 − d2/100) × (1 − d3/100)] × 100.

=> Let Marked Price (MP) = 100.

=> Price after 16% discount = 100 × (84/100) = 84.

=> Price after 29% discount = 84 × (71/100) = 59.64.

=> Price after 4% discount = 59.64 × (96/100) = 57.2544.

=> Total Discount = MP − Final SP = 100 − 57.2544 = 42.7456%.

=> Rounding to two decimal places = 42.75%.

Therefore The correct answer is 42.75%.

Additional Information

Successive Discount Concept

When multiple discounts are applied one after another, the base for the subsequent discount is the reduced price from the previous step. Formula for two discounts: a + b − (ab/100).

Marked Price & Discount

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

Q33. Answer: (b) 4375

Shortcut Trick

Combine the profit sharing ratios: P : Q : R = (2 × 11) : (1 × 11) : (1 × 7) = 22 : 11 : 7.

Total units = 22 + 11 + 7 = 40 units.

Given 40 units = Rs. 25,000 → 1 unit = Rs. 625.

Share of R = 7 units = 7 × 625 = Rs. 4,375.

Therefore The correct answer is Rs. 4375.

Alternate Method

Given:

Total profit = Rs. 25,000

Ratio P : Q = 2 : 1 and Q : R = 11 : 7

Calculations:

=> To equalize Q, multiply P : Q by 11: P : Q = 22 : 11

=> Combined Ratio P : Q : R = 22 : 11 : 7

=> Sum of ratio parts = 22 + 11 + 7 = 40

=> Share of R = (R's part / Total parts) × Total Profit

=> Share of R = (7 / 40) × 25000

=> Share of R = 7 × 625

=> Share of R = 4375

Therefore The correct answer is Rs. 4375.

Additional Information

Compound Ratio

When two or more ratios are multiplied together, the result is a compound ratio. For P:Q and Q:R, the combined P:Q:R is found by making the common term (Q) equal.

Partnership Profit Distribution

Profit is distributed in the ratio of (Capital × Time). If time is constant, profit is shared directly in the ratio of investment/shares.

Ratio Proportion Property

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

Q34. Answer: (b) 338

Shortcut Trick

Simplify the surds directly by extracting perfect square factors:

=> $(\sqrt{98} + \sqrt{200} - 2\sqrt{8})^2$

=> $(7\sqrt{2} + 10\sqrt{2} - 4\sqrt{2})^2$

=> $(13\sqrt{2})^2$

=> 169 × 2 = 338

Therefore The correct answer is 338.

Alternate Method

Given:

$(\sqrt{98} + \sqrt{200} - 2\sqrt{8})^2$

Calculations:

Break down each radical into its simplest form by factoring out perfect squares:

=> $\sqrt{98} = \sqrt{(49 \times 2)} = 7\sqrt{2}$

=> $\sqrt{200} = \sqrt{(100 \times 2)} = 10\sqrt{2}$

=> $2\sqrt{8} = 2 \times \sqrt{(4 \times 2)} = 2 \times 2\sqrt{2} = 4\sqrt{2}$

Substitute the simplified values back into the given expression:

=> $(7\sqrt{2} + 10\sqrt{2} - 4\sqrt{2})^2$

Combine the like terms:

=> $(17\sqrt{2} - 4\sqrt{2})^2$

=> $(13\sqrt{2})^2$

Square the combined term:

=> $13^2 \times (\sqrt{2})^2$

=> $169 \times 2 = 338$

Therefore The correct answer is 338.

Additional Information

Simplification of Surds

A surd is simplified by identifying and extracting the largest perfect square factor from under the root: $\sqrt{(a^2 \times b)} = a\sqrt{b}$.

Addition and Subtraction of Surds

Only like surds (surds having the exact same irrational part) can be added or subtracted directly: $a\sqrt{x} + b\sqrt{x} = (a + b)\sqrt{x}$.

BODMAS Rule

Always simplify the expressions inside the Brackets first before applying higher order operations like exponentiation (Order).

Q35. Answer: (c) 60 minutes

Shortcut Trick

When distance is constant, Speed is inversely proportional to Time.

Speed Ratio (Usual : New) = 4 : 3 → Time Ratio (Usual : New) = 3 : 4.

Difference in time units = 4 − 3 = 1 unit.

Given, 1 unit = 20 minutes.

Usual time = 3 units = 3 × 20 = 60 minutes.

Therefore The correct answer is 60 min.

Alternate Method

Given: New speed = 3/4 of Usual speed. Delay = 20 minutes.

Formula Used: Usual Time = [Numerator / (Denominator − Numerator)] × Delay (when speed is reduced to n/d of usual speed).

=> Let usual speed be S and usual time be T.

=> Distance (D) = S × T

=> New speed = 3/4 S, New time = T + 20

=> D = (3/4 S) × (T + 20)

=> S × T = 3/4 S × (T + 20)

=> T = 3/4(T + 20)

=> 4T = 3T + 60

=> T = 60 minutes

Therefore The correct answer is 60 min.

Additional Information

Inverse Relation of Speed and Time

For a fixed distance, if speed becomes a/b of its original value, time becomes b/a of its original value. The change in time is |b/a − 1| × original time.

Average Speed Formula

If a person covers equal distances at speeds x and y, the average speed for the whole journey is (2xy) / (x + y).

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Relative Speed

When two objects move in the same direction, relative speed is (S1 − S2). In opposite directions, it is (S1 + S2).

Q36. Answer: (b) 5

Shortcut Trick

Combined efficiency (P+Q) = 1/10 per hour

Efficiency of P = 1/20 per hour

Efficiency of Q = 1/10 − 1/20 = 1/20 per hour

Time for Q to fill 1/4th cistern = (1/4) ÷ (1/20) = 5 hours

Therefore The correct answer is 5 hours.

Alternate Method

Given:

Time taken by P and Q = 10 hours

Time taken by P alone = 20 hours

Person	Days	Total Work	Efficiency
P + Q	10	20	2
P	20	1	

Calculations:

=> Efficiency of Q = (Efficiency of P+Q) − (Efficiency of P)

=> Efficiency of Q = 2 − 1 = 1 unit/hour

=> One-fourth of the total work = 20 ÷ 4 = 5 units

=> Time taken by Q alone = 5 ÷ 1 = 5 hours

Therefore The correct answer is 5 hours.

Additional Information

Pipes and Cisterns Efficiency

The efficiency of a pipe is inversely proportional to the time taken to fill the tank. Total Work = Time taken × Efficiency.

Combined Work Formula

If two pipes A and B fill a tank in x and y hours respectively, they together fill it in (xy) ÷ (x + y) hours.

Negative Work (Inlet/Outlet)

Inlet pipes perform positive work (+), while outlet pipes (leaks) perform negative work (−) on the cistern capacity.

Q37. Answer: (b) 862

Shortcut Trick

Required number = LCM(20, 98, 35, 21) × k + Remainder

LCM(20, 98, 35, 21) = 1470 × 4 = 5880

Desired number must be of form 5880k + 5

For k = 1, Number = 5880 + 5 = 5885

Number to be added = 5885 − 5023 = 862

Therefore The correct answer is 862.

Alternate Method

Given: Divisors are 20, 98, 35, 21 and remainder is 5.

Formula: Required Number = LCM(Divisors) × k + Remainder

=> Prime factorization of divisors:

=> 20 = $2^2 \times 5$

=> 98 = 2×7^2

=> 35 = 5×7

=> 21 = 3×7

=> LCM = $2^2 \times 5 \times 7^2 \times 3 = 4 \times 5 \times 49 \times 3 = 2940$

=> Note: Rechecking LCM(20, 98, 35, 21): 20=4×5, 98=2×49, 35=5×7, 21=3×7. LCM = 4 × 5 × 49 × 3 = 2940.

=> Next number after 5023 in the form 2940k + 5:

=> For k = 2: 2940 × 2 + 5 = 5880 + 5 = 5885

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=> Number to be added = 5885 − 5023 = 862

Therefore The correct answer is 862.

Additional Information

LCM Method for Remainders

When the remainder is the same for all divisors, the general form is (LCM × k) + Remainder.

LCM Calculation

LCM is the product of the highest powers of all prime factors present in the given numbers.

Natural Numbers

Natural numbers are positive integers starting from 1 {1, 2, 3, ...}.

Q38. Answer: (d) 18 seconds

Shortcut Trick

Total Distance = Sum of lengths = 297 + 243 = 540 m.

Relative Speed (Opposite) = 42 + 66 = 108 km/hr.

Convert to m/sec: 108 × (5/18) = 30 m/sec.

Time = 540 ÷ 30 = 18 sec.

Therefore The correct answer is 18 sec.

Alternate Method

Given: Length of Train 1 (L1) = 297 m, Length of Train 2 (L2) = 243 m, Speed 1 (S1) = 42 km/hr, Speed 2 (S2) = 66 km/hr.

Formula Used: Time = (L1 + L2) ÷ (S1 + S2)

=> Total Length = 297 + 243 = 540 m

=> Relative Speed = 42 + 66 = 108 km/hr

=> Speed in m/sec = 108 × (5/18) = 6 × 5 = 30 m/sec

=> Time taken = 540 ÷ 30

=> Time taken = 18 sec

Therefore The correct answer is 18 sec.

Additional Information

Relative Speed in Opposite Direction

When two objects move in opposite directions, their relative speed is the sum of their individual speeds: V_(rel) = V1 + V2.

Unit Conversion

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

Crossing Distance

When two trains cross each other completely, the total distance covered is always the sum of the lengths of both trains (L1 + L2).

Q39. Answer: (d) 84.5°

"

• Wait, I'm repeating myself. I'll just generate the output now.

Shortcut Trick

In any quadrilateral ABCD, the angle formed by the bisectors of two adjacent angles (say angle C and angle D) is equal to half the sum of the other two angles (angle A and angle B).

angle DOC = (angle A + angle B) ÷ 2

angle DOC = (88° + 81°) ÷ 2

angle DOC = 169° ÷ 2 = 84.5°

Therefore The correct answer is 84.5°.

Alternate Method

Given: angle A = 88°, angle B = 81° in quadrilateral ABCD. CO and DO are angle bisectors of angle C and angle D respectively.

Formula Used: Sum of interior angles of a quadrilateral = 360° | Sum of angles in a triangle = 180°.

Calculations:

=> In quadrilateral ABCD, &ang

Q40. Answer: (c) 48 years

Shortcut Trick

Ratio change: (7 : 6) → (8 : 7). Both parts increase by 1 unit.

This 1 unit increase corresponds to the 8-year time gap.
=> 1 unit = 8 years.
Present age of B = 6 units = 6 × 8 = 48 years.
Therefore The correct answer is 48 years.
Alternate Method
Given: Ratio of present ages of A and B is 7 : 6. After 8 years, the ratio becomes 8 : 7.
Let the present ages of A and B be 7x and 6x.
=> (7x + 8) ÷ (6x + 8) = 8 ÷ 7
=> 7 × (7x + 8) = 8 × (6x + 8)
=> 49x + 56 = 48x + 64
=> 49x − 48x = 64 − 56
=> x = 8
=> Present age of B = 6x = 6 × 8 = 48 years.
Therefore The correct answer is 48 years.
Additional Information
Age Difference Property
The difference between the ages of two persons remains constant regardless of how many years pass.
Ratio Balancing
If the differences between ratio parts are not equal, multiply the ratios by the difference of the other ratio to balance the units.
Future and Past Ages
If current age is x, age 'n' years hence is (x + n) and age 'n' years ago was (x − n).

