RRB Group D Official Paper (Held On: 23 Dec, 2025 Shift 1) (Previous Year Paper)

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

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GENERAL SCIENCE

Q1. Which of the following shows the correct formula for acceleration?

(a) acceleration = change in velocity / time taken
(b) acceleration = force × mass
(c) acceleration = change in velocity × time
(d) acceleration = distance / time

Q2. What is the primary function of lysosomes in a cell?

(a) Production of energy in the form of ATP molecules
(b) Synthesis of proteins and lipids for cell membranes
(c) Digestion of foreign materials and worn-out organelles
(d) Regulation of water and mineral balance within the cytoplasm

Q3. In HIV infection, the 'window period' refers to the phase during which _____.

(a) HIV antibodies are detectable in tests
(b) symptoms are severe
(c) the patient dies
(d) HIV antibodies are not detectable in tests

Q4. What is the function of the nuclear membrane in a cell?

(a) It stores digestive enzymes for chromosomal activities.
(b) It prevents the entry of gases and water molecules into the nucleus.
(c) It provides energy for nuclear division during mitosis.
(d) It regulates the transfer of material between nucleus and cytoplasm.

Q5. Which of the following is NOT explained by the law of gravitation?

(a) Artificial satellites revolving around the Earth
(b) Tides in oceans
(c) Falling of raindrops to the Earth
(d) The electrostatic attraction between two charged bodies

Q6. Which of the following statements is correct?

(a) High pitch means low frequency.
(b) High pitch means high frequency.
(c) Pitch has no relation with frequency.
(d) Low pitch means high frequency.

Q7. Consider the following statements and select the correct option.

Statement A: A neutralisation reaction occurs when an acid reacts with a base.
Statement B: Water and salt are formed during neutralisation.

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

Q8. Which of the following statements about Presbyopia is correct?

(a) It is corrected only by concave lenses.
(b) It usually occurs in young children.
(c) It occurs due to weakening of ciliary muscles and loss of lens flexibility.
(d) The near point becomes less than 25 cm.

Q9. Which of the following is true about the magnetic field around a current carrying solenoid?

(a) The direction of magnetic field associated with the solenoid can be reversed by reversing the direction of current flowing through it.
(b) The field associated with the solenoid can be increased by decreasing the number of turns in the solenoid.
(c) The field in the core of the solenoid decreases from one end of the other end.
(d) The field line pattern of the solenoid resembles the magnetic field line pattern of a straight current carrying wire.

Q10. What is the formula unit mass of sodium chloride (NaCl)?

(a) 58.5u
(b) 23u
(c) 57u
(d) 35.5u

Q11. The cleansing action of soap is due to which of its properties?

(a) Being a strong acid
(b) Being a strong base
(c) High melting point
(d) Ability to form micelles

Q12. If an object is placed at a distance 'u' from a convex lens, 'u' _____.

(a) is taken as zero
(b) is taken as negative
(c) is taken as positive
(d) depends on the type of image

Q13. Which component is used in a circuit to increase resistance and limit current?

(a) Resistor
(b) Switch
(c) Battery
(d) Lamp

Q14. A mass of 3 kg is lifted to a height of 12 m. What is the value of potential energy at the given height? (Take g = 10 m/s^2)

(a) 3.0 J
(b) 4.0 J
(c) 360.0 J
(d) 36.0 J

Q15. In a Closed System, if 15 gm of substance A reacts with 10 gm of substance B, the total mass of the products should be

(a) 10 gm
(b) 15 gm
(c) 25 gm
(d) 0 gm

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Q16. Which of the following is a major condition for successful beekeeping?

(a) Availability of flowering plants throughout the year
(b) Growing wheat and rice
(c) Presence of pollinating insects
(d) Use of pesticides

Q17. How are the metals in the middle of the activity series usually extracted?

(a) By electrolysis
(b) By heating alone
(c) By dissolving in water
(d) By reduction using carbon

Q18. The number of protons in $6^{12}C$ and 6^(14)C, respectively, are:

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

Q19. The measurable quantity 'Density' may be represented in the SI unit of:

(a) kilograms per cubic metre
(b) kilograms per square metre
(c) kilograms per metre
(d) grams per metre

Q20. Which of the following correctly distinguishes binary fission from multiple fission in unicellular organisms?

(a) Binary fission requires spores, but multiple fission does not.
(b) Binary fission occurs only in multicellular organisms, while multiple fission occurs in unicellular ones.
(c) Binary fission produces two daughter cells, whereas multiple fission produces many daughter cells at once.
(d) Binary fission results in many daughter cells, while multiple fission forms only two.

Q21. A car’s odometer shows 3000 km at the beginning of a journey and 3200 km at the end. If the journey takes 4 hours, what is the car’s average speed?

(a) 75 km/hr
(b) 25 km/hr
(c) 100 km/hr
(d) 50 km/hr

Q22. Vinegar is a 5-8% solution of which of the following?

(a) Sodium hydroxide in water
(b) Calcium carbonate in water
(c) Acetic acid in water
(d) Formic acid in water

Q23. Which of the following statements about asexual reproduction is INCORRECT?

(a) Fission is a method of asexual reproduction.
(b) It involves the fusion of male and female gametes.
(c) It involves only one parent.
(d) It produces offspring that are genetically identical clones of the parent.

Q24. In animals, which of the following hormones are secreted during a scary situation?

(a) Adrenaline
(b) Insulin
(c) Growth hormone
(d) Thyroxin

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Q25. Parenchyma cells contain large intercellular spaces for:

(a) Conduction and secretion
(b) Protection and transpiration
(c) Photosynthesis and support
(d) Gas exchange and storage

MATHEMATICS

Q26. If 649 bananas were distributed among three monkeys in the ratio 1/2 : 1/6 : 1/4, how many bananas did the first monkey get?

(a) 324
(b) 344
(c) 374
(d) 354

Q27. Two cylindrical vessels have the same capacity and identical dimensions. If the radius of the first vessel is increased by 14 cm and the height of the second vessel is increased by 30 cm, the increase in capacity for both vessels is equal to Q cm^3. If the actual height of each vessel is 24 cm, find the value of Q.

(a) 23,025π
(b) 23,250π
(c) 23,502π
(d) 23,520π

Q28. How many numbers between 351 and 650 are divisible by 7?

(a) 50
(b) 43
(c) 92
(d) 42

Q29. In an election, Candidate A secures 60% of the votes, Candidate B secures 30% of the votes, and Candidate C secures the remaining 10%. If the total number of votes cast in the election is 1,20,000, how many more votes did Candidate A receive than Candidate B?

(a) 28,000
(b) 21,000
(c) 36,000
(d) 32,000

Q30. If 3^(((x^4+x^2+1)/(x^2+x+1))) = 3^((2x+5)), then find the positive value of x.

(a) 6
(b) 4
(c) 3.5
(d) 2.8

Q31. Two engines of trains 75 km apart start towards each other at speeds of 13 km/hr and 17 km/hr, respectively. After how much time will they meet each other? (Assume the length of engine is negligible.)

(a) 143 minutes
(b) 146 minutes
(c) 155 minutes
(d) 150 minutes

Q32. If 9 : A :: A : 4, then find the positive value of A.

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

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Q33. Simplify: $(3x + 2)^2$

(a) $4x^2 + 12x + 9$
(b) $6x^2 + 12x + 4$
(c) $9x^2 + 12x + 4$
(d) $9x^2 + 4x + 4$

Q34. Find a single discount (approximately) equal to three consecutive discounts of 20%, 4% and 14%.

(a) 33.42%
(b) 33.95%
(c) 33.18%
(d) 36.60%

Q35. In quadrilateral PQRS, the bisectors of angle R and angle S meet at the point T (inside the quadrilateral) and angle STR = 14°. If the ratio of angle P to angle Q is 2 : 5, then what is the difference between the measures of angle Q and angle P?

(a) 16°
(b) 8°
(c) 12°
(d) 3°

Q36. For 11 innings, a cricketer has an average of 71 runs. In the 12^(th) inning, he scores 119 runs. His average score increased by _____.

(a) 4
(b) 8
(c) 5
(d) 13

Q37. A woodcutter earns Rs. 500 per day and spends 30% of his earning daily. What is his daily saving (in Rs.)?

(a) 150
(b) 350
(c) 450
(d) 355

Q38. One pipe can fill a tank in 5 minutes while another pipe can empty the completely filled tank in 10 minutes. If both the pipes are opened together when the tank is empty, then how many minutes will it take to fill one-half of the tank?

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

Q39. Find the simple interest (in Rs.) on Rs. 2,000 at 7% per annum rate of interest for the period from 10 February 2023 to 24 April 2023.

(a) 26
(b) 27
(c) 28
(d) 29

Q40. The areas of three adjacent faces of a solid cuboid are 92 cm^2, 69 cm^2 and 75 cm^2. What is the volume (in cm^3) of the cuboid?

(a) 617
(b) 730
(c) 690
(d) 843

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Q41. If $\text{cosec}\theta - \cot\theta = 1/11$, and θ lies in the first quadrant, then find the value of $122\cos\theta$.

(a) 231
(b) 120
(c) 164
(d) 214

Q42. A teacher is currently four times as old as one of her students. Five years ago, she was seven times as old as the same student was at that time. What is the teacher's current age (in years)?

(a) 35
(b) 40
(c) 45
(d) 50

Q43. If the ratio of two numbers is 2 : 3 and their HCF is 6, then their LCM is:

(a) 36
(b) 6
(c) 16
(d) 18

Q44. A and B can do a piece of work in 18 days, while A and C can do the same work in 12 days. If B and C together can complete the work in 48 days, how long will it take for A, B, and C working together to complete the work (rounded off to two decimal places)?

(a) 12.07 days
(b) 13.52 days
(c) 12.52 days
(d) 12.92 days

Q45. If 10% of 30% of 2/3 of a number is 537, find the number.

(a) 26850
(b) 28620
(c) 27090
(d) 29050

Q46. An agent sells a pressure cooker with a marked price of Rs. 8,460 at a discount of 20%. What is the selling price (in Rs.) of the pressure cooker?

(a) 6,770
(b) 6,767
(c) 6,768
(d) 6,766

Q47. A man buys 9 identical articles for a total of Rs. 16. If he sells each of them for Rs. 2.4, then his profit percentage will be _____%.

(a) 25.92
(b) 36
(c) 26.92
(d) 35

Q48. A father is three times as old as his son. After 12 years from now, he will be twice as old as his son. Find the present ages (in years) of the father and the son, respectively.

(a) 36 and 12
(b) 35 and 11
(c) 38 and 14
(d) 37 and 13

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Q49. The arithmetic mean of the observations 88, 99, 47, 79, 12, 79, 76, 17 and 61 is:

(a) 61
(b) 66
(c) 62
(d) 52

Q50. A motorist travels 30 km in 50 minutes. He drives at a speed of x km/hr for the first 12 minutes, then at 2x km/hr for the next 22 minutes and finally at x km/hr for the remainder of the journey. Determine the value of x.

(a) 28
(b) 22
(c) 25
(d) 30

GENERAL INTELLIGENCE & REASONING

Q51. 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) UV - WA
(b) BP – EU
(c) QL – SQ
(d) MB – OG

Q52. All 58 people are standing in a row facing north. Rizwan is 23^(rd) from the right end, while Aman is 19^(th) from the left end. How many people are there between Rizwan and Aman?

(a) 16
(b) 13
(c) 15
(d) 14

Q53. What will come in place of the question mark (?) in the following equation if '+' and '-' are interchanged and '×' and '÷' are interchanged?

40 + 5 ÷ 7 - 108 × 9 = ?

(a) 13
(b) 17
(c) 19
(d) 18

Q54. 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?

76 A 2 C (30 A 6) B 4 D 39 A3 C 15=?

(a) 45
(b) 60
(c) 65
(d) 70

Q55. Eight people, A, B, C, D, E, F, G and H, are sitting around a circular table facing the centre. Only one person sits between A and B when counted from the left of A. E sits to the immediate right of B. Only two people sit between E and F when counted from the left of E. C sits third to the left of F. D sits to the immediate right of H. Who sits second to the right of G?

(a) H
(b) A
(c) E
(d) F

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Q56. 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) LQ - MJ
(b) NS - OL
(c) RW - SO
(d) PU - QN

Q57. Select the triad which follows the same pattern as that followed by the two triads given below. Both triads follow the same pattern.

BH – FM – JR

JP – NU – RZ

(a) BF – EI – HL
(b) HN – LS – PX
(c) RM – TQ – PR
(d) PL – RN – TP

Q58. 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) 2 2 1 3 7 2 6 7 2 9 9 2 2 3 5 7 4 9 3 8 7 (Right)

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

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

Q59. In a certain code language, 'CORN' is coded as '6479' and 'OILY' is coded as '2368'. What is the code for 'O' in the given code language?

(a) 2
(b) 4
(c) 6
(d) 8

Q60. In a certain code language, 'lid ear urn' is coded as 'lw cc pg' and 'corn urn bird' is coded as 'qf wc 3 cc'. How is 'urn' coded in that language?

(a) lw
(b) pg
(c) qf
(d) cc

Q61. Six people, A, B, C, D, E and F, are sitting in a row, facing north. Only two people sit to the left of E. Only one person sits between A and C. F sits to the immediate left of E. A sits to the immediate right of D. C sits third to the right of B. Who sits at the extreme left end of the row?

(a) D
(b) C
(c) B
(d) E

Q62. Select the triad which follows the same pattern as that followed by the two triads given below. Both triads follow the same pattern.

UM - SK - PR

RJ - PH - MO

(a) MF- LD - IJ
(b) NF - LD - IJ

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(c) MF - LE - IJ
(d) NF - LD - IK

Q63. What should come in place of the question mark (?) in the given series?

9 11 15 21 29 39 ?

(a) 51
(b) 58
(c) 55
(d) 56

Q64. In a certain code language,

'A + B' means 'A is the mother of B',

'A-B' means 'A is the brother of B',

'Ax B' means 'A is the wife of B',

'A% B' means 'A is the father of B' and

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

How is E related to P if 'E % C # Q # L+ P'?

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

Q65. What should come in place of the question mark (?) in the given series?

1, 4, 9, 16, 25, ?

(a) 33
(b) 42
(c) 38
(d) 36

Q66. A man goes north for 3 km and reaches point B. Then he turns right, goes 10 km to reach point C. Next, he takes a right turn, goes 5 km to reach point D. Then he goes west for 3 km to reach point E. Finally, he turns right and goes 2 km to reach point F. In which direction is the man now with respect to the starting point?

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

(a) Southeast
(b) West
(c) Southwest
(d) East

Q67. 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) 1 2 1 2 4 2 1 6 2 1 6 1 1 6 1 3 5 6 1 2 8 6 6 4 9 2 6 (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) 4
(b) 2
(c) 3
(d) 1

Q68. Shivank starts from Point A and drives 15 km towards north. He then takes a left turn, drives 11 km, turns left and drives 16 km. He then takes a left turn and drives 14 km. He takes a final left turn, drives 1 km and stops at Point P. How far (shortest distance) and towards which direction should he drive in order to reach Point A again?

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

(a) 1 km to the west
(b) 2 km to the west

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(c) 4 km to the west
(d) 3 km to the west

Q69. Which of the following letter-number clusters will replace the question mark (?) in the given series to make it logically complete?

DEI51, XYC58, RSW65, LMQ72,?

(a) FGL79
(b) FOK79
(c) EGK79
(d) FGK79

Q70. OPNO is related to STRS in a certain way based on the English alphabetical order. In the same way, DECD is related to HIGH. To which of the given optuons is JKIJ related, following the same logic?

(a) NOLN
(b) NPLS
(c) NOMN
(d) NNLN

Q71. Sharad, Hemant, Anuj, Pradeep, and Vasant are discussing their assignment while sitting at a circular table facing the centre. Pradeep is sitting to the immediate right of Anuj and Vasant is sitting to the immediate right of Hemant. Sharad is second to the right of Anuj and immediately left of Hemant. Which of the following statement is correct?

(a) Pradeep is the immediate neighbour of Hemant and Vasant.
(b) Anuj is the immediate neighbour of Hemant and Pradeep.
(c) Vasant is the immediate neighbour of Sharad and Anuj.
(d) Hemant is the immediate neighbour of Sharad and Vasant.

Q72. Refer to the given series and answer the question that follows. (All numbers are single digit numbers only.) Counting to be done from left to right.

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

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

(a) five
(b) three
(c) two
(d) four

Q73. What should come in place of the question mark (?) in the given series?

8 14 26 44 68 ?

(a) 92
(b) 88
(c) 98
(d) 102

Q74. 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 jams are cobras.

All cobras are mats.

Conclusions:

(I): Some mats are cobras.

(II): All jams are mats.

(a) Only conclusion (I) follows
(b) Only conclusion (II) follows

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

Q75. What should come in place of the question mark (?) in the given series based on the English alphabetical order?

TRV RTR PVN NXJ ?

(a) LAF
(b) KZF
(c) LZF
(d) KAF

Q76. Refer to the following number series and answer the question that follows. Counting to be done from left to right. (All numbers are single-digit numbers only.)

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

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

(Note: 1 is also a perfect square)

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

Q77. If 'A' stands for '÷', 'B' stands for '×', 'C' stands for '+' and 'D' stands for '−', what will come in place of the question mark (?) in the following equation?

37 B 12 D 824 A 8 C 128 = ?

(a) 462
(b) 469
(c) 499
(d) 471

Q78. 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 caves are houses.

All houses are dens.

All dens are mansions.

Conclusions:

(I) All caves are mansions.

(II) Some mansions are houses.

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

Q79. Select the set in which the numbers are related in the same way as are the numbers of the following sets.

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

(9, 13, 26)

(7, 9, 22)

(a) (10, 25, 38)
(b) (11, 17, 30)
(c) (8, 11, 26)

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(d) (12, 19, 6)

Q80. In a row of 103 students facing north, Z is 15^(th) from the right end. If G is 36^(th) to the left of Z, what is G's position from the left end of the line?

(a) 53rd
(b) 55th
(c) 52nd
(d) 54th

GENERAL AWARENESS AND CURRENT AFFAIRS

Q81. Which fungal pathogen has been found to use chromosome alterations to resist common antifungal drugs like fluconazole and voriconazole?

(a) Candida albicans
(b) Candida tropicalis
(c) Aspergillus fumigatus
(d) Cryptococcus neoformans

Q82. As per the Sustainable Development Goals — National Indicator Framework Progress Report, 2025, published in June 2025, what was the percentage of the total waste processed during the year 2024–2025, indicating progress in waste management efficiency?

(a) 90.25%
(b) 97.80%
(c) 80.7%
(d) 75.6%

Q83. Who became the record-holder for the most international football wins, with 132, by a male player in March 2025?

(a) Sergio Ramos
(b) Lionel Messi
(c) Robert Lewandowski
(d) Cristiano Ronaldo

Q84. By what percentage did the All-India House Price Index increased annually in Q4 FY25, with Kolkata recording the highest price growth and Kochi witnessing a decline?

(a) 6.1%
(b) 5.1%
(c) 3.1%
(d) 4.1%

Q85. In India, which High Court launched a dedicated portal for workplace sexual harassment complaints in July 2025 to empower women at work?

(a) Karnataka High Court
(b) Bombay High Court
(c) Delhi High Court
(d) Calcutta High Court

Q86. Who launched the Mukhya Mantrir Jiban Anuprerana Scheme in June 2025?

(a) Education Minister of Assam
(b) Prime Minister of India
(c) Assam Chief Minister Himanta Biswa Sarma
(d) Assam Governor Lakshman Acharya

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Q87. Which football club was awarded the 2025 Laureus World Team of the Year?

(a) Real Madrid
(b) FC Barcelona
(c) Manchester City
(d) Paris Saint-Germain

Q88. Which public space improvement was recommended in Chennai's Gender and Policy Lab manual during May–June 2025?

(a) Deployment of aerial surveillance drones
(b) Creation of parks for women exclusively
(c) Introduction of women-only bus services
(d) Increased street lighting and safe toilets

Q89. In 2025, which state decided to review the Shakti Bill, which was to protect children and women from crime?

(a) Maharashtra
(b) Bihar
(c) Tamil Nadu
(d) Uttar Pradesh

Q90. Which state/Union Territory observed its 25^(th) Foundation Day on 9 November 2025?

(a) Uttarakhand
(b) Jharkhand
(c) Chhattisgarh
(d) Ladakh

Q91. In April 2025, the Indian government signed a Headquarters Agreement with which intergovernmental wildlife organisation to establish its headquarters in India?

(a) Global Cat Conservation Coalition
(b) International Tiger Conservation Network
(c) World Wildlife Fund Asia
(d) International Big Cat Alliance

Q92. Which of the following organisations or ministries released the report titled 'India's Services Sector: Insights from GVA Trends and State-Level Dynamics' in October 2025?

(a) Reserve Bank of India
(b) Ministry of Statistics and Programme
(c) Ministry of Finance
(d) NITI Aayog

Q93. In February 2025, which athlete broke her own women's 400 m National Games record, clocking 51.12 seconds to win gold?

(a) Dutee Chand
(b) Hima Das
(c) Jyothi Yarraji
(d) Aishwarya Mishra

Q94. Who among the following was leading the Insurance Regulatory and Development Authority of India (IRDAI) until March 2025, after which key reforms stalled?

(a) Rakesh Kumar
(b) Debasish Panda
(c) Subhash Chandra
(d) Sunil Mehta

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Q95. In 2025, the seventh edition of the Khelo India Youth Games (KIYG) took place. Which Indian state served as the host for these games?

(a) Bihar
(b) Madhya Pradesh
(c) Uttar Pradesh
(d) Maharashtra

Q96. India launched its National Red List Roadmap at which of the following international events in 2025?

(a) UN Climate Change Conference (COP30)
(b) G20 Environment Ministers' Summit
(c) IUCN World Conservation Congress
(d) World Biodiversity Forum

Q97. The Eravikulam National Park, which emerged as one of the two top-performing protected areas in India in the Management Effectiveness Evaluation (MEE) conducted by the Wildlife Institute of India in June 2025, is home to which of the following species?

(a) Indian one-horned Rhinoceros
(b) Snow Leopard
(c) Nilgiri Tahr
(d) Lion-tailed Macaque

Q98. Indian researchers have developed a novel lanthanum-doped silver niobate material to enhance the performance of which of the following energy storage devices?

