RRB Group D Official Paper (Held On: 08 Jan, 2026 Shift 1) (Previous Year Paper)

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

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GENERAL SCIENCE

Q1. How much current will flow through a resistor of 20 Ω when a potential difference of 40 V is applied across it?

(a) 1/5 A
(b) 2 A
(c) 1/2 A
(d) 5 A

Q2. In multicellular organisms like humans, digestion occurs in:

(a) specialised digestive organs
(b) entire cell surface
(c) food vacuoles
(d) nucleus

Q3. Which of the following statements is NOT correct?

(a) Sound travels fastest in solids.
(b) Sound can travel through vacuum.
(c) Sound travels slower in gases than in liquids.
(d) Sound travels faster in water than in air.

Q4. If the distance covered is halved and time remains the same, the linear velocity becomes _____.

(a) Zero
(b) Same
(c) Half
(d) Double

Q5. Match the Following Substances and Their Ions.

Column A (Substance)	Column B (Ions Produced)
A. HCl	1. H3O^+ and Cl^-
B. NaOH	2. Na^+ and OH^-
C. KOH	3. K^+ and OH^-
D. Mg(OH)2	4. Mg^(2+) and 2OH^-

(a) A-2; B-1; C-4; D-3
(b) A-4; B-3; C-2; D-1
(c) A-3; B-4; C-1; D-2
(d) A-1; B-2; C-3; D-4

Q6. What is the primary reason that the testes are located outside the abdominal cavity in the scrotum?

(a) To reduce the risk of infection
(b) To facilitate easier hormone secretion
(c) To facilitate sperm formation as it requires a lower temperature than body temperature
(d) To allow proper mixing of sperm and urine

Q7. A farmer stores grains from his crop yield in a damp and warm room. After a few weeks, the grains get spoiled and their quantity reduces. What is the most likely reason for this?

(a) Improper storage conditions
(b) Grains got washed away with water
(c) Grains were eaten by birds and insects
(d) Poor irrigation before harvesting

Q8. What is the main structural component of the plant cell wall?

(a) Collagen
(b) Cellulose
(c) Peptidoglycan
(d) Chitin

Q9. Which of the following is a part of the central nervous system of our body?

(a) Stomach
(b) Spinal cord
(c) Liver
(d) Pancreas

Q10. Unsaturated carbons are _____ than the saturated carbon compounds.

(a) More saturated
(b) More reactive
(c) Equally reactive
(d) Less reactive

Q11. Which term describes the closeness of particles in solids?

(a) Inter-particle space
(b) Density
(c) Rigidity
(d) Compressibility

Q12. Due to the continous random movement of the gas particles, the particles collide with the walls of the container. The pressure exerted by the gas is equal to the:

(a) force exerted by the gas particles per unit volume of the container
(b) force exerted by the gas particles per unit area on the walls of the container
(c) force exerted by the gas particles on the walls of the container
(d) force exerted by the gas particles per unit area of the bottom of the container

Q13. What is/are the general product(s) of the reaction between a non-metallic oxide and a base?

(a) Water only
(b) Gas and water
(c) Salt and water
(d) Salt and hydrogen

Q14. Why do we continue to breathe even when we are sitting or sleeping?

(a) To let digestion go on
(b) To give rest to the heart
(c) To make breathing movements
(d) To supply oxygen for life processes

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Q15. What will be the potential energy of a block of mass 30 kg kept at a height of 20 m?
(Take the value of g = 10 m/s²)

(a) 600 J
(b) 60 J
(c) 6000 J
(d) 6 J

Q16. How does the weight of an object on the Moon compare to its weight on Earth?

(a) It is six times of its weight on Earth.
(b) It is one-sixth of its weight on Earth.
(c) It is one-third of its weight on Earth.
(d) It is the same as that on Earth.

Q17. Which of the following is usually connected in series in a domestic circuit?

(a) Electric bulb
(b) All appliances
(c) Main fuse
(d) Fan

Q18. What type of gas is released when ethanol reacts with sodium?

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

Q19. Which of the following is the smallest alkane that can form a stable ring?

(a) Propane
(b) Cyclopropane
(c) Ethane
(d) Methane

Q20. Why do we feel cool when sweat evaporates from our skin?

(a) Sweat forms crystals that cool the skin.
(b) Sweat turns into ice before evaporation.
(c) Sweat absorbs heat from our skin to evaporate.
(d) Sweat releases heat during evaporation.

Q21. Why is practicing safe sex important for reproductive health?

(a) It ensures hormonal balance in the body
(b) It guarantees pregnancy
(c) It prevents sexually transmitted diseases like HIV-AIDS
(d) It increases fertility

Q22. The emergence of a new plant from a seed under favourable environmental conditions is termed as _____.

(a) pollination
(b) fertilisation
(c) germination
(d) photosynthesis

Q23. Which of the following is an example of an object in uniform circular motion?

(a) A car moving on a crowded street
(b) A train moving on a straight track at varying speeds
(c) A satellite orbiting Earth at a constant speed
(d) A person jogging in a park

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Q24. When an object is placed beyond the centre of curvature (C) of a concave mirror, the image formed is:

(a) virtual, inverted and larger than the object
(b) real, erect and same size as object
(c) virtual, erect and larger than the object
(d) real, inverted and smaller than the object

Q25. The point on the principal axis where rays parallel to the principal axis converge (or appear to diverge) after reflection from a mirror is called which of the following?

(a) Centre of curvature
(b) Pole
(c) Aperture
(d) Principal focus

MATHEMATICS

Q26. What is the mode of the following data?

55, 45, 44, 48, 42, 45, 52, 53, 42, 50, 54, 49, 52, 45, 47, 43, 45, 48

(a) 45
(b) 48
(c) 55
(d) 44

Q27. A person covers half the distance of a journey at 60 km/h and the other half at 30 km/h. What is the average speed for the entire journey?3217

(a) 45 km/h
(b) 50 km/h
(c) 40 km/h
(d) 55 km/h

Q28. Find the value of $\sec^2 50° - \tan^2 50°$.

(a) 0.5
(b) 0
(c) 2
(d) 1

Q29. A retailer offers the given discount schemes for buyers on an article. Which of the following schemes will be least beneficial to the customer?

i. A discount of 34%
ii. A discount of 37% followed by a discount of 8%
iii. Successive discounts of 7% and 27%

(a) Both scheme ii and scheme iii
(b) Scheme ii
(c) Scheme iii
(d) Scheme i

Q30. A person saves 50% of his income. If his expenditure is Rs. 360, then his income (in Rs.) is:

(a) 720
(b) 800
(c) 180
(d) 760

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Q31. P and Q together can fill a cistern with water in 6 hours. If P alone can fill the cistern with water in 12 hours, then in how many hours will Q alone fill one-fourth of the same cistern with water?1417

(a) 6
(b) 3
(c) 7
(d) 4

Q32. Solve: (9.73 × 9.73 × 9.73 + 7.27 × 7.27 × 7.27)/(9.73 × 9.73 - 9.73 × 7.27 + 7.27 × 7.27)

(a) 18
(b) 16
(c) 17
(d) 15

Q33. Find the greatest number that divides 1005, 244 and 1343, leaving the remainders 5, 4 and 3, respectively.

(a) 30
(b) 25
(c) 20
(d) 15

Q34. A basket contains 96 fruits consisting of mangoes and oranges. If there are 48 more mangoes than oranges, how many mangoes are there?

(a) 64
(b) 96
(c) 72
(d) 88

Q35. If the radius of a sphere is increased by 25%, find the percentage increase in its surface area.

(a) 38.15%
(b) 50.48%
(c) 42.36%
(d) 56.25%

Q36. The ratio of 38 hours to 2 days is equivalent to what?

(a) 12:19
(b) 21:27
(c) 22:27
(d) 19:24

Q37. If the mean of 25, 29, 25, 32, 24 and x is 26, then the median of the data is:6544

(a) 24
(b) 29
(c) 27
(d) 25

Q38. If 896 bananas were distributed among three monkeys, respectively, in the ratio 4/6 : 2/2 : 2/2, how many bananas did the third monkey get?

(a) 338
(b) 336
(c) 335
(d) 334

Q39. If the area of a square is 15.21 cm^2, then the perimeter (in cm) of the square is:

(a) 15.6
(b) 16.5
(c) 12.4

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(d) 13.8

Q40. If the number 2X73Y5 is divisible by 11, then find the value of (X−Y).

(a) 1
(b) 6
(c) 3
(d) 5

Q41. Simplify: $\sqrt{(\sqrt{(24^2 - 16^2 + 2^2)} + \sqrt{(2^2 \times 3^2 + \sqrt{169})}}$

(a) 7
(b) 2
(c) 5
(d) 3

Q42. Poonam sold a book to Mohini at a loss of 5% and Mohini sold it to Rupashi at a profit of 8%. If Rupashi bought the book for Rs. 1,539, then what was the cost price (in Rs.) of the book for Poonam?

(a) 1,600
(b) 1,650
(c) 1,550
(d) 1,500

Q43. A tank has three pipes: A, B and C. Pipe A fills the tank in 4 hours, Pipe B fills it in 6 hours and Pipe C empties it in 12 hours. If the three pipes are opened alternatively for 1 hour each (A first, then B, then C), how long will it take to fill the tank?

(a) 11 hours
(b) 10 2/3 hours
(c) 7 1/2 hours
(d) 9 hours

Q44. If 4/7 of 2% of a number is 648, find the number.

(a) 60230
(b) 57580
(c) 57140
(d) 56700

Q45. In triangle ABC, BD perpendicular to AC at D and angle DBC = 65°. E is a point on BC such that angle CAE = 30°. What is the measure of angle AEB ?

(a) 56°
(b) 55°
(c) 53°
(d) 50°

Q46. A mother is 25 years older than her daughter. In 15 years, the mother will be twice as old as the daughter. Find the daughter's current age.

(a) 35 years
(b) 10 years
(c) 20 years
(d) 25 years

Q47. A store is offering 'Buy 5, get 16 free' on household items. What is the net percentage discount (approximately) being offered by the store?

(a) 76.19%
(b) 74.52%
(c) 78.42%
(d) 74.24%

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Q48. The average speed of a car running at 70 km/hr for 1 hour and ‘p’ km/hr for 11/2 hours is 58 km/hr. Find the value of p.

(a) 67.5
(b) 70
(c) 62.5
(d) 50

Q49. In an election, 70% of the total voters cast their votes. Out of these, 60% voted for candidate X and the remaining voted for candidate Y. If candidate Y received 8400 votes, calculate the total number of registered voters.

(a) 40,000
(b) 25,000
(c) 32,000
(d) 30,000

Q50. The amount on a sum of Rs. 1,800 at 10% per annum compound interest, compounded annually, in 2 years will be:

(a) Rs. 2,178
(b) Rs. 3,118
(c) Rs. 2,506
(d) Rs. 2,820

GENERAL INTELLIGENCE & REASONING

Q51. What should come in place of the question mark (?) in the given series?

5 8 14 26 ? 98

(a) 50
(b) 45
(c) 51
(d) 49

Q52. What should come in place of the question mark (?) in the given series?

57 67 82 102 127 ?

(a) 159
(b) 158
(c) 156
(d) 157

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

96 + 15 ÷ 5 − 154 × 14 = ?

(a) 29
(b) 30
(c) 32
(d) 34

Q54. Read the given statements and conclusions carefully. Assuming that the information given in the statements is true, even if it appears to be at variance with commonly known facts, decide which of the given conclusions logically follow(s) from the statements.

Statements:

All hammers are screwdrivers.

No screwdrivers are wrenches.

Some wrenches are pliers.

Conclusions:

(I): No hammers are wrenches.

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(II): No pliers are screwdrivers.

(a) Neither conclusion (I) nor (II) is true
(b) Only conclusion (II) is true
(c) Both conclusions (I) and (II) are true
(d) Only conclusion (I) is true

Q55. JPUG is related to OLXE in a certain way. In the same way, TMQK is related to YITI. To which of the following is NOLT related, following the same logic?

(a) SKOR
(b) TJOQ
(c) SKPR
(d) TJPQ

Q56. Seven boxes D, E, F, U, V, W and X are kept one over the other but not necessarily in the same order. Only U is kept above D. Only V is kept between D and F. No box is kept below E. Only three boxes are kept between D and W. How many boxes are kept between X and E?

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

Q57. TM 13 is related to WR 16 in a certain way. In the same way, MF 18 is related to PK 21. To which of the given options is QJ 26 related, following the same logic?

(a) UM 28
(b) TO 29
(c) UP 29
(d) TM 28

Q58. In a certain code language,

A + B means ‘A is the son of B’,

A - B means ‘A is the brother of B’,

A x B means ‘A is the wife of B’,

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

How is K related to V if ‘K-T+RxZ&V’?

(a) Father
(b) Brother
(c) Son
(d) Husband

Q59. In a certain code language, ‘nice large land’ is coded as ‘cd ak pi’, ‘land is fertile’ is coded as ‘rf pc ak’ and ‘cost is high’ is coded as ‘si ig pc’. How is ‘fertile’ coded in that language?

(a) cd
(b) pc
(c) ak
(d) rf

Q60. A, B, C, D, E, F and G are sitting around a circular table, facing the centre. Only one person sits between E and A when counted from the left of A. B sits third to the right of C. D sits third to the left of F. B sits to the immediate right of D. G is not an immediate neighbour of D. How many people sit between C and F when counted from the right of F?

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

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Q61. What should come in place of the question mark (?) in the given series?

34 44 57 73 92 ?

(a) 116
(b) 118
(c) 112
(d) 114

Q62. Select the set in which the numbers are related in the same way as are the numbers of the following sets.

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

(25, 37, 53)

(40, 52, 68)

(a) (9, 21, 33)
(b) (39, 27, 43)
(c) (32, 44, 28)
(d) (26, 38, 54)

Q63. Refer to the following series and answer the question (all numbers are single digit numbers only).

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

How many unique even digits are there in the series?

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

Q64. Tarun starts from Point A and drives 65 km towards east. He then takes a left turn, drives 42 km, turns left and drives 78 km. He then takes a left turn and drives 71 km. He takes a final left turn, drives 13 km and stops at Point P. How far (shortest distance) and towards which direction should he drive in order to reach Point A again? (All turns are 90 degrees turns only unless specified)

(a) 26 km to the south
(b) 27 km to the south
(c) 28 km to the north
(d) 29 km to the north

Q65. What should come in place of the question mark (?) in the given series based on the English alphabetical order?

FRU HTW JVY LXA ?

(a) NZC
(b) NDS
(c) NZS
(d) NCZ

Q66. 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 chromium are gallium.

No gallium are gold.

All gold are steel.

Conclusions:

I: Some gold are gallium.

II: Some gallium are steel.6672

(a) Both conclusions (I) and (II) follow

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(b) Only conclusion (I) follows
(c) Only conclusion (II) follows
(d) Neither conclusion (I) nor (II) follows

Q67. If 'A' stands for '÷', 'B' stands for '×', 'C' stands for '+' and 'D' stands for '−', then what will come in place of the question mark (?) in the following equation?