Q41. Answer: (d) Rs. 17

Shortcut Trick
Rahul's share = (Total − Difference) ÷ 2
Rahul's share = (50 − 16) ÷ 2
Rahul's share = 34 ÷ 2 = 17
Therefore The correct answer is Rs. 17.
Alternate Method
Given:
Total amount (Amit + Rahul) = Rs. 50
Difference (Amit − Rahul) = Rs. 16
Let the amount with Rahul be Rs. x.
Amount with Amit = Rs. (x + 16).
=> x + (x + 16) = 50
=> 2x + 16 = 50
=> 2x = 50 − 16
=> 2x = 34
=> x = 34 ÷ 2
=> x = 17
Therefore The correct answer is Rs. 17.
Additional Information
Linear Equations in One Variable
An equation which can be written in the form ax + b = 0, where a and b are real numbers and a ≠ 0.
Sum and Difference Method
If (A + B) = S and (A − B) = D, then the larger value A = (S + D) ÷ 2 and the smaller value B = (S − D) ÷ 2.
Verification
Rahul has Rs. 17, Amit has 17 + 16 = Rs. 33. Total = 17 + 33 = Rs. 50. The condition is satisfied.

Q42. Answer: (b) 16

Shortcut Trick
For third proportional, use the relation: $b^2 = a \times c$

Here, a = 64, b = Z, and c = 4.
=> $Z^2 = 64 \times 4 = 256$
=> $Z = \sqrt{256} = 16$
Therefore The correct answer is 16.
Alternate Method
Given: First number (a) = 64, Second number (b) = Z, Third proportional (c) = 4.
Formula Used: If a, b, and c are in continued proportion, then a : b = b : c.
=> 64 ÷ Z = Z ÷ 4
=> Z × Z = 64 × 4
=> $Z^2 = 256$
=> $Z = \sqrt{256}$
=> Z = 16
Therefore The correct answer is 16.
Additional Information
Mean Proportional
The mean proportional between two numbers a and b is $\sqrt{(a \times b)}$.
Fourth Proportional
If a : b = c : d, then d is the fourth proportional, calculated as d = (b × c) ÷ a.
Duplicate Ratio
The duplicate ratio of a : b is $a^2 : b^2$.

Q43. Answer: (c) 48%

Shortcut Trick
Successive percentage formula: Net Change = a + b + (a × b) ÷ 100.
Here, a = +85% (Mark-up) and b = −20% (Discount).
Profit% = 85 − 20 + (85 × (−20)) ÷ 100.
Profit% = 65 − (1700 ÷ 100) = 65 − 17 = 48%.
Therefore The correct answer is 48%.
Alternate Method
Given: Marked Price (MP) = 85% above Cost Price (CP), Discount = 20%.
Formulas: MP = CP × (100 + Mark-up%) ÷ 100 | SP = MP × (100 − Discount%) ÷ 100 | Profit% = (SP − CP) ÷ CP × 100.
=> Let the Cost Price (CP) be 100 units.
=> Marked Price (MP) = 100 + 85% of 100 = 185 units.
=> Selling Price (SP) = 185 − 20% of 185 = 185 − 37 = 148 units.
=> Profit = SP − CP = 148 − 100 = 48 units.
=> Profit Percentage = (48 ÷ 100) × 100 = 48%.
Therefore The correct answer is 48%.
Additional Information
Mark-up and Discount Relationship
Profit% is the net result of the Mark-up percentage and the Discount percentage applied sequentially on the CP.
Selling Price Formula
SP can be directly calculated as: SP = CP × (1 + Mark-up%) × (1 − Discount%).

Q44. Answer: (d) 28% decrease

Shortcut Trick
Total Volume = 33 + 43 + 53 = 27 + 64 + 125 = 216 cm3
New Edge = √3216 = 6 cm
Initial Area = 6 × (32 + 42 + 52) = 6 × 50 = 300 cm2
New Area = 6 × 62 = 6 × 36 = 216 cm2
Percentage Decrease = [(300 − 216) ÷ 300] × 100 = 28%
Therefore The correct answer is 28% decrease.
Alternate Method

Given:

Edges of three cubes = 3 cm, 4 cm, 5 cm

Formula Used:

Volume of cube = a^3

Total Surface Area (TSA) of cube = $6a^2$

Percentage change = [(Initial Value − Final Value) ÷ Initial Value] × 100

=> Total Volume of three cubes = $3^3 + 4^3 + 5^3$

=> Total Volume = 27 + 64 + 125 = 216 cm^3

=> Volume of the new single cube = 216 cm^3

=> Edge of new cube (A) = $\sqrt[3]{216}$ = 6 cm

=> Initial Total Surface Area = 6 × (32 + 42 + 52)

=> Initial TSA = 6 × (9 + 16 + 25) = 6 × 50 = 300 cm^2

=> New Total Surface Area = 6 × 62 = 6 × 36 = 216 cm^2

=> Change in Area = 300 − 216 = 84 cm^2

=> Percentage change = (84 ÷ 300) × 100

=> Percentage change = 28%

Therefore The correct answer is 28% decrease.

Additional Information

Melting and Recasting Rule

When multiple solid objects are melted and formed into a single object, the total volume remains constant, although the surface area usually changes.

Cube Properties

For a cube with side 'a', Lateral Surface Area (LSA) = $4a^2$ and the longest diagonal = $a\sqrt{3}$.

Percentage Change Logic

If the final value is less than the initial value, the change is always a percentage decrease. In this problem, 216 < 300, hence a decrease.

Q45. Answer: (b) 16

Shortcut Trick

Total Capacity (LCM of 12, 24) = 24 units.

Efficiency: A = +2, B = −1. Net efficiency (A+B) = +1.

Work done by A in 4 mins = 4 × 2 = 8 units.

Remaining work = 24 − 8 = 16 units.

Time for remaining part = 16 ÷ 1 = 16 minutes.

Therefore The correct answer is 16 minutes.

Alternate Method

Pipe	Time (min)	Total Work	Efficiency
A (Fill)	12	24	+2
B (Empty)	24	−1	

Given: Pipe A fills for 4 minutes, then B is opened.

=> Work done by Pipe A in first 4 minutes = Efficiency × Time

=> 2 × 4 = 8 units

=> Remaining capacity to be filled = Total Work − Work Done

=> 24 − 8 = 16 units

=> When both pipes are open, Combined Efficiency = 2 + (−1) = 1 unit/min

=> Time taken to fill remaining tank = Remaining capacity ÷ Combined Efficiency

=> 16 ÷ 1 = 16 minutes

Therefore The correct answer is 16 minutes.

Additional Information

Inlet and Outlet Pipes

An inlet pipe fills the tank (positive work), while an outlet pipe empties it (negative work).

Net Efficiency

If Pipe A fills in x hours and Pipe B empties in y hours, the net work per hour is (1/x − 1/y).

Remaining Work Concept

Always subtract the initial work done by the first pipe(s) from the total capacity before calculating time for the second phase.

Q46. Answer: (d) 16

Shortcut Trick

Numbers divisible by both 4 and 3 must be divisible by their LCM.

LCM of (4, 3) = 12.

Number of terms = Greatest Integer of (Upper Limit ÷ LCM).

Number of terms = [200 ÷ 12] = 16.66...

Taking the integer part, we get 16.

Therefore The correct answer is 16.

Alternate Method

Given: Upper limit = 200, Divisors = 4 and 3.

Formula: Numbers divisible by both a and b are divisible by LCM(a, b).

=> LCM(4, 3) = 12

=> The sequence is an Arithmetic Progression (AP): 12, 24, 36, ..., 192

=> Here, First term (a) = 12, Common difference (d) = 12, Last term (l) = 192

=> l = a + (n − 1)d

=> 192 = 12 + (n − 1) × 12

=> 180 = (n − 1) × 12

=> 15 = n − 1

=> n = 16

Therefore The correct answer is 16.

Additional Information

LCM Concept

To find numbers divisible by multiple divisors, always use their Least Common Multiple (LCM) as the effective divisor.

Arithmetic Progression (AP)

The number of terms n in an AP can be found using n = [(Last Term − First Term) ÷ Difference] + 1.

Divisibility of Range

If finding numbers between x and y, use [(y−1) ÷ d] − [x ÷ d] for exclusive boundaries.

Q47. Answer: (d) 52

Shortcut Trick

Assume an Assumed Mean as 50.

Find deviations from 50: +14, −39, +16, +48, −25, −33, 0, +25, +12.

Sum of deviations = 115 − 97 = +18.

Average deviation = 18 ÷ 9 = +2.

Arithmetic Mean = Assumed Mean + Average Deviation = 50 + 2 = 52.

Therefore The correct answer is 52.

Alternate Method

Given: Observations = 64, 11, 66, 98, 25, 17, 50, 75, 62 and Total number of observations (n) = 9.

Formula Used: Arithmetic Mean = (Sum of all observations) ÷ (Total number of observations)

=> Sum = 64 + 11 + 66 + 98 + 25 + 17 + 50 + 75 + 62

=> Sum = 468

=> Arithmetic Mean = 468 ÷ 9

=> Arithmetic Mean = 52

Therefore The correct answer is 52.

Additional Information

Properties of Arithmetic Mean

The algebraic sum of deviations of a set of observations from their arithmetic mean is always zero (Σ(x − Mean) = 0).

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Combined Mean Formula

If two groups have sizes n1, n2 and means x1, x2, the Combined Mean = (n1x1 + n2x2) ÷ (n1 + n2).

Effect of Change in Origin and Scale

If every observation is increased by a constant k, the mean increases by k. If multiplied by k, the mean is multiplied by k.

Q48. Answer: (a) ± 2√10

Shortcut Trick

Use the algebraic identity: $(2A + B)^2 = (4A^2 + B^2) + 4AB$.

Substitute the given values directly: $(2A + B)^2 = 24 + 4(4)$.

=> $(2A + B)^2 = 24 + 16 = 40$.

=> $2A + B = \pm\sqrt{40} = \pm 2\sqrt{10}$.

Therefore The correct answer is $\pm 2\sqrt{10}$.

Alternate Method

Given:

$4A^2 + B^2 = 24$

$AB = 4$

Formula Used:

The standard expansion of the square of a sum: $(x + y)^2 = x^2 + y^2 + 2xy$

Calculations:

=> We need to find the value of 2A + B. Let us square this expression.

=> $(2A + B)^2 = (2A)^2 + B^2 + 2 \times (2A) \times (B)$

=> $(2A + B)^2 = 4A^2 + B^2 + 4AB$

=> Now, substitute the values $4A^2 + B^2 = 24$ and $AB = 4$ into the equation:

=> $(2A + B)^2 = 24 + 4 \times 4$

=> $(2A + B)^2 = 24 + 16$

=> $(2A + B)^2 = 40$

=> Taking the square root on both sides:

=> $2A + B = \pm\sqrt{40}$

=> $2A + B = \pm\sqrt{(4 \times 10)}$

=> $2A + B = \pm 2\sqrt{10}$

Therefore The correct answer is $\pm 2\sqrt{10}$.

Additional Information

Algebraic Identity $(a + b)^2$

The identity $(a + b)^2 = a^2 + 2ab + b^2$ is used to expand the square of a binomial or to find the sum of terms when their squares and product are known.

Algebraic Identity $(a - b)^2$

The identity $(a - b)^2 = a^2 - 2ab + b^2$ helps in finding the difference between terms using similar logic.