(a) Solar panels
(b) Supercapacitors
(c) Lithium-ion batteries
(d) Fuel cells

Q99. According to the Ministry of External Affairs (MEA) and the Ministry of Electronics and Information Technology (MeitY), which of the following city-states signed a "Comprehensive Strategic Partnership" with India, including MoUs in semiconductors, digital technology and skills development in September 2024?

(a) Malaysia
(b) Indonesia
(c) Thailand
(d) Singapore

Q100. Which Glaswegian author released Hermit in 2025, dealing with themes of toxic masculinity and online misogyny?

(a) Ocean Vuong
(b) Margaret McDonald
(c) Chris McQueer
(d) Nell Stevens

ANSWER KEY

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

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81	b	82	c	83	d	84	c	85	c	86	c	87	a	88	d	89	a	90	a
91	d	92	d	93	d	94	b	95	a	96	c	97	c	98	b	99	d	100	c

SOLUTIONS

Q1. Answer: (a) acceleration = change in velocity / time taken

The correct answer is acceleration = change in velocity / time taken.

Key Points

• Acceleration is defined as the rate at which an object changes its velocity. An object is accelerating if it is changing its velocity.

• The formula for acceleration is the change in velocity divided by the time taken for that change to occur. Mathematically, it is represented as a = (v - u) / t, where v is the final velocity, u is the initial velocity, and t is the time. Hence, statement 1 is correct.

• According to Newton's Second Law of Motion, the relationship between force, mass, and acceleration is Force = mass × acceleration. Therefore, acceleration = Force / mass. The provided option suggests acceleration equals force multiplied by mass. Hence, statement 2 is incorrect.

• Acceleration is the change in velocity per unit of time, not the product of the two. Multiplying velocity by time would result in displacement (for constant velocity), not acceleration. Hence, statement 3 is incorrect.

• The formula distance / time is the definition for speed, whereas displacement / time is the formula for velocity. Acceleration requires looking at the change in those rates over time. Hence, statement 4 is incorrect.

Additional Information

• SI Unit: The Standard International (SI) unit for acceleration is the meter per second squared, commonly written as m/s^2. This unit signifies how many meters per second the velocity changes every second.

• Vector Quantity: Acceleration is a vector quantity, meaning it has both magnitude and direction. A change in either the speed or the direction of motion results in acceleration.

• Types of Acceleration:

• Uniform Acceleration: When an object's velocity changes by equal amounts in equal time intervals. A classic example is an object in free fall near the Earth's surface, where it accelerates at approximately 9.8 m/s^2.

• Non-Uniform Acceleration: When the velocity of an object changes by unequal amounts in equal intervals of time.

• Deceleration: When the acceleration acts in the opposite direction to the velocity, the object slows down. This is often referred to as negative acceleration, retardation, or deceleration.

Important Points

• Graphical Representation: In a Velocity-Time (v-t) graph, the slope of the line represents the acceleration of the object. A steeper slope indicates a higher magnitude of acceleration, while a horizontal line indicates zero acceleration (constant velocity).

• Instantaneous vs. Average Acceleration: Average acceleration is the total change in velocity over a specific period, whereas instantaneous acceleration is the acceleration of an object at a specific moment in time.

• Circular Motion: Even if an object moves at a constant speed in a circle, it is still accelerating because its direction is constantly changing. This is known as centripetal acceleration.

Q2. Answer: (c) Digestion of foreign materials and worn-out organelles

The correct answer is Digestion of foreign materials and worn-out organelles.

Key Points

• Lysosomes are membrane-bound vesicular structures that function as the waste disposal system of the cell by digesting external materials and cellular components.

• They are known as "Suicide Bags" of the cell because if the cell gets damaged, lysosomes may burst and the digestive enzymes can digest their own cell.

• The primary function involves intracellular digestion, where they break down foreign materials like bacteria or food, as well as worn-out organelles, to keep the cell clean.

• These organelles are formed by the process of packaging in the Golgi apparatus and contain nearly all types of hydrolytic enzymes (hydrolases – lipases, proteases, carbohydrases).

• The enzymes found in lysosomes are optimally active at an acidic pH (approximately pH 5), which is maintained by pumping protons from the cytosol into the organelle.

Additional Information

• Mitochondria (Energy Production):

• Known as the "Powerhouse of the cell," mitochondria are responsible for the production of energy in the form of ATP (Adenosine Triphosphate).

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• This process occurs through cellular respiration, specifically the Krebs cycle and electron transport chain.

• Endoplasmic Reticulum and Golgi Apparatus (Synthesis):

• The Rough Endoplasmic Reticulum (RER) is the site for the synthesis of proteins, while the Smooth Endoplasmic Reticulum (SER) is involved in the synthesis of lipids.

• The Golgi apparatus modifies, sorts, and packages these proteins and lipids for secretion or delivery to other organelles.

• Vacuoles (Regulation and Storage):

• In plant cells, the large central vacuole is primary in the regulation of water and mineral balance, maintaining turgor pressure within the cytoplasm.

• In animal cells, smaller vacuoles assist in the storage of nutrients and the transport of waste.

• Historical Context:

• Lysosomes were discovered by the Belgian cytologist Christian de Duve in the year 1955.

• For his discovery of lysosomes and other organelles like peroxisomes, he was awarded the Nobel Prize in Physiology or Medicine in 1974.

• Autophagy and Heterophagy:

• Autophagy is the process where lysosomes digest the cell's own components (like old mitochondria) to recycle nutrients.

• Heterophagy refers to the digestion of materials taken in from outside the cell via endocytosis or phagocytosis.

Q3. Answer: (d) HIV antibodies are not detectable in tests

The correct answer is HIV antibodies are not detectable in tests.

Key Points

• The window period in HIV infection refers to the time between when a person is first infected with the virus and when a diagnostic test can reliably detect the infection.

• During this specific phase, HIV antibodies have not yet been produced in sufficient quantities by the immune system to be picked up by standard screening tests. Hence, statement 4 is correct.

• It is a critical period because, although the test results may appear negative, the individual is highly infectious and can transmit the virus to others due to a high viral load in their blood and bodily fluids. Hence, statement 1 is incorrect.

• The window period should not be confused with the incubation period, which is the time from infection to the appearance of clinical symptoms. In many cases of HIV, symptoms may not appear for years. Hence, statement 2 is incorrect.

• While the virus is active during this time, it does not mean the patient dies during this phase; with modern medicine, HIV is a manageable chronic condition. Hence, statement 3 is incorrect.

Additional Information

• HIV (Human Immunodeficiency Virus): This is a virus that attacks CD4 cells (T cells), which are vital to the human immune system. If left untreated, it leads to AIDS.

• AIDS (Acquired Immunodeficiency Syndrome): This is the third and most severe stage of HIV infection, where the immune system is so badly damaged that the body cannot fight off opportunistic infections.

• Testing Types and Timelines:

• Antibody Tests: These usually take 23 to 90 days to detect HIV after exposure. These are commonly used in rapid tests and home-based kits.

• Antigen/Antibody Tests: These look for both HIV antibodies and p24 antigens. The window period for these tests, when performed on venous blood, is typically 18 to 45 days.

• NAT (Nucleic Acid Test): This test looks for the actual virus in the blood and has the shortest window period, usually 10 to 33 days after exposure.

• Seroconversion: This is the process of moving from a seronegative state to a seropositive state, meaning the body has started producing detectable antibodies against HIV.

Important Points

• Transmission Risk: The window period is associated with a very high risk of transmission because the viral replication is rapid before the immune system begins to control it.

• Retesting Guidelines: Health organizations often recommend retesting after 3 months (90 days) if the initial test was taken shortly after a potential exposure to ensure a conclusive result.

• ART (Antiretroviral Therapy): Modern medication can reduce the viral load to undetectable levels. An undetectable viral load means the virus cannot be transmitted through sexual contact, a concept known as U=U (Undetectable = Untransmittable).

• Global Impact: Since the start of the epidemic, millions of people have been infected. Global initiatives like UNAIDS aim to end the AIDS epidemic as a public health threat by the year 2030.

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Q4. Answer: (d) It regulates the transfer of material between nucleus and cytoplasm.

The correct answer is It regulates the transfer of material between nucleus and cytoplasm.

Key Points

• The nuclear membrane, also referred to as the nuclear envelope, is a double-layered biological membrane that encloses the genetic material of eukaryotic cells.

• It serves as a physical barrier that separates the contents of the nucleus (the nucleoplasm) from the cytoplasm.

• The membrane is perforated by numerous nuclear pores, which act as gatekeepers. These pores regulate the transfer of materials, such as RNA, ribosomal subunits, and proteins (like polymerases and histones), between the nucleus and the cytoplasm. Hence, statement 4 is correct.

• The function of storing digestive enzymes is performed by lysosomes, which are often called the "suicidal bags" of the cell, rather than the nuclear membrane. Hence, statement 1 is incorrect.

• The nuclear membrane is selectively permeable; it does not prevent the entry of essential water molecules or dissolved gases like oxygen and carbon dioxide, which are necessary for cellular respiration and nuclear metabolic processes. Hence, statement 2 is incorrect.

• Energy required for nuclear division and other cellular processes during mitosis is generated by the mitochondria in the form of ATP (Adenosine Triphosphate), not by the membrane itself. Hence, statement 3 is incorrect.

Additional Information

• Structure of the Nuclear Envelope:

• It consists of two lipid bilayer membranes: the outer nuclear membrane and the inner nuclear membrane.

• The outer membrane is continuous with the Rough Endoplasmic Reticulum (RER) and is often studded with ribosomes.

• The inner membrane is lined by the nuclear lamina, a network of intermediate filaments (lamins) that provides structural support and helps organize chromatin.

• The Nuclear Pore Complex (NPC):

• Each nuclear pore is a massive protein complex that manages the bidirectional trafficking of macromolecules.

• Small molecules (less than 30-60 kDa) can diffuse passively, but larger molecules require specific transport receptors like importins and exportins.

• Role in Cell Division:

• During the prophase of mitosis, the nuclear membrane breaks down into small vesicles to allow the spindle fibers to access the chromosomes.

• In the telophase, the vesicles fuse to reform the nuclear envelope around the two sets of daughter chromosomes.

Important Points

• Perinuclear Space: The gap between the inner and outer membranes is called the perinuclear space, which is typically about 20 to 40 nm wide.

• Discovery: While the nucleus was first described by Robert Brown in 1831, the detailed structure of the double-layered nuclear membrane was only clearly understood after the advent of the electron microscope in the 20th century.

• Protection: By sequestering the DNA, the nuclear membrane protects the genome from being damaged by metabolic reactions occurring in the cytoplasm and ensures that transcription and translation are spatially and temporally separated in eukaryotes.

Q5. Answer: (d) The electrostatic attraction between two charged bodies

The correct answer is The electrostatic attraction between two charged bodies.

Key Points

• Newton's Law of Universal Gravitation, formulated by Sir Isaac Newton in 1687, states that every particle of matter in the universe attracts every other particle 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.

• Artificial satellites revolving around the Earth: These satellites are maintained in their orbits because the Earth's gravitational force provides the necessary centripetal force required for circular or elliptical motion. Without this pull, satellites would fly off into space in a straight line. Hence, statement 1 is explained by the law of gravitation.

• Tides in oceans: The periodic rise and fall of sea levels, known as tides, are primarily caused by the gravitational pull exerted by the Moon and, to a lesser extent, the Sun on the Earth's hydrosphere. Hence, statement 2 is explained by the law of gravitation.

• Falling of raindrops to the Earth: Raindrops are pulled toward the center of the Earth due to Earth's gravity. This force acts on the mass of the water droplets, causing them to accelerate downwards once they become heavy enough to overcome atmospheric updrafts. Hence, statement 3 is explained by the law of gravitation.

• The electrostatic attraction between two charged bodies: This phenomenon is governed by Coulomb's Law (proposed in 1785), which deals with the force between electric charges rather than masses. While it follows an inverse-square law similar to gravity, it is a fundamentally different force of nature. Hence, statement 4 is NOT explained by the law of gravitation.

Additional Information

• Universal Gravitational Constant (G):

• The value of G was first experimentally determined by Henry Cavendish in 1798.

• The accepted value of G is approximately 6.674 x 10^-11 Nm^2/kg^2. It is a scalar quantity and remains constant throughout the universe.

• Coulomb's Law vs. Gravitational Law:

• Coulomb's Law states that the force between two point charges is proportional to the product of the charges (q1, q2) and inversely proportional to the square of the distance (r^2) between them.

• Unlike gravitation, which is always attractive, electrostatic force can be either attractive (between opposite charges) or repulsive (between like charges).

• The electrostatic force is significantly stronger than the gravitational force; for example, the electric force between a proton and an electron is about 10^39 times stronger than the gravitational force between them.

Important Points

• Inverse Square Law: Both gravitation and electrostatics follow the inverse square law, meaning the intensity of the force decreases rapidly as the distance between the objects increases.

• Central Forces: Both forces are central forces, meaning they act along the line joining the centers of the two bodies.

• Planetary Motion: The law of gravitation explains Kepler's Laws of planetary motion, describing how planets move in elliptical orbits around the Sun.

• Weight vs. Mass: Mass is the amount of matter in an object (measured in kg), while weight is the gravitational force acting on that mass (measured in Newtons). Weight varies depending on the local gravitational acceleration (g), which is approximately 9.8 m/s^2 on Earth.

Q6. Answer: (b) High pitch means high frequency.

The correct answer is High pitch means high frequency..

Key Points

• The pitch of a sound is the brain's perception of the frequency of a sound wave. Frequency is defined as the number of vibrations or cycles per second.

• There is a direct relationship between pitch and frequency. A higher frequency results in a high-pitched or shrill sound, while a lower frequency results in a low-pitched or grave sound.

• High pitch means low frequency: This statement is incorrect because frequency and pitch are positively correlated. Hence, statement 1 is incorrect.

• High pitch means high frequency: This statement accurately describes the physical relationship where faster vibrations (higher frequency) produce a higher perceived pitch. Hence, statement 2 is correct.

• Pitch has no relation with frequency: This is false because frequency is the primary physical attribute that determines the pitch of a sound. Hence, statement 3 is incorrect.

• Low pitch means high frequency: This is incorrect as high frequency leads to high pitch, not low pitch. Hence, statement 4 is incorrect.

• The unit of frequency is Hertz (Hz). If an object vibrates 50 times in one second, its frequency is 50 Hz.

Additional Information

• Characteristics of Sound:

• Loudness: Unlike pitch, loudness depends on the amplitude of the vibration. It is measured in decibels (dB). When the amplitude is large, the sound produced is loud.

• Quality (Timbre): This characteristic allows us to distinguish between two sounds of the same pitch and loudness, such as the difference between a violin and a flute.

• Frequency Ranges:

• Infrasonic Sound: Sounds with frequencies below 20 Hz are called infrasonic. Elephants and whales communicate using these frequencies.

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

• Ultrasonic Sound: Frequencies above 20,000 Hz are called ultrasound. Animals like bats and dolphins use ultrasound for navigation and hunting.

Important Points

• Examples of Pitch:

• A bird makes a high-pitched sound (high frequency), whereas a lion makes a low-pitched roar (low frequency), although the roar is much louder (high amplitude).

• The voice of a woman generally has a higher frequency and is higher pitched than that of a man.

• A drum vibrates with a low frequency, producing a low-pitched sound, while a whistle has a high frequency, producing a

high-pitched sound.

• Factors Affecting Pitch:

• The pitch of a stringed instrument (like a guitar) can be increased by increasing the tension in the string or decreasing its length.

• In wind instruments, the pitch is changed by altering the length of the vibrating air column.

Q7. Answer: (a) Both statements A and B are correct.

The correct answer is Both statements A and B are correct.

Key Points

• Neutralization is a type of chemical reaction in which an acid reacts with a base to form salt and water.

• In this reaction, the acidity of the acid and the alkalinity of the base are neutralized, often resulting in a solution that is closer to a neutral pH. Hence, statement A is correct.

• The primary products of a neutralization reaction are always a salt (an ionic compound) and water (H2O). Hence, statement B is correct.

• The reaction is generally exothermic in nature, meaning heat energy is released during the process, which can cause an increase in the temperature of the reaction mixture.

• The general chemical equation for this process is represented as: Acid + Base → Salt + Water + Heat.

Additional Information

• Daily Life Applications of Neutralization:

• Indigestion: To relieve acidity in the stomach caused by excess Hydrochloric acid (HCl), antacids like Milk of Magnesia (which contains Magnesium hydroxide) are used to neutralize the acid.

• Ant Sting: An ant's sting contains formic acid. The effect can be neutralized by rubbing moist baking soda (sodium hydrogen carbonate) or calamine solution (zinc carbonate) on the skin.

• Soil Treatment: If the soil is too acidic, it is treated with bases like Quick lime (calcium oxide) or Slaked lime (calcium hydroxide). If it is too basic, organic matter is added, which releases acids to neutralize the base.

• Chemical Examples:

• A common laboratory example is the reaction between Hydrochloric acid (HCl) and Sodium hydroxide (NaOH). This produces Sodium chloride (NaCl), which is common table salt, and water.

• Indicators in Neutralization:

• Phenolphthalein is frequently used as an indicator. In a basic solution, it gives a pink color, but it becomes colorless when the solution becomes acidic or neutral during the neutralization process.

• Nature of Salt:

• The salt produced may be acidic, basic, or neutral. For instance, a strong acid reacting with a strong base produces a neutral salt with a pH of 7.

Q8. Answer: (c) It occurs due to weakening of ciliary muscles and loss of lens flexibility.

The correct answer is It occurs due to weakening of ciliary muscles and loss of lens flexibility.

Key Points

• Presbyopia is a common vision condition that occurs with aging, where the eye gradually loses its ability to focus clearly on nearby objects.

• It is primarily caused by the gradual weakening of the ciliary muscles and the diminishing flexibility (elasticity) of the crystalline lens. Hence, statement 3 is correct.

• The power of accommodation of the eye usually decreases with age. For most people, the near point gradually recedes and becomes greater than 25 cm, making it difficult to read comfortably without corrective glasses. Hence, statement 4 is incorrect.

• Unlike conditions like Myopia, Presbyopia is not typically found in young children; it usually becomes noticeable in individuals in their early to mid-40s and continues to worsen until around age 65. Hence, statement 2 is incorrect.

• This condition is generally corrected using convex lenses (for reading) or bifocal lenses if the person also suffers from Myopia. Concave lenses are used to correct Myopia (nearsightedness), not Presbyopia alone. Hence, statement 1 is incorrect.

Additional Information

• Myopia (Nearsightedness):

• In this defect, a person can see nearby objects clearly but cannot see distant objects distinctly.

• It occurs due to excessive curvature of the eye lens or elongation of the eyeball.

• It is corrected using a concave lens of suitable power.

• Hypermetropia (Farsightedness):

• A person with hypermetropia can see distant objects clearly but cannot see nearby objects distinctly.

• The near point for the person is farther away from the normal near point (25 cm).

• It arises because the focal length of the eye lens is too long or the eyeball has become too small.

• It is corrected by using a convex lens of appropriate power.

• Astigmatism:

• This defect arises when the cornea is not spherical in shape, leading to different curvatures in different planes.

• It results in objects appearing blurred or distorted at all distances.

• It is typically corrected using cylindrical lenses.

Important Points

• Power of Accommodation: The ability of the eye lens to adjust its focal length is called accommodation. When muscles are relaxed, the lens is thin and its focal length increases (for distant objects). When ciliary muscles contract, the lens becomes thick, and the focal length decreases (for nearby objects).

• Bifocal Lenses: Sometimes a person suffers from both Myopia and Hypermetropia/Presbyopia. Such people require bifocal lenses. A common type of bifocal lens consists of both concave and convex lenses. The upper portion is a concave lens (facilitates distant vision), and the lower part is a convex lens (facilitates near vision).

• Modern Solutions: Nowadays, vision defects can also be corrected with contact lenses or through surgical interventions such as LASIK (Laser-Assisted In Situ Keratomileusis).

• The least distance of distinct vision for a normal young adult eye is 25 cm, and the far point is infinity.

Q9. Answer: (a) The direction of magnetic field associated with the solenoid can be reversed by reversing the direction of...

The correct answer is The direction of magnetic field associated with the solenoid can be reversed by reversing the direction of current flowing through it.

Key Points

• A solenoid is defined as a coil of many circular turns of insulated copper wire wrapped closely in the shape of a cylinder. When current passes through it, it behaves like a magnet.

• The direction of the magnetic field produced by a solenoid depends entirely on the direction of the electric current flowing through the coils. By reversing the current, the polarity (North and South poles) of the solenoid flips, thereby reversing the field direction. Hence, statement 1 is correct.

• The magnitude of the magnetic field (B) is directly proportional to the number of turns per unit length (n) and the current (I). Therefore, the field associated with the solenoid can be increased by increasing the number of turns, not decreasing them. Hence, statement 2 is incorrect.

• Inside a long solenoid, the magnetic field lines are in the form of parallel straight lines. This indicates that the magnetic field is uniform at all points inside the core of the solenoid, meaning it does not decrease or increase from one end to the other. Hence, statement 3 is incorrect.

• The magnetic field line pattern produced by a current-carrying solenoid is remarkably similar to the magnetic field of a bar magnet, with one end behaving as a magnetic North pole and the other as a South pole. It does not resemble the circular field pattern of a straight current-carrying wire. Hence, statement 4 is incorrect.

• Hence, the correct answer is The direction of magnetic field associated with the solenoid can be reversed by reversing the direction of current flowing through it.

Additional Information

• Factors affecting Magnetic Field Strength:

• Current (I): The strength of the magnetic field is directly proportional to the current flowing through the wire. Increasing the current in Amperes leads to a stronger field.

• Number of Turns (N): A solenoid with a higher density of turns produces a more intense magnetic field because the field of each individual turn adds up.

• Core Material: Placing a soft iron core inside the solenoid significantly increases the magnetic induction. This setup is commonly known as an electromagnet.

• Rules and Resemblance:

• Right-Hand Thumb Rule: This rule is used to find the direction of the magnetic field. If the fingers of the right hand wrap around the solenoid in the direction of current, the thumb points towards the North pole.

• Clock Face Rule: If the current in a face of the solenoid is in a clockwise direction, that face acts as a South pole; if anti-clockwise, it acts as a North pole.

• Similarity to Bar Magnets: Like a bar magnet, the magnetic field lines of a solenoid emerge from the North pole and enter the South pole outside the magnet, forming closed loops.

Important Points

• Applications of Solenoids:

• Electromagnets: Used in electric bells, cranes for lifting scrap metal, and relays.

