RRB Group D Official Paper (Held On: 05 Feb, 2026 Shift 1) (Previous Year Paper)

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

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GENERAL SCIENCE

Q1. What are the primary products formed during the complete combustion of most carbon compounds?

(a) Carbon monoxide and water
(b) Carbon dioxide, water, and energy
(c) Alcohols and carboxylic acids
(d) Soot and carbon dioxide

Q2. Which of the following is a neutralisation reaction?

(a) Fe + CuSO4 → FeSO4 + Cu
(b) NaOH + HCl → NaCl + H2O
(c) CaCO3 → CaO + CO2
(d) Zn + HCl → ZnCl2 + H2

Q3. Which of the following does NOT represent a pair of isotopes?

(a) ^(35)17Cl ^(38)17Cl
(b) ^(35)17Cl ^(37)17Cl
(c) $^{3}1H^{2}1H$
(d) $^{1}1H^{2}1H$

Q4. Rabi crops are harvested in which season?

(a) Summer
(b) Autumn
(c) Winter
(d) Monsoon

Q5. Which of the following statements is correct regarding the female reproductive system?

(a) The cervix connects the ovaries to the uterus.
(b) A girl starts producing eggs only after she reaches puberty.
(c) The fallopian tubes carry the egg from the ovary to the uterus.
(d) The uterus produces eggs that travel through the vagina.

Q6. Which of the following is a characteristic of liquids?

(a) No fixed shape or volume
(b) Fixed shape but variable volume
(c) No fixed shape but fixed volume
(d) Fixed shape and volume

Q7. A ball is dropped from rest. What will be the velocity of the ball after falling 20 m?
(Take, g = 10 m/s²)

(a) 40.0 m/s
(b) 20.0 m/s

(c) 50.0 m/s
(d) 10.0 m/s

Q8. Which part of Bryophyllum develops new plantlets for vegetative propagation?
(a) Root
(b) Leaf margin
(c) Stem
(d) Flower

Q9. Which of the following statements is true about the potential energy?
(a) It cannot be converted into other forms of energy.
(b) It is only present when an object is moving.
(c) It depends on the object's motion.
(d) It is energy stored due to position or condition.

Q10. Which activity of insects directly causes loss of nutrients in plants?
(a) Absorption of cell sap
(b) Consumes only fallen leaves
(c) Laying eggs on the plant
(d) Drilling into the soil

Q11. If the acceleration of a body is halved and mass remains constant, the force will _____.
(a) Remain the same
(b) Halve
(c) Become zero
(d) Double

Q12. To hear a distinct echo, what should be the minimum time interval between the original sound and the reflected sound?
(a) 1.0 s
(b) 0.1 s
(c) 0.01 s
(d) 0.2 s

Q13. A convex lens forms an image of an object placed 30 cm away. The image is formed at 60 cm on the other side. The magnification is:
(a) -2
(b) –1/2
(c) +1/2
(d) +2

Q14. Which of the following combinations will consume more electrical power if connected to the same voltage source?
(a) Higher resistance
(b) Equal resistance
(c) Zero resistance
(d) Lower resistance

Q15. When an iron nail is placed in copper sulphate solution, what is observed?
(a) Iron dissolves and copper deposits on the nail.
(b) Copper dissolves and iron deposits on the nail.
(c) Hydrogen gas is evolved.
(d) No reaction occurs.

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Q16. A characteristic of a colloidal solution is that:

(a) it is a homogeneous mixture
(b) it is a heterogeneous mixture
(c) it is an ideal solution
(d) it is an azeotrope

Q17. Inside the lungs, rapid exchange of gases takes place between the air and the blood. Which type of epithelial tissue helps in this process?

(a) Simple squamous epithelium
(b) Stratified squamous epithelium
(c) Ciliated columnar epithelium
(d) Cuboidal epithelium

Q18. Which statement is correct about magnetic field lines?

(a) They can intersect at the poles.
(b) They never intersect each other.
(c) They form random curves.
(d) They start from the south pole.

Q19. Identify the correct matches mentioned in column A with column B.

Column A	Column B
(p) Sepal and petal	(i) Reproductive part
(q) Stamen and pistil	(ii) Accessory part
(r) Stigma	(iii) Stamen
(s) Pollen grain	(iv) Pistil

(a) p – ii, q – i, r – iv, s - iii
(b) p – iii, q – i, r – iv, s - ii
(c) p – iv, q – iii, r – ii, s - i
(d) p – i, q – ii, r – iii, s - iv

Q20. Which of the following correctly represents the sequence of colours observed on the screen when white light passes through a prism in its standard orientation?

(a) BYVROIG
(b) ROYGBIV
(c) GYORVIB
(d) VIBGYOR

Q21. Which of the following is true about the homologous series?

(a) Each successive member differs by -CH2- group.
(b) All members have different functional groups.
(c) All members have the same molecular weight.
(d) All members have the same boiling point.

Q22. Which of the following is an example of a cyclic hydrocarbon?

(a) Methane
(b) Butane
(c) Cyclohexane
(d) Ethene

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Q23. Which of the following statements about average velocity is NOT correct?

(a) It depends on the direction of motion.
(b) It is always the same as average speed.
(c) It is the total displacement divided by total time.
(d) It is measured in m/s.

Q24. Plastids are easily observed under a microscope because:

(a) they are very small
(b) they are large and contain pigments
(c) they contain DNA
(d) they are colourless

Q25. A botanist observes a plant exhibiting rapid growth at its shoot tip. Which type of plant tissue is most likely responsible for this growth?

(a) Intercalary meristem
(b) Permanent tissue
(c) Lateral meristem
(d) Apical meristem

MATHEMATICS

Q26. A metallic cylindrical tube is open at both ends. The external diameter of the tube is 12 cm, and its length is 63 cm. The thickness of the metal tube everywhere is 0.4 cm. What is the total surface area (in cm^2) of the tube?
(Take $\pi = 22/7$, and round off the answer to the nearest multiple of 5.)

(a) 4630
(b) 4625
(c) 4615
(d) 4620

Q27. In a race, an athlete covers a distance of 390 m in 65 sec in the first lap. He covers the second lap of the same length in 195 sec. What is the average speed (in m/sec) of the athlete?

(a) 3
(b) 9
(c) 12
(d) 1

Q28. A cistern has a hole in the bottom through which water is leaking. A tap can fill the cistern in 3 hours and the hole in the bottom can empty the fully filled cistern in 5 hours. If both the tap and the hole are open, then what will be the time taken to completely fill the empty cistern?

(a) 8 hours
(b) 12.8 hours
(c) 5.6 hours
(d) 7.5 hours

Q29. Sarah's age is 5 years more than twice her sister Emma's age. If the sum of their ages is 29 years, how old is Sarah?

(a) 26 years
(b) 21 years
(c) 18 years
(d) 23 years

Q30. If 5^(x+1) = 1, what is the value of x?

(a) -1
(b) 1
(c) -5
(d) 0

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Q31. P and Q together can fill a cistern with water in 12 hours. If P alone can fill the cistern with water in 21 hours, then in how many hours will Q alone fill one-fourth of the same cistern with water?

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

Q32. The value of $3/4(\sin^2 3x - \tan^2 3x) + 3/4(\cos^2 3x + \sec^2 3x)$ is _____.

(a) 1
(b) 0.75
(c) 1.5
(d) 0.5

Q33. In quadrilateral PQRS, the bisectors of angle R and angle S meet at the point T (inside the quadrilateral) and angle STR = 33°. If the ratio of angle P to angle Q is 3 : 8, then what is the difference between the measures of angle Q and angle P?

(a) 26°
(b) 30°
(c) 34°
(d) 32°

Q34. The sides of a triangle are in the ratio 3 : 4 : 5. A square has its perimeter equal to the perimeter of the triangle. If the difference between their areas is 48 cm^2, find the perimeter of the triangle.

(a) 52 cm
(b) 56 cm
(c) 48 cm
(d) 42 cm

Q35. In a region 86% of registered voters participated in voting. If the total registered voters are 18,000 in that region, then how many voters participated in voting?

(a) 18,000 voters
(b) 15,480 voters
(c) 15,490 voters
(d) 15,080 voters

Q36. A cricketer has an average of 77 runs over 12 innings. If he scores 266 runs in the 13^(th) inning, by how many runs (rounded off to the nearest whole number) does his average score increase?

(a) 15
(b) 9
(c) 6
(d) 19

Q37. What price should Kunal mark on a hoodie which cost him Rs. 8,400, so as to gain 25% after allowing successive discounts of 20% and 25%?

(a) Rs. 17,648
(b) Rs. 17,509
(c) Rs. 17,500
(d) Rs. 17,676

Q38. Evaluate: $3^5 \times 7^5 \div 21^3$

(a) 21
(b) 441
(c) 341
(d) 541

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Q39. In a test, B got 50 marks while A got 75 marks, out of 115 maximum marks. What percentage of A's marks was B's marks? (Round off your answer to two decimal places.)

(a) 115.32%
(b) 65.22%
(c) 66.67%
(d) 150.24%

Q40. There were two candidates in an election. One candidate got 28% of the total valid votes and lost by 13,200 votes. Find the total number of valid votes.

(a) 50,000
(b) 40,000
(c) 30,000
(d) 60,000

Q41. The arithmetic mean of the observations 25, 92, 48, 17, 38, 93, 37, 90 and 73 is:

(a) 58
(b) 67
(c) 55
(d) 57

Q42. Two trains, X and Y, are running along parallel tracks towards each other. The length of train X is 150 m, and the length of train Y is 250 m. Train X is running at a speed of 60 km/hr, and train Y is running at a speed of 90 km/hr. How much time will it take for train X to cross train Y?

(a) 8.6 seconds
(b) 10.6 seconds
(c) 7.6 seconds
(d) 9.6 seconds

Q43. Find the simple interest (in Rs.) on Rs. 2,000 at 7% per annum rate of interest for the period from 8 February 2023 to 22 April 2023.

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

Q44. A sells to B at 20% profit, B sells to C at 25% loss, C sells to D at 40% profit. D pays Rs. 252. How much did A pay originally?

(a) Rs. 200
(b) Rs. 175
(c) Rs. 210
(d) Rs. 180

Q45. If $x+6$ is the HCF of $x^2 + 10x + 24$ and $x^2 + kx + 12$, then the value of k is:

(a) -8
(b) -6
(c) 6
(d) 8

Q46. The number of prime numbers between 368 and 376 is:

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

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Q47. The sum of two numbers is 86 and their difference is 12. Find the product of the two numbers.

(a) 1613
(b) 1913
(c) 1713
(d) 1813

Q48. A total profit of Rs. 28,800 is to be distributed amongst P, Q and R such that P : Q = 17 : 5 and Q : R = 6 : 12. The share (in Rs.) of Q in the profit is:

(a) 4,600
(b) 4,500
(c) 4,650
(d) 4,400

Q49. After allowing a discount of 75% on the marked price of an article, it is sold for Rs. 69,356. Find its marked price (in Rs.).

(a) 2,77,339
(b) 2,77,431
(c) 2,77,424
(d) 2,77,594

Q50. Suman, Tariq and Neha invest sums in the ratio 8 : 25 : 15, respectively. If they earned a total profit of Rs. 44,544 at the end of the year, then what is the positive difference between the shares of Suman and Neha?

(a) Rs. 6,493
(b) Rs. 6,497
(c) Rs. 6,496
(d) Rs. 6,498

GENERAL INTELLIGENCE & REASONING

Q51. Mr. Akai starts from Point A and drives 9 km towards west. He then takes a left turn, drives 9 km, turns left and drives 17 km. He then takes a left turn and drives 18 km. He takes a final left turn, drives 8 km and stops at Point P. How far (shortest distance) and towards which direction should he drive in order to reach Point A again? (All turns are 90-degree turns only, unless specified.)

(a) 9 km to the south
(b) 9 km to the north
(c) 12 km to the north
(d) 12 km to the east

Q52. Based on the English alphabetical order, three of the following four letter-clusters are alike in a certain way and thus form a group. Which letter-cluster DOES NOT belong to that group?

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

(a) SWX
(b) ZEE
(c) HLM
(d) UYZ

Q53. AZXT is related to XWUQ in a certain way based on the English alphabetical order. In the same way, VUSO is related to SRPL. To which of the given options is TSQM related, following the same logic?

(a) QQMS
(b) QOMJ
(c) QPMJ
(d) QPNJ

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Q54. What should come in place of the question mark (?) in the given series?

445 440 450 444 454 447 ?

(a) 457
(b) 454
(c) 456
(d) 458

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

17 32 49 68 89 ?

(a) 111
(b) 112
(c) 114
(d) 109

Q56. Select the set in which the numbers are related in the same way as are the numbers of the following sets.

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

35 - 7 - 5

60 - 6 - 10

(a) 81 - 7 - 8
(b) 40 - 5 - 9
(c) 63 - 7 - 9
(d) 12 - 4 - 2

Q57. In a certain code language, ‘what are those’ is written as ‘np tr sq’ and ‘take those gifts’ is coded as ‘hk my tr’. How is ‘those’ coded in that language?

(a) tr
(b) my
(c) hk
(d) np

Q58. 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 letter-cluster pair that 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) SV−WZ
(b) DG−HK
(c) UX−XD
(d) FI−JM

Q59. Refer to the given number series and answer the question that follows. Counting to be done from left to right only. All numbers are single-digit numbers.

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

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

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

Q60. M, N, O, P, Q and R are sitting around a circular table facing the centre. P is an immediate neighbour of both N and Q. M is sitting second to the right of Q. R is an immediate neighbour of both M and N. What is the position of Q with respect to P?

(a) Immediate right

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(b) Immediate left
(c) Second to the right
(d) Third to the left

Q61. Refer to the following number series and answer the question that follows. Counting to be done from left to right. (All numbers are single-digit numbers only.)

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

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

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

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

YCG−FJN

OSW−VZD

(a) GJM−NRV
(b) GKO−NRV
(c) GKO−MRU
(d) GJM−MQU

Q63. Six boxes, L, M, N, O, P and Q, are stacked vertically. Q is placed at the topmost position. N is placed immediately below P. M is placed immediately above P. L is placed second from the bottom. Which box is placed at the bottommost position?

(a) P
(b) O
(c) M
(d) N

Q64. If ‘P’ stands for ‘×’, ‘Q’ stands for ‘÷’, ‘R’ stands for ‘-’ and ‘S’ stands for ‘+’, what will come in place of the question mark (?) in the following equation?

14 P 4 S (16 Q 4) P 9 R (60 Q 6) P 7 S 20 = ?

(a) 58
(b) 42
(c) 65
(d) 36

Q65. Which of the following letter-number clusters will replace the question mark (?) in the given series to make it logically complete?

XVX 49 AYA 41 DBD 33 GEG 25 ?

(a) JNS 16
(b) JHJ 17
(c) JGI 16
(d) JII 17

Q66. RIVK is related to BSFU in a certain way based on the English alphabetical order. In the same way, FWJY is related to PGTI. To which of the following options is JANC related, following the same logic?

(a) TKXM
(b) TMXD
(c) TXDE
(d) TMKI

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

1 11 31 61 ? 151

(a) 111
(b) 121
(c) 101
(d) 91

Q68. In a certain code language, ‘cute red flowers’ is coded as ‘by gh cf’ and ‘nice red dress’ is coded as ‘jk bt gh’. How is ‘red’ coded in that language? (All codes are two-letter codes.)

(a) cf
(b) jk
(c) by
(d) gh

Q69. In a certain code language,

‘A ± B’ means ‘A is the wife of B’,

‘A * B’ means ‘A is the daughter of B’,

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

‘A # B’ means ‘A is the brother of B’.

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

(a) Daughter
(b) Mother
(c) Wife
(d) Sister

Q70. Read the given statements and conclusions carefully. Assuming that the information given in the statements is true, even if it appears to be at variance with commonly known facts, decide which of the given conclusions logically follow(s) from the statements.

Statements:

Some bells are pots.

All pots are machines.

Conclusions:

(I): Some bells are machines.

(II): All machines are pots

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

Q71. If ‘P’ stands for ‘×’, ‘Q’ stands for ‘÷’, ‘R’ stands for ‘−’ and ‘S’ stands for ‘+’, what will come in place of the question mark (?) in the following equation?

(9 Q 3) P 8 S (72 Q 12) P 7 R 15 P 3 = ?

(a) 21
(b) 12
(c) 39
(d) 44

Q72. Aditi ranked 8 ^(th) from the top and 25 ^(th) from the bottom in her class. How many students are there in the class?

(a) 30
(b) 29
(c) 32
(d) 31

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Q73. Seven people, A, B, C, D, E, F and G, are sitting in a row, facing north.

No one sits to the left of C. Only four people sit between C and A. Only three people sit to the right of G. E sits to the immediate left of B. F is not an immediate neighbour of G.

How many people sit to the right of D?

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

Q74. 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 pots are mats. Some mats are hats. All hats are cats.

Conclusions I: All cats are mats

Conclusions II: Some cats are pots.

(a) Only Conclusion I follows
(b) Only Conclusion II follows
(c) Neither Conclusion I nor II follows
(d) Both Conclusions I and II follow

Q75. A, B, C, D, E and F are sitting around a circular table facing the centre. A sits third to the right of F. B sits second to the left of C. D sits third to the right of C. E sits to the immediate left of A. How many people sit between E and D when counted from the left of D?

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

Q76. What should come in place of the question mark (?) in the given series based on the English alphabetical order?

CAR GYV KWZ OUD ?

(a) TRG
(b) STG
(c) SSH
(d) RSI

Q77. Refer to the following number series and answer the question that follows. Counting to be done from left to right only. (All numbers are single-digit numbers only.)

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

How many 8's are there, each of which is immediately preceded by an even number and also immediately followed by an odd number?

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

Q78. If 'A' stands for '÷', 'B' stands for '×', 'C' stands for '+' and 'D' stands for '−', then what will come in place of the question mark (?) in the following equation?

99 A 9 C 12 B 3 D 7=?

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

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Q79. Refer to the given series and answer the question that follows. All numbers are single-digit numbers only. Counting to be done from left to right.

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

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

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

Q80. Arvind starts from Point K and drives 10 km towards the west. He then takes a left turn; drives 8 km; turns left and drives 4 km. He then takes a right turn and drives 4 km. He then takes a left turn and drives 6 km. He takes a final left turn; drives 8 km and stops at Point Y. How far (shortest distance) and in which direction is Point Y with respect to Point K?

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

(a) 4 km towards west
(b) 4 km towards south
(c) 8 km towards east
(d) 8 km towards north

GENERAL AWARENESS AND CURRENT AFFAIRS

Q81. The 51 ^(st) G7 Summit of 16–17 June 2025 took place in which Canadian location?

(a) Kananaskis, Alberta
(b) Toronto, Ontario
(c) Montreal, Quebec
(d) Vancouver, British Columbia

Q82. In which state was the hedging desk established in 2025 to protect cotton, turmeric and maize farmers?

(a) Kerala
(b) Odisha
(c) Maharashtra
(d) West Bengal

Q83. What is the overdue limit for microfinance lending as per the Microfinance Industry Network directives, effective January 2025?

(a) Rs. 1,000
(b) Rs. 5,000
(c) Rs. 3,000
(d) Rs. 2,000

Q84. In January 2025, which of the following organisations partnered with Chennai’s Metropolitan Transport Corporation (MTC) to launch ‘RuPay on-the-go’ for transit payments?

(a) Indian Banks’ Association (IBA)
(b) Reserve Bank of India (RBI)
(c) Securities and Exchange Board of India (SEBI)
(d) National Payments Corporation of India (NPCI)

Q85. The revised roadmap released in June 2025 for the National Mission for Green India (GIM) places special emphasis on ecological restoration in which of the following critical regions?

(a) Central Indian Highlands and Sundarbans
(b) Deccan Plateau and Andaman Islands
(c) Thar Desert and Eastern Ghats
(d) Aravalli Range, Western Ghats, Himalayas, and mangroves

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Q86. The sixth phase of the ‘Jal Shakti Abhiyan: Catch the Rain 2025’ was launched in which of the following Indian states?

(a) Bihar
(b) Haryana
(c) Uttarakhand
(d) Rajasthan

Q87. In late November 2025, which cyclonic storm prompted the IMD to issue warnings for north Tamil Nadu, Puducherry, and adjoining south Andhra Pradesh, and made landfall around 30 November 2025?

(a) Cyclone Ditwah
(b) Cyclone Shakhti
(c) Cyclone Senyar
(d) Cyclone Montha

Q88. Which Indian javelin thrower won gold at the Taiwan Athletics Open in June 2025?

(a) Davinder Singh Kang
(b) Kishore Kumar
(c) Neeraj Chopra
(d) Rohit Yadav

Q89. The National Red List Assessment Initiative, launched in India in October 2025, aligns with IUCN global standards and supports the country’s commitments under which of the following international frameworks?

(a) Greenhouse Gas (GHG) Framework
(b) Sendai Framework for Disaster Risk Reduction
(c) Kunming–Montreal Global Biodiversity Framework
(d) Ramsar Convention on Wetlands Framework

Q90. Which prodigious ice-hockey talent was awarded the EJ McGuire Award of Excellence, highlighting character and athleticism, ahead of the 2025 NHL Draft?

(a) Michael Misa
(b) Ivan Miroshnichenko
(c) Matvei Michkov
(d) Connor Bedard

Q91. Which of the following nutritional concerns are being highlighted in the food awareness campaign launched by the Ministry of Health and Family Welfare on the occasion of World Food Safety Day, 2025?

(a) Excess iron and protein
(b) High fibre and calcium
(c) Low vitamin C and zinc
(d) Hidden sugars, fats and oils

Q92. Which organization licensed nine breakthrough health technologies to industry partners at the India MedTech Expo in September 2025?

(a) ISRO
(b) NITI Aayog
(c) WHO
(d) ICMR

Q93. How many new medical seats were announced in the Union Budget 2025-26, to be added for the upcoming academic year i.e. 2025-26?

(a) 10000
(b) 4000
(c) 6000
(d) 2000

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Q94. In March 2025, the Ministry of Environment Forest and Climate Change (MoEFCC) tightened emissions standards for which industry under the Environment (Protection) Second Amendment Rules, 2025?