9 B 3 D 56 A 4 C 6 = ?

(a) 19
(b) 15
(c) 24
(d) 27

Q68. Building X is to the south of Building Y and Building Z is to the east of Building Y. In which direction Building X is located with respect to Building Z?

(a) North-East
(b) North-West
(c) South-East
(d) South-West

Q69. Refer to the given number, symbol series and answer the question that follows. Counting to be done from left to right only.

(Left) 4 © 7 # 3 $ 7 6 4 £ 8 $ 2 * £ & $ # % 1 * 2 (Right)

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

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

Q70. Select the pair which follows the same pattern as that followed by the two pairs given below. Both pairs follow the same pattern.

ELP : CJN

IQW : GOU6152

(a) HWZ : FUX
(b) BTS : AWP
(c) BTD : VRY
(d) NRT : FSE

Q71. Which of the following letter-number clusters will replace the question mark (?) in the given series to make it logically complete?

YVW 58 VST 69 SPQ 80 PMN 91 ?

(a) MIJ 101
(b) MRX 101
(c) MKJ 102
(d) MJK 102

Q72. If '+' means '−', '−' means '×', '×' means '÷' and '÷' means '+', then what will come in place of the question mark (?) in the following equation?

20 × 2 ÷ 2 − 3 + 7 = ?

(a) 9
(b) 14
(c) 5
(d) 11

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Q73. 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) HE−FF
(b) MJ−LI
(c) XU−WT
(d) OL−NK

Q74. Seven boxes L, M, N, O, Q, R and S are kept one over the other but not necessarily in the same order. M is kept second from the bottom. Only one box is kept between M and N. Only three boxes are kept between M and S where S is kept above M. L is kept immediately below S. Q is kept at one of the places above O. R is not kept immediately above or below M. How many boxes are kept below O?8480

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

Q75. A, B, C, D, E and F are sitting around a circular table facing the centre. B sits second to the left of D. F is an immediate neighbour of A. B sits to the immediate right of A. C sits second to the left of E. What is the position of C with respect to A?

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

Q76. Refer to the following number series and answer the question that follows (all numbers are single-digit numbers only).

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

How many unique numbers in the series are less than 5 (each number counted only once, regardless of repetitions)?

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

Q77. In a certain code language, VERL is coded as 102 and GZQT is coded as 76. What is the code for BXNO in that language?

(a) 89
(b) 110
(c) 96
(d) 106

Q78. This question is based on the five, three-digit numbers given below.

(Left) 351 369 458 517 619 (Right)

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

(NOTE: All operations to be done from left to right.)

What will be the resultant if the second digit of the highest number is added to the second digit of the lowest number?

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

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Q79. 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) OS - NS
(b) LP - KO
(c) MQ - LP
(d) IM - HL

Q80. Seven people, A, B, C, D, E, F and G, are sitting in a row, facing north. No one sits to the right of G. Only three people sit between G and D. Only two people sit between D and C. E sits third to the left of F. B sits to the immediate right of F. How many people sit to the right of C?

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

GENERAL AWARENESS AND CURRENT AFFAIRS

Q81. Which first-time MP from Thane was named a Sansad Ratna Award recipient in 2025?

(a) Rahul Shewale
(b) Arvind Sawant
(c) Dr. Varsha Gaikwad
(d) Naresh Mhaske

Q82. Which of the following is a drone-launched precision-guided missile successfully test-fired by the Defence Research and Development Organisation (DRDO) at a test range in Andhra Pradesh in July 2025?

(a) Astra Mk-II
(b) Agni-P
(c) Nirbhay-V3
(d) ULPGM-V3

Q83. Which of the following organization's main purpose is collective defence, meaning an attack on one member is considered an attack on all?

(a) World Trade Organization (WTO)
(b) World Health Organization (WHO)
(c) United Nations Educational, Scientific and Cultural Organization (UNESCO)
(d) North Atlantic Treaty Organization (NATO)

Q84. In November 2025, the Commission for Air Quality Management (CAQM) implemented Stage-II of the Graded Response Action Plan (GRAP) across Delhi-NCR. Which air quality category and AQI range did this stage correspond to?

(a) Severe (AQI 401–450)
(b) Very Poor (AQI 301–400)
(c) Severe+ (AQI 451 and above)
(d) Poor (AQI 201–300)

Q85. In November 2025, which of the following government bodies expressed serious concern over Delhi's deteriorating air quality, stating that even wearing masks had become ineffective?

(a) Ministry of Health and Family Welfare
(b) Delhi High Court
(c) Ministry of Home Affairs
(d) Supreme Court of India

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Q86. In March 2025, the Ministry of Environment, Forest and Climate Change conducted a national-level workshop on the National Adaptation Plan on Climate Change at _____.

(a) New Delhi
(b) Lucknow
(c) Bengaluru
(d) Mumbai

Q87. Who was recently appointed as the Chairperson of the Athletics Federation of India (AFI) Athletes Commission in January 2025?

(a) Anju Bobby George
(b) Saurav Ganguly
(c) Neeraj Chopra
(d) PT Usha

Q88. Where in Andhra Pradesh was the Rajiv Sports Complex, developed by Greater Visakhapatnam Municipal Corporation (GVMC), inaugurated in June 2025?

(a) Uttam Nagar
(b) Dwaraka Nagar
(c) Gajuwaka
(d) Kollam

Q89. Which Canadian province held the G7 Summit in June 2025?

(a) Saskatchewan
(b) Alberta
(c) British Columbia
(d) Ontario

Q90. Gyan Seepiyan: Pearls of Wisdom', launched at the Jaipur Literature Festival in January 2025, is written by which author?

(a) Javed Akhtar
(b) Harsha Dehejia
(c) Benoy K Behl
(d) Sudha Murthy

Q91. In January 2025, which of the following expanded its Sandbox Framework to support innovation in the insurance sector?

(a) Reserve Bank of India (RBI)
(b) Insurance Regulatory and Development Authority of India (IRDAI)
(c) Securities and Exchange Board of India (SEBI)
(d) Ministry of Corporate Affairs (MCA)

Q92. In November 2025, which key labour benefit was ensured for beedi and cigar workers under new labour reforms?

(a) Minimum Wage Guarantee
(b) Worker Welfare Act
(c) Labour Protection Scheme
(d) Employment Safety Code

Q93. In which forest region of Kerala were seven new moth species recorded for the first time in 2025 by a team of entomologists?

(a) Wayanad Wildlife Sanctuary
(b) Periyar Tiger Reserve
(c) Silent Valley
(d) Ranipuram forest

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Q94. In April 2024, the Indian Space Research Organisation's (ISRO) Chairman, S Somanath, made a declaration to achieve debris-free space missions by the year _____.

(a) 2035
(b) 2028
(c) 2032
(d) 2030

Q95. As per Union Budget 2025-26, under the new income tax regime, what is the tax-exempt income threshold?

(a) Rs. 12 lakh
(b) Rs. 10 lakh
(c) Rs. 15 lakh
(d) Rs. 13 lakh

Q96. Who set a new world record in the men's 89 kg weightlifting category by lifting 224 kg in the clean and jerk at the 2024 Olympics?

(a) Simon Martirosyan
(b) Karlos Nasar
(c) Akbar Djuraev
(d) Li Fabin

Q97. Which organization collaborated with CBSE to launch the National Automobile Olympiad, 2025?

(a) National Skill Development Corporation
(b) NITI Aayog
(c) Automotive Skills Development Council
(d) Skill India Mission

Q98. Which institution's researchers developed smart peptides for pH-responsive medical applications in June 2025?

(a) IIT Guwahati
(b) BITS Pilani
(c) IIT Delhi
(d) BIT Mesra

Q99. In which district of Arunachal Pradesh did the Union Sports Minister Mansukh Mandaviya inaugurate a new multi-purpose Khelo India Hall in May 2025?

(a) Kamle District
(b) East Siang District
(c) Lower Subansiri District
(d) Papum Pare District

Q100. Which Constitutional Articles did earlier Supreme Court judgements connect manual scavenging to, as a violation in February 2025?

(a) Articles 12 and 20
(b) Articles 22 and 32
(c) Articles 15 and 16
(d) Articles 17 and 21

ANSWER KEY

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

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

SOLUTIONS

Q1. Answer: (b) 2 A

The correct answer is 2 A.

Key Points

• The relationship between potential difference, current, and resistance is governed by Ohm's Law, which was discovered by the German physicist Georg Simon Ohm in 1827.

• According to Ohm's Law, the current (I) flowing through a conductor is directly proportional to the potential difference (V) applied across its ends, provided physical conditions like temperature remain constant. Mathematically, it is expressed as V = I × R.

• In the given problem, the potential difference (V) is 40 V and the resistance (R) of the resistor is 20 Ω.

• To find the current (I), we rearrange the formula to I = V / R. Substituting the values: I = 40 V / 20 Ω.

• The calculation yields I = 2 A. This means a current of 2 Ampere flows through the circuit. Hence, the correct answer is 2 A.

• Comparing with other options:

• 1/5 A (or 0.2 A) would require a resistance of 200 Ω for a 40 V source. Hence, statement 1 is incorrect.

• 2 A matches our calculated value using V = 40 and R = 20. Hence, statement 2 is correct.

• 1/2 A (or 0.5 A) would occur if the resistance were 80 Ω. Hence, statement 3 is incorrect.

• 5 A would occur if the resistance were only 8 Ω. Hence, statement 4 is incorrect.

Additional Information

• Electric Current (I):

• It is defined as the rate of flow of electric charge through a cross-section of a conductor.

• The SI unit of current is the Ampere (A), named after André-Marie Ampère.

• It is measured using an instrument called an Ammeter, which is always connected in series in a circuit because it has low resistance.

• Potential Difference (V):

• It is the work done to move a unit positive charge from one point to another in an electric field.

• The SI unit is the Volt (V), named after Alessandro Volta.

• It is measured by a Voltmeter, which is connected in parallel across the points where the potential difference is to be measured due to its high resistance.

• Resistance (R):

• It is the property of a conductor to oppose the flow of electric current through it.

• The SI unit of resistance is the Ohm (Ω).

• The resistance of a wire depends on several factors: its length (L), its area of cross-section (A), the nature of the material (resistivity), and temperature.

Important Points

• Mathematical Proportionality: If the potential difference across a resistor is doubled, the current flowing through it also doubles, provided the resistance stays the same. Conversely, if the resistance is doubled, the current is halved for a constant voltage.

• Ohmic and Non-Ohmic Conductors: Conductors that follow Ohm's Law (where the V-I graph is a straight line passing through the origin) are called Ohmic conductors (e.g., most metals). Devices like diodes or transistors that do not follow this linear relationship are Non-Ohmic.

• Calculation Fact: In DC circuits, 1 Ampere is equivalent to the flow of approximately 6.242 × 10^18 electrons per second through a point.

Q2. Answer: (a) specialised digestive organs

The correct answer is specialised digestive organs.

Key Points

• In multicellular organisms like humans, digestion is a complex physiological process that occurs in specialised digestive organs.

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This is known as extracellular digestion because the breakdown of food happens outside the individual cells within a specialized cavity or lumen. Hence, statement 1 is correct.

• The human digestive system consists of the alimentary canal and associated secretory glands. The canal is a continuous tube that includes the mouth, oesophagus, stomach, small intestine, large intestine, and anus.

• Digestion through the entire cell surface is characteristic of very simple organisms or certain parasites (like tapeworms) that absorb predigested nutrients directly from the host. It is not the mode of digestion for complex multicellular humans. Hence, statement 2 is incorrect.

• Food vacuoles are the primary site for intracellular digestion in unicellular organisms like Amoeba. In these organisms, the cell membrane engulfs food particles to form a vacuole where enzymes are secreted to break down the material. Hence, statement 3 is incorrect.

• The nucleus is the organelle responsible for storing genetic material (DNA) and coordinating cell activities like growth and reproduction. It does not play a role in the metabolic breakdown of food particles. Hence, statement 4 is incorrect.

Additional Information

• Stages of Digestion:

• Ingestion: Taking food into the body through the mouth.

• Digestion: The mechanical (chewing) and chemical (enzymatic) breakdown of complex food into micromolecules.

• Absorption: The process by which digested food enters the bloodstream, primarily occurring in the small intestine.

• Assimilation: The utilization of absorbed nutrients by body cells for energy, growth, and repair.

• Egestion: The elimination of undigested food waste from the rectum through the anus.

• Role of the Small Intestine:

• This is the site of complete digestion of carbohydrates, proteins, and fats. It receives secretions from the liver and pancreas. The inner walls have villi, which are finger-like projections that increase the surface area for efficient absorption.

• The Stomach:

• A J-shaped organ that acts as a storage tank. It secretes Hydrochloric Acid (HCl), which creates an acidic medium (pH 1.5 to 3.5) to activate the enzyme pepsin for protein digestion and kills harmful bacteria.

Important Points

• Digestive Glands:

• Salivary Glands: Located in the mouth, they produce saliva containing salivary amylase, which breaks down starch into maltose.

• Liver: The largest gland in the human body. It produces bile juice, which is stored in the gallbladder and helps in the emulsification of fats.

• Pancreas: A heterocrine gland that secretes pancreatic juice containing enzymes like trypsin (for proteins) and lipase (for emulsified fats).

• Digestive Enzymes: These are biological catalysts that speed up the chemical breakdown of food. Common examples include pepsin, renin, amylase, and maltase.

• Holozoic Nutrition: Humans exhibit holozoic nutrition, meaning they ingest complex organic matter which is then processed internally through the digestive tract.

Q3. Answer: (b) Sound can travel through vacuum.

The correct answer is Sound can travel through vacuum..

Key Points

• Sound is a mechanical wave that requires a material medium (such as air, water, or steel) for its propagation. It cannot travel through a vacuum because there are no atoms or molecules to transmit the vibrations. Hence, statement 2 is incorrect.

• The speed of sound is highest in solids, followed by liquids, and is the lowest in gases. This is because the molecules in solids are packed very tightly, allowing the vibrations to transfer more quickly. Hence, statement 1 is correct.

• In liquids, the particles are less tightly packed than in solids but more so than in gases. Therefore, sound travels slower in gases than in liquids. Hence, statement 3 is correct.

• Water is a liquid and air is a gas. Since sound moves more efficiently through denser media with higher elasticity, sound travels faster in water (approximately 1480 m/s) than in air (approximately 343 m/s). Hence, statement 4 is correct.

• The propagation of sound involves the back-and-forth motion of particles in the direction of the wave, classifying it as a longitudinal wave.

Additional Information

• Factors affecting Speed of Sound:

• Temperature: The speed of sound increases as the temperature of the medium increases. For every 1 degree Celsius rise in temperature, the speed of sound in air increases by about 0.6 m/s.

• Density and Elasticity: Speed is directly proportional to the square root of elasticity and inversely proportional to the square root

of density. Even though solids are denser, their high bulk modulus (elasticity) overrides the density factor, making sound travel fastest in them.

