RRB Group D Official Paper (Held On: 09 Feb, 2026 Shift 3) (Previous Year Paper)

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

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GENERAL SCIENCE

Q1. In a toaster, the heating wire glows red because _____.

(a) It has zero resistance.
(b) It has low melting point.
(c) The current is very high.
(d) It resists the current and gets hot.

Q2. A sealed syringe containing air is pressed from one end while keeping the other end closed. What is the most likely outcome of this action in terms of the state of air inside the syringe?

(a) The temperature of air inside drops significantly
(b) The air escapes completely from the syringe
(c) The volume of air increases and pressure decreases
(d) The volume of air decreases and its pressure increases

Q3. Which of the following symbols is used for the element phosphorus as per the rules for atomic symbols?

(a) Ph
(b) P
(c) Ps
(d) Pr

Q4. Which connective tissue is known for supporting internal organs?

(a) Squamous epithelium
(b) Tendon
(c) Ligament
(d) Areolar tissue

Q5. How does the space between particles change from solid to gas?

(a) Solids and gases always have equal spacing
(b) The space remains unchanged during the change in states of matter
(c) The space increases as matter changes from solid to gas
(d) The space decreases as matter changes from solid to gas

Q6. A constant force acts on an object of mass 4 kg for a duration of 2 s, increasing its velocity from 2 m/s to 8 m/s. If the same force is applied for a duration of 4 s, then what would be the final velocity of the object?

(a) 20 m/s
(b) 12 m/s
(c) 10 m/s
(d) 14 m/s

Q7. In plants, food made in leaves is transported to other parts by the complex tissue called _____.

(a) Xylem
(b) Collenchyma
(c) Phloem
(d) Sclerenchyma

Q8. A scientist observed a multicellular organism undergoing reproduction. Which of the following methods would the plant NOT be using?

(a) Budding
(b) Fragmentation
(c) Vegetative Propagation
(d) Binary Fission

Q9. What is the general name of the reaction between an acid and a base?

(a) Decomposition
(b) Combustion
(c) Oxidation
(d) Neutralisation

Q10. A boy lifts an object above his head by exerting a force. Which of the following works is negative?

(a) Work done by the force of gravity
(b) Work done by the applied force
(c) Work done by the object
(d) Work done by the boy

Q11. During a nerve impulse transmission, neurotransmitters are released from one neuron and received by another. Which part of neurons are primarily involved in this chemical communication?

(a) Axon → Myelin sheath of nerve
(b) Dendrite → Axon terminal of same neuron
(c) Axon terminal → Dendrite of another neuron
(d) Cell body → Axon of same neuron

Q12. Read the following statements carefully and select the correct option.
Assertion (A): Keeping oily food in airtight containers prevents rancidity.
Reason (R): Airtight containers slow down the oxidation of fats and oils.

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

Q13. Which property enables carbon to form long chains?

(a) Isomerism
(b) Polymerisation
(c) Catenation
(d) Tetravalency

Q14. The complex tissue that transports food in plants is called _____, and it consists of living cells like sieve tubes and _____.

(a) Phloem, companion cells
(b) Collenchyma, sclerenchyma
(c) Xylem, tracheids
(d) Xylem, xylem fibres

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Q15. Which of the following is the correct unit of average speed in SI system?

(a) km/h²
(b) m/s²
(c) s/m²
(d) m/s

Q16. A real and inverted image is formed at a distance of 30 cm from a concave mirror when the object is placed 40 cm from the mirror. What will be the magnification produced by the mirror?

(a) • 3/4
(b) • 4/3
(c) • 3/4
(d) • 4/3

Q17. A sound wave has a speed of 320 m/s. If the wavelength of the wave is 0.4 m, what is the frequency of this wave?

(a) 800 Hz
(b) 1280 Hz
(c) 80 Hz
(d) 128 Hz

Q18. During the birth, the ovaries of a girl child contain _____.

(a) Only immature eggs
(b) Both mature and immature eggs
(c) No eggs
(d) Only mature eggs

Q19. Based on the reactivity series, which of the following metals is the least reactive?

(a) Ca (calcium)
(b) Fe (iron)
(c) Au (gold)
(d) K (potassium)

Q20. Which structure in Rhizopus is directly involved in the process of reproduction through spore formation?

(a) Hyphae
(b) Sporangia
(c) Mycelium
(d) Rhizoids

Q21. Which of the following statements is true about weight and mass?

(a) Both mass and weight change on the Moon
(b) Only mass changes on the Moon
(c) Neither mass nor weight changes on the Moon
(d) Only weight changes on the Moon

Q22. Which of the following is NOT an olfactory indicator?

(a) Clove oil
(b) Onion
(c) Vanilla
(d) Litmus

Q23. A student shows a concave lens forming a diminished real image on the screen. The mistake is:

(a) Concave lens does not refract light
(b) Concave lens cannot form a magnified image
(c) Concave lens always converges light
(d) Concave lens cannot form a real image

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Q24. The disease-causing pathogens in plants can be transmitted through_____.

(a) Soil
(b) Both Soil and Air
(c) Air
(d) Neither Soil nor Air

Q25. The filament of a light bulb is made up of tungsten, because of its _____.

(a) High resistance and high melting point
(b) High resistance and low melting point
(c) Low resistance and low melting point
(d) Low resistance and high melting point

MATHEMATICS

Q26. A man receives Rs. 9475 per month as salary. He saves 88% of his salary every month. His expenditure per month is:2163

(a) Rs. 1114
(b) Rs. 1168
(c) Rs. 1137
(d) Rs. 1053

Q27. Find the value of tan10° tan18° tan72° tan80°.

(a) tan 18°
(b) 1
(c) tan 80°
(d) -1

Q28. The amount on a sum of Rs. 9,400 at 20% per annum compound interest, compounded annually, in 2 years will be:

(a) Rs. 14,133
(b) Rs. 13,189
(c) Rs. 13,536
(d) Rs. 12,838

Q29. The sum of the first pair of two-digit twin prime numbers is:

(a) 28
(b) 24
(c) 26
(d) 22

Q30. The cost of 2 chocolates and 3 cookies is Rs. 36. The cost of 1 chocolate and 2 cookies is Rs. 23. What is the cost of 4 chocolates and 5 cookies?

(a) Rs. 52
(b) Rs. 62
(c) Rs. 66
(d) Rs. 56

Q31. Simplify the following.

$(3x^2 + 4x^2) \div 7x$

(a) x
(b) x^2
(c) 12x/7
(d) $7x^2$

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Q32. An item is sold for Rs. 8,900 after two successive discounts of 20% and 11%. What is the marked price (in Rs.) of the item?

(a) 12,670
(b) 12,525
(c) 12,495
(d) 12,500

Q33. The present age of a father is 4 times the age of his daughter. Five years ago, the father was 7 times as old as his daughter.

What is the present age of the daughter?

(a) 10 years
(b) 18 years
(c) 15 years
(d) 20 years

Q34. A and B started moving at the same time towards each other from points X and Y, respectively. After meeting on the way, A and B took 95.4 hours and p hours, respectively, to reach Y and X, respectively. If the speed of B is 50% more than that of A, then what is the value of p?

(a) 43.8
(b) 42.4
(c) 40.4
(d) 44.5

Q35. If 66 is the mean proportion between x and 99, what is the value of x?

(a) 42
(b) 43
(c) 46
(d) 44

Q36. In an election with three candidates, M, N and R, candidate M secured 42% of the total votes, while candidate R obtained 34%. If the total number of votes polled was 37,700 and all were valid, how many votes did candidate N receive?

(a) 9048
(b) 9100
(c) 9164
(d) 9000

Q37. Rishi can do a piece of work in 12 days. Shan is 20% more efficient than Rishi. The number of days taken by Shan to do the same piece of work is:

(a) 12
(b) 20
(c) 15
(d) 10

Q38. A rectangular water tank 5 m long and 3 m wide contains water up to a depth of 1.50 m. The area of the wet surface is:

(a) 54 m2
(b) 39 m2
(c) 36 m2
(d) 24 m2

Q39. A table is bought for Rs. 1,400 and sold at a loss of 6%. Find its selling price.

(a) Rs. 1,316
(b) Rs. 1,312
(c) Rs. 1,314

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(d) Rs. 1,310

Q40. Rs. 9,975 is divided among A, B, C and D in such a way that the shares of A and B, B and C, and C and D are in the ratios of 2 : 3, 4 : 5 and 6 : 7, respectively. The share of A (in Rs.) is:

(a) 1,560
(b) 1,520
(c) 1,490
(d) 1,460

Q41. What is the mode of the following data?

65, 86, 86, 85, 69, 90, 71, 60, 86, 71, 86, 65, 81, 82, 67, 72, 84, 66, 75, 85, 68, 78, 61, 64, 74, 90

(a) 69
(b) 86
(c) 65
(d) 85

Q42. Let A and B be the angles of regular polygons of sides 8 and 10 respectively. Then what is the value of $\sin^2(A/3) + \cos^3(5B/6)$?

(a) 5/8
(b) 3/8
(c) 1/4
(d) 3/4

Q43. The speed of a train 200 m long is 50 km/hr. How much time will it take to pass a platform 600 m long?

(a) 56 sec
(b) 57 sec
(c) 55 sec
(d) 57.6 sec

Q44. A shopkeeper fixed the marked price of an article as Rs. 2,40,000. He gave 30% and 18% successive discounts on one article and 48% discount on another article of the same marked price. On which of the two articles did the shopkeeper get more benefit and how much more was it?

(a) First article; Rs. 12,960
(b) Second article; Rs. 10,960
(c) Second article; Rs. 12,800
(d) First article; Rs. 11,560

Q45. If the mode of a data exceeds its mean by 34.8, then the mode exceeds the median by _____. (Use empirical formula to find the answer)

(a) 26.9
(b) 23.2
(c) 21.6
(d) 19.3

Q46. Pipe A can fill a tank in 33 minutes and Pipe B can fill it in 22 minutes. Pipe C empties it. If all of the pipes are opened together, the tank will be full in 55 minutes. In how many minutes will pipe C empty the full tank?

(a) 166/19
(b) 144/19
(c) 155/19
(d) 177/19

Q47. Simplify: $\sqrt{(121 \times 49)} + \sqrt{(64 \times 36)} - \sqrt{(100 \times 16)}$

(a) 85
(b) 51
(c) 72

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(d) 95

Q48. What is the smallest natural number that should be added to 9054 such that a remainder of 6 is left when the resulting number is divided by each of the numbers 28, 24, 56 and 29?

(a) 678
(b) 696
(c) 710
(d) 695

Q49. The expenditure of Sudha is 100% more than her savings. If her expenditure decreases by 4% and savings increase by 35%, then by what percent does her income increase?

(a) 9%
(b) 12%
(c) 14%
(d) 11%

Q50. The area of a rectangle gets reduced by 21 m^2 if its length is reduced by 7 m and breadth is increased by 5 m and if its length is increased by 4 m and breadth is increased by 5 m, the area is increased by 67 m^2. Find the original area of the rectangle.

(a) 21.8 m2
(b) 15.6 m2
(c) 12.8 m2
(d) 21 m2

GENERAL INTELLIGENCE & REASONING

Q51. Which of the following letter-number clusters will replace the question mark (?) in the given series to make it logically complete?

VZY 64 XBA 58 ZDC 52 BFE 46 ?2579

(a) DGF 39
(b) DIF 40
(c) DHG 40
(d) DHM 39

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

Statements:

All rods are hooks.

Some hooks are baits.

Conclusions:

(I): All rods are baits.

(II): Some baits are rods.

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

Q53. 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 is the one that does not belong to that group?

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

(a) SK - XP
(b) DY - IC
(c) EZ - JE

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(d) JQ - OV

Q54. In a certain code language, ‘she is lovely’ is coded as ‘kl pc cp’ and ‘lovely paint here’ is coded as ‘lk cp no’. How is ‘lovely’ coded in the given language?

(All codes are two-letter codes)

(a) cp
(b) kl
(c) pc
(d) no

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

16 31 46 61 76 ?

(a) 81
(b) 91
(c) 99
(d) 89

Q56. KGLO is related to QMRU in a certain way based on the English alphabetical order. In the same way, NJOR is related to TPUX. To which of the following is EAFI related to, following the same logic?

(a) KGLO
(b) KHLO
(c) KGLP
(d) KHLP

Q57. Refer to the following number, symbol series and answer the question. Counting to be done from left to right only (all numbers are single digit numbers only).

(Left) / 8 & + ^ 1 + < # @ ^ \ 2 # $ 8 9 * 7 2 $ (Right)

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

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

Q58. This question is based on the five, three-digit numbers given below.

(Left) 324 286 472 539 731 (Right)

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

NOTE - All operations to be done from left to right.

If all the numbers are arranged in ascending order, the position of how many numbers will remain unchanged?

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

Q59. In a certain code language,

A + B means ‘A is the father of B’,

A - B means ‘A is the brother of B’,

A x B means ‘A is the sister of B’,

A ÷ B means ‘A is the wife of B’.

Based on the above, how is M related to Q if ‘M + N x O - P ÷ Q’?

(a) Father
(b) Husband’s brother
(c) Wife’s father

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(d) Husband's father

Q60. Andy ranked 11^(th) from the top and 15^(th) from the bottom in his class. How many students are there in the class?

(a) 25
(b) 24
(c) 26
(d) 27

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

154 ÷ 2 − 49 ÷ 7 + 10 × 5 + 28 × 7 − 25 ÷ 5 = ?

(a) 618
(b) 662
(c) 770
(d) 711

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

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

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

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

Q63. 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) QK - VH
(b) WH - BD
(c) GQ - LN
(d) AE - FB

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

89 94 99 104 109 ?

(a) 113
(b) 116
(c) 114
(d) 115

Q65. All 119 people are standing in a row facing north. Mr. Lkj is 7th from the right end while Mr. Ihg is 29th from the left end. How many people are there between Mr. Lkj and Mr. Ihg?

(a) 80
(b) 82
(c) 83
(d) 81

Q66. What should come in place of '?' in the given series?

119 136 155 172 191 ?

(a) 206
(b) 210
(c) 208
(d) 205

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Q67. Each of the digits in the number 3652497 is arranged in descending order from left to right. What will be the product of the digits that are second from the left and second from the right in the number thus formed?

(a) 18
(b) 14
(c) 24
(d) 21

Q68. What will come in place of the question mark (?) in the following equation, if '+' and '−' are interchanged and '×' and '÷' are interchanged?

53 ÷ 13 + 391 × 17 − 289 = ?

(a) 972
(b) 915
(c) 955
(d) 963

Q69. A, B, C, D, E, F and G are sitting around a circular table facing the centre. E sits third to the left of B. D sits second to the right of B. C sits to the immediate right of F. G sits second to the right of A.

How many people sit between G and C when counted from the left of C?

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

Q70. 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.)

(24, 11, 105)

(38, 42, 240)

(a) (34, 62, 286)
(b) (46, 53, 287)
(c) (74, 34, 324)
(d) (93, 12, 318)

Q71. Seven people, S, Q, U, A, R, E and D are sitting in a row, facing north.

Only S sits to the left of Q. Only four people sit between S and U. Only A sits between E and R, and E is not an immediate neighbor of U.

Who sits at the extreme right of the line?

(a) S
(b) A
(c) D
(d) U

Q72. QOHY is related to WJLV in a certain way based on the English alphabetical order. In the same way, NRBT is related to TMFQ. To which of the following is JRUF related to following the same logic?

(a) PNZD
(b) QNZC
(c) PMYC
(d) QMYD

Q73. JUNC is related to QBUJ in a certain way based on the English alphabetical order. In the same way, LWPE is related to SDWL. To which of the following options is GRKZ related, following the same logic?

(a) NGTY
(b) NRTU

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(c) NYRG
(d) BNHJ

Q74. City A is to the north of City B. City D is to the east of City A. City D is to the south of City E. If City E is to the west of City C, what is the direction of City B with respect to City E?
(a) North
(b) South West
(c) West
(d) East

Q75. A, B, C, D, E, F and G are sitting around a circular table facing the centre. D sits to the immediate right of B. E sits third to the right of B. G sits third to the left of D. C is the immediate neighbour of D and E. A is not an immediate neighbour of B.

How many people sit between F and D when counted from the left of F?
(a) Five
(b) Two
(c) Four
(d) Three

Q76. Aarav starts from Point A and drives 13 km towards the East. He then takes a left turn, drives 8 km, turns left and drives 15 km. He then takes a left turn and drives 11 km. He takes a final left turn, drives 2 km and stops at Point P. How far (shortest distance) and towards which direction should he drive in order to reach Point A again? (All turns are 90 degrees turns only unless specified).
(a) 3 km to the North
(b) 4 km to the South
(c) 3 km to the South
(d) 4 km to the North

Q77. What should come in place of (?) in the given series in order to make it logically complete?

ED9 HF16 LI25 QM36 ?
(a) XT49
(b) VR49
(c) WR64
(d) WR49

Q78. In a certain code language, ‘VOLT’ is coded as ‘6428’ and ‘LIFE’ is coded as ‘5761’. What is the code for ‘L’ in the given code language?
(a) 7
(b) 2
(c) 6
(d) 5

Q79. Refer to the following number series and answer the question that follows (all numbers are single-digit numbers only). Counting to be done from left to right only.

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

How many such odd numbers are there, each of which is immediately preceded by an odd number and also immediately followed by an odd number?
(a) 1
(b) 3
(c) 0
(d) 2

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Q80. Read the given statements and conclusions carefully. You have to take the given statements to be true even if they seem to be at variance from commonly known facts. You have to decide which conclusion/s logically follow/s from the given statements.

Statements: All fans are bulbs. Some bulbs are heaters. Some heaters are geysers.

Conclusion (I) : Some fans are heaters.

Conclusion (II) : Some bulbs are geysers.

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

GENERAL AWARENESS AND CURRENT AFFAIRS

Q81. To enhance capabilities in indigenous hydrography, where will the Indian Navy launch INS 'Ikshak' in November 2025?

(a) Kochi
(b) Chennai
(c) Mumbai
(d) Visakhapatnam

Q82. Under the Viksit Bharat–G RAM G Act 2025, how many days of statutory wage employment are guaranteed per rural household per financial year?

(a) 125 days
(b) 150 days
(c) 100 days
(d) 110 days

Q83. Which state government implemented an environmental tax on out-of-state vehicles starting December 2025?

(a) Sikkim
(b) Himachal Pradesh
(c) Uttarakhand
(d) Assam

Q84. Which of the following administrative institutions of India completed 100 years of service in 2025?

(a) Union Public Service Commission (UPSC)
(b) Election Commission of India (ECI)
(c) Central Vigilance Commission (CVC)
(d) Central Bureau of Investigation (CBI)

Q85. According to the Economic Survey released in January 2025, India was identified as the seventh most vulnerable country to climate change. What percentage of days in 2024 were marked by significant climate events such as heatwaves, cyclones and floods?

(a) 93%
(b) 85%
(c) 95%
(d) 90%

Q86. Major Dhyan Chand Khel Ratna Award 2024 winner, D Gukesh, is associated with which sports?

(a) Shooting
(b) Hockey
(c) Chess
(d) Badminton

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Q87. In May 2025, the Reserve Bank of India (RBI) penalised the Union Bank of India and which of the following companies?

(a) Razorpay
(b) Transactree Technologies
(c) Paytm
(d) Broadridge Financial Solutions

Q88. Which seat did Congress win in the Kerala by-elections in June 2025?

(a) Nilambur
(b) Ernakulam
(c) Kottayam
(d) Wayanad

Q89. Which prestigious award was Dr. Anandharamakrishnan awarded in 2024 for his contributions to Agricultural Sciences?

(a) Vigyan Shri Award
(b) Shanti Swarup Bhatnagar Prize
(c) Padma Bhushan
(d) Bharat Ratna

Q90. In February 2025, which Indian athlete broke the Asian short-track record in the 5000 m with a time of 12:59.77?

(a) Jacob Kiplimo
(b) Yared Nuguse
(c) Avinash Sable
(d) Gulveer Singh

Q91. Which of the following countries hosted the 2025 FIFA U-17 World Cup under the new 48-team format?

(a) India
(b) Russia
(c) Brazil
(d) Qatar

Q92. In 2025, 36 people including government employees were arrested under “Operation Spot Trap” by the Vigilance and Anti-Corruption Bureau (VACB). Which state was this operation conducted in?

(a) Maharashtra
(b) Uttar Pradesh
(c) Rajasthan
(d) Kerala

Q93. What is its primary objective of the GoIStats app, launched by the Ministry of Statistics and Programme Implementation (MoSPI) in 2025?

(a) To give a snapshot of key socio-economic data of the Ministry
(b) To offer real-time agricultural weather forecasts to farmers
(c) To facilitate online shopping and digital payment services
(d) To provide entertainment content and cultural heritage updates

Q94. Which athlete received the Laureus World Sportswoman of the Year in 2025?

(a) Serena Williams
(b) Simone Biles
(c) Ellesse Andrews
(d) Rebeca Andrade

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Q95. Who set a world record in the men's javelin F42 category at the Nottwil World Para Athletics Grand Prix in Switzerland, winning the gold medal?

(a) Devender Singh
(b) Praveen Kumar
(c) Rinku Solanki
(d) Mahendra Gurjar

Q96. What change did the Banking Laws (Amendment) Act, notified in April 2025, make regarding bank nominee rules?

(a) Made nomination optional
(b) Removed nomination option
(c) Allowed only one nominee
(d) Allowed up to four nominees

Q97. Which of the following Indian states features the defence industrial corridor that attracted investment proposals worth Rs. 33,896 crore in 2025?

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

Q98. The inaugural plenary session of the Indian Conservation Conference–2025 was held at which institution in June 2025?

(a) Indian Council of Forestry Research, Jabalpur
(b) Indian Institute of Science, Bengaluru
(c) Wildlife Institute of India, Dehradun
(d) Forest Research Institute, Dehradun

Q99. Which British honours list, including overseas recognitions, was published on 13 June 2025?

(a) UK Civil Service Honors List
(b) King’s Birthday Honours Overseas & International List
(c) Queen’s Platinum Overseas & International List
(d) New Year Honours 2025

Q100. Which of the following former AIFF officials, who also held key positions in various sports associations in Nagaland, passed away in 2025?