(a) Dairy
(b) Cement
(c) Textile
(d) Caustic soda

Q95. The second edition of the STAIRS Youth National Games began on May 19, 2025. In which stadium in New Delhi did this event commence?

(a) Thyagaraj Sports Complex
(b) Indira Gandhi Arena
(c) Talkatora Stadium
(d) Jawaharlal Nehru Stadium

Q96. In the year 2025, on which date was Army Day observed in India?

(a) 20 january
(b) 15 january
(c) 23 january
(d) 13 january

Q97. Which author/translator pair won the International Booker Prize, 2025, for Heart Lamp?

(a) David Szalay and Kiran Desai
(b) Banu Mushtaq and Deepa Bhasthi
(c) Margaret Atwood and Margaret Kiln
(d) Kiran Desai and David Milon

Q98. Where were the inaugural Beach Games, held under the Khelo India banner, conducted?

(a) Puducherry
(b) Andaman and Nicobar Islands
(c) Goa
(d) Diu

Q99. In May 2025, the RBI introduced a new Payments Regulatory Board of how many members to regulate and supervise payment systems in the country?

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

Q100. The 3^(rd) edition of the International Conference organized by the Indian Council of Arbitration (ICA) in June 2025 emphasized “Hybrid Dispute Resolution Models” in commercial conflicts between which countries?

(a) India and Australia
(b) India and Japan
(c) India and USA
(d) India and UK

ANSWER KEY

1	b	2	b	3	a	4	a	5	c	6	c	7	b	8	b	9	d	10	a
11	b	12	b	13	a	14	d	15	a	16	b	17	a	18	b	19	a	20	d
21	a	22	c	23	b	24	b	25	d	26	b	27	a	28	d	29	b	30	a
31	b	32	c	33	b	34	c	35	b	36	a	37	c	38	b	39	c	40	c
41	d	42	d	43	a	44	a	45	d	46	b	47	d	48	b	49	c	50	c

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

SOLUTIONS

Q1. Answer: (b) Carbon dioxide, water, and energy

The correct answer is Carbon dioxide, water, and energy.

Key Points

• Combustion is a chemical process in which a substance reacts rapidly with oxygen and gives off heat. Most carbon compounds are highly flammable and serve as excellent fuels.

• When carbon compounds (like hydrocarbons) undergo complete combustion, they react with a sufficient supply of oxygen to produce carbon dioxide (CO2) and water (H2O).

• This reaction is highly exothermic, meaning it releases a significant amount of energy in the form of heat and light. Hence, the statement that carbon dioxide, water, and energy are the primary products is correct.

• Saturated hydrocarbons (alkanes) generally give a clean blue flame during complete combustion because the carbon is fully oxidized.

• The general chemical equation for the complete combustion of a hydrocarbon can be represented as: Fuel + O2 → CO2 + H2O + Energy. For example, the combustion of Methane (CH4) produces one molecule of carbon dioxide and two molecules of water.

Additional Information

• Incomplete Combustion:

• This occurs when there is an insufficient supply of air or oxygen.

• The products of incomplete combustion include carbon monoxide (CO), which is a highly toxic gas, and soot (unburnt carbon).

• Unsaturated hydrocarbons (like alkenes and alkynes) often undergo incomplete combustion, producing a sooty yellow flame due to the high carbon percentage.

• Oxidation of Carbon Compounds:

• While combustion is a type of oxidation, carbon compounds can also be oxidized using oxidizing agents like alkaline potassium permanganate (KMnO4) or acidified potassium dichromate (K2Cr2O7).

• In such controlled oxidation, alcohols can be converted into carboxylic acids.

• Characteristics of Fuels:

• Common carbon-based fuels include Coal, Petroleum, and Natural Gas.

• The calorific value of a fuel is determined by the amount of heat energy produced during its complete combustion. Methane is the primary component of CNG (Compressed Natural Gas) and is preferred because it undergoes cleaner combustion compared to complex hydrocarbons.

Important Points

• Environmental Impact: While complete combustion is efficient for energy, the release of carbon dioxide (CO2) is a major contributor to the greenhouse effect and global warming.

• Safety Note: Incomplete combustion in closed spaces (like using charcoal heaters indoors) is dangerous because carbon monoxide binds with hemoglobin in the blood more effectively than oxygen, leading to asphyxiation.

• Flame Temperature: The temperature of a blue flame (complete combustion) is significantly higher than that of a yellow flame (incomplete combustion), which is why gas stoves are designed to mix air thoroughly with the fuel.

Q2. Answer: (b) NaOH + HCl → NaCl + H2O

The correct answer is NaOH + HCl → NaCl + H2O.

Key Points

• A neutralisation reaction is a chemical reaction in which an acid and a base react quantitatively with each other to form water and a salt.

• The reaction NaOH + HCl → NaCl + H2O involves Sodium Hydroxide (NaOH), which is a strong base, and Hydrochloric Acid (HCl), which is a strong acid. They react to produce Sodium Chloride (NaCl), a neutral salt, and water (H2O). Hence, the statement representing this reaction is correct.

• In the reaction Fe + CuSO4 → FeSO4 + Cu, Iron (Fe) displaces Copper (Cu) from the Copper Sulphate solution because iron is

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more reactive. This is a single displacement reaction, not neutralisation. Hence, statement 1 is incorrect.

• The reaction CaCO3 → CaO + CO2 represents the thermal decomposition of Calcium Carbonate into Calcium Oxide and Carbon Dioxide upon heating. Hence, statement 3 is incorrect.

• In the reaction Zn + HCl → ZnCl2 + H2, Zinc (Zn) reacts with Hydrochloric Acid to produce Zinc Chloride and Hydrogen gas. This is another example of a displacement reaction. Hence, statement 4 is incorrect.

Additional Information

• Nature of Neutralisation:

• Neutralisation reactions are generally exothermic in nature, meaning they release heat energy during the process.

• The heat of neutralisation is the change in enthalpy when one equivalent of an acid is neutralised by one equivalent of a base.

• pH Scale and Indicators:

• In a complete neutralisation of a strong acid and a strong base, the resulting solution has a pH value of 7 at 25 degrees Celsius.

• Phenolphthalein is a common indicator used in these reactions; it turns pink in basic solutions and becomes colourless when the solution is neutralised or acidic.

• Practical Applications:

• Antacids: Magnesium Hydroxide, commonly known as Milk of Magnesia, is used to neutralise excess hydrochloric acid in the stomach to treat acidity.

• Soil Treatment: If the soil is too acidic, farmers add Quick Lime (Calcium Oxide) or Slaked Lime (Calcium Hydroxide) to neutralise it for better crop growth.

• Insect Stings: The effect of an ant sting, which contains methanoic acid (formic acid), can be neutralised by rubbing moist baking soda (Sodium Hydrogen Carbonate) or calamine solution.

Important Points

• Types of Salts Formed:

• A strong acid reacting with a strong base produces a neutral salt (e.g., NaCl).

• A strong acid reacting with a weak base produces an acidic salt (e.g., Ammonium Chloride).

• A weak acid reacting with a strong base produces a basic salt (e.g., Sodium Acetate).

• Arrhenius Theory: According to the Arrhenius definition, an acid provides Hydrogen ions (H+) and a base provides Hydroxide ions (OH-) in aqueous solutions. During neutralisation, these ions combine to form water (H2O).

Q3. Answer: (a) ^(35)17Cl ^(38)17Cl

The correct answer is ^(35)17Cl & ^(38)17Cl.

Key Points

• Isotopes are defined as atoms of the same element that possess the same atomic number (Z) but have different mass numbers (A). This means they have the same number of protons but a different number of neutrons in their nuclei.

• The chemical properties of isotopes are identical because they have the same number of electrons and the same electronic configuration. However, they exhibit different physical properties due to the difference in their masses.

• In Statement 1, ^(35)17Cl and ^(38)17Cl share the atomic number 17. However, in standard chemistry, the primary stable isotopes of Chlorine are ^(35)Cl and ^(37)Cl. ^(38)Cl is a short-lived radioisotope with a half-life of approximately 37.2 minutes and is not typically considered a standard pair in this context. Hence, statement 1 is the correct answer as it represents an outlier.

• In Statement 2, ^(35)17Cl and ^(3717Cl represent the two naturally occurring isotopes of Chlorine, found in a ratio of approximately 3:1 in nature. Hence, statement 2 is correct.)

• In Statement 3, ³1H and ^(2}_{1H represent Tritium and Deuterium respectively. Both are well-known isotopes of Hydrogen. Hence, statement 3 is correct.)

• In Statement 4, ¹1H and ^(2}_{1H represent Protium and Deuterium, which are the most common isotopes of Hydrogen found in nature. Hence, statement 4 is correct.)

Additional Information

• Hydrogen Isotopes: Hydrogen is the only element whose isotopes have unique names. Protium (¹H) has 0 neutrons, Deuterium (²H) has 1 neutron, and Tritium (³H) has 2 neutrons.

• Isobars: These are atoms of different chemical elements that have the same mass number but different atomic numbers. An example includes Argon-40 (^(40)18Ar) and Calcium-40 (^(40)20Ca).

• Isotones: These are atoms of different elements that have the same number of neutrons. For instance, Carbon-14 (^(14)6C) and Oxygen-16 (^(16)8O) both contain 8 neutrons.

• Radioisotopes: Some isotopes are unstable and undergo radioactive decay. Examples include Carbon-14 used for carbon dating and Uranium-235 used as fuel in nuclear reactors.

• Average Atomic Mass: The atomic mass of an element listed on the Periodic Table is the weighted average of the masses of its naturally occurring isotopes. For Chlorine, this value is approximately 35.5 u.

Important Points

• The concept of isotopes was first proposed by Frederick Soddy in 1913, for which he received the Nobel Prize in Chemistry in 1921.

• The number of neutrons in an atom can be calculated by subtracting the atomic number (Z) from the mass number (A): n = A - Z.

• Stable isotopes do not decay into other elements, whereas unstable isotopes (radioisotopes) emit radiation to reach a more stable state.

• In heavy water (D2O), the Hydrogen atoms are replaced by Deuterium, which is used as a moderator in nuclear power plants.

Q4. Answer: (a) Summer

The correct answer is Summer.

Key Points

• Rabi crops are agricultural crops that are sown in the winter season and harvested in the spring or early summer.

• The sowing of these crops usually begins at the start of winter, specifically from October to December.

• The harvesting period for Rabi crops occurs during the summer months, primarily from April to June. Hence, the statement is correct.

• These crops require a relatively cool climate during the growing period but a warm climate during the germination of their seeds and harvesting.

• Major examples of crops grown in this season include Wheat, Barley, Peas, Gram, and Mustard.

• The success of Rabi crops in North and North-western parts of India is greatly aided by the Western Temperate Disturbances, which provide much-needed precipitation during the winter months.

Additional Information

• Kharif Crops:

• These crops are sown with the onset of the monsoon in different parts of the country, typically in June or July.

• They are harvested in autumn, specifically during September and October.

• Key examples include Paddy (Rice), Maize, Jowar, Bajra, Tur (Arhar), Moong, Urad, Cotton, Jute, Groundnut, and Soybean.

• These crops require high temperatures and high humidity, along with a significant amount of rainfall.

• Zaid Crops:

• In between the Rabi and the Kharif seasons, there is a short season during the summer months (from March to July) known as the Zaid season.

• Crops produced during this period include Watermelon, Muskmelon, Cucumber, various Vegetables, and Fodder crops.

• Sugarcane is also associated with this timing but actually takes almost a full year to grow to maturity.

• Important Agricultural Facts:

• India is one of the world's largest producers of Wheat (a Rabi crop) and Rice (a Kharif crop).

• States like Punjab, Haryana, and Uttar Pradesh became major hubs for Rabi production following the Green Revolution in the 1960s.

• The Indian Council of Agricultural Research (ICAR) is the apex body responsible for coordinating agricultural education and research in the country.

Important Points

• Wheat is the most important Rabi crop in India and is a staple food in the North and North-western parts of the country.

• Irrigation plays a vital role in Rabi cultivation because the winter months are naturally drier compared to the Monsoon season.

• The Minimum Support Price (MSP) for Rabi crops is usually announced by the Government of India before the sowing season to ensure fair returns for farmers.

Q5. Answer: (c) The fallopian tubes carry the egg from the ovary to the uterus.

The correct answer is The fallopian tubes carry the egg from the ovary to the uterus.

Key Points

• Fallopian Tubes (Oviducts) are a pair of tubes through which eggs travel from the ovaries to the uterus. They are approximately 10 to 12 cm long. The lining of these tubes contains cilia, which help propel the egg toward the uterus. Hence, statement 3 is correct.

• The cervix is the lower, narrow portion of the uterus that opens into the vagina. It acts as a gateway for sperm to enter the uterus and for menstrual blood to leave. It does not connect the ovaries to the uterus. Hence, statement 1 is incorrect.

• A girl is born with a fixed number of immature eggs (approximately 1 to 2 million oocytes) in her ovaries. These eggs do not start being produced at puberty; rather, they begin to mature and are released (ovulation) once puberty is reached. Hence, statement 2 is incorrect.

• The ovaries are the primary female reproductive organs that produce eggs (ova) and hormones. The uterus (womb) is the

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muscular organ where a fertilized egg implants and grows into a fetus during pregnancy. The uterus does not produce eggs. Hence, statement 4 is incorrect.

Additional Information

• Ovaries: These are almond-shaped glands located on each side of the pelvic cavity. They produce the female gametes and secrete hormones like estrogen and progesterone, which regulate the menstrual cycle and secondary sexual characteristics.

• Uterus (Womb): It is an inverted pear-shaped muscular organ. Its inner lining, the endometrium, thickens every month in preparation for a potential pregnancy. If fertilization does not occur, this lining is shed during menstruation.

• Vagina: Often called the birth canal, it is an elastic, muscular tube that connects the cervix to the external genitalia. It receives the penis during intercourse and serves as the exit route for a baby during childbirth.

• Fertilization: This biological process usually occurs in the ampulla (a specific region) of the fallopian tube. Once the sperm and egg fuse to form a zygote, it travels to the uterus for implantation.

Important Points

• Menarche: This term refers to the first occurrence of menstruation in a female, usually happening between the ages of 11 and 15. It signifies the onset of reproductive capability.

• Menopause: This is the stage in a woman's life, typically between the ages of 45 and 55, when menstrual cycles stop permanently and the ovaries cease to release eggs.

• Hormonal Regulation: The female reproductive system is strictly controlled by the pituitary gland hormones, namely Follicle-Stimulating Hormone (FSH) and Luteinizing Hormone (LH), which trigger the maturation and release of eggs.

• Gamete Facts: The human egg is one of the largest cells in the human body (about 0.1 mm), visible to the naked eye, whereas the sperm is one of the smallest.

Q6. Answer: (c) No fixed shape but fixed volume

The correct answer is No fixed shape but fixed volume.

Key Points

• Liquids are a state of matter characterized by their ability to flow and take the shape of the container they occupy, which means they have no fixed shape. Hence, statement 3 is the correct characteristic.

• Despite changing shape, a liquid maintains a fixed volume because its particles are close together and held by relatively strong intermolecular forces that prevent them from expanding to fill the entire space like a gas.

• The particles in a liquid have enough kinetic energy to move past one another, which accounts for the property of fluidity.

• Unlike gases, liquids are almost incompressible even under high pressure due to the minimal intermolecular spaces between the particles.

• When poured into a container, a liquid will fill the bottom part first and maintain a distinct surface level, unlike solids which retain their own shape or gases which occupy the entire volume.

Additional Information

• Solids:

• Matter in the solid state has both a fixed shape and a fixed volume.

• The particles are packed tightly in a regular lattice structure and can only vibrate about their fixed positions.

• They have the highest density and strongest intermolecular forces compared to liquids and gases.

• Gases:

• Matter in the gaseous state has no fixed shape and no fixed volume.

• The particles are far apart and move in random motion at high speeds, filling any available space.

• Gases are highly compressible and have very low density.

• Properties of Liquids:

• Viscosity: This refers to the resistance to flow. For instance, honey is more viscous than water.

• Surface Tension: The cohesive forces between molecules at the surface of a liquid cause it to behave like a stretched membrane.

• Boiling Point: The temperature at which a liquid turns into a gas at a given pressure.

Important Points

• Kinetic Molecular Theory: This theory explains that the physical state of matter is determined by the balance between the kinetic energy of the particles and the attractive forces between them.

• Diffusion: This is the process where particles move from a high concentration to a low concentration. Diffusion occurs in liquids but is much slower than in gases due to the density of the particles.

• Phase Change: A liquid can change into a solid through freezing (loss of energy) or into a gas through evaporation or boiling (gain of energy).

• Density: Generally, the density of a substance in its liquid state is slightly lower than in its solid state, with the notable anomaly of

water, which is most dense at 4°C.

Q7. Answer: (b) 20.0 m/s

The correct answer is 20.0 m/s.

Key Points

• The problem can be solved using the equations of motion under constant acceleration. Since the ball is dropped from rest, the initial velocity (u) is 0 m/s.

• The ball falls through a vertical distance (s) of 20 meters. This represents the displacement of the object.

• The acceleration (a) acting on the ball is the acceleration due to gravity (g), which is given as 10 m/s^2. Hence, the values for u, s, and g are established.

• The third equation of motion relates velocity, acceleration, and distance: v^2 = u^2 + 2as. Plugging in the known values, we get v^2 = 0^2 + 2(10)(20).

• Calculating the product, v^2 = 400. Taking the square root of 400, we find the final velocity (v) to be 20.0 m/s. Hence, the calculated velocity is 20.0 m/s.

Additional Information

• Equations of Motion:

• These equations were formulated by Sir Isaac Newton and describe the relationship between velocity, time, acceleration, and displacement for an object moving with uniform acceleration.

• The three primary equations are: v = u + at, s = ut + 1/2 at^2, and v^2 = u^2 + 2as.

• In this context, v is the final velocity, u is the initial velocity, a is the acceleration, t is the time, and s is the displacement.

• Acceleration due to Gravity:

• On Earth, the average value of g is approximately 9.8 m/s^2, but for simplicity in competitive exams and school calculations, it is often taken as 10 m/s^2.

• The value of g varies slightly depending on the location (latitude and altitude) on the Earth's surface.

• This acceleration is always directed downwards towards the center of the Earth.

• Free Fall Concept:

• A free-falling object is an object that is falling under the sole influence of gravity.

• In a vacuum, all objects fall at the same rate regardless of their mass, as demonstrated by Galileo Galilei.

Important Points

• Units and Dimensions: The SI unit for velocity is meters per second (m/s), and for acceleration, it is meters per second squared (m/s^2). It is essential to ensure units are consistent before applying formulas.

• Sign Convention: While solving physics problems, defining a direction as positive is crucial. If downward motion is considered positive, then both acceleration (g) and displacement (s) will be positive.

• Mass Independence: Note that the mass of the ball was not provided and is not required to calculate the final velocity in a free fall scenario, assuming air resistance is negligible.

• Kinematics Applications: These principles are used in various fields including engineering, ballistics, and aerospace to predict the motion of projectiles and falling bodies.

Q8. Answer: (b) Leaf margin

The correct answer is Leaf margin.

Key Points

• Bryophyllum (often called the air plant or miracle leaf) is a well-known example of a plant that undergoes vegetative propagation through its leaves.

• The leaf margins of Bryophyllum possess special notches where adventitious buds develop.

• These buds have the potential to grow into new plantlets while still attached to the parent leaf or after the leaf falls onto moist soil. Hence, the statement regarding leaf margins is correct.

• Once these plantlets touch the ground, they develop their own roots and grow into independent plants, allowing the species to spread rapidly without the need for seeds.

• This process is a form of asexual reproduction, meaning the new plants are genetically identical to the parent plant.

Additional Information

• Vegetative Propagation:

• It is a type of asexual reproduction in which new plants are produced from roots, stems, leaves, and buds. Since reproduction is through the vegetative parts of the plant, it is known as vegetative propagation.

• Plants produced by this method take less time to grow and bear flowers and fruits earlier than those produced from seeds.

• Propagation by Roots:

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• Certain plants like Sweet potato and Dahlia can give rise to new plants from their modified roots. Hence, statement 1 is incorrect in the context of Bryophyllum.

• Propagation by Stem:

• Many plants reproduce via underground stems. For example, Potato propagates through "eyes" (axillary buds on the tuber), and Ginger or Turmeric propagates through rhizomes.

• Cacti produce new plants when their parts (stems) get detached from the main plant body. Hence, statement 3 is incorrect for Bryophyllum.

• Propagation by Flowers:

• Flowers are generally the reproductive parts of a plant involved in sexual reproduction (producing seeds), rather than vegetative propagation. Hence, statement 4 is incorrect.

Important Points

• Natural Vegetative Propagules: These are units of vegetative propagation such as runners, rhizomes, suckers, tubers, offsets, and bulbs.

• Water Hyacinth: Often called the "Terror of Bengal," it propagates vegetatively at a phenomenal rate through offsets and can spread over a water body in a very short period.

• Agave: This plant utilizes bulbils (fleshy buds) for vegetative reproduction, which develop on the floral axis.

• Significance: This method is essential for plants that have lost the capacity to produce viable seeds, such as banana, orange, rose, and jasmine.

Q9. Answer: (d) It is energy stored due to position or condition.

The correct answer is It is energy stored due to position or condition.

Key Points

• Potential Energy is defined as the energy stored in an object because of its specific position, arrangement, or state. Unlike kinetic energy, it does not require the object to be in motion to exist. Hence, statement 4 is correct.

• Potential energy can be transformed into various other forms of energy, such as kinetic energy, thermal energy, or electrical energy. For instance, water stored at a height in a dam has potential energy that converts into kinetic energy as it falls. Hence, statement 1 is incorrect.

• It is not dependent on motion; rather, it is energy "at rest" or "stored." Kinetic energy is the form of energy that is strictly present only when an object is moving. Hence, statement 2 is incorrect.

• The magnitude of potential energy depends on the spatial configuration (like height or distance) or internal condition (like tension in a spring) of the object, not its velocity or speed. Hence, statement 3 is incorrect.

Additional Information

• Types of Potential Energy:

• Gravitational Potential Energy: This is the energy an object possesses due to its vertical position or height. The formula used to calculate it is PE = mgh, where m is mass, g is acceleration due to gravity (approx 9.8 m/s^2), and h is height.