• Human Hearing Range:

• A healthy human ear can typically hear frequencies ranging from 20 Hz to 20,000 Hz (20 kHz).

• Frequencies below 20 Hz are called infrasonic, and those above 20,000 Hz are called ultrasonic.

• Applications of Sound Waves:

• SONAR (Sound Navigation and Ranging) uses ultrasonic waves to measure the depth of the ocean and detect underwater objects like submarines or shipwrecks.

• Echocardiography and Ultrasonography utilize sound reflections to create images of internal organs for medical diagnosis.

Important Points

• Bell Jar Experiment: This is a classic physics experiment used to demonstrate that sound needs a medium. When air is pumped out of a sealed glass jar containing a ringing electric bell, the sound fades and eventually disappears, even though the hammer can still be seen striking the bell.

• Light vs. Sound: Unlike sound, light is an electromagnetic wave. Light does not require a medium and travels at its maximum speed of 3 x 10^8 m/s in a vacuum. This is why we see lightning before we hear thunder.

• Supersonic Speed: When an object travels at a speed greater than the speed of sound in air, it is said to be traveling at supersonic speed. This often results in a sonic boom, which is a powerful shock wave.

Q4. Answer: (c) Half

The correct answer is Half.

Key Points

• Linear velocity is defined as the rate of change of displacement or distance of an object with respect to time.

• The mathematical formula for velocity (v) is expressed as v = d / t, where d represents the distance or displacement and t represents the time taken.

• In this relationship, velocity is directly proportional to the distance covered when the time interval is kept constant.

• If the original distance is halved (new distance = d/2) and the time (t) remains the same, the new velocity (v') calculation is: v' = (d/2) / t, which simplifies to v' = 1/2 * (d/t).

• Since d/t is the original velocity, the new velocity is exactly one-half of the initial linear velocity. Hence, the correct answer is Half.

Additional Information

• Scalar vs Vector Quantities:

• Distance is a scalar quantity because it only has magnitude and no specific direction.

• Velocity is a vector quantity because it possesses both magnitude (speed) and direction.

• SI Units:

• The Standard International (SI) unit for distance is the meter (m).

• The SI unit for velocity is meters per second (m/s).

• Types of Velocity:

• Uniform Velocity: When an object covers equal distances in equal intervals of time in a constant direction.

• Non-uniform Velocity: When either the speed or the direction of the object changes over time.

• Instantaneous Velocity: The velocity of an object at a specific point in time or at a specific point in its path.

• Acceleration: It is the rate of change of velocity with respect to time. If velocity remains constant (uniform velocity), the acceleration is zero. The SI unit for acceleration is m/s^2.

Important Points

• Proportionality Rules:

• If time is doubled while distance remains constant, the velocity becomes half (inverse proportionality).

• If distance is doubled while time remains constant, the velocity becomes double (direct proportionality).

• If both distance and time are doubled, the velocity remains the same.

• Graphical Representation: In a Distance-Time Graph, the slope of the curve or line indicates the velocity. A straight line passing through the origin indicates constant velocity, while a horizontal line indicates the object is at rest (zero velocity).

• Dimensions: The dimensional formula for linear velocity is $[M^0 L^1 T^{-1}]$.

Q5. Answer: (d) A-1; B-2; C-3; D-4

The correct answer is A-1, B-2, C-3, D-4.

Key Points

• Hydrochloric Acid (HCl): When HCl is dissolved in water, it undergoes ionization. Since it is a strong acid, it donates a proton

(H+) to a water molecule (H2O), resulting in the formation of a Hydronium ion (H3O+) and a Chloride ion (Cl-). Hence, A matches with 1 and the statement is correct.

• Sodium Hydroxide (NaOH): Commonly known as caustic soda, this is a strong base. In an aqueous solution, it dissociates completely into its constituent ions, which are the Sodium ion (Na+) and the Hydroxide ion (OH-). Hence, B matches with 2 and the statement is correct.

• Potassium Hydroxide (KOH): Also known as caustic potash, it is an inorganic compound and a strong base. Similar to NaOH, when dissolved in water, it releases Potassium ions (K+) and Hydroxide ions (OH-). Hence, C matches with 3 and the statement is correct.

• Magnesium Hydroxide (Mg(OH)2): This is a dibasic base. When it ionizes in water, one molecule of Mg(OH)2 produces one Magnesium ion with a double positive charge (Mg2+) and two Hydroxide ions (2OH-) to maintain electrical neutrality. Hence, D matches with 4 and the statement is correct.

• Therefore, the correct matching sequence is A-1, B-2, C-3, D-4.

Additional Information

• Arrhenius Theory of Acids and Bases: According to this theory, an acid is a substance that increases the concentration of Hydrogen ions (H+) or Hydronium ions (H3O+) in aqueous solution. A base is a substance that increases the concentration of Hydroxide ions (OH-) in aqueous solution.

• Electrolytes: The substances mentioned (HCl, NaOH, KOH) are strong electrolytes because they ionize almost 100% in water, allowing the solution to conduct electricity efficiently.

• Properties of Bases (Alkalis): Bases like NaOH and KOH are slippery to the touch, have a bitter taste, and turn red litmus paper blue. Their pH values are typically much higher than 7.

• Properties of Acids: Acids like HCl have a sour taste, turn blue litmus paper red, and react with metals to produce hydrogen gas. Their pH values are less than 7.

Important Points

• Milk of Magnesia: Magnesium Hydroxide (Mg(OH)2) is widely used in the medical field as an antacid to neutralize excess hydrochloric acid in the stomach, providing relief from indigestion and heartburn.

• Industrial Uses: Sodium Hydroxide (NaOH) is a critical component in the manufacturing of soaps, detergents, and paper. Potassium Hydroxide (KOH) is frequently used in the production of soft soaps and as an electrolyte in alkaline batteries.

• Hydronium Ion Formation: It is important to note that H+ ions do not exist alone in water; they always associate with H2O molecules to form H3O+.

• Valency and Charge: The production of two OH- ions from Mg(OH)2 is due to the +2 valency of the Magnesium atom, which belongs to Group 2 of the periodic table (Alkaline Earth Metals).

Q6. Answer: (c) To facilitate sperm formation as it requires a lower temperature than body temperature

The correct answer is To facilitate sperm formation as it requires a lower temperature than body temperature.

Key Points

• The testes are the primary reproductive organs in males, serving two main functions: the production of sperm and the secretion of male sex hormones, primarily testosterone.

• In humans and most mammals, the testes are situated outside the abdominal cavity within a sac-like structure known as the scrotum.

• The primary reason for this anatomical arrangement is that spermatogenesis (the process of sperm production) is highly sensitive to temperature. It requires a temperature that is approximately 2 to 2.5 degrees Celsius lower than the normal internal body temperature of 37 degrees Celsius. Hence, the statement regarding temperature requirement is correct.

• The scrotum acts as a natural thermoregulator, maintaining the testes at an optimal temperature to ensure the health, viability, and proper development of spermatozoa.

• If the testes were located inside the abdomen, the higher internal heat would inhibit the enzyme activities required for sperm maturation, leading to infertility.

Additional Information

• Spermatogenesis: This biological process occurs within the seminiferous tubules of the testes. It involves several stages of cell division and transformation, resulting in the formation of mature sperm cells. A cooler environment is essential specifically for the later stages of this process.

• Hormonal Secretion: While sperm production requires a lower temperature, the secretion of androgens (like testosterone) by the Leydig cells is not as strictly dependent on external positioning, though the overall physiological health of the organ is maintained by its location.

• Protective Function: The scrotum provides a physical protective barrier for the testes, though its primary evolutionary advantage remains temperature regulation.

• Pathological Conditions: A condition known as Cryptorchidism occurs when the testes fail to descend into the scrotum during fetal development. If not corrected, the constant exposure to high internal body temperatures can lead to permanent sterility and

an increased risk of testicular cancer.

Important Points

• Muscle Involvement: Two specific muscles, the Dartos muscle and the Cremaster muscle, help in temperature regulation. In cold environments, they contract to pull the testes closer to the body for warmth, and in warm environments, they relax to allow the testes to hang further away for cooling.

• Developmental Phase: Testes actually develop within the abdominal cavity near the kidneys during the early stages of pregnancy and usually descend into the scrotum through the inguinal canal during the seventh month of gestation.

• Sperm Storage: After being produced in the testes, sperm are stored and further matured in the epididymis, a long coiled tube located on the backside of each testis, before being transported through the vas deferens.

Q7. Answer: (a) Improper storage conditions

The correct answer is Improper storage conditions.

Key Points

• Proper storage of harvested food grains is essential to protect them from pests, microorganisms, and moisture. In this case, the damp and warm conditions directly represent Improper storage conditions. Hence, option 1 is correct.

• Moisture content is a critical factor; if grains are stored with high moisture (dampness), they are highly susceptible to attack by fungi, bacteria, and moulds. These microorganisms thrive in humid environments and cause the grains to rot.

• A warm room provides the ideal incubation temperature for microbial growth and increases the rate of respiration in the grains. This metabolic activity leads to the production of heat and moisture, further accelerating the spoilage process.

• The reduction in quantity is primarily due to the loss of dry matter. As microorganisms and the grains themselves respire, they consume carbohydrates stored in the seeds and release carbon dioxide and water vapor into the air.

• While birds and insects can reduce grain quantity, the specific mention of "damp and warm" strongly points towards biochemical and microbial spoilage rather than just external consumption. Hence, statement 3 is less likely than statement 1.

• The scenario does not suggest the grains were physically moved by a liquid force. Hence, statement 2 is incorrect.

• Irrigation refers to the supply of water to crops during their growth phase. Poor irrigation might lead to low crop yield or poor grain quality initially, but it is not the cause of spoilage after the grains have been successfully harvested and stored. Hence, statement 4 is incorrect.

Additional Information

• Biotic Factors: These include living organisms like insects, rodents, fungi, mites, and bacteria that infest and damage the stored produce.

• Abiotic Factors: These are non-living components such as temperature and moisture. For safe storage, food grains should generally have a moisture content of less than 14% by weight.

• Post-Harvest Management: To prevent spoilage, grains must be properly cleaned and sun-dried to reduce moisture before being packed in gunny bags or stored in silos and granaries.

• Fumigation: This is a method of using chemical vapors (pesticides) to kill insects and pests in stored grains without damaging the seeds.

• Mycotoxins: When grains are stored in damp conditions, certain fungi like Aspergillus can produce toxic substances called mycotoxins (e.g., Aflatoxin), which make the food grains poisonous for human and animal consumption.

Important Points

• The Food Corporation of India (FCI) is the nodal agency in India responsible for the scientific storage and distribution of food grains to ensure food security.

• Scientific storage structures like silos are preferred over traditional godowns because they allow for better control of temperature, ventilation, and humidity.

• Physical indicators of grain spoilage include discoloration, foul odor, clumping (due to fungal hyphae), and a loss of germination capacity.

• The loss of viability (the ability of the seed to germinate) is one of the first consequences of storing seeds in damp and warm environments, making them useless for the next sowing season.

Q8. Answer: (b) Cellulose

The correct answer is Cellulose.

Key Points

• Cellulose is the most significant structural component of the primary cell wall of green plants, many forms of algae, and oomycetes.

• It is a complex carbohydrate or polysaccharide consisting of a linear chain of several hundred to over ten thousand β(1→4) linked D-glucose units.

• The mechanical strength of the plant cell wall is primarily due to the organization of cellulose into microfibrils, which provide

tensile strength to the cell.

• It allows plants to maintain structural integrity and withstand turgor pressure, which is the internal pressure exerted by the cell contents against the cell wall.

• Cellulose is considered the most abundant organic polymer on Earth, playing a crucial role in the carbon cycle and as a renewable energy source. Hence, option 2 is correct.

Additional Information

• Collagen:

• It is the main structural protein found in the extracellular matrix of various connective tissues in animals.

• It makes up approximately 25% to 35% of the whole-body protein content in mammals and is found in tendons, ligaments, skin, and bones.

• Unlike cellulose, it is not present in plants. Hence, option 1 is incorrect.

• Peptidoglycan:

• Also known as murein, it is a polymer consisting of sugars and amino acids that forms a mesh-like layer outside the plasma membrane of most bacteria.

• It is the primary component of the bacterial cell wall, providing structural strength and protection against osmotic pressure.

• This substance is unique to prokaryotic organisms and is not found in plants. Hence, option 3 is incorrect.

• Chitin:

• It is a long-chain polymer of N-acetylglucosamine, a derivative of glucose.

• It is the primary component in the exoskeletons of arthropods (such as crustaceans and insects) and the cell walls of fungi.

• While it shares structural similarities with cellulose, it is not the main component of plant cell walls. Hence, option 4 is incorrect.

• Dietary Importance:

• In the human diet, cellulose acts as insoluble dietary fiber or roughage.

• Because humans lack the enzyme cellulase, we cannot digest it, but it aids the digestive system by adding bulk to stools and preventing constipation.

Important Points

• Industrial Applications: Cellulose is the main ingredient of paper, paperboard, and card stock. It is also processed to create rayon, cellophane, and nitrocellulose (used in explosives).

• Cotton: The cotton fiber is the purest natural form of cellulose, containing more than 90% of this polymer.

• Wood: Wood is composed of approximately 40% to 50% cellulose, with the remainder being hemicellulose and lignin.

• Chemical Structure: The beta-glycosidic linkage in cellulose makes it highly insoluble in water and most organic solvents, which is essential for its protective function in plants.

Q9. Answer: (b) Spinal cord

The correct answer is Spinal cord.

Key Points

• The Central Nervous System (CNS) is the primary control center of the body and is composed of two main parts: the brain and the spinal cord.

• The spinal cord is a long, thin, tubular structure made of nervous tissue, which extends from the medulla oblongata in the brainstem to the lumbar region of the vertebral column.

• Its main function is to serve as a conduit for nerve signals traveling between the brain and the rest of the body, facilitating both sensory and motor communication.

• The spinal cord also houses neural circuits that control reflex actions, allowing the body to respond to stimuli almost instantaneously without direct input from the brain.

• While the brain processes complex information, the spinal cord acts as the high-speed highway for electrical impulses.

Additional Information

• Stomach:

• The stomach is a muscular, J-shaped organ located in the upper abdomen. It is a key part of the digestive system.

• It functions by secreting gastric juices (enzymes and hydrochloric acid) to break down food into a semi-liquid form called chyme.

• Liver:

• The liver is the largest gland and the largest internal organ in the human body, typically weighing about 1.5 kg in an adult.

• It performs critical tasks such as detoxification of chemicals, production of bile for fat digestion, and storage of glycogen and vitamins.

• Pancreas:

• The pancreas is a heterocrine (mixed) gland, meaning it has both exocrine and endocrine functions.

• It produces digestive enzymes that enter the small intestine and secretes hormones like insulin and glucagon to regulate blood sugar levels.

• Peripheral Nervous System (PNS):

• The PNS consists of all the nerves outside the CNS, including 12 pairs of cranial nerves and 31 pairs of spinal nerves.

• Its primary role is to connect the CNS to the limbs, skin, and internal organs.