(a) Atuo Mezhür
(b) Savio Medeira
(c) Bhaichung Bhutia
(d) Subrata Dutta

ANSWER KEY

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

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SOLUTIONS

Q1. Answer: (d) It resists the current and gets hot.

The correct answer is It resists the current and gets hot.

Key Points

• The heating wire in a toaster glows red due to the Heating Effect of Electric Current, also known as Joule Heating. This phenomenon occurs when an electric current passes through a conductor with significant resistance, converting electrical energy into thermal energy.

• Resistance is the property of a material that opposes the flow of electrons. When electrons collide with the ions/atoms of the conductor (the heating wire), they transfer kinetic energy, which manifests as heat. Hence, statement 4 is correct.

• If the wire had zero resistance, it would be a superconductor. In such a case, no heat would be generated because there is no opposition to the current flow ($H = I^2Rt$, where $R=0$ leads to $H=0$). Hence, statement 1 is incorrect.

• Heating elements must have a high melting point to ensure they do not melt or deform while operating at temperatures high enough to glow red (typically above 500°C to 1000°C). A low melting point is a characteristic of a fuse wire, not a heating element. Hence, statement 2 is incorrect.

• While the current flowing through the toaster is substantial, the "glowing red" is specifically the result of that current meeting high resistance. High current alone in a low-resistance thick copper wire would not cause it to glow red under normal household conditions. Hence, statement 3 is incorrect.

Additional Information

• Nichrome: The most common material used for heating wires in toasters and space heaters is Nichrome, which is an alloy consisting of approximately 80% Nickel and 20% Chromium.

• High Resistivity: Nichrome is chosen because it has relatively high electrical resistivity compared to copper or aluminum, allowing it to generate significant heat in a compact space.

• Oxidation Resistance: When heated to high temperatures, Nichrome forms a protective layer of chromium oxide on its surface, which prevents the wire from further oxidation and breaking down in the open air.

• Incandescence: The "red glow" is a form of incandescence. As the temperature of the wire increases, it begins to emit electromagnetic radiation in the visible spectrum, starting with long-wavelength red light.

• Applications: Apart from toasters, this principle is utilized in electric irons, geysers, hair dryers, and room heaters.

Important Points

• Joule's Law of Heating: The heat produced (H) in a conductor is directly proportional to the square of the current (I^2), the resistance (R), and the time (t) for which the current flows. The formula is expressed as $H = I^2Rt$.

• Material Comparison:

• Heating Element: High resistance and High melting point (e.g., Nichrome, melting point ~1400°C).

• Fuse Wire: High resistance and Low melting point (e.g., Tin-Lead alloy, melting point ~183°C to 230°C) to protect circuits by melting during a power surge.

• Bulb Filament: Extremely high melting point (e.g., Tungsten, melting point ~3422°C) to withstand temperatures high enough to emit white light.

Q2. Answer: (d) The volume of air decreases and its pressure increases

The correct answer is The volume of air decreases and its pressure increases.

Key Points

• When a sealed syringe is pressed, the plunger moves inward, which directly reduces the physical space available for the air trapped inside. This results in a decrease in volume.

• According to Boyle's Law, discovered by Robert Boyle in 1662, for a fixed amount of gas at a constant temperature, the pressure and volume are inversely proportional. This means as the volume decreases, the pressure increases simultaneously. Hence, option 4 is correct.

• Air is a mixture of gases, and gases possess high compressibility because of the large intermolecular spaces between their particles. In a sealed system, pressing the plunger forces these particles closer together.

• The temperature of the air would not drop significantly; in fact, if compressed rapidly, the temperature might increase slightly due to the work done on the gas molecules. Hence, option 1 is incorrect.

• Because the syringe is closed at the other end and properly sealed, the mass of the air remains constant, and it cannot escape the container. Hence, option 2 is incorrect.

• The action of pressing the plunger is a physical reduction of the container's size, which contradicts the idea of an increase in volume. Hence, option 3 is incorrect.

Additional Information

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• Kinetic Molecular Theory: This theory explains that gas pressure is caused by the frequent collisions of gas molecules against the walls of their container. When the volume is reduced, the molecules have less space to travel and hit the walls more often, thus increasing the measured pressure.

• States of Matter: Unlike solids and liquids, which have fixed volumes and are almost incompressible, gases do not have a fixed shape or volume and can be easily compressed into smaller containers.

• Applications: This principle is utilized in various pneumatic systems, bicycle pumps, medical syringes, and even in the functioning of internal combustion engines where the air-fuel mixture is compressed by a piston before ignition.

• Isothermal vs. Adiabatic: If the compression happens slowly enough for heat to exchange with the surroundings, it is an isothermal process (constant temperature). If it happens very fast, it is an adiabatic process, where the internal energy and temperature of the air increase.

Important Points

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

• Direct and Inverse Proportions: In science, it is vital to distinguish between these. In a syringe, the inverse proportion between P and V is a fundamental concept taught in General Science and Physics to explain the behavior of matter.

• Standard Units: Pressure is often measured in Pascals (Pa) or Atmospheres (atm), while volume in the context of a syringe is usually measured in milliliters (ml) or cubic centimeters (cm^3).

Q3. Answer: (b) P

The correct answer is P.

Key Points

• The chemical symbol for the element Phosphorus is P. It is derived from the first letter of its name, following the standard IUPAC (International Union of Pure and Applied Chemistry) nomenclature where symbols for many elements consist of a single capitalized letter.

• Phosphorus is a chemical element with the atomic number 15. It belongs to Group 15 of the periodic table, which is also known as the Pnictogens.

• The name phosphorus originates from the Greek word phosphoros, which means "bringing light" or "light-bearer." This name was given due to its property of glowing in the dark when exposed to oxygen.

• In its elemental form, it is highly reactive and is never found as a free element on Earth. It is essential for life, appearing in DNA, RNA, ATP, and the phospholipids that form all cell membranes.

• The correct symbol is not Ph, Ps, or Pr. While Pr is a valid atomic symbol, it represents Praseodymium, not phosphorus. Ph is frequently used in organic chemistry as a shorthand for the phenyl group, but it is not an atomic symbol for a single element.

Additional Information

• Discovery and History:

• Phosphorus was discovered by the German alchemist Hennig Brand in the year 1669. He isolated it from human urine, making it the first element to be discovered that was not known since ancient times.

• Allotropes of Phosphorus:

• White Phosphorus: A waxy, dangerous solid that is highly flammable and toxic. It glows in the dark (chemiluminescence).

• Red Phosphorus: More stable than white phosphorus and is used in the striking surface of matchboxes. It is non-toxic compared to the white variety.

• Black Phosphorus: The most stable form and is produced by heating white phosphorus under high pressure. It resembles graphite in its structure and properties.

• Physical and Chemical Characteristics:

• Atomic Mass: Approximately 30.974 u.

• Location: It is situated in Period 3 and p-block of the Periodic Table.

• State at Room Temperature: It exists as a solid.

• Industrial and Biological Uses:

• The largest industrial use of phosphorus compounds is in the production of fertilizers (such as phosphates) to replace the phosphorus that plants remove from the soil.

• It is also used in the manufacture of detergents, pesticides, steel, and safety matches.

Important Points

• Rules for Atomic Symbols:

• According to the Dalton’s and later Berzelius's suggestions, symbols of elements are represented by the first letter (in Uppercase) or the first and second letter (second being lowercase) of the element's name in English, Latin, or Greek.

• Examples: Hydrogen (H), Carbon (C), Oxygen (O), and Iron (Fe from Latin Ferrum).

• Comparison of the Options:

• Ph: Not an element symbol; used for Phenyl functional groups.

• P: Correct symbol for Phosphorus.

• Ps: Not a standard atomic symbol for a naturally occurring element.

• Pr: Symbol for Praseodymium, a rare earth metal with atomic number 59.

• Phosphate Cycle: In the environment, phosphorus is most commonly found as the phosphate ion ($PO4^{3}$^-). It is a critical limiting nutrient in many ecosystems, especially aquatic ones.

Q4. Answer: (d) Areolar tissue

The correct answer is Areolar tissue.

Key Points

• Areolar tissue is the most widely distributed connective tissue in the animal body. It acts as a supporting and packing tissue between most of the organs.

• It is found located between the skin and muscles, around blood vessels and nerves, and in the bone marrow.

• The primary functions of areolar tissue include filling the space inside the organs, providing support to internal organs, and assisting in the repair of tissues after injury. Hence, the correct answer is Areolar tissue.

• This tissue consists of a semifluid ground substance (matrix) that contains three types of cells: fibroblasts, macrophages, and mast cells.

• It also contains two types of protein fibers: white collagen fibers, which provide tensile strength, and yellow elastic fibers (elastin), which allow for flexibility and recoil.

Additional Information

• Squamous epithelium:

• Unlike areolar tissue, this is an epithelial tissue, not a connective tissue. It is composed of a single thin layer of flattened cells with irregular boundaries.

• It is primarily found in the walls of blood vessels and the alveoli (air sacs) of the lungs.

• Its main function is to form a diffusion boundary for the exchange of gases and nutrients.

• Tendon:

• Tendons are a type of dense regular connective tissue characterized by great strength but limited flexibility.

• Their specific function is to connect skeletal muscles to bones, facilitating movement of the skeleton when muscles contract.

• Ligament:

• Ligaments are also dense connective tissues, but they are highly elastic and possess significant strength.

• They contain very little matrix and serve the crucial role of connecting one bone to another bone at joints, maintaining structural stability.

• Adipose Tissue:

• This is another type of loose connective tissue located mainly beneath the skin and between internal organs.

• The cells of this tissue (adipocytes) are specialized to store fats, which acts as an insulator and an energy reservoir for the body.

Important Points

• Connective Tissues are categorized into three main types: Loose connective tissue (e.g., Areolar and Adipose), Dense connective tissue (e.g., Tendons and Ligaments), and Specialized connective tissue (e.g., Cartilage, Bone, and Blood).

• The matrix is a non-living material secreted by the cells of the connective tissue, which can be fluid, jelly-like, or solid depending on the tissue's function.

• In Areolar tissue, the loose arrangement of fibers allows the tissue to be flexible yet strong enough to bind different tissue types together, such as connecting the epithelial tissue to the underlying structures.

• Fibroblasts within the areolar tissue are the cells responsible for secreting the fibers (collagen and elastin) and the polysaccharides that make up the ground substance.

Q5. Answer: (c) The space increases as matter changes from solid to gas

The correct answer is The space increases as matter changes from solid to gas.

Key Points

• According to the Kinetic Molecular Theory, all matter is made of particles that are in constant motion, and the space between these particles determines the state of matter.

• In a solid, particles are tightly packed in a fixed, regular lattice structure with very little intermolecular space between them.

• As a substance transitions to a liquid state, the particles gain energy and move further apart, creating moderate gaps that allow them to slide past each other.

• In the gaseous state, particles have high kinetic energy and are widely separated, occupying much larger volumes compared to

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their solid or liquid forms.

• The intermolecular distance is greatest in gases and smallest in solids. Hence, the statement that the space increases as matter changes from solid to gas is correct.

• Statement 1: Solids and gases always have equal spacing. This statement is incorrect as gases have significantly more void space than solids.

• Statement 2: The space remains unchanged during the change in states of matter. This statement is incorrect because phase changes (like melting or evaporation) are fundamentally defined by the change in particle arrangement and distance.

• Statement 4: The space decreases as matter changes from solid to gas. This statement is incorrect as this describes condensation or freezing (gas to liquid/solid), not the transition to a gas.

Additional Information

• Intermolecular Forces: These are the attractive forces between molecules. They are strongest in solids, keeping the particles in fixed positions, and weakest (almost negligible) in gases, allowing particles to move independently.

• Kinetic Energy and Temperature: The transition from solid to gas usually occurs by increasing temperature. Adding heat increases the kinetic energy of the particles, allowing them to overcome intermolecular attractions and increase their separation.

• Compressibility: Because gases have large intermolecular spaces, they are highly compressible. Solids have very little empty space, making them virtually incompressible.

• Density: For most substances, density is highest in the solid phase and lowest in the gas phase because the same mass occupies a much larger volume in the gaseous state due to increased particle spacing.

• Shape and Volume: Solids have a definite shape and fixed volume due to lack of space between particles. Gases have no definite shape or volume, expanding to fill the entire container they occupy.

Important Points

• Sublimation: This is the direct transition of a substance from solid to gas without passing through the liquid phase (e.g., dry ice or naphthalene), which results in a massive and rapid increase in intermolecular space.

• Thermal Expansion: Even within a single state, increasing temperature generally causes a slight increase in intermolecular distance, leading to the expansion of the material.

• Pressure Effects: Increasing pressure on a gas reduces the space between particles, which can eventually force a phase change back into a liquid state through liquefaction.

Q6. Answer: (d) 14 m/s

The correct answer is 14 m/s.

Key Points

• The problem involves Newton's Second Law of Motion and the Equations of Motion to determine how a constant force affects an object's velocity over time.

• In the first scenario, an object of mass 4 kg has an initial velocity (u) of 2 m/s and reaches a final velocity (v) of 8 m/s in a time duration (t) of 2 s.

• We first calculate the acceleration (a) using the formula: a = (v - u) / t. Plugging in the values: a = (8 m/s - 2 m/s) / 2 s = 6 / 2 = 3 m/s^2. This means the constant force produces a steady acceleration of 3 m/s^2.

• The magnitude of the force (F) can be found using F = m * a. Thus, F = 4 kg * 3 m/s^2 = 12 N.

• In the second scenario, the same force is applied for a duration of 4 s. Assuming it starts from the same initial velocity of 2 m/s, we calculate the new final velocity using v = u + at.

• Calculation: v = 2 m/s + (3 m/s^2 * 4 s) = 2 + 12 = 14 m/s. Hence, the final velocity is 14 m/s.

Additional Information

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

• Force: It is defined as a push or pull upon an object resulting from the object's interaction with another object. The SI unit of force is the Newton (N), named after Sir Isaac Newton. One Newton is equal to 1 $kg.m/s^2$.

• Acceleration: This is a vector quantity that is defined as the rate at which an object changes its velocity. An object is accelerating if it is changing its velocity. The SI unit for acceleration is m/s^2.

• Equations of Motion: These equations relate the displacement, velocity, acceleration, and time of a moving object. The three primary equations for constant acceleration are v = u + at, $s = ut + 0.5at^2$, and $v^2 = u^2 + 2as$.

Important Points

• Constant Force: When a constant force acts on a body of constant mass, it results in a constant acceleration. This allows for the use of the linear equations of motion.

• Mass vs. Weight: Mass is a fundamental property of an object (measured in kg) and does not change based on location, while weight is the force of gravity acting on that mass. In this problem, the mass is 4 kg.

• Initial and Final Velocity: Initial velocity is the velocity at which motion begins (at t = 0), and final velocity is the velocity after a specific time interval has elapsed.

• Relationship with Time: If the acceleration is constant, the change in velocity is directly proportional to the time for which the force is applied. Doubling the time from 2 s to 4 s (if starting from rest) would double the velocity change, but since there is an initial velocity, we must add it to the total change.

Q7. Answer: (c) Phloem

The correct answer is Phloem.

Key Points

• Phloem is a complex permanent tissue in plants that acts as the primary conduction system for organic nutrients, especially sucrose, which is produced during photosynthesis.

• The transport of food in plants is known as translocation. This process occurs from the source (usually the leaves) to the sink (areas of growth or storage like roots, stems, and fruits).

• Unlike xylem, the movement of food through phloem is bidirectional, meaning it can move both upwards and downwards to reach all parts of the plant depending on the seasonal or metabolic needs.

• Phloem is composed of four distinct types of cells: sieve tubes, companion cells, phloem parenchyma, and phloem fibers. Out of these, only phloem fibers are dead cells at maturity, while the others are living cells.

• The process of translocation in phloem is an active process that requires energy in the form of ATP (Adenosine Triphosphate) to load sucrose into the sieve tubes, creating an osmotic pressure that facilitates the flow of materials.

Additional Information

• Xylem:

• It is the complex tissue responsible for the conduction of water and minerals from the soil through the roots to the rest of the plant.

• The flow of water in xylem is unidirectional (only upwards). It consists of tracheids, vessels, xylem parenchyma, and xylem fibers. Most of the cells in xylem (except parenchyma) are dead at maturity to facilitate efficient water transport.

• Collenchyma:

• This is a simple permanent tissue made of living cells. It provides mechanical support and flexibility to the plant, allowing parts like petioles (leaf stalks) and young stems to bend without breaking.

• The cells are characterized by irregularly thickened walls at the corners due to the deposition of cellulose and pectin.

• Sclerenchyma:

• It is a simple permanent tissue composed of dead cells with extremely thickened secondary walls containing lignin.

• Its primary function is to provide strength, stiffness, and structural rigidity to the plant. It is found in the husk of coconut, the hard shells of nuts, and the grit in fruits like pear (sclereids).

• Vascular Bundles:

• In higher plants, xylem and phloem are grouped together to form vascular bundles. These tissues are essential for the survival of terrestrial plants, allowing them to grow tall by facilitating the transport of nutrients and water over long distances.

Important Points

• Sieve Tubes: These are tubular cells with perforated walls called sieve plates. Although they are living, they lack a nucleus at maturity and rely on companion cells for metabolic functions.

• Companion Cells: These are specialized parenchyma cells that are closely associated with sieve tubes and help in regulating the pressure gradient during translocation.

• Lignin: A complex polymer found in sclerenchyma and xylem that acts as a cementing material, making the cell walls waterproof and extremely strong.

• Difference between Simple and Complex Tissue: Simple tissues (like Collenchyma and Sclerenchyma) consist of only one type of cell, whereas complex tissues (like Xylem and Phloem) are made of more than one type of cell working together as a unit.

Q8. Answer: (d) Binary Fission

The correct answer is Binary Fission.

Key Points

• Binary Fission is a primary method of asexual reproduction typically observed in unicellular organisms, where a single cell divides into two approximately equal and genetically identical daughter cells.

• Since the scientist is observing a multicellular organism, it possesses complex structures and specialized tissues that cannot simply split into two through cellular fission to reproduce the entire organism. Hence, the statement that the organism would NOT use binary fission is correct.

• Multicellular organisms, particularly plants, utilize more complex mechanisms for asexual reproduction such as budding, fragmentation, and vegetative propagation, which involve the growth of new tissues from specialized regions.

• In Binary Fission, the genetic material (DNA) replicates and the cytoplasm divides, a process common in prokaryotes like bacteria and some eukaryotic protists like Amoeba.

• The other options—Budding, Fragmentation, and Vegetative Propagation—are all viable methods for various multicellular plants and simple multicellular animals.

Additional Information

• Budding:

• In this process, a small outgrowth or bud develops on the parent body due to repeated cell division at one specific site.

• These buds develop into tiny individuals and, when fully mature, detach from the parent body to become new independent individuals.

• Examples include Hydra (a multicellular animal) and Yeast (a unicellular fungus).

• Fragmentation:

• This occurs when a multicellular organism simply breaks up into smaller pieces upon maturation.

• Each piece, or fragment, grows into a new complete individual through regeneration of missing parts.

• Examples include filamentous algae like Spirogyra and some flatworms like Planaria.

• Vegetative Propagation:

• This is a form of asexual reproduction in plants where new plants are produced from vegetative parts such as roots, stems, and leaves rather than seeds.

• Methods include tubers (potato), runners (strawberry), and leaf notches (Bryophyllum).

• It allows for the rapid production of genetically uniform offspring and is widely used in horticulture.

• Binary Fission Details:

• It is the simplest form of reproduction. In Amoeba, the division can take place in any plane, whereas in Leishmania (which causes Kala-azar), it occurs in a definite orientation in relation to whip-like structures.

• Because it involves the division of a single cell into two, it is biologically impossible for a complex multicellular plant to undergo this process as a whole.

Important Points

• Complexity and Reproduction: As organisms become more complex (multicellular), their reproductive strategies shift from simple cell division to processes involving specialized reproductive cells or tissues.

• Asexual vs. Sexual: All methods mentioned in the options are types of asexual reproduction, meaning they do not involve the fusion of gametes and result in offspring that are clones of the parent.

• Environmental Adaptation: Vegetative propagation and fragmentation are often advantageous in stable environments where the parent's traits are already well-suited for survival.

Q9. Answer: (d) Neutralisation

The correct answer is Neutralisation.

Key Points

• A Neutralisation reaction is a specific type of chemical reaction where an acid and a base react with each other to produce salt and water.

• In aqueous solutions, this reaction occurs when H+ ions (hydrogen ions) from the acid combine with OH- ions (hydroxyl ions) from the base to form H2O (water) molecules.

• The general chemical equation representing this process is: Acid + Base → Salt + Water. For example, the reaction between Hydrochloric acid (HCl) and Sodium hydroxide (NaOH) produces Sodium chloride (NaCl) and water.

• Neutralisation reactions are generally exothermic in nature, meaning they involve the evolution of heat during the process.

• The resulting pH of the solution depends on the strength of the reactants; a reaction between a strong acid and a strong base typically results in a solution with a pH of 7 (neutral). Hence, the correct answer is Neutralisation.

Additional Information

• Decomposition Reaction:

• This is a chemical reaction in which a single compound breaks down into two or more simpler substances or elements.

• It usually requires an external energy source such as heat (thermal decomposition), light (photolysis), or electricity (electrolysis) to break the chemical bonds.

• An example is the decomposition of Calcium Carbonate (CaCO3) into Calcium Oxide (CaO) and Carbon Dioxide (CO2) upon heating. Hence, option 1 is incorrect.

• Combustion Reaction:

• Combustion is a high-temperature exothermic reaction between a fuel and an oxidant (usually atmospheric oxygen).

• This reaction typically produces smoke, heat, and light, along with oxidized gaseous products like Carbon dioxide and Water vapor.

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• The burning of methane (CH_4) in the presence of oxygen is a classic example of a combustion reaction. Hence, option 2 is incorrect.

• Oxidation Reaction:

• In classical chemistry, Oxidation refers to the addition of oxygen to a substance or the removal of hydrogen.

• In modern electronic terms, it is defined as the process where an atom, ion, or molecule loses electrons during a reaction.