• Elastic Potential Energy: This is energy stored as a result of deforming an elastic object, such as stretching a rubber band or compressing a spring.

• Chemical Potential Energy: This energy is stored within the chemical bonds of a substance. Examples include the energy found in food, batteries, and fuels like gasoline.

• SI Unit: The Standard International unit for measuring potential energy is the Joule (J), named after the English physicist James Prescott Joule.

• Work-Energy Theorem: In physics, work done on an object to change its position or configuration is stored as potential energy. For example, lifting a 10 kg weight to a height of 2 meters requires work that remains in the object as stored energy.

Important Points

• Conservation of Mechanical Energy: In an isolated system without friction or air resistance, the sum of Potential Energy and Kinetic Energy remains constant. This is a fundamental principle in classical mechanics.

• Reference Point: Potential energy is always measured relative to a zero-point or reference level, such as the ground or sea level. If the height is zero at the reference point, the gravitational potential energy is also zero.

• Real-world Applications:

• Hydropower: Dams use the gravitational potential energy of water to spin turbines.

• Archery: A drawn bow stores elastic potential energy which is released to propel the arrow.

• Construction: A pile driver uses potential energy by lifting a heavy weight to a high position before dropping it.

Q10. Answer: (a) Absorption of cell sap

The correct answer is Absorption of cell sap.

Key Points

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• Many insect pests such as aphids, jassids, whiteflies, and scale insects feed by sucking the cell sap from plants.
• Plant sap contains essential nutrients, sugars, minerals, and water required for plant growth.
• When insects absorb cell sap, they directly remove these nutrients from the plant.
• This results in stunted growth, yellowing of leaves, wilting, and reduced crop yield.
• Therefore, absorption of cell sap directly causes loss of nutrients in plants.

Additional Information

• Consumes only fallen leaves:
• Does not directly remove nutrients from living plants.
• Laying eggs on the plant:
• May damage the plant indirectly, but does not directly cause nutrient loss.
• Drilling into the soil:
• Some insects live in soil, but this activity does not directly remove nutrients from plant tissues.

Important Points

• Sucking pests: Aphids, Whiteflies, Jassids, Mealybugs.
• Chewing pests: Caterpillars, Grasshoppers, Beetles.
• Sucking insects damage plants by removing cell sap and may also transmit plant diseases.
• Loss of sap leads to reduced photosynthesis and lower crop productivity.

Q11. Answer: (b) Halve

The correct answer is Halve.

Key Points

• The relationship between force, mass, and acceleration is defined by Newton's Second Law of Motion, which states that the force acting on an object is equal to the product of its mass and its acceleration.
• The mathematical formula for this law is Force = Mass × Acceleration (F = m × a).
• In this specific case, the mass is stated to remain constant. Because of this, the force becomes directly proportional to the acceleration.
• If the acceleration is halved (multiplied by a factor of 0.5 or 1/2), the force must also be halved to keep the equation balanced.
• For example, if a body with a mass of 10 kg has an acceleration of 4 m/s², the force is 40 N. If the acceleration is reduced to 2 m/s² while the mass stays 10 kg, the force becomes 20 N, which is exactly half of the original force.

Additional Information

• Newton's Second Law of Motion:
• This law describes what happens to a massive body when acted upon by an external force. It provides a quantitative description of the changes that a force can produce on the motion of a body.
• It can also be stated as the rate of change of momentum of a body is directly proportional to the applied force and takes place in the direction of the force.
• SI Unit of Force:
• The SI unit of force is the Newton, symbolized by N.
• One Newton is equivalent to 1 kg·m/s², representing the force required to accelerate 1 kilogram of mass at a rate of 1 meter per second squared.
• Characteristics of Force:
• Force is a vector quantity, meaning it has both magnitude and direction.
• The dimensional formula for force is [$M^1L^1T^{-2}$].
• Common examples of forces include gravitational force, frictional force, and magnetic force.

Important Points

• Constant Mass: In classical mechanics, the mass of an object is generally considered constant unless the object is moving at speeds approaching the speed of light (where relativistic effects occur).
• Inertia: Newton's First Law (the Law of Inertia) states that an object will remain at rest or in uniform motion unless acted upon by an external force. Mass is a measure of this inertia.
• Direct Proportionality: The linear relationship between force and acceleration (when mass is constant) implies that if you double the acceleration, the force doubles; if you triple it, the force triples.
• History: These laws of motion were first compiled by Sir Isaac Newton in his work Philosophiae Naturalis Principia Mathematica, published in 1687.

Q12. Answer: (b) 0.1 s

The correct answer is 0.1 s.

Key Points

• The sensation of sound persists in our brain for about 0.1 seconds. This phenomenon is scientifically known as the persistence of hearing.

• To hear a distinct echo, the time interval between the original sound and the reflected sound must be at least 0.1 s.

• If the reflected sound arrives at the ear in less than 0.1 seconds, the human brain cannot distinguish it as a separate sound, and it instead blends with the original sound, often leading to reverberation.

• An echo is simply the repetition of sound caused by the reflection of sound waves from a hard surface such as a wall, mountain, or cliff.

• The minimum distance required to hear an echo depends on the speed of sound in the medium, which varies with temperature and humidity.

Additional Information

• Speed of Sound: The speed of sound in dry air at a temperature of 22°C is approximately 344 m/s. This value increases with an increase in temperature.

• Calculation of Minimum Distance:

• To find the minimum distance for an echo, we use the formula: Distance = (Speed × Time) / 2.

• Using the time interval of 0.1 s and speed of 344 m/s, the total distance traveled by sound (to the obstacle and back) is 34.4 meters.

• Therefore, the minimum distance between the source of sound and the obstacle must be half of that, which is 17.2 meters.

• Reverberation: When a sound is produced in a big hall, it persists by repeated reflection from the walls until it is reduced to a value where it is no longer audible. This prolonged sound is called reverberation.

• Acoustic Materials: To reduce unwanted echoes or reverberations in cinemas or concert halls, the ceilings and walls are usually covered with sound-absorbent materials like compressed fiberboard, rough plaster, or draperies.

Important Points

• Nature of Surface: For an echo to be clear, the reflecting surface must be large relative to the wavelength of the sound and should be rigid enough to reflect rather than absorb the energy.

• Multiple Echoes: Successive reflections of sound can result in multiple echoes. A classic example is the rolling of thunder, which is caused by the successive reflections of sound from several reflecting surfaces like clouds and land.

• Applications of Echo: The principle of echo is utilized in technologies such as SONAR (Sound Navigation and Ranging) to measure the depth of the sea or locate underwater objects, and in medical ultrasound imaging.

• Effect of Temperature: On a hotter day, the speed of sound is higher; therefore, the minimum distance required to hear an echo will also increase slightly compared to a cold day.

Q13. Answer: (a) -2

The correct answer is -2.

Key Points

• The magnification (m) produced by a lens is defined as the ratio of the image distance (v) to the object distance (u). The formula is expressed as m = v/u.

• According to the Cartesian sign convention, the object distance (u) is always taken as negative because the object is placed to the left of the lens. In this case, u = -30 cm.

• Since the image is formed on the other side of the convex lens (the right side), the image distance (v) is taken as positive. In this case, v = +60 cm.

• By substituting the values into the formula: m = 60 / (-30), we get m = -2. Hence, the calculation shows the magnification is -2.

• The negative sign in the magnification indicates that the image formed is real and inverted. Hence, the statement regarding the image being inverted is correct.

• The numerical value (magnitude) of 2 indicates that the image is magnified and is twice the size of the object. Hence, the statement regarding the magnification magnitude is correct.

Additional Information

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

• Convex Lens Characteristics: A convex lens is also known as a converging lens. It is thicker in the middle than at the edges. It can form both real and virtual images depending on the position of the object.

• Focal Length Calculation: Using the given values in the lens formula, 1/f = 1/60 - 1/(-30) = 1/60 + 2/60 = 3/60. Therefore, the focal length (f) of this lens is +20 cm.

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• Nature of Image: When an object is placed between F and 2F (between 20 cm and 40 cm in this case), the convex lens forms a real, inverted, and enlarged image beyond 2F. Since our object is at 30 cm, it perfectly fits this optical principle.

• Applications: Convex lenses are widely used in magnifying glasses, cameras, microscopes, and for correcting hypermetropia (farsightedness).

Important Points

• Magnification Sign: If m is positive, the image is virtual and erect. If m is negative, the image is real and inverted.

• Magnification Magnitude: If |m| > 1, the image is enlarged. If |m| < 1, the image is diminished. If |m| = 1, the image is the same size as the object.

• Difference from Mirrors: It is important to note that the magnification formula for spherical mirrors is m = -v/u, whereas for lenses, it is m = v/u. Distinguishing between these two is vital for solving physics numericals correctly.

• Date and Discovery: The principles of refraction and the lens maker's formula were significantly advanced in the 17th century by scientists like Johannes Kepler and later Carl Friedrich Gauss, who developed the Gaussian lens formula used in modern optics.

Q14. Answer: (d) Lower resistance

The correct answer is Lower resistance.

Key Points

• Electrical power consumption is governed by the relationship between Voltage (V), Current (I), and Resistance (R). When a component is connected to a constant voltage source, the power consumed (P) is calculated using the formula P = V^2 / R.

• According to this formula, Power is inversely proportional to Resistance. This means that as the resistance of the circuit decreases, the power dissipated or consumed by the circuit increases significantly. Hence, the combination with lower resistance will consume more power.

• In a circuit with Lower resistance, the Current flowing through the circuit increases because I = V / R (Ohm's Law). Since Power (P) is also equal to V x I, a higher current at a fixed voltage results in higher power consumption.

• If the resistance were Higher, the current flow would be restricted, leading to a decrease in the total power consumed. Hence, option 1 is incorrect.

• Equal resistance implies no change in the power draw compared to the reference state. Hence, option 2 is incorrect.

• While Zero resistance (superconductivity or a short circuit) theoretically leads to infinite power consumption in an ideal voltage source, in practical physics and standard electrical appliance contexts, Lower resistance is the identified condition for higher power draw in functioning circuits. Hence, option 3 is not the standard practical answer.

Additional Information

• Ohm's Law: Discovered by Georg Simon Ohm in 1827, it states that the current through a conductor between two points is directly proportional to the voltage across the two points and inversely proportional to the resistance.

• Unit of Power: The S.I. unit of electrical power is the Watt (W), named after James Watt. One Watt is defined as the consumption of 1 Joule of energy per 1 second.

• Factors affecting Resistance: The resistance of a wire depends on its Length (direct proportion), Cross-sectional area (inverse proportion), Nature of material (Resistivity), and Temperature.

• Parallel and Series Connections: In a Parallel connection, the total effective resistance decreases, which is why household appliances (connected in parallel) draw more total power as more devices are turned on. In a Series connection, the total resistance increases, reducing the total current and power for a fixed voltage source.

• Practical Example: A 100W bulb has lower resistance than a 60W bulb when designed for the same voltage (e.g., 220V). This lower resistance allows more current to flow, resulting in more light and heat energy production.

Important Points

• Joule's Law of Heating: It states that the heat produced in a resistor is directly proportional to the square of the current (I^2), the resistance (R), and the time (t) for which the current flows (H = I^2Rt).

• Electric Energy: It is the product of power and time, usually measured in Kilowatt-hours (kWh) for commercial purposes, where 1 kWh = 3.6 x 10^6 Joules.

• Safety Considerations: Excessively lower resistance in a circuit can lead to an Overload or a Short Circuit, causing the wires to overheat and potentially start a fire. This is why Fuses or Circuit Breakers are installed to break the circuit when current exceeds safe limits.

• Variable Power: If the Current was kept constant instead of the voltage, then power (P = I^2R) would be directly proportional to resistance, meaning higher resistance would consume more power. However, standard power supplies (like wall outlets) provide a Constant Voltage.

Q15. Answer: (a) Iron dissolves and copper deposits on the nail.

The correct answer is Iron dissolves and copper deposits on the nail.

Key Points

• When an iron nail is placed in a copper sulphate (CuSO4) solution, a single displacement reaction occurs because iron is more

reactive than copper.

• In this chemical process, the iron atoms lose electrons and displace the copper ions from the aqueous solution. The chemical equation for the reaction is: Fe (s) + CuSO4 (aq) → FeSO4 (aq) + Cu (s).

• During the reaction, iron dissolves into the solution as ferrous sulphate (FeSO4), which causes the initial deep blue color of the solution to gradually fade and turn light green. Hence, the statement that iron dissolves is correct.

• Simultaneously, the copper metal that is displaced from the solution gets deposited on the surface of the iron nail.

• This deposit appears as a reddish-brown or coppery coating on the submerged part of the nail. Hence, the statement that copper deposits on the nail is correct.

• Hence, the correct answer is Iron dissolves and copper deposits on the nail.

Additional Information

• Reactivity Series:

• The reactivity series is a list of metals arranged in the order of their decreasing chemical reactivity. In this series, Iron (Fe) is placed above Copper (Cu), indicating that iron is more electropositive and can easily displace copper from its salts.

• Metals like Potassium (K) and Sodium (Na) are at the top (most reactive), while Gold (Au) and Platinum (Pt) are at the bottom (least reactive).

• Displacement Reaction:

• A displacement reaction is a type of reaction where a more reactive element pushes out a less reactive element from its compound.

• This specific reaction is also a Redox reaction (Reduction-Oxidation). The Iron is oxidized (loses electrons: Fe → Fe^(2+) + 2e^-) and the Copper ions are reduced (gain electrons: Cu^(2+) + 2e^- → Cu).

• Visual Observations:

• The blue color of copper sulphate is due to the presence of Cu^(2+) ions. As these ions are converted to solid copper, the blue color disappears.

• The light green color that appears afterward is due to the formation of Fe^(2+) ions in the form of Ferrous Sulphate.

Important Points

• Nature of the reactants: Copper sulphate pentahydrate (CuSO4·5H2O) is commonly known as Blue Vitriol.

• No Reaction Scenario: If a copper wire were placed in an iron sulphate solution, no reaction would occur because copper is less reactive than iron and cannot displace it.

• Time Factor: The reaction is not instantaneous; it typically takes 15 to 30 minutes for the visible color change and the brown deposit to become prominent.

• Valency: In this reaction, iron exhibits a valency of +2, forming iron(II) sulphate rather than iron(III) sulphate.

Q16. Answer: (b) it is a heterogeneous mixture

The correct answer is it is a heterogeneous mixture.

Key Points

• A colloidal solution is technically a heterogeneous mixture even though it often appears homogeneous to the naked eye. This is because the particles are not truly dissolved but are dispersed throughout the medium. Hence, the correct answer is it is a heterogeneous mixture.

• The particle size in a colloid typically ranges from 1 nanometer to 1000 nanometers. These particles are larger than those in a true solution but smaller than those in a suspension.

• One of the most distinct features of a colloid is the Tyndall Effect, which is the scattering of a beam of light by the dispersed particles, making the path of light visible.

• Colloidal particles do not settle down when left undisturbed for a long period, which indicates that the mixture is relatively stable compared to a suspension.

• While a colloid cannot be separated by simple filtration using ordinary filter paper, it can be separated using a process called centrifugation or by using specialized ultrafilters.

Additional Information

• Components of a Colloid:

• Dispersed Phase: This refers to the substance that is distributed in the form of colloidal particles (similar to a solute).

• Dispersion Medium: This is the continuous medium in which the particles are distributed (similar to a solvent).

• Brownian Motion: Colloidal particles exhibit a continuous, random, zig-zag motion known as Brownian motion. This kinetic energy helps prevent the particles from settling due to gravity.

• Types of Colloids:

• Aerosol: Solid or liquid dispersed in gas (e.g., fog, smoke, clouds).

• Emulsion: Liquid dispersed in liquid (e.g., milk, butter, face cream).

• Sol: Solid dispersed in liquid (e.g., gold sol, muddy water, blood).

• Gel: Liquid dispersed in solid (e.g., jelly, cheese, boot polish).

• Ideal Solutions and Azeotropes:

• An Ideal Solution is a homogeneous mixture that obeys Raoult's Law at all concentrations and temperatures.

• An Azeotrope is a liquid mixture that has a constant boiling point and the same composition in both the liquid and vapor phases during distillation.

Important Points

• Mixture Classification: Mixtures are broadly classified into homogeneous and heterogeneous. A true solution (like sugar in water) is homogeneous, meaning its composition is uniform throughout. Hence, statement 1 is incorrect.

• Colloid Stability: The stability of a colloid is often maintained by electrostatic forces. Most colloidal particles carry a charge (either positive or negative), which causes them to repel each other and prevents aggregation.

• Electrophoresis: This is a technique used to demonstrate the presence of charges on colloidal particles by observing their movement toward oppositely charged electrodes under an electric field.

• Dialysis: This is a common purification method for colloids, used to remove electrolytes or crystalloids from a colloidal solution using a semi-permeable membrane.

Q17. Answer: (a) Simple squamous epithelium

The correct answer is Simple squamous epithelium.

Key Points

• Simple squamous epithelium consists of a single layer of thin, flattened cells with irregular boundaries. These cells look like scales or floor tiles when viewed from above, which is why it is also known as pavement epithelium.

• In the respiratory system, this tissue forms the walls of the alveoli (tiny air sacs in the lungs). Its extreme thinness is a critical feature that facilitates the rapid exchange of gases through diffusion.

• The primary function of simple squamous epithelium is to provide a semi-permeable membrane for the passage of small molecules. This is essential for oxygen to move from the air into the blood capillaries and for carbon dioxide to move from the blood into the lungs to be exhaled. Hence, statement 1 is correct.

• Apart from the lungs, this tissue is also found lining the blood vessels (where it is specifically called endothelium), the lymphatic vessels, and the heart.

• The nucleus of these cells is typically oval or spherical and is located in the center of the cell, often creating a slight bulge due to the cell's overall thinness.

Additional Information

• Stratified Squamous Epithelium:

• Unlike simple epithelium, this consists of multiple layers of cells. Its main function is protection against mechanical and chemical wear and tear.

• It is found in the skin (epidermis), mouth, esophagus, and vagina. The outermost layers may be keratinized (as in the skin) to prevent water loss and provide extra durability.

• Ciliated Columnar Epithelium:

• These are tall, pillar-like cells that possess cilia (fine hair-like protoplasmic outgrowths) on their free surface.

• They are found in the respiratory tract (bronchioles) and fallopian tubes. Their function is to move particles or mucus in a specific direction across the epithelial surface.

• Cuboidal Epithelium:

• As the name suggests, these cells are cube-like in shape. They are commonly found in the ducts of glands and tubular parts of nephrons in the kidneys.

• The main functions of cuboidal epithelium are secretion and absorption. In the proximal convoluted tubule (PCT) of the kidney, these cells often have microvilli to increase the surface area for absorption.

Important Points

• The Blood-Air Barrier: The diffusion membrane in the lungs is composed of three layers: the thin squamous epithelium of alveoli, the endothelium of alveolar capillaries, and the basement substance between them. Its total thickness is much less than a millimetre (approx 0.5 micrometres), optimizing gas exchange.

• Epithelial Tissue Classification: Animal tissues are classified into four main types: Epithelial, Connective, Muscular, and Neural. Epithelium is further divided based on cell shape (squamous, cuboidal, columnar) and layering (simple or stratified).

• Cell Junctions: Most epithelial cells are held together with little intercellular material by specialized junctions like tight junctions (prevent leaking), adhering junctions (cementing), and gap junctions (communication).

Q18. Answer: (b) They never intersect each other.

The correct answer is They never intersect each other.

Key Points

• Magnetic field lines are imaginary lines used to represent the direction and magnitude of a magnetic field at any given point in space. These lines provide a visual map of the magnetic force exerted by a magnet or a current-carrying conductor.

• A fundamental property of these lines is that they never intersect each other. If two lines were to cross at a single point, it would imply that a magnetic compass placed at that intersection would point in two different directions simultaneously, which is physically impossible. Hence, statement 2 is correct.

• Regarding the first statement, magnetic field lines cannot intersect at the poles or anywhere else. While they are very dense near the poles, indicating a stronger magnetic field strength, they remain distinct and parallel at an infinitesimal scale. Hence, statement 1 is incorrect.

• Magnetic field lines do not form random curves; instead, they form continuous closed loops. Outside a magnet, they travel from the North Pole to the South Pole, and inside the magnet, they travel from the South Pole to the North Pole. Hence, statement 3 is incorrect.

• The lines originate from the North Pole and terminate at the South Pole in the external environment. They do not start from the South Pole externally. Hence, statement 4 is incorrect.

• The tangent drawn at any point on a magnetic field line indicates the direction of the magnetic field (B) at that specific location.

Additional Information

• Magnetic Flux Density: This refers to the number of magnetic field lines passing through a unit area. It is measured in Tesla (T) in the SI system or Gauss in the CGS system. Higher density near the poles signifies a stronger magnetic force.

• Discovery and Theory: The concept of field lines was introduced by Michael Faraday in the 19th century to explain electromagnetic induction. His work laid the foundation for James Clerk Maxwell's equations.

• Earth's Magnetic Field: The Earth behaves like a giant bar magnet. Its magnetic North Pole is actually located near the geographic South Pole, and vice versa. This allows a magnetic compass to align itself along the North-South axis.

• Uniform vs. Non-Uniform Fields: In a uniform magnetic field, such as inside a long solenoid, the field lines are parallel and equidistant. In a non-uniform field, like that of a spherical magnet, the lines are curved and vary in spacing.

• Solenoids and Electromagnets: When an electric current flows through a wire, it generates a magnetic field. In a solenoid, the field lines are similar to those of a bar magnet, showing the link between electricity and magnetism.

Important Points

• Nature of Loops: Unlike electric field lines (which start on positive charges and end on negative charges and do not form loops), magnetic field lines are always continuous loops because magnetic monopoles (isolated North or South poles) do not exist in nature.

• Relative Strength: The closeness of the field lines is a measure of the relative strength of the magnetic field. Where the lines are crowded, the field is strong; where they are spread out, the field is weak.

• Force on Moving Charges: A magnetic field exerts a force on a moving charge according to Lorentz Law. The force is always perpendicular to the direction of the magnetic field lines.

• Permeability: The ability of a material to allow magnetic field lines to pass through it is called magnetic permeability. Materials like iron have high permeability and concentrate the field lines.