Important Points

• The human spinal cord is approximately 45 cm long in men and 43 cm long in women.

• It is protected by the vertebral column (backbone), which is composed of 33 vertebrae.

• The spinal cord and brain are enveloped in three protective layers of membranes known as the meninges: the dura mater, arachnoid mater, and pia mater.

• The space between these layers contains Cerebrospinal Fluid (CSF), which provides buoyancy and acts as a shock absorber for the Central Nervous System.

• Damage to the spinal cord can result in paralysis, such as paraplegia or quadriplegia, depending on the location and severity of the injury.

Q10. Answer: (b) More reactive

The correct answer is More reactive.

Key Points

• Unsaturated carbon compounds are chemically more reactive than saturated carbon compounds due to the presence of double or triple bonds between carbon atoms.

• In saturated compounds (alkanes), all the four valencies of carbon are fully satisfied by single covalent bonds, which are very stable and difficult to break.

• The double or triple bonds in unsaturated compounds consist of pi (π) bonds in addition to sigma (σ) bonds. Pi bonds are significantly weaker and more easily broken than sigma bonds.

• Because these multiple bonds can easily break to accommodate new atoms, unsaturated compounds readily undergo addition reactions, making them highly reactive.

• In contrast, saturated hydrocarbons are relatively inert and generally undergo substitution reactions only under specific conditions, such as in the presence of ultraviolet light.

Additional Information

• Saturated Hydrocarbons (Alkanes):

• These compounds have the general formula CnH2n+2.

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

• They are often called paraffins (from Latin 'parum affinis' meaning little affinity) because of their low chemical reactivity.

• In these molecules, every carbon-carbon bond is a single bond.

• Unsaturated Hydrocarbons (Alkenes and Alkynes):

• Alkenes contain at least one double bond and follow the formula CnH2n (e.g., Ethene, C2H4).

• Alkynes contain at least one triple bond and follow the formula CnH2n-2 (e.g., Ethyne, C2H2).

• The electron density is high around the double or triple bonds, attracting electrophiles and facilitating rapid chemical changes.

• Types of Reactions:

• Addition Reaction: A characteristic reaction of unsaturated hydrocarbons where reagents like Hydrogen (H2), Halogens, or Water add across the multiple bond to form a saturated product.

• Substitution Reaction: A characteristic reaction of saturated hydrocarbons where one or more hydrogen atoms are replaced by another atom or group of atoms (like Chlorine).

Important Points

• Test for Unsaturation: To distinguish between the two, the Bromine Water Test is used. Unsaturated compounds will quickly decolorize the reddish-brown bromine water, whereas saturated compounds will not react with it under normal conditions.

• Industrial Application: The process of Hydrogenation is used to convert unsaturated vegetable oils (liquids) into saturated fats (solids like vanaspati ghee) using catalysts like Nickel (Ni) or Palladium (Pd).

• Bond Energy: While a triple bond is stronger than a single bond in terms of total dissociation energy, the pi-bond components are the "weak links" that provide the gateway for high chemical reactivity.

Q11. Answer: (a) Inter-particle space

The correct answer is Inter-particle space.

Key Points

• Inter-particle space is the term used to describe the voids or gaps between the constituent particles (atoms, molecules, or ions)

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of a substance.

• In the solid state, the inter-particle space is at its minimum. This is because the particles are packed very tightly in a highly organized and regular arrangement.

• The closeness of these particles is a direct result of the strong intermolecular forces of attraction that hold the particles together in fixed positions.

• Due to the negligible inter-particle space, solids possess a definite shape, distinct boundaries, and a fixed volume. Hence, the correct term for the closeness of particles is Inter-particle space.

• In contrast, liquids have more space between particles than solids, and gases have the maximum inter-particle space, allowing for easy movement.

Additional Information

• Density:

• Density is defined as the mass per unit volume of a substance.

• Because particles in a solid are packed closely with very little inter-particle space, solids typically have a high density.

• The formula for density is Density = Mass / Volume.

• Rigidity:

• Rigidity refers to the property of a substance to maintain its shape when subjected to an external force.

• Solids are highly rigid because their particles cannot move from their positions and can only vibrate about their mean positions.

• Compressibility:

• Compressibility is the ability of matter to decrease in volume when pressure is applied.

• Solids have negligible compressibility because the inter-particle spaces are already so small that the particles cannot be pushed much closer together.

• Gases, on the other hand, have high compressibility due to large gaps between their particles.

Important Points

• Kinetic Theory of Matter:

• According to this theory, all matter is made of particles that are in constant motion.

• In solids, the kinetic energy of the particles is very low, which is why they stay close together.

• As temperature increases, the particles gain energy, and the inter-particle space may increase, leading to a change in state (melting).

• Comparison of States:

• Solids: Minimum space, maximum attraction, fixed shape.

• Liquids: Moderate space, moderate attraction, no fixed shape but fixed volume.

• Gases: Maximum space, minimum attraction, neither fixed shape nor fixed volume.

Q12. Answer: (b) force exerted by the gas particles per unit area on the walls of the container

The correct answer is force exerted by the gas particles per unit area on the walls of the container.

Key Points

• According to the Kinetic Theory of Gases, gas particles are in a state of continuous random motion. During this motion, they frequently collide with each other and with the inner walls of the container.

• When a gas particle hits a wall, it undergoes a change in momentum. Based on Newton's Second Law of Motion, this rate of change of momentum translates into an impulsive force exerted on the wall.

• Pressure is scientifically defined as the force acting perpendicularly per unit area of a surface. Therefore, the total pressure of the gas is the sum of all individual collision forces divided by the total surface area of the walls.

• Statement 1 suggests the force is per unit volume. This is incorrect because pressure is a surface phenomenon related to area, while volume relates to the space occupied. Hence, statement 1 is incorrect.

• Statement 2 correctly identifies pressure as the force exerted per unit area on the walls. This aligns with the fundamental physics formula P = F / A. Hence, statement 2 is correct.

• Statement 3 mentions only the force. Force alone is not pressure; for example, the same force applied to a smaller area results in higher pressure. Hence, statement 3 is incorrect.

• Statement 4 specifies the bottom of the container. Unlike solids, gases exert pressure uniformly in all directions (isotropically) on all walls of the container, not just the bottom. Hence, statement 4 is incorrect.

Additional Information

• Units of Pressure:

• The SI unit of pressure is the Pascal (Pa), which is equivalent to 1 Newton per square meter (N/m^2).

• Other common units include atm (atmosphere), bar, torr, and mmHg. 1 atm is approximately equal to 101,325 Pa or 760 mmHg.

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• Factors Affecting Gas Pressure:

• Temperature: According to Gay-Lussac's Law, if the volume is constant, increasing the temperature (in Kelvin) increases the average kinetic energy of the particles, leading to more frequent and more forceful collisions, thereby increasing pressure.

• Volume: According to Boyle's Law (1662), the pressure of a given mass of an ideal gas is inversely proportional to its volume at a constant temperature.

• Number of Molecules: Increasing the number of gas particles in a fixed volume increases the number of collisions per second, which raises the pressure.

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

Important Points

• Isotropic Property: In a stationary gas, the pressure at any point is the same in all directions. This is a key distinction from solids where stress can be directional.

• Atmospheric Pressure: The Earth's atmosphere exerts pressure due to the weight of the air above a surface. At sea level, the standard atmospheric pressure is 1.013 bar.

• Collision Nature: In an Ideal Gas, collisions between particles and the walls are assumed to be perfectly elastic, meaning there is no net loss of kinetic energy during the impact.

Q13. Answer: (c) Salt and water

The correct answer is Salt and water.

Key Points

• The reaction between a non-metallic oxide and a base produces salt and water as the final products. This chemical behavior demonstrates that non-metallic oxides are acidic in nature.

• Since the reaction of a base with a non-metallic oxide is similar to the reaction between an acid and a base (a neutralization reaction), it is concluded that non-metallic oxides are acidic.

• A common example of this reaction is the interaction between Calcium hydroxide, which is a base, and Carbon dioxide, which is a non-metallic oxide. The reaction produces Calcium carbonate (a salt) and Water.

• The general chemical equation for this process is: Non-metallic oxide + Base → Salt + Water. This property is used in various industrial and laboratory processes to neutralize basic solutions or to capture acidic gases.

• The acidic nature of these oxides is due to their ability to form acids when dissolved in water. For instance, Sulfur trioxide reacts with water to form Sulfuric acid.

Additional Information

• Nature of Oxides:

• Metallic Oxides: Most metals react with oxygen to form basic oxides. These oxides react with acids to form salt and water. For example, Magnesium oxide reacts with Hydrochloric acid to produce Magnesium chloride and water.

• Non-Metallic Oxides: Non-metals react with oxygen to form oxides that are either acidic or neutral. Examples of acidic oxides include SO2, CO2, and P4O10.

• Amphoteric Oxides: Some oxides show both acidic and basic properties. Examples include Aluminum oxide (Al2O3) and Zinc oxide (ZnO), which can react with both acids and bases to produce salt and water.

• Common Examples and Applications:

• Carbon dioxide (CO2): Reacts with Sodium hydroxide (NaOH) to form Sodium carbonate and water. This reaction is significant in carbon scrubbing technologies.

• Sulfur dioxide (SO2): A major non-metallic oxide responsible for acid rain. When it reacts with bases like Calcium hydroxide, it forms Calcium sulfite, a process used in flue-gas desulfurization in power plants.

• Test for Carbon dioxide: When CO2 is passed through limewater (aqueous Calcium hydroxide), it turns milky due to the formation of Calcium carbonate, which is an insoluble salt.

• Bonding Characteristics:

• Non-metallic oxides typically involve covalent bonding between the non-metal and oxygen atoms. Because non-metals have high electronegativity, these oxides tend to accept electrons or react with hydroxide ions (OH-) from bases.

Important Points

• While most non-metallic oxides are acidic, some are neutral oxides. Neutral oxides do not react with either acids or bases. Common examples include Carbon monoxide (CO), Nitrous oxide (N2O), and Nitric oxide (NO).

• The acidity of non-metallic oxides generally increases as the oxidation state of the non-metal increases. For instance, Sulfur trioxide (SO3) is more acidic than Sulfur dioxide (SO2).

• In the Periodic Table, the acidic character of oxides increases from left to right across a period as the elements change from metallic to non-metallic.

Q14. Answer: (d) To supply oxygen for life processes

The correct answer is To supply oxygen for life processes.

Key Points

• Breathing is a continuous and involuntary process because the human body requires a constant supply of oxygen to sustain life, regardless of physical activity levels.

• Even during states of rest, such as sitting or sleeping, the body is performing essential metabolic activities including cell repair, blood circulation, and maintaining body temperature.

• The primary biological reason for breathing is to provide the oxygen necessary for cellular respiration, which occurs within the mitochondria of every living cell.

• During respiration, oxygen reacts with glucose to produce ATP (Adenosine Triphosphate), the primary energy currency of the cell, which powers all biological functions.

• Simultaneously, breathing facilitates the removal of carbon dioxide, a waste product of metabolism; if not expelled, it would lead to acidosis and cellular damage. Hence, the correct answer is to supply oxygen for life processes.

Additional Information

• Control Center of Breathing:

• The Medulla Oblongata and Pons, located in the brainstem, act as the respiratory centers that automatically regulate the rate and depth of breathing based on pH levels and CO_2 concentration in the blood.

• Basal Metabolic Rate (BMR):

• This refers to the minimum energy expenditure required to keep the body functioning at rest. A significant portion of the oxygen inhaled during sleep is dedicated to maintaining the BMR for organs like the brain, heart, and kidneys.

• Aerobic Respiration:

• The chemical equation for this process is $C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O + \text{Energy (ATP)}$. This reaction demonstrates the absolute dependency of energy production on atmospheric oxygen.

• Gaseous Exchange:

• This takes place in the alveoli of the lungs, where oxygen diffuses into the capillaries and binds with hemoglobin in Red Blood Cells to be transported throughout the body.

Important Points

• Breathing vs. Respiration: Breathing is the physical act of inhaling and exhaling air, whereas respiration is the biochemical process of breaking down nutrients to release energy.

• Diaphragm Function: The diaphragm is a large, dome-shaped muscle that contracts to create a vacuum in the chest cavity, pulling air into the lungs. This muscle works 24/7 to ensure continuous air intake.

• Vital Organs Activity: The brain consumes about 20% of the body's total oxygen supply. Since the brain never shuts down, even during sleep, the demand for oxygen remains constant to prevent hypoxia.

• Homeostasis: Continuous breathing is crucial for maintaining homeostasis, ensuring the internal environment of the body remains stable despite external changes or periods of inactivity.

Q15. Answer: (c) 6000 J

The correct answer is 6000 J.

Key Points

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

• The formula for Gravitational Potential Energy (P.E.) is given by: $P.E. = m \times g \times h$, where m is the mass, g is the acceleration due to gravity, and h is the height.

• In this question, the mass (m) of the block is 30 kg.

• The height (h) at which the block is kept is 20 m.

• The acceleration due to gravity (g) is given as 10 m/s^2.

• By substituting these values into the formula: $P.E. = 30\ kg \times 10\ m/s^2 \times 20\ m$.

• The calculation results in $30 \times 10 \times 20 = 6000$.

• The SI unit of energy is the Joule (J). Hence, the potential energy is 6000 J.

• Hence, the correct answer is 6000 J.

Additional Information

• Mechanical Energy: It is the sum of potential energy and kinetic energy. It is the energy associated with the motion and position of an object.

• Kinetic Energy: This is the energy possessed by an object due to its motion. The formula for kinetic energy is $K.E. = 1/2\ mv^2$, where v is the velocity of the object.

• Law of Conservation of Energy: According to this law, energy can neither be created nor destroyed; it can only be transformed from one form to another. For a falling object, potential energy decreases while kinetic energy increases, but the total mechanical energy remains constant (in the absence of air resistance).

• Factors Affecting Potential Energy:

• Mass: Potential energy is directly proportional to the mass of the object. Heavier objects have more potential energy at the same height.

• Height: It is directly proportional to the height from the reference point (usually the ground). The higher an object is placed, the more potential energy it possesses.

• Acceleration due to gravity: On Earth, this is approximately 9.8 m/s^2, though 10 m/s^2 is often used in simplified calculations.

Important Points

• Work and Energy: The capacity to do work is called energy. Since the unit of work is the Joule, the unit of energy is also the Joule, named after the physicist James Prescott Joule.

• Scalar Quantity: Energy is a scalar quantity, meaning it has magnitude but no specific direction.

• Reference Level: Potential energy is always measured relative to a reference level (zero point). Changing the reference level (e.g., measuring from a tabletop instead of the floor) will change the calculated value of the potential energy.

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

Q16. Answer: (b) It is one-sixth of its weight on Earth.

The correct answer is It is one-sixth of its weight on Earth.

Key Points

• The weight of an object is defined as the force with which the Earth or any celestial body attracts it. It is calculated using the formula W = m × g, where m is the mass and g is the acceleration due to gravity.

