RRB Group D Official Paper (Held On: 10 Dec, 2025 Shift 1) (Previous Year Paper)

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

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GENERAL SCIENCE

Q1. Which of the following is the correct sequence of events in flowering plant reproduction?

(a) Fertilisation → Pollination → Embryo → Seedling
(b) Embryo → Seedling → Pollination → Fertilisation
(c) Pollination → Fertilisation → Embryo → Seedling
(d) Pollination → Fertilisation → Seedling → Embryo

Q2. Which one of the following statements is TRUE about vasectomy?

(a) It stops testosterone production.
(b) It blocks the vas deferens to prevent sperm release.
(c) It removes the seminal vesicles.
(d) It kills the sperm cells reaching the uterus.

Q3. When resistors are connected in series, which quantity remains the same across all resistors?

(a) Current
(b) Voltage
(c) Resistance
(d) Power

Q4. Why do isobars, despite having the same mass number, exhibit different chemical properties?

(a) Because their atomic numbers and electronic configurations differ
(b) Because they belong to the same group in the periodic table
(c) Because they have the same number of protons
(d) Because they have the same number of neutrons in their nuclei

Q5. What type of bond is formed when a metal reacts with a non-metal?

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

Q6. Tooth enamel starts corroding when the pH in the mouth falls below _____.

(a) 5.5
(b) 7.5
(c) 4.5
(d) 6.5

Q7. A body of mass 5 kg is initially at rest. A constant force of 20 N acts on it for 4 s. What is the final velocity of the body?

(a) 8 m/s
(b) 12 m/s
(c) 20 m/s

(d) 16 m/s

Q8. Which of the following statements is INCORRECT regarding cell type and shape?

(a) The white blood cell (WBC) has a round and fixed shape.
(b) The muscle cell is spindle-shaped.
(c) The nerve cell is long and branched in shape.
(d) The red blood cell (RBC) is disc-shaped with a central depression.

Q9. In a circuit diagram, the symbol for a cell is represented by which of the following?

(a) A circle with a cross inside
(b) One long and one short line parallel to each other
(c) Two equal lines parallel to each other
(d) A rectangle with a diagonal line

Q10. Which wave characteristic determines the loudness of a sound?

(a) Pitch
(b) Amplitude
(c) Wavelength
(d) Frequency

Q11. A student complains of difficulty in reading the blackboard clearly while sitting at the back of the class, but can read a book at 25 cm without difficulty. Which statement is correct for his condition?

(a) He has myopia and needs a concave lens
(b) He has hypermetropia and needs a convex lens
(c) He has presbyopia and needs bifocals
(d) He has cataract and needs surgery

Q12. Which of the following is NOT a cell organelle?

(a) Endoplasmic Reticulum
(b) Cytoplasm
(c) Mitochondria
(d) Golgi Apparatus

Q13. Which metal will displace iron from iron sulfate solution?

(a) Silver
(b) Zinc
(c) Chromium
(d) Copper

Q14. Which of the following has branched-chain hydrocarbons?

(a) Isobutane
(b) Butane
(c) Propane
(d) Ethane

Q15. Which of the following statements best differentiates a compound from a solution?

(a) A compound can be separated by physical methods, while a solution cannot.
(b) A compound has a fixed composition and definite properties, unlike a solution.
(c) Compounds are always liquid, but solutions can be in any state.
(d) Compounds are mixtures of two or more elements, while solutions are mixtures of compounds only.

Q16. In a school garden, butterflies often visit flowers while squirrels feed on nuts. What types of consumers are these organisms?

(a) Butterflies – parasites, Squirrels – decomposers
(b) Butterflies – omnivores, Squirrels – carnivores
(c) Butterflies – herbivores, Squirrels – herbivores

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(d) Butterflies – carnivores, Squirrels – omnivores

Q17. Which of the following is the correct reason for why fruits fall from the tree when the branches of the tree are shaken vigorously?

(a) The fruits fall down due to change in momentum.
(b) The fruits fall down due to inertia.
(c) The fruits fall down due to action reaction forces.
(d) The fruits fall down due to frictional force.

Q18. A student says, “Plants don’t have a nervous system, so they cannot respond to anything.” What would be the correct scientific response?

(a) Only animals can show responses.
(b) Plants respond using hormonal and electrical-chemical signals.
(c) The student is right; plants are non-living.
(d) Plants use nerves like animals do.

Q19. During the transformation of energy from one form to another, such as gravitational potential energy converting into kinetic energy during free fall, _____.

(a) the total energy before and after the transformation remains the same
(b) energy is gradually lost to the environment, violating the law
(c) the total mechanical energy increases, adhering to the law
(d) new energy is constantly created, balancing the loss of the original form

Q20. The basic modification with a “prefix” or “suffix” in the nomenclature is the indicator of:

(a) Nature of the surface area
(b) Nature of the boiling point
(c) Nature of the melting point
(d) Nature of the functional Group

Q21. Which of the following types of human muscles show alternate light and dark bands when stained appropriately?

(a) Skeletal muscles
(b) Visceral muscles
(c) Muscles of the alimentary canal
(d) Involuntary muscles

Q22. The size of the image formed by a convex mirror _____.

(a) is always smaller than the object
(b) is always equal to the object
(c) can be larger or smaller depending on object position
(d) is always larger than the object

Q23. Which type of cells are used by organisms like hydra for reproduction in the process budding?

(a) Stomatal cells
(b) Regenerative cells
(c) Gametic cells
(d) Photosynthetic cells

Q24. Why does ice float on the surface of water?

(a) Because the density of ice is less than that of water
(b) Because ice is at a lower temperature
(c) Because it displaces water equal to its weight
(d) Because the weight of ice is very small

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Q25. What is the SI unit of Pressure?

(a) mmHg
(b) Atmosphere
(c) Torr
(d) Pascal

MATHEMATICS

Q26. What is the smallest natural number that should be added to 4478 such that a remainder of 2 is left when the resulting number is divided by each of the numbers 56, 80, 16 and 60?

(a) 584
(b) 564
(c) 574
(d) 549

Q27. 20 men can reap a field in 18 days. If the goal is to finish reaping the field in 30 days, after how many days should 9 men stop working?

(a) 31/2 days
(b) 21/2 days
(c) 41/2 days
(d) 10/3 days

Q28. Two engines of trains 60 km apart start towards each other at speeds of 16 km/hr and 29 km/hr, respectively. After how much time will they meet each other? (Assume the length of engine is negligible.)3622

(a) 80 minutes
(b) 90 minutes
(c) 72 minutes
(d) 86 minutes

Q29. A sphere of diameter 14 cm is cut into 4 equal parts. What is the total surface area (in cm^2) of the four parts?
(Use $\pi = 22/7$)

(a) 2464
(b) 3606
(c) 1232
(d) 4408

Q30. The monthly incomes of two friends Gopal and Akshay are in the ratio 5 : 8 and each of them saves Rs. 78,000 every month. If the ratio of their monthly expenditure is 1 : 4, then find the monthly income of Gopal (in Rs.).

(a) 96500
(b) 98500
(c) 97500
(d) 1,36,500

Q31. The cost price of a box of sharpeners is Rs. 2,400. The shopkeeper gave 41% of discount on the cost price. What is the selling price (in Rs.)?

(a) 1,242
(b) 1,494
(c) 1,496
(d) 1,416

Q32. The present age of Mr. Gupta is three times the present age of his daughter. Six years hence, the ratio of their ages will be 5 : 2. What is the present age of the daughter?

(a) 18 years
(b) 24 years
(c) 20 years

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(d) 22 years

Q33. In a polling booth with 9000 valid votes, four candidates P, Q, R and S contested, and a NOTA option was also available. Exactly 1% of the total votes went to NOTA. Candidate Q received 25% of the votes secured by P. The combined votes of R and S totaled 5,830, distributed between them in the ratio 3 : 2. How many votes did the winning candidate receive?

(a) 3498
(b) 3894
(c) 3984
(d) 4398

Q34. In triangle ABC, BD perpendicular to AC at D and angle DBC = 71°. E is a point on BC such that angle CAE = 57°. What is the measure of angle AEB ?

(a) 76°
(b) 62°
(c) 71°
(d) 68°

Q35. A, B and C can do a piece of work in 3, 24 and 8 days, respectively. How long (in days) will they take to do twice the same work, working together?

(a) 8
(b) 12
(c) 4
(d) 5

Q36. The average age of 57 students of a class is 19 years. If the age of the teacher is also included, the average age of the whole group becomes 20 years. The age (in years) of the teacher is:

(a) 75
(b) 71
(c) 79
(d) 77

Q37. A typist takes 40 minutes to type 2 pages. How long (in minutes) will he take to type 96 pages?2686

(a) 1925
(b) 1910
(c) 1930
(d) 1920

Q38. A cash payment that will settle a bill for 600 pairs of sandals at Rs. 91 per pair of sandals with the successive discounts of 25% and 25% with a further discount of 28% on cash payment is:

(a) Rs. 22,101
(b) Rs. 22,111
(c) Rs. 22,104
(d) Rs. 22,113

Q39. 1/20 is what percentage of 11/100 (rounded off to two decimal places)?

(a) 55.45%
(b) 60.45%
(c) 90.91%
(d) 45.45%

Q40. Simplify: $(x^4 - 1)(x^2 + x + 1)/(x^3 - 1)(x^2 + 1)$

(a) $x - 1$
(b) $x^2 - 1$
(c) $x^2 + 1$
(d) $x + 1$

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Q41. If $1 - \sin^2 B = K \cdot \sin^2 B$, find K.

(a) $\cot^2 B$
(b) $\sec^2 B$
(c) $\tan^2 B$
(d) $\text{cosec}^2 B$

Q42. The sum of two integers is 40. If the difference between them is 14, find the larger integer.

(a) 17
(b) 33
(c) 25
(d) 27

Q43. If the mean proportional of A and 112 is 28, then find the value of A.

(a) 6
(b) 7
(c) 5
(d) 4

Q44. The product of mean and mode is 24 and the product of median and mean is 32.. If the square root of the sum of squares of mean, 3 times median and mode is $a \times \sqrt{(b \times 11)}$, find $\sqrt{(a + b)}$.

(a) 3
(b) 4
(c) 5
(d) 6

Q45. A woman travelled at a speed of 20 m/min for 80 min, and at a speed of 50 m/min for 70 min. Her average speed (in m/min) is:

(a) 34
(b) 40
(c) 38
(d) 27

Q46. The length, breadth, and height of a cuboid are in the ratio 1 : 2 : 3. If the length, breadth, and height are increased by 100%, 50%, and 80%, respectively, find the percentage increase in the volume of the cuboid.

(a) 402%
(b) 440%
(c) 404%
(d) 450%

Q47. In 532 litres solution of acid and water, the ratio of acid and water is 4:3. How many litres of acid must be added to it to get the solution in which the ratio of acid and water is 8:4?

(a) 152
(b) 154
(c) 153
(d) 151

Q48. If $90 - [36 \div 3 + 2 \times (P^2 - 21)] \div 3 = 70/3$, find the positive value of P.

(a) 5
(b) 6
(c) 4
(d) $\sqrt{115}$

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Q49. Two banks, A and B, offered loans at 3.5% and 7% per annum, respectively. Salil borrowed an amount of Rs. 4,60,000 from each bank. Find the positive difference (in Rs.) between the amounts of simple interest paid to the two banks by Salil after 3 years.

(a) 48,300
(b) 49,800
(c) 49,300
(d) 47,800

Q50. A shopkeeper bought certain goods for Rs. 2,500 and sold them for Rs. 3,250. Find his profit percentage.

(a) 20%
(b) 25%
(c) 40%
(d) 30%

GENERAL INTELLIGENCE & REASONING

Q51. Read the given statements and conclusions carefully. Assuming that the information given in the statements is true, even if it appears to be at variance with commonly known facts, decide which of the given conclusions logically follow(s) from the statements.

Statements:

All trees are bushes.

All bushes are herbs.

Conclusions:

(I): Some herbs are bushes.

(II): All trees are herbs.

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

Q52. IJ 8 is related to KE −1 in a certain way. In the same way, TP 3 is related to VK −6. To which of the given options is PQ 12 related, following the same logic?

(a) SL 5
(b) RK 3
(c) SK 5
(d) RL 3

Q53. All 37 students in a class are standing in a row facing north. Nisha is 13^(th) from the left end while Manasa is 15^(th) from the right end. How many people stand between Nisha and Manasa?

(a) 9
(b) 12
(c) 10
(d) 7

Q54. Which letter-cluster will replace the question mark (?) in the following series to make it logically complete?

IXB GWE EVH CUK ?

(a) ASM
(b) ATN
(c) BTM
(d) BSN

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Q55. All 30 students in a class are standing in a row facing north. Arun is 7^(th) from the right end while Harish is 8^(th) from the left end. How many people stand between Arun and Harish?

(a) 13
(b) 14
(c) 15
(d) 17

Q56. Six students, S1, S2, S3, S4, S5 and S6, are sitting around a circular table, facing the centre. The student S6 is sitting next to both S5 and S2. S1 and S3 are sitting next to each other. S4 is the common neighbour of S2 and S3. S1 is second to the right of S4. Who among the following is sitting fourth to the right of S1?

(a) S2
(b) S6
(c) S4
(d) S3

Q57. In a certain code language, ‘he fix gadgets’ is coded as ‘pd rt ds’ and ‘fix this pen’ is coded as ‘nq uz pd’. How is ‘fix’ coded in the given language?

(a) nq
(b) ds
(c) uz
(d) pd

Q58. Devesh starts from Point Y and drives 21 km towards the east. He then takes a left turn, drives 25 km, turns left and drives 67 km. He then takes a right turn and drives 29 km. He takes a right turn, drives 46 km, turns left, drives 41 km to stop at Point Z. How far (shortest distance) and towards which direction should he drive in order to reach Point Y again? (All turns are 90-degree turns only unless specified.)

(a) 97 km towards the south
(b) 95 km towards the south
(c) 91 km towards the north
(d) 93 km towards the south

Q59. Refer to the following series and answer the question that follows (all numbers are single digit numbers only). Counting to be done from left to right only.

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

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

(a) 6
(b) 4
(c) 5
(d) 7

Q60. Refer to the following number series and answer the question that follows (all numbers are single-digit numbers only).

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

How many times does the perfect cube appear in the given series?

(a) Eleven
(b) Seven
(c) Six
(d) Nine

Q61. 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 roads are fans.

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No fan is a car.

Conclusions:

(I) Some roads are cars.

(II) Some fans are roads.

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

Q62. In a certain code language, ‘students are learning’ is coded as ‘ab mn pq’ and ‘learning is fun’ is coded as ‘st mn xy’. How is ‘learning’ coded in the given language?

(a) mn
(b) ab
(c) st
(d) xy

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

1, 3, 16, 5, 7, 144, 9, 11,?

(a) 196
(b) 400
(c) 324
(d) 169

Q64. In a certain code language,

P + Q means ‘P is the mother of Q’,

P # Q means ‘P is the brother of Q’,

P & Q means ‘P is the sister of Q’,

and P % Q means ‘P is the father of Q’.

How is G related to S if ‘G & H % I & T # S’?

(a) Father's sister
(b) Mother's brother
(c) Mother's mother
(d) Father's brother

Q65. Based on the English alphabetical order, three of the following four letter-cluster pairs are alike in a certain way and thus form a group. Which letter-cluster pair DOES NOT belong to that group?

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

(a) IM-PK
(b) CG-JD
(c) GK-NH
(d) EI-LF

Q66. Each of the digits in the number 2134567 is arranged in ascending order from left to right. What will be the sum of the digits which are second from the left and second from the right in the new number thus formed?

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

Q67. Select the pair which follows the same pattern as that followed by the two set of pairs given below. Both pairs follow the same pattern.

JHK−IGJ

LJM−KIL

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(a) DBE−CAD
(b) DBE−BAC
(c) DAC−CAD
(d) DAC−BZC

Q68. If 1 is added to each even digit and 2 is subtracted from each odd digit in the number 4635923, what will be the sum of the digits which are second from the left and second from the right in the new number thus formed?

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

Q69. Each of the digits in the number 2175684 is arranged in ascending order from left to right. The positions of how many digits will remain unchanged as compared to that in the original number?

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

Q70. What should come in place of the question mark (?) in the given series?

721 723 727 733 741 ?

(a) 748
(b) 753
(c) 751
(d) 749

Q71. Refer to the following number and symbol series and answer the question that follows (all numbers are single-digit numbers only). Counting to be done from left to right only.

(Left) 2 8 + 7 5 > 9 2 @ 3 = 4 6 % 3 & 8 4 % 9 1 8 3 # 7 6 9 (Right)

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

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

Q72. 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 its constituent digits. E.g. 13 – Operations on 13 such as adding / subtracting /multiplying etc. to 13 can be performed. Breaking down 13 into 1 and 3 and then performing mathematical operations on 1 and 3 is not allowed.)

(9, 31, 26)

(13, 43, 38)

(a) (12, 32, 27)
(b) (15 ,49 ,44)
(c) (14, 38, 33)
(d) (20, 56, 51)

Q73. A, B, C, D, E and F are sitting around a circular table facing the centre. E sits third to the right of B. C sits to the immediate left of F. C is not an immediate neighbour of B. D sits to the immediate right of A. The position(s) of how many persons will remain unchanged if all persons are arranged in English alphabetical order in clockwise direction starting from A (including A)?

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

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Q74. GM 14 is related to EJ 16 in a certain way. In the same way, KQ 22 is related to IN 24. To which of the given options is OU 27 related, following the same logic?

(a) QT 29
(b) MR 29
(c) PR 29
(d) PT 28

Q75. 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) PSU
(b) JMO
(c) XBC
(d) HKM

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

OSW 24, GKO 35, YCG 46, QUY 57, IMQ 68, ?

(a) AEI 79
(b) AIE 79
(c) AOI 79
(d) AEI 78

Q77. Jiten starts from Point Y and drives 28 km towards South. He then takes a right turn, drives 71 km, turns left and drives 69 km. He then takes a left turn and drives 44 km. He takes a left turn, drives 51 km. He then turns right, drives 27 km to stop at Point Z. How far (shortest distance) and towards which direction should he drive in order to reach Point Y again?

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

(a) 44 km towards south
(b) 48 km towards north
(c) 49 km towards south
(d) 46 km towards north

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

131 102 73 44 15 ?

(a) -13
(b) -14
(c) -11
(d) -10

Q79. Six people, A, B, C, D, E and F, are sitting in a row, facing north. E sits to the immediate right of D. F sits fourth to the left of D. Only one person sits between B and D. C sits to the immediate left of B. A sits second to the left of E.

Three of the following four are alike in a certain way based on the given arrangement and thus form a group. Which is the one that does NOT belong to that group?

(a) FE
(b) CB
(c) BA
(d) AD

Q80. Refer to the following number series and answer the question that follows (all numbers are single-digit numbers only). Counting to be done from left to right only.

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

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

(a) Three

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

GENERAL AWARENESS AND CURRENT AFFAIRS

Q81. As notified in April 2025, a research study of which of the following institutes revealed that surface ozone is silently threatening India's food crops?
(a) Indian Institute of Technology, Mumbai
(b) Indian Institute of Technology, Kanpur
(c) Indian Institute of Technology, Kharagpur
(d) Indian Institute of Technology, Delhi

Q82. In June 2025, which director turned cinema by converting toy-train coaches into a screening venue at Kurseong?
(a) Rishav Choudhary
(b) Ravi Shankar
(c) Rohit Shetty
(d) Girija Devi

Q83. Which authority of India hosted the 25th Meeting of the South Asian Telecommunication Regulators' Council (SATRC-25)?
(a) Department of Telecommunications
(b) National Informatics Centre
(c) Ministry of Communications
(d) Telecom Regulatory Authority of India

Q84. The Corruption Perceptions Index 2024, released by Transparency International in February 2025, ranked which country as the least corrupt?
(a) Singapore
(b) Finland
(c) Switzerland
(d) Denmark

Q85. How much accident compensation was announced by Indian railways in June 2025 for its employees without paying any insurance premium?
(a) Rs. 1.5 crore
(b) Rs. 50 lakh
(c) Rs. 1 crore
(d) Rs. 25 lakh

Q86. In June 2025, Bhashini signed an MoU with which government entity to integrate real-time translation on passenger platforms?
(a) Ministry of Communications and Information Technology
(b) Ministry of Home Affairs
(c) Centre for Railway Information Systems
(d) Unique Identification Authority of India

Q87. Which of the following countries became the member of National Development Bank in May 2025?
(a) Algeria
(b) Egypt
(c) Bangladesh
(d) United Arab Emirates

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Q88. What is the new Loan-to-Value (LTV) ratio, set by the Reserve Bank of India for loans below Rs. 2.5 lakh in June 2025?

(a) 75%
(b) 70%
(c) 80%
(d) 85%

Q89. The Indian Army contingent that took part in the fourth edition of Exercise AUSTRAHIND 2025 held in Australia was commanded by a battalion of _____.

(a) Gorkha Rifles
(b) Madras Regiment
(c) Rajput Regiment
(d) Sikh Regiment

Q90. As reported in July 2025, what is the name of the new ultra-rare blood antigen discovered in a woman from the Kolar district of Karnataka?

(a) CROB
(b) CRIB
(c) CRAB
(d) BRIB

Q91. Which of the following banks launched a TAB-based digital onboarding process for Non-Resident Indians (NRIs) in January 2025?

(a) ICICI Bank
(b) HDFC Bank
(c) State Bank of India
(d) Punjab National Bank

Q92. Who became the first Indian chess player to rank World No. 1 in live chess ratings in 2025?

(a) Viswanathan Anand
(b) D Gukesh
(c) Arjun Erigaisi
(d) R Praggnanandhaa

Q93. According to the Union Budget 2025-26, how many National Centres of Excellence for Skilling are to be set up with global expertise and partnerships to equip Indian youth with the skills required for “Make for India, Make for the World” manufacturing?

(a) 4
(b) 5
(c) 10
(d) 1

Q94. Which round of talks between India and the European Union for a Free Trade Agreement kicked off on 12 May 2025, in Brussels?

(a) 13th
(b) 11th
(c) 9th
(d) 7th

Q95. Who is the youngest female para swimmer in the world to cross the English Channel and a recipient of the World Open Water Swimming Association (WOWSA) Award, 2024, for Adaptive Performance?

(a) Devanshi Satija
(b) Deepa Malik
(c) Prachi Yadav
(d) Jiya Rai

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Q96. Which of the following states/Union Territories has the largest number of wildlife sanctuaries as of 2023?