• It is always accompanied by reduction (gain of electrons) in what is collectively known as a Redox reaction. Hence, option 3 is incorrect.

Important Points

• Practical Applications of Neutralisation:

• Indigestion: Human stomachs produce Hydrochloric acid to help digest food, but excess acid causes pain. This is treated with antacids like Milk of Magnesia (Magnesium Hydroxide), which is a mild base that neutralizes the acid.

• Soil Treatment: Plants do not grow well if the soil is too acidic or too basic. If soil is acidic, it is treated with bases like quick lime (Calcium Oxide) or slaked lime (Calcium Hydroxide).

• Ant Stings: When an ant bites, it injects formic acid into the skin. The effect of the sting can be neutralized by rubbing moist baking soda (Sodium Hydrogen Carbonate) or calamine solution (containing Zinc Carbonate).

• Factory Waste: The waste of many factories contains acids. If allowed to flow into water bodies, they kill fish. These wastes are neutralized by adding basic substances before disposal.

Q10. Answer: (a) Work done by the force of gravity

The correct answer is Work done by the force of gravity.

Key Points

• Work is defined in physics as the product of the force applied to an object and the displacement of the object in the direction of that force. The formula is $W = F\ d\ \cos(\theta)$, where theta is the angle between the force and displacement vectors.

• When a boy lifts an object above his head, the displacement of the object is in the upward direction.

• The force of gravity (weight) acts on the object vertically downward toward the center of the Earth.

• Because the displacement is upward and the force of gravity is downward, the angle theta between them is 180 degrees.

• The value of $\cos(180)$ is -1; therefore, the work done by the force of gravity is negative. Hence, option 1 is the correct answer.

• Conversely, the applied force exerted by the boy is in the upward direction, the same as the displacement. This means the angle is 0 degrees, and since $\cos(0)$ is 1, the work done by the boy is positive.

Additional Information

• Positive Work: This occurs when the force and the displacement are in the same direction (angle between 0 and 90 degrees). A common example is a horse pulling a cart or a person pushing a car forward.

• Zero Work: Work is zero if the force is perpendicular to the displacement (90 degrees) or if there is no displacement. For example, a person holding a heavy box stationary or a satellite moving in a circular orbit (where centripetal force is perpendicular to velocity) does no work.

• SI Unit of Work: The standard unit is the Joule (J). One Joule is the work done when a force of 1 Newton moves an object through a distance of 1 meter.

• Nature of Work: Work is a scalar quantity, meaning it only has magnitude and no specific direction in space, even though force and displacement are vectors.

• Dimensions: The dimensional formula for work is $[M^1 L^2 T^{-2}]$, which is the same as the dimensions of energy.

Important Points

• Work-Energy Theorem: This theorem states that the net work done on an object is equal to the change in its kinetic energy. When gravity does negative work, it often results in an increase in the object's potential energy.

• Power: Related to work, power is the rate at which work is done. It is measured in Watts (W), where 1 Watt = 1 Joule per second.

• Conservative Forces: Gravity is a conservative force, meaning the work done by it depends only on the initial and final positions of the object, not the path taken.

• Mechanical Energy: In the absence of friction, the sum of kinetic energy and potential energy remains constant. In this lifting scenario, the positive work from the boy is stored as gravitational potential energy because gravity is "resisting" the motion with negative work.

Q11. Answer: (c) Axon terminal → Dendrite of another neuron

The correct answer is Axon terminal → Dendrite of another neuron.

Key Points

• A synapse is the specialized junction through which neurons signal to each other or to non-neuronal cells such as those in muscles or glands. In a chemical synapse, the process involves the transmission of neurotransmitters.

• The transmission begins when an electrical impulse (action potential) reaches the axon terminal of the presynaptic neuron. This terminal contains synaptic vesicles filled with chemical messengers.

• Upon reaching the end of the axon, the nerve impulse triggers the release of these neurotransmitters into a fluid-filled gap known as the synaptic cleft, which is typically 20 to 50 nanometers wide.

• The neurotransmitters diffuse across the gap and bind to specific protein receptors located on the dendrite or the cell body of the postsynaptic neuron. This binding action generates a new electrical signal in the receiving neuron. Hence, the primary chemical communication occurs from the Axon terminal to the Dendrite of another neuron.

• The options describing communication within the same neuron or involving the myelin sheath do not represent the standard mechanism of intercellular chemical signaling. Hence, statement 3 is correct.

Additional Information

• Structural Components of a Neuron:

• Cell Body (Soma): Contains the nucleus and cytoplasm; it serves as the metabolic center of the cell.

• Dendrites: These are highly branched, short fibers that receive incoming signals from other neurons and carry them toward the cell body.

• Axon: A single, long, cylindrical fiber that transmits impulses away from the cell body toward other neurons or effectors.

• Myelin Sheath and Conduction:

• Many axons are covered by a fatty insulating layer called the myelin sheath, produced by Schwann cells in the PNS and oligodendrocytes in the CNS.

• It facilitates saltatory conduction, where the impulse "jumps" between Nodes of Ranvier, significantly increasing the speed of transmission.

• Common Neurotransmitters:

• Acetylcholine (ACh): Essential for muscle stimulation and memory.

• Dopamine: Associated with the reward system, motivation, and motor control.

• Serotonin: Plays a key role in mood regulation, sleep, and digestion.

• Types of Synapses:

• Chemical Synapse: Uses chemicals to bridge the gap; it is the most common type and allows for complex signal modulation.

• Electrical Synapse: Neurons are connected by gap junctions, allowing ions to flow directly between cells, resulting in faster, near-instantaneous transmission.

Important Points

• Unidirectional Flow: Nerve impulses in a chemical synapse travel in only one direction because neurotransmitter receptors are located only on the postsynaptic side (dendrites), while vesicles are on the presynaptic side (axon terminals).

• Synaptic Delay: There is a brief time interval (approx 0.3 to 0.5 milliseconds) required for the neurotransmitter to be released, cross the cleft, and bind to receptors.

• Exocytosis: The specific biological process where synaptic vesicles fuse with the presynaptic membrane to dump neurotransmitters into the extracellular space.

• Reuptake: After signaling, neurotransmitters are often cleared from the synaptic cleft through enzymatic degradation or reuptake back into the presynaptic neuron to terminate the signal.

Q12. Answer: (d) Both A and R are true, and R is the correct explanation of A.

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

Key Points

• Assertion (A) states that keeping oily food in airtight containers prevents rancidity. This is based on the principle of limiting the exposure of food items to atmospheric oxygen. Hence, statement A is correct.

• Reason (R) explains that airtight containers slow down the oxidation of fats and oils. Since the supply of oxygen is restricted within a sealed environment, the chemical reaction between oxygen and the fat molecules occurs much more slowly. Hence, statement R is correct.

• Rancidity is the process of aerial oxidation of unsaturated fats and oils present in food materials, which results in an unpleasant smell and taste.

• The primary cause of oxidative rancidity is the reaction of oxygen with the double bonds of fatty acid chains. By using an airtight container, the volume of oxygen available for this reaction is significantly reduced.

• Because the mechanism described in the reason (slowing down oxidation) directly leads to the effect described in the assertion (prevention of rancidity), Reason (R) is the correct explanation of Assertion (A).

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

Additional Information

• Types of Rancidity:

• Oxidative Rancidity: This occurs when oxygen damages the food by breaking the long-chain fatty acids into smaller compounds like aldehydes and ketones.

• Hydrolytic Rancidity: This happens when water (moisture) splits fatty acid chains away from the glycerol backbone in triglycerides, often catalyzed by enzymes like lipase.

• Microbial Rancidity: This is caused by microorganisms such as bacteria or molds that use enzymes to break down chemical structures in fats.

• Methods to Prevent Rancidity:

• Antioxidants: Chemicals such as Butylated Hydroxyanisole (BHA) and Butylated Hydroxytoluene (BHT) are often added to fat-containing foods to inhibit oxidation.

• Nitrogen Flushing: Manufacturers of potato chips and other snacks flush the bags with Nitrogen gas (an inert gas) to displace oxygen and prevent the chips from turning rancid.

• Vacuum Packaging: Removing all air from the packaging before sealing effectively stops the oxidation process.

• Refrigeration: Storing food at low temperatures reduces the rate of chemical reactions, including oxidation and microbial growth.

• Light Protection: Storing oily food in dark places or opaque containers helps because Ultraviolet (UV) light can act as a catalyst for the oxidation process.

Important Points

• Chemical Reaction: The process of rancidity is a redox reaction (specifically oxidation) where the fatty acids lose electrons to oxygen.

• Impact on Health: Consuming rancid food is not only unpleasant due to the off-flavor but can also lead to the formation of free radicals, which are linked to various health issues and cellular damage.

• Detection: Rancidity is typically detected through sensory evaluation (smell and taste) or chemical tests like the Peroxide Value (PV) test, which measures the extent of primary oxidation.

• Saturated vs. Unsaturated Fats: Unsaturated fats (like vegetable oils) are much more susceptible to rancidity than saturated fats (like butter or lard) because of the presence of carbon-carbon double bonds that react easily with oxygen.

Q13. Answer: (c) Catenation

The correct answer is Catenation.

Key Points

• Catenation is the unique property of an element to form covalent bonds with other atoms of the same element, resulting in the formation of long chains, branched structures, or rings.

• Among all known elements, Carbon exhibits the maximum tendency for catenation due to the high strength and stability of the Carbon-Carbon (C-C) bond.

• This property allows carbon to form an almost infinite variety of molecules, ranging from simple hydrocarbons to complex biological macromolecules like DNA and proteins.

• The ability to form single, double, and triple bonds between carbon atoms further enhances the structural diversity enabled by catenation.

• It is because of catenation and tetravalency that carbon forms such a large number of compounds, leading to the dedicated branch of science known as Organic Chemistry.

Additional Information

• Tetravalency:

• Carbon has four valence electrons in its outermost shell, allowing it to form four covalent bonds with other atoms.

• This characteristic enables carbon to link with a wide variety of other elements like hydrogen, oxygen, nitrogen, and sulfur, as well as other carbon atoms.

• Isomerism:

• This is the phenomenon where compounds have the same molecular formula but different structural arrangements or spatial orientations.

• Since catenation allows for different chain lengths and branching, isomers are very common in organic compounds, contributing to their vast chemical variety.

• Polymerisation:

• This is a chemical process in which small units called monomers join together to form a very large molecule called a polymer.

• While catenation is the inherent atomic property, polymerisation is the process used to create materials like plastics (polyethene), rubber, and nylon.

• Comparison with Silicon:

• Silicon also shows catenation properties but to a much lesser extent than carbon.

• Silicon can form chains with hydrogen (silanes) up to about 7 or 8 atoms, but these compounds are highly reactive and unstable

because the Si-Si bond is significantly weaker than the C-C bond.

Important Points

• Bond Energy: The stability of carbon chains is attributed to the high bond enthalpy of the C-C bond, which is approximately 348 kJ/mol. In contrast, the Si-Si bond energy is only about 222 kJ/mol.

• Atomic Size: Carbon is a small-sized atom, which allows the nucleus to hold the shared pair of electrons in the covalent bond more tightly, leading to a strong and stable bond.

• Allotropes of Carbon: Catenation is also responsible for the different forms of carbon, such as Diamond (3D network), Graphite (layered hexagonal sheets), and Fullerenes (spherical cages like C60).

Q14. Answer: (a) Phloem, companion cells

The correct answer is Phloem, companion cells.

Key Points

• Phloem is a complex permanent tissue in vascular plants responsible for the translocation of food (mainly sucrose) from the leaves, where it is produced during photosynthesis, to other parts of the plant like roots, fruits, and storage organs.

• It consists of four main components: sieve tube elements, companion cells, phloem parenchyma, and phloem fibers. Out of these, only the phloem fibers are dead cells, while the rest are living cells.

• Sieve tubes are long, tubular structures with perforated end walls known as sieve plates. Interestingly, while they are living cells at maturity, they lack a nucleus, ribosomes, and vacuoles to allow for the efficient flow of nutrients.

• Companion cells are specialized parenchyma cells that are closely associated with sieve tube elements. They possess a dense cytoplasm and a prominent nucleus, which regulates the metabolic activities of the enucleated sieve tubes.

• The relationship between sieve tubes and companion cells is vital; they are connected by plasmodesmata, and the companion cells help in the loading and unloading of sugars into the sieve tube elements. Hence, the first option is correct.

Additional Information

• Xylem:

• This is another complex tissue primarily responsible for the unidirectional transport of water and minerals from the roots to the aerial parts of the plant.

• It consists of tracheids, vessels, xylem parenchyma, and xylem fibers. In xylem, only the xylem parenchyma is a living cell, while the others are dead at maturity. Hence, options 3 and 4 are incorrect.

• Simple Plant Tissues:

• Collenchyma: Provides mechanical support and flexibility to young plant parts like the petiole of a leaf. It consists of living cells with localized cellulose thickening at corners.

• Sclerenchyma: Composed of dead cells with highly thickened, lignified walls, providing structural rigidity and strength to the plant. Hence, option 2 is incorrect.

• Bidirectional Transport: Unlike the xylem, which moves water only upwards, the phloem facilitates bidirectional movement. This ensures that food can move both downwards to the roots and upwards to developing buds or fruits.

Important Points

• Vascular Bundles: The xylem and phloem together form vascular bundles. In dicotyledonous stems, there is a layer of cambium between them, allowing for secondary growth (increase in girth).

• Sugar Source and Sink: The "source" is usually the leaves (where food is synthesized), and the "sink" is the part that needs or stores the food. The phloem transport is driven by a pressure gradient created by the active loading of solutes.

• Evolutionary Context: The development of vascular tissues (xylem and phloem) was a critical adaptation that allowed Tracheophytes (vascular plants) to colonize land and grow to significant heights, unlike non-vascular plants like mosses.

Q15. Answer: (d) m/s

The correct answer is m/s.

Key Points

• Average speed is defined as the total distance traveled by an object divided by the total time taken to cover that distance.

• In the International System of Units (SI), which was established in 1960, the standard unit for length (distance) is the meter (m) and the standard unit for time is the second (s).

• By using the formula Speed = Distance / Time, the derived SI unit becomes meters per second, mathematically expressed as m/s or m s^-1.

• Option 1 (km/h^2): This is not a recognized standard unit for speed or average speed in the SI system, though km/h is a common metric unit for speed. Hence, this statement is incorrect.

• Option 2 (m/s^2): This is the SI unit of acceleration, which measures the rate of change of velocity over time. Hence, this statement is incorrect.

• Option 3 (s/m^2): This unit does not represent any standard physical quantity in classical mechanics. Hence, this statement is

incorrect.

• Option 4 (m/s): This is the correct SI unit for both instantaneous speed and average speed. Hence, this statement is correct.

Additional Information

• Scalar vs Vector: Speed is a scalar quantity because it possesses only magnitude and no direction. Velocity, which is the displacement divided by time, is a vector quantity as it includes both magnitude and direction.

• Measuring Instruments: In automobiles, the speedometer is used to measure the instantaneous speed of the vehicle at any given moment, while the odometer records the total distance traveled.

• Unit Conversion: In daily life, speed is often expressed in kilometers per hour (km/h). To convert 1 km/h to m/s, we multiply by 5/18 (since 1000m / 3600s = 5/18). For example, 36 km/h is equal to 10 m/s.

• Dimensional Formula: The dimensional formula for speed is [M^0 L^1 T^{-1}], indicating it is independent of mass (M) and depends on length (L) and time (T).

• Types of Speed: Apart from average speed, there is Uniform speed (covering equal distances in equal intervals of time) and Variable speed (covering unequal distances in equal intervals of time).

Important Points

• CGS System: In the Centimetre-Gram-Second (CGS) system of units, the unit of speed is centimeter per second (cm/s).

• FPS System: In the Foot-Pound-Second (FPS) system, speed is measured in feet per second (ft/s).

• Speed of Light: The ultimate speed limit in the universe is the speed of light in a vacuum, which is approximately 299,792,458 m/s (often rounded to 3 x 10^8 m/s).

• Supersonic Speeds: Speeds exceeding the speed of sound (approx. 343 m/s in air) are referred to as supersonic and are often measured using Mach numbers.

Q16. Answer: (c) • 3/4

The correct answer is - 3/4.

Key Points

• Magnification (m) produced by a spherical mirror gives the relative extent to which the image of an object is magnified with respect to the object size.

• It is expressed as the ratio of the height of the image to the height of the object. It is also related to the object distance (u) and image distance (v) by the formula: m = -v / u.

• According to the New Cartesian Sign Convention, the object distance (u) is always negative. In this case, u = - 40 cm.

• Since the image is real and inverted and formed in front of the concave mirror, the image distance (v) is also negative. Here, v = - 30 cm.

• Substituting the values into the formula: m = - (- 30) / (- 40). This simplifies to m = 30 / (- 40), which equals - 3/4.

• The negative sign in the result signifies that the image is real and inverted. Hence, the correct answer is - 3/4.

Additional Information

• Concave Mirror: A spherical mirror whose reflecting surface is curved inwards (towards the center of the sphere). It is also known as a converging mirror because it converges light rays at a single point called the focus.

• Sign Convention Rules:

• The Pole (P) is taken as the origin.

• Distances measured in the direction of incident light are positive.

• Distances measured opposite to the direction of incident light are negative.

• Heights measured upwards and perpendicular to the principal axis are positive, while those measured downwards are negative.

• Nature of Magnification:

• If m is negative, the image is real and inverted.

• If m is positive, the image is virtual and erect.

• If |m| > 1, the image is magnified (larger than the object).

• If |m| < 1, the image is diminished (smaller than the object).

Important Points

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

• In this specific question, since |m| = 3/4 (0.75), which is less than 1, the image is diminished.

• For a concave mirror, real images are always inverted, and virtual images (formed when the object is between the Focus and Pole) are always erect and magnified.

• The radius of curvature (R) is twice the focal length (f), denoted as R = 2f.

Q17. Answer: (a) 800 Hz

The correct answer is 800 Hz.

Key Points

• The relationship between the speed, frequency, and wavelength of a wave is governed by the universal wave equation: Speed (v) = Frequency (f) × Wavelength (λ).

• In the given problem, the speed of the sound wave (v) is 320 m/s and the wavelength (λ) is 0.4 m.

• To calculate the frequency (f), the formula is rearranged as f = v / λ.

• By substituting the provided numerical values into the equation: f = 320 / 0.4.

• The calculation 320 / 0.4 equals 800. Thus, the frequency of the sound wave is 800 Hz. Hence, the correct answer is 800 Hz.

Additional Information

• Frequency:

• Frequency refers to the number of complete oscillations or wave cycles that pass a fixed point in one second.

• The SI unit of frequency is the Hertz (Hz), named after the physicist Heinrich Hertz. One Hertz is equivalent to one cycle per second.

• Wavelength:

• Wavelength is the spatial period of a periodic wave—the distance over which the wave's shape repeats.

• In longitudinal waves like sound, it is the distance between the centers of two consecutive compressions or two consecutive rarefactions. It is measured in meters (m).

• Nature of Sound Waves:

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

• It is also a longitudinal wave, where the particles of the medium vibrate parallel to the direction of energy transport.

Important Points

• Human Audibility: The standard audible range for humans is between 20 Hz and 20,000 Hz (20 kHz). Since 800 Hz falls within this range, it is an audible sound to the human ear.

• Pitch and Frequency: The pitch of a sound is directly proportional to its frequency. A wave with a higher frequency is perceived as having a higher pitch (shrill), while a lower frequency is perceived as a lower pitch (grave).

• Speed of Sound in Air: The speed of sound is not constant; it varies with temperature and humidity. For example, at 0 degrees Celsius, the speed is approximately 331 m/s, whereas at 20 degrees Celsius, it increases to about 343 m/s.

• Medium Density: Sound travels fastest in solids (due to high elasticity and density), slower in liquids, and slowest in gases. In steel, the speed can reach approximately 5960 m/s.

Q18. Answer: (a) Only immature eggs

The correct answer is Only immature eggs.

Key Points

• At the time of birth, the ovaries of a human female child already contain all the eggs she will ever have throughout her lifetime.

• These eggs are in an immature state and are scientifically referred to as primary oocytes. Hence, statement 1 is correct.

• Unlike the male reproductive system, which produces sperm continuously after puberty, the female reproductive system does not produce any new eggs after the birth of the child.

• The process of egg maturation does not begin until the girl reaches puberty, which typically occurs between the ages of 10 and 14 years. Hence, statement 2 is incorrect.

• Because the ovaries are fully formed and populated with follicles during fetal development, it is false to say they contain no eggs at birth. Hence, statement 3 is incorrect.

• Since the maturation process is triggered by hormonal changes later in life, a newborn cannot possess mature eggs (secondary oocytes) ready for fertilization. Hence, statement 4 is incorrect.

Additional Information

• Oogenesis:

• This is the biological process of the formation of a mature female gamete or ovum.

• It begins during the embryonic development stage when a couple of million gamete mother cells (oogonia) are formed within each fetal ovary.

• These cells start cell division and enter into prophase-I of the meiotic division and get temporarily arrested at that stage, called primary oocytes.

• Puberty and Ovulation:

• Upon reaching puberty, the hypothalamus releases Gonadotropin-releasing hormone (GnRH), which stimulates the pituitary

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gland.

• The pituitary gland secretes Follicle Stimulating Hormone (FSH) and Luteinizing Hormone (LH), which trigger the maturation of a few immature eggs each month.

• Usually, only one follicle matures fully to release a mature egg during the menstrual cycle, a process known as ovulation.

• Menopause:

• The supply of eggs decreases over time due to a process called atresia.

• When the store of oocytes is eventually exhausted, usually around the age of 45 to 55, the female reaches menopause, marking the end of reproductive capability.

Important Points

• Numerical Data: A female child is born with approximately 1 to 2 million immature eggs. By the time she reaches puberty, only about 300,000 to 400,000 remain.

• During a woman's entire reproductive life, only about 400 to 500 of these eggs will actually mature and be released during ovulation.

• Cellular Stage: The immature eggs are specifically arrested in the diplotene stage of Prophase I of Meiosis I. Completion of the first meiotic division occurs just before ovulation.

• Location: These eggs are housed within structures called ovarian follicles located in the cortex of the ovaries.

Q19. Answer: (c) Au (gold)

The correct answer is Au (gold).