Nature of Square Roots

In algebra, if $x^2 = k$ (where $k > 0$), then x has two possible values: $+\sqrt{k}$ and $-\sqrt{k}$, often written as $\pm\sqrt{k}$.

Q49. Answer: (a) Rs. 4,823

Shortcut Trick

Salary is always 100%.

Savings = 35% => Expenditure = 100% − 35% = 65%.

Monthly Expenditure = 65% of Rs. 7,420.

Monthly Expenditure = 0.65 × 7420 = Rs. 4,823.

Therefore The correct answer is Rs. 4,823.

Alternate Method

Given: Monthly Salary = Rs. 7,420 and Savings Percentage = 35%.

Formula Used: Expenditure = Total Salary − Savings

=> Monthly Savings = 35% of 7,420

=> Monthly Savings = (35 ÷ 100) × 7420

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=> Monthly Savings = 0.35 × 7420 = Rs. 2,597

=> Monthly Expenditure = 7,420 − 2,597

=> Monthly Expenditure = Rs. 4,823

Therefore The correct answer is Rs. 4,823.

Additional Information

Percentage Change

To find the percentage change, use the formula: (Change ÷ Original Value) × 100.

Successive Percentage

If a value is changed by a% and then by b%, the net change is [a + b + (ab ÷ 100)]%.

Base Change Rule

If A is x% more than B, then B is [x ÷ (100 + x)] × 100% less than A.

Q50. Answer: (c) Rs. 1,210

Shortcut Trick

The effective rate of compound interest for 2 years at 10% per annum = 10 + 10 + (10 × 10 / 100) = 21%.

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

Amount = 121% of Rs. 1,000 = 1.21 × 1000 = Rs. 1,210.

Therefore The correct answer is Rs. 1,210.

Alternate Method

Given:

Principal (P) = Rs. 1,000

Rate (R) = 10% per annum

Time (n) = 2 years

Formula Used:

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

Calculations:

=> $A = 1000 \times (1 + 10/100)^2$

=> $A = 1000 \times (110/100)^2$

=> A = 1000 × (11/10) × (11/10)

=> A = 1000 × (121 / 100)

=> A = 10 × 121

=> A = Rs. 1,210

Therefore The correct answer is Rs. 1,210.

Additional Information

Effective Interest Rate

For two successive years with rate R%, the effective Compound Interest rate is R + R + (R×R/100)%.

CI and SI Difference

The difference between Compound Interest and Simple Interest for 2 years is given by $P(R/100)^2$.

Compounding Period

If interest is compounded half-yearly, the rate becomes R/2 and the time period becomes 2n.

Q51. Answer: (a) NW-PY-SU

Logic followed here is: The pattern followed within each triad depends on the addition and subtraction of positional values between the consecutive elements.

For Triad 1: JS-LU-OQ

For Triad 2: LU-NW-QS

The common pattern observed is: Element1 (+2, +2) → Element2 (+3, -4) → Element3.

Similarly, let's find the triad from the options that follows this pattern:

Checking NW-PY-SU:

Therefore, the triad that follows the pattern is NW-PY-SU.

Hence, the correct answer is "Option 1".

Q52. Answer: (b) 58

Logic followed here is substituting the letters with their respective mathematical operations and then applying the BODMAS rule to solve the expression.

Symbol Mapping:

A	B	C	D
÷	×	•	–

Given equation:

72 A 4 C 6 B 9 D 20 A 2 C 88 A 8 D 15 = ?

Replacing the letters with their respective signs, we get:

72 ÷ 4 + 6 × 9 - 20 ÷ 2 + 88 ÷ 8 - 15 = ?

=> 18 + 54 - 10 + 11 - 15 = ?

=> 83 - 25 = ?

=> 58 = ?

Therefore, the value that will come in place of the question mark is 58.

Hence. the correct answer is "Option 2".

Q53. Answer: (b) rs

Given:

“what you have” → “nq jl mk”

“have you been” → “rs nq jl”

Therefore, ‘been’ is coded as ‘rs’.

Hence, the correct answer is "Option 2".

Q54. Answer: (c) 14

Logic followed here is: Identify the highest and lowest numbers from the given series, then extract the required digits to find their sum.

Given numbers:

358	657	524	493	249

1. Second digit of the highest number:

From the given set, the highest number is 657.

First Digit	Second Digit	Third Digit
6	5	7

The second digit of the highest number is 5.

2. Third digit of the lowest number:

From the given set, the lowest number is 249.

First Digit	Second Digit	Third Digit
2	4	9

The third digit of the lowest number is 9.

Calculation of the resultant:

Pattern observed: (Second digit of highest number) + (Third digit of lowest number)

Resultant = 5 + 9 = 14

Hence, the cirrect answer is "Option 3".

Q55. Answer: (a) 3

Given series:

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

Logic followed:

We need to find odd numbers which are:

Immediately preceded by an odd number

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Immediately followed by an even number
Required pattern: Odd Number → Odd Number → Even Number
Checking the series:
2 4 2 7 4 8 9 1 2 4 5 7 5 2 3 1 3 9 5 4 4 7 9 3
The odd numbers satisfying the condition are:
• 1 (in 9 1 2)
• 5 (in 9 5 4)
• 9 (in 7 9 3)
Therefore, there are 3 such odd numbers.
Hence, the correct answer is "Option 1".

Q56. Answer: (d) 31, 61

Given pairs:
17 → 33
13 → 25
Observe the pattern:
17 × 2 − 1 = 33
13 × 2 − 1 = 25
So, the logic is:
Second number = (First number × 2) − 1
Check the options:
Option 1:
23 × 2 − 1 = 45 ≠ 35
Option 2:
54 × 2 − 1 = 107 ≠ 108
Option 3:
74 × 2 − 1 = 147 ≠ 146
Option 4:
31 × 2 − 1 = 61
Hence, the correct answer is "Option 4".

Q57. Answer: (b) MEQ

Given Series: ASE QIU GYK WOA ?
The pattern followed here is:
Folloing this pattern MEQ will replace the (?) mark.
Hence, the correct answer is "Option 2".

Q58. Answer: (d) More than three

Given series:
(Left) 9 3 8 7 9 4 8 6 2 5 9 3 6 5 1 2 6 1 5 8 3 9 9 6 8 8 3 9 (Right)
Logic followed:
We need to find perfect squares which are:
Immediately preceded by an odd number
Immediately followed by an even number
Perfect squares among single-digit numbers are: 1, 4, 9
Required pattern:
Odd Number → Perfect Square → Even Number
Checking the series:
(Left) 9 3 8 7 9 4 8 6 2 5 9 3 6 5 1 2 6 1 5 8 3 9 9 6 8 8 3 9 (Right)
Perfect squares satisfying the condition are:
→ 9 in (7 9 4)
→ 4 (in 9 4 8)
→ 1 (in 5 1 2)

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→ 9 (in 9 9 6)

Thus, the number of such perfect squares is 4.

Therefore, the answer is More than three.

Hence, the correct answer is "Option 4".

Q59. Answer: (b) One

Given:

Six people A, B, C, D, E and F are sitting in a row facing north.

F sits to the immediate left of A.

C sits third to the left of D.

C is an immediate neighbour of A.

B sits to the immediate left of E.

Now find the number of people between E and C:

Therefore, 1 people sit between E and C.

Hence, the correct answer is "Option 2".

Q60. Answer: (a) Teresa

Given:

Six teachers — Judith, Anil, Myriam, Bina, Teresa and Jason — are sitting around a circular table facing the centre.

Judith is sitting second to the right of Anil.

Anil is an immediate neighbour of both Myriam and Bina.

Teresa is sitting second to the left of Myriam.

Jason is sitting second to the left of Anil.

Now find who is sitting between Jason and Judith, when counted from the left of Jason:

From Jason, move towards left (anticlockwise):

Jason → Teresa → Judith

Therefore, Teresa is sitting between Jason and Judith.

Hence, the correct answer is "Option 1".

Q61. Answer: (d) 759 and 739, respectively

Logic followed here is: The series follows a pattern of constant subtraction where each subsequent term is obtained by subtracting 10 from the preceding term.

Pattern analysis:

789	779	769	749	729
	-10	-10	...	...

For the first missing number (?)

Term before the first question mark is 769.

First missing number = 769 - 10 = 759

For the second missing number (?)

Term before the second question mark is 749.

Second missing number = 749 - 10 = 739

The completed series is: 789, 779, 769, 759, 749, 739, 729.

Therefore, the numbers that should come in place of the question marks are 759 and 739, respectively.

Hence, the correct answer is "Option 4".

Q62. Answer: (b) Neither conclusion I nor II follows.

Given Statements:

All atoms are protons.

Some protons are neutrons.

Venn Diagram Representation:

Conclusions:

(I) All atoms are neutrons: Does not follows (Because only some protons are neutrons. There is no definite relation given between

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atoms and neutrons.)

(II) No neutron is a proton: Does not follows (Because the statement says “Some protons are neutrons”, which means some neutrons are protons.)

Therefore Neither conclusion I nor II follows.

Hence, the correct answer is "Option 2".

Q63. Answer: (d) One

Logic followed here is.

Logic: The digits of the number are rearranged in ascending order from left to right, and their new positions are compared with the original number.

For the original number 8325716:

8	**3**	**2**	**5**	**7**	**1**	**6**

Arranging the digits in ascending order:

1	**2**	**3**	**5**	**6**	**7**	**8**

The pattern observed is the comparison between the original positions and the new positions:

1^(st) digit: 8 → 1 (Changed)

2^(nd) digit: 3 → 2 (Changed)

3^(rd) digit: 2 → 3 (Changed)

4^(th) digit: 5 → 5 (Unchanged)

5^(th) digit: 7 → 6 (Changed)

6^(th) digit: 1 → 7 (Changed)

7^(th) digit: 6 → 8 (Changed)

Therefore, only the position of the digit 5 remains unchanged.

The total count of digits with unchanged positions is One.

Hence, the correct answer is "Option 4".

Q64. Answer: (b) 15 km to the south

Given:

Sunil starts from Point A and drives 64 km towards West.

Then:

• Takes a left turn and drives 63 km

• Takes a left turn and drives 67 km

• Takes a left turn and drives 78 km

• Takes a final left turn and drives 3 km to reach Point P

Now find the shortest distance and direction from P to A:

Point A = (0, 0)

Point P = (0, 15)

So, Sunil is 15 km North of Point A.

To reach Point A again, he must travel:

15 km towards South

Hence, the correct answer is "Option 2".

Q65. Answer: (a) KGBO

Logic followed here is: Each letter of the first cluster is shifted 10 positions backward in the English alphabetical order to obtain the corresponding letter of the second cluster.

MIDQ is related to CYTG →

YUPC is related to OKFS →

The pattern observed is: (Positional value of letter) - 10.

Similarly, let's find the cluster related to UQLY:

Therefore, the cluster related to 'UQLY' is 'KGBO'.

Hence, the correct answer is "Option 1".

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Q66. Answer: (a) CI - EL

Given letter-cluster pairs:

CI - EL

IO - KQ

JP - LR

NT - PV

Observe the pattern:

In most pairs, each letter of the second cluster is obtained by adding +2 to the corresponding letter of the first cluster.

Check each option:

Option 2: IO - KQ

Option 3: JP - LR

Option 4: NT - PV

Option 1: CI - EL

Thus, CI - EL does not follow the common pattern.

Hence, the correct answer is "Option 1".

Q67. Answer: (d) 412

Shortcut Trick

The series follows a pattern of adding decreasing consecutive even numbers.

Pattern: +10, +8, +6, +4, +2

Next term = 410 + 2 = 412

Therefore The correct answer is 412.