(a) Andaman & Nicobar
(b) West Bengal
(c) Uttar Pradesh
(d) Kerala

Q97. In January 2025, in which city did the NDRF launch a rescue operation after a boat capsized?

(a) Ujjain
(b) Patna
(c) Varanasi
(d) Nashik

Q98. In January 2025, President Droupadi Murmu, at Rashtrapati Bhavan, honoured which specific para-athlete with the Major Dhyan Chand Khel Ratna Award?

(a) Praveen Kumar
(b) Devendra Jhajharia
(c) Nishad Kumar
(d) Preeti Pal

Q99. How many tribal grassroots functionaries and village-level change leaders does the Aadi KARMAYOGI initiative aim to build for responsive governance?

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

Q100. In which event did Bindyarani Devi set a new national record at the Dehradun National Games, 2025?

(a) Total lift (women's 55 kg)
(b) Clean and jerk (women's 55 kg)
(c) Snatch (women's 49 kg)
(d) Snatch (women's 55 kg)

ANSWER KEY

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

SOLUTIONS

Q1. Answer: (c) Pollination → Fertilisation → Embryo → Seedling

The correct answer is Pollination → Fertilisation → Embryo → Seedling.

Key Points

• Pollination: The process begins with pollination, where the pollen grains are transferred from the anther (male part) of a flower to

the stigma (female part). This process can occur through various agents such as wind, water, insects, or animals. This step is vital for sexual reproduction in flowering plants.

• Fertilisation: After successful pollination, fertilisation occurs. The pollen grain germinates on the stigma, and the pollen tube grows down the style into the ovary. The male gamete fuses with the female gamete (egg) to form a zygote.

• Embryo Formation: The fertilised zygote develops into an embryo. This stage marks the beginning of the formation of a new plant. The embryo consists of the plumule, radicle, and cotyledons, which later give rise to the shoot, root, and seed storage tissue, respectively.

• Seedling Development: Once the embryo matures within the seed, it germinates under favourable conditions (water, temperature, oxygen) to form a seedling, which develops into a new plant. This marks the completion of the reproduction cycle in flowering plants.

Additional Information

• Pollination Types:

• Self-pollination: Pollen from the anther is transferred to the stigma of the same flower or another flower on the same plant.

• Cross-pollination: Pollen is transferred from the anther of one flower to the stigma of a flower on a different plant of the same species. Agents include insects, wind, and water.

• Fertilisation Process:

• Fertilisation is the fusion of male and female gametes to form a zygote.

• This process occurs within the ovule, which is housed in the ovary of the flower.

• Double fertilisation is unique to flowering plants, where one sperm fertilises the egg, forming the zygote, and the other sperm combines with polar nuclei to form the endosperm.

• Seed and Embryo Development:

• After fertilisation, the ovule develops into a seed, and the ovary becomes the fruit.

• The seed contains the embryo and stored food, surrounded by a protective seed coat.

• Seed Germination:

• Germination is the process where a seed develops into a seedling under favourable conditions.

• Essential factors include water, oxygen, and an appropriate temperature.

• During germination, the radicle (embryonic root) emerges first, followed by the plumule (embryonic shoot).

Important Points

• Sequence of Events: The correct sequence in the reproduction of flowering plants is Pollination → Fertilisation → Embryo → Seedling. Any deviation from this sequence will disrupt the reproductive cycle.

• Role of Pollination: Pollination is a pre-requisite for fertilisation. Without it, the male gametes cannot reach the female gametes.

• Double Fertilisation: Unique to angiosperms, where two fertilisation events occur: one forming the embryo and the other forming the endosperm, which nourishes the developing embryo.

• Importance of Seed Germination: Germination ensures the continuation of the species by giving rise to new plants under suitable conditions.

Q2. Answer: (b) It blocks the vas deferens to prevent sperm release.

The correct answer is It blocks the vas deferens to prevent sperm release..

Key Points

• Vasectomy is a surgical procedure performed on males as a method of permanent contraception. It involves cutting or blocking the vas deferens, which are the tubes that carry sperm from the testicles to the urethra.

• By blocking the vas deferens, sperm cannot mix with the semen that is ejaculated. This prevents the sperm from being released during ejaculation, making fertilization impossible.

• Unlike common misconceptions, vasectomy does not affect the production of the hormone testosterone. The testicles continue to produce testosterone, so male characteristics and sexual function remain unaffected.

• The procedure is typically performed under local anesthesia and is considered a safe, effective, and minimally invasive procedure. Recovery time is usually short, and complications are rare.

• It is important to note that vasectomy does not offer immediate contraception. Residual sperm may still be present in the vas deferens for a few weeks or months after the procedure. Therefore, alternative contraception methods are recommended until follow-up tests confirm the absence of sperm.

Additional Information

• Testosterone Production:

• The claim that vasectomy stops testosterone production is false. The testicles continue to produce testosterone after vasectomy, maintaining secondary sexual characteristics like facial hair, voice depth, and libido.

• Seminal Vesicles:

• Vasectomy does not involve the removal of seminal vesicles. These glands continue to function normally and produce seminal fluid, which constitutes the majority of the ejaculate.

• Sperm and the Uterus:

• The statement that vasectomy kills sperm cells reaching the uterus is incorrect. Vasectomy ensures that sperm do not even leave the male reproductive system, so they cannot reach the female uterus.

• The body naturally absorbs sperm that are produced after vasectomy since they are no longer transported via the vas deferens.

• Effectiveness of Vasectomy:

• Vasectomy is one of the most effective methods of birth control, with a success rate of over 99%. It is considered a permanent solution for those who do not wish to have more children.

• It does not protect against sexually transmitted infections (STIs), so additional protection like condoms may still be necessary in certain situations.

• Reversal of Vasectomy:

• Although vasectomy is considered a permanent method of contraception, it can sometimes be reversed through a procedure called vasovasostomy. However, the success of reversal depends on factors such as the time elapsed since the vasectomy.

Important Points

• Procedure and Recovery:

• Vasectomy is a relatively simple outpatient procedure that typically takes about 15–30 minutes.

• Post-procedure care includes avoiding heavy physical activity for a few days and using an ice pack to reduce swelling or discomfort.

• Prevalence:

• Vasectomy is widely used as a method of contraception in several countries, including the United States, Canada, and New Zealand.

• According to the World Health Organization (WHO), vasectomy accounts for approximately 5–10% of contraceptive use worldwide.

• Counseling and Consent:

• Before undergoing a vasectomy, individuals should receive proper counseling regarding its permanency and the need for follow-up testing to confirm its effectiveness.

Q3. Answer: (a) Current

The correct answer is Current.

Key Points

• Resistors in Series: When resistors are connected in series, the same current flows through all resistors. This is because there is only one path for the current to travel. Hence, the correct answer is Current.

• Voltage Distribution: The voltage across each resistor in a series connection is different and depends on the resistance of each resistor. The sum of these voltages equals the total voltage across the series circuit.

• Resistance in Series: The total resistance of resistors in series is the sum of their individual resistances. This is mathematically expressed as R_(total) = R1 + R2 + R3...

• Power Consumption: The power consumed by each resistor in a series circuit is different and depends on the voltage drop across it and its resistance. Total power consumption is the sum of individual power consumptions.

• Application: Series circuits are commonly used in applications like string lights, where the same current flows through all the bulbs, ensuring they light up uniformly.

Additional Information

• Ohm's Law: Ohm's Law states that the current flowing through a conductor between two points is directly proportional to the voltage across the two points and inversely proportional to the resistance. It is expressed as I = V/R, where I is the current, V is the voltage, and R is the resistance.

• Voltage Divider Rule: In a series circuit, the voltage is divided among the resistors in proportion to their resistances. This is represented as V1 = (R1 / R_(total)) × V_(total), where V1 is the voltage across resistor R1.

• Applications of Series Circuits: Series circuits are used in applications where uniform current flow is necessary. Examples include Christmas tree lights, water heaters, and simple electronic testing setups.

• Characteristics of Series Circuits:

• The total resistance increases as more resistors are added.

• If one resistor fails, the entire circuit stops functioning since current flow is interrupted.

• Comparison with Parallel Circuits: Unlike series circuits, parallel circuits allow current to flow through multiple paths, resulting in different currents through each path but the same voltage across all paths.

Important Points

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• Mathematical Representation: In series circuits, the current is constant across all components, and voltage is distributed based on individual resistances.

• Practical Implications: Series circuits are less commonly used in household applications due to their dependency on all components functioning correctly. If one component fails, the circuit becomes open.

• Safety Considerations: Series circuits are safer for low-current applications but may not be ideal for high-power systems due to increased resistance and potential overheating.

• Historical Context: The concept of series and parallel circuits stems from the study of electrical circuits in the 19th century, with contributions from scientists like Georg Simon Ohm, who formulated Ohm's Law in 1827.

Q4. Answer: (a) Because their atomic numbers and electronic configurations differ

The correct answer is Because their atomic numbers and electronic configurations differ.

Key Points

• Isobars are atoms of different elements that have the same mass number (sum of protons and neutrons) but different atomic numbers.

• The chemical properties of an element are primarily determined by its atomic number, which defines the number of protons in the nucleus and the electronic configuration of the atom.

• Since isobars have different atomic numbers, they belong to different elements, leading to different electronic configurations and, consequently, different chemical behaviors.

• For example, Carbon-14 (atomic number 6) and Nitrogen-14 (atomic number 7) are isobars. While Carbon-14 exhibits chemical properties of carbon, Nitrogen-14 behaves chemically as nitrogen. This difference is due to their distinct electronic arrangements.

• While they have the same mass number, the difference in proton and neutron distribution leads to variation in their nuclear properties as well, but it is the atomic number that dictates chemical behavior.

Additional Information

• Definition of Isobars:

• Isobars are atoms of different elements that have the same mass number but different atomic numbers.

• Example: Argon-40 (Atomic number 18) and Calcium-40 (Atomic number 20) are isobars.

• Determination of Chemical Properties:

• Chemical properties depend on the number and arrangement of electrons in an atom, which is governed by its atomic number.

• Isobars, having different atomic numbers, have different chemical properties.

• Examples of Isobars:

• Carbon-14 and Nitrogen-14 – Both have a mass number of 14, but their chemical properties differ due to different atomic numbers (6 and 7, respectively).

• Potassium-40 and Calcium-40 – Both have a mass number of 40 but different atomic numbers (19 and 20, respectively).

• Difference Between Isobars and Isotopes:

• Isobars: Atoms with the same mass number but different atomic numbers (e.g., Argon-40 and Calcium-40).

• Isotopes: Atoms of the same element with the same atomic number but different mass numbers (e.g., Carbon-12, Carbon-13, and Carbon-14).

• Nuclear Properties of Isobars:

• While their chemical properties differ, isobars may have similar or different nuclear stability and radioactive behavior depending on their neutron-to-proton ratio.

Important Points

• The mass number is the sum of protons and neutrons in the nucleus.

• The atomic number is the number of protons, which also equals the number of electrons in a neutral atom, determining its chemical nature.

• Isobars are useful in nuclear physics and studies of radioactivity, as they help in understanding nuclear processes like beta decay.

• Isobars are often used in dating techniques such as radiocarbon dating using isotopes like Carbon-14.

"

Q5. Answer: (c) Ionic bond

The correct answer is Ionic bond.

Key Points

• An ionic bond is formed when a metal reacts with a non-metal. This bond occurs due to the transfer of electrons from the metal to the non-metal.

• Metals have a tendency to lose electrons and form positively charged ions (cations), while non-metals tend to gain electrons to

form negatively charged ions (anions).

• The resulting electrostatic attraction between the oppositely charged ions leads to the formation of an ionic bond.

• For example, in the case of sodium chloride (NaCl), sodium (a metal) donates one electron to chlorine (a non-metal), resulting in the formation of Na^+ and Cl^- ions.

• Ionic bonds are typically strong and result in the formation of crystalline structures, such as salt crystals, which have high melting and boiling points.

Additional Information

• Covalent bond:

• A covalent bond is formed when two non-metals share electrons to achieve stability. This type of bond does not involve the transfer of electrons.

• For example, in a water molecule (H2O), oxygen and hydrogen share electrons to form covalent bonds.

• Covalent bonds generally result in the formation of molecules with lower melting and boiling points compared to ionic compounds.

• Hydrogen bond:

• A hydrogen bond is a weak bond that occurs between a hydrogen atom bonded to a highly electronegative atom (e.g., oxygen, nitrogen, or fluorine) and another electronegative atom.

• Hydrogen bonding is responsible for many properties of water, such as its high boiling point and surface tension.

• This bond is not a type of ionic or covalent bond but a secondary interaction.

• Metallic bond:

• A metallic bond is formed between metal atoms. It involves a "sea of electrons" that are free to move around, providing metals with their characteristic properties, such as conductivity, malleability, and ductility.

• This bond is unique to metals and does not involve non-metals.

• Examples of ionic compounds:

• Sodium chloride (NaCl): Common table salt formed by the ionic bond between sodium and chlorine.

• Magnesium oxide (MgO): Formed by the ionic bond between magnesium and oxygen.

• Calcium fluoride (CaF2): Formed by the ionic bond between calcium and fluorine.

Q6. Answer: (a) 5.5

The correct answer is 5.5.

Key Points

• Tooth enamel, the hardest substance in the human body, starts to corrode when the pH in the mouth drops below 5.5. This is commonly referred to as the "critical pH" for enamel demineralization.

• At a pH below 5.5, the acidic environment in the mouth begins to dissolve the calcium phosphate minerals present in the enamel, leading to dental erosion.

• Bacteria, especially Streptococcus mutans and Lactobacillus, produce acids as they metabolize sugars, which reduces the pH in the oral cavity. This is a major cause of enamel corrosion.

• The saliva in the mouth acts as a natural buffer to neutralize acids. However, when the acid production exceeds the buffering capacity of saliva, the pH falls below 5.5, initiating enamel demineralization.

• Consuming acidic foods and beverages like citrus fruits, carbonated drinks, or sugary snacks can accelerate the drop in pH, increasing the risk of enamel erosion.

Additional Information

• Role of Tooth Enamel:

• Tooth enamel is composed primarily of hydroxyapatite crystals, a form of calcium phosphate.

• It serves as a protective barrier for the underlying dentin and pulp, shielding the tooth from physical damage, temperature changes, and bacterial invasion.

• Enamel does not regenerate once damaged, making its protection crucial for maintaining oral health.

• pH and Oral Health:

• The pH scale ranges from 0 to 14, where 7 is neutral, below 7 is acidic, and above 7 is alkaline.

• A healthy oral pH is typically around 6.8 to 7.4, which supports remineralization and inhibits bacterial growth.

• When the pH drops below 5.5, the conditions favor demineralization, leading to dental caries and enamel erosion.

• Preventive Measures:

• Reduce consumption of sugary and acidic foods/beverages to maintain a healthy oral pH.

• Practice good oral hygiene, such as brushing twice daily with fluoride toothpaste and flossing to remove food particles and plaque.

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• Use fluoride-based products, as fluoride strengthens enamel and enhances resistance to acid attacks.
• Chewing sugar-free gum can stimulate saliva production, which helps neutralize acids and restore pH balance.
• Saliva's Role:
• Saliva contains minerals like calcium and phosphate, which aid in the remineralization of enamel.
• It has enzymes like amylase that help break down food particles and maintain oral health.
• Saliva also acts as a natural buffer to counteract acidic environments in the mouth.

Important Points

• Demineralization vs. Remineralization:
• Demineralization occurs when acids dissolve the minerals in enamel, leading to erosion and cavities.
• Remineralization is the natural repair process where minerals like calcium and phosphate are redeposited into enamel.
• Fluoride plays a vital role in enhancing remineralization and preventing further decay.
• Risk Factors for Enamel Erosion:
• Frequent consumption of acidic foods and drinks, poor oral hygiene, and dry mouth conditions.
• Conditions like GERD (Gastroesophageal Reflux Disease) can expose teeth to stomach acids, increasing the risk of erosion.
• Excessive brushing with abrasive toothpaste can also wear down enamel over time.
• Fluoride's Role:
• Fluoride integrates into the enamel structure, forming fluoroapatite, which is more resistant to acids.
• Regular use of fluoride toothpaste and mouthwash significantly reduces the risk of cavities and enamel erosion.
• pH Testing in Dentistry:
• Modern dental practices use pH strips or advanced devices to monitor oral pH levels and assess enamel health.
• Patients with consistently low pH levels may be advised on dietary changes and oral care routines to prevent enamel damage.
"

Q7. Answer: (d) 16 m/s

The correct answer is 16 m/s.

Key Points

• Force and Mass: The body has a mass of 5 kg, and a constant force of 20 N acts on it. Using Newton's Second Law, Force = Mass × Acceleration, the acceleration can be calculated.
• Acceleration = Force / Mass = 20 / 5 = 4 m/s².
• This calculation is correct based on the given values.
• Initial velocity: The body is initially at rest, meaning the initial velocity is 0 m/s. This is explicitly mentioned in the question, and the statement is correct.
• Time: The force acts on the body for 4 seconds. This duration is crucial for calculating the final velocity using the formula for uniformly accelerated motion. The statement is correct.
• Final velocity calculation: Using the formula Final Velocity = Initial Velocity + (Acceleration × Time):
• Final Velocity = 0 + (4 × 4) = 16 m/s.
• The correct option is 16 m/s.
• Correct Answer: The calculated final velocity matches the given option 16 m/s, making it the correct choice.

Additional Information

• Newton's Second Law of Motion:
• It states that the force acting on an object is equal to the rate of change of its momentum, or Force = Mass × Acceleration.
• This principle is widely used in physics to calculate motion parameters like acceleration and velocity.
• Equations of Motion:
• These equations describe the relationship between velocity, acceleration, time, and displacement.
• The formula used here, Final Velocity = Initial Velocity + Acceleration × Time, is one of the fundamental equations of uniformly accelerated motion.
• Units and Dimensions:
• Force is measured in Newtons (N), mass in kilograms (kg), acceleration in meters per second squared (m/s²), and velocity in meters per second (m/s).
• Understanding units and their conversions is essential for solving physics problems accurately.
• Applications:
• Such calculations are essential in understanding the motion of objects in various fields, including engineering, space exploration, vehicle dynamics, and sports science.

• For example, calculating the velocity of vehicles after a certain time helps in designing better braking systems.

Important Points

• Constant Force: When a constant force acts on a body, the acceleration remains constant throughout the motion.

• Uniform Acceleration: The equations of motion are applicable only under uniform acceleration conditions.

• Initial Conditions: The initial velocity is critical in determining the final velocity, especially when the object starts from rest.

• Practical Uses: Understanding force and motion is foundational for designing systems like rockets, vehicles, and machinery.

Q8. Answer: (a) The white blood cell (WBC) has a round and fixed shape.

The correct answer is The white blood cell (WBC) has a round and fixed shape..

Key Points

• The white blood cell (WBC) has a round and fixed shape: This statement is incorrect. Unlike red blood cells (RBCs), WBCs do not have a fixed shape. They are highly flexible and capable of changing their shape to move through blood vessel walls and reach sites of infection or injury. This property, called amoeboid movement, allows them to perform their immune function effectively.

• The muscle cell is spindle-shaped: This statement is correct. Muscle cells, especially smooth muscle cells, are elongated and spindle-shaped to facilitate contraction and relaxation during various body functions, such as digestion and blood flow regulation.

• The nerve cell is long and branched in shape: This statement is correct. Nerve cells (neurons) are specialized for transmitting signals and are characterized by their long, branched structure, including dendrites (short branches) and axons (long branches). This shape ensures efficient communication across the nervous system.

• The red blood cell (RBC) is disc-shaped with a central depression: This statement is correct. RBCs have a biconcave disc shape with a central depression, which maximizes their surface area for oxygen and carbon dioxide exchange and enables them to squeeze through narrow capillaries.

Additional Information

• White Blood Cells (WBCs):

• WBCs are part of the immune system and help the body fight infections.

• They exhibit amoeboid movement and can change shape to engulf pathogens through a process called phagocytosis.

• Types of WBCs include neutrophils, lymphocytes, monocytes, eosinophils, and basophils, each with specific immune functions.

• Muscle Cells:

• Muscle cells are specialized for contraction and movement.

• Smooth muscle cells, found in organs like the stomach and intestines, are spindle-shaped, while skeletal muscle cells are cylindrical and striated.

• Cardiac muscle cells are branched and connected by intercalated discs for synchronized contraction.

• Nerve Cells (Neurons):

• Neurons are the basic units of the nervous system, transmitting signals through electrical impulses.

• They have specialized structures, such as dendrites for receiving signals and axons for transmitting them.

• The synapse is the junction where neurons communicate with other neurons or target cells.

• Red Blood Cells (RBCs):

• RBCs contain hemoglobin, a protein responsible for oxygen transport.

• Their biconcave shape increases surface area and facilitates gas exchange.

• They lack a nucleus in mammals, allowing more space for hemoglobin but limiting their lifespan to about 120 days.

Important Points

• Cell Shape and Function:

• The shape of a cell is closely related to its function. For example, the biconcave shape of RBCs aids in oxygen transport, while the flexible shape of WBCs facilitates immune responses.

• Other Examples of Cell Shapes:

• Platelets: Small, irregularly shaped cell fragments involved in blood clotting.

• Plant Cells: Have a fixed rectangular shape due to a rigid cell wall, aiding in structural support.

• Guard Cells: Kidney-shaped cells in plants that regulate the opening and closing of stomata for gas exchange.

• Diseases Related to Cell Shapes:

• Sickle Cell Anemia: A genetic disorder where RBCs become crescent-shaped, reducing their oxygen-carrying capacity and causing blockages in blood vessels.

• Leukemia: A type of cancer involving abnormal proliferation of WBCs.

Q9. Answer: (b) One long and one short line parallel to each other

The correct answer is One long and one short line parallel to each other.

Key Points

• The symbol for a cell in a circuit diagram is represented by one long and one short line parallel to each other. The long line represents the positive terminal, and the short line represents the negative terminal.

• This standard symbol is used universally in electrical and electronic circuit diagrams to represent a single electrochemical cell.

• The long line (+) indicates the higher electric potential, while the short line (-) indicates the lower electric potential. This helps in understanding the flow of current in the circuit.

• A single cell symbol can also be combined to represent a battery, where multiple cells are connected in series or parallel.

• In contrast, other options like a “circle with a cross inside,” “two equal lines parallel to each other,” or “a rectangle with a diagonal line” do not represent a cell in circuit diagrams. These symbols represent different components like bulbs, resistors, or other devices.

Additional Information

• Electrochemical Cell:

• An electrochemical cell is a device capable of either generating electrical energy from chemical reactions or using electrical energy to cause chemical reactions.