• The acceleration due to gravity on the Moon is approximately 1.625 m/s^2, while on Earth, it is approximately 9.8 m/s^2.

• When comparing these two values, the gravitational pull of the Moon is roughly one-sixth (1/6th) of the gravitational pull of the Earth.

• Consequently, the weight of an object on the Moon becomes one-sixth of its weight on Earth. Hence, option 2 is the correct statement.

• It is important to note that while the weight changes based on the gravitational field, the mass of the object remains constant regardless of its location in the universe.

Additional Information

• Newton’s Law of Universal Gravitation:

• The gravitational force depends on the mass of the two bodies and the distance between them. Since the Moon has a much smaller mass (approximately 7.347 × 10^{22} kg) compared to Earth (5.972 × 10^2^4 kg), its gravity is significantly weaker.

• Even though the Moon is smaller in radius (1,737 km), which would typically increase gravity at the surface, its low density and total mass result in the 1/6th ratio.

• Difference between Mass and Weight:

• Mass is a measure of the amount of matter in an object and is measured in kilograms (kg).

• Weight is a force measured in Newtons (N). An object with a mass of 60 kg would have a weight of about 600 N on Earth but only 100 N on the Moon.

• Calculation Example:

• If an astronaut weighs 120 pounds on Earth, their weight on the Moon would be 120 / 6 = 20 pounds. This reduction in weight allows astronauts to jump much higher and carry heavy equipment more easily.

Important Points

• Escape Velocity: Due to the lower gravity, the escape velocity of the Moon is only 2.38 km/s, compared to 11.2 km/s on Earth. This is why the Moon cannot retain an atmosphere.

• Unit of Force: In the SI system, weight is expressed in Newtons. The acceleration due to gravity (g) is the key variable that dictates the weight of an object across different planets or satellites.

• Historical Context: During the Apollo missions in the 1960s and 1970s, this phenomenon was clearly observed as astronauts performed "moon walks" with a bouncing gait because their muscular strength was adapted to Earth’s gravity, making them feel extremely light on the lunar surface.

Q17. Answer: (c) Main fuse

The correct answer is Main fuse.

Key Points

• A Main fuse is a safety device that is always connected in series with the live wire in a domestic circuit before the electricity enters the main distribution board.

• The primary function of the fuse is to protect the building's electrical system from overloading and short-circuiting. If the current exceeds a specific rated value, the fuse wire heats up and melts, effectively breaking the circuit. Hence, the main fuse is the correct answer.

• In a series connection, the current flowing through all components is the same. If the fuse were connected in parallel, it would not be able to stop the total current from entering the circuit during a fault.

• Electric bulbs and fans are never connected in series in a standard domestic circuit. If they were, switching off one would turn off all other devices, and the voltage would be divided among them, leading to poor performance. Hence, statement 1 and 4 are incorrect.

• Domestic appliances are connected in parallel so that each device gets the same standard voltage (e.g., 220V in India) and can be operated independently with its own switch. Hence, statement 2 is incorrect.

Additional Information

• Series Circuit Characteristics:

• In a series circuit, there is only one path for the flow of electricity.

• The total resistance is the sum of individual resistances (R = R1 + R2 + ...).

• If any single component in the series fails or is disconnected, the entire circuit is broken, and no current flows.

• Parallel Circuit Characteristics:

• In a parallel circuit, the voltage across each component is constant.

• The total resistance decreases as more branches are added (1/R = 1/R1 + 1/R2 + ...).

• Domestic wiring is done in parallel to ensure that high-power devices like geysers and low-power devices like LED bulbs receive the same potential difference.

• Fuse Wire Material:

• A fuse wire is usually made of an alloy of tin and lead or tin-plated copper because it requires a low melting point and high resistance.

• The thickness of the fuse wire determines its current rating (e.g., 5A for light circuits and 15A for power circuits).

• Modern Alternatives:

• Nowadays, Miniature Circuit Breakers (MCBs) are used instead of traditional fuses. They act as automatic switches that trip during an overcurrent situation and can be reset without needing replacement.

Important Points

• Earth Wire (Green/Yellow): This is a safety wire connected to the metal casing of appliances to prevent electric shocks by providing a low-resistance path to the ground.

• Live Wire (Red/Brown): Carries the alternating current from the source to the appliance.

• Neutral Wire (Black/Blue): Completes the circuit by providing a return path for the current.

• Short Circuit: Occurs when the Live wire and Neutral wire come into direct contact, causing a massive surge in current. The Main fuse is the primary defense against this.

Q18. Answer: (d) Hydrogen

The correct answer is Hydrogen.

Key Points

• When Ethanol (an alcohol) reacts with Sodium metal, it results in the formation of Sodium Ethoxide and the liberation of Hydrogen gas.

• The chemical equation for this reaction is: 2Na + 2CH3CH2OH → 2CH3CH2ONa + H2. In this process, the Sodium atom displaces the Hydrogen atom from the Hydroxyl (-OH) group of the Ethanol molecule.

• The evolution of Hydrogen gas is characterized by brisk effervescence. To confirm the presence of this gas, a burning splinter can be brought near the mouth of the test tube, which will produce a distinct 'pop' sound.

• This reaction demonstrates the acidic nature of alcohols, although Ethanol is a very weak acid (even weaker than Water). The Sodium metal acts as a strong reducing agent that forces the release of the Proton from the alcohol.

• This specific reaction is commonly used as a confirmatory test in laboratories to identify the presence of the Alcoholic group in an unknown organic compound.

Additional Information

• Ethanol (C2H5OH):

• Also known as Ethyl Alcohol, it is a volatile, flammable, colorless liquid with a characteristic odor.

• It has a Boiling Point of approximately 78.37 degrees Celsius and is widely used as a Solvent, in Fuel (as Bio-ethanol), and in the production of Alcoholic Beverages.

• In the Chemical Industry, it serves as a precursor for other organic compounds like Ethanoic Acid and Diethyl Ether.

• Sodium (Na):

• It is a highly reactive Alkali Metal belonging to Group 1 of the Periodic Table with Atomic Number 11.

• Due to its extreme reactivity with Moisture and Oxygen in the air, it is always stored under Kerosene or Paraffin Oil to prevent accidental combustion.

• The reaction of Sodium with Water is much more vigorous and Exothermic compared to its reaction with Ethanol, often resulting in the Hydrogen gas catching fire.

• Sodium Ethoxide (C2H5ONa):

• The byproduct of the reaction is an Alkoxide, specifically Sodium Ethoxide, which is a strong Base used in Organic Synthesis.

• It is frequently utilized in reactions such as Claisen Condensation and Williamson Ether Synthesis.

• Comparison with other options:

• Methane (CH4) is not released in this reaction; it is usually produced during the Decarboxylation of Sodium Acetate.

• Carbon Dioxide (CO2) is typically released when Carbonates or Bicarbonates react with Acids (like Ethanoic Acid), not during the reaction of sodium with ethanol.

• Oxygen (O2) is released during the decomposition of Hydrogen Peroxide or during Photosynthesis, but not in the metal-alcohol reaction.

Important Points

• Reactivity Trend: The rate of reaction of alcohols with Sodium decreases with the increase in the size of the Alkyl group. Therefore, Methanol reacts faster than Ethanol, which in turn reacts faster than Propanol.

• Safety Measures: Since Hydrogen is highly flammable and the reaction involves Sodium, it must be performed under strict supervision in a Laboratory setting.

• Industrial Application: This reaction is a primary method for preparing Anhydrous Alkoxides which are essential catalysts in the Biodiesel production process.

Q19. Answer: (b) Cyclopropane

The correct answer is Cyclopropane.

Key Points

• Cyclopropane is the smallest possible cycloalkane, consisting of three carbon atoms linked together to form a ring structure.

• The molecular formula for cyclopropane is C3H6. It exists as a cyclic hydrocarbon where each carbon atom is bonded to two other carbons and two hydrogen atoms.

• Geometrically, the molecule forms an equilateral triangle. This results in C-C-C bond angles of 60 degrees, which is a significant deviation from the ideal tetrahedral angle of 109.5 degrees expected for sp3 hybridized carbons.

• This intense deviation causes what is known as angle strain or Baeyer strain. Despite this high internal energy, cyclopropane is a stable compound that can be isolated and stored, although it is more reactive than its open-chain counterparts.

• A ring structure requires a minimum of three points to close; therefore, any hydrocarbon with fewer than three carbon atoms cannot form a stable ring. Hence, the correct answer is Cyclopropane.

Additional Information

• Propane: This is an acyclic (open-chain) alkane with the chemical formula C3H8. While it has three carbon atoms, they are arranged in a straight chain rather than a ring. Hence, statement 1 is incorrect.

• Ethane: This is an alkane with only two carbon atoms and the formula C2H6. Because a ring requires at least three vertices, ethane is physically unable to form a cyclic structure. Hence, statement 3 is incorrect.

• Methane: The simplest hydrocarbon, methane (CH4), contains only one carbon atom. It is impossible for a single atom to form a ring. Hence, statement 4 is incorrect.

• Cycloalkanes General Formula: Saturated cyclic hydrocarbons follow the general formula CnH2n, which differs from the CnH2n+2 formula used for linear alkanes.

• Historical Use: Cyclopropane was notably used as a potent inhalation anesthetic in medical surgery starting around the year 1930. However, it is rarely used today because it is highly flammable and can be explosive when mixed with air or oxygen.

Important Points

• Ring Strain Components: The instability in cyclopropane arises from two main factors: angle strain (due to the 60-degree bonds) and torsional strain (caused by the eclipsing conformation of all C-H bonds).

• Bent Bonds: To minimize the high energy of the ring, the carbon-carbon bonds in cyclopropane are not straight; they are described as bent bonds or banana bonds, which allow for better orbital overlap than straight-line 60-degree bonds would permit.

• Comparison of Stability: As the number of carbon atoms in the ring increases, the stability generally increases until cyclohexane (C6H12). Cyclohexane is the most stable cycloalkane because its chair conformation allows bond angles to reach 109.5 degrees, eliminating nearly all ring strain.

• Physical Properties: At standard temperature and pressure, cyclopropane is a colorless gas with a characteristic sweet smell. It has a boiling point of approximately -33 degrees Celsius and a melting point of -128 degrees Celsius.

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Q20. Answer: (c) Sweat absorbs heat from our skin to evaporate.

The correct answer is Sweat absorbs heat from our skin to evaporate.

Key Points

• Evaporation is a cooling process because it is endothermic. For a liquid to transform into a gas, it must absorb thermal energy from its immediate environment.

• When the human body temperature rises due to physical exertion or high external temperatures, the nervous system stimulates the sweat glands to release moisture onto the skin surface.

• This moisture, primarily composed of water and small amounts of electrolytes, utilizes the heat energy stored in the skin to overcome the intermolecular forces holding the liquid molecules together.

• As the water molecules acquire sufficient kinetic energy, they transition into the vapor phase and escape into the atmosphere. This removal of energy results in a decrease in the surface temperature of the skin. Hence, the statement that sweat absorbs heat from our skin to evaporate is correct.

• If sweat merely released heat or turned into ice, it would not effectively facilitate the thermoregulation process required to maintain homeostasis.

Additional Information

• Latent Heat of Vaporization: This is the specific amount of energy required to change a substance from a liquid to a gas at a constant temperature. Water has a high latent heat of vaporization, meaning it can remove a significant amount of heat from the body with relatively little fluid loss.

• Thermoregulation: The Hypothalamus in the brain acts as the body's thermostat. It senses changes in blood temperature and receives input from thermoreceptors in the skin to trigger sweating or shivering.

• Environmental Factors: The efficiency of cooling through evaporation is highly dependent on Relative Humidity. When humidity is high (above 70% to 80%), the air is already saturated with water vapor, which slows down the evaporation rate, making the body feel much hotter than the actual ambient temperature.

• Convection and Airflow: Wind or a fan aids the cooling process by moving the saturated air away from the skin and replacing it with drier air, which allows evaporation to continue at a faster rate.

• Homeostasis: This biological process ensures that the internal body temperature remains stable around 37 degrees Celsius (98.6 degrees Fahrenheit), protecting vital organs and enzymatic functions from hyperthermia.

Important Points

• Eccrine Glands: These are the primary sweat glands involved in evaporative cooling. They are distributed over almost the entire human body, with the highest density on the palms, soles, and head.

• Apocrine Glands: Found mainly in the axilla (armpits) and perianal regions, these glands produce a thicker sweat containing proteins and lipids, which is usually associated with body odor rather than primary temperature regulation.

• Dehydration Risk: During intense physical activity or in extreme heat, a person can lose several liters of water per hour through sweating. If these fluids are not replaced, it can lead to dehydration, heat exhaustion, or heatstroke.

• Specific Heat Capacity: Water's high specific heat capacity means it can absorb a lot of thermal energy before it even begins the process of evaporation, providing a buffer for the body's core temperature.

Q21. Answer: (c) It prevents sexually transmitted diseases like HIV-AIDS

The correct answer is It prevents sexually transmitted diseases like HIV-AIDS.

Key Points

• Practicing safe sex is a fundamental aspect of reproductive health, primarily because it serves as a critical barrier against the transmission of Sexually Transmitted Infections (STIs) and Sexually Transmitted Diseases (STDs).

• One of the most significant benefits is the prevention of HIV-AIDS (Human Immunodeficiency Virus/Acquired Immunodeficiency Syndrome), which is a chronic and potentially life-threatening condition that severely impacts the immune system. Hence, statement 3 is correct.

• Safe sex practices, such as the consistent and correct use of latex condoms, provide a physical barrier that prevents the exchange of bodily fluids containing pathogens like bacteria, viruses, and parasites.

• Maintaining reproductive health through safe practices also prevents other serious infections like Syphilis, Gonorrhea, and Chlamydia, which, if left untreated, can lead to chronic pain and infertility.

• Safe sex does not directly ensure hormonal balance; hormones are regulated by the endocrine system and glands like the pituitary and thyroid. Hence, statement 1 is incorrect.

• Safe sex methods, particularly barrier methods, are designed to prevent pregnancy rather than guarantee it. Hence, statement 2 is incorrect.

• While safe sex protects the reproductive organs from damage caused by infections, it does not biologically increase fertility beyond an individual's natural capacity. Hence, statement 4 is incorrect.

Additional Information

• Definition of Reproductive Health: According to the World Health Organization (WHO), reproductive health is a state of complete physical, mental, and social well-being in all matters relating to the reproductive system. It implies that people are able to have a responsible, satisfying, and safe sex life.

• HIV-AIDS Awareness: World AIDS Day is observed on December 1st every year to raise awareness about the spread of the HIV infection. In India, the National AIDS Control Organisation (NACO), established in 1992, plays a pivotal role in prevention and control programs.

• Methods of Safe Sex:

• Barrier Methods: Includes male and female condoms, which are highly effective at preventing both STIs and unintended pregnancy.

• Regular Screening: Periodic medical check-ups for STIs are essential for sexually active individuals to ensure early detection and treatment.