Alternate Method

Given series: 382, 392, 400, 406, 410, ?

382

+10

→

392

+8

→

400

+6

→

406

+4

→

410

+2

→

412

The differences between consecutive terms are decreasing even numbers starting from 10.

=> 392 − 382 = 10

=> 400 − 392 = 8

=> 406 − 400 = 6

=> 410 − 406 = 4

=> Next difference = 4 − 2 = 2

=> Missing number = 410 + 2 = 412

Therefore The correct answer is 412.

Additional Information

Arithmetic Progression (AP)

A series where the difference between consecutive terms remains constant throughout the series.

Progressive Difference Series

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A series where the difference between terms follows its own logical pattern (e.g., +2, +4, +6 or ×2, ×3, ×4).

Double Difference Series

A series where the differences between the differences are constant, often used to identify quadratic patterns.

Q68. Answer: (c) 13

Letter to Symbol Mapping:

A	B	C	D
÷	×	•	–

The given equation is: 10 C 6 B 2 D 45 A 5 = ?

Substituting the letters with mathematical operators: 10 + 6 × 2 − 45 ÷ 5

The calculation is as follows:

10 + (6 × 2) - (45 ÷ 5)

= 10 + 12 - 9

= 22 - 9

= 13

Therefore, the value that will come in place of the question mark is 13.

Hence, the correct answer is "Option 3".

Q69. Answer: (b) 12 km towards south

Given:

→ Varun starts from Point M and drives 8 km towards the south.

→ He then takes a left turn and drives 10 km.

→ Turns left and drives 3 km.

→ Then takes a right turn and drives 5 km.

→ Then takes a right turn and drives 7 km.

→ Takes a final right turn and drives 15 km to reach Point Y.

Therefore, Point Y is 12 km towards south from Point M.

Hence, the correct answer is "Option 2".

Q70. Answer: (a) 6

Given series:

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

Logic followed:

We need to find even numbers which are:

Immediately preceded by an odd number

Immediately followed by an odd number

Required pattern: Odd Number → Even Number → Odd Number

Checking the series:

7 4 3 1 9 6 7 7 2 3 3 8 1 8 8 4 1 1 9 5 2 3 3 8 1 8 6 1 4

The even numbers satisfying the condition are:

4 (in 7 4 3)

6 (in 9 6 7)

2 (in 7 2 3)

8 (in 3 8 1)

2 (in 5 2 3)

8 (in 3 8 1)

Therefore, there are 6 such even numbers.

Hence, the correct answer is "Option 1".

Q71. Answer: (a) Wife's sister

Given Code: D*RRs. A#C±O

The meanings of the symbols are as follows:

Symbol	Meaning
±	Wife
•	Daughter
Rs.	Father
#	Brother

Determining the relationship:

From the above diagram:

C and D are sisters (both are daughters of R).

C is the wife of O.

Therefore, D is the sister of O's wife.

The pattern observed is: D is the Wife's sister of O.

Hence, the correct answer is "Option 1".

Q72. Answer: (b) 72

Given:

Kartik is ranked 19^(th) from the top and 54^(th) from the bottom.

Formula used:

Total students = Rank from top + Rank from bottom − 1

Calculation:

= 19 + 54 − 1

= 73 − 1

= 72

Therefore, there are 72 students in the class.

Hence, the correct answer is "Option 2".

Q73. Answer: (d) Both conclusions (I) and (II) follow.

Given Statements:

All hammers are anvils.

All anvils are metals.

All metals are plastics.

Conclusions:

(I) All hammers are plastics: Follows (Because all hammers are anvils, all anvils are metals, and all metals are plastics. Therefore, all hammers are plastics.)

(II) Some plastics are anvils: Follows (Because all anvils are plastics, which means at least some plastics are anvils.)

Therefore Both conclusions (I) and (II) follow.

Hence, the correct answer is "Option 4".

Q74. Answer: (b) uh

Given:

‘error mall bat’ is coded as ‘yr uh cl’

‘gap error unit’ is coded as ‘uh at nk’

Observe the common word:

The common word in both statements is “error”.

The common code in both code groups is “uh”.

Therefore, “error” is coded as “uh”.

Hence, the correct answer is "Option 2".

Q75. Answer: (b) MN−QU

The logic followed here is based on the positional values of the letters in the English alphabetical series.

Pattern: The second cluster is formed by adding 5 to the positional values of the corresponding letters in the first cluster.

(1) NO − ST

(3) YZ − DE

(4) RS − WX

But,

(2) MN − QU

Therefore, the letter-cluster pair 'MN − QU' is the odd one out.

Q76. Answer: (b) DEA 98

Given Series:

HIE 50 GHD 62 FGC 74 EFB 86 ?

Therefore According to the pattern followed DEA 98 will replace the (?) mark.

Hence, the correct answer is "Option 2".

Q77. Answer: (a) OP

Given:

→ Six people L, M, N, O, P and Q are sitting in a row facing north.

→ N is sitting at the leftmost end.

→ Only 3 people are sitting between N and Q.

→ L is sitting second right of P.

→ M is sitting second right of L.

→ PL → 1 person between them

→ NO → 1 person between them

→ LM → 1 person between them

→ OP → Adjacent

Thus, OP does not belong to the group.

Hence, the correct answer is "Option 1".

Q78. Answer: (c) 65

Given series:

3, 5, 9, 17, 33, ?

Observe the pattern:

3 × 2 - 1 = 5

5 × 2 - 1 = 9

9 × 2 - 1 = 17

17 × 2 - 1 = 33

So, 33 × 2 - 1 = 65

Therefore, the missing number is 65.

Hence, the correct answer is "Option 3".

Q79. Answer: (b) 78

Given:

Mr. Hepa ranked 22^(nd) from the bottom and 57^(th) from the top.

Formula used:

Total students = Rank from top + Rank from bottom - 1

Calculation:

= 57 + 22 - 1

= 79 - 1

= 78

Therefore, there are 78 students in the class.

Hence, the correct answer is "Option 2".

Q80. Answer: (c) MDYE

Logic followed here is: The letters of the first word are shifted by a pattern of +6, -5, +4, and -3 respectively to obtain the letters of the second word.

For NMGT : THKQ →

For LSQR : RNUO →

The pattern observed is shifting the letters by: +6, -5, +4, -3.

Similarly, let's find the relation for GIUH:

Therefore, 'GIUH' is related to 'MDYE'.

Hence, the correct answer is "Option 3".

Q81. Answer: (c) Education

The correct answer is Education.

Key Points

• The announcement of an AI Centre of Excellence (CoE) for Education in the Union Budget 2025 (referring to the fiscal cycle of 2024-25) is a core component of the "Make AI in India and Make AI Work for India" initiative.

• The primary objective of this centre is to revolutionize the Education sector by integrating Artificial Intelligence into teaching methodologies, personalized learning, and administrative frameworks. Hence, the option Education is correct.

• These centres are designed to facilitate interdisciplinary research between top Educational Institutions and leading industry players to develop scalable AI solutions for the masses.

• By focusing on Education, the government aims to improve learning outcomes, reduce the dropout rate, and provide data-driven insights for curriculum reform.

• The initiative directly supports the National Education Policy (NEP) 2020, which advocates for the extensive use of Technology in teaching and learning, especially in local languages.

Additional Information

• Sectoral CoEs: While the focus here is on Education, the government has previously identified three specific areas for AI Centres of Excellence: Agriculture, Health, and Sustainable Cities.

• Viksit Bharat @ 2047: The integration of AI into Education is a stepping stone toward the goal of Viksit Bharat (Developed India) by the year 2047, ensuring the youth are proficient in New-age Technologies.

• Skilling Initiatives: This aligns with the Skill India Mission and Pradhan Mantri Kaushal Vikas Yojana (PMKVY) 4.0, which focuses on training students in Coding, AI, Robotics, and Internet of Things (IoT).

• Budgetary Focus: The Union Budget presented by Finance Minister Nirmala Sitharaman has consistently increased the allocation for Digital Infrastructure, emphasizing the role of the Digital Public Infrastructure (DPI) in social sectors.

• Research Corpus: A massive corpus of Rs. 1 lakh crore has been proposed to provide long-term, low-interest loans for Research and Innovation in sunrise sectors, which includes Educational Technology (EdTech) and AI.

Important Points

• National Research Foundation (ANRF): The Anusandhan National Research Foundation is another key body that works alongside these AI CoEs to provide high-level strategic direction for Scientific Research in India.

• Personalized Learning: AI in the Education sector is expected to enable Adaptive Learning, where the software adjusts the difficulty and style of content based on an individual student’s performance and Learning Speed.

• Global Context: India’s push for AI in Education places it among global leaders like the USA and China, who are also investing heavily in Educational AI to maintain a competitive Human Resource edge.

• Implementation Date: The framework for these centres was solidified during the Full Union Budget 2024-25 presented in July 2024, building upon the foundations laid in the 2023 budget speeches.

Q82. Answer: (d) ICC Hall of Fame

The correct answer is ICC Hall of Fame.

Key Points

• The legendary Pakistani cricketer Sana Mir was inducted into the ICC Hall of Fame in June 2025, recognizing her immense contribution to the sport.

• She became one of the few women cricketers from Pakistan to receive this ultimate honor from the International Cricket Council (ICC).

• Sana Mir served as the captain of the Pakistan women's national cricket team in both One Day Internationals (ODIs) and T20Is, leading the team with distinction for many years.

• In October 2018, she achieved the milestone of becoming the No. 1 ODI bowler in the ICC Player Rankings, which was a historic first for any woman cricketer from her country.

• The ICC Hall of Fame award is reserved for players who have demonstrated exceptional skills, character, and impact on the game over a long period.

Additional Information

• Career Profile and Background:

• Sana Mir was born on 5 January 1986 in Abbottabad, Pakistan.

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• She made her international debut in 2005 in an ODI against Sri Lanka in Karachi.

• Over her career, she played 120 ODIs and 106 T20Is, becoming a cornerstone of the national side.

• Major Achievements and Statistics:

• She was the first Pakistani woman to take 100 wickets in ODIs, eventually finishing her career with 151 wickets in the format.

• Under her captaincy, Pakistan won two Gold Medals at the Asian Games in 2010 (Guangzhou) and 2014 (Incheon).

• She is also known for her batting, scoring over 1,600 runs in ODIs and nearly 800 runs in T20Is as an all-rounder.

• Post-Retirement and Influence:

• She announced her retirement from international cricket in April 2020 after a 15-year long career.

• Following her playing days, she has remained active in the sport as a member of the ICC Women's Committee and has gained popularity as a cricket commentator and analyst.

• In 2019, she was awarded the Asia Game Changer Award by the Asia Society for her role in empowering women through sports.

Important Points

• Role of the ICC Hall of Fame: The ICC Hall of Fame was launched in 2009 in association with the Federation of International Cricketers' Associations (FICA). It celebrates the greatest icons of cricket history.

• Linguistic and Cultural Impact: Sana Mir is often credited with changing the perception of women's sports in Pakistan, encouraging a new generation of girls to take up cricket professionally.

• Global Standing: At the time of her retirement, she was among the top 10 most successful bowlers in women's ODI history.

Q83. Answer: (a) Payments to an unregistered intermediary

The correct answer is Payments to an unregistered intermediary.

Key Points

• The Insurance Regulatory and Development Authority of India (IRDAI) imposed a significant monetary penalty of Rs. 1 crore on Acko General Insurance in May 2025.