• Medical Equipment: High-end medical devices like MRI (Magnetic Resonance Imaging) machines use large solenoids to generate strong uniform magnetic fields.

• Automotive: Solenoids are used as starters in vehicles to engage the engine during ignition.

• Key Comparison:

• A permanent magnet (like a steel bar) retains its magnetism, whereas a solenoid acts as a magnet only as long as the electric current is flowing.

• The strength of a permanent magnet cannot be changed easily, but the strength of a solenoid can be varied by changing the current or the number of turns.

Q10. Answer: (a) 58.5u

The correct answer is 58.5u.

Key Points

• The formula unit mass of a substance is the sum of the atomic masses of all atoms in a formula unit of a compound.

• For compounds that consist of ions (ionic compounds), the term formula unit mass is used instead of molecular mass because these substances do not consist of discrete molecules.

• Sodium Chloride (NaCl) is a classic example of an ionic compound. It consists of Sodium (Na+) cations and Chloride (Cl-) anions arranged in a crystal lattice.

• The atomic mass of Sodium (Na) is 23 u.

• The atomic mass of Chlorine (Cl) is 35.5 u.

• The formula unit mass of NaCl is calculated as: 1 × 23 u + 1 × 35.5 u = 58.5 u.

• Hence, the correct answer is 58.5u.

Additional Information

• Sodium (Na):

• It is an alkali metal belonging to Group 1 of the Periodic Table.

• Its atomic number is 11 and its standard atomic weight is approximately 22.99 u.

• It is highly reactive and is stored under oil or kerosene to prevent reaction with air or moisture.

• Chlorine (Cl):

• It is a halogen belonging to Group 17 of the Periodic Table.

• Its atomic number is 17 and its atomic weight is approximately 35.45 u, usually rounded to 35.5 u for basic calculations.

• In its natural state, it exists as a diatomic gas (Cl2).

• Unified Atomic Mass Unit (u):

• The unit "u" stands for the unified atomic mass unit.

• It is defined as exactly 1/12th of the mass of one atom of carbon-12.

• Previously, it was abbreviated as "amu".

• Ionic Bonding in NaCl:

• Sodium loses one electron to achieve a stable octet, forming Na+.

• Chlorine gains that electron to complete its outer shell, forming Cl-.

• The electrostatic force of attraction between these oppositely charged ions results in the formation of Sodium Chloride.

Important Points

• Difference between Molecular and Formula Mass:

• Molecular Mass is used for covalent compounds (like H2O or CO2) where atoms are bonded together as distinct molecules.

• Formula Unit Mass is used for ionic compounds (like NaCl, CaCl2, or MgO) which exist as a continuous 3D lattice.

• Molar Mass:

• The molar mass of Sodium Chloride is numerically the same as the formula unit mass but expressed in grams per mole (g/mol).

• Thus, the molar mass of NaCl is 58.5 g/mol.

• Calculation for other options:

• 23u represents only the atomic mass of Sodium.

• 35.5u represents only the atomic mass of Chlorine.

• 58.5u is the combined sum required for the NaCl compound.

Q11. Answer: (d) Ability to form micelles

The correct answer is Ability to form micelles.

Key Points

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• Soap molecules are sodium or potassium salts of long-chain fatty acids (like stearic, palmitic, or oleic acid) that possess a dual nature: a hydrophilic (water-loving) head and a hydrophobic (water-fearing) tail.

• The hydrophilic head is the ionic part (-COONa+), which interacts with water, while the hydrophobic tail is a long hydrocarbon chain that interacts with oils, grease, and dirt.

• When soap is dissolved in water, the molecules arrange themselves into spherical aggregates known as micelles. In a micelle, the hydrophobic tails point towards the center to trap grease, while the hydrophilic heads face outwards toward the water. Hence, the statement regarding the ability to form micelles is correct.

• The cleansing action occurs because the oily dirt is collected in the center of the micelle. When the water is agitated, these micelles, containing the trapped dirt, are washed away, leaving the surface clean.

• Soap is generally the product of a weak acid and a strong base, making it slightly alkaline (basic) in nature, but its primary function of cleaning is purely a result of its surfactant properties rather than being a "strong base" or "strong acid". Hence, statements 1 and 2 are incorrect.

• The melting point of soap is a physical property determined by the length of the carbon chain and the type of cation used; it does not dictate the chemical mechanism of removing dirt. Hence, statement 3 is incorrect.

Additional Information

• Saponification: This is the chemical process used to manufacture soap. It involves the hydrolysis of fats or oils (triglycerides) using a strong alkali like Sodium Hydroxide (NaOH) for hard soaps or Potassium Hydroxide (KOH) for soft soaps.

• Emulsification: Soap acts as an emulsifier. Since oil and water do not mix, soap allows them to form a stable emulsion, enabling the oil to be suspended in water and rinsed off.

• Surface Tension: Soap molecules reduce the surface tension of water. By breaking the cohesive forces between water molecules, soap allows the water to "wet" the surface and the fabric fibers more effectively.

• Critical Micelle Concentration (CMC): This is the specific concentration of surfactants above which micelles start to form. Cleaning becomes efficient only once this concentration is reached in the solution.

Important Points

• Hard Water Interaction: Soap does not work effectively in hard water, which contains high levels of Calcium (Ca^{2+}) and Magnesium (Mg^{2+}) ions. These ions react with soap to form an insoluble precipitate called scum.

• Difference between Soaps and Detergents: Unlike soaps, synthetic detergents are sodium salts of alkyl hydrogen sulphates or alkyl benzene sulphonates. Detergents are superior because they do not form scum with hard water and can be used in acidic mediums.

• Biodegradability: Most traditional soaps are biodegradable because the hydrocarbon chains are straight. However, some older synthetic detergents with branched chains were non-biodegradable and caused water pollution.

• History: The use of soap-like materials dates back to 2800 BC in ancient Babylon, where they combined fats with wood ash (a source of alkali).

Q12. Answer: (b) is taken as negative

The correct answer is is taken as negative.

Key Points

• According to the New Cartesian Sign Convention, the object is always placed to the left of the lens. This ensures that the incident light from the object falls on the lens from the left-hand side.

• All distances measured to the right of the optical center (along the direction of incident light) are taken as positive, while all distances measured to the left of the optical center (against the direction of incident light) are taken as negative.

• Since the object is always placed on the left side, the object distance (u) is measured from the optical center to the left. Therefore, u is always taken as negative for both convex and concave lenses.

• This convention is fundamental for solving numerical problems using the lens formula and ensuring consistency in optical calculations. Hence, the correct answer is is taken as negative.

Additional Information

• Convex Lens (Converging Lens):

• A convex lens is thicker at the middle than at the edges. It converges a beam of parallel light rays falling on it.

• The focal length (f) of a convex lens is positive because the principal focus lies on the right side of the lens.

• It can form both real and virtual images depending on the position of the object. When the object is placed beyond the focus (F), the image is real and inverted. If placed between F and the optical center, the image is virtual and erect.

• Concave Lens (Diverging Lens):

• A concave lens is thinner at the middle than at the edges. It diverges parallel rays of light.

• The focal length (f) of a concave lens is always negative as the focus is considered to be on the left side.

• It always forms a virtual, erect, and diminished image, regardless of the object's distance.

• Lens Formula and Magnification:

• The Lens Formula is expressed as 1/v - 1/u = 1/f, where v is the image distance, u is the object distance, and f is the focal length.

• Magnification (m) is the ratio of the height of the image (h') to the height of the object (h), which is also equal to v/u.

Important Points

• Power of a Lens: The power (P) of a lens is the reciprocal of its focal length (f) measured in meters (P = 1/f). The SI unit of power is the Dioptre (D). A convex lens has positive power, while a concave lens has negative power.

• Image Distance (v) Rules: For a real image, v is positive (formed on the opposite side of the object). For a virtual image, v is negative (formed on the same side as the object).

• Height Convention: Heights measured upwards and perpendicular to the principal axis are positive (erect images), while heights measured downwards are negative (inverted images).

Q13. Answer: (a) Resistor

The correct answer is Resistor.

Key Points

• A resistor is a passive two-terminal electrical component that implements electrical resistance as a circuit element. Its primary function is to reduce current flow and, at the same time, act to lower voltage levels within circuits.

• In accordance with Ohm's Law, the current (I) flowing through a circuit is inversely proportional to the resistance (R) for a given voltage (V). This means that by increasing the resistance, one can effectively limit the current. Hence, the resistor is the component used for this purpose.

• Resistors work by converting electrical energy into heat energy through a process known as Joule heating. This occurs as electrons collide with the atoms of the resistive material, losing kinetic energy in the process.

• The standard unit of resistance is the Ohm, which is symbolized by the Greek letter Ω. Components are manufactured with specific resistance values ranging from less than one ohm to several million ohms (megohms).

Additional Information

• Switch:

• A switch is a device designed to interrupt the flow of electrons in a circuit or to divert it from one conductor to another.

• It operates in two primary states: Open (breaking the circuit, zero current) and Closed (completing the circuit, allowing current).

• While a switch controls whether current flows or not, it is not used to gradually limit or adjust the amount of resistance in the way a resistor does.

• Battery:

• A battery is a source of electric power consisting of one or more electrochemical cells with external connections.

• It provides the potential difference (voltage) necessary to drive current through a circuit.

• In a circuit diagram, the battery is the active component that supplies energy, whereas the resistor is a passive component that consumes or limits it.

• Lamp:

• An electric lamp (or light bulb) is a load that converts electrical energy into visible light and infrared radiation (heat).

• While a lamp possesses inherent resistance, its primary application is illumination, not the administrative control of current levels for other components.

Important Points

• Ohm's Law Formula: The relationship between the three fundamental electrical quantities is defined by the formula $V = I \times R$, where V is voltage in volts, I is current in amperes, and R is resistance in ohms.

• Fixed vs. Variable Resistors: Fixed resistors have a set resistance that cannot be changed. In contrast, variable resistors, such as potentiometers or rheostats, allow the user to adjust the resistance value to vary the volume, brightness, or speed of an appliance.

• Power Rating: Every resistor has a wattage rating (e.g., 1/4 watt, 5 watts) which specifies the maximum power it can dissipate without burning out. This is calculated using the formula $P = I^2R$.

• Resistor Color Code: Small resistors typically use a series of colored bands to denote their numerical value and tolerance. For example, a gold band usually signifies a 5% tolerance.

Q14. Answer: (c) 360.0 J

The correct answer is 360.0 J.

Key Points

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

• In this specific case, we are calculating Gravitational Potential Energy, which is the energy an object possesses due to its height in a gravitational field.

• The formula to calculate the Potential Energy of an object is given by PE = m × g × h, where m is the mass, g is the acceleration due to gravity, and h is the height.

• Given the values in the question:

• Mass (m) = 3 kg

• Height (h) = 12 m

• Acceleration due to gravity (g) = 10 m/s²

• Substituting these values into the formula: PE = 3 kg × 10 m/s² × 12 m.

• The calculation yields 3 × 120 = 360. Since the units for energy in the SI system is Joules (J), the result is 360.0 J. Hence, the correct answer is 360.0 J.

Additional Information

• Units of Energy: The standard International System of Units (SI) unit for energy and work is the Joule (J). One Joule is defined as the work done by a force of one Newton acting through a distance of one meter.

• Work-Energy Theorem: The potential energy gained by the object is exactly equal to the work done to lift it to that height. When an object is lifted at a constant speed, the applied force equals the weight (mg), and the work done is Force × Displacement (mg × h).

• Conservation of Energy: According to the Law of Conservation of Energy, energy cannot be created or destroyed, only transformed. If the 3 kg mass were dropped from 12 m, its potential energy would gradually convert into Kinetic Energy (KE) as it falls, reaching 360 J of Kinetic Energy just before hitting the ground.

• Factors Affecting PE: Gravitational Potential Energy is directly proportional to the mass of the object and its height above the reference point. If the mass were doubled, the potential energy would also double.

Important Points

• Reference Level: Potential energy is always measured relative to a reference point (usually the ground). If the reference point changes, the value of the potential energy changes, although the difference in energy between two heights remains the same.

• Scalar Quantity: Energy is a scalar quantity, meaning it has magnitude but no direction. This distinguishes it from vectors like velocity or force.

• Dimensional Formula: The dimensional formula for Potential Energy (and all forms of energy/work) is [ML²T^-²].

• Elastic Potential Energy: Apart from gravitational, another common type is Elastic Potential Energy, which is stored in objects like springs or rubber bands when they are stretched or compressed, calculated using the formula 1/2 kx².

Q15. Answer: (c) 25 gm

The correct answer is 25 gm.

Key Points

• The fundamental principle governing this reaction is the Law of Conservation of Mass, which states that mass is neither created nor destroyed in a chemical reaction.

• According to this law, the total mass of the reactants must be equal to the total mass of the products in a isolated or closed system.

• In the given scenario, substance A has a mass of 15 gm and substance B has a mass of 10 gm. The total mass of the reactants is 15 gm + 10 gm = 25 gm.

• Since the reaction takes place in a Closed System, no matter can escape to the surroundings. Therefore, the total mass of the products formed must be exactly 25 gm. Hence, the correct answer is 25 gm.

• This law was established by the French chemist Antoine Lavoisier in 1789, which laid the foundation for modern chemistry and stoichiometry.

Additional Information

• Closed System:

• A closed system is a physical system that allows the exchange of energy (like heat or work) but does not allow the exchange of matter with its surroundings.

• In chemistry experiments, using a closed container ensures that gaseous products do not escape, allowing for the accurate measurement of mass before and after the reaction.

• Open System vs. Isolated System:

• An Open System can exchange both energy and matter. For example, if substance A and B reacted in an open beaker and produced a gas, the measured mass of the products would appear less than 25 gm because the gas escaped.

• An Isolated System cannot exchange neither energy nor matter with the surroundings.

• Stoichiometry:

• This involves using balanced chemical equations to calculate the relative quantities of reactants and products.

• While the chemical identity of the substances changes (A and B become products), the number of atoms of each element

remains the same, ensuring the mass remains constant.

Important Points

• Mass-Energy Equivalence: In modern physics, specifically nuclear reactions, mass can be converted into energy according to Albert Einstein's equation $E = mc^2$. However, in standard chemical reactions, the change in mass is so infinitesimal that the Law of Conservation of Mass holds true for all practical purposes.

• Limiting Reagents: Even if one substance is in excess and does not fully react, the total mass (products + leftover reactants) will still equal the initial mass of 25 gm.

• Antoine Lavoisier: Known as the Father of Modern Chemistry, he replaced the older Phlogiston theory with the correct understanding of combustion and mass conservation.

Q16. Answer: (a) Availability of flowering plants throughout the year

The correct answer is Availability of flowering plants throughout the year.

Key Points

• Beekeeping, also known as Apiculture, is the maintenance of honeybee colonies, commonly in hives, by humans. The success of this practice is heavily dependent on the surrounding environment, specifically the pasturage.

• Pasturage refers to the flowering plants available to the bees for nectar and pollen collection. The Availability of flowering plants throughout the year ensures a continuous food supply, which is critical for the survival of the colony and the production of honey. Hence, statement 1 is correct.

• The quality and taste of honey are determined by the type of flowers available. A diverse range of flora allows bees to produce better quality honey.

• Growing crops like wheat and rice does not support beekeeping because these are wind-pollinated (anemophilous) crops and do not produce the nectar required by bees. Hence, statement 2 is incorrect.

• While bees are pollinating insects, their "presence" is the result of beekeeping; the primary condition for the bees to thrive is the food source (flowers), not the presence of other pollinators. Hence, statement 3 is not the major prerequisite.

• The use of pesticides is actually a major threat to beekeeping. Chemical pesticides can be toxic to bees, leading to Colony Collapse Disorder (CCD) and high mortality rates in the hive. Hence, statement 4 is incorrect.

Additional Information

• Honey Bee Species:

• Common species used in India include Apis cerana indica (Indian bee), Apis dorsata (Rock bee), and Apis florea (Little bee).

• The Apis mellifera (Italian bee) is frequently introduced for commercial honey production because of its high honey collection capacity and the fact that it stings less and stays in a given beehive for long periods.

• Bee Colony Structure:

• A typical honeybee colony is highly organized and consists of three types of individuals: one Queen (the only fertile female), a few hundred Drones (fertile males), and thousands of Worker bees (sterile females).

• Worker bees perform all tasks including foraging for nectar, building the comb, and protecting the hive.

• Products of Beekeeping:

• Honey: A natural food source rich in iron, calcium, and sugars. It is widely used in indigenous systems of medicine.

• Beeswax: Secreted by the abdominal glands of worker bees, it is used in the manufacture of cosmetics, polishes, and pharmaceuticals.

• Royal Jelly: A nutrient-rich substance fed to larvae and adult queens, often used as a dietary supplement.

• Economic and Ecological Importance:

• Bees are vital pollinators for many crops like sunflower, mustard, apple, and pear. Keeping beehives in crop fields during the flowering period increases pollination efficiency and improves the yield of both the crop and honey.

• The Khadi and Village Industries Commission (KVIC) in India promotes beekeeping through initiatives like the Honey Mission (launched in 2017) to provide employment to rural youth and farmers.

Important Points

• An Apiary is a place where beehives are kept for commercial or research purposes. For a successful apiary, it should be located in a place where there is adequate pasturage within a 1 to 2-kilometer radius.

• Seasonal Management: Beekeepers must provide artificial feeding (sugar syrup) during the dearth period (when flowers are scarce) to ensure the colony does not starve.

• The National Beekeeping and Honey Mission (NBHM) is a central sector scheme launched under the Atmanirbhar Bharat package to achieve the goal of a 'Sweet Revolution' in India.

Q17. Answer: (d) By reduction using carbon

The correct answer is By reduction using carbon.

Key Points

• The metals in the middle of the activity series, such as Iron (Fe), Zinc (Zn), Lead (Pb), and Copper (Cu), are moderately reactive. They are usually found in nature as sulphides or carbonates.

• Since it is easier to extract a metal from its oxide rather than its sulphides or carbonates, these ores are first converted into metal oxides. This is achieved through processes like Roasting (for sulphide ores) and Calcination (for carbonate ores).

• After conversion, the metal oxides are reduced to the corresponding metals using suitable reducing agents such as carbon (in the form of coke). For example, when Zinc Oxide (ZnO) is heated with carbon, it is reduced to metallic Zinc (Zn).

• The chemical reaction for this process is: ZnO + C → Zn + CO. This method is efficient and cost-effective for metals with medium reactivity. Hence, the correct answer is By reduction using carbon.

Additional Information

• Extraction of High Reactivity Metals:

• Metals at the top of the activity series, such as Potassium (K), Sodium (Na), Calcium (Ca), Magnesium (Mg), and Aluminium (Al), are very reactive.

• These metals cannot be reduced by carbon because they have a higher affinity for oxygen than carbon does.

• They are extracted through electrolytic reduction (electrolysis) of their molten chlorides or oxides. For instance, Sodium is obtained by the electrolysis of molten Sodium Chloride (NaCl).

• Extraction of Low Reactivity Metals:

• Metals at the bottom of the activity series are very unreactive and often found in a native state (free state), like Gold and Silver.

• Some, like Mercury, can be extracted by heating alone. For example, Cinnabar (HgS), an ore of mercury, is heated in air to first convert it into Mercuric Oxide (HgO), which then reduces to Mercury upon further heating.

• Use of Displacement Reactions:

• Sometimes, highly reactive metals like Sodium, Calcium, or Aluminium are used as reducing agents to displace metals of lower reactivity from their compounds.

• An example is the Thermite Reaction, where Iron Oxide (Fe2O3) is reacted with Aluminium powder to produce molten iron, commonly used to join railway tracks.

Important Points

• 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 ores strongly in limited air (or absence of air) to convert them into oxides.

• Activity Series: A list that ranks metals in descending order of their chemical reactivity, which dictates the metallurgical method required for extraction.

Q18. Answer: (a) 6 and 6

The correct answer is 6 and 6.

Key Points

• The chemical notation for an element is typically represented as ^A_ZX, where X is the chemical symbol, Z is the atomic number, and A is the mass number.

• The atomic number (Z) represents the total number of protons present in the nucleus of an atom. Since the identity of an element is determined by its number of protons, all atoms of Carbon must have the same atomic number.

• For the isotope $^{12}_{6}C$, the subscript 6 indicates that the atomic number is 6. Therefore, it contains 6 protons. Hence, the first part of the option is correct.

• For the isotope ^(14)6C, the subscript 6 again indicates that the atomic number remains 6, even though the mass number has changed to 14. This means it also contains 6 protons. Hence, the second part of the option is correct.

• In neutral atoms, the number of protons is equal to the number of electrons; however, the number of neutrons varies between these two isotopes, being 6 and 8 respectively.

Additional Information

• Isotopes: These are atoms of the same element that have the same number of protons (atomic number) but different numbers of neutrons (mass number). Carbon-12 and Carbon-14 are classic examples of isotopes.

• Carbon-12 (^{12}C): This is the most abundant stable isotope of carbon, accounting for approximately 98.9% of all natural carbon on Earth. It is used as the standard for atomic weight measurements.

• Carbon-14 (^(14)C): This is a radioactive isotope of carbon. It is famously used in radiocarbon dating to determine the age of organic materials up to about 50,000 years old. It has a half-life of approximately 5,730 years.

• Calculation of Neutrons: The number of neutrons can be calculated using the formula: Neutrons = Mass Number (A) - Atomic Number (Z).

• For $^{12}_{6}C$: 12 - 6 = 6 neutrons.

• For ^(14)6C: 14 - 6 = 8 neutrons.

• Subatomic Particles: Protons and neutrons are located in the nucleus (collectively called nucleons), while electrons orbit the

nucleus in various energy levels or shells. The proton has a positive charge (+1), the electron has a negative charge (-1), and the neutron is neutral (0).

Important Points

• The atomic number of Carbon is always 6. This is its fundamental characteristic in the Periodic Table.

• While isotopes differ in physical properties (like mass and density), they exhibit nearly identical chemical properties because chemical behavior is determined by the number of electrons, which is the same as the number of protons in a neutral atom.

• Isobars: Unlike isotopes, isobars are atoms of different chemical elements that have the same mass number but different atomic numbers (e.g., Argon-40 and Calcium-40).

Q19. Answer: (a) kilograms per cubic metre

The correct answer is kilograms per cubic metre.

Key Points

• Density is a fundamental physical property defined as the mass of a substance per unit volume. It indicates how tightly matter is packed together within a specific space.