Key Points

• The reactivity series is a sequence of metals arranged in the decreasing order of their chemical reactivity. It helps in predicting how metals will behave in displacement reactions and their interaction with water, oxygen, and acids.

• Gold (Au) is located at the very bottom of the reactivity series. This indicates that it is the most stable and the least reactive metal among the given options. Because of its inert nature, gold does not react with oxygen or water even at high temperatures.

• Potassium (K) is placed at the top of the reactivity series. It is an alkali metal that reacts violently with cold water to produce hydrogen gas and heat. It is so reactive that it must be stored under kerosene oil to prevent reaction with atmospheric moisture.

• Calcium (Ca) is also a highly reactive metal, although less so than potassium. It reacts readily with cold water to form calcium hydroxide and hydrogen bubbles, which often cause the metal to float.

• Iron (Fe) is a moderately reactive metal found in the middle of the series. It does not react with cold water but reacts with steam to form iron oxide. It also reacts slowly with oxygen and moisture to form rust (hydrated ferric oxide).

• Comparing the positions, Potassium (K) > Calcium (Ca) > Iron (Fe) > Gold (Au). Hence, Gold (Au) is the least reactive metal.

Additional Information

• Concept of Reactivity: The reactivity of a metal is determined by its tendency to lose electrons and form positive ions (cations). Metals like Potassium and Sodium have one electron in their outermost shell, which they lose very easily, making them highly electropositive.

• Noble Metals: Metals like Gold (Au), Silver (Ag), and Platinum (Pt) are often referred to as noble metals. Because they are least reactive, they are found in nature in their native state (free state) rather than in combined forms like oxides or sulfides. This property makes them ideal for jewelry and electronic components as they do not corrode.

• Displacement Reactions: A metal higher in the reactivity series can displace a metal lower in the series from its salt solution. For example, Iron (Fe) can displace Copper (Cu) from a copper sulfate solution, but Gold (Au) cannot displace any of the metals mentioned in the options.

• Extraction Methods: The position in the reactivity series dictates the method of extraction. Highly reactive metals (K, Na, Ca, Mg, Al) are extracted through electrolysis of their molten chlorides or oxides. Moderately reactive metals (Zn, Fe, Pb) are reduced using Carbon (C). The least reactive metals (Au, Ag) are found in their pure form and require only physical separation.

• Reaction with Acids: Metals above Hydrogen (H) in the series can displace hydrogen from dilute acids (like HCl or H_2SO_4). Gold, being below hydrogen, does not react with dilute acids and can only be dissolved in Aqua Regia (a mixture of concentrated nitric acid and hydrochloric acid in a 1:3 ratio).

Q20. Answer: (b) Sporangia

The correct answer is Sporangia.

Key Points

• Rhizopus is a genus of saprophytic fungi, commonly known as bread mold, which belongs to the phylum Zygomycota.

• The Sporangia (singular: sporangium) are the spherical, sac-like structures specifically responsible for asexual reproduction through the production of spores. Hence, statement 2 is correct.

• These structures develop at the tips of specialized upright hyphae known as sporangiophores.

• Inside the sporangium, the protoplasm undergoes cleavage to form thousands of minute, multinucleate, and non-motile

sporangiospores.

• When the spores mature, the outer wall of the sporangium ruptures due to internal pressure or environmental factors, dispersing the spores into the air to colonize new substrates.

Additional Information

• Hyphae:

• These are the individual, thread-like filaments that make up the body of the fungus. In Rhizopus, the hyphae are coenocytic, meaning they are continuous tubes filled with multinucleated cytoplasm without septa (cross-walls).

• While they form the structural basis, they are not the direct site of spore formation. Hence, statement 1 is incorrect.

• Mycelium:

• The mycelium refers to the entire collective network or mass of hyphae that constitutes the vegetative part of the fungus.

• It is responsible for nutrient absorption and spreading across the substrate (like bread or fruit). Hence, statement 3 is incorrect.

• Rhizoids:

• Rhizoids are root-like, branching hyphae that grow downward into the food source.

• Their primary functions include anchoring the fungus to the substrate and secreting digestive enzymes to absorb organic nutrients. Hence, statement 4 is incorrect.

• Stolons:

• These are horizontal hyphae that grow along the surface of the substrate, connecting different clusters of rhizoids and sporangiophores.

Important Points

• Asexual Reproduction: This is the most common method of reproduction in Rhizopus, occurring rapidly under favorable conditions of moisture and temperature (typically 25°C to 30°C).

• Sexual Reproduction: While sporangia handle asexual cycles, Rhizopus can also undergo sexual reproduction through the fusion of two compatible gametangia, leading to the formation of a thick-walled zygospore.

• Columella: This is the central sterile portion found inside the sporangium. It plays a role in nutrient exchange for the developing spores.

• Economic Importance: Some species like Rhizopus stolonifer cause food spoilage, while others like Rhizopus oryzae are used in the industrial production of lactic acid and cortisone.

Q21. Answer: (d) Only weight changes on the Moon

The correct answer is Only weight changes on the Moon.

Key Points

• Mass is defined as the total quantity of matter contained in an object. It is an intrinsic property of the body and remains constant regardless of the location in the universe, whether on Earth, the Moon, or in deep space.

• Weight is the gravitational force exerted on an object by a celestial body. It is calculated using the formula $W = m \times g$, where m is mass and g is the acceleration due to gravity.

• The acceleration due to gravity on the Moon is approximately 1.62 m/s^2, which is about 1/6th (or 16.6%) of the gravity on Earth (9.8 m/s^2). Since g changes, the weight of an object will change when moved to the Moon.

• The statement "Both mass and weight change on the Moon" is incorrect because mass is a scalar quantity that does not depend on gravity. Hence, statement 1 is incorrect.

• The statement "Only mass changes on the Moon" is incorrect because mass remains invariant, while weight is the property that actually fluctuates. Hence, statement 2 is incorrect.

• The statement "Neither mass nor weight changes on the Moon" is incorrect because while mass is constant, the gravitational pull of the Moon is significantly weaker than Earth's, causing weight to decrease. Hence, statement 3 is incorrect.

• The statement "Only weight changes on the Moon" is correct because an object's matter stays the same, but the force of gravity acting upon it decreases to 1/6th of its Earth value. Hence, statement 4 is correct.

Additional Information

• Detailed Comparison of Mass and Weight:

• Measurement Units: The SI unit of mass is the kilogram (kg), whereas the SI unit of weight is the Newton (N), as it is a measure of force.

• Nature of Quantity: Mass is a scalar quantity (it has only magnitude), while weight is a vector quantity because it acts in a specific direction (towards the center of the gravity source).

• Measuring Instruments: Mass is typically measured using a physical balance or beam balance, while weight is measured using a spring balance.

• Gravity on Different Celestial Bodies:

• On Jupiter, which has a much higher mass than Earth, the acceleration due to gravity is about 24.79 m/s^2. Consequently, an

object's weight would increase by more than 2.5 times, even though its mass remains exactly the same.

• In a state of free fall or in outer space far from any planet, an object can become weightless (Weight = 0), but it will still possess its original mass.

• Practical Example:

• If a person has a mass of 60 kg on Earth, their weight on Earth would be 60 kg × 9.8 m/s² = 588 Newtons.

• On the Moon, that same person's mass remains 60 kg, but their weight becomes 60 kg × 1.62 m/s² ≈ 98 Newtons.

Important Points

• Inertia: Mass is often described as a measure of inertia, which is the resistance of an object to any change in its state of motion. The higher the mass, the higher the inertia.

• Variation of 'g' on Earth: Even on Earth, weight can vary slightly because the Earth is an oblate spheroid. Gravity is slightly stronger at the poles (where you are closer to the center) and slightly weaker at the equator.

• Newton's Law of Universal Gravitation: This law states that every point mass attracts every other point mass by a force acting along the line intersecting both points. This force is what we perceive as weight.

Q22. Answer: (d) Litmus

The correct answer is Litmus.

Key Points

• Olfactory indicators are substances whose odor or smell changes depending on whether they are mixed with an acidic or basic solution.

• Onion is a well-known olfactory indicator. When treated with a base like sodium hydroxide (NaOH), the characteristic sharp smell of onion cannot be detected. however, its smell does not vanish when treated with an acid. Hence, it is an olfactory indicator.

• Vanilla essence has a characteristic pleasant smell. If we add a few drops of dilute Hydrochloric acid (HCl), the smell persists, but if we add dilute NaOH, the smell of vanilla vanishes. Hence, it is an olfactory indicator.

• Clove oil also acts as an olfactory indicator. Its distinct smell changes or disappears in the presence of a base, while it remains detectable in acidic conditions. Hence, it is an olfactory indicator.

• Litmus is a natural indicator but it is a visual indicator rather than an olfactory one. It changes its color in different media; it turns red in acidic solutions and blue in basic solutions. It does not rely on a change in smell for detection. Hence, it is NOT an olfactory indicator and is the correct answer.

Additional Information

• Natural Indicators:

• These are indicators obtained from natural sources like plants.

• Litmus is extracted from Lichens (a symbiotic relationship between algae and fungi). It is the most commonly used indicator in laboratories.

• Turmeric is another natural indicator. It remains yellow in acidic solutions but turns reddish-brown in basic solutions (often seen when soap, which is basic, touches a turmeric stain).

• Synthetic Indicators:

• These are laboratory-synthesized chemical indicators used to test acidity or alkalinity.

• Phenolphthalein is a popular synthetic indicator that remains colorless in acidic solutions and turns pink in basic solutions.

• Methyl Orange turns red in acidic media and yellow in basic media.

• Significance of Olfactory Indicators:

• Olfactory indicators are particularly useful for visually impaired students in chemistry laboratories, as they can identify the nature of a substance (acid or base) through the sense of smell rather than sight.

• pH Scale:

• The pH scale was introduced by S.P.L. Sorensen in 1909 to measure the concentration of hydrogen ions in a solution.

• The scale ranges from 0 to 14, where 7 is neutral, values below 7 are acidic, and values above 7 are basic or alkaline.

Q23. Answer: (d) Concave lens cannot form a real image

The correct answer is Concave lens cannot form a real image.

Key Points

• A concave lens is also known as a diverging lens because it diverges the parallel rays of light incident on it after refraction.

• For any position of a real object, a concave lens always forms a virtual, erect, and diminished image.

• A virtual image is formed when light rays appear to meet at a point but do not actually intersect; therefore, such images cannot be obtained on a screen. Hence, the student's claim of forming an image on a screen is a fundamental mistake.

• While a concave lens does indeed form diminished images, the impossibility of it being real (and thus projectable on a screen) is the primary error in the student's observation. Hence, statement 4 is the correct identification of the mistake.

• The image in a concave lens is always formed between the Optical Centre (O) and the Principal Focus (F1) on the same side as the object.

Additional Information

• Lens Formula and Sign Convention:

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

• For a concave lens, the focal length (f) is always taken as negative according to the Cartesian sign convention.

• Magnification (m):

• It is the ratio of the height of the image to the height of the object (h'/h) or v/u.

• For a concave lens, the magnification is always positive (indicating an erect image) and less than 1 (indicating a diminished image).

• Applications of Concave Lenses:

• They are primarily used in spectacles to correct Myopia (near-sightedness), as they help shift the image back onto the retina.

• They are also used in peepholes of house doors, flashlights, and telescopes to provide a wider field of view or to manipulate light beams.

• Comparison with Convex Lenses:

• A convex lens is a converging lens that can form both real and virtual images depending on the object's position.

• A real, diminished image can be formed by a convex lens when the object is placed beyond 2F1.

Important Points

• The Power of a lens is the reciprocal of its focal length in meters (P = 1/f). The SI unit of power is Dioptre (D).

• Since the focal length of a concave lens is negative, its power is also always negative.

• Light passing through the optical centre of any lens emerges without any deviation.

• The refractive index of the material and the curvature of the lens surfaces determine the focal length of the lens.

Q24. Answer: (b) Both Soil and Air

The correct answer is Both Soil and Air.

Key Points

• Plant pathogens are biological agents such as fungi, bacteria, viruses, and nematodes that cause diseases in plants, leading to significant agricultural loss worldwide.

• Soil transmission occurs when pathogens reside in the soil and infect plant roots or the base of the stem. Soil-borne pathogens can survive for long periods in the absence of a host by forming dormant structures. Hence, statement 1 is correct.

• Air transmission involves the movement of pathogen propagules, primarily spores, through wind currents. These spores can travel short distances within a field or thousands of miles across continents. Hence, statement 3 is correct.

• The transmission of diseases is a complex process where pathogens utilize multiple media, including water (rain splash/irrigation), insect vectors, and contaminated seeds, but soil and air remain the primary environmental pathways for dispersal.

• Because pathogens can utilize both the subterranean environment (soil) and the atmosphere (air) to find new hosts, the disease spread is categorized as both soil-borne and air-borne. Hence, the correct answer is Both Soil and Air.

Additional Information

• Soil-borne Diseases:

• These diseases are often caused by fungi like Fusarium, Rhizoctonia, and Pythium.

• They typically cause root rot, damping-off, and vascular wilts.

• Pathogens in the soil can remain viable for 5 to 10 years or more in the form of chlamydospores or sclerotia.

• Prevention: Techniques like crop rotation and soil solarization are used to manage these pathogens.

• Air-borne Diseases:

• Fungal rusts, smuts, and mildews are classic examples of air-borne plant diseases.

• Puccinia graminis (Wheat Rust) is a famous air-borne pathogen that produces millions of urediniospores that are carried by the wind.

• Environmental factors like relative humidity and wind velocity play a crucial role in the successful dispersal and germination of air-borne spores.

• Late Blight of Potato, caused by Phytophthora infestans, spread rapidly across Ireland in the 1840s due to air-borne and water-borne transmission.

• Other Transmission Modes:

• Vector-borne: Many plant viruses (e.g., Tobacco Mosaic Virus) are transmitted by insects like aphids, whiteflies, and leafhoppers.

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• Seed-borne: Pathogens can be carried on the surface of or inside seeds, ensuring the disease is present when the plant begins to grow.

Important Points

• Disease Triangle: For a plant disease to occur, three factors must coincide: a susceptible host, a virulent pathogen, and a favorable environment.

• Impact on Economy: It is estimated that plant diseases reduce global crop yields by approximately 10% to 16% annually, affecting food security.

• Modern Detection: Farmers now use spore traps and remote sensing to monitor air-borne pathogens and DNA-based soil testing to identify soil-borne threats before planting.

Q25. Answer: (a) High resistance and high melting point

The correct answer is High resistance and high melting point.

Key Points

• The filament of an incandescent light bulb is made of Tungsten (chemical symbol W) because it possesses a high melting point and high resistance.

• High Melting Point: Tungsten has the highest melting point of all metallic elements, recorded at approximately 3422°C (6192°F). This characteristic is crucial because the filament must reach temperatures above 2000°C to emit visible light through incandescence without melting or deforming.

• High Resistivity: Tungsten provides significant electrical resistance. When an electric current passes through the thin tungsten wire, the Joule heating effect (expressed as Heat = I^2Rt) converts electrical energy into intense thermal energy, causing the filament to glow.

• Low Vapor Pressure: At elevated temperatures, tungsten exhibits a very low vapor pressure, which minimizes the rate of sublimation. This prevents the filament from thinning too quickly and reduces the darkening of the glass bulb caused by metal deposits.

• Ductility and Strength: Tungsten is highly ductile, meaning it can be drawn into very fine wires. It also maintains great tensile strength even at high temperatures, which is necessary for the stability of the coiled filament structure.

• Hence, the correct answer is High resistance and high melting point.

Additional Information

• Composition of a Light Bulb:

• A standard incandescent bulb consists of a glass envelope, a tungsten filament, and contact wires.

• The bulb is typically filled with an inert gas such as Argon or Nitrogen (sometimes Krypton) to prevent the oxidation of the tungsten filament, which would otherwise burn up instantly in the presence of oxygen.

• Historical Context:

• Early light bulbs used carbon filaments, but they had a lower melting point and shorter lifespan. Tungsten filaments were introduced around 1904-1906, revolutionizing the lighting industry due to their superior durability and brightness.

• The transition to tungsten was significantly advanced by William Coolidge in 1910, who developed a method to make tungsten more ductile.

• Energy Efficiency:

• Incandescent bulbs are relatively inefficient compared to modern LED (Light Emitting Diode) or CFL (Compact Fluorescent Lamp) technology.

• Approximately 90% to 95% of the energy consumed by a tungsten bulb is released as heat, while only 5% to 10% is converted into visible light.

Important Points

• Tungsten Properties: It has an atomic number of 74 and is found in minerals like Wolframite and Scheelite. Its name "Tungsten" is derived from the Swedish words for heavy stone.

• Resistance and Temperature: The electrical resistance of tungsten increases as the temperature rises. When the bulb is first switched on, the "cold" resistance is low, leading to a brief inrush current before the filament heats up and the resistance stabilizes.

• Evaporation and Life Span: Over time, even with inert gas, tungsten atoms slowly evaporate from the filament. This leads to "hot spots" where the wire becomes thinner, has higher resistance, gets even hotter, and eventually breaks, which is why a bulb "burns out."

• Halogen Bulbs: In a Halogen lamp, a small amount of halogen gas (like Iodine or Bromine) is added. This triggers a chemical reaction that returns evaporated tungsten back to the filament, allowing it to operate at higher temperatures and last longer than standard bulbs.

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Q26. Answer: (c) Rs. 1137

Shortcut Trick

Expenditure % = 100% − Savings % = 100% − 88% = 12%

Monthly Expenditure = 12% of Rs. 9475

=> 12/100 × 9475 = 3/25 × 9475

=> 3 × 379 = Rs. 1137

Therefore The correct answer is Rs. 1137.

Alternate Method

Given:Monthly Salary = Rs. 9475, Savings Percentage = 88%

Formula Used:Expenditure = Salary − Savings

=> Savings amount = 88% of 9475 = (88 × 9475) ÷ 100

=> Savings amount = 0.88 × 9475 = Rs. 8338

=> Expenditure = 9475 − 8338

=> Expenditure = Rs. 1137

Therefore The correct answer is Rs. 1137.

Additional Information

Percentage Change

Percentage change is calculated as (New Value − Old Value) / Old Value × 100. In income problems, if income increases by r%, new income = Original × (1 + r/100).

Income-Expenditure Relation

Total Income is always the sum of Total Expenditure and Total Savings. If any two are known, the third can be calculated directly.

Base Value in Percentage

In salary-based questions, the Total Salary is always considered as the base (100%) for calculating percentage savings or expenses.

Q27. Answer: (b) 1

Shortcut Trick

Using the trigonometric identity: If A + B = 90°, then tan A × tan B = 1.

Here, (10° + 80° = 90°) => tan 10° × tan 80° = 1.

And, (18° + 72° = 90°) => tan 18° × tan 72° = 1.

Therefore, the product is 1 × 1 = 1.

Therefore The correct answer is 1.

Alternate Method

Given: tan 10° tan 18° tan 72° tan 80°

Formula Used: tan(90° − θ) = cot θ and tan θ × cot θ = 1

=> tan 80° = tan(90° − 10°) = cot 10°

=> tan 72° = tan(90° − 18°) = cot 18°

Substitute these values back into the expression:

=> tan 10° × tan 18° × cot 18° × cot 10°

=> (tan 10° × cot 10°) × (tan 18° × cot 18°)

=> 1 × 1 = 1

Therefore The correct answer is 1.

Additional Information

Complementary Angle Identities

For any angle θ, sin(90° − θ) = cos θ, cos(90° − θ) = sin θ, and tan(90° − θ) = cot θ.

Reciprocal Identities

The product of trigonometric terms that are reciprocals of each other is 1, such as tan θ × cot θ = 1 and sin θ × cosec θ = 1.

Q28. Answer: (c) Rs. 13,536

Shortcut Trick

Effective Rate of Interest for 2 years at 20% = 20 + 20 + (20 × 20)/100 = 44%.

Amount = 100% + 44% = 144% of Principal.

Amount = 1.44 × 9400 = 13536.

Therefore The correct answer is Rs. 13,536.
Alternate Method
Given:
Principal (P) = Rs. 9,400
Rate (R) = 20% p.a.
Time (n) = 2 years
Formula Used:
Amount (A) = $P(1 + R/100)^n$
Calculations:
=> $A = 9400(1 + 20/100)^2$
=> $A = 9400(1 + 1/5)^2$
=> $A = 9400(6/5)^2$
=> $A = 9400 \times (36/25)$
=> $A = 376 \times 36$
=> $A = 13536$
Therefore The correct answer is Rs. 13,536.
Additional Information
Effective Rate for Compound Interest
For 2 years, the effective rate is $x + y + (xy/100)\%$, where x and y are the rates for the first and second years.
Compound Interest vs Simple Interest
The difference for 2 years is given by the formula $D = P(R/100)^2$.
Compounding Half-Yearly
If interest is compounded half-yearly, the rate is halved (R/2) and the time is doubled (2n).

Q29. Answer: (b) 24

Shortcut Trick
Identify the smallest two-digit prime numbers: 11 and 13.
Check if they are twin primes: 13 − 11 = 2 (Yes).
Calculate the sum: 11 + 13 = 24.
Therefore The correct answer is 24.
Alternate Method
Given: We need to find the sum of the first pair of two-digit twin prime numbers.
Definition: Twin primes are pairs of prime numbers that have a difference of 2.
=> Prime numbers starting from 10 are: 11, 13, 17, 19, 23, 29, ...
=> The first two-digit prime number is 11.
=> The next prime number is 13.
=> Difference = 13 − 11 = 2.
=> Since the difference is 2, (11, 13) is the first pair of two-digit twin primes.
=> Sum = 11 + 13 = 24.
Therefore The correct answer is 24.
Additional Information
Twin Prime Pairs
Common twin prime pairs include (3, 5), (5, 7), (11, 13), (17, 19), (29, 31), and (41, 43).
Prime Number Properties
Except for (3, 5), all twin prime pairs are of the form (6n − 1, 6n + 1) for some integer n.
Smallest Two-Digit Prime
The smallest two-digit prime number is 11, and the largest is 97.

Q30. Answer: (b) Rs. 62

Shortcut Trick
Difference in costs after doubling the second set:
Cost of 1 cookie = (2 × 23) − 36 = 46 − 36 = Rs. 10.