• Common STIs and their Causative Agents:

• Bacterial: Gonorrhea (Neisseria gonorrhoeae) and Syphilis (Treponema pallidum).

• Viral: Genital Herpes (Herpes Simplex Virus), Hepatitis B, and HIV.

• Fungal/Protozoan: Trichomoniasis.

Important Points

• Long-term Impact of STIs: Untreated infections can lead to Pelvic Inflammatory Disease (PID) in women, which is a major cause of ectopic pregnancy and tubal infertility.

• Contraception vs. Protection: While Oral Contraceptive Pills (OCPs) or Intrauterine Devices (IUDs) are effective for birth control, they do not provide protection against STIs. Only condoms provide dual protection.

• National Health Programs: The Government of India promotes reproductive health through the RMNCH+A (Reproductive, Maternal, Newborn, Child, and Adolescent Health) strategy to reduce morbidity and mortality.

• Age Group: Education regarding safe sex is particularly crucial for the adolescent age group (10-19 years) as they transition into adulthood and become sexually aware.

Q22. Answer: (c) germination

The correct answer is germination.

Key Points

• Germination is the biological process through which a plant grows from a seed. It represents the fundamental stage where the embryo inside the seed resumes growth and emerges as a seedling under favourable environmental conditions. Hence, the correct answer is germination.

• For germination to occur, several external factors must be present, including adequate moisture (water), oxygen for respiration, and an optimal temperature (usually between 25°C and 30°C for many species).

• Pollination is the process of transferring pollen grains from the anther (male part) to the stigma (female part) of a flower. It is a reproductive mechanism but does not describe the emergence of a plant from a seed. Hence, statement 1 is incorrect.

• Fertilisation involves the fusion of male and female gametes to form a zygote. This occurs within the ovule after pollination has taken place and leads to the formation of the seed itself. Hence, statement 2 is incorrect.

• Photosynthesis is the process by which green plants use sunlight, carbon dioxide, and water to synthesize glucose and oxygen. While vital for plant growth, this process typically begins after the seedling has developed chlorophyll and leaves above the ground. Hence, statement 4 is incorrect.

Additional Information

• Stages of Germination:

• Imbibition: The seed absorbs water rapidly, causing the seed coat to soften and swell.

• Respiration: The seed begins aerobic respiration to produce energy (ATP) required for cell division.

• Radicle and Plumule Emergence: The radicle (primary root) emerges first to anchor the plant, followed by the plumule (primary shoot).

• Types of Germination:

• Epigeal Germination: The hypocotyl elongates, and the cotyledons (seed leaves) are pushed above the soil surface, as seen in bean and castor seeds.

• Hypogeal Germination: The epicotyl elongates, while the cotyledons remain below the soil, as seen in maize, pea, and gram.

• Seed Dormancy:

• This is a state where seeds do not germinate even under ideal conditions. It can be caused by a hard seed coat or the presence of growth inhibitors like Abscisic Acid (ABA). Breakage of dormancy is essential for the germination cycle to start.

Important Points

• Role of Water: It activates hydrolytic enzymes like amylase, protease, and lipase that break down stored food in the endosperm or cotyledons into simpler forms for the growing embryo.

• Oxygen Necessity: Since initial growth is very rapid, a high amount of oxygen is required. If soil is waterlogged, oxygen availability decreases, often leading to germination failure.

• Light Sensitivity: Some seeds, known as photoblastic seeds (e.g., lettuce), require light to trigger the germination process, whereas others may be inhibited by it.

Q23. Answer: (c) A satellite orbiting Earth at a constant speed

The correct answer is A satellite orbiting Earth at a constant speed.

Key Points

• Uniform Circular Motion is defined as the motion of an object traveling at a constant speed along a circular path. While the speed remains unchanged, the velocity of the object changes continuously because its direction of motion is constantly changing at every point.

• A satellite orbiting Earth at a constant speed is a classic example of this phenomenon. The gravitational pull of the Earth provides the necessary centripetal force required to keep the satellite in its circular orbit. Hence, option 3 is the correct answer.

• A car moving on a crowded street involves frequent changes in both speed and direction due to traffic and obstacles. This is an example of non-uniform motion. Hence, option 1 is incorrect.

• A train moving on a straight track at varying speeds represents non-uniform rectilinear motion. Since the path is straight and the speed is not constant, it does not satisfy the conditions for circular or uniform motion. Hence, option 2 is incorrect.

• A person jogging in a park typically involves variable speeds and an irregular path, which does not constitute uniform circular motion unless the person runs at a perfectly constant speed in a perfect circle. Hence, option 4 is incorrect.

Additional Information

• Centripetal Force: In any circular motion, an inward force acts on the body towards the center of the circle. This is known as centripetal force. Without this force, an object would move in a straight line tangential to the circle due to inertia.

• Velocity and Acceleration: Even though the speed is constant in uniform circular motion, the object is said to be accelerating. This is because acceleration is defined as the rate of change of velocity, and since the direction is changing, the velocity is changing. This acceleration is called centripetal acceleration.

• Mathematical Expression: The magnitude of centripetal acceleration (a) is given by the formula a = v^2 / r, where v is the linear speed and r is the radius of the circular path. The time taken to complete one full revolution is called the time period (T), calculated as T = 2πr / v.

• Real-world Examples:

• The motion of the tips of the hands of a clock (second, minute, and hour hands) at a constant rate.

• The motion of the Moon revolving around the Earth.

• An electron revolving around the nucleus in a Bohr atom model.

• A point on a spinning ceiling fan moving at a fixed speed setting.

Important Points

• Angular Displacement: This is the angle (measured in radians) through which an object moves on a circular path. The rate of change of angular displacement is called angular velocity (ω).

• Relationship: The relationship between linear velocity (v) and angular velocity (ω) is expressed as v = rω, where r is the radius.

• Work Done: In uniform circular motion, the work done by the centripetal force is always zero. This is because the force acting towards the center is always perpendicular (90 degrees) to the direction of displacement (tangent to the circle) at any given instant.

• Direction of Velocity: At any point in the circular path, the direction of the velocity vector is along the tangent to the circle at that specific point.

Q24. Answer: (d) real, inverted and smaller than the object

The correct answer is real, inverted and smaller than the object.

Key Points

• When an object is placed beyond the centre of curvature (C) of a concave mirror, the light rays originating from the object converge at a point between the focus (F) and the centre of curvature (C).

• The resulting image formed is real because the reflected rays actually intersect at a point in front of the mirror.

• The image is inverted, meaning it appears upside down relative to the orientation of the object.

• In terms of size, the image is diminished or smaller than the object. This occurs because the angle of convergence results in a smaller height of the image compared to the object height.

• This specific configuration is often used in optical experiments to demonstrate the properties of converging mirrors.

Additional Information

• Concave Mirror: A concave mirror is a spherical mirror whose reflecting surface is curved inwards, towards the centre of the sphere. It is also known as a converging mirror because it converges light rays falling on it.

• Ray Diagram Rules:

• A ray parallel to the principal axis will pass through the principal focus (F) after reflection.

• A ray passing through the centre of curvature (C) is reflected back along the same path because it strikes the mirror normally (at 90 degrees).

• A ray passing through the focus (F) will emerge parallel to the principal axis after reflection.

• Image Formation Summary for Concave Mirror:

• At Infinity: Image is formed at F; it is real, inverted, and highly diminished (point-sized).

• At C: Image is formed at C; it is real, inverted, and the same size as the object.

• Between C and F: Image is formed beyond C; it is real, inverted, and magnified (larger).

• At F: Image is formed at infinity; it is real, inverted, and highly enlarged.

• Between F and P (Pole): Image is formed behind the mirror; it is virtual, erect, and enlarged.

• Uses of Concave Mirrors: They are commonly used in shaving mirrors and makeup mirrors to see an enlarged image, by dentists to see large images of teeth, and in solar furnaces to concentrate sunlight.

Important Points

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

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

• Magnification (m): It is the ratio of the height of the image to the height of the object. It is expressed as m = h'/h = -v/u. For real and inverted images, the magnification is negative, and for virtual and erect images, it is positive.

• In the case of an object beyond C, the value of |m| is less than 1, confirming that the image is diminished.

Q25. Answer: (d) Principal focus

The correct answer is Principal focus.

Key Points

• The Principal focus (represented by the letter F) is the point on the principal axis where all incident rays that are traveling parallel to the principal axis meet or appear to originate from after undergoing reflection.

• In a concave mirror, the rays of light actually converge at this point after reflection. Because the rays physically meet at the focus, a concave mirror is said to have a real focus.

• In a convex mirror, the rays of light diverge after reflection, but they appear to come from a point situated behind the mirror. Thus, a convex mirror is characterized by a virtual focus.

• The location of the Principal focus is always on the Principal axis, which is the imaginary line passing through the Pole and the Centre of curvature.

• The focal length (denoted as f) is the distance between the Pole (P) and the Principal focus (F) of a spherical mirror. Hence, the correct answer is Principal focus.

Additional Information

• Centre of Curvature:

• The Centre of curvature (represented by C) is the center of the hollow glass sphere of which the spherical mirror is a part.

• For a concave mirror, the centre of curvature lies in front of the reflecting surface, whereas for a convex mirror, it lies behind the reflecting surface. Hence, statement 1 is incorrect.

• Pole:

• The Pole (represented by P) is the geometric center or the midpoint of the reflecting surface of a spherical mirror.

• It lies on the surface of the mirror and is the point through which the principal axis passes. Hence, statement 2 is incorrect.

• Aperture:

• The Aperture refers to the effective diameter of the reflecting surface of the spherical mirror.

• It determines the amount of light that falls on the mirror and thus influences the intensity or brightness of the image formed. Hence, statement 3 is incorrect.

• Radius of Curvature:

• The Radius of curvature (represented by R) is the distance from the Pole to the Centre of curvature.

• It represents the radius of the sphere from which the mirror was originally cut.

Important Points

• Relationship between R and f: For spherical mirrors with a small aperture, the Radius of curvature (R) is found to be exactly twice the focal length (f). This is expressed by the mathematical formula R = 2f.

• Sign Convention: According to the New Cartesian Sign Convention, the focal length of a concave mirror is considered negative,

while the focal length of a convex mirror is considered positive.

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

• Paraxial Rays: The definitions of focus and focal length usually apply to paraxial rays, which are rays that are very close to the principal axis and make small angles with it.

Q26. Answer: (a) 45

Shortcut Trick

Identify the frequency of each observation in the dataset.

Observations: 45 (4 times), 42 (2 times), 48 (2 times), 52 (2 times), Others (1 time).

The Mode is the value that occurs most frequently.

Maximum frequency is 4, which corresponds to the value 45.

Therefore The correct answer is 45.

Alternate Method

Given Data: 55, 45, 44, 48, 42, 45, 52, 53, 42, 50, 54, 49, 52, 45, 47, 43, 45, 48

Formula Used: Mode = Value with the highest frequency in the distribution.

Arrange the data points and count their occurrences:

=> Frequency of 42 = 2

=> Frequency of 45 = 4

=> Frequency of 48 = 2

=> Frequency of 52 = 2

=> Frequency of 43, 44, 47, 49, 50, 53, 54, 55 = 1 each

=> Comparing frequencies: 4 > 2 > 1

Therefore The observation with the maximum frequency is 45.

Therefore The correct answer is 45.

Additional Information

Empirical Relationship

For a moderately skewed distribution: Mode = 3 × Median − 2 × Mean.

Types of Mode

A data set can be unimodal (one mode), bimodal (two modes), or multimodal (more than two modes).

Median of Data

The Median is the middle value when data is arranged in ascending order. For 18 terms, it is the average of 9^(th) and 10^(th) terms.

Q27. Answer: (c) 40 km/h

Shortcut Trick

When two equal distances are covered at speeds x and y, Average Speed = (2 × x × y) ÷ (x + y).

Here, x = 60 km/h and y = 30 km/h.

Average Speed = (2 × 60 × 30) ÷ (60 + 30) = 3600 ÷ 90 = 40 km/h.

Therefore The correct answer is 40 km/h.

Alternate Method

Given: Speed 1 (v1) = 60 km/h, Speed 2 (v2) = 30 km/h. Let total distance be 2d.

Formula Used: Average Speed = Total Distance ÷ Total Time

=> Time for first half (t1) = d ÷ 60

=> Time for second half (t2) = d ÷ 30

=> Total Time (T) = (d ÷ 60) + (d ÷ 30) = (d + 2d) ÷ 60 = 3d ÷ 60 = d ÷ 20

=> Average Speed = 2d ÷ (d ÷ 20) = 2d × (20 ÷ d)

=> Average Speed = 40 km/h

Therefore The correct answer is 40 km/h.

Additional Information

Harmonic Mean

When distance is constant, Average Speed is the Harmonic Mean of the individual speeds.

Equal Time Intervals

If a person travels at speed v1 for time T and speed v2 for the same time T, Average Speed = (v1 + v2) ÷ 2 (Arithmetic Mean).

Relative Speed

For two objects moving in opposite directions, relative speed = s1 + s2. In same direction, relative speed = |s1 − s2|.

Q28. Answer: (d) 1

Shortcut Trick

By using the standard trigonometric identity:

$\sec^2\theta - \tan^2\theta = 1$

Here, the angle $\theta = 50°$.

$\sec^2 50° - \tan^2 50° = 1$

Therefore The correct answer is 1.

Alternate Method

Given:

Expression: $\sec^2 50° - \tan^2 50°$

Formula Used:

Fundamental Trigonometric Identity: $\sec^2\theta - \tan^2\theta = 1$

Calculations:

=> Let $\theta = 50°$

=> $\sec^2 50° - \tan^2 50° = 1$

Therefore The correct answer is 1.

Additional Information

Pythagorean Trigonometric Identities

There are three fundamental Pythagorean identities: $\sin^2\theta + \cos^2\theta = 1$, $1 + \tan^2\theta = \sec^2\theta$, and $1 + \cot^2\theta = \text{cosec}^2\theta$.

Reciprocal Relations

The functions $\sec\theta$ and $\tan\theta$ can be written as $\sec\theta = 1/\cos\theta$ and $\tan\theta = \sin\theta/\cos\theta$.

Q29. Answer: (c) Scheme iii

Shortcut Trick

To find the least beneficial scheme for a customer, we look for the lowest overall discount percentage.

Scheme i: 34%.

Scheme ii: 37 + 8 − (37 × 8 ÷ 100) = 45 − 2.96 = 42.04%.

Scheme iii: 7 + 27 − (7 × 27 ÷ 100) = 34 − 1.89 = 32.11%.

Comparing the values: 32.11% < 34% < 42.04%.

The lowest discount is 32.11%, which is Scheme iii.

Therefore The correct answer is Scheme iii.

Alternate Method

Given: Three different discount schemes. Goal: Identify the scheme with the minimum effective discount.

Formulas: Effective Discount for successive discounts a% and b% = (a + b − ab ÷ 100)%.

=> Scheme i: Net Discount = 34%.

=> Scheme ii: Net Discount = 37 + 8 − (37 × 8 / 100) = 45 − 2.96 = 42.04%.