• The mathematical formula to determine density is expressed as Density = Mass / Volume. This relationship shows that density is directly proportional to mass and inversely proportional to volume.

• In the International System of Units (SI), mass is measured in kilograms (kg) and length is measured in metres (m). Consequently, the unit for volume is derived as the cubic metre (m^3).

• By combining these base units, the SI unit for density is derived as kilograms per cubic metre, which is written symbolically as kg/m^3.

• Density is considered an intensive property, meaning the value remains constant regardless of the size or quantity of the material being measured, provided the temperature and pressure are constant. Hence, the correct answer is kilograms per cubic metre.

Additional Information

• CGS Units: In the Centimetre-Gram-Second (CGS) system, density is frequently expressed in grams per cubic centimetre (g/cm^3). This unit is commonly used in chemistry and laboratory settings.

• Conversion Factor: It is important to note that 1 g/cm^3 is equivalent to 1000 kg/m^3. For example, if a substance has a density of 2.5 g/cm^3, its SI value is 2500 kg/m^3.

• Density of Water: The density of pure water is a standard reference point, valued at 1000 kg/m^3 (or 1 g/cm^3) at a temperature of 4 degrees Celsius. This is the temperature where water reaches its maximum density.

• Relative Density: This quantity, also known as Specific Gravity, is the ratio of the density of a substance to the density of a reference material (usually water). Because it is a ratio, it is dimensionless and has no units.

• Common Materials: Different materials exhibit widely varying densities; for instance, Air has a very low density of approximately 1.2 kg/m^3 at sea level, while Iron has a much higher density of about 7,874 kg/m^3.

Important Points

• Effect of Temperature: Generally, as the temperature of a substance increases, its particles move faster and spread apart, increasing the volume and thereby decreasing the density.

• Effect of Pressure: Increasing the pressure on a substance, particularly gases, forces the particles closer together. This reduction in volume leads to an increase in density.

• Buoyancy and Floating: According to Archimedes' Principle, an object will float if its density is less than the density of the liquid it is placed in, and it will sink if its density is greater.

• Measuring Instruments: Scientists use specific tools like hydrometers to measure the density of liquids and pycnometers to determine the density of solids or liquids with high precision.

• Mercury: This liquid metal is exceptionally dense, with a value of approximately 13,600 kg/m^3, making it much heavier than an equal volume of water.

Q20. Answer: (c) Binary fission produces two daughter cells, whereas multiple fission produces many daughter cells at once.

The correct answer is Binary fission produces two daughter cells, whereas multiple fission produces many daughter cells at once.

Key Points

• Binary fission is a method of asexual reproduction where a single-celled parent organism divides into two new daughter cells that are nearly equal in size.

• Multiple fission is a process where the parent cell divides into many daughter cells simultaneously, often as a survival mechanism during unfavorable conditions.

• Statement 1 suggests that binary fission requires spores. This is false because spore formation is a separate asexual method used by organisms like fungi (e.g., Rhizopus) and ferns. Hence, statement 1 is incorrect.

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• Statement 2 claims binary fission occurs in multicellular organisms. In reality, it is the primary mode of reproduction for prokaryotes (like bacteria) and certain unicellular eukaryotes (like Amoeba). Hence, statement 2 is incorrect.

• Statement 3 correctly identifies that the fundamental difference lies in the number of offspring; two for binary and many for multiple fission. Hence, statement 3 is correct.

• Statement 4 incorrectly swaps the outcomes of the two processes, claiming binary fission produces many cells. Hence, statement 4 is incorrect.

Additional Information

• Binary Fission in Different Organisms:

• In Amoeba, the division can take place in any plane because the organism lacks a fixed shape.

• In Leishmania (the pathogen causing Kala-azar), which possesses a flagellum (whip-like structure), binary fission occurs in a definite orientation (longitudinal) in relation to the flagellum.

• This process involves DNA replication followed by the division of the nucleus (karyokinesis) and then the cytoplasm (cytokinesis).

• Multiple Fission Characteristics:

• A classic example of multiple fission is seen in Plasmodium, the malarial parasite.

• During this process, a protective wall called a cyst is often formed around the cell. The nucleus inside the cyst divides repeatedly to form several daughter nuclei, which then develop into separate cells.

• Once conditions become favorable, the cyst breaks open, releasing all the daughter cells at once.

• General Features of Fission:

• Fission is a form of asexual reproduction, meaning there is no fusion of gametes (sperm and egg).

• The resulting daughter cells are genetically identical to the parent cell, making them clones.

• It is an extremely rapid process under optimal conditions (e.g., some bacteria can divide every 20 minutes), allowing populations to grow exponentially.

Important Points

• Comparison Table:

• Binary Fission: Occurs during favorable conditions; Parent cell identity is lost; Results in two individuals; Examples: Bacteria, Paramecium, Euglena.

• Multiple Fission: Often occurs during unfavorable conditions; A residual mass of cytoplasm may remain; Results in numerous individuals; Examples: Plasmodium, Monocystis.

• The States of Division: In both types, the replication of genetic material is the first and most critical step to ensure each daughter cell receives a functional copy of the genome.

Q21. Answer: (d) 50 km/hr

Shortcut Trick

Net distance = End reading − Start reading

Net distance = 3200 − 3000 = 200 km

Average speed = Distance ÷ Time

Average speed = 200 ÷ 4 = 50 km/hr

Therefore The correct answer is 50 km/hr.

Alternate Method

Given:

Odometer reading at start = 3000 km

Odometer reading at end = 3200 km

Total journey time = 4 hours

Formula used: Average speed = (Total Distance covered) ÷ (Total Time taken)

=> Total Distance = Final Odometer Reading − Initial Odometer Reading => Total Distance = 3200 − 3000 = 200 km => Average Speed = Total Distance ÷ Total Time => Average Speed = 200 ÷ 4 => Average Speed = 50 km/hr

Therefore The correct answer is 50 km/hr.

Additional Information

Average Speed (Equal Distances)

If a journey covers two equal distances at speeds x and y, the average speed is 2xy ÷ (x + y).

Unit Conversion

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

Odometer vs. Speedometer

An odometer measures the total distance traveled by the vehicle, while a speedometer measures the instantaneous speed.

Q22. Answer: (c) Acetic acid in water

The correct answer is Acetic acid in water.

Key Points

• Vinegar is essentially a dilute aqueous solution consisting primarily of Acetic acid and water.

• In standard commercial vinegar, the concentration of acetic acid typically varies between 5% and 8% by volume, though some specialty table vinegars may have slightly different concentrations.

• The chemical name for acetic acid is ethanoic acid, and its chemical formula is represented as CH3COOH.

• It is produced through a biological process known as fermentation. This is usually a two-step process where yeast first converts sugars into ethanol, and then Acetic Acid Bacteria (specifically from the genus Acetobacter) oxidize the ethanol into acetic acid.

• Because of its acetic acid content, vinegar possesses a distinctly sour taste and a pungent odor, which are characteristic of weak acids.

Additional Information

• Sodium hydroxide (NaOH):

• Commonly known as caustic soda or lye, it is a strong base and not an acid.

• It is highly corrosive and used in the manufacture of soaps, paper, and synthetic fibers like rayon. It is not a component of vinegar.

• Calcium carbonate (CaCO3):

• This is a chemical compound found commonly in rocks such as limestone, marble, and chalk.

• It is also the primary component of eggshells and seashells. It is largely insoluble in water and does not form the solution known as vinegar.

• Formic acid (HCOOH):

• Also known as methanoic acid, it is the simplest carboxylic acid.

• It is naturally found in the venom of ants and bees (stingers). While it is an acid, a solution of formic acid in water is not referred to as vinegar.

• Applications of Vinegar:

• In the food industry, it is used as a preservative for pickling vegetables and as a flavoring agent in salad dressings.

• In households, it serves as an eco-friendly cleaning agent capable of removing mineral deposits from glass and other surfaces.

Important Points

• Chemical Properties: Acetic acid is considered a weak acid because it only partially dissociates into its ions in an aqueous solution.

• pH Level: Commercial vinegar usually has a pH level ranging from 2.4 to 3.4, depending on the concentration of the acid.

• Glacial Acetic Acid: Pure, water-free acetic acid is called glacial acetic acid. It forms ice-like crystals at temperatures below 16.6 degrees Celsius (62 degrees Fahrenheit).

• Types of Vinegar: Depending on the source material used for fermentation, vinegar can be classified into several types, such as Apple Cider Vinegar (from apples), White Vinegar (often from grain alcohol), and Balsamic Vinegar (from grapes).

Q23. Answer: (b) It involves the fusion of male and female gametes.

The correct answer is It involves the fusion of male and female gametes.

Key Points

• Asexual reproduction is a mode of reproduction that involves only one parent. The offspring produced are biological copies of the parent organism because there is no mixing of genetic material from two different individuals. Hence, statement 3 is correct.

• One of the primary characteristics of asexual reproduction is that it does not involve the fusion of male and female gametes. The process of gamete formation and their subsequent fusion (fertilization) is the hallmark of sexual reproduction. In asexual reproduction, the single parent undergoes cell division to produce offspring. Hence, statement 2 is incorrect.

• Fission is a common method of asexual reproduction widely observed in unicellular organisms. It can be Binary Fission, where a cell divides into two equal halves (e.g., Amoeba), or Multiple Fission, where a cell divides into many daughter cells simultaneously (e.g., Plasmodium). Hence, statement 1 is correct.

• This process produces offspring that are genetically identical clones of the parent. Because the offspring inherit the exact DNA of the single parent through Mitosis, they are morphological and genetic carbon copies. Hence, statement 4 is correct.

• Asexual reproduction is typically rapid and requires less energy compared to sexual reproduction, allowing organisms to increase their population size quickly in favorable environmental conditions.

Additional Information

• Types of Asexual Reproduction:

• Budding: A small bud or outgrowth develops on the parent body, which eventually detaches to become a new individual. Examples include Yeast and Hydra.

• Fragmentation: The parent body breaks into several pieces, and each fragment grows into a complete new organism. This is common in Spirogyra and some flatworms.

• Regeneration: This is the ability of an organism to regrow lost body parts or form a whole new organism from a small fragment. Planaria is a classic example of high regenerative capacity.

• Spore Formation: Organisms like Fungi (e.g., Rhizopus) and some ferns produce microscopic reproductive structures called spores that germinate into new individuals under favorable conditions.

• Vegetative Propagation: A form of asexual reproduction in plants where new plants are produced from vegetative parts like roots, stems, or leaves (e.g., Potato tubers, Onion bulbs, and Bryophyllum leaf buds).

• Key Differences:

• In Sexual Reproduction, two parents are involved, Meiosis occurs to form haploid gametes, and there is significant genetic variation due to crossing over.

• In Asexual Reproduction, there is no evolutionary variation unless a mutation occurs, as the offspring are identical to the parent.

Important Points

• Clone Definition: In biology, a clone refers to a group of cells or an entire organism that is genetically identical to the unit from which it was derived. In asexual reproduction, the term is used because the nuclear DNA remains unchanged from parent to offspring.

• Occurrence: Asexual reproduction is prevalent in prokaryotes (like Bacteria and Archaea), many protists, fungi, and even some invertebrate animals and plants.

• Mitosis: This is the underlying cellular mechanism for asexual reproduction. During Mitosis, the parent cell replicates its chromosomes and segregates them into two identical nuclei for the daughter cells.

• Significance: While it lacks the variation needed for rapid evolution in changing environments, it is highly efficient for colonizing stable habitats where the parent's traits are already well-adapted for survival.

Q24. Answer: (a) Adrenaline

The correct answer is Adrenaline.

Key Points

• Adrenaline, also known as epinephrine, is the primary hormone secreted by the adrenal glands (specifically the adrenal medulla) during scary, stressful, or emergency situations.

• It is famously known as the “fight-or-flight” hormone because it prepares the animal body to either face a threat or run away from it. Hence, option 1 is correct.

• When an animal perceives a scary situation, the brain sends signals to the adrenal glands to release adrenaline directly into the bloodstream.

• This hormone rapidly increases the heart rate, resulting in a higher supply of oxygen to the muscles.

• It also triggers the breakdown of glycogen into glucose in the liver, providing an immediate surge of energy to the body.

• Other physical responses include the dilation of pupils, increased breathing rate, and the contraction of small arteries to divert blood toward essential organs like the skeletal muscles.

Additional Information

• Insulin:

• It is a peptide hormone produced by the beta cells of the Islets of Langerhans in the pancreas.

• Its primary function is to regulate blood glucose levels by promoting the absorption of glucose from the blood into the liver, fat, and skeletal muscle cells.

• A deficiency in insulin production leads to a medical condition known as Diabetes Mellitus. Hence, option 2 is incorrect in the context of scary situations.

• Growth Hormone (GH):

• Also known as somatotropin, it is secreted by the anterior pituitary gland located at the base of the brain.

• It stimulates growth, cell reproduction, and cell regeneration in humans and other animals.

• Improper secretion can lead to dwarfism (low secretion in childhood) or gigantism (excessive secretion). Hence, option 3 is incorrect in the context of scary situations.

• Thyroxin:

• This is the main hormone secreted into the bloodstream by the thyroid gland, located in the neck.

• It plays a vital role in regulating the body's basal metabolic rate (BMR) and controls the metabolism of carbohydrates, proteins, and fats.

• Iodine is a necessary component for the synthesis of thyroxin; its deficiency can cause Goitre. Hence, option 4 is incorrect in the

context of scary situations.

Important Points

• The Endocrine System: It is a messenger system comprising feedback loops of hormones released by internal glands directly into the circulatory system.

• Location of Adrenal Glands: In mammals, these are triangle-shaped glands located on top of both kidneys.

• Noradrenaline: Along with adrenaline, the adrenal medulla also secretes noradrenaline (norepinephrine), which helps in maintaining blood pressure and increasing alertness during stress.

• Chemical Coordination: Unlike the nervous system which uses electrical impulses, the endocrine system provides chemical coordination, which is slower to initiate but often has longer-lasting effects on the body.

Q25. Answer: (d) Gas exchange and storage

The correct answer is Gas exchange and storage.

Key Points

• Parenchyma is the most common and fundamental type of simple permanent tissue found in plants, consisting of relatively unspecialized living cells with thin cell walls made of cellulose.

• These cells are typically isodiametric in shape and are characterized by being loosely packed, which results in large intercellular spaces between them.

• The primary function of these large intercellular spaces is to facilitate gas exchange (diffusion of oxygen and carbon dioxide) within the plant body, which is essential for respiration and photosynthesis. Hence, the statement regarding gas exchange is correct.

• Parenchyma cells also possess a large central vacuole, which serves as a major site for the storage of nutrients, water, and food reserves such as starch. Hence, the statement regarding storage is correct.

• These cells are found in various parts of the plant, including the pith, cortex of stems and roots, and the mesophyll of leaves, where they perform vital metabolic functions.

Additional Information

• Types of Simple Permanent Tissues:

• Collenchyma: This tissue provides mechanical support and flexibility to young plant parts like the petiole. Its cells have thickened corners due to the deposition of cellulose and pectin, and they have very little intercellular space.

• Sclerenchyma: Composed of dead cells with highly thickened walls containing lignin, this tissue makes the plant parts hard and stiff (e.g., the husk of a coconut). It provides structural strength but lacks intercellular spaces.

• Specialized Parenchyma:

• Chlorenchyma: When parenchyma cells contain chlorophyll and perform photosynthesis, they are referred to as chlorenchyma.

• Aerenchyma: In aquatic plants, parenchyma cells develop large air cavities to provide buoyancy, helping the plants float; this specialized form is called aerenchyma.

• Functions and Characteristics:

• The Epidermis is the outermost protective layer of the plant, often covered by a waxy cuticle to reduce transpiration.

• Complex Permanent Tissues like Xylem and Phloem are responsible for the conduction of water and food, respectively, throughout the plant system.

• Parenchyma cells retain the ability to divide even at maturity (totipotency), which is crucial for wound healing and regeneration in plants.

Q26. Answer: (d) 354

Shortcut Trick

Convert ratio 1/2 : 1/6 : 1/4 to whole numbers by multiplying with LCM(2, 6, 4) = 12.

New Ratio = 6 : 2 : 3. Total units = 6 + 2 + 3 = 11 units.

11 units = 649 => 1 unit = 59.

First monkey = 6 units = 6 × 59 = 354.

Therefore The correct answer is 354 bananas.

Alternate Method

Given: Total bananas = 649, Ratio = 1/2 : 1/6 : 1/4

=> Ratio of bananas = 1/2 : 1/6 : 1/4

=> Multiply each by 12 → (1/2 × 12) : (1/6 × 12) : (1/4 × 12) = 6 : 2 : 3

=> Sum of ratio parts = 6 + 2 + 3 = 11

=> Share of first monkey = (6/11) × 649

=> Share = 6 × 59 = 354

Therefore The correct answer is 354 bananas.

Additional Information

Ratio Simplification

To convert a fractional ratio a/b : c/d to a whole number ratio, multiply both terms by the LCM of the denominators (b and d).

Proportional Division

If a quantity Z is divided in ratio a:b:c, the share of the first part is calculated as [a / (a + b + c)] × Z.

Inverse Ratio

The inverse ratio of a : b is 1/a : 1/b, which simplifies to b : a for two terms.

Q27. Answer: (d) 23,520π

Shortcut Trick

Equate increase in volumes: $\pi \times (r + 14)^2 \times h - \pi r^2 h = \pi r^2 \times (h + 30) - \pi r^2 h$

Given Height (h) = 24 cm => $24 \times (28r + 196) = 30r^2$

Solving the quadratic $5r^2 - 112r - 784 = 0$ gives Radius (r) = 28 cm.

Calculate $Q = 30 \times \pi \times r^2 = 30 \times \pi \times 28^2 = 23{,}520\pi$ cm³.

Therefore The correct answer is 23,520π cm³.

Alternate Method

Given: Height (h) = 24 cm, increase in radius = 14 cm, increase in height = 30 cm, Increase in volume = Q cm³.

Formula Used: Volume of Cylinder = $\pi r^2 h$

=> Case 1: Increase in volume for vessel 1 (radius increases by 14)

=> $Q = \pi(r + 14)^2 h - \pi r^2 h$

=> $Q = \pi h[(r + 14)^2 - r^2] = \pi h[r^2 + 28r + 196 - r^2] = \pi h(28r + 196)$

=> Case 2: Increase in volume for vessel 2 (height increases by 30)

=> $Q = \pi r^2(h + 30) - \pi r^2 h = 30\pi r^2$

=> Equating Case 1 and Case 2: $24\pi(28r + 196) = 30\pi r^2$

=> $4(28r + 196) = 5r^2$

=> $112r + 784 = 5r^2$ => $5r^2 - 112r - 784 = 0$

=> Roots: $r = [112 \pm \sqrt{(12544 + 15680)}] / 10 = [112 \pm 168] / 10$

=> r = 280 / 10 = 28 cm (ignoring negative value)

=> $Q = 30 \times \pi \times (28)^2 = 30 \times 784 \times \pi = 23{,}520\pi$

Therefore The correct answer is 23,520π cm³.

Additional Information

Volume of Cylinder

The volume of a cylinder is calculated as $V = \pi r^2 h$, where r is the radius and h is the height.

Total Surface Area of Cylinder

The total surface area includes the curved surface and the two circular bases: $TSA = 2\pi rh + 2\pi r^2 = 2\pi r(r + h)$.

Curved Surface Area (CSA)

The area of the lateral surface of the cylinder: $CSA = 2\pi rh$.

Q28. Answer: (d) 42

Shortcut Trick

Number of terms divisible by n in the range [1, L] is given by floor(L ÷ n).

Required count = floor(650 ÷ 7) − floor(351 ÷ 7)

Required count = 92 − 50 = 42

Therefore The correct answer is 42.

Alternate Method

Given: Range is between 351 and 650. We need to find numbers divisible by 7.

Formula Used: n^(th) term of Arithmetic Progression (AP): $a_n = a + (n - 1)d$

=> First number after 351 divisible by 7: 351 ÷ 7 = 50.14 → 7 × 51 = 357 (a)

=> Last number before 650 divisible by 7: 650 ÷ 7 = 92.85 → 7 × 92 = 644 (a_n)

=> $644 = 357 + (n - 1) \times 7$

=> $644 - 357 = (n - 1) \times 7$

=> 287 = (n − 1) × 7
=> 41 = n − 1
=> n = 42
Therefore The correct answer is 42.
Additional Information
Arithmetic Progression (AP)
A sequence where the difference between consecutive terms is constant. Sum S_n = n/2[2a + (n−1)d].
Divisibility Rule of 7
Double the last digit and subtract it from the remaining number. If the result is divisible by 7, the number is divisible by 7.
Inclusive vs Exclusive Ranges
Between A and B usually excludes A and B. From A to B usually includes both endpoints.

Q29. Answer: (c) 36,000

Shortcut Trick
Difference in percentage between Candidate A and Candidate B = 60% − 30% = 30%.
Difference in votes = 30% of 1,20,000.
Difference = 0.30 × 1,20,000 = 36,000.
Therefore The correct answer is 36,000 votes.
Alternate Method
Given:
Total votes = 1,20,000
Candidate A share = 60%
Candidate B share = 30%
Formula Used: Number of votes = (Percentage ÷ 100) × Total votes
Calculations:
=> Votes for Candidate A = (60 ÷ 100) × 1,20,000 = 72,000
=> Votes for Candidate B = (30 ÷ 100) × 1,20,000 = 36,000
=> Required difference = 72,000 − 36,000
=> Difference = 36,000
Therefore The correct answer is 36,000 votes.
Additional Information
Percentage Change
To find the percentage difference between two values, use: |Value1 − Value2| ÷ Reference Value × 100.
Base Change in Election Problems
Always ensure all individual percentages (60% + 30% + 10%) sum up to 100% of the total valid votes.
Successive Percentage
If values change successively, the net percentage change is given by a + b + (ab ÷ 100).

Q30. Answer: (b) 4

Shortcut Trick
Since bases are same => equate powers
(x^4 + x² + 1)/(x² + x + 1) = 2x + 5
Factor: x^4 + x² + 1 = (x² − x + 1)(x² + x + 1)
=> LHS = x² − x + 1
So x² − x + 1 = 2x + 5
=> x² − 3x − 4 = 0
=> (x − 4)(x + 1) = 0
Positive value => x = 4
Therefore Answer = 4
Alternate Method
Given:
3^((x^4 + x² + 1)/(x² + x + 1)) = 3^(2x + 5)

Concept Used:

If a^m = a^n => m = n

Calculation:

=> (x^4 + x² + 1)/(x² + x + 1) = 2x + 5

=> x^4 + x² + 1 = (x² + x + 1)(2x + 5)

=> Simplify => x² − 3x − 4 = 0

=> Solve => x = 4, −1

=> Positive value => x = 4

Therefore The correct answer is 4.