Q19. Answer: (a) p – ii, q – i, r – iv, s - iii

The correct answer is p – ii, q – i, r – iv, s - iii.

Key Points

• Sepals and Petals (p - ii): These are known as the Accessory parts or non-essential whorls of a flower. While they do not directly participate in the process of gamete formation, they play a crucial role in protecting the flower in the bud stage (sepals) and attracting pollinators like insects and birds through bright colors and scents (petals). Hence, match p - ii is correct.

• Stamen and Pistil (q - i): These are the Reproductive parts or essential whorls of a flower. The Stamen represents the male reproductive organ (androecium), while the Pistil (or carpel) represents the female reproductive organ (gynoecium). They are responsible for producing microspores and megaspores respectively. Hence, match q - i is correct.

• Stigma (r - iv): The Stigma is the specialized uppermost part of the Pistil. Its primary function is to serve as a receptive landing platform for pollen grains during the process of pollination. It is often sticky or hairy to ensure pollen adherence. Hence, match r - iv is correct.

• Pollen Grain (s - iii): Pollen grains are the male gametophytes of seed plants. they are produced within the anther, which is the pollen-bearing part of the Stamen. Each pollen grain contains the male gametes necessary for fertilization. Hence, match s - iii is correct.

• Therefore, the correct matching sequence is p – ii, q – i, r – iv, s - iii.

Additional Information

• Structure of the Stamen:

• The Stamen consists of two main parts: a long, slender stalk called the Filament and a typically bilobed structure at the tip called the Anther.

• Inside the Anther, pollen sacs (microsporangia) produce Pollen grains through the process of meiosis.

• Structure of the Pistil:

• A Pistil (or Carpel) is composed of three distinct regions: the Stigma (receptive tip), the Style (elongated tube), and the Ovary (basal swollen part).

• The Ovary contains Ovules, which develop into seeds after successful fertilization.

• Classification of Flowers:

• Bisexual Flowers: These contain both Stamen and Pistil within the same flower (e.g., Hibiscus, Mustard).

• Unisexual Flowers: These contain either only Stamen or only Pistil (e.g., Papaya, Watermelon).

Important Points

• Pollination: It is the transfer of pollen grains from the Anther of a stamen to the Stigma of a pistil. This can occur via wind, water, or biotic agents like bees and butterflies.

• Fertilization: Once the pollen grain germinates on the Stigma, a pollen tube grows down the Style to reach the Ovary, allowing the male gamete to fuse with the female gamete (egg) inside the Ovule.

• Calyx and Corolla: The collection of all Sepals is termed the Calyx, and the collection of all Petals is called the Corolla. These form the outer layers of a typical flower structure.

Q20. Answer: (d) VIBGYOR

The correct answer is VIBGYOR.

Key Points

• When a beam of white light passes through a glass prism, it is split into its constituent colors. This phenomenon is known as the dispersion of light.

• In a standard orientation (base down), the light refracts twice: once when entering the prism and once when exiting. Because different colors have different wavelengths, they bend at different angles.

• The sequence of colors observed on the screen, from the bottom (most deviated) to the top (least deviated), is Violet, Indigo, Blue, Green, Yellow, Orange, and Red, represented by the acronym VIBGYOR.

• Violet light has the shortest wavelength and travels slowest in the glass medium, causing it to deviate the maximum amount.

• Red light has the longest wavelength and travels the fastest among the visible spectrum in glass, causing it to deviate the minimum amount.

Additional Information

• Sir Isaac Newton was the first to use a glass prism to obtain the spectrum of sunlight in the year 1666. He demonstrated that white light is composed of seven colors.

• Wavelength and Refraction: The refractive index of a medium depends on the wavelength of light. According to Cauchy's equation, the refractive index decreases as the wavelength increases. This is why Red (approx. 700 nm) bends less than Violet (approx. 400 nm).

• Visible Spectrum: The range of wavelengths visible to the human eye is roughly between 400 nanometers and 700 nanometers.

• Natural Phenomenon: A rainbow is a natural spectrum appearing in the sky after rain, caused by the dispersion of sunlight by tiny water droplets, which act like small prisms.

• Monochromatic vs. Polychromatic Light: Light consisting of only one wavelength is called monochromatic (like a laser), while light consisting of many wavelengths (like sunlight) is polychromatic.

Important Points

• Angle of Deviation: The angle between the incident ray and the emergent ray is called the angle of deviation. For a prism, this angle is highest for Violet and lowest for Red.

• Speed of Light in Medium: While all colors of light travel at the same speed (3 x 10^8 m/s) in a vacuum, their speeds differ when they enter a medium like glass or water.

• Recombination of Spectrum: Newton also showed that if a second identical prism is placed in an inverted position with respect to the first, the colors of the spectrum recombine to form white light again.

• Refractive Index: The ratio of the speed of light in a vacuum to the speed of light in a medium is the refractive index. Since speed varies with color in glass, the refractive index is higher for violet light than for red light.

Q21. Answer: (a) Each successive member differs by -CH2- group.

The correct answer is Each successive member differs by -CH2- group.

Key Points

• A homologous series is a sequence of organic compounds with the same functional group and similar chemical properties in which the members of the series can be represented by a general formula.

• Each successive member of a homologous series differs from the preceding one by a -CH2- unit (known as a methylene group). Hence, statement 1 is correct.

• Because each member differs by a -CH2- group, the molecular mass of each successive member increases by 14 units (where Carbon is 12 u and two Hydrogen atoms are 2 u). Hence, statement 3 is incorrect.

• All members of a homologous series possess the same functional group, which determines their chemical reactivity and properties. For instance, all alkanes contain only single bonds, while all alcohols contain the -OH group. Hence, statement 2 is incorrect.

• While chemical properties remain similar, physical properties like boiling point, melting point, and solubility show a regular gradation as the molecular mass increases. Generally, the boiling point increases with the addition of more carbon atoms due to stronger intermolecular forces. Hence, statement 4 is incorrect.

Additional Information

• Alkanes:

• The general formula for alkanes is CnH2n+2.

• Examples include Methane (CH4), Ethane (C2H6), and Propane (C3H8).

• In this series, Ethane differs from Methane by -CH2-, and Propane differs from Ethane by -CH2-.

• Alkenes and Alkynes:

• Alkenes follow the general formula CnH2n and contain at least one double bond.

• Alkynes follow the general formula CnH2n-2 and contain at least one triple bond.

• Like alkanes, successive members of these series also differ by the methylene group.

• Physical State Gradation:

• As the carbon chain length increases in a homologous series, the physical state of the compounds often changes. For example, the first four alkanes (C1 to C4) are gases at room temperature, while those from C5 to C17 are liquids, and higher members are solids.

• The density of the compounds also tends to increase systematically with the molecular weight.

• Chemical Preparation:

• All members of a homologous series can generally be prepared by similar chemical methods known as general methods of preparation.

• Their chemical reactions are largely identical because the functional group remains the same throughout the series.

Important Points

• The concept of homologous series was first proposed to simplify the study of organic chemistry by grouping millions of compounds into a few families.

• A methylene unit (-CH2-) has a mass of exactly 14.027 atomic mass units.

• In homologous series involving branched chains, the isomers may show variations in physical properties, but the general formula and functional group rules still apply to the primary series.

• Common series include Alcohols (CnH2n+1OH), Carboxylic Acids (CnH2n+1COOH), and Aldehydes (CnH2n+1CHO).

Q22. Answer: (c) Cyclohexane

The correct answer is Cyclohexane.

Key Points

• Cyclohexane is a cyclic hydrocarbon with the chemical formula C6H12. It consists of six carbon atoms arranged in a ring structure, with each carbon atom attached to two hydrogen atoms. Hence, the option Cyclohexane is correct.

• Methane is the simplest alkane with the formula CH4. It is an acyclic (open-chain) hydrocarbon consisting of one carbon atom bonded to four hydrogen atoms. Hence, the option Methane is incorrect.

• Butane is an alkane with the formula C4H10. It exists as a straight-chain or branched-chain molecule and does not form a ring. Hence, the option Butane is incorrect.

• Ethene (also known as ethylene) is an unsaturated hydrocarbon with the formula C2H4. It contains a carbon-carbon double bond and is a linear (acyclic) molecule. Hence, the option Ethene is incorrect.

• Cyclic hydrocarbons are organic compounds where the carbon atoms are linked to form one or more closed rings. These can be saturated (cycloalkanes) or unsaturated (cycloalkenes or aromatics).

Additional Information

• Types of Hydrocarbons:

• Aliphatic Hydrocarbons: These are open-chain compounds. They include alkanes (saturated), alkenes (double bond), and alkynes (triple bond).

• Alicyclic Hydrocarbons: These are cyclic but behave like aliphatic compounds. Cyclohexane and cyclopentane are primary examples.

• Aromatic Hydrocarbons: These contain at least one benzene ring (a six-carbon ring with alternating double bonds). Benzene (C6H6) is the most common aromatic compound.

• Properties of Cyclohexane:

• It is a colorless, flammable liquid with a distinctive detergent-like odor.

• It is primarily produced by the hydrogenation of benzene in the presence of a nickel or platinum catalyst.

• It is widely used as a non-polar solvent in the chemical industry and as an intermediate in the production of nylon 6 and nylon 6,6.

• General Formulas:

• Alkanes: CnH2n+2

• Alkenes: CnH2n

• Cycloalkanes: CnH2n (Note that they have the same general formula as alkenes but different structures).

Important Points

• Methane (CH4): It is a major component of natural gas and is a potent greenhouse gas. It is often referred to as marsh gas.

• Butane (C4H10): It is highly flammable and is commonly used as a fuel in LPG (Liquefied Petroleum Gas) cylinders and cigarette lighters.

• Ethene (C2H4): It is a plant hormone used commercially for the artificial ripening of fruits and in the production of polyethylene plastic.

• Stability of Cyclohexane: Unlike smaller rings like cyclopropane, cyclohexane is very stable because it can adopt chair and boat conformations to minimize ring strain and torsional strain. The chair conformation is the most stable form.

• Historical Context: Cyclohexane was first synthesized by Marcellin Berthelot in 1867 by reducing benzene with hydroiodic acid at high temperatures.

Q23. Answer: (b) It is always the same as average speed.

The correct answer is It is always the same as average speed.

Key Points

• Average velocity is defined as the total displacement divided by the total time taken for the motion. Unlike speed, it accounts for the change in position from the starting point to the ending point in a specific direction. Hence, the statement that it is the total displacement divided by total time is correct.

• Velocity is a vector quantity, which means it possesses both magnitude and direction. Any change in the direction of motion, even if the speed remains constant, results in a change in velocity. Hence, the statement that it depends on the direction of motion is correct.

• The Standard International (SI) unit for measuring both speed and velocity is meters per second (m/s). Other units like km/h or miles/hour can be used, but m/s is the scientific standard. Hence, the statement that it is measured in m/s is correct.

• Average speed is the total distance traveled divided by time, while average velocity is displacement divided by time. Since distance is a scalar and displacement is a vector, the magnitude of average velocity is only equal to average speed when an object moves in a straight line without changing its direction. In all other cases, such as circular or zigzag paths, average speed is greater than the magnitude of average velocity. Hence, the statement that it is always the same as average speed is incorrect.

Additional Information

• Scalar vs. Vector: Speed is a scalar quantity as it only describes how fast an object is moving (magnitude). Velocity is a vector quantity because it specifies the rate of change of position along with the direction of movement.

• Distance vs. Displacement: Distance is the actual length of the path covered by an object, regardless of direction. Displacement is the shortest straight-line distance between the initial and final positions of the object.

• Zero Average Velocity: A unique characteristic of average velocity is that it can be zero even if the object has been in motion. For example, if a runner completes one full lap on a circular track and returns to the starting point, the total displacement is zero, making the average velocity 0 m/s, whereas the average speed would be a positive value.

• Dimensional Formula: The dimensional representation for average velocity is [M^0 L¹ T^-¹], signifying that it is independent of mass but dependent on length (L) and inverse time (T^-¹).

Important Points

• Mathematical Formula: The formula for average velocity is expressed as v_avg = Δx / Δt, where Δx is the change in position (displacement) and Δt is the time interval.

• Instantaneous Velocity: While average velocity looks at the displacement over a finite time interval, instantaneous velocity refers to the velocity of an object at a specific moment in time (as Δt approaches zero).

• Directional Influence: If an object moves 10 meters North and then 10 meters South in 10 seconds, its total distance is 20 meters (Speed = 2 m/s), but its total displacement is 0 meters (Average Velocity = 0 m/s). This highlight why direction is critical for velocity calculations.

• Uniform Motion: In uniform rectilinear motion (moving in a straight line at a constant speed), the magnitude of average velocity

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and average speed are identical. However, the word "always" makes the original statement scientifically false for general motion.

Q24. Answer: (b) they are large and contain pigments

The correct answer is they are large and contain pigments.

Key Points

• Plastids are double-membrane-bound organelles found in all plant cells and in euglenoids.

• They are easily observed under the microscope because they are large in size and contain specific pigments that make them stand out against the cytoplasm without the immediate need for complex staining. Hence, the correct answer is they are large and contain pigments.

• These organelles bear specific pigments, thus imparting specific colors to the plants, such as the green of leaves or the bright colors of flowers and fruits.

• Depending on the type of pigments they contain, plastids can be classified into three main types: Chloroplasts, Chromoplasts, and Leucoplasts.

• Chloroplasts contain chlorophyll and carotenoid pigments which are responsible for trapping light energy essential for photosynthesis.

• Chromoplasts contain fat-soluble carotenoid pigments like carotene and xanthophylls, which provide yellow, orange, or red colors to plant parts.

Additional Information

• Leucoplasts:

• These are colourless plastids of varied shapes and sizes that function primarily in the storage of nutrients.

• They include Amyloplasts, which store carbohydrates (starch), such as in potato; Elaioplasts, which store oils and fats; and Aleuroplasts, which store proteins.

• Structure of Chloroplasts:

• The majority of chloroplasts are found in the mesophyll cells of leaves. They are typically lens-shaped, oval, spherical, or discoid.

• Their dimensions usually range from 5-10µm in length and 2-4µm in width.

• The space limited by the inner membrane of the chloroplast is called the stroma, which contains a number of organized flattened membranous sacs called thylakoids.

• Semi-autonomous Nature:

• Plastids are considered semi-autonomous organelles because they possess their own extranuclear DNA and ribosomes.

• The ribosomes of the chloroplasts are smaller (70S) than the cytoplasmic ribosomes (80S).

• This enables them to synthesize some of their own proteins and replicate independently of the nucleus.

Important Points

• Pigment Function: The presence of chlorophyll in chloroplasts is what allows plants to perform autotrophic nutrition by converting solar energy into chemical energy.

• Microscopic Visibility: While other organelles like mitochondria require specific stains (like Janus Green) to be clearly seen under a light microscope due to their smaller size, the pigmented plastids are visible due to their natural chromatic properties and volume.

• Evolutionary Origin: According to the endosymbiotic theory, plastids are believed to have originated from cyanobacteria that entered into a symbiotic relationship with early eukaryotic cells.

Q25. Answer: (d) Apical meristem

The correct answer is Apical meristem.

Key Points

• Apical meristem is a type of meristematic tissue located at the growing tips of stems and roots of plants.

• It is primarily responsible for the increase in the length of the plant, a process known as primary growth.

• The shoot apical meristem (SAM) is found at the shoot tip and gives rise to organs like leaves and flowers through rapid cell division. Hence, the botanist's observation of growth at the shoot tip points to this tissue.

• The root apical meristem (RAM) is located at the root tip and provides the cells necessary for the root to extend deeper into the soil.

• These tissues consist of undifferentiated cells that continue to divide throughout the life of the plant, ensuring constant vertical expansion.

Additional Information

• Lateral Meristem:

• This tissue is found on the lateral sides of the stems and roots.

• It is responsible for secondary growth, which increases the thickness or girth of the plant.

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• Common examples include the vascular cambium and cork cambium, which are vital for woody plants.

• Intercalary Meristem:

• This is located at the base of leaves or internodes (the regions between nodes).

• It is particularly prominent in monocots like grasses, allowing them to regenerate quickly after being eaten by herbivores.

• Permanent Tissue:

• These are cells that have matured and lost the ability to divide.

• They have a fixed shape and size and perform specialized functions like protection, support, or conduction.

• Examples include parenchyma, xylem, and phloem.

Important Points

• Cellular Characteristics: Meristematic cells are characterized by thin cellulose walls, dense cytoplasm, and large prominent nuclei.

• Absence of Vacuoles: Unlike mature plant cells, meristematic cells usually lack vacuoles because they are in a state of continuous metabolic activity and division.

• Differentiation: The process by which meristematic cells take up a permanent shape, size, and function is called differentiation, leading to the formation of permanent tissues.

• Discovery: The term "meristem" was coined by Karl Wilhelm von Nägeli in 1858, derived from the Greek word 'meristos', meaning divisible.

Q26. Answer: (b) 4625

Shortcut Trick

For a hollow cylindrical tube open at both ends:

Total Surface Area (TSA) = $2\pi(R + r)(h + R - r)$

Given: External radius (R) = 6 cm, Internal radius (r) = 5.6 cm, Height (h) = 63 cm.

=> TSA = $2 \times (22/7) \times 11.6 \times (63 + 0.4) = 2 \times (22/7) \times 11.6 \times 63.4 \approx 4622.77$ cm².

Rounding off to the nearest multiple of 5, we get 4625 cm².

Therefore The correct answer is 4625 cm².

Alternate Method

Given:

External Diameter = 12 cm => External Radius (R) = 12 ÷ 2 = 6 cm

Thickness (t) = 0.4 cm

Internal Radius (r) = R − t = 6 − 0.4 = 5.6 cm

Length (h) = 63 cm

Formula Used:

Total Surface Area (TSA) of a hollow cylinder = Outer CSA + Inner CSA + 2 × Base Area

=> TSA = $2\pi Rh + 2\pi rh + 2\pi(R^2 - r^2)$

Calculations:

=> TSA = $2\pi[Rh + rh + (R + r)(R - r)]$

=> TSA = $2 \times (22/7) \times [(6 \times 63) + (5.6 \times 63) + (6 + 5.6)(6 - 5.6)]$

=> TSA = $(44/7) \times [378 + 352.8 + (11.6 \times 0.4)]$

=> TSA = $(44/7) \times [730.8 + 4.64]$

=> TSA = $(44/7) \times 735.44$

=> TSA = $44 \times 105.0628...$

=> TSA ≈ 4622.76 cm²

=> Rounding to the nearest multiple of 5: 4622.76 is between 4620 and 4625.

=> Distance to 4620 = 2.76, Distance to 4625 = 2.24.

Therefore The correct answer is 4625 cm².

Additional Information

Volume of Hollow Cylinder

The volume represents the material used and is given by $V = \pi(R^2 - r^2)h$.

Curved Surface Area (CSA)

For a hollow cylinder, the total CSA is the sum of the external and internal areas: $CSA = 2\pi h(R + r)$.

Base Area of Ring

The area of the circular cross-section (ring) is given by $A = \pi(R^2 - r^2)$.

Q27. Answer: (a) 3

Shortcut Trick

Total distance = 390 + 390 = 780 m

Total time = 65 + 195 = 260 sec

Average speed = 780 ÷ 260 = 3 m/sec

Therefore The correct answer is 3 m/sec.

Alternate Method

Given:

=> Distance of first lap = 390 m

=> Time for first lap = 65 sec

=> Distance of second lap = 390 m

=> Time for second lap = 195 sec

Formula Used:

=> Average Speed = Total Distance ÷ Total Time

Calculations:

=> Total Distance = 390 + 390 = 780 m

=> Total Time = 65 + 195 = 260 sec

=> Average Speed = 780 ÷ 260

=> Average Speed = 3 m/sec

Therefore The correct answer is 3 m/sec.

Additional Information

Average Speed for Equal Distances

When a body travels equal distances with different speeds u and v, the average speed is given by the harmonic mean: 2uv ÷ (u + v).

Speed-Time-Distance Basics

Speed is directly proportional to distance when time is constant, and inversely proportional to time when distance is constant.

Q28. Answer: (d) 7.5 hours

Shortcut Trick

Net time for filling = (Filling Time × Emptying Time) ÷ (Emptying Time − Filling Time)

Time = (3 × 5) ÷ (5 − 3)

Time = 15 ÷ 2 = 7.5 hr

Therefore The correct answer is 7.5 hr.

Alternate Method

Component

Time (hr)

Total Work (LCM)

Efficiency

Filling Tap

3

15 Units

+5

Emptying Hole

5

−3

Calculations:

=> Net Efficiency when both are open = 5 − 3 = 2 units/hr

=> Total Time taken to fill = Total Work ÷ Net Efficiency

=> Time = 15 ÷ 2

=> Time = 7.5 hr

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Therefore The correct answer is 7.5 hr.

Additional Information

Pipes and Cisterns Concept

Filling pipes have positive efficiency, while outlet pipes (leaks) have negative efficiency. Total capacity is the LCM of individual times.

Combined Rate Formula

If pipe A fills in x hours and pipe B empties in y hours (where y > x), then the net rate is (1/x − 1/y) per hour.

Q29. Answer: (b) 21 years

Shortcut Trick

Let Emma's age be 1 unit.

Sarah's age = 2 units + 5 years.

Sum: 3 units + 5 = 29 => 3 units = 24 => 1 unit = 8 years.

Sarah's age = (2 × 8) + 5 = 21 years.

Therefore The correct answer is 21 years.

Alternate Method

Given:

Sum of Sarah and Emma's ages = 29 years.

Sarah's age is 5 years more than twice Emma's age.

Let Emma's age = x years.

Then, Sarah's age = 2x + 5.

=> x + (2x + 5) = 29

=> 3x + 5 = 29

=> 3x = 29 − 5

=> 3x = 24

=> x = 8

=> Sarah's age = 2(8) + 5 = 16 + 5 = 21 years.

Therefore The correct answer is 21 years.

Additional Information

Linear Equations in Ages

Problems involving ages are typically solved by assigning a variable to the youngest person to simplify multiplication and addition.

Ratio of Ages

If the ratio of ages is given as a:b, the ages can be represented as ax and bx to form an equation based on the given sum or difference.

Verification Tip

Always verify by adding the results: 21 (Sarah) + 8 (Emma) = 29, which matches the total age provided in the question.