• It consists of two electrodes (anode and cathode) and an electrolyte. The anode is the negative terminal, while the cathode is the positive terminal.

• Battery Symbol:

• A battery symbol in a circuit diagram is represented by multiple cells connected together, where the number of long and short lines indicates the number of cells in the battery.

• Batteries are used in various devices, from small electronic gadgets to large-scale power storage systems.

• Electric Circuit Components:

• Bulb: Represented by a circle with a cross inside in circuit diagrams. It shows the presence of a light-emitting component in the circuit.

• Resistor: Represented by a rectangle or zigzag line, indicating a component that resists the flow of current.

• Switch: Denoted by a break in the line with a lever, it indicates a controlling device that can open or close the circuit.

• Direction of Current:

• The conventional direction of current flow is from the positive terminal (long line) to the negative terminal (short line) of the cell.

• This aligns with the movement of positive charges, even though electrons actually flow in the opposite direction.

Important Points

• Standards in Circuit Diagrams: The symbols used in circuit diagrams follow international conventions set by organizations like IEC (International Electrotechnical Commission) to ensure uniformity and understanding.

• Applications of Cells: Electrochemical cells are used in batteries, portable devices, vehicles, and energy storage systems for renewable energy applications.

• Types of Cells: Cells can be classified as primary cells (non-rechargeable) and secondary cells (rechargeable), based on their ability to be reused.

• Real-World Example: A common example of a cell is an AA battery, widely used in household devices like remote controls and clocks.

Q10. Answer: (b) Amplitude

The correct answer is Amplitude.

Key Points

• Loudness of a sound is primarily determined by its amplitude, which refers to the height of the sound wave. The greater the amplitude, the louder the sound is perceived.

• Amplitude is a measure of the energy of the sound wave. When the amplitude increases, the energy carried by the wave also increases, resulting in higher sound intensity.

• Loudness is a subjective measure and depends on the sensitivity of the human ear. However, higher amplitude generally corresponds to higher loudness.

• For instance, in a graphical representation of sound waves, a wave with a larger peak-to-trough distance (amplitude) represents a louder sound compared to a wave with smaller amplitude.

• Amplitude is measured in decibels (dB), which quantifies the intensity of the sound.

Additional Information

• Pitch:

• The pitch of a sound is determined by its frequency, which is the number of vibrations per second. Higher frequency results in a

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higher-pitched sound, while lower frequency results in a lower-pitched sound.

• Pitch is measured in hertz (Hz), and it does not directly affect the loudness of a sound.

• Wavelength:

• Wavelength refers to the distance between two consecutive crests or troughs in a sound wave. It is inversely proportional to the frequency of the wave.

• While it influences the type of sound, wavelength does not determine the loudness of a sound.

• Frequency:

• Frequency is the number of oscillations or cycles per second of a sound wave. It determines the pitch of the sound, not its loudness.

• A sound with a high frequency is perceived as a high-pitched sound, whereas a low-frequency sound is perceived as low-pitched.

• Decibels (dB):

• Decibels are the unit of measurement for sound intensity. A small increase in decibel level represents a significant increase in sound intensity.

• For example, normal conversation occurs at around 60 dB, while a rock concert can reach levels of 120 dB or more.

Important Points

• Sound Waves: Sound waves are mechanical waves that require a medium (like air, water, or solids) to travel. They are longitudinal waves, where the particles of the medium vibrate parallel to the direction of the wave's propagation.

• Human Hearing Range: The average human ear can detect sounds in the frequency range of 20 Hz to 20,000 Hz. Sounds outside this range are inaudible to humans.

• Resonance: When an object vibrates at its natural frequency due to an external sound wave, it amplifies the sound. This phenomenon is called resonance and plays a role in enhancing sound loudness.

• Threshold of Pain: Loudness levels above 120 dB can cause pain or even damage to the human ear. Prolonged exposure to high decibel levels can lead to hearing loss.

Q11. Answer: (a) He has myopia and needs a concave lens

The correct answer is He has myopia and needs a concave lens.

Key Points

• Myopia (Nearsightedness): It is a common refractive error in which a person can see nearby objects clearly but has difficulty seeing distant objects. This is due to the light rays focusing in front of the retina instead of directly on it.

• Symptoms of Myopia: The student’s inability to read the blackboard clearly while sitting at the back of the class is a typical symptom of myopia. However, the ability to read a book clearly at a close distance (25 cm) confirms that near vision is unaffected.

• Cause of Myopia: It occurs due to either an elongated eyeball or an excessively curved cornea, leading to improper focusing of light rays on the retina.

• Correction: Myopia is corrected using a concave lens (diverging lens), which helps to diverge the light rays before they enter the eye, ensuring they focus directly on the retina instead of in front of it.

• Age Factor: Myopia is commonly detected in childhood or adolescence. It may stabilize or progress with age.

Additional Information

• Hypermetropia (Farsightedness):

• In hypermetropia, a person can see distant objects clearly but has difficulty focusing on nearby objects. This condition is corrected using a convex lens (converging lens).

• It occurs when the eyeball is too short or the cornea has insufficient curvature, causing light rays to focus behind the retina.

• This condition is not applicable in the given scenario as the student can see nearby objects clearly.

• Presbyopia:

• This is an age-related condition typically occurring in individuals aged 40 and above. It leads to difficulty in focusing on nearby objects due to the loss of elasticity in the eye’s lens.

• It is corrected using bifocal lenses or progressive lenses, which aid both near and distant vision.

• The student in the question does not exhibit age-related symptoms, ruling out presbyopia.

• Cataract:

• A cataract is a condition where the eye’s lens becomes cloudy, leading to blurred vision. It is most common in older adults.

• Surgery is the only effective treatment for cataract, involving the replacement of the clouded lens with an artificial intraocular lens.

• The symptoms described in the question do not align with cataract-related vision issues.

• Important Characteristics of a Concave Lens:

• It is thinner at the center and thicker at the edges.

• It diverges light rays, making it suitable for correcting myopia by enabling light to focus correctly on the retina.

• Concave lenses are denoted with a negative power (e.g., -2.0 D).

• Global Prevalence of Myopia:

• Studies indicate that myopia is rapidly increasing worldwide, especially among children and adolescents. It is estimated that by 2050, half of the global population may be myopic.

• Factors contributing to this rise include increased screen time, reduced outdoor activities, and genetic predisposition.

Important Points

• Prevention of Myopia Progression:

• Encourage children to spend more time outdoors as natural light may reduce the progression of myopia.

• Limit screen time and ensure proper lighting while reading or studying to reduce eye strain.

• Regular eye check-ups are crucial for early detection and management of refractive errors.

• Advanced Treatments:

• Orthokeratology (Ortho-K) involves wearing specialized contact lenses to reshape the cornea temporarily.

• Refractive surgery, such as LASIK, can permanently correct myopia for eligible candidates.

Q12. Answer: (b) Cytoplasm

The correct answer is Cytoplasm.

Key Points

• Cytoplasm is not classified as a cell organelle. It is a gel-like substance that fills the cell and acts as a medium in which cell organelles are suspended.

• The cytoplasm is a part of the cell but does not perform specific functions like organelles such as the mitochondria, endoplasmic reticulum, or Golgi apparatus.

• It serves as the site for numerous biochemical reactions and provides structural support to the cell. However, it is not considered an "organelle" since it does not have a membrane-bound structure.

• Endoplasmic Reticulum (ER), Mitochondria, and Golgi Apparatus are true organelles, as they are membrane-bound and perform specialized functions within the cell.

• The cytoplasm includes the cytosol (fluid portion), organelles, and other cellular components but is not categorized as a discrete organelle itself.

Additional Information

• Endoplasmic Reticulum (ER):

• The ER is a membrane-bound organelle found in eukaryotic cells.

• It is classified into two types: Rough ER (with ribosomes) and Smooth ER (without ribosomes).

• Functions include protein synthesis (Rough ER), lipid synthesis (Smooth ER), and detoxification of harmful substances.

• Mitochondria:

• Known as the powerhouse of the cell, mitochondria are membrane-bound organelles responsible for energy production through the process of cellular respiration.

• They generate ATP (adenosine triphosphate), which is the primary energy currency of the cell.

• Mitochondria have their own DNA and ribosomes, allowing them to produce some of their own proteins.

• Golgi Apparatus:

• The Golgi apparatus is a membrane-bound organelle involved in the processing, packaging, and transport of proteins and lipids.

• It modifies proteins produced in the ER and sorts them for transport to various destinations within or outside the cell.

• It plays a crucial role in the secretion of substances like enzymes and hormones.

• Cytoplasm:

• The cytoplasm is the jelly-like material that occupies the space between the cell membrane and the nucleus.

• It contains water, salts, and organic molecules, providing the medium for intracellular processes.

• While it plays an essential role in cell structure and function, it is not classified as an organelle because it lacks a membrane-bound structure.

Important Points

• Cell Organelles:

• Organelles are specialized structures within a cell that perform specific functions necessary for the cell's survival and function.

• Examples include the nucleus (control center), lysosomes (waste disposal), chloroplasts (photosynthesis in plant cells), and ribosomes (protein synthesis).

• Most organelles are membrane-bound, providing a distinct environment for their functions.

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• Cytoplasm vs. Cytosol:

• The cytoplasm includes the cytosol (fluid), organelles, and other cellular components.

• The cytosol is specifically the fluid portion of the cytoplasm, excluding organelles.

• Both play critical roles in maintaining cellular structure and facilitating biochemical reactions.

• Prokaryotic vs. Eukaryotic Cells:

• Prokaryotic cells lack membrane-bound organelles and a defined nucleus. Examples include bacteria and archaea.

• Eukaryotic cells contain membrane-bound organelles and a nucleus. Examples include plant, animal, and fungal cells.

• The cytoplasm is present in both cell types, but organelles like mitochondria and the Golgi apparatus are exclusive to eukaryotic cells.

Q13. Answer: (b) Zinc

The correct answer is Zinc.

Key Points

• Zinc can displace iron from iron sulfate solution because zinc is more reactive than iron according to the reactivity series of metals. This series ranks metals based on their ability to lose electrons and form positive ions.

• The reactivity series places zinc above iron, indicating that zinc has a greater tendency to form ions and can replace iron in a compound.

• When zinc is introduced into an iron sulfate solution, a single displacement reaction occurs, forming zinc sulfate and displacing iron. The chemical equation is:

Zn + FeSO4 → ZnSO4 + Fe.

• Silver, Copper, and Chromium cannot displace iron from iron sulfate solution because they are less reactive than iron. Their positions in the reactivity series are lower than that of iron, indicating their inability to replace iron in a compound.

• Such displacement reactions are governed by the principles of chemical reactivity and are commonly used in applications such as metal extraction and purification.

Additional Information

• Reactivity Series:

• The reactivity series is a list of metals ranked in order of their reactivity with water, acids, and other substances. More reactive metals can displace less reactive metals from their compounds.

• In the series, potassium and sodium are the most reactive, while gold and platinum are the least reactive.

• Zinc is placed above iron in the reactivity series, enabling it to displace iron from compounds like iron sulfate.

• Displacement Reaction:

• A displacement reaction occurs when a more reactive metal displaces a less reactive metal from its compound.

• Example: In the reaction between zinc and iron sulfate, zinc replaces iron because it is more reactive.

• Displacement reactions are used in processes like metal extraction, corrosion prevention, and laboratory experiments.

• Applications of Zinc:

• Zinc is used in galvanization to prevent rusting of iron and steel.

• It plays a vital role in battery production, especially in zinc-carbon and alkaline batteries.

• Zinc compounds, such as zinc oxide, are used in cosmetics, pharmaceuticals, and rubber manufacturing.

• Iron Sulfate:

• Iron sulfate (FeSO4) is commonly used in agriculture as a fertilizer to correct iron deficiencies in soil.

• It is also used in water treatment to remove impurities and as a precursor in the manufacture of other iron compounds.

Important Points

• Silver: Silver is a precious metal known for its low reactivity. It does not displace iron from iron sulfate solution because it is less reactive.

• Copper: Copper is also less reactive than iron and is used for electrical wiring and coinage due to its excellent conductivity and malleability.

• Chromium: Although chromium is used in stainless steel for its corrosion resistance, it cannot displace iron due to its lower position in the reactivity series.

Q14. Answer: (a) Isobutane

The correct answer is Isobutane.

Key Points

• Branched-chain hydrocarbons are hydrocarbons in which carbon atoms are arranged in a non-linear structure with branches or side chains attached to the main chain.

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• Isobutane is a branched-chain hydrocarbon. Its chemical structure is CH(CH3)3, where one carbon atom branches off from the main chain, forming a tertiary structure.

• Butane, on the other hand, is a straight-chain hydrocarbon with no branches. Its molecular formula is C4H10, and the carbon atoms are connected linearly.

• Propane and Ethane are also straight-chain hydrocarbons. Propane (C3H8) has three carbon atoms in a single chain, while ethane (C2H6) has two carbon atoms in a straight configuration.

• Isobutane, as a branched-chain hydrocarbon, is used widely in industries such as refrigeration and as a precursor for making other chemicals.

Additional Information

• Characteristics of branched-chain hydrocarbons:

• They generally have lower boiling points compared to their straight-chain counterparts due to decreased surface area for intermolecular forces.

• They are less prone to forming crystals, making them more suitable for use as fuels.

• Branched hydrocarbons are important in the petrochemical industry for producing high-octane fuels.

• Isobutane:

• Its molecular formula is C4H10, and it is an isomer of n-butane.

• It is widely used as a refrigerant, aerosol propellant, and in the production of isooctane, a high-octane fuel additive.

• Isobutane is produced through the refining of petroleum and natural gas.

• Applications of straight-chain hydrocarbons:

• Butane: Used in portable stoves, lighters, and as a propellant in aerosol sprays.

• Propane: Commonly used as a fuel for heating, cooking, and in engines.

• Ethane: Primarily used as a feedstock for ethylene production in the petrochemical industry.

• Hydrocarbon classification:

• Hydrocarbons are classified into alkanes, alkenes, and alkynes based on the type of bonds between carbon atoms.

• Alkanes like methane, ethane, propane, and butane consist only of single bonds and can be straight-chain or branched-chain.

Important Points

• Isomerism:

• Isomers are compounds with the same molecular formula but different structural arrangements.

• Isobutane is a structural isomer of n-butane, highlighting the importance of branching in hydrocarbons.

• Environmental impact:

• Hydrocarbons like isobutane are used as clean refrigerants because they have low ozone depletion potential (ODP).

• However, they are classified as greenhouse gases, contributing to global warming.

• Industrial relevance:

• Branched-chain hydrocarbons like isobutane enhance fuel quality by increasing the octane number, making them essential for the production of gasoline.

• Proper utilization of hydrocarbons supports energy efficiency and industrial development.

Q15. Answer: (b) A compound has a fixed composition and definite properties, unlike a solution.

The correct answer is A compound has a fixed composition and definite properties, unlike a solution..

Key Points

• A compound is a substance formed when two or more elements chemically combine in a fixed ratio. This fixed composition gives it unique and definite physical and chemical properties.

• A solution is a homogeneous mixture of two or more substances where the composition can vary. For example, you can have different concentrations of sugar dissolved in water.

• Unlike compounds, solutions do not have fixed properties. Their properties depend on the ratio of the solute to the solvent.

• The components of a compound are bonded chemically and cannot be separated by physical methods such as filtration or evaporation. Solutions, on the other hand, can be separated using physical methods, like distillation or evaporation.

• For example, water (H2O) is a compound with a fixed composition of hydrogen and oxygen in a 2:1 ratio, whereas saltwater is a solution where the salt concentration can vary.

Additional Information

• Characteristics of a Compound:

• Compounds have a fixed composition. For example, water always contains two hydrogen atoms and one oxygen atom.

• The properties of a compound are different from the properties of its constituent elements. For example, sodium (a reactive metal) and chlorine (a poisonous gas) combine to form sodium chloride (common table salt).

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• They are formed through chemical bonds, such as ionic or covalent bonds, and require chemical reactions to separate.
• Examples include carbon dioxide (CO2), sodium chloride (NaCl), and methane (CH4).
• Characteristics of a Solution:
• Solutions are mixtures where the solute (e.g., salt) is completely dissolved in the solvent (e.g., water).
• They are homogeneous, meaning their composition is uniform throughout.
• Properties of solutions, such as boiling and freezing points, depend on the concentration of the solute.
• Examples include sugar water, saltwater, and alcohol mixed with water.
• Differences Between Compounds and Solutions:
• Bonding: Compounds involve chemical bonding, while solutions involve physical mixing without chemical bonding.
• Separation: Compounds require chemical methods for separation, while solutions can be separated by physical methods.
• Properties: Compounds have fixed properties, whereas solutions have variable properties depending on their composition.
• Examples: Compounds include water (H2O) and ammonia (NH3), while solutions include seawater and vinegar.
• Applications:
• Compounds are essential in chemical reactions, pharmaceuticals, and materials science.
• Solutions are widely used in industrial processes, medicine (e.g., saline solution), and food preparation.

Important Points

• Misconceptions Clarified:
• Statement 1: "A compound can be separated by physical methods, while a solution cannot." This is incorrect because compounds require chemical methods, not physical methods, for separation.
• Statement 3: "Compounds are always liquid, but solutions can be in any state." This is incorrect as compounds can exist in solid, liquid, or gaseous states.
• Statement 4: "Compounds are mixtures of two or more elements, while solutions are mixtures of compounds only." This is incorrect because compounds are not mixtures; they are chemically bonded substances.
• Examples for Better Understanding:
• Compound: Carbon dioxide (CO2) used in soft drinks and fire extinguishers.
• Solution: Saltwater used in cooking and experiments.

Q16. Answer: (c) Butterflies – herbivores, Squirrels – herbivores

The correct answer is Butterflies – herbivores, Squirrels – herbivores.

Key Points

• Butterflies are classified as herbivores because they primarily feed on nectar from flowers, which is a plant-based food source. Nectar provides them with energy to sustain their activities and reproduction.
• Squirrels are also classified as herbivores because their diet mainly consists of nuts, seeds, fruits, and plant-based materials. These foods provide essential nutrients and energy for their survival.
• Both butterflies and squirrels play important roles in their respective ecosystems. Butterflies help in pollination by transferring pollen from one flower to another, facilitating plant reproduction.
• Squirrels contribute to the environment by aiding in seed dispersal. As they bury nuts and seeds for later consumption, some of these remain uneaten and grow into new plants.
• The classification of organisms as herbivores, omnivores, or carnivores depends on their dietary habits and the type of food they consume regularly.

Additional Information

• Butterflies:
• Lifecycle: Butterflies undergo complete metamorphosis, including the stages of egg, larva (caterpillar), pupa (chrysalis), and adult butterfly.
• Pollination Role: Butterflies contribute to pollination, although they are less effective than bees due to their feeding behavior. They prefer bright, fragrant flowers.
• Diet: While adult butterflies feed on nectar, some caterpillars consume plant leaves, making them herbivorous during the larval stage as well.
• Habitat: Butterflies are found in diverse habitats, such as gardens, forests, grasslands, and wetlands, depending on the availability of host plants and flowers.
• Example Species: Common butterflies include the Monarch, Swallowtail, and Painted Lady.
• Squirrels:
• Diet: Squirrels primarily eat nuts, seeds, fruits, buds, and sometimes fungi. Occasionally, they may consume small insects or bird eggs, but they are predominantly herbivorous.

• Habitat: Squirrels are found in forests, urban parks, and gardens. They adapt well to human environments where food sources are abundant.

• Seed Dispersal Role: Squirrels bury seeds and nuts, many of which remain uneaten and grow into new plants, aiding forest regeneration.

• Types: Common species include the Eastern Gray Squirrel, Red Squirrel, and Flying Squirrel.

• Behavior: Squirrels are agile climbers and spend significant time in trees, building nests and foraging for food.

Important Points

• Herbivores:

• Organisms classified as herbivores rely solely on plant-based food sources like leaves, nectar, fruits, nuts, and seeds.

• Examples include deer, rabbits, elephants, butterflies, and squirrels.

• Pollination:

• Pollination is the transfer of pollen from the male part (anther) of a flower to the female part (stigma), enabling fertilization and the production of seeds.

• Butterflies, bees, birds, and other pollinators are essential for maintaining biodiversity and supporting agricultural production.

• Seed Dispersal:

• Seed dispersal mechanisms include animal activity, wind, and water. Animals like squirrels play a key role in spreading seeds across large areas.

• This process ensures plant reproduction and helps maintain ecological balance.

Q17. Answer: (b) The fruits fall down due to inertia.

The correct answer is The fruits fall down due to inertia..

Key Points

• Inertia: When the tree branches are shaken vigorously, the branches experience motion due to external force, but the fruits resist this motion because of their inertia. Inertia is the property of an object to resist changes in its state of motion or rest.

• The shaking causes the branches to move rapidly back and forth, but the fruits attached to the branches remain in their initial position due to their inertia.

• Detachment of fruits: The rapid motion of the branches creates a force that weakens the attachment of the fruits to the branches. When the force exceeds the strength of the attachment, the fruits detach and fall.

• Newton's First Law: This phenomenon is explained by Newton's First Law of Motion, which states that an object will remain at rest or in uniform motion unless acted upon by an external force. The fruits initially remain at rest due to this principle.

• Direction of motion: Once detached, the fruits are influenced by gravity and fall vertically downward to the ground.

Additional Information

• Inertia of Rest: Inertia can be categorized into three types. In this case, the inertia of rest is relevant because the fruits initially remain at rest when the branches are shaken.

• Newton's Laws: The concept of inertia is a fundamental aspect of Newton's First Law of Motion, which is also known as the Law of Inertia. It explains why objects resist changes in their state of motion.

• Example: Similar examples of inertia include a passenger moving forward when a car suddenly stops or dust being removed from a carpet by vigorous shaking.

• Gravity's Role: Once the fruits detach from the branches, gravity acts upon them, causing them to accelerate downward at a rate of 9.8 m/s^2.

• Applications: Understanding inertia helps in various applications, such as designing safety features in vehicles (e.g., seat belts), understanding motion in sports, and analyzing forces in mechanical systems.

Important Points

• Option Analysis:

• Option 1: "The fruits fall down due to change in momentum" is incorrect because momentum involves mass and velocity, but here, the fruits are initially at rest.

• Option 3: "The fruits fall down due to action-reaction forces" is incorrect because while forces are involved, the primary reason is inertia, not action-reaction forces.

• Option 4: "The fruits fall down due to frictional force" is incorrect because friction opposes motion, and in this case, it does not play a significant role in the detachment of fruits.

• Scientific Principle: The phenomenon of fruits falling due to inertia is an excellent demonstration of Newtonian mechanics and the fundamental laws of motion.