=> Scheme iii: Net Discount = 7 + 27 − (7 × 27 / 100) = 34 − 1.89 = 32.11%.

=> Comparing all schemes, 32.11% is the smallest value.

Therefore The correct answer is Scheme iii.

Additional Information

Effective Discount

When multiple discounts are applied, the total discount is always less than the sum of individual percentages because subsequent discounts are applied to already reduced prices.

Customer's Perspective

A customer always benefits from the highest discount percentage, while the least beneficial scheme is the one providing the lowest effective discount.

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Q30. Answer: (a) 720

Shortcut Trick

Savings = 50% => Expenditure = 100% − 50% = 50%.

Since 50% (Expenditure) = Rs. 360,

Then 100% (Income) = Rs. 360 × 2 = Rs. 720.

Therefore The correct answer is Rs. 720.

Alternate Method

Given:

Savings Percentage = 50%

Expenditure Value = Rs. 360

Formula Used:

Income = Expenditure + Savings

Calculations:

=> Let total Income be Rs. X.

=> Expenditure % = 100% − Savings % = 100% − 50% = 50%.

=> 50% of X = 360

=> (50/100) × X = 360

=> X/2 = 360

=> X = 360 × 2 = 720

Therefore The correct answer is Rs. 720.

Additional Information

Percentage Change

Percentage change = (Change / Original Value) × 100. This is used to calculate growth or reduction in income.

Income-Expenditure Relation

The fundamental relation is Income = Expenditure + Savings. If any two variables are known, the third can be found.

Successive Percentage

If income increases by a% and then b%, effective increase = (a + b + ab/100)%.

Q31. Answer: (b) 3

Shortcut Trick

Let the total capacity of the cistern be 12 units (LCM of 6 and 12).

Combined efficiency of P and Q = 12 ÷ 6 = 2 units/hour.

Efficiency of P alone = 12 ÷ 12 = 1 unit/hour => Efficiency of Q = 2 − 1 = 1 unit/hour.

One-fourth of the cistern = 12 ÷ 4 = 3 units.

Time taken by Q alone to fill one-fourth of the cistern = 3 ÷ 1 = 3 hours.

Therefore The correct answer is 3 hours.

Alternate Method

Given:

Time taken by P and Q together = 6 hours

Time taken by P alone = 12 hours

Person	Days	Total Work	Efficiency
P + Q	6 hours	12 units	2 units/hour
P	12 hours	1 unit/hour	

Calculations:

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

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

=> One-fourth of the total work = 12 × (1 ÷ 4) = 3 units

=> Time taken by Q to complete 3 units of work = 3 ÷ 1 = 3 hours

Therefore The correct answer is 3 hours.

Additional Information

Efficiency and Time Relationship

Efficiency of a worker is inversely proportional to the time taken to complete a work. If time ratio is a:b, then the efficiency ratio is b:a.

Pipes and Cisterns Negative Work

In inlet-outlet pipe systems, the outlet pipe performs negative work. Net efficiency is calculated by subtracting the outlet pipe efficiency from the inlet pipe efficiency.

Q32. Answer: (c) 17

Shortcut Trick

The given expression is in the form of $(a^3 + b^3) \div (a^2 - ab + b^2)$.

By Algebraic Identity, this always simplifies to $(a + b)$.

Here, a = 9.73 and b = 7.27.

Result = 9.73 + 7.27 = 17.

Therefore The correct answer is 17.

Alternate Method

Given:

The expression is $(9.73 \times 9.73 \times 9.73 + 7.27 \times 7.27 \times 7.27) \div (9.73 \times 9.73 - 9.73 \times 7.27 + 7.27 \times 7.27)$

Formula Used:

We use the Sum of Cubes identity: $a^3 + b^3 = (a + b)(a^2 - ab + b^2)$

Calculations:

Let a = 9.73 and b = 7.27.

=> The expression becomes: $(a^3 + b^3) \div (a^2 - ab + b^2)$

=> Substituting the identity: $[(a + b)(a^2 - ab + b^2)] \div (a^2 - ab + b^2)$

=> The common term $(a^2 - ab + b^2)$ in the numerator and denominator cancels out.

=> Remaining expression = a + b

=> Required value = 9.73 + 7.27

=> Required value = 17.00

Therefore The correct answer is 17.

Additional Information

Algebraic Identities for Cubes

Standard identities like $a^3 + b^3$ and $a^3 - b^3$ are essential for simplifying complex decimal or fraction calculations in Quantitative Aptitude.

Difference of Cubes

The formula $a^3 - b^3 = (a - b)(a^2 + ab + b^2)$ is the counterpart to the sum of cubes identity and follows similar simplification steps.

BODMAS Rule

While identities provide shortcuts, always follow the BODMAS (Brackets, Orders, Division, Multiplication, Addition, Subtraction) priority for general simplification tasks.

Q33. Answer: (c) 20

Shortcut Trick

Subtract the remainders from the numbers: (1005 − 5), (244 − 4), (1343 − 3).

Resulting numbers: 1000, 240, 1340.

Find the HCF of 1000, 240, and 1340.

Since all numbers end in 0, 10 is a factor; check the remaining parts (100, 24, 134), their common factor is 2. Therefore HCF = 20.

Therefore The correct answer is 20.

Alternate Method

Given:

Numbers: 1005, 244, 1343

Remainders: 5, 4, 3

Calculations:

=> Number 1 = 1005 − 5 = 1000

=> Number 2 = 244 − 4 = 240

=> Number 3 = 1343 − 3 = 1340

=> To find the greatest number, calculate HCF(1000, 240, 1340).

=> Prime factorization:

=> 1000 = $2^3 \times 5^3$

=> 240 = 2^4 × 3 × 5

=> 1340 = $2^2 \times 5 \times 67$

=> HCF = $2^2 \times 5 = 4 \times 5 = 20$

Therefore The correct answer is 20.

Additional Information

HCF and Remainder Concept

To find the greatest number that divides x, y, and z leaving remainders a, b, and c, we calculate HCF((x−a), (y−b), (z−c)).

LCM and Remainder Concept

To find the least number which when divided by x, y, and z leaves a remainder r in each case, the answer is LCM(x, y, z) + r.

Difference Method for HCF

The HCF of a set of numbers is always a factor of the difference between any two numbers in that set.

Q34. Answer: (c) 72

Shortcut Trick

In problems where Sum (S) and Difference (D) are given:

Larger Quantity (Mangoes) = (Sum + Difference) ÷ 2

=> Mangoes = (96 + 48) ÷ 2 = 144 ÷ 2 = 72

Therefore The correct answer is 72.

Alternate Method

Let the number of Oranges be x.

Then the number of Mangoes = x + 48

=> Total fruits = Mangoes + Oranges = 96

=> (x + 48) + x = 96

=> 2x + 48 = 96

=> 2x = 96 − 48 = 48

=> x = 24

=> Mangoes = 24 + 48 = 72

Therefore The correct answer is 72.

Additional Information

Sum and Difference Formula

If A + B = S and A − B = D, then the larger value A = (S + D) ÷ 2 and the smaller value B = (S − D) ÷ 2.

Ratio and Proportion

Once values are found, the ratio of Mangoes to Oranges can be expressed as 72:24, which simplifies to 3:1.

Linear Equations

Problems involving two variables can always be solved by establishing two independent equations based on the given conditions.

Q35. Answer: (d) 56.25%

Shortcut Trick

Surface area of a sphere is proportional to r^2 (radius squared).

When a value depends on the product of two variables (r × r), apply the successive percentage change formula: x + y + (x × y)/100.

Net percentage increase = 25 + 25 + (25 × 25)/100

=> 50 + 625/100 = 50 + 6.25 = 56.25%

Therefore The correct answer is 56.25%.

Alternate Method

Given: Percentage increase in radius (r) = 25%

Formula Used: Surface Area (A) = $4\pi r^2$

=> Let the initial radius (r1) be 100 units.

=> Initial Surface Area (A1) = $4 \times \pi \times (100)^2 = 40000\pi$

=> New radius (r2) after 25% increase = 125 units.

=> New Surface Area (A2) = $4 \times \pi \times (125)^2 = 4 \times \pi \times 15625 = 62500\pi$

=> Increase in Surface Area = $62500\pi - 40000\pi = 22500\pi$

=> Percentage Increase = (Increase ÷ Initial Area) × 100

=> Percentage Increase = $(22500\pi \div 40000\pi) \times 100 = 56.25\%$

Therefore The correct answer is 56.25%.

Additional Information

Volume Change of Sphere

Since Volume (V) = $4/3\ \pi r^3$, if the radius increases by x%, the volume increases by $[(1 + x/100)^3 - 1] \times 100\%$.

Ratio of Areas

If the ratio of the radii of two spheres is a : b, then the ratio of their surface areas is $a^2 : b^2$ and the ratio of their volumes is $a^3 : b^3$.

Hemisphere Surface Area

For a hemisphere of radius r, the Curved Surface Area (CSA) is $2\pi r^2$ and the Total Surface Area (TSA) is $3\pi r^2$.

Q36. Answer: (d) 19:24

Shortcut Trick

Convert 2 days into hours: 2 × 24 = 48 hours.

Required Ratio = 38 : 48.

Divide both by the Highest Common Factor (HCF) which is 2.

Simplified Ratio = 19 : 24.

Therefore The correct answer is 19:24.

Alternate Method

Given:

First value = 38 hours

Second value = 2 days

Conversion:

=> 1 day = 24 hours

=> 2 days = 2 × 24 = 48 hours

Calculation:

=> Ratio = 38 / 48

=> Ratio = (2 × 19) / (2 × 24)

=> Ratio = 19 : 24

Therefore The correct answer is 19:24.

Additional Information

Unit Consistency in Ratio

A ratio must always be calculated between quantities of the same unit. Always convert the larger unit to the smaller unit to avoid decimals.

Simplest Form of Ratio

A ratio a:b is in its simplest form if the HCF of a and b is 1. In this case, HCF(38, 48) = 2, so we divide both by 2.

Time Conversion Constants

1 Day = 24 Hours, 1 Hour = 60 Minutes, 1 Minute = 60 Seconds.

Q37. Answer: (d) 25

Shortcut Trick

Net deviation of given 5 numbers from Mean (26) = (25−26) + (29−26) + (25−26) + (32−26) + (24−26) = −1 + 3 − 1 + 6 − 2 = +5.

To maintain the mean at 26, the deviation of x must be −5 => x = 26 − 5 = 21.

Arranging data in ascending order: 21, 24, 25, 25, 29, 32.

For n = 6 (even), Median = Average of 3^(rd) and 4^(th) terms = (25 + 25) ÷ 2 = 25.

Therefore The correct answer is 25.

Alternate Method

Given: Observations = 25, 29, 25, 32, 24, x | Number of observations (n) = 6 | Mean = 26.

Formula Used: Mean = Sum of observations ÷ Total number of observations

=> Mean = (25 + 29 + 25 + 32 + 24 + x) ÷ 6 = 26
=> 135 + x = 26 × 6
=> 135 + x = 156
=> x = 156 − 135 = 21
=> Arranging observations in ascending order: 21, 24, 25, 25, 29, 32
=> Since n = 6 (even), Median = [(n/2)^(th) term + (n/2 + 1)^(th) term] ÷ 2
=> Median = [3^(rd) term + 4^(th) term] ÷ 2
=> Median = (25 + 25) ÷ 2 = 25
Therefore The correct answer is 25.
Additional Information
Arithmetic Mean
The average of a set of numbers, calculated by dividing the sum of all values by the total count of values.
Median for Odd Observations
If n is odd, the median is the middle-most value, calculated as the ((n + 1)/2)^(th) observation.
Empirical Relationship
For a moderately skewed distribution: Mode = 3 × Median − 2 × Mean.

Q38. Answer: (b) 336

Shortcut Trick
Simplified Ratio = 4/6 : 1 : 1 = 2/3 : 1 : 1 = 2 : 3 : 3
Total units = 2 + 3 + 3 = 8 units
8 units = 896 → 1 unit = 112
Third monkey (3 units) = 3 × 112 = 336
Therefore The correct answer is 336 bananas.
Alternate Method
Given: Total bananas = 896 | Ratio = 4/6 : 2/2 : 2/2
Step 1: Simplify the fractions in the ratio
=> 4/6 = 2/3
=> 2/2 = 1
=> Ratio = 2/3 : 1 : 1
Step 2: Convert to whole numbers by multiplying by 3
=> 2 : 3 : 3
Step 3: Calculate the share of the third monkey
=> Sum of ratio parts = 2 + 3 + 3 = 8
=> Third monkey's share = (3/8) × 896
=> 3 × 112 = 336
Therefore The correct answer is 336 bananas.
Additional Information
Ratio Simplification
To simplify a ratio involving fractions, multiply each term by the Least Common Multiple (LCM) of the denominators.
Proportional Division
If a quantity 'A' is divided in ratio a:b:c, the third part is calculated as [c / (a + b + c)] × A.
Duplicate Ratio
The duplicate ratio of a:b is $a^2 : b^2$.

Q39. Answer: (a) 15.6

Shortcut Trick
For a square, the relationship between Area and Perimeter is:
Perimeter = 4 × √Area
Perimeter = 4 × √15.21 = 4 × 3.9 = 15.6
Therefore The correct answer is 15.6 cm.
Alternate Method

Given:

Area of the square = 15.21 cm²

Formula Used:

1. Area of square = (side)²

2. Perimeter of square = 4 × side

Calculations:

=> Let the side length of the square be a cm.

=> a² = 15.21

=> a = √15.21

=> a = 3.9 cm

=> Perimeter = 4 × a

=> Perimeter = 4 × 3.9

=> Perimeter = 15.6 cm

Therefore The correct answer is 15.6 cm.

Additional Information

Properties of a Square

A square is a regular quadrilateral with four equal sides and four equal angles (each 90°).

Diagonal of a Square

The length of the diagonal (d) is given by d = side × √2.

Relationship between Area and Diagonal

The Area can also be calculated using the diagonal: Area = (diagonal)² ÷ 2.

Q40. Answer: (a) 1

Shortcut Trick

For divisibility by 11, the difference between the sum of digits at odd positions and even positions must be 0 or a multiple of 11.

Sum of odd position digits (2 + 7 + Y) − Sum of even position digits (X + 3 + 5) = 0, 11, ...

=> (9 + Y) − (X + 8) = 0

=> 1 + Y − X = 0 => X − Y = 1.

Therefore The correct answer is 1.

Alternate Method

Given: The number is 2X73Y5 and it is divisible by 11.

Step-by-step Calculation:

=> Sum of digits at odd places (S1) = 2 + 7 + Y = 9 + Y

=> Sum of digits at even places (S2) = X + 3 + 5 = X + 8

=> According to Divisibility Rule of 11: (S1 − S2) = 0 or 11k

=> (9 + Y) − (X + 8) = 0

=> 9 + Y − X − 8 = 0

=> 1 + Y − X = 0

=> X − Y = 1

Therefore The correct answer is 1.