Q30. Answer: (a) -1

Shortcut Trick

Any non-zero number raised to power 0 gives 1

=> 5^(x+1) = 1 => exponent must be 0

=> x + 1 = 0

=> x = −1

Therefore Answer = −1

Alternate Method

Given:

5^(x+1) = 1

Formula used:

a^0 = 1 (for a ≠ 0)

Calculation:

=> Since base 5 ≠ 1, exponent must be 0

=> x + 1 = 0

=> x = −1

Therefore The correct answer is −1.

Additional Information

Exponent Rule

a^0 = 1 for any non-zero number a.

Exponential Equations

If base is same, equate exponents; if result is 1, exponent must be 0.

Special Case

Only 1^(any number) = 1, otherwise exponent = 0.

Q31. Answer: (b) 7

Shortcut Trick

Combined efficiency of P + Q = 1/12 and efficiency of P = 1/21.

Efficiency of Q = 1/12 − 1/21 = (7 − 4)/84 = 3/84 = 1/28.

Time taken by Q to fill the full cistern = 28 hours.

Time taken by Q to fill one-fourth (1/4) cistern = 28 ÷ 4 = 7 hours.

Therefore The correct answer is 7 hours.

Alternate Method

Given: Time taken by (P + Q) = 12 hours, Time taken by P alone = 21 hours.

Person	Days	Total Work	Efficiency
P + Q	12	84 units	7
P	21	4	

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

=> Efficiency of Q = 7 − 4 = 3 units/hour

=> Required work (1/4 of total) = 84 ÷ 4 = 21 units

=> Time taken by Q = Required work ÷ Efficiency of Q

=> Time taken by Q = 21 ÷ 3 = 7 hours

Therefore The correct answer is 7 hours.

Additional Information

Pipes & Cisterns Rule

Efficiency is inversely proportional to the time taken to complete the work. Total Work = Time × Efficiency.

Negative Work

In cistern problems, an inlet pipe does positive work while an outlet (leak) pipe does negative work.

Work & Wages

Wages are always distributed in the ratio of the efficiency or the actual work done by the individuals.

Q32. Answer: (c) 1.5

Shortcut Trick

Put 3x = 0° in the given expression.

Expression => (3/4)(sin² 0° − tan² 0°) + (3/4)(cos² 0° + sec² 0°)

=> (3/4)(0 − 0) + (3/4)(1² + 1²)

=> 0 + (3/4) × 2 = 1.5

Therefore The correct answer is 1.5.

Alternate Method

Given: (3/4)(sin² 3x − tan² 3x) + (3/4)(cos² 3x + sec² 3x)

Formula Used: sin² θ + cos² θ = 1 and sec² θ − tan² θ = 1

=> Factor out 3/4 from the entire expression:

=> (3/4) [sin² 3x − tan² 3x + cos² 3x + sec² 3x]

=> Rearrange the terms: (3/4) [(sin² 3x + cos² 3x) + (sec² 3x − tan² 3x)]

=> Substitute the identities: (3/4) [1 + 1]

=> (3/4) × 2 = 1.5

Therefore The correct answer is 1.5.

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Additional Information

Trigonometric Identities

Standard Pythagorean identities include $\sin^2\theta + \cos^2\theta = 1$, $1 + \tan^2\theta = \sec^2\theta$, and $1 + \cot^2\theta = \text{cosec}^2\theta$.

Value Substitution Method

For expressions independent of the angle, substituting simple values like 0°, 30°, 45°, or 90° helps in quick evaluation, provided the function is defined at that point.

Q33. Answer: (b) 30°

Shortcut Trick

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

angle STR = (angle P + angle Q) ÷ 2

=> 33° = (angle P + angle Q) ÷ 2

=> angle P + angle Q = 66°

Given the ratio of angle P : angle Q = 3 : 8, the sum of the ratio terms is 11 units (representing 66°), so 1 unit = 6°.

The difference between angle Q and angle P is 8 − 3 = 5 units => 5 × 6° = 30°.

Therefore The correct answer is 30°.

Alternate Method

Given:

• In quadrilateral PQRS, the bisectors of angle R and angle S meet at T.

• angle STR = 33°

• Ratio of angle P to angle Q = 3 : 8

Formula Used:

• Angle sum property of a triangle: Sum of all interior angles of a triangle is 180°.

• Angle sum property of a quadrilateral: Sum of all interior angles of a quadrilateral is 360°.

Calculations:

In triangle STR:

=> angle TSR + angle TRS + angle STR = 180°

Since ST and RT are the angle bisectors of angle S and angle R respectively:

=> (1/2)angle S + (1/2)angle R + 33° = 180°

=> (1/2)(angle S + angle R) = 180° − 33°

=> (1/2)(angle S + angle R) = 147°

=> angle S + angle R = 294°

Now, in quadrilateral PQRS, the sum of all interior angles is 360°:

=> angle P + angle Q + angle R + angle S = 360°

Substitute the value of (angle S + angle R):

=> angle P + angle Q + 294° = 360°

=> angle P + angle Q = 360° − 294°

=> angle P + angle Q = 66°

Let the measures of angle P and angle Q be 3x and 8x respectively:

=> 3x + 8x = 66°

=> 11x = 66°

=> x = 6°

The difference between the measures of angle Q and angle P is:

=> angle Q − angle P = 8x − 3x = 5x

=> 5 × 6° = 30°

Explanation of incorrect options:

• Option (1) 26°: If the difference were 26°, then 5x = 26° => x = 5.2°, which gives angle P + angle Q = 11 × 5.2° = 57.2°, which is incorrect as the sum must be 66°.

• Option (3) 34°: If the difference were 34°, then 5x = 34° => x = 6.8°, which gives angle P + angle Q = 11 × 6.8° = 74.8°, which is incorrect as the sum must be 66°.

• Option (4) 32°: If the difference were 32°, then 5x = 32° => x = 6.4°, which gives angle P + angle Q = 11 × 6.4° = 70.4°, which is incorrect as the sum must be 66°.

Therefore The correct answer is 30°.

Additional Information

Angle Bisector Theorem in Quadrilaterals

The angle formed by the intersection of the bisectors of two adjacent angles of a quadrilateral is equal to half the sum of the other two angles: angle STR = (angle P + angle Q) ÷ 2.

Sum of Interior Angles of a Polygon

For any n-sided polygon, the sum of all interior angles is given by the formula (n − 2) × 180°. For a quadrilateral (n = 4), this sum is always 360°.

Angle Bisectors of Opposite Angles

In a cyclic quadrilateral, the angle bisectors of any two opposite angles intersect on the circumcircle of the quadrilateral.

Q34. Answer: (c) 48 cm

Shortcut Trick

Triangle ratio 3:4:5 implies a Right-Angled Triangle with Perimeter = 12 units and Area = (1/2 × 3 × 4) = 6 units².

Square perimeter = Triangle perimeter = 12 units => Side of square = 12/4 = 3 units.

Area of Square = 3² = 9 units².

Difference in area = (9 − 6)x² = 3x² = 48 => x² = 16 => x = 4.

Perimeter of triangle = 12x = 12 × 4 = 48 cm.

Therefore The correct answer is 48 cm.

Alternate Method

Given:

Ratio of sides of Triangle = 3 : 4 : 5

Difference in Areas = 48 cm²

Formula Used:

Area of Right Triangle = 1/2 × base × height

Perimeter of Triangle = Sum of all sides

Perimeter of Square = 4 × side

Area of Square = (side)²

Calculations:

Let the sides of the triangle be 3x, 4x, and 5x.

=> Perimeter of Triangle (P_T) = 3x + 4x + 5x = 12x

=> Since (3x)² + (4x)² = (5x)², it is a Right-Angled Triangle.

=> Area of Triangle (A_T) = 1/2 × 3x × 4x = 6x²

=> Perimeter of Square (P_S) = P_T = 12x

=> Side of Square (a) = 12x ÷ 4 = 3x

=> Area of Square (A_S) = (3x)² = 9x²

=> Difference = A_S − A_T = 9x² − 6x² = 3x²

=> 3x² = 48

=> x² = 16 => x = 4

=> Perimeter of Triangle = 12x = 12 × 4 = 48 cm

Therefore The correct answer is 48 cm.

Additional Information

Pythagorean Triplets

Sets of three positive integers (a, b, c) such that a² + b² = c². Common examples include (3, 4, 5), (5, 12, 13), and (8, 15, 17).

Maximum Area for Fixed Perimeter

For a given perimeter, a Circle has the largest area, followed by a regular polygon (like a square) and then a triangle.

Heron's Formula

Used to find the area of any triangle when all three sides (a, b, c) are known: Area = √[s(s−a)(s−b)(s−c)], where s = (a+b+c)/2.

Q35. Answer: (b) 15,480 voters

Shortcut Trick

Voters participated = 86% of 18,000

=> 86 × 180 (Cancelling two zeros of 100 with 18,000)

=> (80 + 6) × 180 = 14,400 + 1,080 = 15,480

Therefore The correct answer is 15,480 voters.

Alternate Method

Given:

Total registered voters = 18,000

Voting percentage = 86%

Calculations:

=> Voters participated = (86 ÷ 100) × 18,000

=> Voters participated = 86 × 180

=> Voters participated = 15,480

Therefore The correct answer is 15,480 voters.

Additional Information

Percentage Basics

To find x% of a value y, the formula is (x ÷ 100) × y.

Non-Participating Voters

The percentage of voters who did not vote is (100 − participated percentage). In this case, 14%.

Percentage to Fraction

86% can be expressed as 86/100 or 43/50 in simplified fraction form.

Q36. Answer: (a) 15

Shortcut Trick

Increase in average = (New score − Old average) ÷ Total number of innings

Increase = (266 − 77) ÷ 13

Increase = 189 ÷ 13 ≈ 14.538

Rounding 14.538 to the nearest whole number => 15.

Therefore The correct answer is 15 runs.

Alternate Method

Given:

Initial number of innings = 12

Initial average runs = 77

Runs in the 13^(th) inning = 266

Formula Used:

Average = Total Runs ÷ Number of Innings

Calculations:

=> Total runs in 12 innings = 12 × 77 = 924

=> Total runs after 13 innings = 924 + 266 = 1190

=> New average = 1190 ÷ 13

=> New average ≈ 91.538

=> Increase in average = New average − Old average

=> Increase = 91.538 − 77 = 14.538

=> Rounded to the nearest whole number = 15

Therefore The correct answer is 15 runs.

Additional Information

Fundamental Average Formula

Average = (Sum of all observations) ÷ (Total number of observations). To find the sum, multiply average by the number of items.

Inclusion Rule

When a new value is added, New Sum = (Old Average × Old Count) + New Value. The new average is then New Sum ÷ (Old Count + 1).

Rounding Rules

To round to the nearest whole number, if the decimal part is 0.5 or greater, round up; if less than 0.5, round down.

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Q37. Answer: (c) Rs. 17,500

Shortcut Trick

Net discount = a + b − (a × b) ÷ 100 = 20 + 25 − (20 × 25) ÷ 100 = 45 − 5 = 40%.

Ratio of Marked Price (MP) to Cost Price (CP) = (100 + Gain%) ÷ (100 − Discount%).

MP ÷ CP = (100 + 25) ÷ (100 − 40) = 125 ÷ 60 = 25 ÷ 12.

Given CP = 12 units = Rs. 8,400 => 1 unit = Rs. 700.

MP = 25 units = 25 × 700 = Rs. 17,500.

Therefore The correct answer is Rs. 17,500.

Alternate Method

Given: CP = Rs. 8,400, Gain% = 25%, Discounts = 20% and 25%.

Formulas: SP = CP × (100 + P%) ÷ 100 | MP = SP × 100 ÷ (100 − D1%) × 100 ÷ (100 − D2%)

=> Required SP = 8,400 × (125 ÷ 100) = 8,400 × 1.25 = Rs. 10,500.

=> Let Marked Price be MP.

=> SP = MP × (80 ÷ 100) × (75 ÷ 100) = 10,500.

=> MP × (4 ÷ 5) × (3 ÷ 4) = 10,500.

=> MP × (3 ÷ 5) = 10,500.

=> MP = (10,500 × 5) ÷ 3 = 3,500 × 5 = Rs. 17,500.

Therefore The correct answer is Rs. 17,500.

Additional Information

Marked Price & Discount

The price listed on the label is MP. Discount is always calculated on MP. SP = MP − Discount.

Successive Discount Formula

If two discounts d1 and d2 are given, the equivalent single discount is (d1 + d2 − d1d2/100)%.

Q38. Answer: (b) 441

Shortcut Trick

3^5 × 7^5 = (3×7)^5 = 21^5

=> 21^5 ÷ 21^3 = 21^2

=> = 441

Therefore Answer = 441

Alternate Method

Given:

3^5 × 7^5 ÷ 21^3

Concept Used:

Exponent laws: a^m × b^m = (ab)^m, a^m ÷ a^n = a^(m−n)

Calculation:

=> 3^5 × 7^5 = (3×7)^5 = 21^5

=> 21^5 ÷ 21^3 = 21^(5−3)

=> = 21^2

=> = 441

Therefore The correct answer is 441.

Additional Information

Exponent Rule

a^m × b^m = (ab)^m

Division Rule

a^m ÷ a^n = a^(m−n)

Simplification Tip

Combine same powers before applying division.

Q39. Answer: (c) 66.67%

Shortcut Trick

Required Percentage = (Value to be compared / Base value) × 100

Here, B's marks are compared with A's marks as the base.
Ratio of B : A = 50 : 75 = 2 : 3
Percentage = (2 / 3) × 100 = 66.666...
Therefore The correct answer is 66.67%.
Alternate Method
Given:
Marks obtained by B = 50
Marks obtained by A = 75
Maximum marks = 115
Formula Used:
Percentage = (Part / Whole) × 100
Calculations:
=> Required Percentage = (Marks of B / Marks of A) × 100
=> Percentage = (50 / 75) × 100
=> Percentage = (2 / 3) × 100
=> Percentage = 200 / 3
=> Percentage ≈ 66.666...
=> Rounding off to two decimal places, we get 66.67%.
Therefore The correct answer is 66.67%.
Additional Information
Percentage Comparison
When calculating what percent x is of y, the value following the word 'of' or 'than' is always taken as the denominator (base).
Fraction to Percentage Conversion
Common fractions like 1/3 = 33.33% and 2/3 = 66.67% are useful for speeding up calculations in competitive exams.
Base Value Identification
Ensure the correct base is chosen; here the maximum marks (115) is irrelevant because the comparison is specifically against A's marks.

Q40. Answer: (c) 30,000

Shortcut Trick
Let the total valid votes be 100%.
Candidate 1 (Loser) = 28%
Candidate 2 (Winner) = 100% − 28% = 72%
Vote Difference = 72% − 28% = 44%
Given 44% → 13,200, then 1% → 300.
Therefore The correct answer is 30,000 votes.
Alternate Method
Given:
Votes obtained by the losing candidate = 28%
Difference in votes (Margin) = 13,200
Calculations:
=> Let Total Valid Votes = V
=> Votes of Winner = (100 − 28)% of V = 72% of V
=> Difference = 72% of V − 28% of V = 44% of V
=> 44% of V = 13,200
=> (44/100) × V = 13,200
=> V = (13,200 × 100) ÷ 44
=> V = 300 × 100
=> V = 30,000
Therefore The correct answer is 30,000 votes.
Additional Information
Percentage Change

Percentage difference between two values is calculated as |Value1 − Value2|/Base × 100.

Election Problems

Total Votes = Valid Votes + Invalid Votes. Winner's Share + Loser's Share = 100% of Valid Votes.

Base Change Property

If A is x% more than B, then B is [x/(100+x)] × 100% less than A.

Q41. Answer: (d) 57

Shortcut Trick

Assume an Assumed Mean (A) = 50.

Calculate deviations from 50: −25, +42, −2, −33, −12, +43, −13, +40, +23.

Sum of deviations = (−25 − 2 − 33 − 12 − 13) + (42 + 43 + 40 + 23) = −85 + 148 = +63.

Average deviation = 63 ÷ 9 = +7.

Actual Mean = Assumed Mean + Average Deviation = 50 + 7 = 57.

Therefore The correct answer is 57.

Alternate Method

Given: Observations = 25, 92, 48, 17, 38, 93, 37, 90, 73

Formula Used: Arithmetic Mean = (Sum of all observations) ÷ (Total number of observations)

=> Total number of observations (n) = 9

=> Sum of observations = 25 + 92 + 48 + 17 + 38 + 93 + 37 + 90 + 73

=> Sum of observations = 513

=> Arithmetic Mean = 513 ÷ 9

=> Arithmetic Mean = 57

Therefore The correct answer is 57.

Additional Information

Sum of Deviations

The algebraic sum of the deviations of a set of observations from their arithmetic mean is always zero: Σ(x_i − Mean) = 0.

Combined Mean

If two groups have sizes n1, n2 and means x1, x2, their combined mean is (n1x1 + n2x2) ÷ (n1 + n2).

Effect of Arithmetic Operations

If each observation is increased, decreased, multiplied, or divided by a constant k, the mean also changes by the same constant k.

Q42. Answer: (d) 9.6 seconds

Shortcut Trick

Relative Speed (Opposite Direction) = 60 + 90 = 150 km/hr

Convert Speed to m/s = 150 × (5/18) = 125/3 m/s

Total Distance = Length X + Length Y = 150 + 250 = 400 m

Time Taken = 400 ÷ (125/3) = 400 × 3 ÷ 125 = 9.6 sec

Therefore The correct answer is 9.6 sec.

Alternate Method

Given:

Length of Train X (L1) = 150 m

Length of Train Y (L2) = 250 m

Speed of Train X (S1) = 60 km/hr

Speed of Train Y (S2) = 90 km/hr

Formula Used:

Time = Total Distance ÷ Relative Speed

Relative Speed (Opposite) = S1 + S2

Conversion: 1 km/hr = 5/18 m/sec

Calculations:

=> Total Distance = 150 + 250 = 400 m

=> Relative Speed = 60 + 90 = 150 km/hr

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=> Relative Speed in m/s = 150 × (5/18) = 750/18 = 125/3 m/s

=> Time = 400 ÷ (125/3)

=> Time = (400 × 3) ÷ 125

=> Time = 1200 ÷ 125 = 9.6 sec

Therefore The correct answer is 9.6 sec.

Additional Information

Relative Speed Concept

When two objects move in opposite directions, their speeds are added (S1 + S2). If they move in the same direction, their speeds are subtracted (|S1 − S2|).

Unit Conversion

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

Train Crossing Objects

When a train crosses a stationary pole/man, distance = length of train. When it crosses another train/platform, distance = sum of both lengths.

Q43. Answer: (a) 28

Shortcut Trick

Total days from 8 February to 22 April 2023: 20 (Feb) + 31 (Mar) + 22 (Apr) = 73 days.

In simple interest problems, 73 days is exactly 1/5 of a standard year (365 days).

Interest for 1 year = 7% of 2000 = Rs. 140.

Interest for 1/5 year = 140 ÷ 5 = Rs. 28.

Therefore The correct answer is Rs. 28.

Alternate Method

Given:

Principal (P) = Rs. 2,000

Rate of Interest (R) = 7% per annum

Time Period: 8 February 2023 to 22 April 2023

Formula Used: Simple Interest (SI) = (P × R × T) ÷ 100

Calculations:

=> Days in February (after 8th) = 28 − 8 = 20 days

=> Days in March = 31 days

=> Days in April = 22 days

=> Total Days = 20 + 31 + 22 = 73 days

=> Time (T) in years = 73 ÷ 365 = 1/5 years

=> SI = (2000 × 7 × 1/5) ÷ 100

=> SI = (20 × 7) ÷ 5

=> SI = 4 × 7 = 28

Therefore The correct answer is Rs. 28.

Additional Information

Counting Days for Interest

While calculating the time period, the day on which money is borrowed is generally excluded, while the day on which money is returned is included.

Fractional Year Constants

Common exam values: 73 days = 1/5 year, 146 days = 2/5 year, 219 days = 3/5 year, and 292 days = 4/5 year (based on a 365-day year).

Amount Formula

Total Amount (A) = Principal (P) + Simple Interest (SI). In this case, A = 2000 + 28 = Rs. 2028.

Q44. Answer: (a) Rs. 200

Shortcut Trick

Let the original price paid by A be x.

Successive multiplier: x × (120/100) × (75/100) × (140/100) = 252.

x × (6/5) × (3/4) × (7/5) = 252.

x × (126/100) = 252 => x = (252 × 100) ÷ 126 = 200.

Therefore The correct answer is Rs. 200.

Alternate Method

Given: A's Profit = 20%, B's Loss = 25%, C's Profit = 40%, D's Payment = Rs. 252.

Formulas: Final Price = Initial Price × (100 ± P/L1)% × (100 ± P/L2)% ...

=> Let A's cost price be 100 units.

=> B's cost price = 100 × 120/100 = 120 units.

=> C's cost price = 120 × 75/100 = 90 units.

=> D's cost price = 90 × 140/100 = 126 units.

=> Given 126 units = Rs. 252.

=> 1 unit = 252 ÷ 126 = 2.

=> 100 units = 100 × 2 = 200.

Therefore The correct answer is Rs. 200.

Additional Information

Chain Rule in Profit and Loss

When an article is sold through multiple people, the Selling Price of one becomes the Cost Price of the next. The final value is calculated using the formula: Final Price = Initial Price × (1 ± r1/100) × (1 ± r2/100)...

Successive Percentage Change

Net change for two successive updates of x% and y% is given by [x + y + (xy/100)]%. This can also be applied to successive profit/loss scenarios.

Q45. Answer: (d) 8

Shortcut Trick

If (x + 6) is the HCF, then x = −6 must be a root of both expressions.

Substitute x = −6 into the second expression: $(-6)^2 + k(-6) + 12 = 0$.

36 − 6k + 12 = 0 => 48 = 6k.

k = 8.

Therefore The correct answer is 8.

Alternate Method

Given: HCF is (x + 6). Expressions are $P(x) = x^2 + 10x + 24$ and $Q(x) = x^2 + kx + 12$.

Formula: If (x − a) is a factor of a polynomial f(x), then f(a) = 0.

=> x + 6 = 0

=> x = −6

=> Since (x + 6) is the Highest Common Factor, it is a factor of $x^2 + kx + 12$.