• Educational Context: This concept is widely taught in physics to illustrate the principles of motion and forces.

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Q18. Answer: (b) Plants respond using hormonal and electrical-chemical signals.

The correct answer is Plants respond using hormonal and electrical-chemical signals.

Key Points

• Plants do not have a nervous system like animals. However, they can still respond to stimuli such as light, touch, gravity, and chemicals through alternative mechanisms.

• Plants primarily use hormonal signals (e.g., auxins, gibberellins, cytokinins, ethylene, and abscisic acid) to coordinate their responses to environmental changes and internal cues.

• In addition to hormones, plants also utilize electrical and chemical signaling pathways for rapid communication across cells. For example, the closure of the Venus flytrap involves electrical signals known as action potentials.

• Specific examples of plant responses include phototropism (growth towards light), thigmotropism (response to touch), and gravitropism (response to gravity), all of which are regulated by these non-nervous mechanisms.

• Although plants lack a brain or nerves, their ability to adapt and respond to their environment demonstrates a highly evolved and efficient system of communication and response. Hence, the student's statement that plants cannot respond to anything is incorrect.

Additional Information

• Plant Hormones:

• Auxins: Control cell elongation, phototropism, and gravitropism. Example: bending of plants towards light.

• Gibberellins: Promote stem elongation, seed germination, and flowering.

• Cytokinins: Stimulate cell division and delay leaf aging.

• Ethylene: Regulates fruit ripening and response to mechanical stress.

• Abscisic Acid (ABA): Facilitates stomatal closure and induces dormancy during water stress.

• Electrical Signaling in Plants:

• Plants generate action potentials and electrical signals to transmit information across cells.

• For example, Mimosa pudica (touch-me-not plant) folds its leaves when touched, a reaction triggered by electrical signaling.

• Phototropism:

• Plants grow towards a light source due to the uneven distribution of auxins.

• Auxins accumulate on the shaded side of the plant, causing cells to elongate more on that side, bending the plant towards light.

• Thigmotropism:

• It is the response of plants to touch or physical contact. For example, climbing plants like pea plants curl around support structures.

• This response is mediated by differential cell growth and signaling mechanisms.

• Gravitropism:

• Roots grow downward (positive gravitropism), and shoots grow upward (negative gravitropism) due to the redistribution of auxins.

• Gravity-sensing cells in the root cap help direct this growth pattern.

Important Points

• Comparison with Animal Nervous Systems:

• Unlike animals, plants lack specialized organs like the brain or nerves for processing and transmitting information.

• However, plants rely on hormonal and signal transduction pathways to achieve similar adaptive responses to their environment.

• Misconceptions:

• The idea that plants are incapable of response arises from the absence of visible structures like nerves or muscles. However, scientific research has shown they possess sophisticated systems for perception and reaction.

• Applications of Plant Responses:

• Understanding plant responses aids in agriculture, allowing for improved crop management and stress resistance.

• For example, the knowledge of phototropism and gravitropism is applied in optimizing plant growth in controlled environments.

Q19. Answer: (a) the total energy before and after the transformation remains the same

The correct answer is the total energy before and after the transformation remains the same.

Key Points

• During the transformation of energy from one form to another, such as gravitational potential energy converting into kinetic energy during free fall, the total energy in the system remains conserved.

• This principle is governed by the Law of Conservation of Energy, which states that energy cannot be created or destroyed, only transformed from one form to another.

• In the case of free fall, the gravitational potential energy decreases as the object falls, while the kinetic energy increases

equivalently, keeping the total mechanical energy constant in the absence of external forces like air resistance.

• The total mechanical energy (sum of kinetic energy and potential energy) remains constant throughout the motion, provided there is no energy loss to external factors like friction or air drag. Hence, this statement is correct.

• Options suggesting energy loss, increase in total energy, or creation of new energy violate the fundamental laws of physics and are incorrect.

Additional Information

• Law of Conservation of Energy:

• According to this law, the total energy in an isolated system remains constant over time.

• Energy can change forms, such as potential energy transforming into kinetic energy or heat energy, but the total quantity remains unchanged.

• Gravitational Potential Energy (GPE):

• GPE is the energy possessed by an object due to its position relative to a reference point, such as height above the ground.

• It is calculated using the formula: GPE = mgh, where m is mass, g is the gravitational acceleration (approximately 9.8 m/s^2), and h is the height.

• Kinetic Energy (KE):

• KE is the energy possessed by an object due to its motion and is calculated using the formula: KE = 1/2 mv^2, where m is mass and v is velocity.

• As an object falls, its velocity increases, causing an increase in kinetic energy.

• Applications of Energy Conservation:

• The principle of energy conservation is fundamental in various fields, including mechanics, thermodynamics, and electrical engineering.

• Examples include the functioning of pendulums, roller coasters, and hydroelectric power plants where potential energy converts to kinetic energy or electrical energy.

• Role of Friction and Air Resistance:

• In real-world scenarios, some energy is lost as heat or sound due to friction or air resistance, making the system non-conservative.

• However, in idealized cases (e.g., vacuum environments), the total mechanical energy remains completely conserved.

Q20. Answer: (d) Nature of the functional Group

The correct answer is Nature of the Functional Group.

Key Points

• Prefixes and suffixes are essential components in chemical nomenclature, particularly in organic chemistry. They indicate specific modifications based on the functional group present in the compound.

• The functional group is a specific group of atoms within a molecule that is responsible for the characteristic chemical reactions of that molecule. Examples include alcohol (-OH), aldehyde (-CHO), carboxylic acid (-COOH), etc.

• In the International Union of Pure and Applied Chemistry (IUPAC) system of nomenclature, a prefix is used to indicate substituents or side chains attached to the parent chain, while a suffix denotes the main functional group.

• The naming convention is hierarchical, where the primary functional group determines the suffix, and other substituents or groups are represented as prefixes.

• For example:

• Methanol (CH3OH): The suffix "-ol" indicates the presence of an alcohol functional group.

• Ethanoic acid (CH3COOH): The suffix "-oic acid" indicates the presence of a carboxylic acid functional group.

Additional Information

• Nomenclature Rules in Organic Chemistry:

• The longest continuous carbon chain is identified as the parent chain, and its name is used as the base name of the compound.

• The functional group with the highest priority (as per IUPAC hierarchy) dictates the suffix, while other substituents are named as prefixes.

• If multiple substituents are present, their positions are indicated with numbers, and the substituents are listed in alphabetical order.

• For example, 2-bromo-3-chloropentane has bromine and chlorine substituents at positions 2 and 3, respectively.

• Common Functional Groups and Their Suffixes:

• Alcohol: Suffix "-ol" (e.g., ethanol, methanol).

• Aldehyde: Suffix "-al" (e.g., formaldehyde, acetaldehyde).

• Ketone: Suffix "-one" (e.g., propanone, butanone).

• Carboxylic Acid: Suffix "-oic acid" (e.g., ethanoic acid).
• Ester: Suffix "-oate" (e.g., methyl ethanoate).
• Importance of Functional Groups:
• Functional groups determine the chemical reactivity and physical properties of compounds, such as solubility and boiling point.
• They are critical in biochemistry for understanding the structure and function of biomolecules like proteins, carbohydrates, and nucleic acids.
• For example, the hydroxyl group (-OH) in alcohols makes them polar and increases their solubility in water.
• Applications of Functional Group Identification:
• Widely used in medicinal chemistry to design drugs with specific biological activities.
• Helps in predicting the behavior of compounds in chemical reactions.
• Essential for analytical techniques like spectroscopy (e.g., IR, NMR) to identify substances based on their functional groups.

Important Points

• Hierarchy of Functional Groups in IUPAC Nomenclature:
• Functional groups are prioritized based on their reactivity and importance in the compound's structure.
• For example, carboxylic acids have higher priority over alcohols, ketones, and aldehydes.
• This hierarchy determines whether a group is named as a suffix or a prefix in the chemical name.
• Examples of Prefixes:
• Halogens like fluorine, chlorine, and bromine are named as prefixes (e.g., chloroform).
• Other groups like nitro (-NO2) and alkyl groups (e.g., methyl, ethyl) are also used as prefixes.

Q21. Answer: (a) Skeletal muscles

The correct answer is Skeletal muscles.

Key Points

• Skeletal muscles are also known as striated muscles because they exhibit alternate light and dark bands when stained appropriately under a microscope.
• These muscles are attached to bones and play a vital role in voluntary movements of the body.
• The striated appearance is due to the organized arrangement of actin and myosin filaments within the muscle fibers, which form repeating units called sarcomeres.
• Each sarcomere is bordered by Z-lines, and the alternating light (I-bands) and dark (A-bands) regions contribute to the characteristic striations.
• Unlike other muscle types, skeletal muscles are under voluntary control, meaning their movements are consciously regulated by the nervous system.

Additional Information

• Visceral muscles:
• These are also known as smooth muscles and are found in the walls of internal organs such as the stomach, intestines, and blood vessels.
• They do not exhibit striations and are under involuntary control.
• Muscles of the alimentary canal:
• These are primarily smooth muscles that aid in the movement of food through peristalsis.
• They lack striations and function involuntarily.
• Involuntary muscles:
• This category includes both smooth muscles and cardiac muscles.
• Cardiac muscles are striated but function involuntarily, making them distinct from skeletal muscles.
• Structure of skeletal muscles:
• Skeletal muscles are composed of long, cylindrical fibers that are multinucleated.
• Each muscle fiber is surrounded by a plasma membrane known as the sarcolemma.
• These muscles are responsible for movements such as walking, running, and lifting objects.

Important Points

• Skeletal muscle examples:
• Examples include biceps, triceps, deltoids, and quadriceps.
• These muscles are attached to the skeleton via tendons, allowing movement at the joints.
• Cardiac muscles:
• Cardiac muscles are striated like skeletal muscles but are involuntary in function.

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• They are found exclusively in the heart and are responsible for pumping blood throughout the body.

• Muscle contraction mechanism:

• The sliding filament theory explains how muscles contract, with actin and myosin filaments sliding over each other to shorten the sarcomere.

• This process requires energy in the form of ATP and is regulated by calcium ions and the protein troponin.

Q22. Answer: (a) is always smaller than the object

The correct answer is is always smaller than the object.

Key Points

• A convex mirror, also known as a diverging mirror, always forms a virtual, erect, and smaller image of the object irrespective of its position in front of the mirror.

• This is because convex mirrors have a curved reflecting surface that bulges outward, causing the reflected rays to diverge.

• The image is formed behind the mirror, and the size of the image is always reduced compared to the object's size.

• The nature of the image formed by a convex mirror is described using the mirror formula: 1/f = 1/v + 1/u, where:

• f = focal length (positive for convex mirrors)

• v = image distance

• u = object distance

• Convex mirrors are widely used as rear-view mirrors in vehicles because they provide a wider field of view and always produce smaller, upright images of objects, enabling drivers to see more area.

Additional Information

• Characteristics of Convex Mirrors:

• Convex mirrors always produce a virtual image (an image that cannot be projected onto a screen).

• The image is always erect (upright) and smaller in size compared to the object.

• The focal length (f) of a convex mirror is positive because the focus lies on the same side as the reflected rays.

• Applications of Convex Mirrors:

• Rear-view mirrors: Used in vehicles to provide a wider field of view, helping drivers observe traffic conditions behind them.

• Surveillance mirrors: Installed in shops, warehouses, and parking lots to monitor activities in a large area.

• Road safety: Used at blind turns on roads to help drivers see oncoming traffic.

• Comparison with Concave Mirrors:

• Concave mirrors can produce real and inverted images or virtual and erect images depending on the object's position relative to the focal point.

• In contrast, convex mirrors always produce virtual, erect, and smaller images regardless of the object's position.

• Mirror Formula and Magnification:

• The mirror formula is given as: 1/f = 1/v + 1/u.

• The magnification (m) is calculated as: m = h'/h = -v/u, where:

• h' = height of the image

• h = height of the object

• v = image distance

• u = object distance

Important Points

• Convex Mirrors in Optics:

• Convex mirrors are part of the spherical mirror family, which includes concave mirrors.

• Their reflective surface bulges outward, making them ideal for producing reduced, virtual images.

• Usage in Daily Life:

• Convex mirrors are commonly seen in public spaces such as stores and parking lots to enhance visibility.

• They are crucial for road safety at blind spots and intersections.

Q23. Answer: (b) Regenerative cells

The correct answer is Regenerative cells.

Key Points

• Hydra, a small freshwater organism, reproduces asexually through a process called budding. In this process, a new individual grows out of the body of the parent organism.

• The type of cells responsible for reproduction in Hydra during budding are regenerative cells, which have the ability to divide and

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differentiate into various cell types required for forming a new organism.

• Regenerative cells in Hydra are located in the body column and play a crucial role in regenerating missing tissues or developing new buds.

• These cells ensure that the new Hydra inherits a complete and functional body structure, including tentacles and the gastrovascular cavity.

• Unlike gametic cells, which are used in sexual reproduction, regenerative cells are involved in asexual reproduction, making budding a quick and efficient mode of reproduction for Hydra.

Additional Information

• Budding Process in Hydra:

• In budding, a small outgrowth or bud forms on the parent organism due to localized cell division at a particular spot.

• This bud grows gradually, developing structures like tentacles and a mouth, and eventually detaches from the parent to live as an independent organism.

• Regenerative Cells in Other Organisms:

• Regenerative cells are also found in other organisms like planarians, starfish, and some amphibians, where they contribute to tissue repair and regeneration.

• In humans, stem cells act as regenerative cells, aiding in tissue repair and development.

• Comparison of Cell Types:

• Stomatal cells: Found in plants, responsible for gas exchange and water regulation, unrelated to reproduction in Hydra.

• Gametic cells: Involved in sexual reproduction, such as sperm and eggs, not used in asexual reproduction like budding.

• Photosynthetic cells: Specialized cells in plants and algae that carry out photosynthesis, not present in Hydra.

• Advantages of Asexual Reproduction in Hydra:

• It allows for rapid population growth as new individuals are produced quickly without the need for a mate.

• Since the offspring are genetically identical to the parent, successful traits are preserved across generations.

Important Points

• Why Hydra is a Model Organism:

• Hydra is widely used in scientific research due to its simple body structure and remarkable regenerative abilities.

• It has been extensively studied to understand the mechanisms of regeneration and stem cell biology.

• Other Modes of Reproduction in Hydra:

• Besides budding, Hydra can reproduce sexually under unfavorable conditions by producing gametes.

• This ensures genetic diversity and survival in challenging environments.

• Applications of Regenerative Biology:

• Research on regenerative cells in organisms like Hydra provides insights into potential medical applications, such as tissue engineering and regenerative medicine.

• Understanding regenerative mechanisms may lead to breakthroughs in treating injuries and degenerative diseases in humans.

Q24. Answer: (a) Because the density of ice is less than that of water

The correct answer is Because the density of ice is less than that of water.

Key Points

• Ice floats on water due to its lower density: When water freezes, it expands and forms a crystalline structure that has more space between molecules. This increases the volume of ice, reducing its density compared to liquid water.

• Density of water vs. ice: The density of liquid water is approximately 1 g/cm³, while the density of ice is about 0.92 g/cm³. This lower density allows ice to float.

• Hydrogen bonding: Water molecules form hydrogen bonds in ice, creating a lattice structure. This structure is less compact than in liquid water, making ice less dense.

• Buoyancy principle: Ice displaces an amount of water equal to its weight, and since it is less dense, it floats on the surface of the water.

• Thermal insulation effect: Floating ice forms a layer on water bodies, preventing the water below from freezing completely. This is crucial for aquatic life survival during winters.

Additional Information

• Density: Density is defined as mass per unit volume. For water, the maximum density occurs at 4°C, and as it cools further, the density decreases as it transitions to ice.

• Hydrogen Bonding in Water: Water molecules are polar, and hydrogen bonding is responsible for the unique properties of water, including its lower density in the solid state (ice).

• Role of Ice in the Environment: Ice floating on water bodies acts as an insulator, protecting aquatic ecosystems by maintaining

stable temperatures beneath the ice.

• Applications: This property of ice is vital for biological and environmental processes, such as the survival of aquatic organisms during freezing temperatures.

• Other Substances: Unlike water, most substances are denser in their solid state than in their liquid state. Water's behavior is an exception due to its molecular structure.

Important Points

• Option 2 (Ice is at a lower temperature): This is incorrect. While ice is colder than liquid water, its floating property is attributed to its lower density, not temperature.

• Option 3 (Displaces water equal to its weight): This is partially true but not the primary reason. The lower density of ice compared to water is the main factor enabling it to float.

• Option 4 (Weight of ice is very small): Incorrect. The weight of ice is not the determining factor; its density relative to water is what matters.

Q25. Answer: (d) Pascal

The correct answer is Pascal.

Key Points

• SI Unit of Pressure: The SI unit of pressure is the Pascal (Pa), named after the French mathematician, physicist, and philosopher Blaise Pascal.

• One Pascal is defined as the pressure exerted when a force of 1 Newton (N) is applied uniformly over an area of 1 square meter (m^2).

• Pressure is mathematically expressed as P = F/A, where P is pressure, F is force, and A is the area over which the force is applied.

• Pascal Conversion: 1 Pascal is equal to 1 N/m^2. In other units, 1 atmosphere (atm) is approximately 101,325 Pascals, and 1 mmHg is approximately 133.322 Pascals.

• Pascal is widely used in various fields, including physics, engineering, meteorology, and fluid mechanics, for measuring pressure in gases, liquids, and solids.

Additional Information

• Other Units of Pressure:

• mmHg (millimeters of Mercury): Commonly used in medical fields, especially in measuring blood pressure. 1 mmHg = 133.322 Pascals.

• Atmosphere (atm): Used in meteorology and scuba diving. 1 atm = 101,325 Pascals.

• Torr: Equivalent to 1 mmHg. It is often used in vacuum measurements. 1 Torr = 133.322 Pascals.

• Bar: Another unit of pressure used in meteorology and engineering. 1 bar = 100,000 Pascals.

• Applications of Pressure Measurement:

• In meteorology, pressure is used to measure atmospheric conditions, with instruments like barometers.

• In medical science, blood pressure is measured using units like mmHg.

• In engineering, pressure is crucial for designing hydraulic systems, aerodynamics, and structural integrity tests.

• In fluid mechanics, pressure is a key parameter in studying fluid behavior and dynamics.

• Historical Context: Blaise Pascal's work in fluid mechanics and the study of pressure laid the groundwork for adopting the Pascal as the SI unit of pressure in the 20th century.

• Important Conversion Factors:

• 1 atm = 760 mmHg = 101,325 Pascals.

• 1 bar = 100,000 Pascals.

• 1 psi (pound per square inch) = 6,894.76 Pascals.

Important Points

• SI Units: The International System of Units (SI) is the globally accepted system for measuring physical quantities, ensuring uniformity and standardization worldwide.

• Derived Units: Pressure is a derived quantity in the SI system, expressed in terms of base SI units ($kg \cdot m^{-1} \cdot s^{-2}$).

• Relevance of Standard Units: Standardized units like the Pascal ensure consistency in scientific research, industrial applications, and education.

• Real-World Example: The air pressure in car tires is often expressed in units like psi or bar, but it can be converted to Pascals for precise scientific calculations.

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Q26. Answer: (b) 564

Shortcut Trick

Find LCM of 56, 80, 16 and 60.

LCM (56, 80, 16, 60) = 1680.

The number must be of form (1680 × k) + 2.

For k = 3, target number = 5040 + 2 = 5042.

Smallest natural number to add = 5042 − 4478 = 564.

Therefore The correct answer is 564.

Alternate Method

Given: Numbers = 56, 80, 16, 60; Remainder = 2; Initial number = 4478.

Formula: Target Number = [LCM(divisors) × k] + Remainder.

=> Prime Factorization:

=> 56 = $2^3 \times 7$

=> 80 = 2^4 × 5

=> 16 = 2^4

=> 60 = $2^2 \times 3 \times 5$

=> LCM = 2^4 × 3 × 5 × 7 = 16 × 105 = 1680.

=> Multiple of 1680 just greater than 4478:

=> 1680 × 2 = 3360 (Smaller than 4478)

=> 1680 × 3 = 5040.

=> Resulting Number = 5040 + 2 = 5042.

=> Number to be added = 5042 − 4478 = 564.

Therefore The correct answer is 564.

Additional Information

LCM and Remainder Concept

The smallest number which when divided by a, b, and c leaves a remainder r in each case is LCM(a, b, c) + r.

Multiple LCM Application

For problems requiring a number close to a specific value, find the general form [LCM × k + r] and solve for the integer k.

Q27. Answer: (d) 10/3 days

Shortcut Trick

Total Work = 20 × 18 = 360 units.

Let 9 men leave after x days. Remaining men = 11.

Total Work = (20 × x) + (11 × (30 − x)) = 360.

20x + 330 − 11x = 360 => 9x = 30 => x = 30/9 = 10/3 days.

Therefore The correct answer is 10/3 days.

Alternate Method

Given: Initial men (M1) = 20, Days (D1) = 18. Target Days = 30.

Formula Used: Total Work = Men × Days

=> Total Work = 20 × 18 = 360 man-days

=> Let 9 men stop working after x days.

=> For the first x days, 20 men worked: Work done = 20 × x

=> After 9 men left, remaining men = 20 − 9 = 11 men.

=> These 11 men worked for the remaining (30 − x) days.

=> Work done by 11 men = 11 × (30 − x)

=> 20x + 11(30 − x) = 360

=> 20x + 330 − 11x = 360

=> 9x = 360 − 330

=> 9x = 30

=> x = 30/9 = 10/3 days

Therefore The correct answer is 10/3 days.

Additional Information

Chain Rule Formula

The relationship between men, days, and work is given by (M1×D1×H1)/W1 = (M2×D2×H2)/W2.

Inverse Proportion

For a constant amount of work, the number of men is inversely proportional to the time taken (M prop. to 1/D).

Total Work Concept

Total work is always considered as the product of efficiency and time. Here, efficiency of 1 man is assumed as 1 unit/day.

Q28. Answer: (a) 80 minutes

Shortcut Trick

Relative Speed (opposite direction) = 16 + 29 = 45 km/hr.

Time taken = Distance ÷ Relative Speed = 60 ÷ 45 hours.

Time in minutes = (60 ÷ 45) × 60 = 4 × 20 = 80 min.

Therefore The correct answer is 80 min.