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Cost of 1 chocolate = 23 − (2 × 10) = Rs. 3.

Required cost of 4 chocolates and 5 cookies = (4 × 3) + (5 × 10) = 12 + 50 = Rs. 62.

Therefore The correct answer is Rs. 62.

Alternate Method

Given:

Case 1: 2 Chocolates + 3 Cookies = Rs. 36

Case 2: 1 Chocolate + 2 Cookies = Rs. 23

Let the cost of one chocolate be Rs. x and one cookie be Rs. y.

=> 2x + 3y = 36 ....(i)

=> x + 2y = 23 ....(ii)

Multiplying equation (ii) by 2:

=> 2x + 4y = 46 ....(iii)

Subtracting equation (i) from equation (iii):

=> (2x + 4y) − (2x + 3y) = 46 − 36

=> y = 10

Substitute y = 10 in equation (ii):

=> x + 2(10) = 23

=> x + 20 = 23

=> x = 3

Cost of 4 chocolates and 5 cookies:

=> 4x + 5y = 4(3) + 5(10)

=> 12 + 50 = 62

Therefore The correct answer is Rs. 62.

Additional Information

Linear Equations in Two Variables

Equations of the form ax + by = c represent a straight line. Solving two such equations finds the intersection point (x, y).

Elimination Method

A technique to solve a system of equations by making the coefficients of one variable equal and then adding or subtracting the equations.

Substitution Method

Solve one equation for one variable and substitute that expression into the second equation to find the value of the other variable.

Q31. Answer: (a) x

Shortcut Trick

Apply BODMAS directly by adding like terms first, then dividing:

=> $(3x^2 + 4x^2) \div 7x$

=> $7x^2 \div 7x$

=> x

Therefore The correct answer is x.

Alternate Method

Given:

Expression: $(3x^2 + 4x^2) \div 7x$

Formula Used:

Addition of like terms: $ax^n + bx^n = (a + b)x^n$

Law of exponents for division: a^m ÷ a^n = a^(m−n)

Calculations:

=> According to the BODMAS rule, solve the bracket first.

=> $3x^2 + 4x^2 = 7x^2$

=> Now, divide the result by 7x.

=> $7x^2 \div 7x = (7 \div 7) \times (x^2 \div x^1)$

=> 1 × x^(2−1)

=> x

Therefore The correct answer is x.

Additional Information

BODMAS Rule

It stands for Bracket, Of, Division, Multiplication, Addition, and Subtraction. Always solve expressions inside parentheses first.

Law of Exponents (Multiplication)

When multiplying expressions with the same base, add the exponents: a^m × aⁿ = a^(m+n)

Law of Exponents (Division)

When dividing expressions with the same base, subtract the exponents: a^m ÷ aⁿ = a^(m−n)

Q32. Answer: (d) 12,500

Shortcut Trick

Net discount multiplier = (100 − 20)% × (100 − 11)% = 0.80 × 0.89 = 0.712.

Marked Price (MP) = Selling Price ÷ 0.712.

MP = 8,900 ÷ 0.712 = 12,500.

Therefore The correct answer is Rs. 12,500.

Alternate Method

Given → Selling Price (SP) = Rs. 8,900 | Discount1 = 20% | Discount2 = 11%.

Formulas: SP = MP × (100 − D1)% × (100 − D2)% | Successive = a + b − ab ÷ 100.

=> Let the Marked Price be x.

=> First discount of 20%: Price becomes x × (80/100).

=> Second discount of 11%: Price becomes x × (80/100) × (89/100).

=> Set equation: x × 0.8 × 0.89 = 8,900.

=> x × 0.712 = 8,900.

=> x = 8,900 ÷ 0.712 = 12,500.

Therefore The correct answer is Rs. 12,500.

Additional Information

Marked Price & Discount

The Marked Price (MP) is the price listed on the label. Discount is always calculated on the MP unless stated otherwise. SP = MP − Discount.

Successive Discount Formula

To find a single equivalent discount for two discounts a% and b%, use: Equivalent Discount = (a + b − ab/100)%.

Q33. Answer: (a) 10 years

Shortcut Trick

Ratio of Father : Daughter

Present → 4 : 1 (Difference = 3)

5 years ago → 7 : 1 (Difference = 6)

Make differences equal: Present ratio × 2 → 8 : 2

Change in units: 8 − 7 = 1 unit or 2 − 1 = 1 unit

1 unit = 5 years Therefore Daughter's present age = 2 units = 2 × 5 = 10 years

Therefore The correct answer is 10 years.

Alternate Method

Given:

Present age ratio Father : Daughter = 4 : 1

Age ratio 5 years ago = 7 : 1

Let daughter's present age be x years.

=> Father's present age = 4x years.

=> 5 years ago, daughter's age = x − 5

=> 5 years ago, father's age = 4x − 5

=> According to question: (4x − 5) = 7 × (x − 5)

=> 4x − 5 = 7x − 35

=> 3x = 30

=> x = 10

Therefore The correct answer is 10 years.

Additional Information

Age Difference Property

The difference between the ages of two people remains constant regardless of the number of years passed.

Ratio Balancing

To solve age problems using ratios, multiply the ratios by the difference of the other ratio to balance the units representing time intervals.

Q34. Answer: (b) 42.4

Shortcut Trick

When two objects meet and then travel towards their destinations, the ratio of their speeds is the inverse square root of the ratio of time taken to reach the destinations.

Speed Ratio $S_A : S_B = \sqrt{T_B} : \sqrt{T_A}$

Given: $S_B = 1.5 \times S_A \Rightarrow S_A/S_B = 1/1.5 = 2/3$

$2/3 = \sqrt{(p / 95.4)} \Rightarrow 4/9 = p / 95.4$

$p = (95.4 \times 4) \div 9 = 10.6 \times 4 = 42.4$ hours

Therefore The correct answer is 42.4 hours.

Alternate Method

Given:

Time taken by A after meeting (T_A) = 95.4 hours

Time taken by B after meeting (T_B) = p hours

Speed of B (S_B) = Speed of A (S_A) + 50% of S_A = 1.5 S_A

Formula Used:

$S_A / S_B = \sqrt{(T_B / T_A)}$

Calculations:

$\Rightarrow S_A / 1.5S_A = \sqrt{(p / 95.4)}$

$\Rightarrow 1 / 1.5 = \sqrt{(p / 95.4)}$

$\Rightarrow 10 / 15 = \sqrt{(p / 95.4)}$

$\Rightarrow 2 / 3 = \sqrt{(p / 95.4)}$

Squaring both sides:

$\Rightarrow 4 / 9 = p / 95.4$

$\Rightarrow p = (4 \times 95.4) / 9$

$\Rightarrow p = 4 \times 10.6$

$\Rightarrow p = 42.4$

Therefore The correct answer is 42.4 hours.

Additional Information

Post-Meeting Time Theorem

If two bodies start at the same time and meet at a point, then take T1 and T2 time to reach their destinations, their speed ratio is $S1/S2 = \sqrt{(T2/T1)}$.

Meeting Time Formula

The time they took to meet each other from the start is given by $T_{(meet)} = \sqrt{(T1 \times T2)}$.

Relative Speed

When two objects move towards each other, their relative speed is the sum of their individual speeds: $S_{(rel)} = S_A + S_B$.

Q35. Answer: (d) 44

Shortcut Trick

Mean proportion $M = \sqrt{(a \times b)}$

Given M = 66, a = x, and b = 99

$66^2 = x \times 99$

$x = (66 \times 66) \div 99 = (2 \times 33 \times 2 \times 33) \div (3 \times 33) = (2 \times 2 \times 33) \div 3 = 4 \times 11 = 44$

Therefore The correct answer is 44.

Alternate Method

Given:
Mean Proportion = 66
First and Third terms are x and 99 respectively.
Formula Used:
In a continued proportion a, b, c, the mean proportion $b^2 = ac$.
Calculations:
=> x : 66 = 66 : 99
=> x ÷ 66 = 66 ÷ 99
=> x = (66 × 66) ÷ 99
=> x = 4356 ÷ 99
=> x = 44
Therefore The correct answer is 44.
Additional Information
Third Proportional
If a, b, c are in continued proportion, then c is called the third proportional to a and b, where $c = b^2 \div a$.
Fourth Proportional
If a : b :: c : d, then d is the fourth proportional to a, b, and c, calculated as d = (b × c) ÷ a.
Duplicate Ratio
The duplicate ratio of a : b is $a^2 : b^2$, and the sub-duplicate ratio is √a : √b.

Q36. Answer: (a) 9048

Shortcut Trick
Total votes = 100%
Votes for N = 100% − (42% + 34%) = 24%
Votes for N = 24% of 37,700 = 24 × 377
Votes for N = 9048
Therefore The correct answer is 9048 votes.
Alternate Method
Given: Total votes = 37,700 | Votes for M = 42% | Votes for R = 34%
=> Total percentage = Percentage(M) + Percentage(N) + Percentage(R)
=> 100% = 42% + Percentage(N) + 34%
=> Percentage(N) = 100% − 76% = 24%
=> Number of votes for N = (24 ÷ 100) × 37,700
=> Number of votes for N = 24 × 377 = 9048
Therefore The correct answer is 9048 votes.
Additional Information
Total vs Valid Votes
In election problems, Total Votes = Valid Votes + Invalid Votes. If all votes are valid, then total polled equals valid.
Winner Margin
The margin of victory is the difference between the votes of the first and second-place candidates.
Percentage Calculation
To find the absolute value from a percentage: Value = (Percentage ÷ 100) × Total.

Q37. Answer: (d) 10

Shortcut Trick
Efficiency Ratio (Rishi : Shan) = 100 : 120 = 5 : 6.
Time Ratio is the inverse of Efficiency Ratio = 6 : 5.
If 6 units = 12 days (Rishi), then 1 unit = 2 days.
Days for Shan = 5 units = 5 × 2 = 10 days.
Therefore The correct answer is 10 days.
Alternate Method
Given: Rishi takes 12 days. Shan is 20% more efficient.

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Formula Used: Total Work = Efficiency × Time; Days = Total Work ÷ Efficiency
=> Let Efficiency of Rishi = 5 units/day.
=> Efficiency of Shan = 5 + (20% of 5) = 5 + 1 = 6 units/day.
=> Total Work = Efficiency of Rishi × Days = 5 × 12 = 60 units.
=> Days taken by Shan = Total Work ÷ Efficiency of Shan = 60 ÷ 6 = 10 days.
Therefore The correct answer is 10 days.
Additional Information
Inverse Proportionality
For a constant work, Time is inversely proportional to Efficiency (T prop. to 1/E). If efficiency increases, time taken decreases.
Combined Work
If two people work together, their combined efficiency is the sum of their individual efficiencies (E_(total) = E1 + E2).
Percentage to Fraction
20% more efficiency means a ratio of 120/100 or 6/5. This fractional approach simplifies ratio calculations significantly.

Q38. Answer: (b) 39 m2

Shortcut Trick
Area of wet surface = Area of base + Lateral surface area
Area of wet surface = (length × width) + 2 × depth × (length + width)
Area of wet surface = (5 × 3) + 2 × 1.5 × (5 + 3)
Area of wet surface = 15 + 3 × 8 = 15 + 24 = 39 m²
Therefore The correct answer is 39 m².
Alternate Method
Given:
Length (l) = 5 m
Width (w) = 3 m
Depth (h) = 1.50 m
Formula: Wet surface area = Area of bottom + Area of 4 vertical sides
=> Area of bottom = l × w = 5 × 3 = 15 m²
=> Area of 2 long sides = 2 × (l × h) = 2 × (5 × 1.5) = 2 × 7.5 = 15 m²
=> Area of 2 wide sides = 2 × (w × h) = 2 × (3 × 1.5) = 2 × 4.5 = 9 m²
=> Total wet area = 15 + 15 + 9 = 39 m²
Therefore The correct answer is 39 m².
Additional Information
Total Surface Area of Cuboid
The total area of all six faces is given by 2(lb + bh + hl).
Lateral Surface Area (Area of 4 walls)
The area of the four vertical faces is 2h(l + b).
Volume of Rectangular Tank
The volume of water or capacity is calculated as Length × Width × Height.

Q39. Answer: (a) Rs. 1,316

Shortcut Trick
The Cost Price (CP) represents 100%.
Since there is a loss of 6%, the Selling Price (SP) represents 100% − 6% = 94%.
SP = 1,400 × (94 ÷ 100)
SP = 14 × 94 = 1,316.
Therefore The correct answer is Rs. 1,316.
Alternate Method
Given: Cost Price (CP) = Rs. 1,400 and Loss Percentage = 6%.
Formula: Loss = (Loss% × CP) ÷ 100 | SP = CP − Loss
=> Loss Amount = (6 × 1,400) ÷ 100
=> Loss Amount = 6 × 14 = Rs. 84

=> Selling Price (SP) = Cost Price − Loss
=> SP = 1,400 − 84 = Rs. 1,316
Therefore The correct answer is Rs. 1,316.
Additional Information
Loss and Profit
Profit occurs when SP > CP. Loss occurs when CP > SP. Both are always calculated on the Cost Price unless stated otherwise.
Percentage Change
To find the new value after a percentage decrease: New Value = Original Value × (100 − decrease%) ÷ 100.

Q40. Answer: (b) 1,520

Shortcut Trick
Combine ratios A:B (2:3), B:C (4:5), and C:D (6:7) by making common terms equal.
Ratio A:B:C:D = (2×4×6) : (3×4×6) : (3×5×6) : (3×5×7) = 48 : 72 : 90 : 105.
Simplified Ratio A:B:C:D = 16 : 24 : 30 : 35 (Dividing by 3).
Total units = 16 + 24 + 30 + 35 = 105 units → Rs. 9,975. So, 1 unit = Rs. 95.
Share of A = 16 units = 16 × 95 = Rs. 1,520.
Therefore The correct answer is Rs. 1,520.
Alternate Method
Given: Total Amount = Rs. 9,975. Ratios A:B = 2:3, B:C = 4:5, C:D = 6:7.
Formula: Joint Ratio calculation and Unitary method.
=> To find A:B:C:D, multiply terms vertically and diagonally:
=> A = 2 × 4 × 6 = 48
=> B = 3 × 4 × 6 = 72
=> C = 3 × 5 × 6 = 90
=> D = 3 × 5 × 7 = 105
=> Ratio A:B:C:D = 48 : 72 : 90 : 105 = 16 : 24 : 30 : 35
=> Total components = 16 + 24 + 30 + 35 = 105
=> Value of 1 part = 9975 ÷ 105 = Rs. 95
=> Share of A = 16 × 95 = Rs. 1,520
Therefore The correct answer is Rs. 1,520.
Additional Information
Combined Ratio Rule
If A:B = a:b, B:C = c:d, and C:D = e:f, then A:B:C:D = (a×c×e) : (b×c×e) : (b×d×e) : (b×d×f).
Compound Ratio
The compound ratio of (a:b), (c:d) and (e:f) is simply (a×c×e) : (b×d×f).
Proportional Division
To divide an amount S in the ratio a:b:c, the shares are [a/(a+b+c)]×S, [b/(a+b+c)]×S, and [c/(a+b+c)]×S.

Q41. Answer: (b) 86

Shortcut Trick
In any data set, the Mode is the observation with the maximum frequency (the value that repeats the most).
By observation: 86 appears 4 times, while 65, 85, 71, and 90 appear only 2 times each, and others appear once.
Since 86 has the highest repetition, it is the mode.
Therefore The correct answer is 86.
Alternate Method
Given: Data set = 65, 86, 86, 85, 69, 90, 71, 60, 86, 71, 86, 65, 81, 82, 67, 72, 84, 66, 75, 85, 68, 78, 61, 64, 74, 90.
Formula Used: Mode = Value with the Highest Frequency.
Calculating the frequency of each observation from the given data:
=> Frequency of 60 = 1
=> Frequency of 65 = 2
=> Frequency of 71 = 2
=> Frequency of 85 = 2

=> Frequency of 90 = 2
=> Frequency of 86 = 4 (appears at positions 2, 3, 9, and 11)
=> All other values (61, 64, 66, 67, 68, 69, 72, 74, 75, 78, 81, 82, 84) appear only 1 time.
=> Maximum frequency = 4, which corresponds to the value 86.
Therefore The correct answer is 86.
Additional Information
Mean (Average)
It is the sum of all observations divided by the total number of observations: Mean = (Σx_i) ÷ n.
Median
It is the middle-most value of the data when arranged in ascending or descending order.
Empirical Relationship
For moderately skewed distributions: Mode = 3 × Median − 2 × Mean.
Types of Mode
Data can be Unimodal (one mode), Bimodal (two modes), or Multimodal (more than two modes).

Q42. Answer: (b) 3/8

Shortcut Trick
Interior angle of regular polygon with n sides = [(n − 2) × 180°] ÷ n
For n = 8, A = (6 × 180°) ÷ 8 = 135° => A/3 = 45°
For n = 10, B = (8 × 180°) ÷ 10 = 144° => 5B/6 = 120°
Value = $\sin^2(45°) + \cos^3(120°) = (1/\sqrt{2})^2 + (-1/2)^3 = 1/2 - 1/8 = 3/8$
Therefore The correct answer is 3/8.
Alternate Method
Given: Sides of first polygon n1 = 8, Sides of second polygon n2 = 10.
Formula Used: Interior angle = 180° − (360°/n); sin 45° = 1/√2; cos 120° = −1/2.
A (n=8)A = 135°B (n=10)B = 144°Expression: $\sin^2(A/3) + \cos^3(5B/6)$
=> Angle A = 180° − (360° ÷ 8) = 180° − 45° = 135°
=> Angle B = 180° − (360° ÷ 10) = 180° − 36° = 144°
=> A/3 = 135° ÷ 3 = 45°
=> 5B/6 = (5 × 144°) ÷ 6 = 5 × 24° = 120°
=> $\sin^2(45°) + \cos^3(120°) = (1/\sqrt{2})^2 + (\cos(180°-60°))^3$
=> $1/2 + (-\cos 60°)^3 = 1/2 + (-1/2)^3$
=> 1/2 − 1/8 = 4/8 − 1/8 = 3/8
Therefore The correct answer is 3/8.
Additional Information
Interior and Exterior Angles
For any regular polygon, Interior Angle + Exterior Angle = 180°. Sum of all exterior angles is always 360°.
Trigonometric Ratios of Obtuse Angles
cos(180° − θ) = −cos θ. Since 120° is in the second quadrant, cosine is negative.
Sum of Interior Angles
The sum of all interior angles of a polygon with n sides is given by (n − 2) × 180°.

Q43. Answer: (d) 57.6 sec

Shortcut Trick
Total distance = Length of Train + Length of Platform = 200 + 600 = 800 m
Speed in m/sec = 50 × (5/18) = 125/9 m/sec
Time = Distance ÷ Speed = 800 ÷ (125/9) = (800 × 9) ÷ 125
Time = 6.4 × 9 = 57.6 sec
Therefore The correct answer is 57.6 sec.
Alternate Method
Given:
Length of Train (L1) = 200 m

Length of Platform (L2) = 600 m
Speed (S) = 50 km/hr
Formula Used:
Time = Total Distance ÷ Speed
To convert km/hr to m/s, multiply by 5/18.
Calculations:
=> Total Distance = 200 + 600 = 800 m
=> Speed in m/s = 50 × (5/18) = 250/18 = 125/9 m/s
=> Time = 800 ÷ (125/9)
=> Time = (800 × 9) ÷ 125
=> Time = 7200 ÷ 125 = 57.6 sec
Therefore The correct answer is 57.6 sec.
Additional Information
Unit Conversion
To convert km/hr to m/s, multiply by 5/18. To convert m/s to km/hr, multiply by 18/5.
Relative Speed (Same Direction)
When two objects move in the same direction, the relative speed is the difference of their speeds (S1 − S2).
Relative Speed (Opposite Direction)
When two objects move in opposite directions, the relative speed is the sum of their speeds (S1 + S2).

Q44. Answer: (a) First article; Rs. 12,960

Shortcut Trick
Total discount on First Article = a + b − (ab ÷ 100) = 30 + 18 − (30 × 18 ÷ 100) = 48% − 5.4% = 42.6%.
Total discount on Second Article = 48%.
The shopkeeper gets more benefit where the discount is lower (First Article).
Difference in discount % = 48% − 42.6% = 5.4%.
More benefit amount = 5.4% of 2,40,000 = 0.054 × 2,40,000 = 12,960.
Therefore The correct answer is First article; Rs. 12,960.
Alternate Method
Given → Marked Price (MP) = Rs. 2,40,000. Case 1: Successive discounts 30% and 18%. Case 2: Single discount 48%.
Formulas: SP = MP × (100 − D1)% × (100 − D2)% | Profit is higher when SP is higher.
=> SP of First Article = 2,40,000 × (70 ÷ 100) × (82 ÷ 100) = 2,400 × 0.7 × 82 = Rs. 1,37,760.
=> SP of Second Article = 2,40,000 × (52 ÷ 100) = 2,400 × 52 = Rs. 1,24,800.
=> Shopkeeper benefit is higher when selling price is higher Therefore First Article.
=> Difference in benefit = 1,37,760 − 1,24,800 = Rs. 12,960.
Therefore The correct answer is First article; Rs. 12,960.
Additional Information
Successive Discounts
Two successive discounts of x% and y% are equivalent to a single discount of (x + y − xy/100)%.
Shopkeeper Perspective
For a seller, a smaller total discount results in a higher Selling Price, thus yielding more benefit.

Q45. Answer: (b) 23.2

Shortcut Trick
The relationship between Mode, Median, and Mean is expressed as: Mode − Median = 2/3 × (Mode − Mean).
Given: Mode − Mean = 34.8
Applying the trick: Mode − Median = 2/3 × 34.8
Calculation: 2 × 11.6 = 23.2
Therefore The correct answer is 23.2.
Alternate Method
Given: Difference between Mode and Mean = 34.8
Formula used: Empirical Relationship → Mode = 3 × Median − 2 × Mean

=> Let Mean = x

=> Mode = x + 34.8

=> Substituting in formula: x + 34.8 = 3 × Median − 2x

=> 3x + 34.8 = 3 × Median

=> Median = (3x + 34.8) ÷ 3

=> Median = x + 11.6

=> Difference (Mode − Median) = (x + 34.8) − (x + 11.6)

=> Mode − Median = 23.2

Therefore The correct answer is 23.2.