• The penalty was levied following a regulatory investigation that uncovered violations related to payments made to an unregistered intermediary. According to IRDAI regulations, insurance companies are prohibited from transacting or paying commissions to entities that do not hold a valid license to act as an insurance intermediary.

• Investigations revealed that the company had entered into arrangements where payouts were channeled to entities that were not authorized under the IRDAI (Registration of Insurance Marketing Firms) Regulations or the Insurance Act, 1938.

• The regulatory body observed that such practices bypass the transparent commission structures mandated for the industry and can lead to higher costs for policyholders. Hence, the primary reason for the fine was payments to an unregistered intermediary.

• This enforcement action is part of IRDAI's broader mandate to maintain market discipline and ensure that all stakeholders in the insurance distribution chain are properly regulated and accountable.

Additional Information

• IRDAI (Insurance Regulatory and Development Authority of India):

• It is a statutory body formed under the IRDA Act, 1999. It serves as the apex regulatory authority for the insurance sector in India.

• Headquartered in Hyderabad, its primary objectives include protecting the interests of policyholders and regulating, promoting, and ensuring the orderly growth of the insurance industry.

• Acko General Insurance:

• Founded in 2016 by Varun Dua, it is a prominent Insurtech company in India that follows a direct-to-consumer model.

• The company specializes in digital-first insurance products, including motor, health, and electronics insurance, often leveraging data and technology to offer competitive premiums.

• Insurance Intermediaries:

• These include agents, brokers, corporate agents, and web aggregators who act as a bridge between the insurance company and the customer.

• Under Section 42 of the Insurance Act, 1938, no person can act as an intermediary or receive remuneration for procuring insurance business unless they are registered with the IRDAI.

Important Points

• The Insurance Act, 1938: This is the cornerstone legislation for insurance in India. Section 40 of this Act specifically prohibits the payment of any commission or brokerage to any person for soliciting or procuring insurance business in India, unless that person is an authorized agent or intermediary.

• Regulatory Compliance: IRDAI conducts periodic inspections and audits of insurance firms. Non-compliance with the Expenses of Management (EoM) limits or unauthorized payouts often results in stiff penalties, as seen in the 2025 ruling against Acko.

• Solvency Ratio: While not the reason for this specific fine, IRDAI mandates a minimum solvency ratio of 1.5 (150%) for all insurers to ensure they have sufficient capital to settle claims even during financial stress.

• Impact of Penalties: Fines of this nature serve as a deterrent to other players in the Insurtech and traditional insurance space, emphasizing that digital innovation must go hand-in-hand with strict regulatory compliance.

Q84. Answer: (a) Amit Shah

The correct answer is Amit Shah.

Key Points

• Union Home Minister and Minister of Cooperation, Shri Amit Shah, chaired the meeting of the Parliamentary Consultative Committee attached to the Ministry of Home Affairs in August 2025.

• The primary theme of the meeting was ‘Disaster Management and Capacity Building’, reflecting India's commitment to strengthening its resilience against natural and man-made calamities.

• During the meeting, Amit Shah highlighted the significant shift in India's approach from a relief-centric to a proactive and early warning-based disaster management strategy.

• The committee discussed the progress of various initiatives like the Aapda Mitra scheme, which aims to train community volunteers in disaster-prone districts across the country.

• He emphasized the government’s vision of "Zero Casualty" during disasters, citing the successful evacuation and management strategies employed during recent cyclones and floods.

Additional Information

• Parliamentary Consultative Committees:

• These committees are constituted by the Ministry of Parliamentary Affairs and provide a forum for informal discussions between Ministers and Members of Parliament (MPs) on the policies and working of various Ministries.

• Unlike Standing Committees, their meetings are usually held during Parliament sessions and inter-session periods to facilitate a direct exchange of ideas.

• Ministry of Home Affairs (MHA) and Disaster Management:

• The MHA is the nodal ministry in India for managing natural disasters (except droughts, which fall under the Ministry of Agriculture).

• It oversees the National Disaster Management Authority (NDMA) and the National Disaster Response Force (NDRF).

• National Disaster Response Force (NDRF):

• The NDRF is a specialized force constituted under the Disaster Management Act, 2005, for the purpose of specialist response to a threatening disaster situation.

• As of 2025, the force has been expanded with more battalions and advanced technological equipment to reduce response time during emergencies.

• Capacity Building Initiatives:

• Capacity building involves training, resource mobilization, and infrastructure development.

• The National Institute of Disaster Management (NIDM) plays a crucial role in providing training and capacity building programs for officials and stakeholders at the national, state, and district levels.

Important Points

• The Disaster Management Act, 2005, remains the foundational legal framework for disaster governance in India, establishing the National, State, and District Disaster Management Authorities.

• Financial support for disaster activities is managed through the National Disaster Response Fund (NDRF) and the State Disaster Response Fund (SDRF), with the 15th Finance Commission introducing a specific Mitigation Fund.

• The August 2025 meeting also touched upon the use of Space Technology and Artificial Intelligence (AI) for Early Warning Systems (EWS) to provide accurate and timely alerts to the common citizens.

• Amit Shah reiterated that India is aiming to become a global leader in disaster risk reduction, aligning with the Sendai Framework for Disaster Risk Reduction 2015-2030.

Q85. Answer: (d) Varuna

The correct answer is Varuna.

Key Points

• Varuna is the flagship bilateral naval exercise conducted between the Indian Navy and the French Navy.

• In January 2025, the French Navy's nuclear-powered aircraft carrier, Charles de Gaulle, led the French Carrier Strike Group (CSG) during the 23rd edition of the Varuna exercise.

• The exercise took place in the Arabian Sea, a strategically vital part of the Indian Ocean, focusing on advanced maritime operations.

• The primary objectives of Varuna 2025 included enhancing interoperability, conducting high-intensity combat maneuvers, and practicing carrier strike group operations, including anti-submarine warfare and air defense drills.

• This exercise highlights the growing defense synergy and the shared commitment of India and France toward maintaining a free,

open, and inclusive Indo-Pacific region. Hence, the correct answer is Varuna.

Additional Information

• History of Varuna:

• Naval cooperation between India and France was initiated in 1993.

• The exercise was officially christened as 'Varuna' in the year 2001 and has since become a cornerstone of the India-France Strategic Partnership.

• Tiger Triumph:

• This is a tri-service (Army, Navy, and Air Force) amphibious exercise conducted between India and the United States of America.

• The focus of Tiger Triumph is primarily on Humanitarian Assistance and Disaster Relief (HADR) operations and improving coordination between the two nations' armed forces.

• TROPEX (Theatre Level Operational Readiness Exercise):

• TROPEX is the Indian Navy's largest biennial theatre-level exercise.

• It involves the participation of all operational units of the Indian Navy, including ships, submarines, and aircraft, alongside the Indian Army, Indian Air Force, and Coast Guard to test combat readiness in the Indian Ocean Region.

• Dharma Guardian:

• This is an annual joint military exercise conducted between the Indian Army and the Japan Ground Self-Defense Force (JGSDF).

• Launched in 2018, it aims to share best practices in counter-terrorism and jungle warfare tactics in urban and semi-urban environments.

Important Points

• Charles de Gaulle (R91):

• It is the flagship of the French Navy (Marine Nationale) and the first French nuclear-powered surface vessel.

• The carrier typically operates with Rafale-M fighter jets and E-2C Hawkeye airborne early warning aircraft, making it one of the most potent naval platforms in the European Union.

• Strategic Partnership:

• India and France established a Strategic Partnership in January 1998.

• Other major bilateral exercises between the two countries include Garuda (Air Force) and Shakti (Army).

• The Reciprocal Logistics Support Agreement signed between the two nations allows their respective navies to access each other's military facilities, significantly boosting their operational reach in the Indian Ocean.

Q86. Answer: (d) Gender Budgeting Knowledge Hub

The correct answer is Gender Budgeting Knowledge Hub.

Key Points

• The Gender Budgeting Knowledge Hub was established by the Ministry of Women and Child Development (MWCD) to serve as a central resource repository for all stakeholders involved in Gender Responsive Budgeting (GRB).

• The portal acts as a digital platform that provides technical support, guidelines, and analytical tools to various central ministries, state governments, and union territories to facilitate the integration of gender perspectives into the budget cycle.

• It contains a comprehensive collection of training modules, research reports, and best practices from across India and the world, aimed at enhancing the capacity building of government officials.

• The primary function of this hub is to streamline the monitoring and evaluation of gender-related expenditures, ensuring that government schemes effectively address the specific needs and socio-economic challenges faced by women.

• By consolidating relevant circulars, manuals, and data indices, the hub assists in the preparation of the Gender Budget Statement, which is a critical part of the annual Union Budget process.

Additional Information

• Gender Budgeting in India:

• India formally institutionalized Gender Budgeting in the Union Budget of 2005-06 following recommendations from various committees and the Ninth Five Year Plan.

• It is not a separate budget for women but an analytical tool used to examine the gender-differential impact of government programs and fiscal policies.

• Gender Budget Statement (GBS):

• The GBS is presented annually alongside the Union Budget and is divided into two parts: Part A (schemes with 100% allocation for women) and Part B (schemes with at least 30% allocation for women).

• The number of Ministries and Departments reporting in the GBS has significantly increased from just 9 in 2005-06 to over 40 in recent years.

• Institutional Mechanisms:

• The government has mandated the setting up of Gender Budgeting Cells (GBCs) within all central ministries to oversee the implementation of gender-responsive planning.

• The National Institute of Public Finance and Policy (NIPFP) and the National Institute of Rural Development (NIRD) often collaborate with the hub to conduct gender audits and impact assessments.

• Global Context and SDGs:

• Gender Budgeting is a key strategy to achieve Sustainable Development Goal 5 (SDG 5), which focuses on Gender Equality and empowering all women and girls.

• India's model of Gender Budgeting is recognized globally for its comprehensive framework and its role in improving transparency and accountability in public spending.

Important Points

• Significance of the Portal: It bridges the gap between policy formulation and implementation by providing real-time access to data and policy circulars.

• Evolution of Budgeting: From a welfare-oriented approach to a rights-based approach, the hub reflects the shift in India's governance strategy toward inclusivity.

• State Initiatives: Several states like Rajasthan, Kerala, and Karnataka have been pioneers in adopting sub-national Gender Budgeting, and their successful case studies are hosted on the Knowledge Hub.

Q87. Answer: (c) India and Japan

The correct answer is India and Japan.

Key Points

• The Chandrayaan-5 mission, also known as the Lunar Polar Exploration (LUPEX) mission, is a joint robotic lunar mission by the Indian Space Research Organisation (ISRO) and the Japan Aerospace Exploration Agency (JAXA).

• As announced in March 2025, the mission specifically targets the Lunar South Pole, a region believed to contain significant deposits of water ice in permanently shadowed craters.

• Under this bilateral agreement, ISRO is tasked with the development of the Lunar Lander, leveraging the technical success achieved during the Chandrayaan-3 mission.

• JAXA is responsible for providing the Lunar Rover and the H3 Rocket, which will serve as the launch vehicle for the mission.

• The mission's primary objective is to demonstrate surface exploration technologies and investigate the quantity and quality of lunar water resources for future human habitation. Hence, the correct answer is India and Japan.

Additional Information

• Mission Architecture:

• The LUPEX mission involves a Rover that is significantly heavier than the Pragyan rover used in Chandrayaan-3, weighing approximately 350 kg.

• The Rover will be equipped with a drill capable of extracting samples from a depth of 1.5 meters to analyze the subsurface volatile content.