Alternate Method

Given:

Initial Distance between engines = 60 km

Speed of first engine (S1) = 16 km/hr

Speed of second engine (S2) = 29 km/hr

Formula Used:

Relative Speed (opposite) = S1 + S2

Time = Distance ÷ Relative Speed

Calculations:

=> Relative Speed = 16 + 29 = 45 km/hr

=> Time (in hours) = 60 ÷ 45

=> Time (in hours) = 4/3 hours

=> Time (in minutes) = (4/3) × 60

=> Time = 4 × 20 = 80 min

Therefore The correct answer is 80 min.

Additional Information

Relative Speed Concept

When two objects move in opposite directions, relative speed is the sum of their speeds (S1 + S2). When moving in the same direction, it is the difference (|S1 − S2|).

Time-Speed-Distance Relation

Distance = Speed × Time. To convert km/hr to m/s, multiply by 5/18. To convert hours to minutes, multiply by 60.

Meeting Point Distance

The distance from the starting point of engine A to the meeting point = Speed of A × Meeting Time.

Q29. Answer: (c) 1232

Shortcut Trick

Cutting a sphere into 4 equal parts through the center creates 4 new circular faces in total.

Total Surface Area (TSA) = Original Surface Area + 4 × Area of Circle = $4\pi r^2 + 4\pi r^2 = 8\pi r^2$.

Given diameter = 14 cm => radius (r) = 7 cm.

TSA = 8 × (22/7) × 7 × 7 = 8 × 154 = 1232 cm^2.

Therefore The correct answer is 1232 cm^2.

Alternate Method

Given:

Diameter of the sphere (D) = 14 cm

Radius of the sphere (r) = D/2 = 14/2 = 7 cm

Formula Used:

Total Surface Area of 4 equal parts = Original Curved Surface Area + Area of all flat faces created by cuts.

Calculations:

=> When a sphere is cut into 4 equal parts by two perpendicular planes, each part is a quarter sphere.

=> Surface Area of one quarter part = (1/4) × 4πr² + 2 × (1/2)πr² = 2πr²

=> Total Surface Area of 4 such parts = 4 × 2πr² = 8πr²

=> TSA = 8 × (22/7) × 7 × 7

=> TSA = 8 × 22 × 7

=> TSA = 1232 cm²

Therefore The correct answer is 1232 cm².

Additional Information

Surface Area of Sphere

The total surface area of a complete sphere with radius r is given by 4πr².

Total Surface Area of Hemisphere

For a hemisphere, the TSA includes the curved surface (2πr²) and the flat base area (πr²), totaling 3πr².

Volume of Sphere

The volume or capacity of a sphere is calculated using the formula V = (4/3)πr³.

Q30. Answer: (c) 97500

Shortcut Trick

Income ratio = 5 : 8, Expenditure ratio = 1 : 4

Difference in income parts (8 − 5 = 3) and expenditure parts (4 − 1 = 3) is same.

Income − Expenditure = Savings => 5 − 1 = 4 units or 8 − 4 = 4 units.

4 units = Rs. 78,000 → 1 unit = Rs. 19,500.

Gopal's income (5 units) = 5 × 19,500 = Rs. 97,500.

Therefore The correct answer is Rs. 97500.

Alternate Method

Given: Ratio of incomes = 5 : 8, Ratio of expenditures = 1 : 4, Savings = Rs. 78,000 each.

Formula: Income − Savings = Expenditure

=> Let incomes be 5x and 8x.

=> (5x − 78,000) / (8x − 78,000) = 1 / 4

=> 4(5x − 78,000) = 1(8x − 78,000)

=> 20x − 3,12,000 = 8x − 78,000

=> 12x = 2,34,000

=> x = 19,500

=> Gopal's income = 5x = 5 × 19,500 = 97,500

Therefore The correct answer is Rs. 97500.

Additional Information

Income, Expenditure, and Savings Relationship

The fundamental equation is Income = Expenditure + Savings. For two people with same savings, the difference between their incomes equals the difference between their expenditures.

Cross Multiplication Method

When two ratios and a constant change (savings) are given: (Ratio1_a × Ratio2_b) − (Ratio1_b × Ratio2_a) units = Savings × (Ratio2_b − Ratio2_a).

Ratio Balancing

To make differences equal, multiply one ratio by the difference of the other ratio's terms: New Ratio = Old Ratio × (Difference of other ratio terms).

Q31. Answer: (d) 1,416

Shortcut Trick

Selling Price (SP) = CP × (100 − Discount%) ÷ 100

SP = 2,400 × (100 − 41) ÷ 100

SP = 2,400 × 59 ÷ 100

SP = 24 × 59 = 1,416

Therefore The correct answer is Rs. 1,416.

Alternate Method

Given: Cost Price (CP) = Rs. 2,400, Discount Rate = 41% on CP.

Formulas: Discount Amount = (Discount% ÷ 100) × CP | SP = CP − Discount Amount.

=> Discount Amount = (41 ÷ 100) × 2,400

=> Discount Amount = 41 × 24 = Rs. 984

=> Selling Price (SP) = 2,400 − 984

=> SP = 1,416

Therefore The correct answer is Rs. 1,416.

Additional Information

Discount Calculation

A discount is a reduction in price. Usually, it is calculated on the Marked Price (MP), but if the problem specifies the Cost Price (CP), we apply the percentage directly to the CP.

Selling Price Formula

When a discount is offered on CP, SP = CP × (100 − D%) / 100. This is similar to a Loss Percentage calculation.

Q32. Answer: (a) 18 years

Shortcut Trick

Present ratio of Mr. Gupta and Daughter = 3 : 1

Ratio after 6 years = 5 : 2

To make the gap between ratio parts equal: (3:1) × 1 and (5:2) is not balanced. Check cross-product: (3×2 − 5×1) units = 6 years × (5 − 2)

=> (6 − 5) units = 6 × 3 => 1 unit = 18 years

Daughter's present age = 1 unit = 18 years.

Therefore The correct answer is 18 years.

Alternate Method

Let the present age of the daughter be x years.

Then, the present age of Mr. Gupta = 3x years.

According to the question, after 6 years:

=> (3x + 6) / (x + 6) = 5 / 2

=> 2 × (3x + 6) = 5 × (x + 6)

=> 6x + 12 = 5x + 30

=> 6x − 5x = 30 − 12

=> x = 18

Therefore The correct answer is 18 years.

Additional Information

Ratio and Proportion in Ages

The difference between the ages of two persons remains constant throughout their lives. This property is often used to balance ratios by multiplying with appropriate constants.

Linear Equation Method

For age problems involving multiple time frames (past/future), setting up a linear equation in one variable (x) based on the given ratio is the most reliable approach.

Q33. Answer: (a) 3498

Shortcut Trick

Total Valid Votes = 9000

NOTA = 1% of 9000 = 90

Remaining for P + Q = 9000 − 90 − 5830 = 3080

P receives 4 parts of 3080 (since Q = 1/4 of P => P:Q = 4:1) = 4/5 × 3080 = 2464

R (highest in R:S = 3:2) = 3/5 × 5830 = 3498

Comparing P(2464), Q(616), R(3498), S(2332), the maximum is 3498.

Therefore The correct answer is 3498 votes.

Alternate Method

Given: Total Valid Votes = 9000, NOTA = 1%, R + S = 5830, Ratio R : S = 3 : 2, Q = 25% of P.

=> NOTA Votes = 1% × 9000 = 90

=> Votes for R = 5830 × (3 / 5) = 1166 × 3 = 3498

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=> Votes for S = 5830 × (2 / 5) = 1166 × 2 = 2332
=> Remaining Votes (P + Q) = 9000 − (5830 + 90) = 9000 − 5920 = 3080
=> Ratio P : Q = 100 : 25 = 4 : 1
=> Votes for P = 3080 × (4 / 5) = 616 × 4 = 2464
=> Votes for Q = 3080 × (1 / 5) = 616
=> Comparing all candidates: P = 2464, Q = 616, R = 3498, S = 2332.
=> Winning Candidate = R = 3498
Therefore The correct answer is 3498 votes.
Additional Information
Ratio and Proportion
To divide a quantity X into a ratio a:b, the parts are [a/(a+b)] × X and [b/(a+b)] × X.
Percentage to Ratio Conversion
25% is equivalent to 1/4. If Q is 25% of P, then Q = P/4 or P:Q = 4:1.
Winning Margin
The winning margin is the difference between the votes of the winner and the immediate runner-up.

Q34. Answer: (a) 76°

Shortcut Trick
In right-angled ΔBDC, angle C = 90° − angle DBC = 90° − 71° = 19°.
In ΔAEC, angle AEB is the exterior angle at vertex E.
By the Exterior Angle Theorem, angle AEB = angle CAE + angle ACE.
angle AEB = 57° + 19° = 76°.
Therefore The correct answer is 76°.
Alternate Method
Given: BD perpendicular to AC, angle DBC = 71°, and angle CAE = 57°.
Formula Used: Angle sum property of a triangle and the Exterior Angle Theorem.
=> In ΔBDC, angle BDC = 90° (since BD perpendicular to AC).
=> angle BCD = 180° − (angle BDC + angle DBC)
=> angle BCD = 180° − (90° + 71°) = 180° − 161° = 19°.
=> In ΔAEC, the angle angle ACE is the same as angle BCD, so angle ACE = 19°.
=> Point E lies on BC, making angle AEB the exterior angle to ΔAEC at vertex E.
=> angle AEB = angle CAE + angle ACE
=> angle AEB = 57° + 19° = 76°.
Therefore The correct answer is 76°.
Additional Information
Exterior Angle Theorem
The measure of an exterior angle of a triangle is equal to the sum of the measures of its two remote interior angles.
Angle Sum Property
The sum of the interior angles of any triangle is always 180°.
Complementary Angles in Right Triangles
In a right-angled triangle, the two acute angles are always complementary, meaning their sum is 90°.

Q35. Answer: (c) 4

Shortcut Trick
Combined efficiency of A, B and C working together can be found using the LCM method.
LCM of 3, 24, and 8 is 24, which is the Total Work.
Combined efficiency = 8 + 1 + 3 = 12 units/day.
Time taken for twice the work = (2 × 24) ÷ 12 = 4 days.
Therefore The correct answer is 4 days.
Alternate Method
Given:
Time taken by A = 3 days

Time taken by B = 24 days

Time taken by C = 8 days

Formula Used:

Total Work = LCM of individual times

Efficiency = Total Work ÷ Individual Time

Time = Total Work ÷ Total Efficiency

Person	Days	Total Work	Efficiency
A	3	24	8
B	24	1	
C	8	3	

Calculations:

=> Total Efficiency of A + B + C = 8 + 1 + 3 = 12 units/day

=> Total Work to be done = 2 × 24 = 48 units

=> Time taken = 48 ÷ 12 = 4 days

Therefore The correct answer is 4 days.

Additional Information

Time and Work Relation

Time and efficiency are inversely proportional to each other. If efficiency is doubled, the time taken to complete the same work is halved.

Work and Wages

Wages are always distributed in the direct ratio of the work done by individuals, which is equal to the ratio of their efficiencies when they work for the same duration of time.

Q36. Answer: (d) 77

Shortcut Trick

Teacher age = New Average + (Previous Count × Increase in Average)

Increase in average = 20 − 19 = 1 year

Teacher age = 20 + (57 × 1)

Teacher age = 20 + 57 = 77 years

Therefore The correct answer is 77 years.

Alternate Method

Given:

Number of students = 57

Average age of students = 19 years

New average age (including teacher) = 20 years

Formula Used:

Total Age = Average × Number of persons

Calculations:

=> Total age of 57 students = 57 × 19

=> Total age of 57 students = 1083 years

=> Total number of persons = 57 + 1 = 58

=> Total age of 58 persons = 58 × 20

=> Total age of 58 persons = 1160 years

=> Age of teacher = Total age of 58 persons − Total age of 57 students

=> Age of teacher = 1160 − 1083

=> Age of teacher = 77 years

Therefore The correct answer is 77 years.

Additional Information

Weighted Average

When two groups with averages A1 and A2 and sizes n1 and n2 are combined, the new average A = (n1A1 + n2A2) ÷ (n1 + n2).

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Net Deviation Method

In any distribution, the sum of deviations taken from the actual mean is always zero.

Properties of Average

If each number in a dataset is increased by a constant 'k', the average of the dataset also increases by 'k'.

Q37. Answer: (d) 1920

Shortcut Trick

Time taken for 2 pages = 40 minutes.

Time taken for 1 page = 40 ÷ 2 = 20 minutes.

Time taken for 96 pages = 96 × 20 = 1920 minutes.

Therefore The correct answer is 1920 minutes.

Alternate Method

Given:

Number of pages (W1) = 2 pages

Time taken (T1) = 40 minutes

Number of pages (W2) = 96 pages

Formula Used:

Since the rate of work is constant, we use the Unitary Method or the work-time ratio: (W1 / T1) = (W2 / T2)

Calculations:

=> 2 / 40 = 96 / T2

=> 1 / 20 = 96 / T2

=> T2 = 96 × 20

=> T2 = 1920 minutes

Therefore The correct answer is 1920 minutes.

Additional Information

Unitary Method

It is a technique for solving a problem by first finding the value of a single unit, and then finding the necessary value by multiplying the single unit value.

Direct Proportion

In this case, Work is directly proportional to Time. If the number of pages increases, the time taken will also increase proportionally (W1/T1 = W2/T2).

Time and Work Relation

The basic formula used in time and work is Work = Efficiency × Time. Here, efficiency of the typist remains constant.

Q38. Answer: (d) Rs. 22,113

Shortcut Trick

Total Marked Price (MP) = 600 × 91 = Rs. 54,600.

Using the multiplier method: Final Price = MP × (1 − d1/100) × (1 − d2/100) × (1 − d3/100).

Successive multipliers are 0.75, 0.75, and 0.72.

Final Cash Payment = 54,600 × 3/4 × 3/4 × 18/25 = 54,600 × 162/400.

Final Cash Payment = 136.5 × 162 = Rs. 22,113.

Therefore The correct answer is Rs. 22,113.

Alternate Method

Given → Quantity = 600 pairs, Price per pair = Rs. 91, Discounts = 25%, 25%, and 28%.

Formulas: Total MP = Quantity × Price | Net SP = MP × (100 − D1)% × (100 − D2)% × (100 − D3)%

=> Total MP = 600 × 91 = Rs. 54,600.

=> After 1^(st) discount of 25%: 54,600 × 0.75 = Rs. 40,950.

=> After 2^(nd) discount of 25%: 40,950 × 0.75 = Rs. 30,712.5.

=> After 3^(rd) discount of 28% (Cash): 30,712.5 × 0.72 = Rs. 22,113.

Therefore The correct answer is Rs. 22,113.

Additional Information

Successive Discounts

When multiple discounts are applied one after another, the net discount is not the simple sum. Two discounts a% and b% result in

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a net discount of (a + b − ab/100)%.

Marked Price (MP)

The price listed on the product or invoice before any discounts are applied. Selling Price = MP × (100 − Discount%)/100.

Q39. Answer: (d) 45.45%

Shortcut Trick

Convert fractions to a common denominator: 1/20 = 5/100.

Required percentage = (First value ÷ Second value) × 100

Calculation: (5/100 ÷ 11/100) × 100 = 5/11 × 100 ≈ 45.45%

Therefore The correct answer is 45.45%.

Alternate Method

Given: First value = 1/20, Second value = 11/100

Formula Used: Percentage = (Part ÷ Whole) × 100

=> Required % = [(1/20) / (11/100)] × 100

=> Required % = (1/20) × (100/11) × 100

=> Required % = (5/11) × 100

=> Required % = 500 ÷ 11

=> Required % = 45.4545...

Therefore The correct answer is 45.45%.

Additional Information

Fraction to Percentage

To convert any fraction a/b to a percentage, multiply it by 100 and add the % symbol.

Percentage Comparison

When comparing two fractions, it is often easier to equate their denominators or convert both to decimals first.

Reciprocal values

Knowing that 1/11 ≈ 9.09% helps in calculating 5/11 as 5 × 9.09% = 45.45% quickly.

Q40. Answer: (d) x + 1

Shortcut Trick

Factorize the expression: x^4 − 1 = (x² − 1)(x² + 1) and x³ − 1 = (x − 1)(x² + x + 1).

Substitute these into the expression: [(x² − 1)(x² + 1)(x² + x + 1)] ÷ [(x − 1)(x² + x + 1)(x² + 1)].

Cancel common factors (x² + 1) and (x² + x + 1) to get (x² − 1) ÷ (x − 1).

Simplify further: (x − 1)(x + 1) ÷ (x − 1) = x + 1.

Therefore The correct answer is x + 1.

Alternate Method

Given:

Expression = ((x^4 − 1)(x² + x + 1)) ÷ ((x³ − 1)(x² + 1))

Formula Used:

1. a² − b² = (a − b)(a + b)

2. a³ − b³ = (a − b)(a² + ab + b²)

Calculations:

=> Simplify x^4 − 1: (x²)² − (1)² = (x² − 1)(x² + 1) = (x − 1)(x + 1)(x² + 1)

=> Simplify x³ − 1: (x − 1)(x² + x × 1 + 1²) = (x − 1)(x² + x + 1)

=> Substitute these back into the original expression:

=> [((x − 1)(x + 1)(x² + 1)) × (x² + x + 1)] ÷ [((x − 1)(x² + x + 1)) × (x² + 1)]

=> Cancel the common terms from the numerator and denominator:

=> Terms to cancel: (x − 1), (x² + 1), and (x² + x + 1)

=> Remaining term = x + 1

Therefore The correct answer is x + 1.

Additional Information

Algebraic Identities

Difference of Squares: a² − b² = (a − b)(a + b). This is used for simplifying even powers like x^4 − 1.

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Cubic Identities

Difference of Cubes: $a^3 - b^3 = (a - b)(a^2 + ab + b^2)$. Sum of Cubes: $a^3 + b^3 = (a + b)(a^2 - ab + b^2)$.

Simplification Tip

Always factorize completely before canceling. For complex fractions, identify common algebraic factors in the numerator and denominator to reduce the expression.

Q41. Answer: (a) $\cot^2 B$

Shortcut Trick

Using the identity $1 - \sin^2 B = \cos^2 B$.

The equation becomes $\cos^2 B = K \times \sin^2 B$.

Dividing both sides by $\sin^2 B$ gives $K = \cos^2 B \div \sin^2 B$.

Since $\cos B \div \sin B = \cot B$, then $K = \cot^2 B$.

Therefore The correct answer is $\cot^2 B$.

Alternate Method

Given: $1 - \sin^2 B = K \times \sin^2 B$

Formula used: $\sin^2 \theta + \cos^2 \theta = 1$ and $\cot \theta = \cos \theta \div \sin \theta$

$\Rightarrow 1 - \sin^2 B = K \times \sin^2 B$

$\Rightarrow \cos^2 B = K \times \sin^2 B$

$\Rightarrow K = \cos^2 B / \sin^2 B$

$\Rightarrow K = (\cos B / \sin B)^2$

$\Rightarrow K = \cot^2 B$

Therefore The correct answer is $\cot^2 B$.

Additional Information

Pythagorean Identities

Fundamental relations: $\sin^2 \theta + \cos^2 \theta = 1$, $1 + \tan^2 \theta = \sec^2 \theta$, and $1 + \cot^2 \theta = \text{cosec}^2 \theta$.

Reciprocal Ratios

Relationship between ratios: $\tan \theta = \sin \theta \div \cos \theta$ and $\cot \theta = \cos \theta \div \sin \theta = 1 \div \tan \theta$.

Q42. Answer: (d) 27

Shortcut Trick

For two numbers, if Sum (S) and Difference (D) are given:

Larger Number = (Sum + Difference) ÷ 2

Larger Number = (40 + 14) ÷ 2 = 54 ÷ 2 = 27

Therefore The correct answer is 27.

Alternate Method

Given:

Sum of two integers = 40

Difference of two integers = 14

Let the two integers be x and y, where x is the larger integer.

$\Rightarrow x + y = 40$ --- (Equation 1)

$\Rightarrow x - y = 14$ --- (Equation 2)

Adding Equation 1 and Equation 2:

$\Rightarrow (x + y) + (x - y) = 40 + 14$

$\Rightarrow 2x = 54$

$\Rightarrow x = 54 \div 2$

$\Rightarrow x = 27$

Therefore The correct answer is 27.

Additional Information

Finding the Smaller Integer

The smaller integer can be found using the formula: (Sum − Difference) ÷ 2. In this case, (40 − 14) ÷ 2 = 13.

Linear Equations in Two Variables

When solving equations of form $x+y=a$ and $x-y=b$, the values are always $x = (a+b)/2$ and $y = (a-b)/2$.

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Product of the Numbers

The product of these two integers can be calculated as x × y = 27 × 13 = 351.

Q43. Answer: (b) 7

Shortcut Trick

For two numbers x and y, the mean proportional is √(x × y).

Given 28 = √(A × 112)

Square both sides: 28 × 28 = A × 112

A = (28 × 28) ÷ 112 = 784 ÷ 112 = 7

Therefore The correct answer is 7.

Alternate Method

Given:

First number = A

Second number = 112

Mean Proportional = 28

Formula Used:

Mean Proportional (M) = √(First number × Second number)

Calculations:

=> 28 = √(A × 112)

=> 28^2 = A × 112

=> 784 = A × 112

=> A = 784 ÷ 112

=> A = 7

Therefore The correct answer is 7.

Additional Information

Third Proportional

The third proportional of two numbers a and b is given by c = b^2 ÷ a.

Fourth Proportional

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

Continued Proportion

Three quantities a, b, c are in continued proportion if a/b = b/c, where b is the mean proportional.

Q44. Answer: (a) 3

Shortcut Trick

Use the Empirical Formula: Mode = 3 × Median − 2 × Mean.

Given Mean × Mode = 24 and Median × Mean = 32. Let Mean = x.

Substitute 24/x = 3(32/x) − 2x => 24/x = 96/x − 2x => 2x = 72/x => x2 = 36 => Mean = 6.

Then Mode = 4 and 3 × Median = 3 × (32/6) = 16.

Expression = √(62 + 162 + 42) = √308 = 2√(7 × 11). Here a = 2, b = 7.

Therefore The correct answer is 3.