Additional Information

Exponent Rule

Same base => powers are equal

Factorization

x^4 + x² + 1 = (x² − x + 1)(x² + x + 1)

Root Selection

Choose positive solution as required

Q31. Answer: (d) 150 minutes

Shortcut Trick

Relative Speed when moving towards each other = Sum of speeds = 13 + 17 = 30 km/hr.

Time to meet = Distance ÷ Relative Speed = 75 ÷ 30 = 2.5 hours.

Convert to minutes: 2.5 × 60 = 150 min.

Therefore The correct answer is 150 min.

Alternate Method

Given:

Distance (D) = 75 km

Speed of Engine 1 (S1) = 13 km/hr

Speed of Engine 2 (S2) = 17 km/hr

Formula Used:

Time = Distance ÷ Relative Speed

Relative Speed (Opposite Direction) = S1 + S2

Calculations:

=> Relative Speed = 13 + 17 = 30 km/hr

=> Time (in hours) = 75 ÷ 30

=> Time (in hours) = 2.5 hours

=> Time (in minutes) = 2.5 × 60

=> Time = 150 min

Therefore The correct answer is 150 min.

Additional Information

Relative Speed Concept

When two objects move toward each other, their relative speed is the sum of their individual speeds (S1 + S2). If they move in the same direction, it is the difference |S1 − S2|.

Unit Conversion

To convert hours to minutes, multiply by 60. To convert km/hr to m/s, multiply by 5/18.

Meeting Point Distance

Distance from starting point of Engine 1 = S1 × Time = 13 × 2.5 = 32.5 km.

Q32. Answer: (c) 6

Shortcut Trick

For a Mean Proportional between two numbers x and y, the value of A is √(x × y).

Given values are 9 and 4.

A = √(9 × 4) = √36 = 6.

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Therefore The correct answer is 6.

Alternate Method

Given: 9 : A :: A : 4

Formula Used: In a proportion a : b :: c : d, the product of extremes is equal to the product of means (a × d = b × c).

=> 9 ÷ A = A ÷ 4

=> A × A = 9 × 4

=> $A^2 = 36$

=> A = √36

=> A = 6

Therefore The correct answer is 6.

Additional Information

Mean Proportional

If three numbers a, b, and c are in continued proportion (a : b :: b : c), then b is called the mean proportional and $b^2 = ac$.

Third Proportional

In the continued proportion a : b :: b : c, the term c is known as the third proportional to a and b, calculated as $c = b^2 \div a$.

Fourth Proportional

For four numbers in proportion a : b :: c : d, d is the fourth proportional and is calculated as d = (b × c) ÷ a.

Q33. Answer: (c) $9x^2 + 12x + 4$

Shortcut Trick

Apply the algebraic identity $(a + b)^2 = a^2 + 2ab + b^2$.

First term square: $(3x)^2 = 9x^2$

Middle term (2 × Product): 2 × 3x × 2 = 12x

Last term square: $2^2 = 4$

Combine all terms: $9x^2 + 12x + 4$

Therefore The correct answer is $9x^2 + 12x + 4$.

Alternate Method

Given:

Expression to simplify: $(3x + 2)^2$

Formula Used:

The standard expansion for a binomial square is $(a + b)^2 = a^2 + 2ab + b^2$.

Calculations:

=> Identify the values: a = 3x and b = 2.

=> Substitute into the expansion formula: $(3x + 2)^2 = (3x)^2 + 2 \times (3x) \times (2) + (2)^2$

=> Square the first term: $(3x)^2 = 9x^2$

=> Multiply the middle terms: 2 × 3x × 2 = 12x

=> Square the second term: $(2)^2 = 4$

=> Simplify the full expression: $9x^2 + 12x + 4$

Therefore The correct answer is $9x^2 + 12x + 4$.

Additional Information

Binomial Square (Subtraction)

The expansion for the difference of a binomial is $(a - b)^2 = a^2 - 2ab + b^2$.

Difference of Two Squares

Multiplying the sum and difference of the same terms results in $(a + b)(a - b) = a^2 - b^2$.

Square of a Trinomial

For three terms, the formula is $(a + b + c)^2 = a^2 + b^2 + c^2 + 2ab + 2bc + 2ca$.

Q34. Answer: (b) 33.95%

Shortcut Trick

The reasoning involves applying the successive discount formula iteratively to combine multiple percentage reductions into a single equivalent value.

Successive discount for 20% and 4% = 20 + 4 − (20 × 4) ÷ 100 = 23.2%.

Successive discount for 23.2% and 14% = 23.2 + 14 − (23.2 × 14) ÷ 100.

Result = 37.2 − 3.248 = 33.952%.

Therefore The correct answer is 33.95%.

Alternate Method

Given → Discounts = 20%, 4%, 14%.

Formulas: Net SP = MP × (100 − d1)% × (100 − d2)% × (100 − d3)% | Single Discount = 100 − Net SP.

=> Let Marked Price (MP) = 100.

=> After 20% discount: 100 × (80/100) = 80.

=> After 4% discount: 80 × (96/100) = 76.8.

=> After 14% discount: 76.8 × (86/100) = 66.048.

=> Single Discount = 100 − 66.048 = 33.952%.

Therefore The correct answer is 33.95%.

Additional Information

Successive Discounts

When a series of discounts are applied, the subsequent discount is calculated on the reduced price, not the original Marked Price.

Formula for Two Discounts

Equivalent single discount for a% and b% = (a + b − ab/100)%.

Q35. Answer: (c) 12°

Shortcut Trick

In any quadrilateral PQRS, the angle formed by the bisectors of two adjacent angles (angle R and angle S) is equal to half the sum of the other two angles (angle P and angle Q).

Logic: angle STR = (angle P + angle Q) ÷ 2

Calculation: 14° = (angle P + angle Q) ÷ 2 => angle P + angle Q = 28°

Given ratio angle P : angle Q = 2 : 5. Total parts = 7.

Difference = (5 − 2) ÷ 7 × 28° = 3 × 4° = 12°.

Therefore The correct answer is 12°.

Alternate Method

Given:

angle STR = 14° (Angle between bisectors of angle R and angle S)

Ratio angle P : angle Q = 2 : 5

Formula Used:

Sum of interior angles of a quadrilateral = 360°

In ΔSTR, angle TSR + angle TRS + angle STR = 180°

Calculations:

=> In ΔSTR: (angle S ÷ 2) + (angle R ÷ 2) + 14° = 180°

=> (angle S + angle R) ÷ 2 = 18

Q36. Answer: (a) 4

Shortcut Trick

Calculate the excess runs scored above the old average: 119 − 71 = 48 runs.

Distribute these excess runs equally across all 12 innings to find the average increase.

Increase in average = 48 ÷ 12 = 4 runs.

Therefore The correct answer is 4 runs.

Alternate Method

Given:

Average of 11 innings = 71 runs

Score in 12^(th) inning = 119 runs

Formula Used:

Total Sum = Average × Number of items

Increase in Average = New Average − Old Average

Calculations:

=> Total runs in 11 innings = 11 × 71 = 781 runs
=> Total runs after 12 innings = 781 + 119 = 900 runs
=> New average score = 900 ÷ 12 = 75 runs
=> Increase in average = 75 − 71 = 4 runs
Therefore The correct answer is 4 runs.
Additional Information
Net Change in Average
When a new value is added, the change in average = (New Value − Old Average) ÷ Total New Count.
Weighted Average Formula
Combined Average = (n1x1 + n2x2) ÷ (n1 + n2), where n is the count and x is the individual average.
Effect of Constant Addition
If a constant value 'k' is added to every observation in a data set, the new average also increases by exactly 'k'.

Q37. Answer: (b) 350

Shortcut Trick
Saving % = 100% − 30% = 70%
Daily Saving = 70% of Rs. 500
=> 0.70 × 500 = 350
Therefore The correct answer is Rs. 350.
Alternate Method
Given:
Daily Earning = Rs. 500
Expenditure Percentage = 30%
Formula Used:
Saving = Earning − Expenditure
Calculations:
=> Daily Expenditure = 30% of Rs. 500
=> Daily Expenditure = (30/100) × 500 = Rs. 150
=> Daily Saving = Total Earning − Daily Expenditure
=> Daily Saving = Rs. 500 − Rs. 150 = Rs. 350
Therefore The correct answer is Rs. 350.
Additional Information
Percentage Change
If a value is decreased by x%, the remaining value is (100 − x)% of the original.
Saving-Income Relation
Income = Expenditure + Savings. This fundamental equation is used for budget and tax problems.
Base Value
In profit, loss, or saving calculations, the Income or Cost Price is usually treated as the 100% base.

Q38. Answer: (d) 5 minutes

Shortcut Trick
Net efficiency = Filling rate − Emptying rate
Total capacity = LCM(5, 10) = 10 units
Filling pipe efficiency = 10 ÷ 5 = 2 units/min; Emptying pipe efficiency = 10 ÷ 10 = 1 unit/min
Net efficiency = 2 − 1 = 1 unit/min
Time to fill half tank (5 units) = 5 ÷ 1 = 5 minutes
Therefore The correct answer is 5 min.
Alternate Method

Pipe Type	Time (min)	Total Work (LCM)	Efficiency
Filling Pipe	5	10 units	+2
Emptying Pipe	10	−1	

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Given: Filling time = 5 min, Emptying time = 10 min.
Formula: Total Work = Time × Efficiency
=> Total Capacity of tank = LCM of 5 and 10 = 10 units
=> Capacity to be filled (one-half) = 10 ÷ 2 = 5 units
=> Combined Efficiency = 2 + (−1) = 1 unit/min
=> Required Time = Half Capacity ÷ Combined Efficiency
=> Required Time = 5 ÷ 1 = 5 minutes
Therefore The correct answer is 5 min.
Additional Information
Pipes and Cisterns Logic
Filling pipes have positive efficiency while outlet or emptying pipes have negative efficiency.
Net Work Formula
If pipe A fills in 'x' hours and pipe B empties in 'y' hours, net work in 1 hour = (1/x − 1/y).
Time and Work Relation
Total Work = Efficiency × Time. For partial filling, multiply the total capacity by the required fraction.

Q39. Answer: (c) 28

Shortcut Trick
Total days from 10 Feb to 24 Apr 2023 = 18 (Feb) + 31 (Mar) + 24 (Apr) = 73 days.
Time in years = 73 ÷ 365 = 1/5 year.
Simple Interest = (2000 × 7 × 1) ÷ (100 × 5) = 20 × 7 ÷ 5 = 4 × 7 = Rs. 28.
Therefore The correct answer is Rs. 28.
Alternate Method
Given:
Principal (P) = Rs. 2,000
Rate (R) = 7% per annum
Time period: 10 February 2023 to 24 April 2023
Step-by-step Calculation:
=> Number of days in Feb = 28 − 10 = 18 days (2023 is not a leap year)
=> Number of days in March = 31 days
=> Number of days in April = 24 days
=> Total days = 18 + 31 + 24 = 73 days
=> Time (T) in years = 73 ÷ 365 = 1/5 year
=> Simple Interest (SI) = (P × R × T) ÷ 100
=> SI = (2000 × 7 × 1/5) ÷ 100
=> SI = (400 × 7) ÷ 100
=> SI = 2800 ÷ 100 = Rs. 28
Therefore The correct answer is Rs. 28.
Additional Information
Standard Day Conversion
In simple interest problems involving days, 73 days is frequently used as it equals exactly 1/5 of a year (73 × 5 = 365).
Leap Year Check
Always check if February falls in a leap year (divisible by 4). If yes, February has 29 days; otherwise, it has 28 days.
Date Calculation Rule
While counting days, generally the day on which money is deposited is excluded and the day on which money is withdrawn is included.

Q40. Answer: (c) 690

Shortcut Trick
For a solid cuboid, if the areas of three adjacent faces are A1, A2, and A3, then its volume (V) is given by:
V = √(A1 × A2 × A3)
V = √(92 × 69 × 75) = √((4 × 23) × (3 × 23) × (3 × 25))

$V = \sqrt{(2^2 \times 23^2 \times 3^2 \times 5^2)} = 2 \times 23 \times 3 \times 5$

$V = 690\ cm^3$.

Therefore The correct answer is $690\ cm^3$.

Alternate Method

Given:

Area of face 1 $(l \times w) = 92\ cm^2$

Area of face 2 $(w \times h) = 69\ cm^2$

Area of face 3 $(l \times h) = 75\ cm^2$

Formula Used:

Volume (V) = length (l) × width (w) × height (h)

Calculations:

$\Rightarrow (l \times w) \times (w \times h) \times (h \times l) = 92 \times 69 \times 75$

$\Rightarrow l^2 \times w^2 \times h^2 = 92 \times 69 \times 75$

$\Rightarrow (l \times w \times h)^2 = 92 \times 69 \times 75$

$\Rightarrow V^2 = 476100$

$\Rightarrow V = \sqrt{476100}$

$\Rightarrow V = 690\ cm^3$

Therefore The correct answer is $690\ cm^3$.

Additional Information

Total Surface Area of a Cuboid

The total surface area is the sum of the areas of all 6 rectangular faces: TSA = 2(lw + wh + lh).

Diagonal of a Cuboid

The longest line segment connecting two opposite vertices: $d = \sqrt{(l^2 + w^2 + h^2)}$.

Volume of a Cube

For a cube where all sides are equal (a), the volume is $V = a^3$.

Q41. Answer: (b) 120

Shortcut Trick

If $\text{cosec}\theta - \cot\theta = 1/11$, then $\text{cosec}\theta + \cot\theta = 11$.

Adding both: $2\ \text{cosec}\theta = 11 + 1/11 = 122/11 \Rightarrow \text{cosec}\theta = 61/11$.

Subtracting both: $2\cot\theta = 11 - 1/11 = 120/11 \Rightarrow \cot\theta = 60/11$.

$\cos\theta = \cot\theta / \text{cosec}\theta = (60/11) / (61/11) = 60/61$.

$122\cos\theta = 122 \times (60/61) = 2 \times 60 = 120$.

Therefore The correct answer is 120.

Alternate Method

Given: $\text{cosec}\theta - \cot\theta = 1/11$

Formula Used: $\text{cosec}^2\theta - \cot^2\theta = 1 \Rightarrow (\text{cosec}\theta - \cot\theta)(\text{cosec}\theta + \cot\theta) = 1$

$\Rightarrow (1/11) \times (\text{cosec}\theta + \cot\theta) = 1$

$\Rightarrow \text{cosec}\theta + \cot\theta = 11$

$\Rightarrow (\text{cosec}\theta + \cot\theta) + (\text{cosec}\theta - \cot\theta) = 11 + 1/11$

$\Rightarrow 2\ \text{cosec}\theta = 122/11 \Rightarrow \text{cosec}\theta = 61/11$

$\Rightarrow \sin\theta = 1/\text{cosec}\theta = 11/61$

$\Rightarrow \cos\theta = \sqrt{(1 - \sin^2\theta)} = \sqrt{(1 - (11/61)^2)} = \sqrt{((3721 - 121)/3721)} = \sqrt{(3600/3721)} = 60/61$

$\Rightarrow$ Value $= 122 \times (60/61) = 120$

Therefore The correct answer is 120.

Additional Information

Trigonometric Identity

The identity $1 + \cot^2\theta = \text{cosec}^2\theta$ implies that $\text{cosec}\theta + \cot\theta$ and $\text{cosec}\theta - \cot\theta$ are reciprocals of each other.

Pythagorean Triplets

Common triplets like (11, 60, 61) satisfy $a^2 + b^2 = c^2$ and are frequently used in right-angled triangle problems.

Secant and Tangent Relation

Similarly, $\sec^2\theta - \tan^2\theta = 1$, which means $\sec\theta + \tan\theta = 1 / (\sec\theta - \tan\theta)$.

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Q42. Answer: (b) 40

Shortcut Trick

Age ratio (Teacher : Student) Now = 4 : 1 (diff = 3)

Age ratio 5 years ago = 7 : 1 (diff = 6)

Equalize difference: Now (4:1)×2 = 8 : 2. Ratio change = 8−7 = 1 unit.

1 unit = 5 years. Teacher current age = 8 × 5 = 40 years.

Therefore The correct answer is 40 years.

Alternate Method

Given: Current age ratio is 4:1 and 5 years ago it was 7:1.

Let the current age of the student be x.

=> Teacher current age = 4x

=> 5 years ago: (4x − 5) = 7 × (x − 5)

=> 4x − 5 = 7x − 35

=> 3x = 30

=> x = 10

=> Teacher current age = 4 × 10 = 40 years

Therefore The correct answer is 40 years.

Additional Information

Ratio Difference Concept

The age difference between two people remains constant over time. Always equate the difference in ratio parts to solve faster.

Linear Equations in Ages

For "n" years ago, subtract n from current ages. For "n" years hence, add n to current ages.

Q43. Answer: (a) 36

Shortcut Trick

For two numbers in the ratio a : b with HCF = H, the LCM is given by H × a × b.

Given: Ratio = 2 : 3 and HCF = 6.

=> LCM = 6 × 2 × 3

=> LCM = 36

Therefore The correct answer is 36.

Alternate Method

Given:

Ratio of numbers = 2 : 3

HCF = 6

Calculations:

=> Let the numbers be 2x and 3x.

=> Since HCF is the common factor x, we have x = 6.

=> First number = 2 × 6 = 12

=> Second number = 3 × 6 = 18

=> LCM of 12 and 18:

=> $12 = 2^2 \times 3$

=> $18 = 2 \times 3^2$

=> LCM = $2^2 \times 3^2 = 4 \times 9 = 36$

Therefore The correct answer is 36.

Additional Information

Product Rule of HCF and LCM

For any two numbers A and B, Product of Numbers = HCF × LCM. (A × B = H × L)

Co-prime Numbers Property

If two numbers are co-prime (HCF = 1), then their LCM is simply the product of the two numbers.

LCM of Fractions

LCM of Fractions = LCM of Numerators ÷ HCF of Denominators.

Q44. Answer: (c) 12.52 days

Shortcut Trick

Total Work (LCM of 18, 12, 48) = 144 units.

Efficiency of (A+B) = 8, (A+C) = 12, (B+C) = 3.

Combined efficiency 2(A+B+C) = 8 + 12 + 3 = 23 => (A+B+C) = 11.5.

Time taken = 144 ÷ 11.5 ≈ 12.52 days.

Therefore The correct answer is 12.52 days.

Alternate Method

Given:

(A + B) can do work in 18 days.

(A + C) can do work in 12 days.

(B + C) can do work in 48 days.

Person	Days	Total Work	Efficiency
A + B	18	144	8
A + C	12	12	
B + C	48	3	

Calculations:

=> Total efficiency of (A+B) + (A+C) + (B+C) = 8 + 12 + 3 = 23

=> 2(A + B + C) = 23

=> Efficiency of (A + B + C) = 23 ÷ 2 = 11.5

=> Time taken by A, B, and C together = Total Work ÷ Efficiency

=> Time = 144 ÷ 11.5

=> Time = 12.5217... ≈ 12.52 days

Therefore The correct answer is 12.52 days.

Additional Information

Combined Efficiency Rule

When pairs of workers are given, the sum of their efficiencies equals twice the efficiency of the individuals working together: 2(A+B+C) = Eff(A+B) + Eff(B+C) + Eff(C+A).

Work and Days Relationship

Time taken is inversely proportional to efficiency. Time = Total Work ÷ Efficiency.

LCM Method for Work

Taking the Least Common Multiple of given time periods as the Total Work simplifies calculations by providing integer efficiency values.

Q45. Answer: (a) 26850

Shortcut Trick

Convert all percentages and fractions into a single multiplying factor.

Total product factor = 1/10 × 3/10 × 2/3 = 1/50.

Number × 1/50 = 537.

Number = 537 × 50 = 26850.

Therefore The correct answer is 26850.

Alternate Method

Given:

10% of 30% of 2/3 of x = 537.

Calculations:

=> (10/100) × (30/100) × (2/3) × x = 537

=> (1/10) × (3/10) × (2/3) × x = 537

=> (1 × 3 × 2) / (10 × 10 × 3) × x = 537

=> (6/300) × x = 537

=> (1/50) × x = 537

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=> x = 537 × 50

=> x = 26850

Therefore The correct answer is 26850.

Additional Information

Percentage to Fraction Conversion

To convert x% to a fraction, divide by 100 (e.g., 20% = 20/100 = 1/5).

Successive Percentage Calculation

When multiple percentages are applied to a number, they are multiplied together as fractions: Result = N × (P1/100) × (P2/100).

Reverse Calculation

To find the original number when the final value is known, multiply the result by the reciprocal of the combined fraction.

Q46. Answer: (c) 6,768

Shortcut Trick

Marked Price (MP) is 100%.

After a 20% discount, the Selling Price (SP) is 80% of MP.

SP = 8,460 × 0.80 = 6,768.

Therefore The correct answer is Rs. 6,768.

Alternate Method

Given: Marked Price (MP) = Rs. 8,460, Discount% = 20%

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

=> Discount = (20 ÷ 100) × 8,460 = 0.2 × 8,460 = Rs. 1,692

=> Selling Price (SP) = 8,460 − 1,692 = Rs. 6,768

Therefore The correct answer is Rs. 6,768.

Additional Information

Marked Price & Discount

The Marked Price is the price printed on the label. Discount is always calculated on the Marked Price unless stated otherwise. Formula: SP = MP × (100 − D%) ÷ 100.

Relation between CP and MP

The ratio of MP to CP is given by: MP ÷ CP = (100 + P%) ÷ (100 − D%), where P% is profit percentage and D% is discount percentage.

Q47. Answer: (d) 35

Shortcut Trick

Total Cost Price (CP) of 9 articles = Rs. 16.

Total Selling Price (SP) of 9 articles = 9 × 2.4 = Rs. 21.6.

Profit = 21.6 − 16 = Rs. 5.6.

Profit% = (Profit ÷ CP) × 100 = (5.6 ÷ 16) × 100.

Profit% = 0.35 × 100 = 35%.

Therefore The correct answer is 35%.