• Technological Objectives:

• The mission aims to achieve a high-precision landing within a few hundred meters of the designated site, which is essential for navigating the rugged terrain of the Moon's polar regions.

• It will test night-survivability technologies, allowing the hardware to function during the 14-day lunar night where temperatures drop below -200 degrees Celsius.

• Scientific Significance:

• By determining the distribution of water molecules, the mission supports the Artemis Accords and the global goal of establishing a sustainable lunar base.

• Data collected will help scientists understand the lunar exosphere and the chemical composition of the regolith near the poles.

Important Points

• Collaboration History: The partnership between India and Japan in space began intensifying after a series of joint meetings in 2017, leading to the formalization of LUPEX as a flagship project for Asian space cooperation.

• Launch Vehicle: The H3 Rocket is Japan's next-generation heavy-lift launch system, designed to provide high reliability and lower costs for deep-space missions.

• Future Lunar Roadmap: Chandrayaan-5 follows the Chandrayaan-4 (Lunar Sample Return) mission, marking India's transition from simple landing missions to complex resource prospecting and international collaborative science.

• Global Context: This mission places ISRO and JAXA as major competitors and contributors alongside NASA (USA) and CNSA (China) in the race to explore the Moon's resources.

Q88. Answer: (b) Akhil P Dharmajan

The correct answer is Akhil P Dharmajan.

Key Points

• The Sahitya Akademi announced the Yuva Puraskar for 2024 (and recognized in cycles extending into 2025) to honor young writers across various Indian languages.

• Akhil P Dharmajan was conferred with the Sahitya Akademi Yuva Puraskar for his exceptionally popular novel, ‘Ram C/O Anandhi’.

• He is a noted author in the Malayalam language, and his winning work ‘Ram C/O Anandhi’ has been a major bestseller, noted for its engaging storytelling and relatable themes for the youth.

• The award was announced in June as part of the annual literary honors provided by the Sahitya Akademi, India's National Academy of Letters.

• The selection for the Yuva Puraskar is based on books published by an author of the age of 35 and below as of 1st January of the year of the award.

• The winners are selected by a three-member jury in each language, following a rigorous evaluation process of the literary merit of the submitted works.

Additional Information

• Sahitya Akademi Yuva Puraskar:

• Established in the year 2011, this award aims to encourage and promote young Indian writers.

• The award is presented for literary works in 24 languages recognized by the Sahitya Akademi, including English and Rajasthani.

• The prize comprises a casket containing an engraved copper plaque and a cheque of Rs. 50,000.

• Other Notable Recipients:

• Kirtida Brahmbhatt: She won the Yuva Puraskar 2024 in the Gujarati language category for her poetry collection titled ‘Dhavan’.

• Parvati Tirkey: She was awarded the honor in the Santhali language for her collection of poems titled ‘Phir Ugna’.

• Vikas Swarup: While a renowned Indian diplomat and author of 'Q & A' (adapted as Slumdog Millionaire), he is not the recipient of the Yuva Puraskar in this specific context.

• Sahitya Akademi:

• The Sahitya Akademi was inaugurated by the Government of India on 12 March 1954.

• It functions as an autonomous organization under the Ministry of Culture.

• Its primary objective is to promote Indian literature worldwide and foster a sense of unity through literary exchanges between the different linguistic groups of India.

Important Points

• The Yuva Puraskar is one of the three major awards given by the Sahitya Akademi, the others being the main Sahitya Akademi Award and the Bal Sahitya Puraskar (for children's literature).

• The Bal Sahitya Puraskar 2024 was also announced alongside the Yuva Puraskar, where writers like Nandini Sengupta (English) and Devendra Kumar (Hindi) were recognized for their contributions.

• The award ceremony is usually held at a later date in a formal function where the recipients are honored by the President of the Sahitya Akademi.

Q89. Answer: (d) 6.8%

The correct answer is 6.8%.

Key Points

• According to the Monetary Policy Report released by the Reserve Bank of India (RBI) in October 2025, the revised GDP growth forecast for India for the Financial Year 2025–26 has been projected at 6.8%.

• The Monetary Policy Committee (MPC), which is responsible for fixing the benchmark interest rates in India, revised these growth estimates based on a comprehensive assessment of the macroeconomic outlook and global economic trends.

• The real GDP growth projection of 6.8% reflects the resilience of the Indian economy, driven by robust domestic demand, improving private investment, and sustained government capital expenditure.

• The report indicates that the services sector and manufacturing activity remain the primary engines of growth, while the agricultural sector is expected to benefit from favorable monsoon conditions in the preceding year.

• The RBI utilizes sophisticated economic modeling and high-frequency indicators to arrive at these projections, ensuring that the monetary policy stance remains aligned with the objective of maintaining price stability while supporting growth.

Additional Information

• Reserve Bank of India (RBI):

• Established on April 1, 1935, under the Reserve Bank of India Act, 1934, it serves as India's central bank and regulatory body for the banking system.

• Its primary functions include the issuance of currency, managing foreign exchange reserves, and acting as a banker to the government and other banks.

• Monetary Policy Committee (MPC):

• The MPC is a six-member committee constituted by the Central Government under Section 45ZB of the amended RBI Act, 1934.

• It is chaired by the Governor of the RBI and meets at least four times a year to decide on the policy repo rate required to achieve the inflation target.

• Gross Domestic Product (GDP):

• GDP is the total monetary or market value of all the finished goods and services produced within a country's borders in a specific time period, typically a financial year.

• In India, the National Statistical Office (NSO), under the Ministry of Statistics and Programme Implementation (MoSPI), is responsible for calculating and releasing GDP data.

• Financial Year in India:

• The Financial Year (FY) in India begins on April 1 and ends on March 31 of the following calendar year. Therefore, FY 2025–26 covers the period from April 2025 to March 2026.

Important Points

• The October 2025 report factors in several global risks, including geopolitical tensions, volatility in global commodity prices, and the monetary policy actions of major central banks like the US Federal Reserve.

• The output gap—the difference between actual output and potential output—is a key metric monitored by the RBI to determine if the economy is operating at full capacity without generating excessive inflation.

• The 6.8% growth target is supported by a significant increase in bank credit growth and healthy corporate balance sheets, which encourage fresh capacity expansion (Capex) by the private sector.

• Inflation targeting remains a core focus of the RBI, with a medium-term target of 4% within a band of +/- 2%, as per the flexible inflation targeting framework adopted in 2016.

Q90. Answer: (d) Reclaiming India’s Knowledge Legacy through Manuscript Heritage

The correct answer is Reclaiming India’s Knowledge Legacy through Manuscript Heritage.

Key Points

• The first Global Conference on Manuscript Heritage was held in January 2025 at the iconic Bharat Mandapam, located in Pragati Maidan, New Delhi.

• The event was inaugurated by the Prime Minister of India, Narendra Modi, highlighting the importance of ancient texts in the modern era.

• The official theme of the conference was "Reclaiming India’s Knowledge Legacy through Manuscript Heritage", which focused on the restoration and global recognition of Indian intellectual history. Hence, statement 4 is correct.

• The conference aimed to create a roadmap for the digitization and preservation of over 10 million manuscripts currently housed in various institutions across India.

• It served as a platform for scholars, archivists, and researchers from across the globe to discuss traditional and modern methods of conserving manuscripts written in languages like Sanskrit, Prakrit, Tamil, and Persian.

Additional Information

• National Mission for Manuscripts (NMM):

• Established in February 2003 by the Ministry of Culture, Government of India, its motto is "Conserving the past for the future".

• The mission is the primary body responsible for locating, documenting, and digitizing manuscripts across the country.

• It has established Manuscript Resource Centres (MRCs) and Manuscript Conservation Centres (MCCs) in various states to safeguard rare documents.

• Manuscript Diversity in India:

• India possesses one of the largest collections of manuscripts in the world, covering subjects such as Ayurveda, Mathematics, Astronomy, Philosophy, and Literature.

• These are found on diverse materials like Palm leaf, Birch bark (Bhurjapatra), Paper, and Cloth.

• Scripts commonly found include Brahmi, Kharosthi, Grantha, and Nandinagari.

• Significance of Bharat Mandapam:

• The venue, Bharat Mandapam, is a world-class International Exhibition-cum-Convention Centre (IECC).

• It gained global fame for hosting the G20 Summit in 2023 under India's presidency.

Important Points

• Digital Preservation: During the 2025 conference, the government emphasized the Vigyan Nidhi portal, which acts as a central repository for Indian research and heritage data.

• Global Collaboration: The conference saw participation from countries like Thailand, Vietnam, and Cambodia, aimed at exploring

the Shared Heritage of manuscript traditions across Asia.

• Policy Development: A key outcome was the proposal for a national policy on Manuscript Conservation to prevent the illicit trade and damage of historical documents.

• Public Access: The Ministry of Culture highlighted that by 2025, a significant portion of the 5.2 million documented manuscripts had been uploaded to digital platforms for public and academic access.

Q91. Answer: (d) GeM (Government e-Marketplace) and ONDC (Open Network for Digital Commerce)

The correct answer is GeM (Government e-Marketplace) and ONDC (Open Network for Digital Commerce).

Key Points

• The National Cooperation Policy, 2025 is a comprehensive framework designed to provide a new direction to the cooperative movement in India, aiming to fulfill the vision of "Sahakar se Samriddhi" (Prosperity through Cooperation).

• One of the primary objectives of the policy is the digital transformation of cooperatives, which includes their integration with the Government e-Marketplace (GeM). This allows cooperative societies to register as sellers, providing them direct access to government procurement worth billions of rupees.

• The policy also emphasizes integration with the Open Network for Digital Commerce (ONDC). This initiative enables cooperatives to list their products on an open network, ensuring they are not restricted to a single e-commerce platform and can reach consumers nationwide.

• The integration with GeM and ONDC is intended to enhance transparency, reduce transaction costs, and eliminate middlemen, thereby increasing the income of cooperative members and small-scale producers.

• By leveraging these platforms, the Ministry of Cooperation seeks to bring the 8.5 lakh cooperatives in the country into the mainstream digital economy. Hence, the correct answer is GeM (Government e-Marketplace) and ONDC (Open Network for Digital Commerce).

Additional Information

• Government e-Marketplace (GeM):

• GeM was launched on August 9, 2016, by the Ministry of Commerce and Industry to create an open and transparent procurement platform for Government buyers.

• In June 2022, the Union Cabinet expanded the mandate of GeM to allow cooperative societies to register as buyers, enabling them to get competitive prices for their operational requirements.

• Open Network for Digital Commerce (ONDC):

• ONDC is an initiative of the Department for Promotion of Industry and Internal Trade (DPIIT) under the Ministry of Commerce and Industry.

• It is a non-profit Section 8 company that aims to democratize e-commerce by moving from a platform-centric model to an open-network model, benefiting small retailers and cooperatives.

• Ministry of Cooperation:

• This Ministry was created by the Government of India in July 2021 to provide a separate administrative, legal, and policy framework for strengthening the cooperative movement.

• It is currently headed by the Union Minister, Shri Amit Shah.

• Computerization of PACS:

• A major project under the policy is the computerization of 63,000 functional Primary Agricultural Credit Societies (PACS) with a total budget of Rs. 2,516 crore to bring them onto a common digital software.

Important Points

• National Level Cooperatives: Under the new policy direction, three new national-level multi-state cooperative societies have been established for Exports, Organic Products, and Seeds.

• Economic Impact: The policy aims to increase the contribution of cooperatives to the Gross Domestic Product (GDP) and help India reach the $5 trillion economy goal.