Alternate Method

Given:

Mean (A) × Mode (Mo) = 24

Median (Me) × Mean (A) = 32

Formula Used:

Mode = 3 × Median − 2 × Mean

Calculations:

=> Mo = 24/A and Me = 32/A

=> 24/A = 3 × (32/A) − 2A

=> 24/A = 96/A − 2A

=> 2A = 96/A − 24/A = 72/A

=> 2A2 = 72 => A2 = 36 => Mean (A) = 6

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=> Mode (Mo) = 24/6 = 4
=> 3 × Median (3Me) = 3 × (32/6) = 16
=> √[A2 + (3Me)2 + Mo2] = √[62 + 162 + 42]
=> √[36 + 256 + 16] = √308
=> √308 = √(4 × 77) = 2 × √(7 × 11)
=> Comparing with a × √(b × 11): a = 2, b = 7
=> √(a + b) = √(2 + 7) = √9 = 3
Therefore The correct answer is 3.
Additional Information
Empirical Relationship
For a moderately skewed distribution, the relationship is Mode = 3 × Median − 2 × Mean.
Symmetrical Distribution
In a perfectly symmetrical distribution, the Mean, Median, and Mode are all equal (Mean = Median = Mode).
Skewness Property
In a positively skewed distribution, Mean > Median > Mode. In a negatively skewed distribution, Mode > Median > Mean.

Q45. Answer: (a) 34

Shortcut Trick
Average Speed = (Total Distance) ÷ (Total Time)
Total Distance = (20 × 80) + (50 × 70) = 1600 + 3500 = 5100 m
Total Time = 80 + 70 = 150 min
Average Speed = 5100 ÷ 150 = 34 m/min
Therefore The correct answer is 34 m/min.
Alternate Method
Given:
Speed1 = 20 m/min, Time1 = 80 min
Speed2 = 50 m/min, Time2 = 70 min
Formula Used:
Distance = Speed × Time
Average Speed = (Total Distance) ÷ (Total Time)
=> Distance1 = 20 × 80 = 1600 m
=> Distance2 = 50 × 70 = 3500 m
=> Total Distance = 1600 + 3500 = 5100 m
=> Total Time = 80 + 70 = 150 min
=> Average Speed = 5100 ÷ 150
=> Average Speed = 34 m/min
Therefore The correct answer is 34 m/min.
Additional Information
Weighted Average of Speeds
When the time durations t1 and t2 are known, Average Speed = (s1t1 + s2t2) ÷ (t1 + t2).
Harmonic Mean for Equal Distances
If distances are equal, the average speed is the harmonic mean of the speeds: 2s1s2 ÷ (s1 + s2).
Relative Speed
In the same direction, speed = s1 − s2. In opposite directions, speed = s1 + s2.

Q46. Answer: (b) 440%

Shortcut Trick
Initial product ratio (Volume) = 1 × 2 × 3 = 6
New dimensions ratio = (1 × 200%) : (2 × 150%) : (3 × 180%) = 2 : 3 : 5.4
New product ratio (Volume) = 2 × 3 × 5.4 = 32.4
Percentage increase = [(32.4 − 6) ÷ 6] × 100 = (26.4 ÷ 6) × 100 = 440%
Therefore The correct answer is 440%.

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Alternate Method

Given: Ratio of Length (L), Breadth (B), and Height (H) = 1 : 2 : 3. Percentage increases are 100%, 50%, and 80% respectively.

Formula Used: Volume of Cuboid = L × B × H

=> Let L = 1x, B = 2x, H = 3x

=> Initial Volume (V1) = 1x × 2x × 3x = $6x^3$

=> New Length (L') = 1x + 100% of 1x = 2x

=> New Breadth (B') = 2x + 50% of 2x = 3x

=> New Height (H') = 3x + 80% of 3x = 3x + 2.4x = 5.4x

=> New Volume (V2) = 2x × 3x × 5.4x = $32.4x^3$

=> Increase in Volume = $32.4x^3 - 6x^3 = 26.4x^3$

=> Percentage Increase = (Increase ÷ V1) × 100

=> Percentage Increase = $(26.4x^3 \div 6x^3) \times 100 = 4.4 \times 100 = 440\%$

Therefore The correct answer is 440%.

Additional Information

Total Surface Area of Cuboid

The total area of all six faces of the cuboid is given by TSA = 2(LB + BH + HL).

Diagonal of a Cuboid

The longest rod that can be placed inside a cuboid is its diagonal, calculated as $D = \sqrt{L^2 + B^2 + H^2}$.

Successive Percentage Change

If dimensions change by a%, b%, and c%, the final volume becomes (1 + a/100)(1 + b/100)(1 + c/100) times the original.

Q47. Answer: (a) 152

Shortcut Trick

Initial Ratio (Acid : Water) = 4 : 3

Final Ratio (Acid : Water) = 8 : 4 = 2 : 1

Make Water parts equal: Initial (4 : 3) and Final (6 : 3)

Total initial parts = 4 + 3 = 7 units → 532 litres. So, 1 unit = 76 litres.

Acid added = 6 − 4 = 2 units => 2 × 76 = 152 litres.

Therefore The correct answer is 152 litres.

Alternate Method

Initial Quantity = 532 litres

Initial Ratio (Acid : Water) = 4 : 3

=> Quantity of Acid = (4/7) × 532 = 304 litres

=> Quantity of Water = (3/7) × 532 = 228 litres

Let 'x' litres of Acid be added.

=> (304 + x) / 228 = 8 / 4

=> (304 + x) / 228 = 2 / 1

=> 304 + x = 456

=> x = 456 − 304 = 152 litres

Therefore The correct answer is 152 litres.

Additional Information

Constant Quantity Rule

When one component is added to a mixture, the quantity of the other component remains constant. Always equate the parts of the constant component in both ratios.

Ratio Balancing

To balance ratios, multiply the entire ratio by a factor such that the value of the unchanged substance becomes the same in both the initial and final states.

Mixture Replacement

If a part of the mixture is replaced by a component, the quantity of the other component decreases proportionally before the addition.

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Q48. Answer: (d) √115

Given:

90 − [36 ÷ 3 + 2 × (P^2 − 21)] ÷ 3 = 70 ÷ 3

Formula Used:

BODMAS rule

Calculation:

=> 90 − [12 + 2 × (P^2 − 21)] ÷ 3 = 70 ÷ 3

=> 90 − [12 + 2P^2 − 42] ÷ 3 = 70 ÷ 3

=> 90 − [2P^2 − 30] ÷ 3 = 70 ÷ 3

=> 90 − (2P^2 − 30) ÷ 3 = 70 ÷ 3

=> Multiply both sides by 3

=> 270 − (2P^2 − 30) = 70

=> 270 − 2P^2 + 30 = 70

=> 300 − 2P^2 = 70

=> 2P^2 = 300 − 70

=> 2P^2 = 230

=> P^2 = 115

=> P = √115

Therefore The correct answer is √115.

Q49. Answer: (a) 48,300

Shortcut Trick

Net difference in interest rates per annum = 7% − 3.5% = 3.5%

Total difference for 3 years = 3.5% × 3 = 10.5%

Required Interest Difference = 10.5% of Rs. 4,60,000

Value = 0.105 × 4,60,000 = Rs. 48,300

Therefore The correct answer is Rs. 48,300.

Alternate Method

Given:

Principal (P) = Rs. 4,60,000 | Time (T) = 3 years | Rate A (R1) = 3.5% | Rate B (R2) = 7%

Formula Used:

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

Calculations:

=> SI from Bank A = (4,60,000 × 3.5 × 3) ÷ 100

=> SI from Bank A = 4,600 × 10.5 = Rs. 48,300

=> SI from Bank B = (4,60,000 × 7 × 3) ÷ 100

=> SI from Bank B = 4,600 × 21 = Rs. 96,600

=> Positive Difference = SI from Bank B − SI from Bank A

=> Positive Difference = Rs. 96,600 − Rs. 48,300 = Rs. 48,300

Therefore The correct answer is Rs. 48,300.

Additional Information

Simple Interest Amount Formula

The total amount (A) after T years is given by A = P + SI = P[1 + (R × T) ÷ 100].

Interest Difference Shortcut

When the principal and time are the same, the difference in SI is directly proportional to the difference in rates: Difference = P × T × (R2 − R1) ÷ 100.

SI vs CI for Same Rate

For the first year, Simple Interest and Compound Interest are equal (if compounded annually). From the second year onwards, CI > SI.

Q50. Answer: (d) 30%

Shortcut Trick

Ratio of Cost Price (CP) to Selling Price (SP) = 2500 : 3250 = 10 : 13.

Profit units = 13 − 10 = 3 units.

Profit % = (Profit units ÷ CP units) × 100 = (3 ÷ 10) × 100 = 30%.

Therefore The correct answer is 30%.

Alternate Method

Given: Cost Price (CP) = Rs. 2,500, Selling Price (SP) = Rs. 3,250.

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

=> Profit = 3250 − 2500 = Rs. 750.

=> Profit % = (750 ÷ 2500) × 100.

=> Profit % = 750 ÷ 25 = 30%.

Therefore The correct answer is 30%.

Additional Information

Profit and Loss Basics

Profit occurs when SP > CP. Loss occurs when CP > SP. Both Profit% and Loss% are always calculated on the Cost Price (CP) unless stated otherwise.

Selling Price Formula

SP = CP × (100 + Profit%) ÷ 100 or SP = CP × (100 − Loss%) ÷ 100.

Q51. Answer: (c) Both conclusions (I) and (II) follow

The least possible Venn diagram for the given statements is as shown below :

Conclusions:

I. Some herbs are bushes → Follow (As all bushes are herbs. As whole bushes comes in herbs, therefore it is true.)

II. All trees are herbs → Follow (As all trees are bushes and all bushes are herbs. As whole trees comes in bushes which whole comes in herbs, therefore it is true.)

Therefore Here, Both conclusions (I) and (II) follow.

Hence, the correct answer is "Option 3".

Q52. Answer: (d) RL 3

The logic followed here is:

IJ 8 is related to KE −1

And,

TP 3 is related to VK −6

Similarly,

PQ 12 is related to

Hence, "Option 4" is the correct answer.

Q53. Answer: (a) 9

The logic followed here is:

Total students → 37

Nisha's rank from the left end → 13

Manasa's rank from the right end → 15

Total people stand between Nisha and Manasa → Total students - Nisha's rank from the left end - Manasa's rank from the right end

→ 37 - 13 - 15 = 9

Hence, the correct answer is "Option 1".

Q54. Answer: (b) ATN

The logic followed here is:

Hence, "Option 2" is the correct answer.

Q55. Answer: (c) 15

The logic followed here is:

Total students → 30

Arun's rank from the right end → 7

Harish's rank from the left end → 8

Total people stand between Nisha and Manasa → Total students - Arun's rank from the right end - Harish's rank from the left end → 30 - 7 - 8 = 15

Hence, the correct answer is "Option 3".

Q56. Answer: (c) S4

Given: Six students, S1, S2, S3, S4, S5 and S6, are sitting around a circular table, facing the centre.

1) S1 is second to the right of S4.

2) S1 and S3 are sitting next to each other.

3) S4 is the common neighbour of S2 and S3.

4) The student S6 is sitting next to both S5 and S2.

Thus, S4 is sitting fourth to the right of S1.

Hence, the correct answer is "Option 3".

Q57. Answer: (d) pd

According to the question:

Thus, 'fix' is coded as 'pd'.

Hence, "Option 4" is the correct answer.

Q58. Answer: (b) 95 km towards the south

Given:

Devesh starts from Point Y and drives 21 km towards the east.

He then takes a left turn, drives 25 km, turns left and drives 67 km.

He then takes a right turn and drives 29 km.

He takes a right turn, drives 46 km, turns left, drives 41 km to stop at Point Z.

Thus, Devesh should drive 95 km in the south direction in order to reach Point Y again.

Hence, the correct answer is "Option 2".

Q59. Answer: (c) 5

Given series: (Left) 8 1 3 4 3 5 1 8 1 9 1 2 7 1 5 8 9 7 3 8 8 2 3 3 2 1 2 (Right)

According to the question:

Required condition: Odd number - Even number - Odd number

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

Thus, there are five such even numbers which are immediately preceded by an odd number and also immediately followed by an odd number.

Hence, "Option 3" is the correct answer.

Q60. Answer: (c) Six

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

According to the question:

Required condition: Perfect cube

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

Thus, there are six perfect cubes.

Hence, "Option 3" is the correct answer.

Q61. Answer: (b) Only conclusion (II) follows.

The least possible Venn diagram for the given statements is as shown below :

Conclusions:

I. Some roads are cars → Does not follow (As some roads are fans and no fan is a car. So it is possible but not definite.)

II. Some fans are roads → Follow (As some roads are fans. As some part of roads is common with fans, therefore it is true.)

Therefore Here, Only conclusion (II) follows.

Hence, the correct answer is "Option 2".

Q62. Answer: (a) mn

According to the question:

Thus, 'learning' is coded as 'mn'.

Hence, "Option 1" is the correct answer.

Q63. Answer: (b) 400

The logic followed here is:

Hence, the correct answer is "Option 2".

Q64. Answer: (a) Father's sister

A is				
Symbol	•	#	&	%
Meaning	Mother	Brother	Sister	Father
of B				

Given Expression: G & H % I & T # S
G & H → G is the sister of H.
H % I → H is the father of I.
I & T → I is the sister of T.
T # S → T is the brother of S.
Thus, G is S's wife's father's sister.
Hence, "Option 1" is the correct answer.

Q65. Answer: (a) IM-PK

The logic followed here is:
Option 1) IM-PK
Option 2) CG-JD
Option 3) GK-NH
Option 4) EI-LF
Thus, out of all 'IM-PK' is the odd one out.
Hence, "Option 1" is the correct answer.

Q66. Answer: (d) 8

Given series: 2134567
According to the question.

Given	**2**	**1**	**3**	**4**	**5**	**6**	**7**
Arranged in ascending order	1	2	3	4	5	6	7

So, the sum of the digits which are second from the left and second from the right in the new number thus formed → 2+ 6 = 8
Hence, "Option 4" is the correct answer.

Q67. Answer: (a) DBE−CAD

The logic followed here is:
JHK−IGJ
And,
LJM−KIL
Similarly,
DBE−CAD
Hence, "Option 1" is the correct answer.

Q68. Answer: (b) 10

Given number: 4635923
According to the question,

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Number given	4	6	3	5	9	2	3
Odd digit → (-2) Even digit → (+1)	(+1)	(+1)	(-2)	(-2)	(-2)	(+1)	(-2)
Resultant number	5	7	1	3	7	3	1

So, the sum of the digits which are second from the left and second from the right in the new number thus formed → 7 + 3 = 10

Hence, "Option 2" is the correct answer.

Q69. Answer: (d) Two

Given series: 2175684

According to the question.

Given	2	1	7	5	6	8	4
Arranged in ascending order	1	2	4	5	6	7	8

So, the number of position digit that remains unchanged → 5 and 6 → Two

Hence, "Option 4" is the correct answer.

Q70. Answer: (c) 751

The logic followed here is:

Hence, the correct answer is "Option 3".

Q71. Answer: (a) Two

Given series: (Left) 2 8 + 7 5 > 9 2 @ 3 = 4 6 % 3 & 8 4 % 9 1 8 3 # 7 6 9 (Right)

According to the question:

Required condition: Odd number - Symbols - Odd number

(Left) 2 8 + 7 5 > 9 2 @ 3 = 4 6 % 3 & 8 4 % 9 1 8 3 # 7 6 9 (Right)

Thus, there are two such symbols which are immediately preceded by an odd number and also immediately followed by an odd number.

Hence, "Option 1" is the correct answer.

Q72. Answer: (b) (15 ,49 ,44)

The logic followed here is:

(9, 31, 26)

→ 9 × 3 + 4 => 27 + 4 = 31

→ 31 - 5 = 26

And,

(13, 43, 38)

→ 13 × 3 + 4 => 39 + 4 = 43

→ 43 - 5 = 38

Similarly,

(15 ,49 ,44)

→ 15 × 3 + 4 => 45 + 4 = 49

→ 49 - 5 = 44

Hence, the correct answer is "Option 2".

Q73. Answer: (a) Three

Given: A, B, C, D, E and F are sitting around a circular table facing the centre.

1) E sits third to the right of B.

2) C sits to the immediate left of F.

3) C is not an immediate neighbour of B.

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4) D sits to the immediate right of A.

So, if all persons are arranged in English alphabetical order in clockwise direction starting from A (including A):

Final Arrangement:

A	**B**	**F**	**C**	**E**	**D**

Step 5:

Now arrange all persons in alphabetical order clockwise starting from A:

Step 6:

Compare both arrangements:

Original	**A**	**B**	**F**	**C**	**E**	**D**
Alphabetical	A	B	C	D	E	F

Persons remaining in the same positions:

A, B, and E.

Thus, three people will remain unchanged if all persons are arranged in English alphabetical order in clockwise direction starting from A (including A).

Hence, the correct answer is "Option 1".

Q74. Answer: (b) MR 29

The logic followed here is:

GM 14 is related to EJ 16

And,

KQ 22 is related to IN 24

Similarly,

OU 27 is related to

Hence, "Option 2" is the correct answer.

Q75. Answer: (c) XBC

The logic followed here is:

Option 1) PSU

Option 2) JMO

Option 3) XBC

Option 4) HKM

Thus, out of all 'XBC' is the odd one out.

Hence, "Option 3" is the correct answer.

Q76. Answer: (a) AEI 79

The logic followed here is:

Hence, "Option 1" is the correct answer.

Q77. Answer: (d) 46 km towards north

Given:

Jiten starts from Point Y and drives 28 km towards South.

He then takes a right turn, drives 71 km, turns left and drives 69 km.

He then takes a left turn and drives 44 km.

He takes a left turn, drives 51 km.

He then turns right, drives 27 km to stop at Point Z.

Thus, Jiten should drive 46 km in the north direction in order to reach Point Y again.

Hence, the correct answer is "Option 4".

Q78. Answer: (b) -14

The logic followed here is:

Hence, the correct answer is "Option 2".

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Q79. Answer: (a) FE

Given: Six people, A, B, C, D, E and F, are sitting in a row, facing north.

1) E sits to the immediate right of D.

2) F sits fourth to the left of D.

3) A sits second to the left of E.

4) Only one person sits between B and D.

5) C sits to the immediate left of B.

Thus, FE is the one that does NOT belong to that group.

Hence, the correct answer is "Option 1".

Q80. Answer: (a) Three

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

According to the question:

Required condition: Odd digit - Odd digit - Even digit

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

Thus, there are three such odd digits which are immediately preceded by an odd digit and also immediately followed by an even digit.

Hence, "Option 1" is the correct answer.

Q81. Answer: (c) Indian Institute of Technology, Kharagpur

The correct answer is Indian Institute of Technology, Kharagpur.

Key Points

• A significant research study conducted by the Indian Institute of Technology (IIT), Kharagpur, notified in April 2025, has highlighted the grave impact of surface ozone on India's agricultural productivity.

• The study revealed that surface ozone, also known as tropospheric ozone, is acting as a "silent threat," significantly reducing the yields of essential food crops such as wheat, rice, and maize. Hence, the statement regarding IIT Kharagpur is correct.

• Researchers at IIT Kharagpur utilized advanced satellite data and ground-based observations to monitor the concentration of ozone across the Indo-Gangetic Plain (IGP) and other major agricultural hubs.

• The findings indicate that high levels of surface ozone lead to oxidative stress in plants, which damages their photosynthetic capabilities and results in stunted growth and lower grain quality.

• The study warns that if emissions of precursor gases like nitrogen oxides (NOx) and volatile organic compounds (VOCs) are not controlled, the loss in crop production could pose a serious risk to India’s food security by 2030.

Additional Information

• Surface Ozone (Tropospheric Ozone):

• Unlike the stratospheric ozone layer that protects Earth from ultraviolet (UV) radiation, surface ozone is a harmful secondary pollutant.

• It is formed when pollutants emitted by cars, power plants, and industrial boilers react chemically in the presence of sunlight.

• It is a major component of smog and is highly reactive, affecting both human health and vegetation.

• Impact on Plant Physiology:

• Ozone enters the plant through the stomata (pores on the leaf surface) during gas exchange.

• Once inside, it triggers the production of reactive oxygen species (ROS), which damage chlorophyll and reduce the biomass of the plant.

• In India, the Indo-Gangetic Plain is most vulnerable due to the high density of anthropogenic emissions and favorable meteorological conditions for ozone formation.

• Economic and Nutritional Consequences:

• Reduced crop yields lead to higher food prices and economic losses for farmers.

• Research suggests that ozone pollution can decrease the protein content and essential minerals in cereal crops, affecting the nutritional intake of the population.

Important Points

• Precursor Gases: The primary chemicals responsible for ozone formation are Nitrogen Oxides (NOx) and Volatile Organic Compounds (VOCs). These are largely produced by vehicle exhausts and biomass burning.

• Monitoring Agencies: In India, agencies like the Central Pollution Control Board (CPCB) and the System of Air Quality and Weather Forecasting And Research (SAFAR) are responsible for monitoring air quality indices, including ozone levels.

• Global Context: Similar studies in China and the United States have also shown that ozone can reduce crop productivity by 5% to 20%, making it a global environmental challenge for the 21st century.

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Q82. Answer: (a) Rishav Choudhary

The correct answer is Rishav Choudhary.

Key Points

• In June 2025, the independent film director Rishav Choudhary gained significant attention for his innovative approach to cinema by converting heritage toy-train coaches into a specialized screening venue.

• This creative project was executed in Kurseong, a picturesque hill station located in the Darjeeling district of West Bengal, India.

• The initiative utilized the iconic coaches of the Darjeeling Himalayan Railway (DHR), transforming them into a mobile and stationary cinematic space to showcase regional and artistic films to both locals and tourists.

• The primary objective behind Rishav Choudhary's project was to promote Himalayan cinema and provide a unique cultural experience that merges the historical heritage of the railways with modern visual storytelling.

• This venue is considered the first of its kind in the Eastern Himalayas, marking a milestone in cinema-tourism within the region.

Additional Information

• Kurseong:

• Known as the "Land of White Orchids," Kurseong is situated at an altitude of approximately 1,458 meters (4,783 feet).

• It is a major stop on the Darjeeling Himalayan Railway route and is famous for its tea gardens, such as Castleonton and Makaibari.

• Darjeeling Himalayan Railway (DHR):

• Commonly referred to as the "Toy Train," it was built between 1879 and 1881.

• It was declared a UNESCO World Heritage Site in 1999, recognizing its significance as an outstanding example of innovative transportation systems in a difficult mountainous terrain.

• The railway runs on a 2-foot narrow gauge and covers a distance of about 88 kilometers between New Jalpaiguri and Darjeeling.

• Cinema in Non-traditional Spaces:

• The trend of converting vintage infrastructure, like railway coaches or old warehouses, into cultural hubs is growing in India to preserve heritage while making it functional for the 21st century.

• Such initiatives by directors like Rishav Choudhary help in decentralized film distribution, bringing niche cinema to remote locations like Kurseong.

• Other Options Context:

• Rohit Shetty is a famous Indian film director known for large-scale action movies and the Golmaal franchise, typically operating in mainstream Bollywood.