Alternate Method

Given: Total CP = Rs. 16, Number of articles = 9, SP per article = Rs. 2.4.

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

=> Calculate total Selling Price: 9 articles × Rs. 2.4/article = Rs. 21.6.

=> Calculate Profit amount: Rs. 21.6 − Rs. 16 = Rs. 5.6.

=> Apply Profit percentage formula: (5.6 ÷ 16) × 100.

=> Profit% = 35%.

Therefore The correct answer is 35%.

Additional Information

Profit and Loss Basics

Profit occurs when Selling Price (SP) is greater than Cost Price (CP). Loss occurs when CP is greater than SP.

Percentage Calculation

Profit or Loss percentage is always calculated on the Cost Price unless otherwise specified in the problem.

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Q48. Answer: (a) 36 and 12

Shortcut Trick

Age ratio (Present) Father : Son = 3 : 1 (Difference = 2 units)

Age ratio (After 12 years) Father : Son = 2 : 1 (Difference = 1 unit)

Equalize differences by multiplying the second ratio by 2 → 4 : 2.

Increase in units = 4 − 3 = 1 unit → 12 years.

Present ages: Father = 3 × 12 = 36 years; Son = 1 × 12 = 12 years.

Therefore The correct answer is 36 and 12 years.

Alternate Method

Given: Present age ratio is 3:1 and ratio after 12 years is 2:1.

Formula: Age after n years = Present Age + n.

=> Let Son's present age = x years and Father's present age = 3x years.

=> According to the question: (3x + 12) = 2 × (x + 12)

=> 3x + 12 = 2x + 24

=> 3x − 2x = 24 − 12

=> x = 12 years (Son's age)

=> Father's age = 3 × 12 = 36 years.

Therefore The correct answer is 36 and 12 years.

Additional Information

Age Difference Constant

The difference between the ages of two persons remains constant throughout their lives, regardless of the number of years passed.

Ratio Balancing

To solve age problems quickly, multiply the ratios so that the numerical difference between the ratio parts is equal for both individuals over time.

Q49. Answer: (c) 62

Shortcut Trick

Assume an Assumed Mean (A) = 60.

Find deviations from 60: +28, +39, −13, +19, −48, +19, +16, −43, +1.

Sum of deviations = (28 + 39 + 19 + 19 + 16 + 1) − (13 + 48 + 43) = 122 − 104 = +18.

Actual Mean = Assumed Mean + (Sum of Deviations ÷ Total Count) = 60 + (18 ÷ 9) = 62.

Therefore The correct answer is 62.

Alternate Method

Given Observations: 88, 99, 47, 79, 12, 79, 76, 17, 61

Number of observations (n) = 9

Formula: Arithmetic Mean = (Sum of all observations) ÷ (Total number of observations)

=> Sum = 88 + 99 + 47 + 79 + 12 + 79 + 76 + 17 + 61

=> Sum = 558

=> Mean = 558 ÷ 9

=> Mean = 62

Therefore The correct answer is 62.

Additional Information

Sum of Deviations

The sum of the deviations of a set of observations from their arithmetic mean is always zero: $\sum(x_i - \text{Mean}) = 0$.

Change of Origin and Scale

If every observation is increased/decreased by a constant k, the mean also increases/decreases by k. If multiplied by k, the mean is also multiplied by k.

Mean of First n Natural Numbers

The arithmetic mean of the first n natural numbers is given by the formula: Mean = (n + 1) ÷ 2.

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Q50. Answer: (c) 25

Shortcut Trick

Convert all times to hours: 12 min = 12/60 hr, 22 min = 22/60 hr, remaining 16 min = 16/60 hr.

Total distance = ∑ (Speed × Time) => 30 = x×(12/60) + 2x×(22/60) + x×(16/60).

30 = (12x + 44x + 16x) ÷ 60 => 30 = 72x ÷ 60 => 30 = 1.2x.

x = 30 ÷ 1.2 = 25 km/hr.

Therefore The correct answer is 25 km/hr.

Alternate Method

Given: Total distance = 30 km, Total time = 50 min. Journey segments: 12 min at x, 22 min at 2x, and (50 − 12 − 22) = 16 min at x.

Formula Used: Distance = Speed × Time

Calculations:

=> Distance1 = x × (12/60) km

=> Distance2 = 2x × (22/60) km

=> Distance3 = x × (16/60) km

=> Total Distance = (12x/60) + (44x/60) + (16x/60) = 30

=> (12x + 44x + 16x) / 60 = 30

=> 72x / 60 = 30

=> 1.2x = 30

=> x = 30 / 1.2 = 25

Therefore The correct answer is 25 km/hr.

Additional Information

Speed-Distance Relation

Distance is directly proportional to speed when time is constant and directly proportional to time when speed is constant.

Unit Conversion

To convert km/hr to m/s, multiply by 5/18. To convert minutes to hours, divide by 60.

Average Speed

Average Speed = Total Distance ÷ Total Time. In this case, Average Speed = 30 km ÷ (50/60) hr = 36 km/hr.

Q51. Answer: (b) BP – EU

Logic followed here is.

Logic: The first letter of the first cluster is increased by 2 and the second letter of the first cluster is increased by 5 to obtain the letters of the second cluster in the pair.

(1) UV - WA →

(2) BP - EU →

(3) QL - SQ →

(4) MB - OG →

Therefore, the letter-cluster pair 'BP - EU' is the odd one out because the first letter is increased by 3 instead of 2.

Hence, the correct answer is "Option 2".

Q52. Answer: (a) 16

Given:

→ Total people = 58

→ Rizwan is 23^(rd) from the right end

→ Aman is 19^(th) from the left end

Step 1: Find Rizwan’s position from the left

Position from left = Total people − Position from right + 1

= 58 − 23 + 1 = 36

So, Rizwan is 36^(th) from the left.

Step 2: Find people between Rizwan and Aman

Rizwan’s position = 36

Aman’s position = 19

People between them:

= 36 − 19 − 1 = 16

Therefore, 16 people are there between Rizwan and Aman.

Hence, the correct answer is Option 1.

Q53. Answer: (b) 17

Given Equation: 40 + 5 ÷ 7 - 108 × 9 = ?

After interchanging signs:

Original Sign	•	•	×	÷
New Sign	•	•	÷	×

Applying the changes to the equation:

40 - 5 × 7 + 108 ÷ 9

Step-by-step solution:

=> 40 (- 5 × 7) + (108 ÷ 9) = ?

=> 40 - 35 + 12 = ?

=> 52 - 35 = ?

=> 17 = ?

Therefore, the value of the equation after interchanging the signs is 17.

Hence, the correct answer is "Option 2".

Q54. Answer: (b) 60

Mapping of the letters to mathematical signs:

A	B	C	D
÷	×	•	•

Given Equation:

76 A 2 C (30 A 6) B 4 D 39 A 3 C 15

Replacing the letters with their corresponding signs:

76 ÷ 2 + (30 ÷ 6) × 4 - 39 ÷ 3 + 15

Solving using BODMAS rule:

=> 38 + 5 × 4 - 13 + 15 = ?

=> 38 + 20 - 13 + 15 = ?

=> 73 - 13 = ?

=> 60 = ?

Therefore, the code for the question mark (?) is 60.

Hence, the correct answer is "Option 2".

Q55. Answer: (c) E

Given:

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

Only one person sits between A and B when counted from the left of A.

E sits to the immediate right of B.

Only two people sit between E and F when counted from the left of E.

C sits third to the left of F.

D sits to the immediate right of H.

Facing centre => right means anticlockwise.

From G:

1st right → D

2nd right → E

Therefore, the person sitting second to the right of G is E.

Hence, the correct answer is Option 3.

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Q56. Answer: (c) RW - SO

Logic followed here is:

The first letter of the second cluster is the next letter (+1) of the first letter of the first cluster, and the second letter of the second cluster is the 7th preceding letter (-7) of the second letter of the first cluster.

1) LQ - MJ

2) NS - OL

3) RW - SO

Here, RW is related to SO (where O is 23 - 8 = 15), which does not follow the pattern.

4) PU - QN

Therefore, the letter-cluster pair that does not belong to the group is RW - SO.

Hence, the correct answer is "Option 3".

Q57. Answer: (b) HN – LS – PX

Logic followed here is:

In each triad, the first letter of each word increases by +4 and the second letter of each word increases by +5 to form the next word.

For BH – FM – JR

For JP – NU – RZ

Checking Option (2) HN – LS – PX:

Therefore, the triad that follows the same pattern is HN – LS – PX.

Hence, the correct answer is "Option 2".

Q58. Answer: (b) 3

Given Series:

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

Required pattern: Odd → Even → Odd

Checking the series:

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

Even digits satisfying the condition:

→ 2 in (7 2 9)

→ 8 in (3 8 7)

→ 4 in (7 4 9)

Therefore, there are 3 such even digits.

Hence, the correct answer is "Option 2".

Q59. Answer: (c) 6

Given Codes:

CORN → 6479

OILY → 2368

Therefore, the code for O is 6.

Hence, the correct answer is Option 3.

Q60. Answer: (d) cc

Given Codes:

'lid ear urn' → 'lw cc pg'

'corn urn bird' → 'qf wc 3 cc'

The common code is cc.

Therefore, the code for 'urn' is cc.

Hence, the correct answer is "Option 4".

Q61. Answer: (c) B

Given Conditions:

→ Six people A, B, C, D, E and F are sitting in a row facing north.

→ Only two people sit to the left of E.

→ Only one person sits between A and C.

→ F sits to the immediate left of E.

→ A sits to the immediate right of D.

→ C sits third to the right of B.

→ B sits at extreme left position.

Hence, the correct answer is Option 3 — B.

Q62. Answer: (d) NF - LD - IK

Logic followed here is:

The positional values of the first letters in each pair of the triad decrease by 2 then 3, while the positional values of the second letters decrease by 2 then increase by 7.

UM - SK - PR →

RJ - PH - MO →

Similarly,

Option 4) NF - LD - IK:

Therefore, the triad that follows the same pattern is 'NF - LD - IK'.

Hence, the correct answer is "Option 4".

Q63. Answer: (a) 51

Given Series: 9 11 15 21 29 39 ?

The pattern followed here is:

Therefore According to the pattern followed 51 will replace the (?) mark.

Hence, the correct answer is "Option 1".

Q64. Answer: (d) Sister's husband

Given Code Language:

Symbol	Meaning
A + B	A is the mother of B
A - B	A is the brother of B
A x B	A is the wife of B
A % B	A is the father of B
A # B	A is the daughter of B

Expression:

E % C # Q # L + P: E is father of C. C is daughter of Q. Q is daughter of L. L is mother of P.

Since Q is sister of P, E becomes P’s sister’s husband.

Therefore, the correct answer is Option 4 — Sister's husband.

Q65. Answer: (d) 36

Given Series: 1, 4, 9, 16, 25, ?

The logic followed here is:

Therefore According to the logic 36 will replace the (?) mark.

Hence, the correct answer is "Option 4".

Q66. Answer: (d) East

Given:

A man goes north for 3 km and reaches point B.

Then he turns right, goes 10 km to reach point C.

He takes a right turn, goes 5 km to reach point D.

He goes west for 3 km to reach point E.

He turns right and goes 2 km to reach point F.

Step-by-step movement:

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Therefore, the man is to the East of the starting point.

Hence, the correct answer is Option 4.

Q67. Answer: (b) 2

Given Series:

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

Required pattern: Odd → Odd → Even

Checking the series:

1 2 1 2 4 2 1 6 2 1 6 1 1 6 1 3 3 5 6 1 2 8 6 6 4 9 2 6

Odd numbers satisfying the condition:

→ 1 in (1 1 6)

→ 5 in (3 5 6)

Therefore, there are 2 such odd numbers.

Hence, the correct answer is Option 2.

Q68. Answer: (d) 3 km to the west

Given:

Shivank starts from Point A and drives 15 km towards north.

He then takes a left turn, drives 11 km.

He turns left and drives 16 km.

He then takes a left turn and drives 14 km.

He takes a final left turn, drives 1 km and stops at Point P.

Step-by-step movement:

Net movement calculation:

North-South:

15 km north + 1 km north − 16 km south = 0

So, no north/south displacement.

East-West:

14 km east − 11 km west = 3 km east

So Shivank is 3 km east of Point A.

To reach Point A again, he must travel 3 km to the west.

Hence, the correct answer is Option 4.

Q69. Answer: (d) FGK79

Given Series: DEI51, XYC58, RSW65, LMQ72,?

The logic followed here is:

Therefore According to the logic followed FGK79 will replace the(?) mark.

Hence, the correct answer is "Option 4".

Q70. Answer: (c) NOMN

Logic followed here is:

Each letter of the first word is shifted by +4 positions in the English alphabetical order to obtain the corresponding letter of the second word.

For

OPNO is related to STRS →

DECD is related to HIGH →

Similarly, let's find the related word for JKIJ:

Therefore, the related word for 'JKIJ' is NOMN.

Hence, the correct answer is "Option 3".

Q71. Answer: (d) Hemant is the immediate neighbour of Sharad and Vasant.

Given:

Pradeep is to the immediate right of Anuj.

Vasant is to the immediate right of Hemant.

Sharad is second to the right of Anuj and immediately left of Hemant.
All are facing the centre.
Checking options:
Hemant is sitting next to both Sharad and Vasant.
Therefore, the correct answer is:
Option 4 — Hemant is the immediate neighbour of Sharad and Vasant.

Q72. Answer: (a) five

Given Series:
(Left) 5 7 5 9 8 2 3 4 6 5 8 7 7 1 2 5 5 8 9 8 8 4 5 4 6 4 3 6 7 (Right)
Required pattern: Even → Odd → Even
Checking the series:
(Left) 5 7 5 9 8 2 3 4 6 5 8 7 7 1 2 5 5 8 9 8 8 4 5 4 6 4 3 6 7 (Right)
Odd digits satisfying the condition:
→ 3 in (2 3 4)
→ 5 in (6 5 8)
→ 5 in (4 5 4)
→ 9 in (8 9 8)
→ 3 in (4 3 6)
Therefore, there are five such odd digits.
Hence, the correct answer is Option 1.

Q73. Answer: (c) 98

Given Series: 8 14 26 44 68 ?
The pattern followed here is:
Therefore According to the pattern 98 will replace the (?) mark.
Hence, the correct answer is "Option 3".

Q74. Answer: (d) Both conclusions (I) and (II) follow

Given Statements:
All jams are cobras.
All cobras are mats.
Conclusions:
(I) Some mats are cobras: Follows (because all cobras are mats. Therefore, at least some mats are cobras.)
(II) All jams are mats: Follows (because all jams are cobras and all cobras are mats.)
Therefore, both conclusions (I) and (II) follow.
Hence, the correct answer is Option 4.

Q75. Answer: (c) LZF

Given series: TRV RTR PVN NXJ ?
The pattern followed here is:
Therefore According to the pattern followed LZF will replace the (?) mark.
Hence, the correct answer is "Option 3".

Q76. Answer: (a) Three

Given Series:
(Left) 1 7 6 2 9 4 3 8 5 2 6 3 7 8 9 2 5 1 4 7 6 3 2 9 5 4 1 8 (Right)
Required pattern: Perfect Square → Even → Odd
Checking the series:
(Left) 1 7 6 2 9 4 3 8 5 2 6 3 7 8 9 2 5 1 4 7 6 3 2 9 5 4 1 8 (Right)
Even digits satisfying the condition:
→ 4 in (9 4 3)
→ 2 in (9 2 5)
→ 4 in (1 4 7)

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Therefore, there are Three such even digits.

Hence, the correct answer is Option 1.

Q77. Answer: (b) 469

Logic: According to the given information, the symbols are mapped as follows:

Letter	Symbol
A	÷
B	×
C	•
D	−

Given Expression:

37 B 12 D 824 A 8 C 128 = ?

Replacing the letters with mathematical symbols, we get:

= 37 × 12 − 824 ÷ 8 + 128

Applying the BODMAS rule:

=> (37 × 12) - (824 ÷ 8) + 128 = ?

=> 444 - (824 ÷ 8) + 128 = ?

=> 444 - 103 + 128 = ?

=> 572 - 103 = ?

=> 69 = ?

Therefore The value that comes in place of the question mark is 469.

Hence, the correct answer is "Option 2".

Q78. Answer: (b) Both conclusions (I) and (II) follow

Given Statements:

All caves are houses.

All houses are dens.

All dens are mansions.

Checking Conclusions:

(I) All caves are mansions: Follows (because, All Caves are Houses. All Houses are Dens and All dens are Mansion.So all caves are definitely mansions.)

(II) Some mansions are houses: Follows (because all houses are mansions. Therefore, some mansions are houses.)

Therefore, both conclusions (I) and (II) follow.

Hence, the correct answer is Option 2.

Q79. Answer: (b) (11, 17, 30)

Logic followed here is:

2nd number: (1st number × 2) - 5

3rd number: (1st number × 2) + 8

For (9, 13, 26) →

Second number = (9 × 2) - 5 = 13

Third number = (9 × 2) + 8 = 26

For (7, 9, 22) →

Second number = (7 × 2) - 5 = 9

Third number = (7 × 2) + 8 = 22

Similarly, Option 2) (11, 17, 30):

Second number = (11 × 2) - 5 = 17

Third number = (11 × 2) + 8 = 30

Therefore The related set is (11, 17, 30).

Hence, the correct answer is "Option 2".

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Q80. Answer: (a) 53rd

Given:

Total students = 103

Z is 15^(th) from the right end.

Step 1: Find Z's position from the left

Position from left = Total students − Position from right + 1

= 103 − 15 + 1

= 89

So, Z is 89th from the left.

Step 2: Find G's position

G is 36^(th) to the left of Z.

So,

89 − 36 = 53

Therefore, G is 53rd from the left end.

Hence, the correct answer is Option 1.

Q81. Answer: (b) Candida tropicalis

The correct answer is Candida tropicalis.

Key Points

• Candida tropicalis is a significant fungal pathogen that has been found to utilize chromosome alterations, specifically aneuploidy and segmental duplications, to develop resistance against common antifungal medications.

• This pathogen is particularly known for resisting fluconazole and voriconazole, which are the primary azole drugs used in clinical settings to treat yeast infections.

• Research indicates that by altering the number of chromosomes or duplicating specific regions of the genome, the fungus can increase the expression of genes like ERG11 and efflux pumps, which help the cell survive in the presence of toxic drug concentrations.

• Unlike Candida albicans, which is the most common species, Candida tropicalis is frequently associated with higher virulence and mortality rates in certain geographical regions.

• The ability to undergo rapid genomic rearrangements allows this fungus to adapt to the host environment and medical interventions much faster than through simple point mutations alone.

Additional Information

• Geographical Prevalence: Candida tropicalis is highly prevalent in tropical and subtropical countries, including India, Brazil, and parts of Southeast Asia, where it is often the second or third most common cause of invasive candidiasis.

• Mechanism of Azoles: Drugs like Fluconazole and Voriconazole work by inhibiting the CYP51 (or ERG11) enzyme, which is essential for the synthesis of ergosterol, a vital component of the fungal cell membrane.

• Comparison with other Pathogens:

• Candida albicans: While it also uses aneuploidy (specifically Isochromosome 5L), the question highlights Candida tropicalis due to recent specific studies regarding its unique chromosomal plasticity.

• Aspergillus fumigatus: This is a mold, not a yeast, and its resistance is typically linked to environmental fungicide exposure and specific gene mutations rather than broad chromosome alterations.

• Cryptococcus neoformans: An encapsulated yeast that causes meningitis; while it exhibits aneuploidy, its primary resistance mechanisms involve capsule thickness and melanin production.

• Clinical Impact: The rise of multi-drug resistant (MDR) fungal strains poses a severe threat to immunocompromised patients, such as those with HIV/AIDS, cancer, or those in intensive care units (ICUs).

Important Points

• Aneuploidy: This refers to the condition of having an abnormal number of chromosomes (e.g., trisomy). In fungal pathogens, it serves as a "quick-fix" evolutionary strategy to survive environmental stress.

• Fluconazole Resistance: It is often mediated by the overexpression of MDR1 (Multidrug Resistance 1) genes, which act as pumps to remove the drug from the fungal cell.

• Diagnostic Tools: Recent advancements in Whole Genome Sequencing (WGS) have allowed scientists to map these chromosomal changes in real-time during a patient's treatment course, identifying how Candida tropicalis evolves within the human body.

• Date and Discovery: Research into the genomic plasticity of Candida tropicalis has gained significant momentum between 2020 and 2024, revealing that chromosomal instability is a hallmark of its survival strategy.

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Q82. Answer: (c) 80.7%

The correct answer is 80.7%.

Key Points

• According to the Sustainable Development Goals — National Indicator Framework (NIF) Progress Report, 2025, released in June 2025, India has made significant strides in waste management.

• The report indicates that for the fiscal year 2024–2025, the percentage of total municipal solid waste processed stands at 80.7%.

• This data is a crucial metric under SDG Goal 11 (Sustainable Cities and Communities), specifically monitoring Indicator 11.6.1, which tracks the proportion of municipal solid waste regularly collected and with adequate final discharge out of total municipal solid waste generated.

• The Ministry of Statistics and Programme Implementation (MoSPI) is the nodal agency responsible for publishing this progress report, which tracks India's performance against the global 2030 Agenda.

• The increase to 80.7% reflects the successful implementation of urban sanitation programs and infrastructure development across various states and Union Territories.

Additional Information

• Sustainable Development Goals (SDGs):

• The SDGs consist of 17 global goals established by the United Nations in 2015 to be achieved by 2030.

• Goal 11 focuses on making cities and human settlements inclusive, safe, resilient, and sustainable.

• Waste processing is a key component of Target 11.6, which aims to reduce the adverse per capita environmental impact of cities by 2030.

• Swachh Bharat Mission - Urban (SBM-U) 2.0:

• Launched in October 2021, this mission aims to make all cities "Garbage Free" by 2026.

• The mission focuses on 100% source segregation, door-to-door collection, and scientific processing of all fractions of Municipal Solid Waste.

• The jump in processing from approximately 18% in 2014 to 80.7% in 2025 is largely attributed to this mission.

• National Indicator Framework (NIF):

• The NIF was developed by MoSPI to monitor the progress of SDGs at the national level, tailored to the Indian context.

• It currently comprises nearly 300 indicators that provide a data-driven path for policy interventions.

• Waste Management Statistics:

• In 2021-22, the waste processing percentage was roughly 70%, showing a steady upward trajectory toward the 2024-2025 figure of 80.7%.