• Governance: The Multi-State Co-operative Societies (Amendment) Act, 2023 was enacted to introduce electoral reforms and improve the governance and accountability of these societies in alignment with the 2025 policy goals.

Q92. Answer: (c) Kuno National Park

The correct answer is Kuno National Park.

Key Points

• India’s first Cheetah Safari was officially scheduled to begin in October 2025 at the Kuno National Park, located in the state of Madhya Pradesh.

• The safari is a specialized enclosure designed to promote eco-tourism while providing a safe environment for visitors to witness the cheetahs reintroduced under Project Cheetah.

• The dedicated safari area covers approximately 181 hectares of land near the Sesaipura entrance of the park, ensuring that the

core habitat remains undisturbed for the breeding population.

• This initiative marks a significant step in the reintroduction program, transitioning from purely conservation-focused phases to public engagement and education. Hence, the correct answer is Kuno National Park.

Additional Information

• Project Cheetah:

• It is the world's first intercontinental large wild carnivore translocation project.

• The cheetah was declared extinct in India in 1952 due to overhunting and habitat loss.

• The first batch of 8 cheetahs was brought from Namibia and released on September 17, 2022, by Prime Minister Narendra Modi.

• A second batch of 12 cheetahs was translocated from South Africa in February 2023.

• Kuno National Park:

• Located in the Sheopur and Morena districts of Madhya Pradesh, it spans an area of over 748 square kilometers.

• It was established as a wildlife sanctuary in 1981 and was elevated to the status of a National Park in 2018.

• The park features Kardhai, Khair, and Salai flora, providing an ideal grassland-woodland mosaic for cheetahs.

• Other Options:

• Kanha National Park: Known for the successful conservation of the Barasingha (Swamp Deer) and being the largest park in Madhya Pradesh.

• Bandhavgarh National Park: Famous for having one of the highest densities of Royal Bengal Tigers in the world.

• Satpura National Park: Recognized for its diverse terrain and being part of the Pachmarhi Biosphere Reserve.

Important Points

• Management: The project is overseen by the National Tiger Conservation Authority (NTCA) in collaboration with the Wildlife Institute of India (WII) and the Madhya Pradesh Forest Department.

• Local Impact: The Cheetah Safari is expected to generate significant employment opportunities for local communities in the Sheopur region through hospitality, guiding, and transport services.

• Conservation Goal: The long-term goal is to establish a self-sustaining population of cheetahs in India and restore the open forest and grassland ecosystems.

• Cheetah Mitras: More than 400 volunteers, known as Cheetah Mitras, were trained to raise awareness among the villagers about cheetah behavior and safety protocols.

Q93. Answer: (d) Nepal

The correct answer is Nepal.

Key Points

• The Indian men’s team etched their names in history by winning the first-ever Kho Kho World Cup title in 2025.

• In the final match held on January 19, 2025, the Indian men's team defeated Nepal with a convincing scoreline of 40-30, winning by an innings and 10 points. Hence, the correct answer is Nepal.

• The tournament final was played at the prestigious Indira Gandhi Indoor Stadium located in New Delhi, India.

• The Indian team remained unbeaten throughout the tournament, showcasing tactical dominance and physical agility under the captaincy of Akshay Bhangre.

• This victory marks a significant milestone for the sport of Kho Kho, as it was the inaugural edition of the global championship, aimed at promoting this traditional Indian sport on an international platform.

Additional Information

• Double Glory for India:

• Apart from the men's team, the Indian women’s team also secured the championship title by defeating Nepal in their respective final.

• The women's team won by an innings and 13 points with a final score of 33-20, completing a historic double gold for the host nation.

• Tournament Scale and Participation:

• The 2025 Kho Kho World Cup featured participation from 24 countries across six continents, including teams from Brazil, South Africa, England, and Australia.

• The event was organized by the Kho Kho Federation of India (KKFI) in association with the International Kho Kho Federation.

• Promotion of Indigenous Sports:

• The championship was supported by the Ministry of Youth Affairs and Sports, Government of India, as part of a broader initiative to include Kho Kho in the 2032 Olympic Games.

• The tournament followed the theme of "Homecoming," highlighting the sport's ancient roots in India, dating back to the Mahabharata era.

Important Points

• Prize Money: The winners of the tournament were awarded a significant cash prize, with the KKFI announcing a total prize pool to encourage athletes from developing nations.

• Historical Context: Kho Kho is one of the oldest forms of outdoor sport in India. The first formal rules were framed in the 1910s, and the Kho Kho Federation of India was established in 1955.

• Global Reach: Before the World Cup, the sport gained international visibility through the Ultimate Kho Kho League, which introduced modern technology like Review Systems and high-speed cameras to the game.

• Key Figures: The event was graced by various dignitaries, including the Union Sports Minister and officials from the Indian Olympic Association (IOA), emphasizing the government's "Khel Mahakumbh" and "Khelo India" visions.

Q94. Answer: (d) Kunlavut Vitidsarn

The correct answer is Kunlavut Vitidsarn.

Key Points

• Kunlavut Vitidsarn achieved a historic milestone by becoming the World No. 1 in the Badminton World Federation (BWF) men's singles rankings in January 2025.

• He is the first-ever male singles player from Thailand to reach the top spot in the global rankings, solidifying his status as a national sporting icon. Hence, the statement is correct.

• His rise to the top was propelled by a series of high-profile successes, including winning the silver medal at the 2024 Paris Olympics, where he reached the final after defeating top seeds.

• In 2023, he became the first Thai man to win the BWF World Championships title in men's singles by defeating Japan's Kodai Naraoka in the final held in Copenhagen.

• The achievement is significant as it broke the dominance of traditional badminton powerhouses and showcased the rapid development of the sport in Thailand.

Additional Information

• Profile of Kunlavut Vitidsarn:

• Commonly known by his nickname "View," he was born on May 11, 2001, in Bangkok, Thailand.

• He gained international fame by winning three consecutive World Junior Championship titles in 2017, 2018, and 2019, a feat never before achieved in the men's singles category.

• Other Options Context:

• Lakshya Sen: A prominent Indian player who reached the semi-finals of the 2024 Olympics but has not yet reached the World No. 1 ranking.

• Kodai Naraoka: A top-ranked Japanese player known for his defensive style; he has been a consistent rival to Kunlavut but did not mark this specific history for his country in 2025.

• Loh Kean Yew: The 2021 World Champion from Singapore; while he was the first Singaporean to win a World title, he did not reach No. 1 in 2025.

• The BWF Ranking System:

• The World No. 1 rank is determined by the BWF World Ranking system, which tallies points from a player's best 10 tournament results over the preceding 52 weeks.

Important Points

• Thai Badminton History: Before Kunlavut, the only other Thai player to reach World No. 1 in a singles category was Ratchanok Intanon, who achieved the top spot in women's singles in 2016.

• Major Career Titles: Kunlavut's trophy cabinet includes the German Open (2022), India Open (2023), and the Thailand Open (2023), all of which contributed to his points tally for the World No. 1 spot.

• Coaching: He trains at the Banthongyord Badminton School, the same academy that produced Ratchanok Intanon.

• Olympic Significance: His 2024 Olympic silver was the first-ever Olympic medal for Thailand in the sport of badminton, marking a turning point for the Badminton Association of Thailand.

Q95. Answer: (d) Employees' State Insurance Corporation

The correct answer is Employees' State Insurance Corporation.

Key Points

• The Employees' State Insurance Corporation (ESIC) launched the 'Scheme for Promoting Registration of Employers and Employees' (SPREE 2025) to enhance the coverage of social security benefits.

• The main objective of SPREE 2025 is to encourage employers to register themselves and their employees who were previously eligible but remained unregistered under the ESI Act, 1948.

• The scheme is designed as a one-time opportunity for employers to come forward and formalize their workforce without the immediate burden of past penalties, thereby promoting ease of doing business.

• The duration of this scheme is set for six months, specifically remaining operational from October 2024 to March 2025.

• By registering under this scheme, employees gain access to a wide array of social security benefits, including comprehensive medical care and cash benefits during contingencies like sickness or injury.

• This initiative is a strategic step by the Ministry of Labour and Employment to ensure the formalization of the Indian workforce and provide a safety net to those in the organized and semi-organized sectors.

Additional Information

• Employees' State Insurance (ESI) Act, 1948:

• It was the first major social security legislation in independent India, designed to provide health insurance and disability benefits to workers.

• The ESIC is a statutory body established under this Act and functions under the administrative control of the Ministry of Labour and Employment, Government of India.

• Contribution Rates:

• The ESI Scheme is self-financing, where contributions are made by both the employer and the employee.

• Currently, the employer's contribution is 3.25% and the employee's contribution is 0.75% of the total wages paid.

• Eligibility Criteria:

• The Act applies to factories and other establishments like shops, hotels, restaurants, cinemas, and private medical institutions employing 10 or more persons.

• The current wage ceiling for coverage under the ESI Scheme is Rs. 21,000 per month (Rs. 25,000 for persons with disabilities).

• Types of Benefits provided by ESIC:

• Medical Benefit: Full medical care is provided to an Insured Person and their family members from the day they enter insurable employment.

• Sickness Benefit: Periodic payments to any insured person in case of sickness certified by a medical practitioner.

• Maternity Benefit: Payable to insured women for confinement or miscarriage, generally for a period of 26 weeks.

• Disablement Benefit: Provided to employees who suffer employment injury resulting in temporary or permanent disability.

• Dependants' Benefit: Paid in the form of a monthly pension to the dependants of a deceased Insured Person in cases where death occurs due to employment injury or occupational hazards.

Important Points

• The ESIC headquarters is located in New Delhi, and it manages a vast network of hospitals and dispensaries across the country.

• Digital integration through the Shram Suvidha Portal and the issuance of Pehchan Cards (identity cards) has streamlined the process of availing cashless medical services.

• The Atal Beemit Vyakti Kalyan Yojana (ABVKY) is another significant welfare scheme under ESIC that provides unemployment allowance to insured persons who have lost their jobs.

Q96. Answer: (a) Dadasaheb Phalke Award, 2023

The correct answer is Dadasaheb Phalke Award, 2023.

Key Points

• In September 2025, the Government of India conferred the Dadasaheb Phalke Award for the year 2023 upon the veteran actor Mohanlal for his iconic and lifetime contribution to Indian Cinema.

• Known affectionately as "The Complete Actor," Mohanlal Viswanathan has a prolific career spanning over 45 years, during which he has acted in more than 360 films, predominantly in the Malayalam film industry.

• The announcement was made by the Union Ministry of Information and Broadcasting, recognizing his versatility and impact on the cinematic landscape across multiple languages including Tamil, Telugu, Hindi, and Kannada.

• The Dadasaheb Phalke Award is the highest honor in Indian cinema, awarded during the National Film Awards ceremony by the President of India.

• By receiving the 2023 citation, Mohanlal joins an elite group of cinematic legends who have shaped the artistic direction of the nation's film industry. Hence, the correct answer is Dadasaheb Phalke Award, 2023.

Additional Information

• History of the Dadasaheb Phalke Award:

• The award was instituted in 1969 by the Government of India to honor the memory of Dhundiraj Govind Phalke, popularly known as Dadasaheb Phalke.

• Phalke is regarded as the "Father of Indian Cinema" for directing India's first full-length feature film, Raja Harishchandra, in 1913.

• The first recipient of the award was Devika Rani in 1969.

• The award consists of a Swarna Kamal (Golden Lotus) medallion, a shawl, and a cash prize of Rs. 15 lakh (revised from 10 lakh in 2024).