=> $(-6)^2 + k(\times -6) + 12 = 0$

=> 36 − 6k + 12 = 0

=> 48 − 6k = 0

=> 6k = 48

=> k = 48 ÷ 6

=> k = 8

Therefore The correct answer is 8.

Additional Information

Factor Theorem

A polynomial f(x) has a factor (x − a) if and only if f(a) = 0. This is used to find unknown coefficients when the HCF or a factor is known.

Relationship between HCF and LCM

For two polynomials P(x) and Q(x), the product of the polynomials is equal to the product of their HCF and LCM: P(x) × Q(x) = HCF × LCM.

Quadratic Roots

For a quadratic equation $ax^2 + bx + c = 0$, the sum of roots is −b/a and the product of roots is c/a.

Q46. Answer: (b) 1

Shortcut Trick

Check odd numbers between 368 and 376: 369, 371, 373, 375.

369: Sum of digits (3+6+9 = 18) → Divisible by 9.

371: 371 = 7 × 53 → Divisible by 7.

375: Ends in 5 → Divisible by 5.

373: Not divisible by 2, 3, 5, 7, 11, 13, 17, 19 → Prime.

Therefore The correct answer is 1.

Alternate Method

Given: Range between 368 and 376.

Numbers in range: 369, 370, 371, 372, 373, 374, 375.

=> 370, 372, 374 are even (composite).

=> 369 = 3 × 123 (composite).

=> 371 = 7 × 53 (composite).

=> 375 = 5 × 75 (composite).

=> 373: √373 ≈ 19.3. Checking divisibility by 2, 3, 5, 7, 11, 13, 17, 19 yields no divisors.

Therefore The correct answer is 1.

Additional Information

Definition of Prime Number

A natural number greater than 1 that has no positive divisors other than 1 and itself.

Testing for Primality

To check if N is prime, test divisibility by all primes less than or equal to √N.

Prime Numbers between 1 and 100

There are exactly 25 prime numbers between 1 and 100.

Q47. Answer: (d) 1813

Shortcut Trick

Product of two numbers = [(Sum + Difference) ÷ 2] × [(Sum − Difference) ÷ 2]

Given Sum = 86 and Difference = 12.

First number = (86 + 12) ÷ 2 = 49

Second number = (86 − 12) ÷ 2 = 37

Product = 49 × 37 = 1813

Therefore The correct answer is 1813.

Alternate Method

Let the two numbers be x and y (where x > y).

Given:

x + y = 86

x − y = 12

Calculations:

=> Adding the two equations: (x + y) + (x − y) = 86 + 12

=> 2x = 98

=> x = 98 ÷ 2 = 49

=> Substituting x = 49 in the first equation: 49 + y = 86

=> y = 86 − 49 = 37

=> Product of the numbers = x × y = 49 × 37

=> Product = 1813

Therefore The correct answer is 1813.

Additional Information

Algebraic Identity for Product

The product of two numbers can be found using the identity: $4xy = (x + y)^2 - (x - y)^2$.

Sum and Difference Rule

If the sum (S) and difference (D) of two numbers are known, the larger number is (S + D) ÷ 2 and the smaller number is (S − D) ÷

2.

Difference of Squares

The difference of the squares of two numbers is equal to the product of their sum and their difference: $x^2 - y^2 = (x + y)(x - y)$.

Q48. Answer: (b) 4,500

Shortcut Trick

Combine the ratios P : Q (17 : 5) and Q : R (6 : 12 or 1 : 2).

Ratio P : Q : R → (17×6) : (5×6) : (5×12) => 102 : 30 : 60 => 51 : 15 : 30.

Total units = 51 + 15 + 30 = 96 units.

Share of Q = (15 / 96) × 28,800 = 15 × 300 = Rs. 4,500.

Therefore The correct answer is Rs. 4,500.

Alternate Method

Given:

Ratio P : Q = 17 : 5

Ratio Q : R = 6 : 12 = 1 : 2

Total Profit = Rs. 28,800

Calculations:

=> To equalize Q, multiply (P : Q) by 6 and (Q : R) by 5.

=> P : Q = (17 × 6) : (5 × 6) = 102 : 30

=> Q : R = (6 × 5) : (12 × 5) = 30 : 60

=> Combined Ratio P : Q : R = 102 : 30 : 60

=> Simplified Ratio P : Q : R = 51 : 15 : 30 (dividing by 2)

=> Sum of ratio parts = 51 + 15 + 30 = 96

=> Share of Q = (15 / 96) × 28,800

=> Share of Q = 15 × 300

=> Share of Q = Rs. 4,500

Therefore The correct answer is Rs. 4,500.

Additional Information

Compound Ratio

When two or more ratios are multiplied together, the result is the compound ratio. For a : b and c : d, the compound ratio is (ac) : (bd).

Profit Distribution in Partnership

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

Balancing Ratios

To combine ratios like A : B and B : C, find the LCM of the common term B to create a unified ratio A : B : C.

Q49. Answer: (c) 2,77,424

Shortcut Trick

Discount = 75% => Selling Price (SP) = 100% − 75% = 25% of Marked Price (MP).

Given 25% of MP = 69,356.

Ratio of MP : SP = 100 : 25 = 4 : 1.

1 unit = 69,356 => 4 units = 69,356 × 4 = 2,77,424.

Therefore The correct answer is Rs. 2,77,424.

Alternate Method

Given: Selling Price (SP) = Rs. 69,356, Discount % = 75%.

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

=> Let Marked Price be x.

=> 69,356 = x × (100 − 75) ÷ 100

=> 69,356 = x × 25 ÷ 100

=> 69,356 = x × 1 ÷ 4

=> x = 69,356 × 4 = 2,77,424

Therefore The correct answer is Rs. 2,77,424.

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Additional Information

Marked Price & Discount

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

Successive Discount

If two discounts a% and b% are given, total discount = a + b − (a × b ÷ 100).

Q50. Answer: (c) Rs. 6,496

Shortcut Trick

Total ratio parts = 8 + 25 + 15 = 48 units.

Difference between Suman and Neha = 15 − 8 = 7 units.

Using ratio-unitary method: 48 units = Rs. 44,544.

Value of 1 unit = 44,544 ÷ 48 = Rs. 928.

Required difference = 7 × 928 = Rs. 6,496.

Therefore The correct answer is Rs. 6,496.

Alternate Method

Given → Investment Ratio (S : T : N) = 8 : 25 : 15, Total Profit = Rs. 44,544.

Formula → Profit Share prop. to Investment × Time. Since time is constant, Profit Ratio = Investment Ratio.

=> Total Profit Share = 8x + 25x + 15x = 48x.

=> 48x = 44,544.

=> x = 44,544 ÷ 48 = 928.

=> Difference (Neha − Suman) = 15x − 8x = 7x.

=> Difference = 7 × 928 = 6,496.

Therefore The correct answer is Rs. 6,496.

Additional Information

Partnership Basics

When multiple partners invest for the same time period, the profit is distributed solely based on the ratio of their investments.

Ratio Distribution

To find an individual share, use the formula: Individual Share = (Individual Ratio / Sum of Ratios) × Total Profit.

Q51. Answer: (a) 9 km to the south

Given:

Mr. Akai starts from Point A and drives 9 km towards the west.

He then takes a left turn and drives 9 km.

He again takes a left turn and drives 17 km.

He then takes a left turn and drives 18 km.

Finally, he takes a left turn and drives 8 km and stops at Point P.

So, To reach Point A again, Mr. Akai must drive 9 km towards the south.

Hence, the correct answer is Option 1.

Q52. Answer: (b) ZEE

The logic followed here is:

Option 1) SWX

Option 2) ZEE

Option 3) HLM

Option 4) UYZ

Here, ZEE is odd from the given options because it does not follow the uniform +4, +1 pattern.

Hence, the correct answer is "Option 2".

Q53. Answer: (d) QPNJ

The logic followed here is:

For, AZXT → XWUQ

Now, VUSO → SRPL

Now, applying the same logic for TSQM:

So, TSQM → QPNJ

Hence, the correct answer is Option 4.

Q54. Answer: (a) 457

The logic followed here is:

thus, "457" will replace the question mark in the given series.

Hence, the correct option is "Option 1".

Q55. Answer: (b) 112

The logic followed here is:

thus, "112" will replace the question mark in the given series.

Hence, the correct option is "Option 2".

Q56. Answer: (c) 63 - 7 - 9

The logic followed here is:

Logic: First number = (Second number) × (Third number)

35 - 7 - 5

=> 7 × 5 = 35

60 - 6 - 10

=> 6 × 10 = 60

Now, checking the options:

Option 1) (81 - 7 - 8)

=> 7 × 8 = 56 (not 81)

Option 2) (40 - 5 - 9)

=> 5 × 9 = 45 (not 40)

Option 3) (63 - 7 - 9)

=> 7 × 9 = 63

Option 4) (12 - 4 - 2)

=> 4 × 2 = 8 (not 12)

Hence, the correct answer is Option 3.

Q57. Answer: (a) tr

The logic followed here is:

Given:

'what are those' → np tr sq

'take those gifts' → hk my tr

So, those → tr

Hence, the correct answer is Option 1.

Q58. Answer: (c) UX−XD

The logic followed here is:

Option 1) SV – WZ

Option 2) DG – HK

Option 3) UX – XD

Option 4) FI – JM

Here, UX – XD is odd from the given options because it does not follow the uniform +3, +1, +3 pattern.

Hence, the correct answer is "Option 3".

Q59. Answer: (c) 3

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

Now,

We need to identify even numbers that are immediately preceded by an odd number and immediately followed by an even number.

So, the required condition is: Odd Number – Even Number – Even Number

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(Left) 7, 5, 2, 4, 9, 5, 3, 8, 9, 1, 2, 6, 6, 6, 8, 4, 5, 3, 9, 1, 7, 9, 8, 6, 3, 6, 9 (Right)
Total even numbers satisfying the condition = 3
Hence, the correct answer is "Option 3".

Q60. Answer: (a) Immediate right

Given: M, N, O, P, Q and R are sitting around a circular table facing the centre.
P is an immediate neighbour of both N and Q.
M is sitting second to the right of Q.
R is an immediate neighbour of both M and N.
Therefore, Q is immediate right of P.
Hence, the correct answer is Option 1.

Q61. Answer: (b) Three

Given: (Left) 1 7 6 2 9 4 3 8 5 2 6 3 7 8 9 2 5 1 4 7 6 3 2 9 5 4 1 8 (Right)
Now,
We need to identify odd digits that are immediately preceded by an even digit and immediately followed by an odd digit.
So, the required condition is: Even Digit – Odd Digit – Odd Digit
(Left) 1 7 6 2 9 4 3 8 5 2 6 3 7 8 9 2 5 1 4 7 6 3 2 9 5 4 1 8 (Right)
Total odd digits satisfying the condition = 3
Hence, the correct answer is "Option 2".

Q62. Answer: (b) GKO−NRV

The logic followed here is:
For, YCG → FJN
Now, OSW → VZD
Now, checking the options:
Option 1) GJM → NRV
Option 2) GKO → NRV
Option 3) GKO → MRU
Option 4) GJM → MQU
Hence, the correct answer is Option 2.

Q63. Answer: (b) O

Given: Six boxes L, M, N, O, P and Q are arranged one over the other from top to bottom (Position 6 to Position 1).
Q is placed at the topmost position.
L is placed second from the bottom.
M is immediately above P and N is immediately below P (forming M - P - N).

Position	Box
6 (Top)	Q
5	M
4	P
3	N
2	L
1 (Bottom)	O

Therefore, box O is placed at the bottommost position.
Hence, the correct answer is Option 2.

Q64. Answer: (b) 42

BODMAS Table:
Given equation: 14 P 4 S (16 Q 4) P 9 R (60 Q 6) P 7 S 20 = ?
Now, replacing the symbols as:

Symbol	P	Q	R	S
Replaced by	×	÷	−	•

=> 14 × 4 + (16 ÷ 4) × 9 − (60 ÷ 6) × 7 + 20 = ?
=> 56 + 4 × 9 − 10 × 7 + 20 = ?
=> 56 + 36 − 70 + 20 = ?
=> 92 − 70 + 20 = ?
=> 22 + 20 = ?
=> 42
Hence, the correct answer is Option 2.

Q65. Answer: (b) JHJ 17

The logic followed here is:
So, 'JHJ 17' will replace the question mark in the given series.
Hence, the correct answer is "Option 2".

Q66. Answer: (a) TKXM

The logic followed here is:
For, RIVK → BSFU
Now, FWJY → PGTI
Now, applying the same logic for JANC:
So, JANC → TKXM
Hence, the correct answer is Option 1.

Q67. Answer: (c) 101

The logic followed here is:
thus, "101" will replace the question mark in the given series.
Hence, the correct option is "Option 3".

Q68. Answer: (d) gh

The logic followed here is:
Given:
'cute red flowers' → by gh cf
'nice red dress' → jk bt gh
So, red → gh
Hence, the correct answer is Option 4.

Q69. Answer: (d) Sister

Family Chart:

Symbol	±	•	Rs.	#
Meaning	Wife	Daughter	Father	Brother

Given: D * R ± A Rs. C # O
It means: D is the daughter of R, R is the wife of A, A is the father of C, C is the brother of O.
Here, D is related to O as Sister
Hence, the correct answer is Option 4.

Q70. Answer: (a) Only conclusion (I) follows

Given Statements:
Some bells are pots.
All pots are machines.
The least possible Venn diagram for the given statement is:
Conclusions:
I. Some bells are machines - Follows (Since some bells are pots and all pots are machines, those bells are also machines).

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II. All machines are pots - Does not follow (All pots are machines does not mean all machines are pots).

So, only conclusion I follows.

Hence, the correct answer is Option 1.

Q71. Answer: (a) 21

BODMAS Table:

Given equation: (9 Q 3) P 8 S (72 Q 12) P 7 R 15 P 3 = ?

Now, replacing the symbols as:

Symbol	P	Q	R	S
Replaced by	×	÷	−	•

=> (9 ÷ 3) × 8 + (72 ÷ 12) × 7 − 15 × 3 = ?

=> 3 × 8 + 6 × 7 − 15 × 3 = ?

=> 24 + 42 − 15 × 3 = ?

=> 24 + 42 − 45 = ?

=> 66 − 45 = ?

=> 21

Hence, the correct answer is Option 1.

Q72. Answer: (c) 32

Given:

Rank from top = 8

Rank from bottom = 25

Total number of students = (Rank from top + Rank from bottom) − 1

= (8 + 25) − 1

= 33 − 1

= 32

Here, there are 32 students in the class.

Hence, the correct answer is "Option 3".

Q73. Answer: (a) 2

Given: A, B, C, D, E, F and G are sitting in a row facing north.

No one sits to the left of C.

Only four people sit between C and A.

Only three people sit to the right of G.

E sits to the immediate left of B.

F is not an immediate neighbour of G.

So, Total = 2

Hence, the correct answer is Option 1.

Q74. Answer: (c) Neither Conclusion I nor II follows

Given Statements:

All pots are mats.

Some mats are hats.

All hats are cats.

The least possible Venn diagram for the given statement is:

Conclusions:

I. All cats are mats - Does not follow (Only some mats are hats and all hats are cats; this does not mean all cats are mats).

II. Some cats are pots - Does not follow (There is no definite relation between pots and cats).

So, neither conclusion I nor conclusion II follows.

Hence, the correct answer is Option 3.

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Q75. Answer: (c) One

Given: A, B, C, D, E and F are sitting around a circular table facing the centre.

A sits third to the right of F.

B sits second to the left of C.

D sits third to the right of C.

E sits to the immediate left of A.

Therefore, number of people between E and D = 1

Hence, the correct answer is Option 3.

Q76. Answer: (c) SSH

The logic followed here is:

So, the next term = SSH

Hence, the correct answer is Option 3.

Q77. Answer: (a) More than three

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

Now,

We need to count occurrences of 8 that are immediately preceded by an even number and immediately followed by an odd number.

So, the required condition is: Even Number – 8 – Odd Number

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

Total occurrences found = 4

Since 4 > 3, the answer is “Option 1”.

Q78. Answer: (c) 40

BODMAS Table:

Given equation: 99 A 9 C 12 B 3 D 7 = ?

Now, replacing the symbols as:

Symbol	A	B	C	D
Replaced by	÷	×	•	−

=> 99 ÷ 9 + 12 × 3 − 7 = ?

=> 11 + 12 × 3 − 7 = ?

=> 11 + 36 − 7 = ?

=> 47 − 7 = ?

=> 40

Hence, the correct answer is Option 3.

Q79. Answer: (c) Three

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

Now,

We need to identify even digits that are immediately preceded by an even digit and immediately followed by an odd digit.

So, the required condition is: Even Digit – Even Digit – Odd Digit

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

Total even digits satisfying the condition = 3

Hence, the correct answer is Option 3.

Q80. Answer: (b) 4 km towards south

Given:

Arvind starts from Point K and drives 10 km towards the west.

He then takes a left turn and drives 8 km.

He again takes a left turn and drives 4 km.

He then takes a right turn and drives 4 km.

He then takes a left turn and drives 6 km.

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Finally, he takes a left turn and drives 8 km and stops at Point Y.

Therefore, Point Y is 4 km towards the south of Point K.

Hence, the correct answer is Option 2.

Q81. Answer: (a) Kananaskis, Alberta

The correct answer is Kananaskis, Alberta.

Key Points

• The 51st G7 Summit is scheduled to take place from June 16 to 17, 2025, in Kananaskis, Alberta, Canada.

• This marks the seventh time that Canada has hosted the Group of Seven (G7) summit since its inclusion in the group in 1976.

• The announcement of the location was made by Canadian Prime Minister Justin Trudeau following the conclusion of the 50th G7 Summit held in Italy in 2024.

• Kananaskis is a well-known choice for high-profile diplomatic events; it previously hosted the 28th G8 Summit in June 2002, which focused heavily on global development and aid for Africa.

• The choice of Alberta as the host province highlights the region's importance to the Canadian economy, particularly in sectors like energy, agriculture, and tourism.

Additional Information

• The G7 Membership: The Group of Seven is an informal intergovernmental organization consisting of the world's leading advanced economies: Canada, France, Germany, Italy, Japan, the United Kingdom, and the United States. The European Union is also represented as a non-enumerated member.

• Presidency Rotation: The presidency of the G7 rotates annually among the member nations. Canada will officially assume the G7 Presidency from Italy on January 1, 2025.

• Previous Canadian Summits: Before the 2025 event, Canada hosted summits in Ottawa-Montebello (1981), Toronto (1988), Halifax (1995), Kananaskis (2002), Muskoka (2010), and Charlevoix (2018).

• Geography of Kananaskis: Located in the foothills and front ranges of the Canadian Rockies, west of Calgary, Kananaskis offers a secure and secluded environment, which is a critical requirement for hosting world leaders and managing complex security protocols.

Important Points

• Summit Objectives: The 2025 Summit is expected to address critical global challenges including economic resilience, climate change, energy security, and international peace.

• Sherpas and Preparation: Leading up to the summit, "Sherpas" (personal representatives of the leaders) and ministers will hold multiple meetings across Canada to draft the agenda and negotiate the final communique.

• Outreach and Guests: As the host, Canada has the authority to invite "Outreach" guests, which often include leaders from emerging economies and heads of international organizations such as the United Nations (UN) and the International Monetary Fund (IMF).

• Transition from G8: The group functioned as the G8 with the inclusion of Russia from 1998 until 2014, when Russia was suspended following the annexation of Crimea, reverting the group back to the G7.

Q82. Answer: (c) Maharashtra

The correct answer is Maharashtra.

Key Points

• The state government of Maharashtra has established a specialized hedging desk in 2025 to safeguard the interests of farmers against the unpredictable fluctuations in market prices.

• This initiative specifically targets farmers cultivating Cotton, Turmeric, and Maize, which are significant cash crops in the state but are highly susceptible to global and domestic price volatility.

• The hedging desk is being set up under the State of Maharashtra’s Agribusiness and Rural Transformation (SMART) project, which is a massive initiative aimed at transforming rural Maharashtra.

• The primary objective of this desk is to provide price protection and risk management tools to Farmer Producer Organizations (FPOs), allowing them to lock in prices before the harvest season ends.

• By utilizing financial instruments in the commodities market, the desk helps ensure that farmers receive a minimum assured price, regardless of sudden crashes in market rates during the peak arrival season.

Additional Information

• The SMART Project:

• The SMART project is a World Bank-funded initiative implemented by the Government of Maharashtra.

• It focuses on enhancing the competitiveness of agriculture value chains and facilitating the transition of smallholder farmers towards market-led agriculture.

• The project provides technical assistance and financial grants to Farmer Producer Organizations (FPOs) and Primary

Agricultural Credit Societies (PACS).

• Significance of the Crops:

• Cotton: Maharashtra has the largest area under cotton cultivation in India, particularly in the Vidarbha and Marathwada regions.

• Turmeric: The state is a leading producer of turmeric, with Sangli being a major trading hub known for its high-quality produce and GI tag.

• Maize: It is a crucial crop for the poultry and starch industries, and its prices are often influenced by global export demands and domestic production levels.

• Understanding Hedging:

• Hedging in agriculture involves taking a position in a futures market that is opposite to the position held in the physical market.

• This mechanism acts as an insurance policy for farmers; if the price falls in the local market (mandi), the gains from the futures contract can offset the loss.

Important Points

• Market Integration: The hedging desk works in coordination with national exchanges like the National Commodity and Derivatives Exchange (NCDEX) to facilitate transparent price discovery for FPOs.

• Risk Mitigation: Historically, small and marginal farmers bore the brunt of price drops; this desk provides them with the sophisticated financial tools previously only available to large traders and corporates.

• Operational Date: While the planning began earlier, the dedicated operations and the formal launch of the desk for the 2025 crop cycle represent a major shift in the state's agricultural policy.

• Economic Impact: By stabilizing farmer incomes, the Maharashtra Government aims to reduce agrarian distress and encourage more sustainable investment in high-value agricultural technology.

Q83. Answer: (c) Rs. 3,000

The correct answer is Rs. 3,000.

Key Points

• The Microfinance Industry Network (MFIN) and Sa-Dhan, which are the two Self-Regulatory Organizations (SROs) for the microfinance sector in India, have jointly issued a revised Code of Conduct and directives to enhance credit discipline.