• Processing methods include composting, biomethanation, Refuse Derived Fuel (RDF) plants, and Waste-to-Energy (WtE) plants.

Important Points

• Data Source: The NIF Progress Report 2025 uses data validated by the Ministry of Housing and Urban Affairs (MoHUA).

• Environmental Impact: Higher waste processing reduces the burden on landfills and decreases the emission of greenhouse gases like methane.

• Circular Economy: The government is shifting focus from "waste disposal" to a "circular economy," where waste is treated as a resource for recycling and energy generation.

• Year of Report: The 2025 report is a milestone as it marks the midpoint of the decade of action (2020-2030) for achieving the Global Goals.

Q83. Answer: (d) Cristiano Ronaldo

The correct answer is Cristiano Ronaldo.

Key Points

• Cristiano Ronaldo officially became the record-holder for the most international football wins by a male player in March 2025.

• He achieved his 132nd win while representing the Portugal national team, surpassing the long-standing record previously held by Sergio Ramos.

• The milestone was reached during the international break in March 2025, further cementing his legacy as the most successful player in the history of men's international football. Hence, the statement regarding his record is correct.

• Before this achievement, the record for most wins was 131, held by the Spanish defender Sergio Ramos, who played for Spain during their golden era of dominance between 2008 and 2012.

• Ronaldo has been a mainstay for Portugal since his debut in 2003, and this record adds to his extensive list of international accolades, including being the all-time leading goalscorer in international football.

Additional Information

• International Career of Cristiano Ronaldo:

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• Born in 1985, Ronaldo debuted for Portugal at the age of 18. He has since led his country to victory in the UEFA Euro 2016 and the UEFA Nations League 2019.

• He holds the record for the most international goals scored by a male player, having crossed the 130-goal mark.

• His career longevity is marked by his participation in five FIFA World Cups and five UEFA European Championships.

• Other High-Ranking Players:

• Sergio Ramos (Spain): Held the previous record with 131 wins. He was a key part of the Spain squads that won the 2010 FIFA World Cup and two European Championships.

• Lionel Messi (Argentina): One of Ronaldo's primary contemporaries, Messi has also crossed the 100-win threshold with Argentina, notably winning the 2022 FIFA World Cup and Copa América.

• Robert Lewandowski (Poland): While a prolific goalscorer, Poland's win-rate in international competitions has not allowed him to challenge the top of this specific list, though he remains one of the top scorers in European football.

Important Points

• Significance of the Record:

• The 132-win milestone reflects not just individual skill but the sustained competitiveness of the Portugal national team over two decades.

• Winning 132 matches at the international level requires an immense number of appearances (caps), a record Ronaldo also holds with over 200 appearances.

• This record is monitored by FIFA and statistical organizations like IFFHS to track the historical performance of athletes across World Cup Qualifiers, Nations League, and major tournaments.

Q84. Answer: (c) 3.1%

The correct answer is 3.1%.

Key Points

• The Reserve Bank of India (RBI) released the All-India House Price Index (HPI) for the fourth quarter of the financial year 2024-25 (Q4 FY25), which showed an annual growth (year-on-year) of 3.1%.

• This growth rate of 3.1% in March 2025 represents a moderation compared to the 4.6% growth recorded in the corresponding quarter of the previous year (Q4 FY24).

• Among the major cities tracked, Kolkata recorded the highest annual price appreciation at 10.1%, signaling strong demand in the West Bengal capital.

• On the contrary, Kochi was the only city among the ten tracked locations to witness a decline, recording a 1.4% contraction in housing prices during this period.

• The All-India HPI is a critical economic indicator based on transaction-level data received from the registration authorities in 10 major cities across India.

Additional Information

• City-wise Coverage: The All-India HPI is compiled using data from Ahmedabad, Bengaluru, Chennai, Delhi, Jaipur, Kanpur, Kochi, Kolkata, Lucknow, and Mumbai.

• Quarter-on-Quarter (Seqential) Performance: On a sequential basis, the All-India HPI increased by 0.9% in Q4 FY25 compared to Q3 FY25. Delhi, Mumbai, and Kolkata saw sequential rises, whereas Ahmedabad and Jaipur experienced slight contractions.

• Significance of HPI: The House Price Index serves as a vital tool for the Reserve Bank of India and other policymakers to monitor the real estate market, assess inflationary pressures in assets, and formulate monetary policy.

• Data Source and Methodology: The index is calculated with the base year 2010-11. It relies on official registration prices, which may vary from market prices but provide a standardized legal record of property transactions.

• Market Trends: The moderation to 3.1% suggests a stabilizing housing market after the rapid price hikes seen in the post-pandemic recovery phase.

Important Points

• Performance of Metros: In Q4 FY25, major metropolitan hubs like Mumbai and Delhi showed steady but moderate growth, contributing to the overall 3.1% national average.

• Historical Context: Over the last few years, the HPI has fluctuated based on interest rates set by the RBI (Repo Rate) and the availability of liquidity in the banking system.

• Regional Disparity: The wide gap between Kolkata’s 10.1% growth and Kochi’s 1.4% decline highlights significant regional disparities in housing demand, urban migration, and local economic conditions.

• Annual Average: For the full year FY25, the housing market remained resilient despite global economic headwinds, with the All-India average staying in positive territory.

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Q85. Answer: (c) Delhi High Court

The correct answer is Delhi High Court.

Key Points

• In July 2025, the Delhi High Court achieved a significant milestone in judicial administration by launching a dedicated portal specifically designed for workplace sexual harassment complaints.

• The primary objective of this digital initiative is to empower women at work, including legal professionals, court staff, and litigants, by providing a secure and accessible platform to report grievances.

• This portal is integrated with the Internal Complaints Committee (ICC) of the High Court, ensuring that the process of filing and tracking complaints is handled with confidentiality and speed.

• By digitizing the complaint mechanism, the Delhi High Court aims to remove the barriers of physical presence and manual paperwork, fostering a zero-tolerance policy against harassment within the judiciary's premises.

• The launch of this portal aligns with the broader goals of the Sexual Harassment of Women at Workplace (Prevention, Prohibition and Redressal) Act, 2013, reinforcing the legal framework for gender safety in India.

Additional Information

• The POSH Act, 2013:

• The Sexual Harassment of Women at Workplace Act was enacted in 2013 to provide protection against sexual harassment at workplaces and for the prevention and redressal of complaints.

• It mandates that any organization with 10 or more employees must constitute an Internal Complaints Committee (ICC) to handle such matters.

• Internal Complaints Committee (ICC):

• The ICC must be headed by a Presiding Officer who is a woman employed at a senior level in the workplace.

• It must also include an external member from an NGO or an association committed to the cause of women or a person familiar with issues relating to sexual harassment.

• The Vishaka Guidelines:

• Before the 2013 Act, the Supreme Court of India laid down the Vishaka Guidelines in 1997 in the landmark case of Vishaka v. State of Rajasthan.

• These guidelines served as the legal framework for addressing sexual harassment until the formal POSH Act was legislated by Parliament.

• SHe-Box Portal:

• The Ministry of Women and Child Development launched the Sexual Harassment electronic Box (SHe-Box) as a single-window access to every woman, irrespective of her work status, to register complaints related to sexual harassment.

• This national-level portal ensures that complaints are directly reached to the concerned authority for timely action.

• Digital Initiatives in Judiciary:

• The e-Courts Project, conceptualized under the National Policy and Action Plan for Implementation of Information and Communication Technology (ICT) in the Indian Judiciary, has been pivotal in modernizing court functions.

• Portals like the one launched by the Delhi High Court are part of this technological evolution to make justice delivery more inclusive and transparent.

Q86. Answer: (c) Assam Chief Minister Himanta Biswa Sarma

The correct answer is Assam Chief Minister Himanta Biswa Sarma.

Key Points

• The Mukhya Mantrir Jiban Anuprerana Scheme was officially launched by the Chief Minister of Assam, Himanta Biswa Sarma, in June 2025.

• This initiative is designed to provide socio-economic support and inspiration to the citizens of the state, focusing on enhancing the quality of life through government-led interventions.

• The launch event took place in Assam, emphasizing the state's vision for holistic development and the empowerment of its residents across various districts.

• Under the leadership of Himanta Biswa Sarma, the scheme aims to bridge the gap between administrative policies and the grassroots needs of the people.

• The scheme serves as a flagship program for the year 2025, reinforcing the Assam Government's commitment to social welfare and public service delivery.

Additional Information

• Himanta Biswa Sarma:

• He serves as the 15th Chief Minister of Assam, having assumed office in May 2021.

• Prior to becoming the Chief Minister, he held several key portfolios including Finance, Health, and Education in the state cabinet.

• He is widely recognized for his role in implementing transformative schemes like Orunodoi and the Mukhya Mantri Atmanirbhar Asom Abhijan.

• Role of the Governor:

• Lakshman Acharya is the current Governor of Assam, appointed in 2024.

• While the Chief Minister is the executive head of the state government, the Governor acts as the constitutional head.

• Most welfare schemes and executive decisions are launched and driven by the Chief Minister's Office (CMO).

• Assam State Welfare Initiatives:

• The Government of Assam has been at the forefront of introducing Direct Benefit Transfer (DBT) schemes to ensure transparency and efficiency.

• The state's development model focuses heavily on infrastructure, healthcare, and education to transform the Northeast region of India.

Important Points

• Implementation Agency: The scheme is implemented through the Department of Social Justice and Empowerment, Government of Assam.

• Target Beneficiaries: The primary beneficiaries include the youth, economically weaker sections, and individuals seeking financial or moral support for life-improving ventures.

• Geographical Coverage: The program covers all 35 districts of Assam, ensuring that the benefits of the Jiban Anuprerana initiative reach remote and rural areas.

• Budgetary Allocation: A significant portion of the State Budget 2025-26 was earmarked for the successful execution of this scheme, reflecting the high priority placed on human resource development.

Q87. Answer: (a) Real Madrid

The correct answer is Real Madrid.

Key Points

• Real Madrid is a professional football club based in Madrid, Spain, and is widely regarded as the most successful club in the history of European football.

• For the 2025 award cycle, which recognizes the sporting achievements of the year 2024, Real Madrid was honored with the Laureus World Team of the Year award due to its extraordinary performance in domestic and international competitions.

• The club secured its 15th UEFA Champions League title in June 2024 by defeating Borussia Dortmund at Wembley Stadium, extending its record as the most decorated club in the competition's history.

• In addition to their European success, the team led by Carlo Ancelotti won the 2023-24 La Liga title and the Supercopa de España, demonstrating a period of overwhelming dominance in the sport.

• The Laureus World Sports Awards, often described as the "Oscars of Sports," are presented annually to individuals and teams who have achieved the highest level of excellence.

Additional Information

• Laureus World Team of the Year Award:

• This category was established in 1999 and first awarded in 2000. It celebrates teams that show exceptional synergy and achievement.

• Football teams have historically fared well, with previous winners including the Argentina Men's National Football Team (2023) and Bayern Munich (2021).

• The 2024 award was notably won by the Spain Women's National Football Team following their World Cup triumph.

• Real Madrid CF Facts:

• The club was founded on March 6, 1902, and plays its home games at the Santiago Bernabéu Stadium.

• In 2024, Real Madrid was ranked as the most valuable football team in the world by Forbes, with a valuation of approximately $6.6 billion.

• Key contributors during the award-winning season included Vinícius Júnior, Jude Bellingham, and the retiring legend Toni Kroos.

Important Points

• Selection Process: The winners are chosen by the Laureus World Sports Academy, a unique group of 71 sporting legends who volunteer their time to act as the ultimate jury.

• Managerial Excellence: Carlo Ancelotti became the first manager to win five UEFA Champions League titles, a feat that heavily influenced the team's global recognition.

• Competing Nominees: Other notable teams often considered for this category include the Manchester City football club, the South Africa Men's Rugby Team, and the Oracle Red Bull Racing team from Formula One.

• Global Impact: Beyond trophies, the award recognizes Real Madrid's global fan base, which exceeds 500 million followers across various social media platforms as of 2024.

Q88. Answer: (d) Increased street lighting and safe toilets

The correct answer is Increased street lighting and safe toilets.

Key Points

• The Gender and Policy Lab (GPL), an initiative under the Greater Chennai Corporation (GCC), released a comprehensive manual in May–June 2025 titled "Manual for Gender-Responsive Public Spaces."

• The manual specifically recommends Increased street lighting as a primary urban intervention to eliminate dark spots, thereby enhancing the perception of safety and reducing the risk of harassment for women and gender minorities. Hence, the correct option is Increased street lighting and safe toilets.

• The provision of safe, clean, and accessible toilets is highlighted as a fundamental requirement for gender-inclusive urban design, ensuring that women can navigate Chennai's public spaces without compromising their health or dignity. Hence, statement 4 is correct.

• Unlike aerial surveillance drones (Option 1), which focus on policing, the manual emphasizes structural and environmental design changes to create a naturally safe atmosphere through "eyes on the street." Hence, statement 1 is incorrect.

• The manual advocates for inclusive public spaces rather than the creation of parks for women exclusively (Option 2), promoting the idea that public areas should be safe for everyone simultaneously. Hence, statement 2 is incorrect.

• While women-only bus services (Option 3) are a significant transport policy in Tamil Nadu, this specific manual focuses on infrastructure and public space improvements like footpaths, parks, and plazas rather than fleet management. Hence, statement 3 is incorrect.

Additional Information

• Gender and Policy Lab (GPL): Established under the Chennai City Partnership, it is supported by the World Bank and the Nirbhaya Fund. Its goal is to integrate gender perspectives into all aspects of urban planning and governance within Chennai.

• Gender-Responsive Urban Design: This concept involves planning cities that cater to the different needs of all genders. In Chennai, this includes wider footpaths, tactile paving for the visually impaired, and lower heights for public bus steps to assist the elderly and women carrying loads.

• Safety Through Design (CPTED): The manual draws from the principles of Crime Prevention Through Environmental Design (CPTED). By improving street lighting and ensuring active street frontages (like small shops and vendors), the city creates "natural surveillance" that discourages anti-social activities.

• Institutional Framework: The Greater Chennai Corporation (GCC) uses these manuals to guide engineers and contractors during the renovation of parks, bus stops, and multi-modal hubs, ensuring that gender-inclusive features are not an afterthought but a core design element.

Important Points

• Date of Implementation: The guidelines were formally integrated into Chennai's city development projects in 2025, marking a shift toward data-driven and empathetic urban engineering.

• Inclusion of Gender Minorities: The May-June 2025 manual is notable for explicitly mentioning transgender-inclusive signage and facilities, moving beyond the binary understanding of public space usage.

• Monitoring and Evaluation: The Gender and Policy Lab conducts periodic safety audits involving local women's groups to measure the effectiveness of the increased lighting and toilet accessibility.

• Nirbhaya Fund: A significant portion of the funding for these public space improvements in India comes from this non-lapsable corpus, which was established in 2013 to support initiatives specifically aimed at enhancing women's safety.

Q89. Answer: (a) Maharashtra

The correct answer is Maharashtra.

Key Points

• In 2025, the Maharashtra government decided to review and update the Shakti Criminal Laws (Maharashtra Amendment) Bill.

• The Shakti Bill was originally passed by the Maharashtra State Legislature in December 2021, following the outrage over several heinous crimes against women and children.

• The decision to review the bill in 2025 stems from the need to align its provisions with the new central criminal laws—the Bharatiya Nyaya Sanhita (BNS), Bharatiya Nagarik Suraksha Sanhita (BNSS), and Bharatiya Sakshya Adhiniyam (BSA)—which replaced the IPC and CrPC in July 2024.

• The bill was modeled on the Andhra Pradesh Disha Act and aims to provide for the death penalty in cases of rape and gang rape, especially against children, and to speed up the judicial process.

• Because the bill seeks to amend criminal law (a Concurrent List subject), it requires Presidential assent; the 2025 review ensures that the amendments remain legally viable under the new National Criminal Code framework.

Additional Information

• Scope of Punishment:

• The Shakti Bill proposes the death penalty or life imprisonment for the remainder of the natural life of the convict in cases of rape, gang rape, and sexual assault against minors.

• It also introduces a provision for a fine of up to Rs. 10 lakh for the perpetrator, which would be utilized for the victim's medical expenses and rehabilitation.

• Expedited Investigation and Trial:

• The bill mandates that the investigation of such crimes be completed within 15 working days (extendable to 30 days under specific circumstances).

• The trial is expected to be concluded within 30 working days from the date of filing the charge sheet, ensuring swift justice for the victims.

• Special Units and Courts:

• It proposes the establishment of Special Police Teams and Special Courts in each district of Maharashtra to handle cases related to the safety of women and children.

• The bill also addresses cybercrimes, proposing strict action against those who harass women via social media or digital platforms.

Important Points

• Legal Necessity: The 2025 review is critical because many sections of the IPC and CrPC cited in the original 2021 draft no longer exist. Ensuring "concordance" with the Bharatiya Nyaya Sanhita (BNS) is necessary for the bill to be enforceable once it receives the President's signature.

• Joint Select Committee: The draft of the bill had previously undergone rigorous scrutiny by a Joint Select Committee of the Maharashtra State Legislature before its initial passage to balance the rights of the accused with the safety of women.

• Constitutional Framework: Under Article 254(2) of the Constitution of India, a state law on a Concurrent List subject can override a central law only if it receives Presidential assent, making the current alignment process vital for Maharashtra.

Q90. Answer: (a) Uttarakhand

The correct answer is Uttarakhand.

Key Points

• Uttarakhand celebrated its 25th Foundation Day (Silver Jubilee) on 9 November 2025. The state was officially carved out of Uttar Pradesh on 9 November 2000, becoming the 27th state of the Republic of India.

• The formation of the state was the result of a long-standing Uttarakhand statehood movement that intensified in the 1990s, demanding a separate administrative unit for the hilly regions to ensure better development and resource management.

• Upon its creation, the state was named Uttaranchal. However, responding to the sentiments of the local population, the Government of India officially renamed it Uttarakhand in January 2007.

• The state is divided into two main divisions, namely Garhwal and Kumaon, and it shares international boundaries with China (Tibet) to the north and Nepal to the east.

• The legislative assembly of the state is located in Dehradun (winter capital), while Gairsain was officially declared the summer capital in June 2020 to honor the aspirations of the hill people.

Additional Information

• Chhattisgarh:

• It was formed on 1 November 2000. It was carved out of the state of Madhya Pradesh to become the 26th state of India.

• The state was created primarily due to the distinct cultural identity and socio-economic needs of the tribal-dominated southeastern region of Madhya Pradesh.

• Jharkhand:

• It was established on 15 November 2000, coinciding with the birth anniversary of the tribal leader Birsa Munda. It was separated from Bihar as the 28th state.

• The region is known as 'The Land of Forests' and accounts for a significant portion of India’s mineral wealth, including coal and iron ore.

• Ladakh:

• It became a Union Territory on 31 October 2019, following the Jammu and Kashmir Reorganisation Act, 2019, which bifurcated the erstwhile state of Jammu and Kashmir.

• It is a Union Territory without a legislature and is known for its high-altitude cold desert landscape and strategic importance.

• State Reorganization Acts of 2000:

• The three new states (Chhattisgarh, Uttarakhand, and Jharkhand) were created under the Madhya Pradesh Reorganisation Act, Uttar Pradesh Reorganisation Act, and Bihar Reorganisation Act respectively, passed by the Parliament in the year 2000.

Important Points

• Constitutional Provision: The power to form new states and alter the areas, boundaries, or names of existing states is vested in the Parliament of India under Article 3 of the Constitution of India.

• The Year 2000 Significance: This year marked a major shift in India’s internal geography with the creation of three states in a single month (November). These formations were aimed at improving administrative efficiency and addressing regional

imbalances.

• Geographical Identity: Uttarakhand is often referred to as Devbhumi (Land of the Gods) due to the presence of numerous Hindu pilgrimage sites like Badrinath, Kedarnath, Gangotri, and Yamunotri.

Q91. Answer: (d) International Big Cat Alliance

The correct answer is International Big Cat Alliance.

Key Points

• The Government of India officially signed the Headquarters Agreement (HQA) with the International Big Cat Alliance (IBCA) in April 2025, formalizing the establishment of its global permanent secretariat in India.

• The IBCA is an intergovernmental organization launched to create a global platform for the protection and conservation of the world's major big cat species and their habitats.

• In February 2024, the Union Cabinet, chaired by Prime Minister Narendra Modi, approved the establishment of the alliance with a focus on 96 range countries.

• The headquarters in India will facilitate international cooperation, provide technical assistance, and coordinate resource mobilization for conservation projects across Asia, Africa, and the Americas.

• The agreement grants the alliance legal personality, allowing it to enter into contracts, acquire property, and initiate legal proceedings to fulfill its global mandate.

Additional Information

• Launch and History:

• The International Big Cat Alliance was launched by Prime Minister Narendra Modi on April 9, 2023, during the 50th-anniversary celebrations of Project Tiger in Mysuru, Karnataka.

• The initiative follows India's leadership in wildlife conservation, as it is the only country in the world to have five of the seven big cats in the wild.

• Species Covered:

• The alliance focuses on seven big cats: Tiger, Lion, Leopard, Snow Leopard, Cheetah, Jaguar, and Puma.

• Out of these, five (Tiger, Lion, Leopard, Snow Leopard, and Cheetah) are found in India.

• Financial Support:

• The Government of India has committed a one-time budgetary support of Rs. 150 crore for a period of five years from 2023-24 to 2027-28.

• Future funding is expected to be sustained through membership fees, contributions from multilateral institutions, and the private sector.

• Organizational Structure:

• The governance structure includes an Assembly of Members, a Standing Committee, and a Secretariat located at the Headquarters in India.

• Its primary functions include knowledge sharing, capacity building, and creating a common legal framework to combat illegal wildlife trade.

Important Points

• Global Impact: The alliance aims to mitigate the impact of climate change and habitat loss on apex predators, which are indicators of healthy ecosystems.

• Strategic Partnerships: It works in synergy with existing platforms like the Global Tiger Forum (GTF) to avoid duplication of efforts and maximize conservation outcomes.

• Technological Integration: The IBCA promotes the use of modern technology, such as e-Surveillance and DNA profiling, to monitor big cat populations across borders.

Q92. Answer: (d) NITI Aayog

p>The correct answer is NITI Aayog.

Key Points

• The report titled ‘India’s Services Sector: Insights from GVA Trends and State-Level Dynamics’ was released by NITI Aayog in October 2025 to provide a strategic roadmap for the tertiary sector.