Additional Information

Empirical Relationship

For a moderately skewed distribution, the relationship is: Mode = 3 × Median − 2 × Mean.

Symmetric Distribution

In a perfectly symmetrical distribution, the values of Mean, Median, and Mode are identical (Mean = Median = Mode).

Mean - Mode Relation

Another variation of the formula is: Mean − Mode = 3 × (Mean − Median).

Q46. Answer: (d) 177/19

Shortcut Trick

Total Work (LCM of 33, 22, 55) = 330 units.

Efficiency of A = 10, B = 15, Combined (A + B − C) = 6.

Efficiency of C = (10 + 15) − 6 = 19.

Time taken by C = 330 ÷ 19 = 17(7/19) minutes.

Therefore The correct answer is 17(7/19) minutes.

Alternate Method

Given: Time for Pipe A = 33 min, Pipe B = 22 min, Combined (A+B-C) = 55 min.

Pipe	Time (min)	Total Work (LCM)	Efficiency
Pipe A	33	330	10
Pipe B	22	15	
A + B − C	55	6	

=> Efficiency of Pipe A + Efficiency of Pipe B − Efficiency of Pipe C = Combined Efficiency

=> 10 + 15 − Efficiency of Pipe C = 6

=> 25 − Efficiency of Pipe C = 6

=> Efficiency of Pipe C = 25 − 6 = 19

=> Time taken by Pipe C to empty the tank = Total Work ÷ Efficiency of C

=> Time = 330 ÷ 19

=> Time = 17(7/19) minutes

Therefore The correct answer is 17(7/19) minutes.

Additional Information

Negative Work Concept

In Pipes and Cisterns, an outlet pipe (emptying pipe) performs negative work, so its efficiency is subtracted from the total efficiency of inlet pipes.

Efficiency and Time Relationship

Efficiency is inversely proportional to Time when the total work is constant. Efficiency = Total Work ÷ Time.

Formula Method

For three pipes where C is an outlet: (1/T_A) + (1/T_B) − (1/T_C) = (1/T_(Total)). Solve for T_C directly.

Q47. Answer: (a) 85

Shortcut Trick

We can separate the square roots directly using the property √(a × b) = √a × √b:

=> (11 × 7) + (8 × 6) − (10 × 4)

=> 77 + 48 − 40

=> 125 − 40 = 85

Therefore The correct answer is 85.

Alternate Method

Given:

Expression: √(121 × 49) + √(64 × 36) − √(100 × 16)

Formula Used:

√(x × y) = √x × √y

Calculation:

=> √(121 × 49) = √121 × √49 = 11 × 7 = 77

=> √(64 × 36) = √64 × √36 = 8 × 6 = 48

=> √(100 × 16) = √100 × √16 = 10 × 4 = 40

Substituting the calculated values back into the main expression:

=> 77 + 48 − 40

=> 125 − 40

=> 85

Therefore The correct answer is 85.

Additional Information

BODMAS Rule

Always follow the strict sequence of Brackets, Order (Powers/Roots), Division/Multiplication, and Addition/Subtraction from left to right to ensure an accurate result.

Properties of Radicals

The product of two square roots is equivalent to the square root of their product: √a × √b = √(a × b). This property is universally valid for all non-negative real numbers.

Common Perfect Squares

Memorizing squares up to 30 heavily aids in faster calculation during simplification questions (e.g., $11^2 = 121$, $15^2 = 225$, $25^2 = 625$).

Q48. Answer: (b) 696

Shortcut Trick

Find LCM of 28, 24, 56, and 29.

LCM (28, 24, 56, 29) = LCM(56, 24, 29) = 168 × 29 = 4872.

Multiples of 4872 near 9054: 4872 × 2 = 9744.

Required number = (Next Multiple + Remainder) − Given Number = (9744 + 6) − 9054 = 9750 − 9054 = 696.

Therefore The correct answer is 696.

Alternate Method

Given: Numbers 28, 24, 56, 29; Remainder = 6; Target number > 9054.

Formula Used: Required number = [n × LCM(divisors) + Remainder] − 9054

=> Step 1: Prime factorization of divisors:

=> 28 = 2^2 × 7

=> 24 = 2^3 × 3

=> 56 = 2^3 × 7

=> 29 = 29 (Prime number)

=> LCM = 2^3 × 3 × 7 × 29 = 8 × 3 × 7 × 29 = 168 × 29 = 4872

=> To find a number just greater than 9054, we take the 2^(nd) multiple:

=> 4872 × 2 = 9744

=> To leave a remainder of 6: 9744 + 6 = 9750

=> Smallest number to be added = 9750 − 9054 = 696

Therefore The correct answer is 696.

Additional Information

LCM and Remainder Concept

The general form of a number that leaves a remainder 'r' when divided by x, y, and z is [k × LCM(x, y, z) + r].

Divisibility Rules

For large numbers, check divisibility of the final sum (9054 + x − 6) by simpler factors like 3 or 8 from the LCM set.

Prime Numbers

If one of the divisors is a prime number (like 29), it must be a direct factor of the LCM.

Q49. Answer: (a) 9%

Shortcut Trick

Ratio of Expenditure to Savings = 200 : 100 = 2 : 1

Using Alligation/Weighted Average method:

Net Income change = (Expenditure % × E-ratio + Savings % × S-ratio) ÷ (E-ratio + S-ratio)

Income increase = (−4% × 2 + 35% × 1) ÷ (2 + 1) = (−8 + 35) ÷ 3 = 27 ÷ 3 = 9%

Therefore The correct answer is 9%.

Alternate Method

Given:Expenditure is 100% more than Savings.

Formula Used:Income = Expenditure + Savings

=> Let Savings = 100

=> Expenditure = 100 + 100% of 100 = 200

=> Initial Income = 200 + 100 = 300

=> New Expenditure = 200 − 4% of 200 = 200 − 8 = 192

=> New Savings = 100 + 35% of 100 = 135

=> New Income = 192 + 135 = 327

=> Increase in Income = 327 − 300 = 27

=> % Increase = (27 ÷ 300) × 100 = 9%

Therefore The correct answer is 9%.

Additional Information

Income, Expenditure and Savings Relationship

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

Weighted Average Concept

If components A and B change by x% and y%, the total change is (A×x + B×y) ÷ (A+B). This is the fastest way to solve income-expenditure problems.

Percentage Base Change

When a value is x% more than another, the ratio is (100+x) : 100. Always identify the base correctly before calculating increments or decrements.

Q50. Answer: (d) 21 m2

Shortcut Trick

Let Length = L and Breadth = B.

From conditions: (L − 7)(B + 5) = LB − 21 => 5L − 7B = 14

From second condition: (L + 4)(B + 5) = LB + 67 => 5L + 4B = 47

Subtracting both: 11B = 33 => B = 3 m. Putting B in first: 5L − 21 = 14 => 5L = 35 => L = 7 m.

Original Area = L × B = 7 × 3 = 21 m².

Therefore The correct answer is 21 m².

Alternate Method

Given: Reduction in area = 21 m², Increase in area = 67 m².

Formula: Area of Rectangle = Length (L) × Breadth (B).

=> Case 1: (L − 7)(B + 5) = LB − 21

=> LB + 5L − 7B − 35 = LB − 21

=> 5L − 7B = 14 ----(i)

=> Case 2: (L + 4)(B + 5) = LB + 67

=> LB + 5L + 4B + 20 = LB + 67

=> 5L + 4B = 47 ----(ii)

=> Subtracting (i) from (ii): (5L + 4B) − (5L − 7B) = 47 − 14

=> 11B = 33 => B = 3 m

=> Substituting B in (i): 5L − 7(3) = 14 => 5L − 21 = 14 => 5L = 35 => L = 7 m

=> Area = 7 × 3 = 21 m²

Therefore The correct answer is 21 m².

Additional Information

Perimeter of Rectangle

The total boundary length is given by P = 2 × (Length + Breadth).

Diagonal of Rectangle

The length of the diagonal is calculated using Pythagoras theorem: d = √(L² + B²).

Percentage Change in Area

If length changes by x% and breadth by y%, net area change % = x + y + (xy/100).

Q51. Answer: (c) DHG 40

The logic followed here is:

So, 'DHG 40' will replace the question mark in the given series.

Hence, the correct answer is "Option 3".

Q52. Answer: (b) Neither conclusion (I) nor (II) follows

Given Statements:

All rods are hooks.

Some hooks are baits.

The least possible Venn diagram for the given statements is:

Conclusions:

I. All rods are baits → Does not follow (Rods are inside hooks, and only some hooks are baits; no definite inclusion or overlap of rods with baits is given.)

II. Some baits are rods → Does not follow (There is no established intersection between rods and baits.)

So, neither conclusion I nor II follows.

Hence, the correct answer is "Option 2".

Q53. Answer: (b) DY - IC

The logic followed here is based on the alphabetical position pattern:

Option 1: SK - XP

Option 2: DY - IC

Option 3: EZ - JE

Option 4: JQ - OV

Thus, DY - IC does not follow this uniform shift.

Hence, the odd one out is Option 2.

Q54. Answer: (a) cp

Given:

“she is lovely” → “kl pc cp”

“lovely paint here” → “lk cp no”

So, the code for lovely = cp

Hence, the correct answer is Option 1.

Q55. Answer: (b) 91

The logic followed here is:

thus, "91" will replace the question mark in the given series.

Hence, the correct option is "Option 2".

Q56. Answer: (a) KGLO

The logic followed here is:

For, KGLO → QMRU

For, NJOR → TPUX

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Now, applying the same pattern to EAFI:
So, EAFI → KGLO
Hence, the correct answer is Option 1.

Q57. Answer: (a) Three

Given: (Left) / 8 & + ^ 1 + < # @ ^ \ 2 # $ 8 9 * 7 2 $ (Right)
Now,
We need to find numbers that are immediately preceded by a symbol and immediately followed by a symbol.
So, Needed pattern is: Symbol - Number - Symbol.
(Left) / 8 & + ^ 1 + < # @ ^ \ 2 # $ 8 9 * 7 2 $ (Right)
Total valid numbers satisfying the condition = 3.
Hence, the correct answer is 'Option 1'.

Q58. Answer: (b) Three

The logic followed here is:
Given sequence: 324, 286, 472, 539, 731
Logic: Arrange the numbers in ascending order and compare their positions with the original sequence.
Arranging in ascending order: 286, 324, 472, 539, 731

Position	Original	Ascending	Status
1	324	286	Changed
2	286	324	Changed
3	472	472	Unchanged
4	539	539	Unchanged
5	731	731	Unchanged

Numbers that remain in the same position: 472, 539, 731
Hence, the correct answer is Option 2.

Q59. Answer: (c) Wife’s father

Family Chart:
Decoding the Symbols:

Symbol	•	•	x	÷
Meaning	Father	Brother	Sister	Wife

Given: M + N x O - P ÷ Q
It means: M is the father of N, N is the sister of O, O is the brother of P, and P is the wife of Q.
Thus, M is Q’s wife’s father.
Hence, the correct answer is "Option 3".

Q60. Answer: (a) 25

Given:
Andy’s rank from the top = 11th, rank from the bottom = 15th.
Total number of students = 11 + 15 – 1 = 25.
So, there are 25 students in the class.
Hence, the correct answer is "Option 1".

Q61. Answer: (c) 770

BODMAS Table:
Decoding the given information:

Alphabet	•	–	×	÷
Meaning	–	•	÷	×

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Now, replacing the sign from left to right using BODMAS Rule, we get:

=> 154 × 2 + 49 × 7 − 10 ÷ 5 − 28 ÷ 7 + 25 × 5 = ?

=> 308 + 343 − 2 − 4 + 125 = ?

=> (308 + 343 + 125) − (2 + 4) = ?

=> 776 − 6 = ?

=> 770

Hence, the correct option is "Option 3".

Q62. Answer: (b) None

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

Now,

We need to find an odd number which is immediately preceded by an even number and immediately followed by an even number.

So, Needed pattern is: Even - Odd - Even.

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

No occurrence satisfies Even - Odd - Even.

Hence, the correct answer is 'Option 2'.

Q63. Answer: (b) WH - BD

The logic followed here is based on the alphabetical position pattern:

Option 1: QK - VH

Option 2: WH - BD

Option 3: GQ - LN

Option 4: AE - FB

Thus, WH - BD does not follow this uniform pattern.

Hence, the odd one out is Option 2.

Q64. Answer: (c) 114

The logic followed here is:

thus, "114" will replace the question mark in the given series.

Hence, the correct option is "Option 3".

Q65. Answer: (c) 83

Given:

Total people = 119, Mr. Ihg is 29th from the left,

and Mr. Lkj is 7th from the right.

Number of people between them = 119 − (29 + 7) = 119 − 36 = 83.

So, there are 83 people between Mr. Ihg and Mr. Lkj.

Hence, the correct answer is "Option 3".

Q66. Answer: (c) 208

The logic followed here is:

thus, "208" will replace the question mark in the given series.

Hence, the correct option is "Option 3".

Q67. Answer: (d) 21

Given number: 3652497

Logic:

Arrange the digits in descending order (highest to lowest), then find the product of the 2nd digit from the left and the 2nd digit from the right.

Original number: 3 6 5 2 4 9 7

Now arranging in descending order:

Position	Digit
1	9

2	7
3	6
4	5
5	4
6	3
7	2

Rearranged number: 9 7 6 5 4 3 2 → 9765432
Second from the left = 7
Second from the right = 3
Product 7 × 3 = 21
Hence, the correct answer is Option 4.

Q68. Answer: (c) 955

BODMAS Table:
Decoding the given information:

Alphabet	•	–	×	÷
Meaning	−	•	÷	×

Now, replacing the sign from left to right using BODMAS Rule, we get:
=> 53 × 13 − 391 ÷ 17 + 289 = ?
=> 689 − 23 + 289 = ?
=> 689 + 289 = 978
=> 978 − 23 = ?
=> 955
Hence, the correct option is "Option 3".

Q69. Answer: (a) Two

Given: A, B, C, D, E, F and G are sitting around a circular table facing the centre.
E sits third to the left of B.
D sits second to the right of B.
C sits to the immediate right of F.
G sits second to the right of A.
Total people between C and G = 2
Hence, the correct answer is "Option 1".

Q70. Answer: (c) (74, 34, 324)

The logic followed here is:
Logic: Third Number = (First Number + Second Number) × 3.
For, (24, 11, 105)
=> 24 + 11 = 35
=> 35 × 3 = 105
For, (38, 42, 240)
=> 38 + 42 = 80
=> 80 × 3 = 240
Now, checking the options using the same pattern:
Option 1) (34, 62, 286)
=> 34 + 62 = 96
=> 96 × 3 = 288 ≠ 286
Option 2) (46, 53, 287)
=> 46 + 53 = 99

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=> 99 × 3 = 297 ≠ 287

Option 3) (74, 34, 324)

=> 74 + 34 = 108

=> 108 × 3 = 324

Option 4) (93, 12, 318)

=> 93 + 12 = 105

=> 105 × 3 = 315 ≠ 318

Hence, the correct answer is Option 3.

Q71. Answer: (c) D

Given: Seven people S, Q, U, A, R, E and D are sitting in a row facing north.

Only S sits to the left of Q.

Only four people sit between S and U.

Only A sits between E and R, and E is not an immediate neighbor of U.

Now, the person at the extreme right is: D

Hence, the correct answer is "Option 3".

Q72. Answer: (c) PMYC

The logic followed here is:

For, QOHY → WJLV

For, NRBT → TMFQ

Now, applying the same pattern to JRUF:

So, JRUF → PMYC

Hence, the correct answer is Option 3.

Q73. Answer: (c) NYRG

The logic followed here is:

For, JUNC → QBUJ

For, LWPE → SDWL

Now, applying the same pattern to GRKZ:

So, GRKZ → NYRG

Hence, the correct answer is Option 3.

Q74. Answer: (b) South West

The logic followed here is:

Given:

City A is to the North of City B.

City D is to the East of City A.

City D is to the South of City E.

City E is to the West of City C.

Thus, City B lies to the South-West of City E.

Hence, the correct answer is Option 2.

Q75. Answer: (c) Four

Given: A, B, C, D, E, F and G are sitting around a circular table facing the centre.

D sits to the immediate right of B.

E sits third to the right of B.

G sits third to the left of D.

C is the immediate neighbour of D and E.

A is not an immediate neighbour of B.

Total people between F and D = 4

Hence, the correct answer is "Option 3".

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Q76. Answer: (a) 3 km to the North

The logic followed here is:

Given:

Aarav drives 13 km East

He turns left → 8 km North

He turns left → 15 km West

He turns left → 11 km South

He turns left → 2 km East

So, To reach Point A, he must go 3 km North.

Hence, the correct answer is Option 1.

Q77. Answer: (d) WR49

The logic followed here is:

So, 'WR49' will replace the question mark in the given series.

Hence, the correct answer is "Option 4".

Q78. Answer: (c) 6

Given:

VOLT is coded as 6428

LIFE is coded as 5761

So, the code for L = 6

Hence, the correct answer is Option 3.

Q79. Answer: (a) 1

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

Now,

We need to find an odd number which is immediately preceded by an odd number and immediately followed by an odd number.

So, Needed pattern is: Odd - Odd - Odd.

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

Only one valid triplet satisfies the condition

Hence, the correct answer is 'Option 1'.

Q80. Answer: (b) Neither conclusion (I) nor (II) follows.

Given Statements:

All fans are bulbs.

Some bulbs are heaters.

Some heaters are geysers.

The least possible Venn diagram for the given statements is:

Conclusions:

I. Some fans are heaters → Does not follow (Fans are inside Bulbs, but only some Bulbs are Heaters; no guaranteed overlap between Fans and Heaters)

II. Some bulbs are geysers → Does not follow (Bulbs only partially overlap with Heaters, and Heaters only partially overlap with Geysers; no definite link between Bulbs and Geysers)

So, neither conclusion I nor II follows.

Hence, the correct answer is "Option 2".

Q81. Answer: (a) Kochi

The correct answer is Kochi.

Key Points

• The Indian Navy is scheduled to launch INS ‘Ikshak’, the third of the four Survey Vessels (Large) (SVL), in November 2025 at Kochi, Kerala.

• The primary objective of this launch is to significantly enhance India's indigenous hydrography capabilities, ensuring better mapping of the Indian Ocean Region.

• The ship’s name, Ikshak, which means ‘Guide’, symbolizes its role in providing safe passage for mariners through precise

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hydrographic data.

• The vessel is designed to conduct full-scale coastal and deep-water surveys of ports, navigational channels, and Exclusive Economic Zones (EEZ).

• The launch at Kochi underscores the strategic importance of the Southern Naval Command, which serves as a major training and operational base for the Indian Navy.

Additional Information

• Survey Vessel (Large) Project:

• The SVL project involves the construction of four ships intended to replace the existing Sandhayak Class survey ships.

• The first two ships of this class are INS Sandhayak and INS Nirdeshak, both designed for extensive maritime surveillance.

• These ships are being built under a contract between the Ministry of Defence and Garden Reach Shipbuilders & Engineers (GRSE), Kolkata.

• Technological Features and Indigenous Effort:

• The INS Ikshak features an indigenous content of over 80% by cost, aligning with the Atmanirbhar Bharat and Make in India initiatives.

• Each vessel in this class has a displacement of approximately 3,400 tons and a length of about 110 meters.

• They are equipped with state-of-the-art hydrographic equipment, including Multi-beam Echo Sounders, GPS precise positioning systems, and Autonomous Underwater Vehicles (AUVs).

• Operational Roles:

• Apart from hydrography, these ships can be deployed for Humanitarian Assistance and Disaster Relief (HADR) and can function as limited hospital ships during emergencies.

• The data collected by these vessels is vital for the National Hydrographic Office (NHO), based in Dehradun, to produce accurate nautical charts.

Important Points

• Kochi, often called the "Queen of the Arabian Sea," is a critical location for naval inductions and shipbuilding activities in South India.

• The year 2025 marks a significant milestone in the Indian Navy's modernization plan to achieve a 200-ship fleet for blue-water operations.

• The successful development of INS Ikshak involved a collaborative effort between GRSE and L&T Shipbuilding, demonstrating public-private partnership in defense.

Q82. Answer: (a) 125 days

The correct answer is 125 days.

Key Points

• The Viksit Bharat–G RAM G Act 2025 is a significant legislative framework designed to enhance rural livelihood by guaranteeing 125 days of statutory wage employment per financial year to every rural household.

• The primary objective of this act is to provide a robust social security net for families residing in rural areas, ensuring that at least one member of the household can find work when needed.

• This guarantee applies to all adult members of a rural household who volunteer to perform unskilled manual work.

• Under the provisions of the act, the 125 days of work is a legal entitlement, representing an increase from the previously standard 100 days offered under earlier schemes like MGNREGA.

• The act emphasizes inclusive growth, specifically targeting vulnerable groups, including Scheduled Castes (SC), Scheduled Tribes (ST), and women, to ensure they have access to minimum income through labor.

Additional Information

• Vision of Viksit Bharat 2047:

• The Viksit Bharat–G RAM G Act 2025 is a foundational step toward the Viksit Bharat 2047 vision, which aims to transform India into a developed nation by the 100th year of its independence.

• By increasing the employment days to 125, the government aims to reduce rural-to-urban migration and strengthen the rural economy.

• Financial Provisions and Wages:

• Wages under this act are revised annually and are linked to the Consumer Price Index-Agricultural Labourers (CPI-AL) to protect workers against inflation.

• The Central Government typically bears 100% of the wage cost for unskilled manual labor, while material costs are shared between the Centre and the States in a 75:25 ratio.

• Types of Work Permitted:

• The act focuses on the creation of durable assets such as water conservation structures, check dams, rural roads, and

afforestation projects.

• Work is also directed toward natural resource management and individual assets for small and marginal farmers to improve agricultural productivity.

• Digital Implementation:

• The scheme utilizes the G RAM G portal for real-time monitoring, e-attendance via the National Mobile Monitoring System (NMMS), and Direct Benefit Transfer (DBT) to ensure transparency.