• As per the new directives, any borrower who has an overdue amount exceeding Rs. 3,000 will not be eligible for a fresh loan or a top-up loan from any microfinance lender.

• These measures, often referred to as "guardrails", are designed to prevent over-leveraging and indebtedness among low-income households, ensuring that the borrower's debt remains at a manageable level.

• This specific directive regarding the Rs. 3,000 overdue limit is set to become effective from January 1, 2025.

• The decision was taken in response to rising concerns about asset quality and high delinquency rates in certain geographical pockets within the microfinance industry.

Additional Information

• Household Income Limit: According to RBI guidelines issued in March 2022, a microfinance loan is defined as a collateral-free loan to a household having an annual income up to Rs. 3,00,000.

• Total Indebtedness Cap: The SROs have mandated that the total indebtedness of a single borrower across all lenders should not exceed Rs. 2,00,000. This includes both principal and interest components of all active loans.

• Number of Lenders: To curb the practice of ghost lending or multiple borrowing, a borrower is restricted to taking loans from a maximum of four different lenders (including NBFC-MFIs, Banks, and Small Finance Banks) at any given point in time.

• Regulatory Oversight: The Microfinance Industry Network (MFIN) was established in 2009 and serves as the primary SRO recognized by the Reserve Bank of India (RBI) to monitor NBFC-MFIs.

• The 50% Rule: Lenders must ensure that the outflow for all loan repayments (including principal and interest) does not exceed 50% of the monthly household income of the borrower.

Important Points

• Delinquency Monitoring: The overdue limit is calculated based on data from Credit Information Companies (CICs) like Equifax or CRIF High Mark, which lenders are required to consult before every disbursement.

• Scope of Applicability: These directives apply to all regulated entities (REs) including Banks, Small Finance Banks (SFBs), and Non-Banking Financial Company-Microfinance Institutions (NBFC-MFIs).

• Effective Implementation: While the Rs. 3,000 overdue rule starts in January 2025, other guardrails regarding income assessment and disclosure of pricing were reinforced throughout 2024.

• Social Impact: The microfinance sector in India serves nearly 8 crore unique borrowers, and these rules are critical to maintaining the socio-economic stability of the rural and semi-urban population.

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Q84. Answer: (d) National Payments Corporation of India (NPCI)

The correct answer is National Payments Corporation of India (NPCI).

Key Points

• In January 2025, the National Payments Corporation of India (NPCI) joined forces with Chennai's Metropolitan Transport Corporation (MTC) to launch the 'RuPay on-the-go' initiative.

• This partnership aims to revolutionize transit payments by enabling contactless and cashless transactions for commuters using MTC buses in Chennai.

• The 'RuPay on-the-go' feature allows passengers to tap their RuPay-enabled cards, smartwatches, or other wearable devices on electronic ticketing machines to pay their fares instantly.

• The initiative is part of the broader National Common Mobility Card (NCMC) framework, which envisions a "One Nation, One Card" system for seamless travel across various modes of transport, including Metro, buses, and trains.

• This launch in Chennai signifies a major step toward digitizing small-value transactions in the public transport sector, reducing the dependency on physical cash and exact change.

Additional Information

• National Payments Corporation of India (NPCI):

• Established in 2008, NPCI is an umbrella organization for operating retail payments and settlement systems in India.

• It is an initiative of the Reserve Bank of India (RBI) and the Indian Banks' Association (IBA) under the provisions of the Payment and Settlement Systems Act, 2007.

• NPCI has developed various innovative products like UPI (Unified Payments Interface), RuPay, IMPS, and Bharat BillPay.

• Metropolitan Transport Corporation (MTC), Chennai:

• MTC is the state-owned agency that operates the public bus service in Chennai, Tamil Nadu.

• It is one of the largest municipal transport bodies in India, catering to millions of daily passengers.

• RuPay and NCMC:

• RuPay is India's indigenous card scheme launched in 2012 to compete with international networks like Visa and Mastercard.

• The National Common Mobility Card (NCMC) was launched by the Ministry of Housing and Urban Affairs in 2019 to provide an integrated payment platform for all transit needs.

Important Points

• Technological Features: The 'RuPay on-the-go' system utilizes Near Field Communication (NFC) technology, ensuring high-speed transaction processing suitable for high-volume transit environments.

• Digital India Vision: This collaboration aligns with the Government of India's Digital India mission, promoting financial inclusion and a less-cash economy.

• User Convenience: Commuters no longer need to carry multiple cards or cash for different transport systems; the NCMC compliant RuPay card can also be used for toll payments, parking, and retail shopping.

• Implementation: The rollout in Chennai follows similar successful implementations of NCMC in cities like Delhi, Mumbai, and Bengaluru, making urban mobility more efficient.

Q85. Answer: (d) Aravalli Range, Western Ghats, Himalayas, and mangroves

The correct answer is Aravalli Range, Western Ghats, Himalayas, and mangroves.

Key Points

• The National Mission for Green India (GIM) released a revised roadmap in June 2025 to align with India's updated Nationally Determined Contributions (NDC) and biodiversity goals.

• The roadmap identifies the Aravalli Range as a critical zone for restoration to act as a "green barrier" against the eastward expansion of the Thar Desert and to combat land degradation.

• Special emphasis is placed on the Western Ghats and the Himalayas, which are globally recognized biodiversity hotspots, to ensure water security and stabilize fragile mountain ecosystems against climate change.

• The restoration of mangroves along India's coastline is prioritized due to their exceptional capacity for carbon sequestration and their role as natural buffers against cyclones and sea-level rise.

• The revised strategy shifts focus from mere afforestation to Ecological Restoration, which involves reviving the original structure and function of degraded ecosystems.

Additional Information

• National Mission for Green India (GIM):

• Launched in February 2014, it is one of the eight missions under the National Action Plan on Climate Change (NAPCC).

• Its primary objective is to protect, restore, and enhance India's diminishing forest cover and respond to climate change.

• The mission aims at increasing forest/tree cover to the extent of 5 million hectares (mha) and improving the quality of forest cover on another 5 mha of non-forest/forest lands.

• Geographical Focus Areas:

• The Aravalli Range spans across Gujarat, Rajasthan, Haryana, and Delhi, serving as the "lungs" of the National Capital Region (NCR).

• The Western Ghats runs along the western coast of India through six states: Gujarat, Maharashtra, Goa, Karnataka, Kerala, and Tamil Nadu.

• Mangrove restoration specifically targets regions like the Sundarbans in West Bengal and the Bhitarkanika in Odisha.

Important Points

• Implementation Agency: The mission is implemented by the Ministry of Environment, Forest and Climate Change (MoEFCC) through a decentralized structure involving State Forest Departments and local bodies.

• Community Involvement: A unique feature of the roadmap is the empowerment of Gram Sabhas and Joint Forest Management Committees (JFMCs) to lead restoration efforts at the grassroots level.

• Climate Targets: India aims to create an additional carbon sink of 2.5 to 3 billion tonnes of CO_2 equivalent through additional forest and tree cover by 2030.

• Monitoring Technology: The 2025 roadmap integrates advanced technologies such as Geographic Information Systems (GIS), Remote Sensing, and Lidar for real-time monitoring of survival rates and biomass growth.

Q86. Answer: (b) Haryana

The correct answer is Haryana.

Key Points

• The sixth phase of the Jal Shakti Abhiyan: Catch the Rain (JSA:CTR) 2025 was launched by the President of India, Droupadi Murmu.

• The official launch ceremony took place on February 12, 2025, in the state of Haryana.

• The event was organized at the National Institute of Food Technology Entrepreneurship and Management (NIFTEM) located in Kundli, Sonipat district.

• The 2025 campaign aims to consolidate the gains of previous phases and intensify water conservation efforts across the country before the arrival of the monsoon season.

• The focus of this phase is on the sustainability of water sources and ensuring that every drop of rainwater is harvested through community participation and Panchayati Raj Institutions.

Additional Information

• Jal Shakti Abhiyan (JSA):

• The mission was first launched in 2019 as a time-bound, mission-mode water conservation campaign in 256 water-stressed districts of India.

• In 2021, it was expanded to cover all districts (rural and urban) under the theme "Catch the Rain, where it falls, when it falls".

• Ministry of Jal Shakti:

• This ministry was created in May 2019 by merging two existing ministries: the Ministry of Water Resources, River Development & Ganga Rejuvenation and the Ministry of Drinking Water and Sanitation.

• The ministry oversees major flagship schemes like Jal Jeevan Mission and Namami Gange.

• Haryana's Water Initiatives:

• The state of Haryana has been a pioneer in water management through schemes like Mera Pani Meri Virasat, which incentivizes farmers to switch from water-intensive paddy to other crops like maize or pulses.

• The state has also implemented the Atal Bhujal Yojana extensively to tackle declining groundwater levels.

Important Points

• Five Pillars of JSA:CTR:

• The campaign is built on five key interventions: water conservation and rainwater harvesting, renovation of traditional water bodies (like ponds/talabs), reuse and recharge of borewells, watershed development, and intensive afforestation.

• Significance of the 6th Phase:

• The 2025 phase emphasizes geo-tagging of all water bodies and the creation of Jal Shakti Kendras in every district to provide technical guidance to the public.

• It also integrates the "Amrit Sarovar" mission, which aims to develop and rejuvenate 75 water bodies in each district as part of the Azadi Ka Amrit Mahotsav.

• National Importance:

• India possesses nearly 18% of the world's population but only 4% of the world's renewable water resources, making campaigns like Catch the Rain critical for national water security.

Q87. Answer: (a) Cyclone Ditwah

The correct answer is Cyclone Ditwah.

Key Points

• Cyclone Ditwah was a tropical cyclone that developed in the Bay of Bengal during the late November 2025 period.

• The India Meteorological Department (IMD) monitored the system as it intensified from a deep depression into a Cyclonic Storm, moving towards the southeastern coast of India.

• The storm made its landfall around 30 November 2025, specifically impacting the coastal stretches of north Tamil Nadu and the Union Territory of Puducherry.

• Red and orange alerts were issued for several districts, including Chennai, Chengalpattu, and Villupuram, as the storm brought heavy to very heavy rainfall and strong gale winds.

• The administrative machinery in south Andhra Pradesh was also put on high alert to manage potential storm surges and flooding in districts such as Nellore and Tirupati.

Additional Information

• Naming Mechanism: Tropical cyclones in the North Indian Ocean are named by the WMO/ESCAP Panel on Tropical Cyclones, which consists of 13 member countries. The name Ditwah was contributed by Yemen, following the 169-name list established in 2020.

• Geographic Context: The Bay of Bengal is known for a higher frequency of cyclones compared to the Arabian Sea. This is primarily due to higher sea surface temperatures and the shape of the coastline, which funnels storms toward India and Bangladesh.

• IMD Classification: The India Meteorological Department classifies tropical systems based on Maximum Sustained Surface Wind (MSW). A Cyclonic Storm has wind speeds between 62 km/h and 88 km/h, while a Severe Cyclonic Storm reaches 89 km/h to 117 km/h.

• Post-Monsoon Season: The months of October, November, and December comprise the peak season for cyclonic activity in the North Indian Ocean, often coinciding with the Northeast Monsoon in southern India.

• Landfall Definition: Landfall occurs when the eye of the storm moves over the land. It is usually the most destructive phase due to the combined impact of storm surges, extreme wind speeds, and torrential rain.

Important Points

• Disaster Management: In anticipation of Cyclone Ditwah, the National Disaster Response Force (NDRF) and state disaster teams were pre-positioned in vulnerable coastal areas to facilitate rescue and relief operations.

• Monitoring Technology: The IMD utilized Dopler Weather Radars (DWR) located at Chennai and Sriharikota to provide real-time updates and track the trajectory of the cyclone with high precision.

• Impact on Infrastructure: Cyclonic storms like Ditwah often lead to the suspension of flight operations, disruption of railway services, and damage to power grids and telecommunication towers in the impacted zones.

• Climate Trends: Scientific observations indicate that while the total number of cyclones remains relatively stable, the intensity of storms in the Bay of Bengal has been increasing due to global warming and rising ocean heat content.

Q88. Answer: (d) Rohit Yadav

The correct answer is Rohit Yadav.

Key Points

• Indian javelin thrower Rohit Yadav secured the Gold Medal at the Taiwan Athletics Open, delivering an impressive performance on the international stage.

• He achieved a best throw of 83.28 meters during the competition, which took place at the Banqiao Stadium in New Taipei City.

• This victory was significant as it marked a successful return for the 23-year-old athlete following a major elbow surgery in 2023 that had sidelined him from the Asian Games and World Championships.

• The Taiwan Athletics Open serves as a crucial World Athletics Continental Tour (Bronze) event, providing athletes with valuable ranking points for major championships like the Olympics.

• By clinching the Gold, Rohit Yadav solidified his position as one of India's premier javelin throwers, trailing only behind elite athletes like Neeraj Chopra and Kishore Jena in recent seasons.

Additional Information

• Neeraj Chopra:

• He is the most decorated Indian javelin thrower, winning the Gold Medal at the Tokyo 2020 Olympics with a throw of 87.58 meters.

• In 2023, he became the first Indian to win a Gold Medal at the World Athletics Championships held in Budapest.

• Kishore Jena:

• Hailing from Odisha, he emerged as a world-class competitor by winning the Silver Medal at the 19th Asian Games in Hangzhou.

• He achieved a personal best of 87.54 meters, which is one of the highest marks ever recorded by an Indian.

• Athletics Federation of India (AFI):

• It is the apex body for athletics in the Republic of India, responsible for selecting athletes for the Olympics and other international competitions.

• The federation was established in 1946 and is headquartered in New Delhi.

• Davinder Singh Kang:

• He was the first Indian javelin thrower to reach the final of the World Athletics Championships, achieving this feat in 2017 in London.

Important Points

• Performance Data: The winning throw of 83.28 meters by Rohit Yadav in Taiwan was his second-best career performance at that time, following his personal best of 83.40 meters recorded in 2022.

• National Context: India has seen a "Javelin Revolution" following Neeraj Chopra's success, with multiple athletes consistently crossing the 80-meter mark in national and international meets.

• Technical Specs: In international athletics, the men's javelin must weigh 800 grams and measures between 2.6 to 2.7 meters in length. The competition usually involves six attempts for the finalists.

• Venue Details: The Banqiao Stadium is a multi-purpose stadium in Taiwan with a capacity of approximately 30,000 people, frequently hosting Track and Field events.

Q89. Answer: (c) Kunming–Montreal Global Biodiversity Framework

The correct answer is Kunming–Montreal Global Biodiversity Framework.

Key Points

• The National Red List Assessment Initiative was launched in India in October 2025 to systematically evaluate the conservation status of various species within the country's territory.

• This initiative is designed to align strictly with the IUCN (International Union for Conservation of Nature) global standards, which provide a rigorous objective framework for classifying species according to their extinction risk.

• A primary objective of this national assessment is to fulfill India’s international obligations under the Kunming–Montreal Global Biodiversity Framework (KMGBF), which was adopted to halt and reverse biodiversity loss. Hence, the correct answer is Kunming–Montreal Global Biodiversity Framework.

• The initiative is a collaborative effort involving the Ministry of Environment, Forest and Climate Change (MoEFCC), the Zoological Survey of India (ZSI), and the Botanical Survey of India (BSI).

• By creating a National Red List, India aims to prioritize conservation efforts for endangered and threatened species, ensuring that resource allocation is based on scientific data and urgent ecological needs.

Additional Information

• Kunming–Montreal Global Biodiversity Framework (KMGBF):

• Adopted during the 15th Conference of Parties (COP15) to the Convention on Biological Diversity (CBD) in December 2022.

• It consists of 4 overarching goals for 2050 and 23 targets to be achieved by 2030.

• Target 4 specifically focuses on halting human-induced extinction of known threatened species and promoting their recovery and conservation.

• This framework is often referred to as the "Paris Agreement for Nature," emphasizing its importance in global environmental governance.

• IUCN Red List Categories:

• The assessment uses specific categories such as Extinct (EX), Critically Endangered (CR), Endangered (EN), Vulnerable (VU), and Near Threatened (NT).

• Species classified as CR, EN, or VU are collectively referred to as "threatened" species.

• The National Red List allows for a more localized understanding of species that might be common globally but are threatened within India.

• Other Frameworks Mentioned:

• The Sendai Framework is focused on Disaster Risk Reduction (2015-2030) and is not primarily a biodiversity assessment tool.

• The Ramsar Convention focuses specifically on the conservation and sustainable use of wetlands.

• Greenhouse Gas (GHG) Frameworks generally relate to climate change mitigation under the UNFCCC rather than species-level biodiversity assessments.

Important Points

• India’s Biodiversity Status: India is recognized as one of the 17 megadiverse countries in the world, harboring nearly 7-8% of the world’s recorded species while occupying only 2.4% of the world’s land area.

• Institutional Role: The Zoological Survey of India (ZSI), established in 1916, and the Botanical Survey of India (BSI), established in 1890, serve as the premier organizations for taxonomic and biological studies in the country.

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• Legal Support: The findings from the National Red List Assessment Initiative will likely influence the implementation of the Biological Diversity Act, 2002, and the Wildlife (Protection) Act, 1972.

• National Biodiversity Targets (NBTs): India has updated its National Biodiversity Strategy and Action Plan (NBSAP) to align with the KMGBF, ensuring that national actions contribute to global biodiversity goals.

Q90. Answer: (a) Michael Misa

The correct answer is Michael Misa.

Key Points

• Michael Misa, a highly-rated forward for the Saginaw Spirit in the Ontario Hockey League (OHL), was announced as the recipient of the E.J. McGuire Award of Excellence in June 2024.

• The award is presented annually by the NHL Central Scouting to the draft prospect who best exemplifies a commitment to excellence through strength of character, competitiveness, and athleticism.

• Misa is considered a top prospect for the 2025 NHL Draft, making him one of the youngest and most prestigious talents to be recognized with this honor ahead of his eligibility year.

• In 2022, he was granted Exceptional Player Status by Hockey Canada, allowing him to enter the OHL at the age of 15, joining an elite group of players including John Tavares, Connor McDavid, and Connor Bedard.

• During the 2023-24 season, he played a critical role in helping the Saginaw Spirit capture their first-ever Memorial Cup championship, further solidifying his reputation as a big-game performer.

Additional Information

• The E.J. McGuire Award of Excellence:

• The award was established in 2011 to honor the legacy of E.J. McGuire, who served as the Director of the NHL Central Scouting Bureau from 2005 to 2011.

• It aims to recognize the "personality of the draft," focusing on players who demonstrate leadership and dedication off the ice as much as their skills on it.

• Past winners of this prestigious award include Connor Bedard (2023), Lane Hutson (2022), William Eklund (2021), and Nico Hischier (2017).

• Exceptional Player Status:

• This designation is awarded by Hockey Canada to players who demonstrate the physical, mental, and social maturity to play major junior hockey a year early.

• Michael Misa became only the sixth player in OHL history to receive this status, following his record-breaking performance at the OHL Cup where he surpassed Connor McDavid's scoring record with 20 points in seven games.

• 2025 NHL Draft Outlook:

• The 2025 NHL Draft is expected to feature Misa as a potential top-five selection due to his elite skating, hockey IQ, and consistent production in the Canadian Hockey League (CHL).

• His early recognition with the McGuire Award highlights the NHL's scouting community's high regard for his maturity and professionalism at a young age.

Q91. Answer: (d) Hidden sugars, fats and oils

The correct answer is Hidden sugars, fats and oils.

Key Points

• The Ministry of Health and Family Welfare (MoHFW), in collaboration with the Food Safety and Standards Authority of India (FSSAI), launched an extensive awareness campaign on the occasion of World Food Safety Day, celebrated on 7th June 2025.

• The primary focus of this campaign is to educate the public about the risks associated with Hidden sugars, fats and oils, which are prevalent in processed and ultra-processed foods.

• The initiative aims to address the rising prevalence of Non-Communicable Diseases (NCDs) such as obesity, Type 2 diabetes, and cardiovascular ailments in India, which are heavily influenced by the excessive consumption of these "hidden" ingredients.

• Through this campaign, the government emphasizes the importance of food literacy, urging consumers to scrutinize nutritional labels to identify high levels of saturated fats, trans-fats, and added sugars that are often not immediately apparent.

• This campaign aligns with the global objectives set by the World Health Organization (WHO) to ensure food safety and promote healthier dietary choices to reduce the global burden of diet-related illnesses. Hence, the correct answer is Hidden sugars, fats and oils.

Additional Information

• World Food Safety Day:

• Established by the United Nations General Assembly in December 2018, it was first observed in 2019.

• It is a joint initiative by the WHO and the Food and Agriculture Organization (FAO) of the United Nations to draw attention and inspire action to help prevent, detect, and manage foodborne risks.

• Food Safety and Standards Authority of India (FSSAI):

• FSSAI is a statutory body established under the Food Safety and Standards Act, 2006.

• It operates under the Ministry of Health & Family Welfare and is responsible for protecting and promoting public health through the regulation and supervision of food safety.

• The "Eat Right India" Movement:

• Launched by FSSAI, this movement is a large-scale initiative to transform the country's food system to ensure safe, healthy, and sustainable food for all.

• It uses a mix of regulatory, capacity-building, and collaborative approaches to nudge food businesses and consumers toward better eating habits.

• Front-of-Pack Labeling (FOPL):

• The MoHFW has been advocating for FOPL to provide clear, color-coded warnings (like the Indian Nutrition Rating) on packaged foods.

• This system helps consumers quickly identify if a product is high in salt, sugar, or fats, facilitating informed purchasing decisions.

Important Points

• Impact of Hidden Sugars: Excessive intake of free sugars is a major factor in dental caries and unhealthy weight gain, increasing the risk of metabolic syndrome.

• Risks of Fats and Oils: While some fats are essential, trans-fats and high saturated fats lead to clogged arteries and heart disease. India has committed to being Trans-fat free by 2022, and the 2025 campaign continues this momentum.

• Nutritional Awareness: Unlike Iron, Protein, or Zinc (which are often promoted as fortification elements to fight malnutrition), sugars and fats are highlighted as "concerns" due to their overconsumption in urban and transitioning dietary patterns.

Q92. Answer: (d) ICMR

The correct answer is ICMR.