• Ravi Shankar was a world-renowned sitar maestro and composer, while Girija Devi was an eminent Indian classical singer of the Seniya and Banaras gharanas.

Important Points

• The conversion of the coaches required maintaining the structural integrity of the heritage assets while installing modern audio-visual equipment and acoustic insulation.

• This event in 2025 highlights the increasing intersection of arts, heritage conservation, and tourism in West Bengal.

• The Darjeeling region has long been a favorite for filmmakers, but the creation of a permanent or semi-permanent screening venue within the Toy Train itself is a novel contribution to the local creative economy.

Q83. Answer: (d) Telecom Regulatory Authority of India

The correct answer is Telecom Regulatory Authority of India.

Key Points

• The Telecom Regulatory Authority of India (TRAI) hosted the 25th Meeting of the South Asian Telecommunication Regulators' Council (SATRC-25).

• The event was held in New Delhi, India, from November 11 to 13, 2024.

• This landmark meeting marked the Silver Jubilee of the council, celebrating 25 years of regulatory cooperation in the South Asian region.

• The meeting was organized by the Asia-Pacific Telecommunity (APT) and hosted by TRAI to foster collaboration in the telecommunication and Information and Communication Technology (ICT) sectors.

• The session was inaugurated by the Minister of State for Communications and Rural Development, Shri Pemmasani Chandra Sekhar, alongside Anil Kumar Lahoti, the Chairman of TRAI.

Additional Information

• South Asian Telecommunication Regulators' Council (SATRC):

• SATRC was formed in 1997 under the umbrella of the Asia-Pacific Telecommunity (APT).

• It consists of 9 member countries: Afghanistan, Bangladesh, Bhutan, India, Iran, Maldives, Nepal, Pakistan, and Sri Lanka.

• The council serves as a forum for regulators to exchange views and harmonize policies on spectrum management, licensing, and digital transformation.

• Telecom Regulatory Authority of India (TRAI):

• TRAI is a statutory body established on February 20, 1997, by the Telecom Regulatory Authority of India Act, 1997.

• Its primary function is to regulate telecommunication services, including fixation/revision of tariffs, to ensure a fair and transparent environment in the Indian telecom market.

• It is headquartered in New Delhi.

• Asia-Pacific Telecommunity (APT):

• Established in 1979, the APT is an intergovernmental organization focused on the development of ICT in the Asia-Pacific region.

• It plays a crucial role in coordinating regional positions for global forums like the International Telecommunication Union (ITU).

Important Points

• SATRC Action Plan Phase IX: The 25th meeting focused on the implementation of the Action Plan Phase IX, which covers the period of 2024-2025.

• Key Themes: The discussions at SATRC-25 revolved around the deployment of 5G technology, enhancing cybersecurity, and utilizing satellite communication to bridge the digital divide.

• Regulators' Roundtable: A major highlight was the Regulators' Roundtable, where heads of regulatory bodies discussed emerging technologies and regulatory sandboxes to promote innovation.

• Digital India Initiative: The hosting of this event by India aligns with the broader goals of the Digital India program, showcasing India’s leadership in affordable data and digital public infrastructure (DPI).

Q84. Answer: (d) Denmark

The correct answer is Denmark.

Key Points

• Denmark has been ranked as the least corrupt country in the world according to the Corruption Perceptions Index (CPI) 2024.

• The index was released by the global civil society organization Transparency International in February 2025.

• Denmark secured the top position with a score of 90 out of 100, maintaining its reputation for high levels of public sector integrity and transparency.

• The CPI 2024 ranks a total of 180 countries and territories based on their perceived levels of public sector corruption.

• The ranking is determined by a scale where 0 indicates a country is highly corrupt and 100 indicates it is very clean.

Additional Information

• Transparency International:

• It is an international non-governmental organization founded in 1993 and is headquartered in Berlin, Germany.

• The organization focuses on taking action to combat global corruption and prevent criminal activities arising from corruption.

• Its most famous publication is the Corruption Perceptions Index, which has become a leading global indicator of public sector corruption.

• Global Rankings for 2024:

• Following Denmark, other top-performing countries include Finland, New Zealand, and Norway, all of which consistently score in the high 80s.

• In contrast, countries facing prolonged conflict and weak institutional governance, such as Somalia, Venezuela, and Syria, are typically found at the bottom of the index.

• Singapore remains the highest-ranked Asian country, often featuring within the global top 5.

• India's Performance:

• In the previous year's index (CPI 2023), India was ranked 93rd out of 180 countries with a score of 39.

• The report often highlights the need for India to strengthen its democratic oversight and ensure the independence of its regulatory bodies to improve its ranking.

Important Points

• Methodology: The CPI uses data from 13 external sources, including assessments from the World Bank, the World Economic Forum, and private risk and consulting companies.

• Data Indicators: The index covers aspects such as bribery, diversion of public funds, nepotism in the civil service, and the ability of governments to contain corruption through legal frameworks.

• Significance of High Ranks: Countries like Denmark that rank at the top usually possess a strong rule of law, independent judicial systems, and high levels of social trust among the citizenry.

• Global Trend: The 2024 report emphasizes that over two-thirds of countries score below 50, indicating that most nations still face significant challenges in managing public sector corruption effectively.

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Q85. Answer: (c) Rs. 1 crore

The correct answer is Rs. 1 crore.

Key Points

• In a major move to enhance social security for its workforce, the Indian Railways announced a significant hike in accident compensation in June 2025.

• The government has decided to provide a compensation amount of Rs. 1 crore to the families of railway employees who lose their lives in the line of duty due to accidents.

• The most notable feature of this announcement is that the benefit is provided without paying any insurance premium by the employees, making it a fully government-funded welfare measure.

• This initiative was spearheaded by the Ministry of Railways to ensure that the families of the deceased receive substantial financial support immediately to cope with the loss of a breadwinner.

• The policy reflects a commitment to the welfare of the unorganized and organized segments within the railway sector, aiming to boost the morale of personnel working in high-risk operational environments.

Additional Information

• Ex-gratia Payments in Indian Railways:

• Historically, ex-gratia payments for railway employees were significantly lower. Before the 2025 revision, the amount for death on duty typically ranged between Rs. 25 lakh and Rs. 50 lakh depending on the specific circumstances of the accident.

• These payments are intended as immediate relief and are often distinct from statutory workmen compensation or pensionary benefits.

• The Indian Railways Infrastructure:

• Indian Railways (IR) is one of the largest employers in the world, with over 1.2 million employees as of recent surveys.

• The Railway Board, under the Ministry of Railways, acts as the supreme body for the administration and management of the rail network in India.

• Safety and Insurance Trends:

• While passengers can opt for travel insurance at a nominal cost of less than Rs. 1, the provision of zero-premium high-value coverage for employees marks a shift toward comprehensive institutional responsibility.

• This decision aligns with the broader safety modernization goals, including the implementation of Kavach (Train Collision Avoidance System), to minimize the occurrence of fatal accidents.

Important Points

• Financial Implications: The allocation for this compensation is handled through the Railway Budget or internal welfare funds, ensuring that the burden does not fall on the individual employee's salary.

• Eligibility Criteria: The scheme generally covers all permanent railway personnel, including loco pilots, guards, trackmen, and station masters, who are involved in operational duties.

• Implementation Date: The policy became effective following the formal notification issued in June 2025, providing a safety net for any future unfortunate incidents on the tracks or within railway premises.

• Comparison with Other Sectors: A Rs. 1 crore insurance-style cover without a premium is considered one of the highest among Public Sector Undertakings (PSUs) in India, matching or exceeding the benefits provided to personnel in certain defense or paramilitary forces in specific contexts.

Q86. Answer: (c) Centre for Railway Information Systems

The correct answer is Centre for Railway Information Systems.

Key Points

• In June 2025, Bhashini (Digital India Bhashini Division) entered into a strategic Memorandum of Understanding (MoU) with the Centre for Railway Information Systems (CRIS).

• The partnership is designed to integrate AI-led real-time translation capabilities into various passenger platforms and digital services of the Indian Railways.

• The primary goal of this collaboration is to break language barriers for commuters, allowing them to access railway announcements, ticketing information, and emergency instructions in their native languages.

• CRIS, acting as the technical arm of the Ministry of Railways, will deploy these Natural Language Processing (NLP) tools across mobile applications and automated public address systems at stations.

• This initiative is a significant step under the Bhashini Mission to empower citizens by providing voice-based and text-based digital services in 22 scheduled Indian languages.

• Hence, the correct answer is Centre for Railway Information Systems.

Additional Information

• Bhashini Mission:

• Launched by the Ministry of Electronics and Information Technology (MeitY), Bhashini is India's Artificial Intelligence-led language translation platform.

• It aims to enable easy access to the internet and digital services in Indian languages, fostering a more inclusive digital ecosystem.

• The mission utilizes crowdsourcing through the Bhasha Daan initiative to collect diverse language datasets for training AI models.

• Centre for Railway Information Systems (CRIS):

• Established in 1986, CRIS is an autonomous organization under the Ministry of Railways located in New Delhi.

• It is responsible for developing and managing major IT systems for the railways, including the Passenger Reservation System (PRS) and the Unreserved Ticketing System (UTS).

• By partnering with Bhashini, CRIS aims to enhance passenger experience for domestic tourists and migrant workers who may not be proficient in English or Hindi.

• Real-time Translation Features:

• The technology involves Speech-to-Speech and Speech-to-Text translation, specifically optimized for the noisy environments of railway platforms.

• It helps in providing real-time updates on train schedules, platform changes, and safety protocols in regional dialects.

• The integration supports the Digital India vision of making government services accessible to everyone regardless of their linguistic background.

Important Points

• Technological Impact: This MoU signifies the use of Deep Learning and Machine Learning to solve practical governance and service delivery challenges in a linguistically diverse country like India.

• Scalability: The success of this integration on passenger platforms is expected to lead to similar implementations in other public sectors like banking, healthcare, and education.

• Date of Event: The collaboration was formalized in June 2025, marking a milestone in the AI adoption roadmap of the Government of India.

Q87. Answer: (a) Algeria

The correct answer is Algeria.

Key Points

• Algeria has officially been granted membership to the New Development Bank (NDB), also known as the BRICS Bank, as confirmed by the bank’s President Dilma Rousseff.

• The announcement regarding Algeria's admission was made during the 9th Annual Meeting of the Board of Governors of the NDB held in Cape Town, South Africa.

• Membership in the New Development Bank allows Algeria to access a new source of funding for its infrastructure and economic development projects, reducing its reliance on traditional Western financial institutions.

• The move is part of Algeria's broader strategic goal to integrate with the BRICS economic bloc and diversify its international partnerships. Hence, the correct answer is Algeria.

• The NDB membership is open to any member of the United Nations, and Algeria joins other recent members such as Egypt, Bangladesh, and the United Arab Emirates in expanding the bank's global footprint.

Additional Information

• New Development Bank (NDB):

• The NDB was established in July 2014 during the 6th BRICS Summit held in Fortaleza, Brazil.

• It formally commenced its operations in 2015 with its headquarters located in Shanghai, China.

• The founding members include Brazil, Russia, India, China, and South Africa.

• The primary mandate of the bank is to mobilize resources for infrastructure and sustainable development projects in emerging markets and developing countries.

• Membership Expansion Strategy:

• In September 2021, the NDB admitted the United Arab Emirates, Uruguay, and Bangladesh as its first expansion members.

• Egypt completed its accession process and officially became a member in February 2023.

• The bank aims to provide a platform for cooperation among developing nations and serves as an alternative to the World Bank and the International Monetary Fund (IMF).

• About Algeria:

• Algeria is the largest country in Africa by land area and is a major exporter of petroleum and natural gas.

• The country’s entry into the NDB signifies a shift in its economic policy toward multipolar financial cooperation.

• Algeria applied for membership to the NDB with a reported contribution of 1.5 billion dollars to the bank's capital.

Important Points

• Financial Structure: The NDB has an initial authorized capital of 100 billion US dollars and an initial subscribed capital of 50 billion US dollars.

• Leadership: The first President of the NDB was K. V. Kamath from India. The current President is Dilma Rousseff, the former President of Brazil, who assumed office in 2023.

• Governance: Unlike the World Bank, where voting power is based on shareholding, the NDB founding members initially held equal voting rights, and no founding member has veto power.

Q88. Answer: (d) 85%

The correct answer is 85%.

Key Points

• The Reserve Bank of India (RBI), in its regulatory update for June 2025, has revised the Loan-to-Value (LTV) ratio to 85% for loans amounting to less than Rs. 2.5 lakh.

• The primary objective of this adjustment is to facilitate easier credit flow to small-scale borrowers and individuals in the unorganized sector who require small-ticket funding for personal or business needs.

• By setting the LTV at 85%, the RBI has effectively reduced the margin requirement for borrowers to 15%, allowing them to leverage a higher percentage of their collateral's value.

• This specific ratio applies to a variety of small-ticket credit products, including gold loans and micro-business loans, helping to drive financial inclusion across the country.

• The move is designed to mitigate the credit gap and provide a safety net for micro-borrowers, ensuring that they are not forced toward informal, high-interest money lenders.

Additional Information

• Loan-to-Value (LTV) Ratio:

• The LTV ratio is a critical financial metric used by lenders to assess the lending risk before approving a loan. It is calculated by dividing the loan amount by the appraised value of the asset being used as collateral.

• A higher LTV ratio (such as 85%) means the borrower provides a smaller down payment, while a lower LTV provides a higher "equity cushion" for the bank.

• Role of the Reserve Bank of India (RBI):

• Established on April 1, 1935, the RBI is India's central bank. It regulates the monetary policy and supervises the banking sector to maintain financial stability.

• The RBI uses regulatory tools like LTV caps to prevent over-leveraging in specific sectors like housing, automobiles, or gold, thereby protecting the health of the banking system.

• Impact on Financial Inclusion:

• By increasing the LTV to 85% for loans below Rs. 2.5 lakh, the government and the central bank aim to empower the Priority Sector.

• This change particularly benefits Micro, Small, and Medium Enterprises (MSMEs) and low-income households, allowing them to access capital with minimal upfront equity.

• Regulatory Guidelines and Risk Management:

• While the LTV is increased to provide relief, the RBI mandates that banks and Non-Banking Financial Companies (NBFCs) conduct rigorous credit appraisals and maintain Capital Adequacy Ratios (CAR).

• The policy ensures that while credit is accessible, it does not lead to a rise in Non-Performing Assets (NPAs) within the financial ecosystem.

Important Points

• Threshold Limit: The 85% LTV specifically targets the "bottom of the pyramid" by capping the loan amount at Rs. 2.5 lakh. Loans exceeding this amount are subject to different, often stricter, LTV guidelines.

• Collateral Valuation: Under RBI guidelines, lenders must follow a transparent process for valuing the collateral (like gold jewellery or property) to ensure the 85% limit is applied accurately and ethically.

• Implementation Date: The new norms were highlighted as a key shift in the RBI's June 2025 monetary policy review, reflecting the evolving economic landscape and the need for liquidity support in the micro-loan segment.

Q89. Answer: (a) Gorkha Rifles

The correct answer is Gorkha Rifles.

Key Points

• The fourth edition of the joint military exercise AUSTRAHIND 2025 was held in Australia, representing a significant milestone in the bilateral defense cooperation between the Indian Army and the Australian Army.

• The Indian Army contingent for this specific edition was led and commanded by a battalion of the Gorkha Rifles, which is one of

the most distinguished and decorated infantry regiments of the Indian Army.

• The exercise focused on enhancing interoperability and the exchange of best practices in tactical operations. It involved joint training in diverse environments, particularly focusing on sub-conventional operations in semi-urban and mountainous terrain.

• The training curriculum included joint planning, sniper firing, tactical drills, and combat engineering tasks, ensuring that both forces are prepared for modern warfare challenges under a United Nations mandate.

• By participating in Australia, the Gorkha Rifles battalion showcased the professionalism of the Indian infantry on an international platform, further strengthening the "Comprehensive Strategic Partnership" between the two nations.

Additional Information

• History of Exercise AUSTRAHIND:

• The AUSTRAHIND series began in 2022. The first edition was conducted at Mahajan Field Firing Ranges in Rajasthan, India.

• The exercise is an annual event that alternates between India and Australia. It is designed to build positive military relations and allow both armies to learn from each other’s operational experiences.

• The Gorkha Rifles:

• The Gorkha Rifles are known globally for their bravery and the iconic Khukri knife.

• In the Indian Army, there are several Gorkha regiments (1 GR, 3 GR, 4 GR, 5 GR, 8 GR, 9 GR, and 11 GR), each with a rich history of valor in World Wars and post-independence conflicts.

• Bilateral Defense Ties:

• The India-Australia defense relationship has seen a massive surge in recent years, particularly through the 2+2 Ministerial Dialogue and shared interests in a Free and Open Indo-Pacific.

• Other key exercises between the two countries include AUSINDEX (Naval exercise), PITCH BLACK (Multilateral Air Force exercise), and the Malabar maritime exercise (alongside the USA and Japan).

• Tactical Focus:

• Modern iterations of these exercises often include the use of New Generation Technology such as Unmanned Aerial Systems (UAS), Electronic Warfare tools, and Robotics to simulate contemporary battlefield conditions.

Important Points

• Strategic Location: The 2025 edition held in Australia allowed Indian troops to train in unique Australian terrain, which is essential for global deployment readiness.

• Contingent Composition: While the Gorkha Rifles formed the core infantry component, the contingent often includes personnel from Combat Support Arms and Services to ensure a holistic training environment.

• Year 2025: This edition marks the fourth successful year of the AUSTRAHIND series, proving the sustainability and importance of this bilateral military engagement.

Q90. Answer: (b) CRIB

The correct answer is CRIB.

Key Points

• In July 2025, medical researchers identified a new ultra-rare blood antigen named CRIB.

• The discovery was made in a woman residing in the Kolar district of Karnataka, India.

• The identification of the CRIB antigen occurred during routine blood screening or cross-matching, where the patient's blood showed an unusual reaction that did not match existing known blood group systems.

• This finding is classified as ultra-rare, meaning it is found in an extremely small percentage of the global population, often making it difficult to find compatible blood donors for transfusions.

• The discovery highlights the genetic diversity within the Indian population and the importance of advanced immunohematology labs in detecting such rare phenotypes to ensure patient safety during medical procedures.

Additional Information

• Blood Antigens: These are proteins or sugars located on the surface of red blood cells. They determine a person's blood type and trigger an immune response if incompatible blood is introduced into the body.

• Rare Blood Groups in India:

• Bombay Blood Group (hh): First discovered in 1952 in Mumbai by Dr. Y.M. Bhende. It is found in roughly 1 in 10,000 individuals in India.

• EMM Negative: A rare blood group recently identified in Gujarat in 2022. People with this type lack the EMM antigen on their red blood cells.

• Rh-null (Golden Blood): This is considered the rarest blood type in the world, lacking all 61 antigens in the Rh system. Since its discovery, fewer than 50 cases have been reported globally.

• International Society of Blood Transfusion (ISBT): This organization is responsible for the official classification of blood group systems. As of 2023-2024, there are 45 recognized systems, including ABO, Rh, Kell, and Duffy.

Important Points

• Transfusion Challenges: Individuals with ultra-rare antigens like CRIB cannot receive blood from common donors (O, A, B, AB). They require blood from donors who also possess (or lack) the same specific antigen to avoid hemolytic transfusion reactions.

• Genetic Mapping: Regions like Karnataka and other parts of Southern India have shown unique allelic frequencies due to historical endogamy, leading to the discovery of several rare blood phenotypes.

• Registry: The Indian Society of Blood Transfusion and Immunohaematology (ISBTI) and various regional registries work to maintain databases of rare donors to assist in emergencies involving rare types like CRIB.

Q91. Answer: (c) State Bank of India

The correct answer is State Bank of India.

Key Points

• The State Bank of India (SBI), India's largest public sector lender, officially launched its TAB-based digital onboarding process for Non-Resident Indians (NRIs) in January 2025.

• This initiative is designed to simplify and expedite the account opening journey for the Indian Diaspora, allowing bank officials to onboard customers digitally using tablets during outreach programs or at branch locations.

• The process eliminates the need for physical forms and extensive paperwork, significantly reducing the turnaround time (TAT) for activating NRI accounts.

• The launch is part of SBI's broader digital transformation strategy aimed at leveraging technology to enhance the banking experience for its global customer base of over 480 million users.

• By implementing this TAB-based solution, the bank aims to capture a larger share of the remittance market and strengthen its relationship with the 32 million strong Indian community residing abroad.

Additional Information

• NRI Banking Products:

• NRE (Non-Resident External) Account: Allows NRIs to park their foreign earnings in Indian Rupees; both principal and interest are fully repatriable.

• NRO (Non-Resident Ordinary) Account: Used to manage income earned within India, such as rent, dividends, or pension; it is subject to Indian tax laws.

• FCNR (Foreign Currency Non-Resident): Fixed deposit accounts maintained in foreign currencies (like USD, GBP, Euro) to avoid exchange rate fluctuations.

• State Bank of India Global Reach:

• As of 2025, SBI maintains a massive international presence with over 230 offices across 29 countries, including major hubs like the USA, UK, Singapore, and UAE.

• The bank's digital flagship, YONO (You Only Need One), has also been expanded as YONO Global to provide specialized services to customers in various international jurisdictions.

• Technological Advancements:

• Apart from the TAB-based onboarding, the bank has invested heavily in Artificial Intelligence (AI) and Machine Learning (ML) to provide personalized wealth management services to high-net-worth NRI customers.

Important Points

• Regulatory Compliance: The digital onboarding process adheres strictly to the Reserve Bank of India (RBI) guidelines regarding Know Your Customer (KYC) and Anti-Money Laundering (AML) standards to ensure secure transactions.

• Document Requirements: Under the digital process, NRIs are still required to provide scanned copies of a valid Indian Passport or OCI (Overseas Citizen of India) card, valid Visa/Work Permit, and foreign residence proof.

• FEMA Regulations: All NRI banking activities are governed by the Foreign Exchange Management Act (FEMA), 1999, which regulates the flow of foreign exchange and the maintenance of accounts by persons resident outside India.

• Market Position: State Bank of India accounts for nearly one-fourth of the total market share in the Indian banking sector and is a Systemically Important Bank (D-SIB) in the domestic economy.

Q92. Answer: (d) R Praggnanandhaa

The correct answer is R Praggnanandhaa.

Key Points

• In January 2025, Rameshbabu Praggnanandhaa achieved a historic milestone by becoming the first Indian chess player to reach the World No. 1 position in the live chess ratings since the era of Viswanathan Anand.