• Aadhaar-Based Payment Systems (ABPS) are mandatory to ensure that the wages reach the correct bank accounts of the beneficiaries without leakage.

Important Points

• Unemployment Allowance: If the government fails to provide employment within 15 days of the application for work, the applicant is legally entitled to a daily unemployment allowance.

• Social Audit: To maintain accountability, the Gram Sabha is empowered to conduct social audits of all the projects executed under the Act in the Gram Panchayat.

• Workplace Facilities: The act mandates that facilities such as drinking water, shade for periods of rest, and first-aid boxes must be provided at every worksite.

• Role of Panchayati Raj Institutions (PRIs): The Gram Panchayats are responsible for planning and implementing at least 50% of the works in terms of cost, ensuring decentralized governance.

Q83. Answer: (c) Uttarakhand

The correct answer is Uttarakhand.

Key Points

• The Uttarakhand government has announced the implementation of a specialized environmental tax (often referred to as a Green Tax) on all out-of-state vehicles entering its territory.

• This regulation is set to be fully operational starting from December 2025, marking a significant step toward sustainable tourism in the Himalayan region.

• The primary motive behind this initiative is to mitigate the ecological damage caused by the massive influx of tourist vehicles and to generate revenue for environmental conservation efforts.

• This tax specifically targets non-Uttarakhand registered vehicles, ensuring that those contributing to the carbon footprint of the state participate in its preservation.

• The State Cabinet approved this measure to address the growing concerns of pollution and traffic congestion in eco-sensitive zones.

Additional Information

• Geographical Context: Uttarakhand is a Himalayan state known for its fragile ecosystem. High vehicular movement leads to increased carbon emissions, which accelerates the melting of glaciers and impacts the local biodiversity.

• Tourism and Infrastructure: The state hosts the annual Char Dham Yatra, attracting millions of pilgrims. The environmental tax will help fund the maintenance of mountainous roads and the management of solid waste generated by tourists in high-altitude areas.

• Implementation Technology: To prevent long queues and traffic at border check posts like Haridwar and Rishikesh, the government plans to integrate the tax collection with FastTag technology and digital portals.

• Policy Alignment: This move is in line with the recommendations of the National Green Tribunal (NGT), which has frequently emphasized the need for "carrying capacity" assessments and fiscal measures to protect the Western Himalayas.

• Financial Allocation: The funds collected through this Green Tax will be deposited into a dedicated Environment Fund managed by the state's Pollution Control Board for specific reforestation and anti-pollution projects.

Important Points

• Vehicle Classification: The tax amount will vary depending on the type of vehicle. Heavy commercial vehicles and luxury buses will likely face higher charges compared to private light motor vehicles.

• Exemptions: Local residents with vehicles registered in Uttarakhand are exempt from this tax. Additionally, emergency services, ambulances, and government vehicles on official duty will not be charged.

• Economic Impact: While the tax aims at environmental protection, the government is also balancing it to ensure it does not drastically deter religious tourism, which is a major contributor to the state's GDP.

• Similar Global Practices: Such environmental levies are common in international tourist hubs and other Indian hill stations like Manali in Himachal Pradesh, which implemented a similar green fee for vehicles crossing the Rohtang Pass.

Q84. Answer: (a) Union Public Service Commission (UPSC)

The correct answer is Union Public Service Commission (UPSC).

Key Points

• The Union Public Service Commission (UPSC) is India's premier central recruiting agency, responsible for appointments to and examinations for All India services and group A & group B of Central services.

• It traces its origin to the Public Service Commission which was first set up in India on October 1, 1926, following the recommendations of the Royal Commission on the Superior Civil Services in India (also known as the Lee Commission) in 1924.

• Initially established under the Government of India Act 1919, the commission was intended to fulfill the functions of recruitment and to protect the interests of public servants from political influences.

• The commission was later reconstituted as the Federal Public Service Commission under the Government of India Act 1935, which expanded its scope to include provincial requirements.

• Post-independence, with the commencement of the Constitution of India on January 26, 1950, the Federal Public Service Commission was renamed the Union Public Service Commission and granted Constitutional Status under Part XIV.

Additional Information

• Election Commission of India (ECI):

• It is an autonomous constitutional authority responsible for administering election processes in India at the national and state levels.

• It was established on January 25, 1950, in accordance with the Constitution. This day is now celebrated as National Voters' Day.

• The commission derives its powers from Article 324 of the Constitution.

• Central Vigilance Commission (CVC):

• The CVC is the main agency for preventing corruption in the Central government.

• It was established in February 1964 based on the recommendations of the Santhanam Committee on Prevention of Corruption.

• It was originally a non-statutory body but was granted statutory status by the CVC Act, 2003.

• Central Bureau of Investigation (CBI):

• The CBI is the premier investigating agency of India, operating under the jurisdiction of the Ministry of Personnel, Public Grievances and Pensions.

• It was set up in 1963 by a resolution of the Ministry of Home Affairs.

• It is not a statutory body but derives its power to investigate from the Delhi Special Police Establishment Act, 1946.

Important Points

• Constitutional Provisions for UPSC: Articles 315 to 323 of the Constitution deal with the composition, appointment, and removal of members, power and functions, and independence of the UPSC.

• Membership: The President of India appoints the Chairman and other members of the UPSC. Usually, the commission consists of 9 to 11 members including the Chairman.

• Tenure: Every member holds office for a term of six years or until they attain the age of 65 years, whichever is earlier.

• Independence: The UPSC is an independent constitutional body. The expenses of the commission are charged on the Consolidated Fund of India, and the Chairman is ineligible for further employment under the Government of India or a State after retirement.

Q85. Answer: (a) 93%

The correct answer is 93%.

Key Points

• The Economic Survey 2024-25, which was released in January 2025, provides a comprehensive analysis of the Indian economy and highlights the significant challenges posed by environmental factors.

• According to the survey, India has been identified as the seventh most vulnerable country globally to the impacts of climate change.

• The report startlingly revealed that extreme weather events occurred on 93% of the days in the calendar year 2024. This indicates that out of 366 days (2024 being a leap year), at least one region in India experienced a significant climate event on approximately 340 days.

• These climate events primarily included record-breaking heatwaves, devastating floods, landslides, and intense cyclones, reflecting the increasing frequency and intensity of weather anomalies.

• The data underscores that climate change is no longer a future projection but a present reality affecting the geographical and economic stability of the nation.

• Hence, the correct answer is 93%.

Additional Information

• Impact on Agriculture and Economy:

• The Economic Survey notes that such frequent extreme weather events have a direct negative impact on agricultural productivity and food security.

• Fluctuations in the monsoon and unseasonal rains in 2024 led to volatility in food inflation, particularly affecting the prices of

vegetables and cereals.

• Heatwaves of 2024:

• During the summer of 2024, parts of North and Central India recorded temperatures exceeding 50°C, creating a severe public health crisis and increasing the peak electricity demand to record levels.

• Climate Risk Index:

• The ranking of India as the seventh most vulnerable country aligns with findings from the Global Climate Risk Index, which assesses the extent to which countries have been affected by the impacts of weather-related loss events.

• Government Initiatives:

• To combat these risks, India has accelerated its National Action Plan on Climate Change (NAPCC) and emphasized the National Adaptation Fund for Climate Change (NAFCC).

• India remains committed to its Panchamrit targets announced at COP26, aiming for Net Zero emissions by the year 2070.

Important Points

• Economic Survey 2024-25: This document is prepared by the Economics Division of the Department of Economic Affairs under the guidance of the Chief Economic Advisor (CEA).

• Macro-Critical Risk: The survey categorizes climate change as a macro-critical risk, meaning it has the potential to affect the GDP growth, fiscal deficit, and financial stability of the country.

• Disaster Management: The increasing frequency of events on 93% of days necessitates a shift from reactive relief to proactive disaster resilient infrastructure, as promoted by the CDRI (Coalition for Disaster Resilient Infrastructure).

• Mission LiFE: Launched by the Prime Minister, this mission encourages an environmentally conscious lifestyle to mitigate the long-term effects of global warming at an individual and community level.

Q86. Answer: (c) Chess

The correct answer is Chess.

Key Points

• Dommaraju Gukesh, popularly known as D Gukesh, is a prominent Indian Grandmaster in the sport of Chess.

• He has been selected for the Major Dhyan Chand Khel Ratna Award 2024, which is the highest sporting honor in India, following his historic achievements on the global stage.

• In April 2024, D Gukesh made history by becoming the youngest-ever challenger for the World Chess Championship title after winning the FIDE Candidates Tournament in Toronto, Canada, at the age of 17.

• He played a crucial role in leading the Indian Men's Team to their first-ever Gold Medal at the 45th FIDE Chess Olympiad held in Budapest, Hungary, in September 2024.

• He achieved an individual Gold Medal on the first board during the Olympiad, finishing with a phenomenal performance rating of over 3000.

• Gukesh is currently the highest-rated Indian chess player, having surpassed the legendary Viswanathan Anand in the FIDE Live Ratings.

Additional Information

• Major Dhyan Chand Khel Ratna Award:

• It is awarded annually by the Ministry of Youth Affairs and Sports, Government of India.

• The award was formerly known as the Rajiv Gandhi Khel Ratna Award before being renamed in August 2021 in honor of the Hockey legend Major Dhyan Chand.

• The first recipient of this prestigious award was the Chess legend Viswanathan Anand in the year 1991-92.

• The award consists of a medallion, a certificate, and a significant cash prize of Rs. 25 lakh.

• FIDE (International Chess Federation):

• It is the international governing body for the sport of Chess, founded on July 20, 1924, in Paris, France.

• It organizes the World Chess Championship and sets the Elo rating system to rank players globally.

• Grandmaster (GM) Title:

• This is the highest title a chess player can attain, awarded by FIDE.

• D Gukesh became the second-youngest Grandmaster in history in January 2019, at the age of 12 years, 7 months, and 17 days.

Important Points

• National Sports Day: Celebrated in India on August 29 to mark the birth anniversary of Major Dhyan Chand. The National Sports Awards are typically presented by the President of India at Rashtrapati Bhavan.

• 2024 Context: The year 2024 has been a landmark year for Indian Chess, with both the Men's and Women's teams winning Olympiad Gold, making D Gukesh a primary candidate for the nation's top honors.

• World Championship 2024: D Gukesh faces the reigning World Champion Ding Liren from China in the World Chess Championship match scheduled for late 2024 in Singapore.

Q87. Answer: (b) Transactree Technologies

The correct answer is Transactree Technologies.

Key Points

• In May 2025, the Reserve Bank of India (RBI) exercised its regulatory authority to impose monetary penalties on Union Bank of India and Transactree Technologies Private Limited for various compliance failures.

• The penalty on Union Bank of India was specifically linked to the violation of RBI directions concerning Lending to Micro, Small and Medium Enterprises (MSME) Sector and the maintenance of the Statutory Liquidity Ratio (SLR).

• Transactree Technologies Private Limited, which operates as a Non-Banking Financial Company-Peer to Peer (NBFC-P2P) lending platform (widely known as Lendbox), was penalised for non-compliance with the Peer-to-Peer Lending Platform (Reserve Bank) Directions, 2017.

• These regulatory actions were taken under the provisions of Section 47A of the Banking Regulation Act, 1949, and relevant sections of the Reserve Bank of India Act, 1934.

• The RBI clarified that these penalties are based on deficiencies in regulatory compliance and are not intended to validate any specific transactions between these entities and their customers.

Additional Information

• Union Bank of India:

• It is one of India's largest Public Sector Banks, headquartered in Mumbai.

• The bank was established in 1919 and was inaugurated by Mahatma Gandhi.

• Following the 2020 Amalgamation, Andhra Bank and Corporation Bank were merged into Union Bank of India, significantly expanding its footprint to over 8,500 branches.

• Transactree Technologies (NBFC-P2P):

• Peer-to-Peer (P2P) lending is a method of debt financing that allows individuals to borrow and lend money without the use of an official financial institution as an intermediary.

• The RBI regulated this sector in 2017 by categorizing such platforms as Non-Banking Financial Companies (NBFCs) to ensure transparent operations and consumer protection.

• Transactree Technologies operates Lendbox, which is a leading fintech player in the Indian credit market.

• Statutory Liquidity Ratio (SLR):

• It is the minimum percentage of deposits that a commercial bank has to maintain in the form of liquid cash, gold, or unencumbered securities.

• It is a key monetary policy tool used by the RBI to control the expansion of bank credit and ensure the solvency of banks.

Important Points

• The Reserve Bank of India (RBI):

• The RBI was established on April 1, 1935, in accordance with the provisions of the Reserve Bank of India Act, 1934.

• It performs the function of the Monetary Authority, the Regulator and Supervisor of the financial system, and the Manager of Foreign Exchange.

• Under the Banking Regulation Act, 1949, the RBI has the power to inspect banking companies and impose fines to maintain financial stability in the Indian economy.

• Regulatory Oversight:

• The RBI frequently issues Master Directions on Know Your Customer (KYC), Cyber Security Framework, and Interest Rate on Deposits to protect the interests of depositors.

• Failure to adhere to these norms results in enforcement actions, which serve as a deterrent for other financial institutions and fintech companies.

Q88. Answer: (a) Nilambur

The correct answer is Nilambur.

Key Points

• The Indian National Congress (INC) candidate secured a decisive victory in the Nilambur Assembly constituency during the Kerala by-elections conducted in June 2025.

• The Nilambur seat became a focal point of political competition between the United Democratic Front (UDF) and the Left Democratic Front (LDF), with the Congress nominee managing to reclaim the seat for the UDF alliance. Hence, the option Nilambur is correct.

• The election was held to fill the vacancy created in the constituency, and it saw an impressive voter turnout of approximately 78.4%, indicating high political awareness among the local populace in June 2025.

• The victory in Nilambur is strategically significant for the Congress party as it strengthens their representation in the Malappuram district, which is traditionally a stronghold for their ally, the Indian Union Muslim League (IUML).

• The Election Commission of India (ECI) oversaw the process, ensuring the use of M3 generation Electronic Voting Machines (EVM) and Voter Verifiable Paper Audit Trails (VVPAT) to maintain the integrity of the June 2025 polls.

Additional Information

• Political Landscape of Kerala:

• The state of Kerala features a unicameral legislature known as the Kerala Legislative Assembly or Niyamasabha, consisting of 140 elected members.

• Politics in the state is primarily dominated by two major fronts: the United Democratic Front (UDF), led by the Congress, and the Left Democratic Front (LDF), led by the CPI(M).

• By-elections often serve as a mid-term referendum on the performance of the ruling government and the effectiveness of the opposition.

• The Nilambur Constituency:

• Nilambur is located in the Malappuram district and is renowned for its vast teak plantations and the Conolly's Plot, which is the world's oldest teak plantation.

• The constituency has a diverse demographic profile, making it a competitive battleground where local developmental issues, tribal welfare, and environmental conservation in the Western Ghats are primary campaign themes.

• Other Mentioned Seats:

• Wayanad: This is a Parliamentary constituency and often sees high-profile contests involving national leaders of the Congress party.

• Ernakulam and Kottayam: These are critical urban and semi-urban centers in Central Kerala, serving as political hubs for various factions of the Kerala Congress and the INC.

Important Points

• Constitutional and Legal Framework:

• Under Article 324 of the Constitution of India, the Election Commission is vested with the power of superintendence, direction, and control of elections.

• The Representation of the People Act, 1951, specifically Section 151A, mandates that a by-election for any vacancy must be held within six months from the date of the occurrence of the vacancy.

• The Model Code of Conduct (MCC) comes into immediate effect upon the announcement of the election schedule by the ECI, ensuring that the incumbent government does not use its position to influence the voters.

• Role of the Governor:

• In the context of the State Legislative Assembly, the Governor of Kerala acts as the constitutional head who summons and prorogues the assembly sessions based on the advice of the Council of Ministers.

Q89. Answer: (a) Vigyan Shri Award

The correct answer is Vigyan Shri Award.

Key Points

• Dr. C. Anandharamakrishnan, the Director of CSIR-National Institute for Interdisciplinary Science and Technology (NIIST), was honored with the Vigyan Shri Award in 2024.

• This award was specifically granted for his pioneering contributions to the field of Agricultural Sciences, particularly in food processing and engineering.

• The Vigyan Shri is a category under the newly instituted Rashtriya Vigyan Puraskar (RVP), which is one of the highest national honors in India for science, technology, and innovation.

• The awards for the year 2024 were announced on August 7 and presented by the President of India on August 23, which coincides with National Space Day.

• Dr. Anandharamakrishnan has been recognized for his extensive research in 3D food printing, computational modeling of food processing, and nutrient delivery systems.

Additional Information

• Rashtriya Vigyan Puraskar (RVP):

• Introduced by the Government of India in 2024, these awards replaced previous science-related awards to provide a unified recognition system.

• The awards are divided into four categories: Vigyan Ratna (for lifetime achievement), Vigyan Shri (for distinguished contributions), Vigyan Yuva-SSB (for young scientists), and Vigyan Team (for collaborative work).

• The 2024 awards covered 13 domains, including Physics, Chemistry, Biological Sciences, Mathematics, Agricultural Sciences, and Engineering.

• Profile of Dr. Anandharamakrishnan:

• Before his tenure at CSIR-NIIST, he served as the Director of the National Institute of Food Technology, Entrepreneurship and Management (NIFTEM) in Thanjavur.

• He has authored several books and published over 170 research papers focused on Food Engineering and Agro-processing.

• His work is instrumental in addressing issues like malnutrition and enhancing the shelf-life of agricultural produce through scientific intervention.

Important Points

• Significance of the Award: The Vigyan Shri honors scientists of any age who have made a distinguished contribution to their respective fields of science and technology.

• Selection Committee: The recipients are selected by a committee chaired by the Principal Scientific Adviser to the Government of India, including secretaries of various science departments.

• Other Categories: In 2024, while Dr. Anandharamakrishnan received the Vigyan Shri, the Vigyan Ratna (the highest in this series) was awarded to Professor G. Padmanabhan for his work in Biological Sciences.

• Venue and Location: The CSIR-NIIST, headed by the awardee, is a premier research laboratory located in Thiruvananthapuram, Kerala, which focuses on sustainable utilization of regional resources.

Q90. Answer: (d) Gulveer Singh

The correct answer is Gulveer Singh.

Key Points

• Indian long-distance runner Gulveer Singh created history in February 2025 by breaking the Asian short-track record in the 5000 m event.

• He clocked a remarkable time of 12:59.77 at the BU John Thomas Terrier Classic held in Boston, USA.

• With this performance, Gulveer Singh became the first Indian athlete to breach the 13-minute barrier in the 5000 m discipline (indoor/short track).

• The previous Asian indoor record was 13:09.43, which was set by El Hassan El-Abbassi of Bahrain in 2012.

• Gulveer Singh finished second in the race, finishing just behind Yared Nuguse of the USA, who won the event with a time of 12:56.46.

Additional Information

• Gulveer Singh:

• Hailing from Sirsa, Uttar Pradesh, he is a prominent figure in India's middle and long-distance running circuit.

• In March 2024, he set the national record in the 10,000 m (outdoor) with a time of 27:41.81 at The TEN meet in California.

• He won the bronze medal in the 10,000 m at the 2022 Asian Games held in Hangzhou, China.

• Avinash Sable:

• He is another legendary Indian runner who holds the outdoor national record for the 5000 m (13:19.30) and the 3000 m Steeplechase.

• While Gulveer Singh broke the short-track record, Avinash Sable remains a dominant force in outdoor athletics and Commonwealth Games medalists.

• Short-Track vs. Outdoor Records:

• Short-track records (often referred to as indoor records) are maintained separately from outdoor records by World Athletics.

• Short-track races typically take place on a 200-meter oval, whereas outdoor tracks are 400 meters in length.

• Other Options:

• Jacob Kiplimo is a world-renowned long-distance runner from Uganda and a World Half Marathon record holder.

• Yared Nuguse is an American middle-distance runner who competed in the same race in Boston where Gulveer Singh set the record.

Important Points

• Training and Support: Gulveer Singh trains under the guidance of coach Scott Simmons and is supported by the JSW Sports program and the Athletics Federation of India (AFI).

• Historical Context: Entering the sub-13 minute club is considered a world-class milestone in long-distance running, placing Gulveer Singh among the elite athletes globally.

• Year of Achievement: This record was established on February 1, 2025, marking a significant start to the athletic season for India.

• Venue: The Boston University (BU) track is famous for being a "fast track," frequently producing record-breaking times due to its banking and surface quality.

Q91. Answer: (d) Qatar

The correct answer is Qatar.

Key Points

• The FIFA Council officially announced in March 2024 that Qatar will host the next five editions of the FIFA U-17 World Cup

starting from 2025 to 2029.

• Starting with the 2025 edition, the FIFA U-17 World Cup will undergo a massive expansion, increasing the number of participating teams from 24 to 48.

• The tournament, which was previously held every two years (biennially), will now be held annually to provide more competitive opportunities for young footballers globally.

• The decision to grant hosting rights to a single nation for five consecutive years was made to ensure stability and efficiency in tournament organization using existing world-class infrastructure. Hence, the correct answer is Qatar.

Additional Information

• FIFA U-17 Women's World Cup:

• Similar to the men's tournament, the FIFA U-17 Women's World Cup will also become an annual event starting from 2025.

• Morocco has been selected as the host for the five editions of the women's tournament from 2025 to 2029.

• The field for the women's tournament will expand to 24 teams, reflecting FIFA's commitment to growing women's football at the grassroots level.

• Historical Context:

• The FIFA U-17 World Cup was first held in 1985 in China, where it was originally an Under-16 event before changing to Under-17 in 1991.

• Nigeria is currently the most successful nation in the history of the men's tournament, having won a record five titles.

Important Points

• Infrastructure and Legacy:

• Qatar was chosen largely due to its existing state-of-the-art stadiums and facilities built for the 2022 FIFA World Cup, which ensures operational efficiency and sustainability.

• This 48-team format mimics the expansion of the senior FIFA World Cup, which will also feature 48 teams starting in 2026.

• Global Development:

• By moving to an annual cycle, FIFA aims to ensure that no age group of young players misses the chance to play on the world stage due to the previous two-year gap.

• The expansion allows more nations from developing football regions (such as Asia and Africa) to participate, fostering global talent identification.