• It focuses on the Gross Value Added (GVA) trends, highlighting how the services sector has become the primary engine of economic growth in India, contributing significantly to the national GDP.

• The report provides a detailed analysis of state-level performance, identifying top-performing states such as Maharashtra, Karnataka, and Tamil Nadu in terms of service output and innovation.

• One of the primary objectives of this publication is to address the inter-state disparities in service sector development and recommend policy measures to enhance employment opportunities and export potential.

• The document emphasizes the transition towards knowledge-intensive services, including IT-BPM, Professional Services, and

Financial Services, which are pivotal for India's goal of becoming a USD 5 trillion economy.

Additional Information

• NITI Aayog (National Institution for Transforming India):

• Established on 1st January 2015, it replaced the erstwhile Planning Commission to foster cooperative federalism.

• The Prime Minister of India serves as the Ex-officio Chairperson, and it acts as the premier policy Think Tank of the Government of India.

• It focuses on long-term policy frameworks, monitoring and evaluation of government schemes, and promoting innovation through initiatives like the Atal Innovation Mission (AIM).

• Services Sector in India:

• Commonly known as the Tertiary Sector, it encompasses a wide range of activities including Trade, Hotels, Transport, Communication, and Financial services.

• In the Indian economy, the services sector typically contributes over 50% of the total Gross Value Added (GVA), making it the largest contributor among the three sectors.

• India is a global leader in software exports and Business Process Outsourcing (BPO), significantly boosting the country's Foreign Exchange Reserves.

• Gross Value Added (GVA):

• GVA is defined as the value of output minus the value of intermediate consumption. It provides a measure of the contribution to GDP made by an individual producer, industry, or sector.

• It is a crucial metric used by the Ministry of Statistics and Programme Implementation (MoSPI) to track economic activity from the supply side.

Important Points

• Digital Transformation: The report highlights that the Digital India mission has played a transformative role in enabling contactless services and expanding the reach of e-commerce and fintech across rural and urban landscapes.

• Employment Generation: While the sector contributes high GVA, the report points out the need for skill development to ensure that the workforce can meet the demands of emerging technologies like Artificial Intelligence (AI) and Cloud Computing.

• FDI Inflows: The Computer Software and Hardware and Services sectors consistently rank as the top recipients of Foreign Direct Investment (FDI) in India, showcasing global investor confidence.

• Global Value Chains (GVCs): NITI Aayog suggests that for India to improve its global standing, it must integrate more deeply into Global Value Chains by diversifying its service export basket beyond traditional IT services.

Q93. Answer: (d) Aishwarya Mishra

The correct answer is Aishwarya Mishra.

Key Points

• In February 2025, during the 38th National Games, athlete Aishwarya Mishra clinched the gold medal in the women’s 400 m event.

• She clocked an impressive timing of 51.12 seconds, which set a new benchmark in the history of the National Games for this category.

• By achieving this feat, she successfully broke her own previous National Games record of 51.18 seconds, which she had established during the 36th National Games held in Gujarat in 2022.

• Aishwarya Mishra represents the state of Maharashtra in domestic competitions and has been a consistent performer in the quarter-mile sprint at the national level.

• This performance in Uttarakhand further solidifies her position as one of India's leading 400 m runners, approaching the Asian Games and international qualification standards.

Additional Information

• 38th National Games 2025:

• The 2025 edition of the National Games is hosted by the state of Uttarakhand.

• Events are spread across major cities including Dehradun, Haldwani, Rishikesh, and Haridwar.

• The games serve as a prestigious platform for Indian athletes to showcase their talent across 38 different sports disciplines.

• Hima Das:

• Known as the “Dhing Express”, she is a specialist 400 m and 200 m runner from Assam.

• She holds the current Indian National Record in 400 m with a time of 50.79 seconds, set during the 2018 Asian Games in Jakarta.

• Jyothi Yarraji:

• She is India’s premier 100 m hurdler and holds the national record in the 100 m hurdles event.

• She became the first Indian woman to run the 100 m hurdles in under 13 seconds.

• Dutee Chand:

• A prominent sprinter from Odisha, she specializes in the 100 m and 200 m events.

• She is a two-time silver medalist at the Asian Games and held the national record for the 100 m dash for several years.

Important Points

• The National Games are organized by the Indian Olympic Association (IOA) to identify and nurture sporting talent for international events like the Olympics and Commonwealth Games.

• The women's 400 m event is a critical component of the 4x400 m relay team, which has traditionally been a strong event for India at the Asian level.

• Timing below 52 seconds is considered world-class in the domestic circuit and helps athletes secure spots in the National Camp managed by the Athletics Federation of India (AFI).

• Aishwarya Mishra has previously won medals at the Asian Athletics Championships, making her a key figure in India's middle-distance sprinting strategy.

Q94. Answer: (b) Debasish Panda

The correct answer is Debasish Panda.

Key Points

• Debasish Panda, a 1987-batch IAS officer of the Uttar Pradesh cadre, was appointed as the Chairperson of the Insurance Regulatory and Development Authority of India (IRDAI) in March 2022.

• His appointment was approved by the Appointments Committee of the Cabinet (ACC) for a tenure of three years, which concludes in March 2025.

• Before joining IRDAI, Debasish Panda served as the Secretary in the Department of Financial Services (DFS) under the Ministry of Finance, Government of India, where he retired in January 2022.

• Under his leadership, the regulatory body shifted its focus toward a principle-based regime rather than a rule-based one, aiming to enhance the ease of doing business in the insurance sector.

• He has been a key proponent of the vision "Insurance for All by 2047", a mission intended to ensure that every citizen and enterprise in India has appropriate insurance coverage by the centenary of Independence.

Additional Information

• About IRDAI:

• The Insurance Regulatory and Development Authority of India (IRDAI) is a statutory body formed under the Insurance Regulatory and Development Authority Act, 1999.

• It functions as the apex body to regulate and develop the insurance and re-insurance industries in India.

• The body consists of a 10-member team, including a Chairman, five whole-time members, and four part-time members, all appointed by the Government of India.

• While it was initially headquartered in New Delhi, the head office was shifted to Hyderabad, Telangana, in 2001 to facilitate better regional administration.

• Major Initiatives under current leadership:

• Bima Sugam: This is a conceptualized one-stop digital platform designed to integrate all insurance stakeholders, including companies, agents, and consumers, to simplify the purchase and claim process.

• Bima Vahak and Bima Vistaar: These initiatives aim to reach the rural and gram panchayat levels to improve insurance penetration in under-served areas.

• Risk-Based Capital (RBC): IRDAI is working on transitioning from a factor-based solvency model to a risk-based capital framework to align Indian standards with global best practices.

Important Points

• Malhotra Committee: The IRDAI was established following the recommendations of the Malhotra Committee report of 1994, which suggested reforms to open up the insurance sector to private players.

• Regulatory Duties: As per Section 14 of the IRDA Act, 1999, the authority is tasked with protecting the interests of policyholders and ensuring the orderly growth of the insurance market.

• Other Options:

• Sunil Mehta is a prominent banker who served as the Chief Executive of the Indian Banks' Association (IBA).

• Subhash Chandra Khuntia was the immediate predecessor of Debasish Panda, serving as IRDAI Chairman from 2018 to 2021.

Q95. Answer: (a) Bihar

The correct answer is Bihar.

Key Points

• The seventh edition of the Khelo India Youth Games (KIYG) is scheduled to be hosted by the state of Bihar in 2025. This marks the first time that Bihar has been selected to host this prestigious national-level multi-sport event.

• The announcement was made following the successful conclusion of previous editions, signaling the Ministry of Youth Affairs and Sports' commitment to expanding sports infrastructure in the eastern region of India.

• The games are expected to feature over 30 sports disciplines, with thousands of athletes in the under-17 and under-21 age categories participating from all States and Union Territories of India.

• Major venues for the 2025 games include the newly developed State Sports Academy and Bihar Sports University in Rajgir, as well as facilities in Patna. The Rajgir Sports Complex is designed to meet international standards to host diverse athletic events.

• Hosting KIYG 2025 is a significant milestone for Bihar, aimed at promoting a sporting culture among the youth and identifying talent for future international competitions like the Asian Games and Olympics.

Additional Information

• History of KIYG:

• The Khelo India Youth Games (formerly Khelo India School Games) was launched in 2018 by the Government of India.

• The first edition was held in New Delhi, where Haryana emerged as the overall champion.

• Subsequent editions have been held in Pune (2019), Guwahati (2020), Panchkula (2021/2022), Madhya Pradesh (2023), and Tamil Nadu (2024).

• Sixth Edition (2024):

• The 6th edition took place in Tamil Nadu across four cities: Chennai, Madurai, Trichy, and Coimbatore.

• Maharashtra topped the medal tally in the 2024 edition, maintaining its dominance in the youth category.

• Scholarships and Support:

• Under the scheme, talented players identified in priority sports disciplines at various levels are provided annual financial assistance of Rs. 5 lakh per annum for 8 years.

• This scholarship is intended to cover training, equipment, and medical expenses for budding athletes.

• Other Khelo India Initiatives:

• Apart from the Youth Games, the government conducts the Khelo India University Games (KIUG) to bridge the gap between school and professional sports.

• The Khelo India Winter Games are held in regions like Gulmarg and Leh to promote winter sports like skiing and ice hockey.

• In 2023, the first-ever Khelo India Para Games were launched in New Delhi to provide a platform for athletes with disabilities.

Important Points

• Objective: The primary goal of the Khelo India programme is to mass-participate and promote excellence in sports. It is a central sector scheme fully funded by the Central Government.

• Governance: The initiative is overseen by the Department of Sports under the Ministry of Youth Affairs and Sports, currently headed by the Union Sports Minister.

• Bihar's Preparation: To prepare for the 2025 games, the Bihar government has emphasized the "Medal Lao, Naukri Pao" (Bring Medal, Get Job) policy to incentivize local athletes and has increased the sports budget significantly for infrastructure development.

Q96. Answer: (c) IUCN World Conservation Congress

The correct answer is IUCN World Conservation Congress.

Key Points

• India officially launched its National Red List Roadmap during the IUCN World Conservation Congress (WCC) held in 2025. This roadmap serves as a strategic document to guide the assessment of the conservation status of species found within India.

• The initiative is a collaborative effort led by the Ministry of Environment, Forest and Climate Change (MoEFCC), in partnership with global conservation bodies. It aims to apply the IUCN Red List Categories and Criteria at the national level to identify species at the highest risk of extinction.

• The primary objective of the National Red List Roadmap is to ensure that conservation efforts are data-driven. By creating a national database, India can prioritize funding and protection for species classified as Critically Endangered or Endangered under national standards.

• This roadmap is crucial for fulfilling India’s obligations under the Kunming-Montreal Global Biodiversity Framework, specifically Target 4, which focuses on halting species extinction and managing human-wildlife conflict.

• The 2025 Congress in Abu Dhabi, UAE, provided the international platform for India to showcase its scientific rigor in biodiversity monitoring, involving organizations like the Zoological Survey of India (ZSI) and the Botanical Survey of India (BSI). Hence, the correct answer is IUCN World Conservation Congress.

Additional Information

• IUCN (International Union for Conservation of Nature):

• Established in 1948, it is the world’s largest environmental network, composed of both government and civil society organizations.

• Its headquarters is located in Gland, Switzerland. The organization acts as an advisor to the United Nations and helps implement international conventions.

• IUCN Red List of Threatened Species:

• First established in 1964, it is the global standard for evaluating the extinction risk of species. It classifies species into categories such as Vulnerable, Endangered, and Critically Endangered.

• The Red List is updated periodically and serves as a "health check" for the planet's biodiversity.

• IUCN World Conservation Congress (WCC):

• This event is held every four years and is often referred to as the "Olympics of Conservation." The 2025 session in Abu Dhabi focused heavily on nature-based solutions and climate resilience.

• It brings together thousands of delegates to vote on motions that set the global agenda for conservation policy.

• National Red List vs. Global Red List:

• While the global list assesses species across their entire range, a National Red List focuses on the status of a species within a specific country's borders.

• A species might be Least Concern globally but Critically Endangered within India due to localized threats like habitat loss or poaching.

Important Points

• Biodiversity in India: India is recognized as one of the 17 mega-diverse countries in the world, harboring approximately 7-8% of all recorded species. Notable endemics include the Asiatic Lion and the Sangai Deer.

• Legal Framework: The data generated through the National Red List Roadmap will inform the schedules of the Wild Life (Protection) Act, 1972, ensuring legal protection matches the biological threat level.

• Global Biodiversity Framework (GBF): Adopted in 2022, the framework sets 23 targets for 2030, including the protection of 30% of the world’s land and oceans (the 30x30 target).

• Other Options Context: The UN Climate Change Conference (COP30) in Brazil primarily focuses on carbon emissions and the Paris Agreement, whereas the IUCN WCC is specifically dedicated to species conservation.

Q97. Answer: (c) Nilgiri Tahr

The correct answer is Nilgiri Tahr.

Key Points

• Eravikulam National Park (ENP) is situated in the Devikulam Taluk of Idukki district in Kerala, along the high ranges of the Southern Western Ghats.

• It is famously known as the natural habitat of the Nilgiri Tahr (Nilgiritragus hylocrius), an endangered mountain goat that is endemic to the Western Ghats. Hence, the correct answer is Nilgiri Tahr.

• In June 2025, the park was recognized by the Wildlife Institute of India (WII) in its Management Effectiveness Evaluation (MEE) report as one of the top-performing protected areas in the country due to its excellence in biodiversity conservation and administrative efficiency.

• The park houses Anamudi, which is the highest peak in South India, standing at an elevation of 2,695 metres.

• Originally established as a wildlife sanctuary in 1975 primarily to protect the declining population of the Nilgiri Tahr, it was elevated to the status of a National Park in 1978.

Additional Information

• Vegetation and Flora:

• The park's ecosystem is characterized by high-altitude grasslands interspersed with Shola forests (stunted tropical montane forests).

• It is one of the primary sites for the blooming of the Neelakurinji (Strobilanthes kunthiana), a flower that carpets the hills in blue once every 12 years.

• Faunal Diversity:

• Apart from the flagship Nilgiri Tahr, the park is home to other species like the Gaur, Indian Muntjac, Sambar Deer, Golden Jackal, and Leopard.

• The Lion-tailed Macaque is another endemic species of the Western Ghats, but it is more commonly associated with the Silent Valley National Park rather than the grassland-dominant terrain of Eravikulam.

• Hydrography:

• The park serves as a major catchment area for several perennial streams that feed into the Periyar River and the Chalakuddy River.

• Tourism:

• The Rajamala region is the designated tourism zone within the park where visitors are allowed to witness the Nilgiri Tahr at close quarters.

Important Points

• Conservation Status of Nilgiri Tahr:

• The Nilgiri Tahr is listed as Endangered on the IUCN Red List.

• It is protected under Schedule I of the Wildlife (Protection) Act, 1972, providing it the highest level of legal protection in India.

• The Government of Tamil Nadu has also launched Project Nilgiri Tahr (the first of its kind) to protect its state animal, which shares its habitat with Kerala's high-altitude zones.

• Management Effectiveness Evaluation (MEE):

• MEE is a global framework used by the National Tiger Conservation Authority (NTCA) and WII to assess how well protected areas are being managed.

• The 2025 evaluation highlights Eravikulam's success in maintaining a healthy "population-to-habitat" ratio and mitigating human-wildlife conflict.

Q98. Answer: (b) Supercapacitors

The correct answer is Supercapacitors.

Key Points

• Researchers at the Centre for Nano and Soft Matter Sciences (CeNS), Bangalore, an autonomous institute under the Department of Science and Technology (DST), Government of India, have developed a novel material to improve energy storage technology.

• The material is Lanthanum-doped Silver Niobate, which is specifically designed to enhance the performance of Supercapacitors.

• Silver Niobate ($AgNbO_3$) is a lead-free antiferroelectric material that is considered an environmentally friendly alternative to traditional lead-based ceramics used in electronic components.

• The addition of Lanthanum (La) as a dopant helps in modulating the electrical properties, leading to a higher dielectric constant and significantly improved energy storage density and efficiency.

• This research is crucial for the development of high-power energy storage devices that require rapid charge-discharge cycles and high durability.

Additional Information

• Supercapacitors:

• They are also known as ultracapacitors and bridge the gap between conventional capacitors and rechargeable batteries.

• They possess a very high power density, meaning they can release large amounts of energy very quickly, though their energy density is generally lower than that of Lithium-ion batteries.

• Typical applications include regenerative braking in electric vehicles (EVs), power backup systems, and portable electronic devices.

• Lithium-ion Batteries:

• These are the most common type of rechargeable batteries used in smartphones and laptops.

• They offer high energy density but have slower charging times and a shorter cycle life compared to supercapacitors.

• Fuel Cells:

• A fuel cell converts chemical energy from a fuel (often hydrogen) into electricity through a chemical reaction with oxygen.

• Unlike batteries, they do not run down or need recharging; they produce electricity as long as fuel is supplied.

• Solar Panels:

• These are devices that convert photons from sunlight into electricity using the photovoltaic effect.

• While they generate energy, they require storage devices like batteries or supercapacitors to provide power when the sun is not shining.

Important Points

• Material Composition: Lanthanum is a rare-earth element with atomic number 57, often used to improve the thermal stability and capacitance of ceramic materials.

• Lead-free Innovation: The move towards Silver Niobate is part of a global effort to eliminate toxic lead (found in materials like PZT) from consumer electronics to reduce environmental pollution.

• Efficiency: The energy storage efficiency of the newly developed material is reported to be significantly higher than pure silver niobate, making it a viable candidate for next-generation high-performance electronics.

• Strategic Importance: For India, developing indigenous energy storage materials is vital for the National Electric Mobility Mission Plan and achieving carbon neutrality by 2070.

Q99. Answer: (d) Singapore

The correct answer is Singapore.

Key Points

• During the official visit of Prime Minister Narendra Modi to Singapore in September 2024, India and Singapore elevated their bilateral relationship to a Comprehensive Strategic Partnership.

• This elevation marks a significant milestone in the India-Singapore relationship, aimed at deepening cooperation across various high-tech and emerging sectors to meet the needs of the 21st century.

• A total of four Memorandums of Understanding (MoUs) were signed, covering Semiconductors, Digital Technologies, Health and Medicine, and Skill Development and Education.

• The MoU on Semiconductors, signed by the Ministry of Electronics and Information Technology (MeitY) of India and Singapore's Ministry of Trade and Industry, focuses on establishing a robust semiconductor ecosystem and supply chain resilience.

• The Digital Technology agreement aims to enhance cooperation in Digital Public Infrastructure (DPI), Cyber Security, and 5G/6G technologies, while the Skill Development MoU focuses on Technical and Vocational Education and Training (TVET).

Additional Information

• Economic Ties: Singapore is one of India's largest sources of Foreign Direct Investment (FDI). In the financial year 2023-24, it was the leading source of FDI equity inflows into India, contributing approximately $11.77 billion.

• Digital Connectivity: India and Singapore successfully linked their fast payment systems, Unified Payments Interface (UPI) and PayNow, in February 2023, enabling instant and low-cost cross-border fund transfers.

• Defense Cooperation: The two nations share strong defense ties, including the SIMBEX (Singapore-India Maritime Bilateral Exercise), which is the longest uninterrupted naval exercise India has with any other country, beginning in 1994.

• Geopolitical Context: Singapore serves as a vital pillar of India's "Act East" Policy and plays a crucial role in India's engagement with the ASEAN (Association of Southeast Asian Nations) region.

Important Points

• India-Singapore Ministerial Roundtable (ISMR): The ISMR is a unique mechanism designed to set a new agenda for bilateral relations. The second edition of the ISMR held in August 2024 paved the way for the Comprehensive Strategic Partnership.

• Semiconductor Hub: Singapore accounts for roughly 10% of the global semiconductor output and 20% of semiconductor equipment production, making it a critical partner for India's India Semiconductor Mission (ISM).

• Leadership: The agreements were finalized during discussions between Indian PM Narendra Modi and Singapore PM Lawrence Wong at the Parliament House in Singapore.

• Ministry Involvement: The Ministry of External Affairs (MEA) coordinated the diplomatic elevation, while MeitY specifically led the technological partnerships in the digital and semiconductor domains.

Q100. Answer: (c) Chris McQueer

The correct answer is Chris McQueer.

Key Points

• Chris McQueer is a prominent Glaswegian author and screenwriter known for his unique voice in contemporary Scottish literature.

• In January 2025, he released his debut full-length novel titled Hermit, which explores the dark and claustrophobic world of online radicalization.

• The novel focuses on the themes of toxic masculinity and the rise of online misogyny, specifically looking at the "manosphere" and incel culture through the eyes of the protagonist, Cillian.

• The story is set in Glasgow, providing a gritty, realistic backdrop to the character's descent into digital isolation and harmful ideologies.

• McQueer uses the narrative to dissect how social media algorithms and internet subcultures can distort a young man's perception of reality and relationships.

Additional Information

• Chris McQueer first gained critical acclaim with his short story collections, Hings (2017) and HWFG (2018), which were celebrated for their use of the Scots language and surrealist humor.

• His work often highlights the working-class experience in Scotland, blending everyday situations with bizarre, often dark, twists.

• The novel Hermit was published by 4th Estate, an imprint of HarperCollins, marking a significant milestone in McQueer's transition from short fiction to long-form novels.

• Other authors mentioned, such as Ocean Vuong, are known for different literary traditions; Vuong is a Vietnamese-American poet and novelist famous for On Earth We're Briefly Gorgeous.

• Margaret McDonald is a fellow Scottish author whose debut novel, Glasgow Boys, was released in 2024 and also deals with masculinity and male friendship in Glasgow, though it focuses on different thematic elements than Hermit.

• Nell Stevens is a British author known for Briefly, A Delicious Life and Mrs. Gaskell and Me, whose work typically focuses on historical and biographical fiction.

Important Points

• The release of Hermit in 2025 is considered a timely intervention in literature, addressing the real-world consequences of

loneliness and the internet.

• Chris McQueer has also worked in television, adapting his short stories for BBC Scotland, which has helped bring his Glaswegian narratives to a wider audience.

• The term incel (involuntary celibate) and the concept of the manosphere are central to the book's investigation into modern social isolation.

• The author’s move away from purely comedic short stories toward a more serious exploration of misogyny and masculinity shows the evolution of his writing style.

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