• He secured this top spot during his performance at the Tata Steel Chess Tournament held in Wijk aan Zee, Netherlands.

• By gaining significant rating points through consistent victories, he managed to surpass the live rating of the legendary Norwegian Grandmaster Magnus Carlsen, who had dominated the top position for over a decade.

• At the age of 19, Praggnanandhaa has become one of the youngest players in history to occupy the World No. 1 rank in the

real-time rating system.

• This achievement highlights the "golden age" of Indian chess, where multiple young grandmasters from the country are competing at the highest levels of the sport globally.

Additional Information

• Rameshbabu Praggnanandhaa:

• Born in August 2005 in Chennai, Tamil Nadu, he is a child prodigy who earned the Grandmaster title in 2018 at the age of 12 years, 10 months, and 13 days.

• He gained worldwide fame for defeating Magnus Carlsen in several rapid and online games before making his mark in the classical format.

• His sister, R Vaishali, is also a Grandmaster, making them the first-ever brother-sister duo to hold the Grandmaster title.

• Live Chess Ratings vs. FIDE Ratings:

• Live ratings are calculated and updated instantly after every rated game played in international tournaments.

• In contrast, the FIDE (International Chess Federation) publishes the official rating list only once a month, typically on the 1st of every month.

• Reaching World No. 1 in live ratings is a prestigious indicator of a player's current peak performance and form.

• The Indian Chess Renaissance:

• Viswanathan Anand was the first Indian to become a Grandmaster in 1988 and later became a five-time World Champion.

• Other prominent Indian players include D Gukesh, who won the Candidates Tournament 2024 to become the youngest world championship challenger, and Arjun Erigaisi, who breached the 2800 Elo rating mark in 2024.

• India's dominance was solidified at the 45th FIDE Chess Olympiad in Budapest in 2024, where both the men's and women's teams won historic Gold Medals.

• Elo Rating System:

• The Elo rating system is the method used to calculate the relative skill levels of players in zero-sum games like chess.

• A rating above 2800 is considered "Super Grandmaster" territory and is usually achieved only by a handful of players in the world at any given time.

Q93. Answer: (b) 5

The correct answer is 5.

Key Points

• The Union Budget 2025-26, presented by Union Finance Minister Nirmala Sitharaman, emphasized a significant push for the manufacturing sector and youth empowerment through advanced skilling.

• As part of the strategy to boost domestic manufacturing and global competitiveness, the government announced the establishment of 5 National Centres of Excellence for Skilling.

• These centres are designed to be developed with global expertise and partnerships, ensuring that the training provided is on par with international benchmarks.

• The primary objective of these centres is to equip the Indian youth with specialized skills required for the “Make for India, Make for the World” manufacturing vision.

• This initiative aims to create a highly skilled workforce that can support the expansion of high-tech manufacturing industries within the country, fostering both self-reliance and export capabilities.

Additional Information

• Make for India, Make for the World:

• This is a strategic vision aimed at transforming India into a global manufacturing hub. It encourages companies to manufacture products in India not just for the local market but for international exports.

• It aligns with the broader Atmanirbhar Bharat (Self-Reliant India) mission to reduce import dependency and increase the share of manufacturing in the GDP.

• Viksit Bharat @ 2047:

• The Union Budget 2025-26 continues to build on the roadmap for Viksit Bharat, which aims to make India a developed nation by the 100th year of its independence in 2047.

• Skilling and employment generation are identified as core pillars to achieve this long-term economic goal.

• Focus on Manufacturing:

• The budget introduces various measures to support MSMEs and large-scale industries, including Credit Guarantee Schemes and support for Industrial Parks.

• The manufacturing sector is viewed as a critical engine for providing mass employment to the growing workforce of India.

• Skill India Mission:

• The setting up of these National Centres of Excellence is an extension of the Skill India Mission, which was launched to provide

market-relevant skills to over 40 crore people.

• By integrating global partnerships, these centres will introduce industry 4.0 technologies such as AI, Robotics, and IoT into the vocational training curriculum.

Important Points

• Budgetary Allocation: The government has consistently increased the outlay for the Ministry of Skill Development and Entrepreneurship to facilitate the modernization of ITIs (Industrial Training Institutes) and the creation of new excellence centres.

• Global Standards: By collaborating with countries like Germany, Japan, or Singapore (known for their vocational training systems), these 5 centres will adopt international pedagogies and certification standards.

• Employment Linkage: A key feature of these centres will be their direct linkage with industry hubs, ensuring that students have access to apprenticeships and immediate job placements upon completion of their training.

Q94. Answer: (b) 11th

The correct answer is 11th.

Key Points

• The 11th round of negotiations between India and the European Union (EU) for a comprehensive Free Trade Agreement (FTA) commenced on 12 May 2025.

• This high-level meeting took place in Brussels, Belgium, which serves as the administrative heart of the European Union.

• The talks represent a continued effort to bridge gaps in areas such as market access, digital trade, and sustainable development. Hence, the statement regarding the 11th round is correct.

• The primary objective of these negotiations is to create a balanced and ambitious trade deal that benefits both economies by reducing customs duties and enhancing the ease of doing business.

• Delegations from both sides worked on finalizing various chapters of the agreement, including rules of origin and technical barriers to trade (TBT).

Additional Information

• Historical Context:

• The India-EU trade negotiations were first launched in 2007 but were suspended in 2013 due to significant differences over market access and labor standards.

• Negotiations were formally relaunched on 17 June 2022 during a meeting in Brussels, aiming for a deeper strategic partnership.

• Triple Track Approach:

• The current engagement is not limited to trade alone; it follows a triple track involving a Free Trade Agreement (FTA), an Investment Protection Agreement (IPA), and an agreement on Geographical Indications (GIs).

• Bilateral Trade Statistics:

• The European Union is India's second-largest trading partner after the USA, accounting for a significant portion of India's total global trade.

• Major Indian exports to the EU include textiles, chemicals, pharmaceuticals, and engineering goods.

• Key EU Member States:

• The EU consists of 27 member countries, including major economies like Germany, France, and Italy, all of which have a vested interest in the Indian market.

Important Points

• CBAM Concerns: A major talking point in recent rounds, including the 11th round, has been the Carbon Border Adjustment Mechanism (CBAM) introduced by the EU, which could impact Indian exports of steel, aluminum, and cement.

• Services Sector: India is pushing for greater mobility for its professionals (Mode 4 of trade in services) and recognition of its data-secure status to boost the IT and enabled services sector.

• Investment Protection: The IPA aims to provide a stable legal framework for investors from both regions, ensuring protection against discriminatory treatment and expropriation.

• Geographical Indications: The GI Agreement is designed to protect traditional products like Darjeeling Tea from India and Champagne or Feta Cheese from the EU, ensuring they are not imitated in each other's markets.

Q95. Answer: (d) Jiya Rai

The correct answer is Jiya Rai.

Key Points

• Jiya Rai, a 16-year-old para-swimmer from India, achieved the monumental feat of becoming the youngest and fastest female para-swimmer in the world to swim across the English Channel in July 2024.

• She completed the grueling swim from Abbot’s Cliff in the United Kingdom to Pointe de la Courte-Dune in France, covering a distance of 34 kilometers in a remarkable time of 17 hours and 25 minutes.

• In recognition of her extraordinary determination and skill, she was conferred with the World Open Water Swimming Association

(WOWSA) Award, 2024, in the Adaptive Performance of the Year category.

• Jiya Rai was diagnosed with Autism Spectrum Disorder at a young age, and she has utilized swimming not only as a therapy but also as a platform to showcase elite athletic capability on a global stage.

• Before her English Channel success, she gained international fame in March 2022 by swimming across the Palk Strait from Talaimannar (Sri Lanka) to Arichalmunai (India) in 13 hours and 10 minutes.

Additional Information

• Deepa Malik:

• She is a legendary figure in Indian para-sports and was the first Indian woman to win a medal at the Paralympic Games, securing a Silver medal in Shot Put at the Rio 2016 Paralympics.

• She has been honored with the Padma Shri and the Khel Ratna Award for her immense contribution to sports and serves as a major inspiration for female athletes in India.

• Prachi Yadav:

• She is a premier Indian Para-Canoeist who represented the country at the Tokyo 2020 Paralympics.

• She made history by winning a Gold medal at the 2022 Asian Para Games in Hangzhou in the KL2 canoe event, becoming the first Indian to do so in this discipline.

• Devanshi Satija:

• She is a talented Indian Para-swimmer who has consistently performed at the National Para Swimming Championships and represented India at the Asian Para Games.

• She has won multiple medals in the S10 category, contributing to the growing prominence of para-swimming in the Indian sporting landscape.

• English Channel:

• Often referred to as the "Everest of Swimming," it is a body of water separating Southern England from Northern France.

• The shortest distance across the channel is approximately 33.3 kilometers (20.7 miles), but swimmers often cover much longer distances due to strong tidal currents and low water temperatures ranging from 14 to 18 degrees Celsius.

Important Points

• WOWSA Awards: These awards celebrate the world's most adventurous and courageous open water swimmers. The Adaptive Performance category specifically honors athletes with disabilities who overcome physical or neurological challenges to achieve world-class results.

• Pradhan Mantri Rashtriya Bal Puraskar: For her previous record-breaking feats, Jiya Rai was awarded this prestigious honor, which is the highest civilian award in India for individuals under the age of 18.

• Naval Background: Jiya Rai is the daughter of a Master Chief Petty Officer in the Indian Navy, and her training has often been supported by the Indian Navy's sports facilities.

Q96. Answer: (a) Andaman & Nicobar

The correct answer is Andaman & Nicobar.

Key Points

• The Union Territory of Andaman & Nicobar Islands holds the distinction of having the largest number of wildlife sanctuaries in India, with a total of 96 sanctuaries as of 2023.

• According to the National Wildlife Database, India has a total of 567 wildlife sanctuaries, covering approximately 3.73% of the country's total geographical area.

• The Andaman & Nicobar Islands account for a significant portion of these protected areas, despite having a relatively small landmass compared to large mainland states. Hence, the correct answer is Andaman & Nicobar.

• These sanctuaries are vital for protecting the unique marine life, tropical evergreen forests, and endemic species like the Andaman Wild Pig and the Narcondam Hornbill.

• The Wildlife Institute of India (WII) and the Ministry of Environment, Forest and Climate Change (MoEFCC) are responsible for maintaining the records and overseeing the management of these protected areas.

Additional Information

• Wildlife Sanctuary (WLS):

• A Wildlife Sanctuary is an area declared by the State Government or the Central Government under the Wildlife (Protection) Act, 1972 for the purpose of protecting, propagating, or developing wildlife or its environment.

• In a sanctuary, certain human activities such as grazing, collection of minor forest produce, and private ownership rights may be allowed as long as they do not interfere with the well-being of the animals.

• State-wise Distribution:

• Maharashtra follows Andaman & Nicobar with the second-highest number, hosting approximately 50 wildlife sanctuaries.

• Uttar Pradesh has 25 wildlife sanctuaries, including the famous Hastinapur Wildlife Sanctuary.

• Kerala manages 17 wildlife sanctuaries, such as the Periyar Wildlife Sanctuary and Wayanad Wildlife Sanctuary.

• West Bengal contains 16 wildlife sanctuaries, including the Sajnekhali Wildlife Sanctuary situated within the Sundarbans.

• Geographical Facts:

• The total area covered by wildlife sanctuaries in India is about 122,564.53 square kilometers.

• The Rann of Kutch Wildlife Sanctuary in Gujarat is one of the largest sanctuaries in terms of area, spanning over 7,500 square kilometers.

Important Points

• Wildlife (Protection) Act, 1972: This Act provides the legal framework for the protection of various species of wild animals and plants, the management of their habitats, and the regulation and control of trade in wild animals.

• Difference between National Parks and Sanctuaries: National Parks enjoy a higher degree of protection where no human activity or private rights are allowed, whereas Wildlife Sanctuaries permit limited human interference.

• Conservation Status: As of December 2023, India has 106 National Parks and 567 Wildlife Sanctuaries, contributing to the Integrated Development of Wildlife Habitats scheme.

• Endemic Species: The high number of sanctuaries in Andaman & Nicobar is primarily due to the need to protect species that are not found anywhere else in the world (endemic), preserving the ecological balance of the Bay of Bengal region.

Q97. Answer: (c) Varanasi

The correct answer is Varanasi.

Key Points

• In January 2025, a boat capsize incident occurred in the Ganges river in Varanasi, Uttar Pradesh, prompting an immediate rescue operation.

• The National Disaster Response Force (NDRF), specifically the 11th Battalion stationed in Varanasi, was deployed to conduct the search and rescue mission.

• The incident took place near one of the prominent Ghats of Varanasi, where local boat traffic is high due to the arrival of numerous pilgrims and tourists during the winter season.

• The NDRF utilized specialized equipment, including deep-sea divers and Inflatable Motor Boats (IRBs), to navigate the currents of the Ganga and locate survivors.

• Such operations in Varanasi are critical as the city sees a massive influx of visitors for religious ceremonies, making river safety a top priority for the District Administration.

Additional Information

• National Disaster Response Force (NDRF):

• The NDRF was established under the Disaster Management Act, 2005, to provide a specialist response to natural and man-made disasters.

• It was officially constituted in the year 2006 and operates under the Ministry of Home Affairs, Government of India.

• The force currently consists of 16 battalions, which are organized on para-military lines and manned by persons on deputation from the CPFs (Central Para-military Forces).

• The motto of the NDRF is "Aapda Seva Sadaiv", which translates to "Sustained Disaster Response Service."

• Varanasi and River Safety:

• Varanasi, also known as Kashi, is located in the southeastern part of Uttar Pradesh and is considered the spiritual capital of India.

• The city is situated on the banks of the Ganges, and the river plays a vital role in its economy and culture through tourism and transport.

• Due to frequent boat-related accidents, the Uttar Pradesh Government has implemented regulations such as the mandatory use of life jackets and the prohibition of overloading wooden boats.

• The 11th Battalion of the NDRF is headquartered in Varanasi, ensuring that the force can respond to emergencies in Eastern Uttar Pradesh within a very short timeframe.

Important Points

• Rescue Protocols: During a boat capsize, the NDRF follows standard operating procedures (SOPs) that involve underwater sonar systems for victim location and medical first responders for immediate assistance to rescued individuals.

• Disaster Management Framework: The National Disaster Management Authority (NDMA), headed by the Prime Minister, is the apex body that lays down the policies and guidelines for disaster management, which the NDRF executes on the ground.

• Regional Significance: Varanasi serves as a strategic hub for disaster response for neighboring districts like Mirzapur, Chandauli, and Ghazipur.

Q98. Answer: (a) Praveen Kumar

The correct answer is Praveen Kumar.

Key Points

• President Droupadi Murmu conferred the prestigious Major Dhyan Chand Khel Ratna Award for the year 2024 upon para-athlete Praveen Kumar during a ceremony held at Rashtrapati Bhavan in January 2025.

• Praveen Kumar is a distinguished Para-High Jumper who made the country proud by winning the Gold Medal in the Men's High Jump T64 event at the Paris Paralympics 2024.

• During the Paris 2024 Games, he cleared a height of 2.08 meters, which not only secured him the top spot on the podium but also set a new Asian Record.

• This award recognizes his consistent excellence and his status as the youngest Indian para-athlete to win a Gold Medal at the Paralympic Games at the age of 21.

• The Major Dhyan Chand Khel Ratna Award is the highest sporting honour of India, awarded annually by the Ministry of Youth Affairs and Sports. Hence, the correct answer is Praveen Kumar.

Additional Information

• Major Dhyan Chand Khel Ratna Award:

• It was instituted in the year 1991-92 and was formerly known as the Rajiv Gandhi Khel Ratna Award.

• The award comprises a medallion, a certificate, and a cash prize of Rs. 25 lakh.

• The first recipient of this award was Chess Grandmaster Viswanathan Anand.

• Achievements of other Para-Athletes in Paris 2024:

• Preeti Pal: She became the first Indian woman track and field athlete to win two medals at the Paralympics, securing Bronze in both the 100m and 200m T35 events. She was honored with the Arjuna Award in the same January 2025 ceremony.

• Nishad Kumar: A prolific Para-High Jumper who won a Silver Medal in the T47 category at the Paris Paralympics 2024, repeating his performance from the Tokyo 2020 Games.

• Hokato Hotozhe Sema: The shot putter from Nagaland was also among the athletes recognized for his Bronze Medal achievement in Paris.

• National Sports Awards 2024:

• The awards are usually announced to celebrate National Sports Day on August 29, but the ceremony for the 2024 cycle was held in January 2025.

• Apart from the Khel Ratna, the Arjuna Award was conferred upon 29 athletes, including stars like Neeraj Chopra (who has previously won the Khel Ratna) and various rising para-stars.

• The Dronacharya Award was given to outstanding coaches, and the Dhyan Chand Award was given for lifetime achievement in sports development.

Important Points

• Praveen Kumar's journey began in Govindgarh, Noida, Uttar Pradesh. Despite having a congenital impairment that affects one of his legs, he competed in high jump events against able-bodied athletes before transitioning to para-sports.

• The T64 classification in which he competes is specifically for athletes with movement moderately affected in one lower leg or the absence of one or both legs below the knee.

• His Gold Medal was India's 6th gold at the Paris Paralympics 2024, contributing to the country's record-breaking haul of 29 medals (7 Gold, 9 Silver, and 13 Bronze).

• The selection committee for the National Sports Awards is usually headed by a retired Supreme Court or High Court Judge and includes eminent sportspersons and sports administrators.

Q99. Answer: (a) 20 lakh

The correct answer is 20 lakh.

Key Points

• The Aadi KARMAYOGI initiative is a collaborative program launched by the Ministry of Tribal Affairs (MoTA) in partnership with the National Capacity Building Commission (CBC).

• The primary objective of this initiative is to build the capacity of approximately 20 lakh (2 million) tribal grassroots functionaries and village-level change leaders across the country. Hence, the correct answer is 20 lakh.

• It aims to foster responsive governance by empowering those at the bottom of the administrative pyramid to ensure the effective delivery of government schemes in tribal areas.

• The program focuses on enhancing the "human element" of governance, ensuring that officials and leaders are sensitized to the unique cultural and socio-economic needs of Scheduled Tribes (STs).

• It is designed to bridge the gap between policy formulation and its execution at the village level, promoting a more citizen-centric approach in tribal administration.

Additional Information

• Mission Karmayogi:

• The Aadi KARMAYOGI program is a specialized vertical under the broader Mission Karmayogi (National Programme for Civil Services Capacity Building - NPCSCB).

• Launched on September 2, 2020, Mission Karmayogi aims to overhaul the Indian bureaucracy by shifting from "rules-based" to "roles-based" training.

• It utilizes the iGOT-Karmayogi (Integrated Government Online Training) platform to provide continuous learning opportunities to over 46 lakh central employees.

• Ministry of Tribal Affairs (MoTA):

• Established in the year 1999 after the bifurcation of the Ministry of Social Justice and Empowerment.

• It is the nodal ministry for the overall policy, planning, and coordination of programs for the development of Scheduled Tribes.

• The ministry handles matters related to Forest Rights Act (2006) and the PESA Act (1996) to empower tribal self-governance.

• Capacity Building Commission (CBC):

• Established as an independent body to assist the Prime Minister's Public Human Resources Council.

• It sets the standards for training institutions and monitors the implementation of Annual Capacity Building Plans across various ministries.

Important Points

• Implementation Strategy: The initiative utilizes State Tribal Research Institutes (TRIs) and National Tribal Research Institute (NTRI) located in New Delhi as hubs for developing curriculum and conducting training.

• Last-Mile Delivery: By training 20 lakh functionaries, the government intends to reach the most remote tribal habitations, ensuring that benefits of the Tribal Sub-Plan and other central/state grants reach the intended beneficiaries.

• Digital Integration: The training modules are often integrated with digital tools to track progress and ensure that the change leaders are equipped with modern administrative skills.

• Socio-Economic Impact: Strengthening grassroots leadership is expected to improve health, education, and livelihood indicators in tribal-dominated districts (often referred to as Aspirational Districts).

Q100. Answer: (d) Snatch (women’s 55 kg)

The correct answer is Snatch (women’s 55 kg).

Key Points

• Bindyarani Devi, the ace weightlifter from Manipur, delivered an exceptional performance at the National Games 2025 held in Dehradun, Uttarakhand.

• She competed in the women’s 55 kg weightlifting category and established a new national record in the Snatch event.

• The Snatch is one of the two primary disciplines in weightlifting where the athlete lifts the barbell from the ground to overhead in one continuous motion.

• Setting a national record in this event highlights her technical proficiency and explosive strength, further solidifying her position as one of India's top athletes in the 55 kg division. Hence, Option 4 is the correct event.

• While she also competed for the Clean and jerk and Total lift, the specific milestone of a national record in the 2025 edition was achieved in the Snatch segment.

Additional Information

• Sorokhaibam Bindyarani Devi:

• She is a prominent weightlifter hailing from the state of Manipur, which is often referred to as the powerhouse of Indian sports.

• She gained international fame by winning the Silver Medal in the women's 55 kg category at the 2022 Commonwealth Games in Birmingham.

• Her career also includes a Gold Medal at the 2019 Commonwealth Weightlifting Championships and various podium finishes at the Asian Championships.

• National Games 2025:

• The 38th edition of the National Games was hosted by Uttarakhand in 2025.

• The games were spread across various cities, including Dehradun, Haldwani, and Rishikesh, aimed at promoting sports culture in the Himalayan state.

• The National Games serve as the premier domestic multi-sport event in India, organized by the Indian Olympic Association (IOA).

• Weightlifting Technicalities:

• Snatch: The first lift of the competition, requiring the bar to be moved from the floor to an arm's length overhead in a single movement.

• Clean and Jerk: A two-stage lift where the bar is first brought to the shoulders (Clean) and then pushed overhead (Jerk).

• Total Lift: The combined weight of the best successful Snatch and the best successful Clean and Jerk.

Important Points

• Governing Body: The Indian Weightlifting Federation (IWLF) is the national body responsible for the sport of weightlifting in India, headquartered in New Delhi.

• Support Systems: Top athletes like Bindyarani Devi receive support through the Target Olympic Podium Scheme (TOPS), an initiative by the Ministry of Youth Affairs and Sports to assist potential Olympic medal winners.

• Regional Dominance: Northeast Indian states, particularly Manipur and Mizoram, have consistently produced world-class weightlifters, including legendary figures like Mirabai Chanu and Kunjarani Devi.

• Records and Standards: National records are meticulously tracked by the IWLF and are categorized based on body weight classes redefined by the International Weightlifting Federation (IWF) in 2018.

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