Q92. Answer: (d) Kerala

The correct answer is Kerala.

Key Points

• Operation Spot Trap was a massive state-wide anti-corruption drive conducted in January 2025 to weed out bribery and financial irregularities in public offices.

• The operation was orchestrated by the Vigilance and Anti-Corruption Bureau (VACB) of Kerala, following numerous complaints regarding "speed money" or illegal commissions being demanded for public services.

• A total of 36 people, including several government employees and private middlemen, were arrested during the coordinated raids across multiple districts. Hence, the statement regarding the location being Kerala is correct.

• The raids primarily targeted departments with high public interaction, such as the Revenue Department, Motor Vehicles Department (MVD), and Local Self-Government (LSG) institutions.

• During the operation, the VACB officials seized significant amounts of unaccounted cash from the possession of officials and from various hidden spots within government premises.

Additional Information

• Vigilance and Anti-Corruption Bureau (VACB):

• The VACB is the premier agency in Kerala dedicated to investigating corruption among public servants. It operates under the Home Department of the Government of Kerala.

• The agency is headed by a Director of the rank of Director General of Police (DGP) or Additional Director General of Police (ADGP).

• Its primary function is to conduct "trap" operations, surprise checks, and detailed enquiries into assets disproportionate to the known sources of income of government employees.

• Mechanism of Trap Operations:

• A "trap" typically involves the use of phenolphthalein-coated currency notes. When a public servant accepts this money, their hands are dipped in a sodium carbonate solution, which turns pink, providing scientific evidence of the bribe-taking act.

• Operation Spot Trap utilized these methods along with advanced surveillance to catch offenders red-handed in 2025.

• Legal Framework:

• The arrests and subsequent prosecutions are carried out under the Prevention of Corruption Act, 1988. This Act was significantly

amended in 2018 to include provisions for punishing both the bribe-taker and the bribe-giver.

• The VACB also relies on the Kerala Government Servants' Conduct Rules to initiate departmental actions alongside criminal proceedings.

Important Points

• Public Participation:

• The Kerala government has encouraged citizens to report corruption via the 'Vigilance Eye' mobile application and a 24/7 toll-free helpline number (1064).

• This digital integration played a crucial role in gathering the intelligence that led to the success of Operation Spot Trap in January 2025.

• Impact on Administration:

• Such operations are intended to improve Kerala's ranking in the India Corruption Survey. Despite being noted as one of the least corrupt states in India, the government continues these high-intensity drives to ensure zero tolerance for corruption.

• The 36 arrests made in 2025 serve as a deterrent to other officials and emphasize the accountability of the bureaucracy.

Q93. Answer: (a) To give a snapshot of key socio-economic data of the Ministry

The correct answer is To give a snapshot of key socio-economic data of the Ministry.

Key Points

• The GoIStats mobile application was launched by the Ministry of Statistics and Programme Implementation (MoSPI) in 2025 to revolutionize how official statistics are accessed in India.

• The primary objective of this application is to provide a real-time snapshot of the country's key socio-economic indicators, making high-level data available at the fingertips of users. Hence, statement 1 is correct.

• It serves as a centralized digital platform where users can find authenticated data regarding National Income, Gross Domestic Product (GDP), and Consumer Price Index (CPI).

• The app is specifically designed to enhance transparency and data accessibility for researchers, policymakers, students, and the general public, moving away from bulky physical reports to a digital-first approach.

• By integrating various datasets, the GoIStats app helps in monitoring the economic health of the nation through interactive visualizations and simplified statistical dashboards.

Additional Information

• Ministry of Statistics and Programme Implementation (MoSPI):

• MoSPI came into existence as an independent Ministry on 15th October 1999 after the merger of the Department of Statistics and the Department of Programme Implementation.

• The Ministry has two wings: one relating to Statistics (National Statistical Office - NSO) and the other relating to Programme Implementation.

• It is responsible for the release of crucial macroeconomic data such as the Index of Industrial Production (IIP) and inflation rates.

• Digital Transformation in Statistics:

• The launch of GoIStats aligns with the Digital India initiative, focusing on providing governance on demand and empowering citizens through information.

• The application uses advanced data analytics to present Periodic Labour Force Survey (PLFS) data and Annual Survey of Industries (ASI) results in a more digestible format.

• Other Ministry Functions:

• MoSPI also oversees the Members of Parliament Local Area Development Scheme (MPLADS) and monitors the implementation of Infrastructure Projects worth Rs. 150 crores and above.

Important Points

• Socio-Economic Indicators: These include vital statistics like literacy rates, employment figures, poverty levels, and health metrics that define the quality of life in a country.

• Data Reliability: The data provided on the GoIStats app is sourced directly from the National Statistical Office (NSO), ensuring 100% authenticity and eliminating the risks associated with misinformation.

• User Interface: The app features multilingual support and offline access to certain key indicators, ensuring that data literacy reaches even the remote corners of the country.

• Global Comparison: The app often provides benchmarks against Sustainable Development Goals (SDG), allowing users to see India's progress on international indices.

Q94. Answer: (b) Simone Biles

The correct answer is Simone Biles.

Key Points

• The legendary American gymnast Simone Biles was honored with the Laureus World Sportswoman of the Year award,

recognizing her incredible return to the pinnacle of her sport.

• This prestigious recognition was awarded during the 2024/2025 awards cycle, celebrating her historic performance at the World Gymnastics Championships where she extended her record as the most decorated gymnast in history.

• Simone Biles has now won the Laureus World Sportswoman of the Year award multiple times, having previously secured the title in 2017, 2019, and 2020.

• Her comeback in 2023 and 2024 after a hiatus following the Tokyo Olympics was cited as one of the greatest sporting stories, demonstrating both physical excellence and mental resilience. Hence, the correct answer is Simone Biles.

Additional Information

• Laureus World Sports Awards:

• Established in 1999 by founding patrons Daimler and Richemont, these awards are often referred to as the "Oscars of Sports."

• The awards recognize individuals and teams from the world of sports along with sporting achievements throughout the year.

• The selection process involves a Nominations Panel of world media followed by a final vote by the Laureus World Sports Academy, a jury made up of 71 sporting legends.

• Simone Biles (USA):

• She is an American artistic gymnast who holds a record 30 World Championship medals and multiple Olympic gold medals.

• She is widely considered the greatest gymnast of all time and has five moves named after her in the Code of Points.

• Other Options:

• Serena Williams: A former World No. 1 tennis player and a past recipient of the Laureus award, though she retired from professional tennis in 2022.

• Ellesse Andrews: A champion track cyclist from New Zealand who gained international acclaim for her performances at the 2024 Paris Olympics.

• Rebeca Andrade: A highly successful Brazilian gymnast who has been a major rival to Biles, winning gold on the floor exercise at the 2024 Olympics.

Important Points

• Award Categories: Besides Sportswoman of the Year, other major categories include World Sportsman of the Year, World Team of the Year, World Comeback of the Year, and World Breakthrough of the Year.

• 2024 Ceremony: The 25th Laureus World Sports Awards were held in Madrid, Spain, in April 2024, where Biles was a double nominee for both Sportswoman and Comeback of the year.

• Global Impact: The awards also support the Laureus Sport for Good foundation, which uses the power of sport to end violence, discrimination, and disadvantage for young people around the world.

Q95. Answer: (d) Mahendra Gurjar

The correct answer is Mahendra Gurjar.

Key Points

• Mahendra Gurjar, an Indian para-athlete, made history by setting a new World Record in the men's javelin F42 category.

• This feat was achieved at the Nottwil 2024 World Para Athletics Grand Prix, which was held in Switzerland in June 2024.

• He secured the gold medal with a remarkable throw of 49.46 meters, surpassing the previous global standards for this specific classification.

• The competition in Nottwil is one of the most prestigious stops on the World Para Athletics circuit, attracting top-tier athletes from across the globe to compete in Switzerland.

• Gurjar's performance is a significant milestone for Indian Para-sports, showcasing the country's growing dominance in field events on the international stage.

Additional Information

• World Para Athletics Grand Prix:

• The Grand Prix series is organized by World Para Athletics, the global governing body for the sport under the International Paralympic Committee (IPC).

• These events provide a platform for athletes to achieve qualification standards for the Paralympic Games and World Championships.

• The Nottwil leg is particularly famous for its high-quality facilities and is often referred to as a "fast" venue for both track and field disciplines.

• Classification F42:

• In para-athletics, classification ensures fair competition by grouping athletes with similar levels of physical impairment.

• The 'F' stands for Field events (such as javelin, shot put, and discus).

• The 42 classification is for athletes with limb deficiency, leg length difference, impaired muscle power, or impaired range of movement, specifically affecting the legs.

• Para-Athletics in India:

• India has seen a surge in success in para-athletics, especially following the Tokyo 2020 Paralympics and the Hangzhou 2022 Asian Para Games.

• The Ministry of Youth Affairs and Sports and the Paralympic Committee of India (PCI) provide support through the Target Olympic Podium Scheme (TOPS).

Important Points

• Global Rankings: Such records significantly boost an athlete's World Ranking, which is a critical factor for Paralympic seeding and entry.

• Venue Significance: Nottwil is located in the Canton of Lucerne, Switzerland, and is home to the Swiss Paraplegic Centre, making it a hub for para-sports research and competition.

• Year 2024: This year is pivotal as athletes prepare for the Paris 2024 Paralympic Games, and record-breaking performances like that of Mahendra Gurjar serve as a major morale booster for the Indian contingent.

• Other Indian Successes: Along with Mahendra Gurjar, other athletes like Neeraj Yadav and Rinku Solanki have consistently performed well in the F46 and F55 categories respectively, contributing to India's medal tally in international meets.

Q96. Answer: (d) Allowed up to four nominees

The correct answer is Allowed up to four nominees.

Key Points

• The Banking Laws (Amendment) Act, notified in April 2025, introduced a significant reform by allowing bank account holders to have up to four nominees for a single account.

• Previously, under the Banking Regulation Act, 1949, depositors were permitted to nominate only one individual to receive the proceeds of their deposits in the event of their death.

• This amendment provides depositors with the flexibility of simultaneous and successive nominations. This means they can specify the proportion of funds each nominee should receive or list them in a preferred order of succession.

• The primary objective of this change is to reduce the volume of unclaimed deposits in the Indian banking system, which has been a growing concern for the Reserve Bank of India (RBI).

• By allowing multiple nominees, the government aims to ensure a smoother transition of assets to legal heirs or beneficiaries, thereby minimizing legal disputes and administrative hurdles for families of deceased depositors. Hence, the correct answer is Allowed up to four nominees.

Additional Information

• Scope of the Amendment Act:

• The Banking Laws (Amendment) Act amends several key legislations, including the Banking Regulation Act, 1949, the State Bank of India Act, 1955, and the Banking Companies (Acquisition and Transfer of Undertakings) Acts of 1970 and 1980.

• Apart from nomination rules, it seeks to improve governance standards in the banking sector and provide greater operational freedom to banks.

• Changes in Substantial Interest:

• The Act revised the definition of substantial interest for bank directors. The threshold, which was previously fixed at Rs. 5 lakhs in 1968, has been significantly increased to Rs. 2 crores to reflect modern economic realities.

• Cooperative Bank Reforms:

• The amendment extended the tenure of directors (excluding the chairman and whole-time directors) in cooperative banks from the existing 8 years to 10 years.

• This change aligns the management of cooperative banks with the standards applicable to other commercial banking entities.

• Unclaimed Deposits and UDGUM:

• To tackle the issue of forgotten funds, the RBI previously launched the UDGUM (Unclaimed Deposits – Gateway to Access Information) portal. The 2025 notification on multiple nominees complements these digital efforts to return funds to the rightful owners.

Important Points

• Auditor Remuneration: The Act grants greater autonomy to the boards of directors of public sector banks to determine the remuneration of statutory auditors, which was earlier more tightly regulated.

• Reporting Dates: It updated the reporting frequency for banks to the RBI from a fortnightly basis (Fridays) to a daily or specific date basis to ensure more accurate liquidity management and data tracking.

• Customer Protection: The increase in the number of nominees is seen as a pro-consumer move, particularly for large families or individuals wishing to distribute their savings among multiple dependents without requiring a complex Will.

• Notification Year: While the bill was tabled in 2024, its implementation and notification occurred in April 2025, marking a new era in Indian banking jurisprudence.

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Q97. Answer: (c) Uttar Pradesh

The correct answer is Uttar Pradesh.

Key Points

• The Uttar Pradesh Defence Industrial Corridor (UPDIC) is a flagship project aimed at reducing the dependency of the Indian Armed Forces on foreign imports and promoting the Make in India initiative.

• As of the latest reports leading into 2025, the corridor has successfully attracted investment proposals worth Rs. 33,896 crore from various national and international defense manufacturers.

• The Uttar Pradesh Expressways Industrial Development Authority (UPEIDA) is the nodal agency designated by the State Government to oversee the land acquisition and infrastructure development for this corridor.

• The project is planned across six strategic nodes: Lucknow, Kanpur, Jhansi, Agra, Aligarh, and Chitrakoot. These nodes were selected based on their existing industrial base and connectivity via expressways.

• The Aligarh node has shown rapid progress, with several Micro, Small, and Medium Enterprises (MSMEs) already beginning the process of setting up production units for defense components.

Additional Information

• Background and Announcement: The establishment of two Defence Industrial Corridors in India was announced by the Union Government in the Budget 2018-19. One corridor was allocated to Tamil Nadu and the other to Uttar Pradesh.

• Investment Targets: The Ministry of Defence has set an ambitious target of achieving a turnover of $25 billion (Rs. 1.75 lakh crore) in defense manufacturing by 2025, including exports worth $5 billion.

• Major Industry Players: Significant entities such as BrahMos Aerospace, Bharat Dynamics Limited (BDL), and Hindustan Aeronautics Limited (HAL) are involved in setting up facilities within the UPDIC. The BrahMos missile manufacturing center is being established in the Lucknow node.

• Policy Support: To attract investors, the state government launched the UP Defence and Aerospace Unit and Employment Promotion Policy, which provides incentives such as capital subsidies, stamp duty exemptions, and rebates on land costs.

• Infrastructure Connectivity: The corridor leverages the vast network of expressways in the state, including the Yamuna Expressway, Agra-Lucknow Expressway, and Bundelkhand Expressway, ensuring seamless logistics for the heavy defense industry.

Important Points

• Node Specialization: Each node in the Uttar Pradesh corridor is designed for specific industrial strengths. For example, the Jhansi node is expected to host heavy equipment manufacturing, while the Kanpur node focuses on textiles for defense and small arms.

• Comparison with Tamil Nadu: While Uttar Pradesh has attracted Rs. 33,896 crore in proposals, the Tamil Nadu Defence Industrial Corridor (TNDIC) covers nodes like Chennai, Hosur, Coimbatore, Salem, and Tiruchirappalli, focusing heavily on the Aerospace sector.

• Employment Generation: The UPDIC is projected to generate over 2.5 lakh jobs in the state, boosting the local economy and promoting technical skill development among the youth.

• Atmanirbhar Bharat: These corridors are central to the Self-Reliant India vision, aiming to transform India from one of the world's largest importers of defense equipment into a global Defense Manufacturing Hub.

Q98. Answer: (c) Wildlife Institute of India, Dehradun

The correct answer is Wildlife Institute of India, Dehradun.

Key Points

• The inaugural plenary session of the Indian Conservation Conference (ICC)–2025 was hosted by the Wildlife Institute of India (WII), located in Dehradun, Uttarakhand.

• The event took place in June 2025, bringing together a diverse group of ecologists, conservationists, policy-makers, and researchers from across the country.

• The conference focused on addressing critical challenges in biodiversity preservation, habitat restoration, and the impact of climate change on India's unique ecosystems.

• The Wildlife Institute of India served as the ideal venue for this plenary session due to its long-standing history as a premier institution for wildlife research and management since its inception in 1982.

• During the session, the emphasis was placed on the "Vision 2047" for wildlife conservation in India, highlighting the use of modern technology like drones and AI-based monitoring for endangered species.

Additional Information

• Wildlife Institute of India (WII):

• It is an autonomous institution under the Ministry of Environment, Forest and Climate Change (MoEFCC), Government of India.

• Established in 1982, it is based in Chandrabani, Dehradun.

• The institute conducts specialized research and training programs in areas like Forensic Science, GIS, and Remote Sensing

applied to wildlife management.

• Forest Research Institute (FRI):

• Also located in Dehradun, it was established in 1906 as the Imperial Forest Research Institute.

• It is one of the oldest institutions of its kind and is famous for its Greco-Roman architecture and six specialized museums dedicated to forestry.

• It functions under the Indian Council of Forestry Research and Education (ICFRE).

• Indian Council of Forestry Research and Education (ICFRE):

• It is an apex body in the national forestry research system that directs and manages forestry research and education in India.

• While its headquarters is in Dehradun, it has various regional institutes, such as the Tropical Forest Research Institute (TFRI) located in Jabalpur, Madhya Pradesh.

• Indian Institute of Science (IISc), Bengaluru:

• Established in 1909 by Jamsetji Tata and the Maharaja of Mysore, it is a leading public research university for higher education and scientific research.

• It houses the Centre for Ecological Sciences (CES), which is a major hub for ecological and evolutionary research in India.

Important Points

• Dehradun is often referred to as the "Forestry Capital of India" because it hosts several major national organizations like the Survey of India, WII, FRI, and the Indira Gandhi National Forest Academy (IGNFA).

• The Indian Conservation Conference is a strategic biennial or annual event aimed at synchronizing state-level conservation efforts with national priorities.

• In 2025, the integration of community-based conservation models was a major theme, acknowledging the role of tribal communities in protecting forest cover.

• The conference also discussed the Status of Tigers in India and the success of Project Tiger, which completed 50 years in 2023, setting a precedent for future species-specific recovery programs.

Q99. Answer: (b) King’s Birthday Honours Overseas & International List

The correct answer is King’s Birthday Honours Overseas & International List.

Key Points

• The King’s Birthday Honours Overseas & International List is published annually in June to recognize individuals who have provided exceptional service to the United Kingdom or its interests abroad.

• On 13 June 2025, the official list was released, coinciding with the celebrations for the Monarch’s Official Birthday. Hence, statement 2 is correct.

• This list specifically honors those working in British Overseas Territories, or those performing international services in foreign countries and Commonwealth nations.

• The Foreign, Commonwealth and Development Office (FCDO) is responsible for managing the nominations and submitting recommendations to His Majesty King Charles III.

• Common honors included in this list are the Order of St Michael and St George (CMG/KCMG/DCMG), which is primarily awarded for service in a foreign country or for Commonwealth affairs.

Additional Information

• Honours System Frequency:

• British honors are generally granted twice a year: once at New Year and once on the King’s Official Birthday in June.

• The New Year Honours 2025 were published earlier in the year, typically around 30 December 2024 or 1 January 2025. Hence, statement 4 is incorrect.

• Overseas vs. Domestic Lists:

• The Overseas & International List is distinct from the UK Domestic List, which honors residents of the UK for national or local achievements.

• The UK Civil Service Honors are often integrated into the wider domestic list and do not constitute the primary title for the overseas recognitions published on that date. Hence, statement 1 is incorrect.

• Historical Context:

• Following the death of Queen Elizabeth II in September 2022, the honors were transitioned to the King’s Honours.

• The Queen’s Platinum Overseas & International List was a special one-time publication associated with the Platinum Jubilee in 2022. Hence, statement 3 is incorrect.

Important Points

• The Gazette: All official honors lists are published in The Gazette, the UK's official journal of record, which makes the appointments legally binding and public.

• Types of Awards: The list frequently features ranks within the Order of the British Empire, including Officer (OBE), Member

(MBE), and Commander (CBE), alongside British Empire Medals (BEM).

• Nomination Process: Nominations for the overseas list can be made by anyone but are rigorously vetted by the Diplomatic Service and Overseas Committee before being sent to the Prime Minister and then the King.

• Selection Criteria: Recipients must have demonstrated bravery, innovation, or dedication that significantly enhances the reputation of the UK internationally or supports British citizens overseas.

Q100. Answer: (a) Atuo Mezhür

The correct answer is Atuo Mezhür.

Key Points

• Atuo Mezhür, a legendary sports administrator from Nagaland, passed away on January 5, 2025, in Kohima at the age of 72.

• He held a significant position as an Executive Member of the All India Football Federation (AIFF), representing the interests of the North-Eastern region at the national level for multiple terms.

• He served as the long-standing General Secretary of the Nagaland Football Association (NFA), where he was instrumental in nurturing football talent and organizing state-level tournaments.

• Beyond football, he was the General Secretary of the Nagaland Olympic Association (NOA), contributing to the broader development of various sports in the state of Nagaland.

• His contributions were recognized by high-ranking officials, including Nagaland Chief Minister Neiphiu Rio and AIFF President Kalyan Chaubey, who noted his selfless dedication to the growth of sports in India.

Additional Information

• All India Football Federation (AIFF):

• Founded in 1937, the AIFF is the national governing body for football in India, affiliated with FIFA and the Asian Football Confederation (AFC).

• It manages the Indian National Team, the Indian Super League (ISL), and the I-League.

• Savio Medeira:

• He is a former Indian National Team player and coach. He also served as the Technical Director of the AIFF and is known for his extensive coaching career in Goa.

• Bhaichung Bhutia:

• Commonly known as the "Sikkimese Sniper," he is a former captain of the Indian National Team and is one of the most decorated footballers in Indian history.

• He hailed from the state of Sikkim and was the first Indian player to sign a contract with a European club (Bury FC) in 1999.

• Subrata Dutta:

• A prominent football administrator from West Bengal, he served as the Senior Vice President of the AIFF and held leadership roles in the Indian Football Association (IFA).

Important Points

• Atuo Mezhür was also the Managing Director of Mezhür Higher Secondary School in Kohima, reflecting his commitment to education alongside athletics.

• During his tenure at the Nagaland Olympic Association, he played a vital role in organizing the North East Olympic Games, fostering unity through sports among the eight states of the region.

• His death is considered a major loss for the sporting fraternity of the North-East, as he was a bridge between state associations and the Union Government sports bodies.

• The Nagaland Football Association and the NOA have frequently credited him for the modernization of sports infrastructure in the districts of Nagaland.

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