• Other Options and Distinctions:

• Filmfare Lifetime Achievement Award: While Mohanlal has won numerous Filmfare Awards South, this is a private award organized by the Times Group, unlike the state-conferred Phalke award.

• National Film Award for Best Actor: Mohanlal has won the National Film Award for Best Actor twice (for Bharatham in 1991 and Vanaprastham in 1999). This award recognizes specific performances rather than a lifetime of work.

• Padma Shri: The Padma Shri is India's fourth-highest civilian award. Mohanlal was already conferred with the Padma Shri in 2001 and the Padma Bhushan in 2019.

Important Points

• National Film Awards: The 71st National Film Awards (held in 2025) served as the platform for this recognition. The awards are organized by the Directorate of Film Festivals.

• Mohanlal's Career Milestones: He made his debut with the film Thiranottam in 1978. Beyond acting, he was awarded the honorary rank of Lieutenant Colonel in the Territorial Army of India in 2009.

• Recent Predecessors: Before Mohanlal, the Dadasaheb Phalke Award was conferred upon Mithun Chakraborty (for 2022) and Waheeda Rehman (for 2021).

• Selection Process: The recipient is selected by a Jury comprising eminent personalities from the Indian film industry, appointed by the government.

Q97. Answer: (b) 5.50%

p>The correct answer is 5.50%.

Key Points

• The 56^(th) meeting of the Monetary Policy Committee (MPC) was conducted in August 2025 to evaluate the macroeconomic situation and determine the course of India's monetary policy.

• After a comprehensive review of the prevailing economic indicators, the MPC decided to maintain the policy repo rate at 5.50%.

• The decision to keep the repo rate unchanged reflects the committee's focus on maintaining a balance between inflation control and supporting economic growth momentum.

• By keeping the rate at 5.50%, the Reserve Bank of India (RBI) aims to ensure that retail inflation remains within the target range while providing a stable environment for investment and consumption.

• The MPC also decided to remain focused on the withdrawal of accommodation to ensure that inflation progressively aligns with the target, while supporting GDP growth.

• The voting process during the 56^(th) meeting involved all six members of the committee, who assessed both global and domestic economic conditions before reaching the consensus on the 5.50% rate. Hence, the correct answer is 5.50%.

Additional Information

• Monetary Policy Committee (MPC):

• The MPC is a statutory and institutionalized framework under the Reserve Bank of India Act, 1934, for maintaining price stability.

• It consists of 6 members: three members from the RBI (including the Governor as the ex-officio Chairperson) and three external members appointed by the Central Government.

• The MPC is required to meet at least four times a year, though it typically meets bi-monthly to announce the Monetary Policy Statement.

• Key Monetary Policy Instruments:

• Repo Rate: The fixed interest rate at which the Reserve Bank provides overnight liquidity to banks against the collateral of government securities.

• Reverse Repo Rate: The rate at which the RBI absorbs liquidity from banks against the collateral of eligible government securities under the LAF.

• Standing Deposit Facility (SDF): A liquidity management tool that allows the RBI to absorb excess liquidity from the banking system without the need for collateral.

Important Points

• Inflation Targeting: The primary objective of the MPC is to maintain price stability while keeping in mind the objective of growth. The Government of India has set an inflation target of 4% with a tolerance band of +/- 2% (i.e., between 2% to 6%).

• Impact of Repo Rate: A change in the repo rate directly influences the cost of borrowing for commercial banks. A lower rate, such as the 5.50% mentioned, generally leads to cheaper home loans, car loans, and business credits, thereby stimulating the economy.

• Decision Making: Each member of the MPC has one vote, and in the case of a tie, the Governor of the RBI has a casting vote to break the deadlock.

• Global Context: The August 2025 meeting likely considered international factors such as crude oil prices, US Federal Reserve policies, and global supply chain stability, which impact domestic inflationary pressures.

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Q98. Answer: (c) Padma Awards

The correct answer is Padma Awards.

Key Points

• PR Sreejesh, the veteran goalkeeper of the Indian Men's Hockey Team, was conferred with the Padma Shri (which falls under the Padma Awards category) for his distinguished service in the field of Sports.

• The honor was presented by President Droupadi Murmu during a civil investiture ceremony held at Rashtrapati Bhavan in April 2025.

• Sreejesh is widely recognized as one of the greatest goalkeepers in the history of hockey, often referred to as "The Wall" for his exceptional reflexes and leadership on the field.

• He played a pivotal role in ending India's 41-year Olympic medal drought by helping the team secure the Bronze Medal at the Tokyo 2020 Olympics and subsequently defending the title at the Paris 2024 Olympics.

• The Padma Awards are one of the highest civilian honors of the country, announced annually on the eve of Republic Day (January 26th).

Additional Information

• PR Sreejesh's Accolades:

• Before the Padma Shri, he was honored with the Major Dhyan Chand Khel Ratna Award in 2021, which is India's highest sporting honor.

• He was also the recipient of the Arjuna Award in 2015 and was named the World Games Athlete of the Year 2021, becoming only the second Indian to win this global award.

• Hailing from Kerala, he served as the Captain of the Indian national team during the 2016 Rio Olympics.

• The Padma Awards:

• Instituted in 1954, these awards are given in three categories: Padma Vibhushan (for exceptional and distinguished service), Padma Bhushan (distinguished service of high order), and Padma Shri (distinguished service in any field).

• The awards seek to recognize achievements in all fields of activities or disciplines where an element of public service is involved, such as Art, Social Work, Public Affairs, Science and Engineering, Trade and Industry, Medicine, Literature and Education, Sports, and Civil Service.

• National Sports Awards:

• These are separate from civilian honors and include the Major Dhyan Chand Khel Ratna, Arjuna Award, Dronacharya Award (for coaches), and Dhyan Chand Award for Lifetime Achievement.

• These are usually conferred by the Ministry of Youth Affairs and Sports on National Sports Day (August 29).

• Bharat Ratna:

• This is the highest civilian award of the Republic of India. It is awarded in recognition of exceptional service/performance of the highest order in any field of human endeavor.

Q99. Answer: (b) India

The correct answer is India.

Key Points

• The Indian Deaf Cricket Team created history by winning a 5-match series against Trinidad & Tobago in early 2025.

• This tour was a landmark event as it represented the first time an Indian Deaf Cricket squad traveled to the West Indies for a bilateral international series.

• The series was played in the T20 format, and the Indian team showcased a dominant performance throughout the matches held at various venues in Trinidad, including the National Cricket Centre in Couva.

• The tour was organized and facilitated by the Indian Deaf Cricket Association (IDCA) in collaboration with the Trinidad and Tobago Deaf Cricket Association and the Trinidad and Tobago Cricket Board.

• The victory highlights the growing prowess of differently-abled athletes from India on the global stage and serves as a significant boost for the sport's visibility.

Additional Information

• Indian Deaf Cricket Association (IDCA):

• The IDCA is the governing body for deaf cricket in India, focused on promoting the sport among hearing-impaired individuals.

• It is led by President Sumit Jain and has been instrumental in organizing national championships and international tours to provide exposure to Indian talent.

• The association aims for formal recognition from the BCCI (Board of Control for Cricket in India) to further professionalize the sport for the deaf community.

• International Achievements:

• Prior to the 2025 series win, India had already established itself as a major contender, notably winning the DICC (Deaf

International Cricket Council) T20 Champions Trophy in 2022.

• The 2025 series victory against Trinidad & Tobago serves as critical preparation for future global events like the Deaf Cricket World Cup.

• Deaf Cricket Dynamics:

• The game follows the standard ICC (International Cricket Council) rules for T20 and ODI formats, but with specific adaptations for communication.

• Umpires often use colored flags in addition to standard hand signals to communicate decisions to the players who cannot hear the sound of the whistle or the ball hitting the bat.

• Significance of the Tour:

• International tours like the one to Trinidad & Tobago promote social inclusion and provide a platform for athletes to represent India globally.

• Such events help in attracting sponsorships and government support for para-sports, which is essential for the long-term sustainability of deaf cricket.

Important Points

• Location: The historic series took place in the Caribbean nation of Trinidad & Tobago, known for its rich cricketing heritage.

• Format: The matches were specifically T20 Internationals, which is the most popular format for deaf cricket due to its fast-paced nature.

• Year: The series was successfully concluded in January-February 2025.

• Inclusivity: The success of the team is often celebrated as a part of the broader "Khelo India" spirit, encouraging sports participation across all sections of society, including those with physical impairments.

Q100. Answer: (b) UN Sustainable Development Solutions Network

The correct answer is UN Sustainable Development Solutions Network.

Key Points

• The Sustainable Development Report (SDR), which includes the SDG Index and Dashboards, is a global assessment of countries' progress towards achieving the Sustainable Development Goals (SDGs).

• This report is released annually by the UN Sustainable Development Solutions Network (SDSN). Hence, the correct answer is option 2.

• The SDSN has been publishing these reports since 2016 (with earlier iterations dating back to the adoption of the goals), and the 2024 edition marks the 9th global edition, while the 10th anniversary of the SDSN itself or specific regional versions often lead to the "10th" nomenclature in various academic contexts.

• The report provides a score (0–100) for each country, representing the percentage of SDG achievement. A score of 100 indicates that all targets have been met.

• It uses a "traffic light" system (green, yellow, orange, red) in its Dashboards to help countries identify where they are lagging and where they are making progress across the 17 Goals.

• The Sustainable Development Solutions Network operates under the auspices of the UN Secretary-General and was established in 2012.

Additional Information

• World Economic Forum (WEF):

• The WEF is an international non-governmental organization based in Cologny, Switzerland, founded by Klaus Schwab in 1971.

• It is famous for its annual meeting in Davos and releases reports such as the Global Gender Gap Report, Global Competitiveness Report, and Global Risks Report.

• It does not release the primary global SDG Index.

• World Bank Report:

• The World Bank is an international financial institution that provides loans and grants to the governments of low- and middle-income countries.

• Its flagship publication is the World Development Report (WDR), which focuses on a different aspect of development each year (e.g., Digital Dividends, Governance and the Law).

• While it provides data for the SDGs, it is not the publisher of the Sustainable Development Report.

• International Monetary Fund (IMF) Report:

• The IMF focuses on global monetary cooperation, financial stability, and international trade.

• Major reports include the World Economic Outlook (WEO), Global Financial Stability Report, and Fiscal Monitor.

• The IMF monitors macroeconomic health rather than specific SDG indicator rankings.

• The 17 SDGs:

• Adopted by all 193 United Nations Member States in September 2015 as part of the 2030 Agenda for Sustainable Development.

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• Key goals include Goal 1: No Poverty, Goal 5: Gender Equality, Goal 13: Climate Action, and Goal 17: Partnerships for the Goals.

Important Points

• SDSN Leadership: The SDSN is currently led by Professor Jeffrey Sachs, a world-renowned economist and expert in sustainable development.

• Data Sources: The report relies heavily on official data from the United Nations, World Bank, World Health Organization (WHO), and International Labour Organization (ILO), as well as non-official data where gaps exist.

• India's Context: In the Sustainable Development Report 2024, India was ranked 109th out of 166 countries with a score of approximately 64.0. The country has shown progress in goals like Climate Action and Responsible Consumption but faces challenges in Zero Hunger (Goal 2) and Gender Equality (Goal 5).

• Spillover Index: A unique feature of the SDSN report is the Spillover Index, which measures the positive and negative effects one country has on another's ability to achieve the SDGs (e.g., through trade, security, or environmental impacts).

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