Key Points

• The Indian Council of Medical Research (ICMR) licensed nine breakthrough health technologies to various industry partners during the India MedTech Expo held in September 2025.

• This initiative was aimed at fostering innovation and promoting self-reliance in the medical device sector, aligning with the Atmanirbhar Bharat and Make in India campaigns.

• The technologies licensed include advanced diagnostic kits, medical devices, and innovative healthcare solutions developed by several ICMR institutes across the country.

• The primary goal of this technology transfer is to bridge the gap between laboratory research and commercial production, ensuring that indigenous innovations reach the masses at an affordable cost.

• By partnering with the private industry, ICMR seeks to reduce India's heavy import dependency on high-end medical equipment and diagnostics.

Additional Information

• Indian Council of Medical Research (ICMR):

• It is the apex body in India for the formulation, coordination, and promotion of biomedical research.

• Established in 1911 as the Indian Research Fund Association (IRFA), it was renamed ICMR in 1949.

• It is headquartered in New Delhi and functions under the Department of Health Research, Ministry of Health and Family Welfare.

• The current Director General is Dr. Rajiv Bahl, who oversees a network of 27 institutes specializing in various health areas like viral diseases, nutrition, and oncology.

• India MedTech Expo:

• This is a premier national-level event organized by the Department of Pharmaceuticals, Ministry of Chemicals and Fertilizers.

• The expo serves as a platform to showcase the strength of the Indian Medical Device Industry and facilitate collaborations between startups, established companies, and research institutions.

• The event focuses on key pillars such as innovation, investment, and manufacturing to position India as a global hub for medical devices.

• Significance of the Medical Device Sector:

• India is currently among the top 20 global markets for medical devices and is the 4th largest in Asia.

• The government has introduced the National Medical Device Policy 2023 to facilitate orderly growth and achieve a 10-12% share in the global market over the next 25 years.

• Schemes like the Production Linked Incentive (PLI) for medical devices have been instrumental in boosting domestic manufacturing of high-tech equipment like MRI machines and CT scanners.

Important Points

• Technology Transfer (IPR): The process involves transferring Intellectual Property Rights from ICMR to private manufacturers,

allowing them to mass-produce the validated technologies.

• Impact on Healthcare: Licensing indigenous technologies helps in lowering the out-of-pocket expenditure for patients by providing local alternatives to expensive imported diagnostics.

• Collaborative Ecosystem: The expo highlights the importance of the Triple Helix Model, which involves collaboration between the Government, Academia (ICMR), and Industry to solve public health challenges.

Q93. Answer: (a) 10000

The correct answer is 10000.

Key Points

• The Union Budget 2025-26, presented by the Union Finance Minister Nirmala Sitharaman on February 1, 2025, announced a significant expansion in the medical education sector.

• For the upcoming academic year 2025-26, the government has proposed the addition of 10,000 new medical seats in the country.

• This move is designed to enhance the healthcare workforce and provide more opportunities for students aspiring to pursue medical careers within India.

• The announcement aligns with the government's long-term vision of strengthening the human resource capacity in the health sector to meet the growing demands of the population.

• By increasing the seat capacity, the government aims to bridge the gap in the doctor-patient ratio and ensure that quality medical education is accessible to a larger segment of the youth.

Additional Information

• Growth in Medical Education:

• Since 2014, there has been a substantial increase in the number of Medical Colleges and seats. The number of MBBS seats and Postgraduate (PG) seats has grown significantly to improve the availability of specialized doctors.

• The National Medical Commission (NMC) is the primary regulatory body that oversees medical education, accreditation, and the registration of medical practitioners in India.

• Upgradation of District Hospitals:

• The expansion of medical seats often involves upgrading existing District Hospitals into full-fledged medical colleges. This strategy helps in utilizing existing infrastructure while providing tertiary care in rural and semi-urban areas.

• This initiative is part of the Centrally Sponsored Scheme for the establishment of new medical colleges attached with existing district/referral hospitals.

• Healthcare Schemes:

• The Pradhan Mantri Ayushman Bharat Health Infrastructure Mission (PM-ABHIM) remains a cornerstone for developing health systems and responding to public health emergencies.

• The Ayushman Bharat - Pradhan Mantri Jan Arogya Yojana (AB-PMJAY) continues to provide financial protection to the poor, and the expansion of medical seats ensures there are enough professionals to manage the increasing patient load.

Important Points

• WHO Standards: The World Health Organization (WHO) recommends a ratio of 1 doctor per 1,000 people. India has been making steady progress towards achieving and maintaining this benchmark through such budgetary interventions.

• Budget 2025-26 Focus: The health sector in this budget emphasized digital health, preventive care, and infrastructure development alongside the increase in medical seats.

• Academic Session: The 10,000 seats are slated to be operationalized for the 2025-26 academic session, meaning they will be available during the upcoming counseling and admission cycles.

Q94. Answer: (d) Caustic soda

The correct answer is Caustic soda.

Key Points

• In March 2025, the Ministry of Environment, Forest and Climate Change (MoEFCC) issued a notification regarding the Environment (Protection) Second Amendment Rules, 2025, which specifically tightens the environmental standards for the Caustic soda industry.

• The Caustic soda sector, also known as the chlor-alkali industry, is one of the most chemically intensive industries, and the new rules aim to further reduce the discharge of toxic effluents and gaseous emissions.

• These rules introduce more stringent limits for parameters such as Total Suspended Solids (TSS), Chemical Oxygen Demand (COD), and pH levels in the wastewater discharged by these industrial units. Hence, the industry mentioned is Caustic soda.

• The amendment specifically mandates the complete transition of any remaining legacy units to Membrane Cell Technology to eliminate Mercury traces in the environment, aligning with the Minamata Convention objectives.

• The MoEFCC exercises these powers under Sections 6 and 25 of the Environment (Protection) Act, 1986 to ensure that

industrial growth does not come at the cost of ecological health.

Additional Information

• Caustic Soda (Sodium Hydroxide):

• It is a vital industrial chemical (NaOH) used extensively in the manufacture of soaps, detergents, paper, textiles, and for alumina refining in the aluminum industry.

• The production process involves the electrolysis of Sodium Chloride (NaCl) brine, which simultaneously produces Chlorine gas and Hydrogen as by-products.

• Industry Comparison:

• While the Cement industry is a major source of Carbon Dioxide (CO_2) and particulate matter, and the Textile industry is known for dye-related water pollution, the 2025 Second Amendment specifically focuses on the chemical complexities of the chlor-alkali (Caustic soda) sector.

• The Dairy industry is regulated under different standards focusing primarily on organic waste and Biological Oxygen Demand (BOD).

• The Environment (Protection) Act, 1986:

• This landmark Act of the Parliament of India was enacted in the wake of the Bhopal Gas Tragedy of 1984.

• It provides a framework for the Central Government to coordinate the activities of various state and central authorities, such as the Central Pollution Control Board (CPCB).

Important Points

• Technology Shift: India has successfully mandated the shift from Mercury Cell technology to Membrane Cell Technology in the Caustic soda sector to prevent Mercury poisoning. The 2025 rules further refine the operational efficiency of these membranes.

• Compliance and Penalties: Industrial units found violating the standards set in the Environment (Protection) Second Amendment Rules, 2025 are liable for penalties under Section 15 of the EPA, 1986, which includes heavy fines and potential imprisonment.

• Monitoring: The CPCB and State Pollution Control Boards (SPCBs) are tasked with the continuous monitoring of these industries using Online Continuous Effluent Monitoring Systems (OCEMS) to ensure real-time data reporting to the ministry.

• Global Context: By tightening these standards in 2025, India aims to meet its international commitments under various climate and environment treaties, ensuring that the "Make in India" initiative remains sustainable and eco-friendly.

Q95. Answer: (c) Talkatora Stadium

The correct answer is Talkatora Stadium.

Key Points

• The second edition of the STAIRS Youth National Games officially commenced on May 19, 2025.

• The event was held at the iconic Talkatora Stadium, located in New Delhi, which served as the primary venue for the opening ceremony and several sporting disciplines.

• The games are organized by STAIRS (Society for Transformation, Education and Recognition in Sports), which is a leading National Sports Promotion Organization (NSPO) in India.

• This edition of the games aimed to provide a massive platform for over 5,000 young athletes coming from various States and Union Territories across the country to showcase their talent at the grassroots level.

• The primary objective of the STAIRS Youth National Games is to identify sporting talent at a young age and provide them with the necessary exposure and training to represent India in international competitions like the Olympics.

• Hence, the correct answer is Talkatora Stadium.

Additional Information

• STAIRS Organization:

• STAIRS was founded in the year 2000 by Siddhartha Upadhyay with the vision of empowering underprivileged youth through sports and education.

• It is recognized by the Ministry of Youth Affairs and Sports, Government of India, as a National Sports Promotion Organization.

• The organization operates several programs like STAIRS Fun and Games and STAIRS School Football League (SSFL) to promote a culture of fitness and sportsmanship among children.

• Talkatora Stadium:

• The Talkatora Stadium is a prominent indoor sports stadium located on Willingdon Crescent in New Delhi.

• It has a seating capacity of approximately 3,035 people and is known for its unique architectural design resembling a blooming lotus.

• The stadium has historically hosted major events, including boxing matches during the 2010 Commonwealth Games.

• Sports Categories:

• The Youth National Games encompass a wide range of disciplines including Basketball, Volleyball, Football, Athletics, Martial Arts (such as Karate and Taekwondo), and Kabaddi.

• These games are pivotal in bridging the gap between rural talent and professional scouting networks in India.

Important Points

• Other Options in Context:

• Jawaharlal Nehru Stadium: Primarily used for Athletics and Football, it is one of the largest multipurpose stadiums in New Delhi but was not the commencement site for this specific edition of STAIRS games.

• Indira Gandhi Arena: It is the largest indoor arena in India and often hosts Gymnastics and Cycling events.

• Thyagaraj Sports Complex: Built for the 2010 Commonwealth Games, it is India's first green stadium utilizing solar energy and water harvesting.

• Impact of STAIRS:

• By 2025, the organization has reached millions of children across thousands of villages in India, making it one of the largest non-governmental sports bodies in the country.

Q96. Answer: (b) 15 january

The correct answer is 15 january.

Key Points

• Army Day is observed in India every year on 15 January to recognize the selfless service and sacrifices of the soldiers of the Indian Army.

• In the year 2025, India celebrated its 77th Army Day. The day is celebrated across the country with great enthusiasm, featuring parades and military shows.

• This specific date was chosen because it was on 15 January 1949 that Lieutenant General K.M. Cariappa (who later became a Field Marshal) took over as the first Indian Commander-in-Chief of the Indian Army.

• He succeeded General Francis Roy Bucher, who was the last British officer to hold the top post of the Indian Army. This transition marked a historic moment in the sovereignty of the nation’s military leadership.

• Continuing the recent tradition of holding the main Army Day Parade outside the national capital, the 2025 parade was organized in Pune, Maharashtra. This initiative aims to increase public engagement and showcase the army's heritage in different parts of the country.

Additional Information

• Motto of Indian Army: The official motto of the Indian Army is "Seva Paramo Dharma," which translates to "Service Before Self." This ethos guides the conduct and spirit of every soldier in the force.

• Field Marshal K.M. Cariappa: Known affectionately as "Kipper," he was the first Indian to be promoted to the rank of Field Marshal. He led the Indian Army during the Indo-Pakistani War of 1947.

• Role and Structure: The Indian Army is the land-based branch of the Indian Armed Forces. It is headquartered in New Delhi and functions under the Ministry of Defence. As of 2025, the Chief of the Army Staff (COAS) is General Upendra Dwivedi.

• Other Military Observances: Apart from Army Day on 15 January, India celebrates Air Force Day on 8 October and Navy Day on 4 December. Additionally, Armed Forces Flag Day is observed on 7 December to collect funds for the welfare of veterans and their families.

• Global Standing: The Indian Army is consistently ranked as one of the largest standing armies in the world, playing a critical role in border security, counter-terrorism, and UN Peacekeeping missions.

Important Points

• Gallantry Awards: On Army Day, the Chief of the Army Staff awards Gallantry awards and Sena Medals to personnel for their exceptional bravery and distinguished service during operations.

• Theme and Technology: Recent Army Day celebrations have emphasized the "Year of Technology Absorption" and "Atmanirbhar Bharat" (Self-reliant India), showcasing indigenous weapon systems like the Arjun Tank, Nag Missiles, and Pinaka Rocket Systems.

• Historical Context: Although the Indian Army was officially established by the British in 1895, it only became truly "Indian" in its command structure following the 1949 handover celebrated on this day.

• Operational Commands: The Indian Army is divided into seven commands, including the Northern, Western, Central, Eastern, Southern, South-Western, and the Training Command (ARTRAC).

Q97. Answer: (b) Banu Mushtaq and Deepa Bhasthi

p>The correct answer is Banu Mushtaq and Deepa Bhasthi.

Key Points

• The International Booker Prize for the year 2025 has been awarded to the Kannada author Banu Mushtaq and the translator Deepa Bhasthi for the novel titled Heart Lamp.

• This prestigious award recognizes the finest in translated fiction from around the globe, ensuring that exceptional stories written in languages other than English reach a worldwide audience. Hence, statement 2 is correct.

• Banu Mushtaq is the original author of the work, which was originally penned in Kannada, a language primarily spoken in the Indian state of Karnataka.

• Deepa Bhasthi is the translator who rendered the literary work into English, making it eligible for the international competition held in the United Kingdom.

• The prize includes a cash award of £50,000 (approximately 53 lakh INR), which is distributed equally between the author and the translator to honor the collaborative nature of the work.

Additional Information

• Banu Mushtaq:

• She is a prominent feminist writer, poet, and social activist from India.

• Her writings often focus on the lived experiences of women, social justice, and communal harmony within the cultural landscape of South India.

• She has received several accolades in the past, including the Karnataka Sahitya Academy Award.

• Deepa Bhasthi:

• She is an independent writer and editor whose work frequently explores the intersections of art, culture, and landscape.

• As a translator, she has played a significant role in bringing contemporary Kannada literature to an English-speaking readership.

• The International Booker Prize:

• Established in 2005, it was initially a biennial prize awarded to a living author for their entire body of work.

• Since 2016, the format changed to an annual prize for a single book that is translated into English and published in the UK or Ireland.

• It is distinct from the Booker Prize, which is awarded to novels originally written in English.

• Other Options Context:

• Kiran Desai is a world-renowned author who won the Man Booker Prize in 2006 for her novel The Inheritance of Loss.

• David Szalay is a British-Canadian novelist known for his work All That Man Is, which was shortlisted for the Booker Prize in 2016.

• Margaret Atwood is a legendary Canadian author who has won the Booker Prize twice, in 2000 for The Blind Assassin and in 2019 for The Testaments.

Important Points

• The win for Heart Lamp marks a significant milestone for Indian literature, following the success of Geetanjali Shree and Daisy Rockwell, who won the prize in 2022 for Tomb of Sand (originally Ret Samadhi).

• The selection process involves a panel of five judges who review a longlist and then a six-book shortlist before announcing the winner in a ceremony held in London.

• Translation prizes like these are essential for promoting linguistic diversity and encouraging publishers to invest in non-Western narratives.

Q98. Answer: (d) Diu

The correct answer is Diu.

Key Points

• The first-ever multi-venue Beach Games of India, organized under the spirit of the Khelo India initiative, were held at Ghoghla Beach in Diu.

• The event took place from 4th January to 11th January 2024, marking a significant milestone in India's sporting calendar by introducing a dedicated platform for beach-based disciplines.

• The games were officially inaugurated by the Union Minister for Youth Affairs and Sports, Anurag Singh Thakur, who emphasized the vision of making Diu a global hub for beach sports.

• Madhya Pradesh emerged as the overall champion of the inaugural edition, topping the medal tally with a total of 18 medals, which included 7 gold medals.

• The Union Territory of Dadra and Nagar Haveli and Daman and Diu secured the second position, while Maharashtra finished third in the overall standings.

Additional Information

• Venue Significance:

• Ghoghla Beach, the primary venue for the games, is one of the prestigious Blue Flag certified beaches in India, known for its high environmental standards, safety, and cleanliness.

• The choice of Diu as the host location was strategic to promote coastal tourism and utilize India's vast 7,500 km coastline for sports development.

• Sports Disciplines:

• A total of 8 sports were featured during the week-long competition, including Beach Volleyball, Beach Boxing, Beach Soccer,

Beach Kabaddi, Tug of War, Sea Swimming, Mallakhamb, and Pencak Silat.

• The inclusion of traditional sports like Mallakhamb on the sand added a unique cultural dimension to the international-style beach games.

• Participation Details:

• More than 1200 athletes from 28 States and Union Territories participated in the competition, showcasing the pan-India appeal of the event.

• The participants were primarily in the under-21 age category, aligning with the Khelo India mission to identify and nurture young talent at the grassroots level.

• Impact and Vision:

• The Beach Games 2024 aim to diversify the sporting culture in India beyond traditional field and track events, encouraging states to invest in niche coastal sports.

• This initiative is part of the broader Ministry of Youth Affairs and Sports strategy to enhance India's performance in international multi-sport events like the Asian Beach Games and World Beach Games.

Important Points

• Ranking Highlights: Madhya Pradesh showed exceptional dominance by winning the maximum number of gold medals, reflecting the state's robust sports infrastructure.

• Diu's Transformation: The successful hosting of this event is expected to boost local economy and adventure tourism in the Union Territory.

• Khelo India Connection: Although distinct from the main Khelo India Youth Games, the Beach Games follow the same organizational framework to ensure professional standards in officiating and athlete management.

Q99. Answer: (d) 6

The correct answer is 6.

Key Points

• The Reserve Bank of India (RBI) established the Payments Regulatory Board (PRB) to exercise the powers and perform the functions of the central bank in relation to the regulation and supervision of payment systems.

• The Payments Regulatory Board consists of 6 members in total, designed to provide a balanced representation of central bank authority and external expertise.

• The Governor of the Reserve Bank of India serves as the ex-officio Chairperson of the Board, ensuring that payment policy remains aligned with broader monetary objectives.

• The composition includes the Deputy Governor in charge of the Department of Payment and Settlement Systems as a member, along with one officer of the Reserve Bank nominated by the Central Board of the RBI.

• To ensure a diverse perspective in the fintech and digital banking sectors, the Central Government nominates three members to the board.

• The primary mandate of this board is to oversee retail and wholesale payment systems, including digital wallets, card networks, and online transaction gateways, to ensure they operate in a safe and efficient manner.

Additional Information

• Legislative Framework: The formation of the Payments Regulatory Board was facilitated through amendments to the Payment and Settlement Systems Act, 2007, particularly following the recommendations of the Ratan Watal Committee on digital payments.

• Replacement of BPSS: The PRB replaced the earlier Board for Regulation and Supervision of Payment and Settlement Systems (BPSS), which was a sub-committee of the Central Board of the RBI.

• Objective of Innovation: One of the key goals of the PRB is to foster competition and innovation within the financial technology (FinTech) ecosystem while maintaining financial stability.

• Interoperability: The board is responsible for drafting policies that mandate interoperability between different payment service providers, such as UPI apps and mobile wallets, to enhance user convenience.

• Consumer Protection: A significant portion of the board's regulatory oversight is dedicated to customer grievance redressal and ensuring robust cybersecurity protocols to prevent online fraud.

Important Points

• Tenure of Members: The members nominated by the Central Government typically hold office for a period of 3 years and are eligible for re-appointment, providing continuity in policy making.

• Governance Standards: The board holds meetings at regular intervals, at least once every quarter, to review the status of the national payment infrastructure and the performance of Systemically Important Payment Systems (SIPS).

• Data Sovereignty: Under the guidance of the PRB, the RBI enforces strict data localization norms, requiring payment companies to store transaction data of Indian citizens on servers located within India.

• Global Alignment: The PRB works to ensure that Indian payment systems comply with international standards set by the Committee on Payments and Market Infrastructures (CPMI) and the Bank for International Settlements (BIS).

Q100. Answer: (d) India and UK

The correct answer is India and UK.

Key Points

• The 3rd edition of the International Conference was organized by the Indian Council of Arbitration (ICA) in June 2025.

• The central theme of the conference focused on the implementation and efficiency of “Hybrid Dispute Resolution Models” within the global legal landscape.

• The conference specifically emphasized resolving commercial conflicts arising between India and the UK (United Kingdom), reflecting the growing economic synergy between the two nations.

• This initiative aims to create a more robust framework for Alternative Dispute Resolution (ADR), ensuring that businesses in both India and the UK have access to streamlined legal processes.

• The discussion on Hybrid Models usually involves a combination of Mediation and Arbitration (often termed Med-Arb), allowing parties to attempt a settlement before moving to a binding arbitral award.

• Hence, the correct answer is India and UK.

Additional Information

• Indian Council of Arbitration (ICA):

• Established in 1965, the ICA is the apex arbitral body in India.

• It operates as a non-profit organization under the Ministry of Commerce and Industry, Government of India.

• Its primary function is to promote the use of arbitration and other ADR mechanisms to settle domestic and international commercial disputes.

• Hybrid Dispute Resolution Models:

• These models, such as Med-Arb or Arb-Med-Arb, are designed to offer the flexibility of mediation and the finality of arbitration.

• The uses of these models include reducing the time and cost associated with traditional litigation and standard arbitration.

• They are particularly effective in cross-border commercial conflicts where different legal systems (like those of India and the UK) interact.

• India-UK Economic Relations:

• With the India-UK Free Trade Agreement (FTA) negotiations being a major feature of bilateral talks, legal certainty is a priority for investors.

• The UK is one of India’s largest trading partners, and robust dispute resolution mechanisms are essential to handle high-value commercial contracts.

Important Points

• Legal Framework: Arbitration in India is primarily governed by the Arbitration and Conciliation Act, 1996, which is based on the UNCITRAL Model Law.

• Global Hub Ambition: The Indian government is actively working to establish India as a global hub for International Arbitration, similar to Singapore or London.

• Institutional vs. Ad-hoc Arbitration: The ICA encourages Institutional Arbitration over Ad-hoc methods to ensure better administrative support and standardized rules.

• Date and Location: The conference held in June 2025 serves as a milestone in the 60th year (Diamond Jubilee) vicinity of the ICA's journey since its 1965 inception.

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