Additional Information

Divisibility Rule of 11

A number is divisible by 11 if the difference between the sum of the digits at odd places and the sum of the digits at even places is either 0 or a multiple of 11.

Divisibility Rule of 9

A number is divisible by 9 if the sum of all its digits is divisible by 9.

Divisibility Rule of 3

A number is divisible by 3 if the sum of its digits is a multiple of 3.

Q41. Answer: (c) 5

Shortcut Trick

Simplify inner values first

$24^2 - 16^2 + 2^2 = 576 - 256 + 4 = 324 \Rightarrow \sqrt{324} = 18$

$2^2 \times 3^2 + \sqrt{169} = 4 \times 9 + 13 = 36 + 13 = 49 \Rightarrow \sqrt{49} = 7$

Total = $\sqrt{(18 + 7)} = \sqrt{25}$

Therefore Answer = 5

Alternate Method

Given:

$\sqrt{(\sqrt{(24^2 - 16^2 + 2^2)} + \sqrt{(2^2 \times 3^2 + \sqrt{169})})}$

Concept Used:

BODMAS rule

Calculation:

$\Rightarrow \sqrt{(\sqrt{(576 - 256 + 4)} + \sqrt{(4 \times 9 + \sqrt{169})})}$

$\Rightarrow \sqrt{(\sqrt{(320 + 4)} + \sqrt{(36 + \sqrt{169})})}$

$\Rightarrow \sqrt{(\sqrt{324} + \sqrt{(36 + 13)})}$

$\Rightarrow \sqrt{(18 + \sqrt{49})}$

$\Rightarrow \sqrt{(18 + 7)}$

$\Rightarrow \sqrt{25}$

$\Rightarrow 5$

Therefore The correct answer is 5.

Additional Information

BODMAS Rule

Order: Brackets → Orders (powers, roots) → Division → Multiplication → Addition → Subtraction

Perfect Squares

Numbers like 324 and 49 are perfect squares: $\sqrt{324} = 18$, $\sqrt{49} = 7$

Nested Roots

Solve inner square roots first, then move outward step-by-step

Simplification Trick

Always try to convert expressions into perfect squares for quick evaluation

Q42. Answer: (d) 1,500

Shortcut Trick

Let the cost price for Poonam be x.

Using the multiplier method: $x \times (95 \div 100) \times (108 \div 100) = 1,539$.

$x \times 0.95 \times 1.08 = 1,539$.

$x \times 1.026 = 1,539$.

$x = 1,539 \div 1.026 = 1,500$.

Therefore The correct answer is Rs. 1,500.

Alternate Method

Given: Loss% of Poonam = 5%, Profit% of Mohini = 8%, Price paid by Rupashi = Rs. 1,539.

Formulas: SP = CP × (100 ± P/L%) ÷ 100

=> Let Poonam cost price = CP1.

=> Mohini cost price (SP of Poonam) = CP1 × (95 ÷ 100).

=> Rupashi cost price (SP of Mohini) = [CP1 × (95 ÷ 100)] × (108 ÷ 100) = 1,539.

=> CP1 × (19 ÷ 20) × (27 ÷ 25) = 1,539.

=> CP1 × (513 ÷ 500) = 1,539.

=> CP1 = (1,539 × 500) ÷ 513 = 3 × 500 = 1,500.

Therefore The correct answer is Rs. 1,500.

Additional Information

Chain Rules in Profit and Loss

When an item is passed through multiple hands, the final cost price is calculated by multiplying the initial cost price with successive profit/loss factors.

Successive Percentage Change

If there is a loss of x% followed by a gain of y%, the net change is given by $[y - x - (xy \div 100)]\%$.

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Q43. Answer: (c) 7 1/2 hours

Shortcut Trick

Total Capacity (LCM of 4, 6, 12) = 12 units.

Efficiencies: A = +3, B = +2, C = −1.

In 1 cycle (3 hours), net work done = 3 + 2 − 1 = 4 units.

After 2 cycles (6 hours), work done = 4 × 2 = 8 units.

Remaining 4 units: A fills 3 units in 1 hour; B fills remaining 1 unit in 1/2 hour.

Total time = 6 + 1 + 1/2 = 7 ½ hours.

Therefore The correct answer is 7 ½ hr.

Alternate Method

Given: Filling time for Pipe A = 4 hr, Pipe B = 6 hr. Emptying time for Pipe C = 12 hr.

Person	Days	Total Work	Efficiency
Pipe A	4 hr	12 units	+3
Pipe B	6 hr	+2	
Pipe C	12 hr	−1	

=> Total work in 1 cycle (3 hours) = Efficiency (A + B + C)

=> Work in 3 hours = 3 + 2 − 1 = 4 units

=> Work in 6 hours (2 cycles) = 4 × 2 = 8 units

=> Remaining work = 12 − 8 = 4 units

=> On 7^(th) hour, Pipe A fills 3 units. Remaining = 4 − 3 = 1 unit.

=> On 8^(th) hour, Pipe B fills 1 unit. Time taken = 1 unit ÷ 2 unit/hr = 0.5 hr.

=> Total time = 6 + 1 + 0.5 = 7.5 hr.

Therefore The correct answer is 7 ½ hr.

Additional Information

Alternative Work Pattern

When pipes work alternately, calculate the net work for one full cycle and determine how many full cycles fit into the total work before the final filling stage.

Pipes and Cisterns Convention

Inlet pipes are assigned positive efficiency (+), while outlet/leakage pipes are assigned negative efficiency (−).

Total Work Formula

Total Capacity = LCM of individual times. Time taken = Total Capacity ÷ Combined Efficiency.

Q44. Answer: (d) 56700

Shortcut Trick

Let the number be N.

Direct Equation: 4/7 × 2/100 × N = 648

8/700 × N = 648

N = 648 × 700 ÷ 8 = 81 × 700 = 56700

Therefore The correct answer is 56700.

Alternate Method

Given: 4/7 of 2% of a number is 648.

Formula Used: Value = (Percentage ÷ 100) × Fraction × Number

=> Let the number be x.

=> (4/7) × (2/100) × x = 648

=> (8/700) × x = 648

=> x = (648 × 700) ÷ 8

=> x = 81 × 700

=> x = 56700

Therefore The correct answer is 56700.

Additional Information

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Percentage to Fraction Conversion

To convert percentage to fraction, divide by 100. Example: 2% = 2/100 = 1/50.

Product of Fractions

The word 'of' in mathematical expressions represents multiplication (×).

Base Value Calculation

If a/b of c% of N = V, then N = (V × b × 100) ÷ (a × c).

Q45. Answer: (b) 55°

Shortcut Trick

In right-angled ΔBDC, the acute angles are complementary.

angle C = 90° − angle DBC = 90° − 65° = 25°.

By the Exterior Angle Theorem in ΔAEC, the exterior angle angle AEB is the sum of interior opposite angles.

angle AEB = angle CAE + angle C = 30° + 25° = 55°.

Therefore The correct answer is 55°.

Alternate Method

Given: angle DBC = 65°, angle CAE = 30°, BD perpendicular to AC at D.

Formula Used: Sum of angles in a triangle = 180°; Exterior angle property.

In ΔBDC:

=> angle BDC = 90° (Since BD perpendicular to AC)

=> angle BCD = 180° − (angle BDC + angle DBC)

=> angle BCD = 180° − (90° + 65°) = 25°

Q46. Answer: (b) 10 years

Shortcut Trick

The age difference between two people remains constant throughout their lives.

Difference = 25 years. After 15 years, Ratio of Mother : Daughter = 2 : 1.

Ratio difference (2 − 1) = 1 unit → 25 years.

Daughter's age after 15 years = 1 unit × 25 = 25 years.

Daughter's current age = 25 − 15 = 10 years.

Therefore The correct answer is 10 years.

Alternate Method

Given: Difference in age = 25 years; Future condition = after 15 years.

Let Daughter's current age = x years.

Mother's current age = x + 25 years.

After 15 years:

=> Daughter = x + 15

=> Mother = (x + 25) + 15 = x + 40

According to the question:

=> Mother = 2 × Daughter

=> x + 40 = 2(x + 15)

=> x + 40 = 2x + 30

=> 2x − x = 40 − 30

=> x = 10

Therefore The correct answer is 10 years.

Additional Information

Constant Age Difference

The difference between the ages of two persons never changes over time; if A is 5 years older than B today, A will always be 5 years older than B.

Ratio Method for Ages

When ratios at two different times are given, equate the difference in ratio units to the constant actual age difference to find the value of 1 unit.

Linear Equation in One Variable

Most age problems can be solved by assuming the current age of the younger person as 'x' and forming an equation based on the

given conditions.

Q47. Answer: (a) 76.19%

Shortcut Trick

Identify the Free Articles and Total Articles: Free = 16, Paid = 5.

Total Articles = 16 + 5 = 21.

Discount% = (Free Articles ÷ Total Articles) × 100.

Discount% = (16 ÷ 21) × 100 ≈ 76.19%.

Therefore The correct answer is 76.19%.

Alternate Method

Given → Buy 5 articles and get 16 articles free.

Formulas: Discount% = (Discount ÷ MP) × 100 | MP = Price of total articles.

→ Let the Marked Price (MP) of 1 article be 1 unit.

→ MP of total articles (5 + 16 = 21) = 21 units.

→ Selling Price (SP) = Price of 5 articles = 5 units.

→ Discount = MP − SP = 21 − 5 = 16 units.

→ Discount% = (16 ÷ 21) × 100.

→ Discount% = 1600 ÷ 21 = 76.1904...% ≈ 76.19%.

Therefore The correct answer is 76.19%.

Additional Information

Buy X Get Y Free

In such offers, the discount is always calculated on the total quantity (X + Y) as the Marked Price is representative of all items leaving the store. Discount% = [Y ÷ (X + Y)] × 100.

Marked Price vs Selling Price

The Marked Price is the total value of all items (Paid + Free), while the Selling Price is the value the customer actually pays (Paid items only).

Q48. Answer: (d) 50

Shortcut Trick

Using the Weighted Average formula: Average Speed = (s1×t1 + s2×t2) ÷ (t1 + t2)

58 = (70×1 + p×1.5) ÷ (1 + 1.5)

58 × 2.5 = 70 + 1.5p

145 − 70 = 1.5p => 75 = 1.5p => p = 50

Therefore The correct answer is 50 km/hr.

Alternate Method

Given:

Speed 1 (s1) = 70 km/hr, Time 1 (t1) = 1 hour

Speed 2 (s2) = p km/hr, Time 2 (t2) = 1.5 hours

Total Average Speed = 58 km/hr

Formula Used:

Total Distance = (s1 × t1) + (s2 × t2)

Average Speed = Total Distance ÷ Total Time

Calculations:

=> Total Time = 1 + 1.5 = 2.5 hours

=> Total Distance = 58 × 2.5 = 145 km

=> Distance covered in 1st part = 70 × 1 = 70 km

=> Distance covered in 2nd part = 145 − 70 = 75 km

=> Speed p = Distance ÷ Time = 75 ÷ 1.5

=> p = 50 km/hr

Therefore The correct answer is 50 km/hr.

Additional Information

Average Speed (Equal Distances)

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

Weighted Average Concept

Average Speed is the weighted mean of speeds with time as weights: (s1t1 + s2t2 + ...) ÷ (t1 + t2 + ...).

Relative Speed

When two objects move in the same direction, relative speed is |s1 − s2|. In opposite directions, it is s1 + s2.

Q49. Answer: (d) 30,000

Shortcut Trick

Let the total registered voters be 100%.

Voters who cast votes = 70%.

Candidate X got 60% of cast votes → Candidate Y got 40% of cast votes.

Votes for Y = 40% of 70% of Total = 28% of Total.

28% = 8400 → 1% = 300 → 100% = 30,000.

Therefore The correct answer is 30,000.

Alternate Method

Given:

Percentage of voters who cast votes = 70%

Percentage of votes for Candidate X = 60% of cast votes

Votes for Candidate Y = 8400

Calculations:

=> Percentage of votes for Candidate Y = 100% − 60% = 40% of cast votes

=> Let total registered voters be V

=> Cast votes = 0.70 × V

=> Votes for Y = 40% of (0.70 × V) = 0.40 × 0.70 × V

=> 8400 = 0.28 × V

=> V = 8400 ÷ 0.28

=> V = 30,000

Therefore The correct answer is 30,000.

Additional Information

Successive Percentage

When a percentage is applied on a value that has already been modified by another percentage, it is a successive change: Total × a% × b%.

Valid and Invalid Votes

In election problems, always distinguish between Total Voters, Cast Votes, and Valid Votes based on the question constraints.

Base Value Selection

Always identify what the percentage refers to (e.g., % of total vs % of cast votes) to avoid calculation errors.

Q50. Answer: (a) Rs. 2,178

Shortcut Trick

Effective rate for 2 years at 10% compound interest = 10 + 10 + (10 × 10)/100 = 21%.

Total amount percentage = 100% (Principal) + 21% (Interest) = 121%.

Amount = 121% of Rs. 1,800 = 1.21 × 1800 = Rs. 2,178.

Therefore The correct answer is Rs. 2,178.

Alternate Method

Given:

Principal (P) = Rs. 1,800

Rate (R) = 10% per annum

Time (n) = 2 years

Formula Used:

Amount (A) = $P(1 + R/100)^n$

Calculations:

=> $A = 1800 \times (1 + 10/100)^2$

=> $A = 1800 \times (110/100)^2$

=> A = 1800 × (11/10) × (11/10)

=> A = 1800 × (121/100)

=> A = 18 × 121

=> A = 2178

Therefore The correct answer is Rs. 2,178.

Additional Information

Compound Interest vs Simple Interest

The difference between CI and SI for 2 years is given by $P \times (R/100)^2$.

Successive Percentage Method

Compound interest is essentially a successive percentage increase on the principal. For two years, the net percentage change is x + y + (xy/100).

Rule of 72

To find the approximate time required to double the money at a given interest rate, divide 72 by the annual rate of interest.

Q51. Answer: (a) 50

The logic followed here is:

thus, "50" will replace the question mark in the given series.

Hence, the correct option is "Option 1".

Q52. Answer: (d) 157

The logic followed here is:

thus, "157" will replace the question mark in the given series.

Hence, the correct option is "Option 4".

Q53. Answer: (c) 32

BODMAS Table:

Given equation: 96 + 15 ÷ 5 − 154 × 14 = ?

Now, interchanging Signs '+' and '−', and Signs '×' and '÷', then:

=> 96 − 15 × 5 + 154 ÷ 14

=> 96 − 15 × 5 + 11

=> 96 − 75 + 11

=> 107 - 75

=> 32

Hence, the correct answer is Option 3.

Q54. Answer: (d) Only conclusion (I) is true

Given Statements:

All hammers are screwdrivers.

No screwdrivers are wrenches.

Some wrenches are pliers.

The least possible Venn diagram for the given statement is:

Conclusions:

I. No hammers are wrenches - True (Since all hammers are screwdrivers and no screwdrivers are wrenches, hammers cannot be wrenches).

II. No pliers are screwdrivers - False (Only some pliers are wrenches, and wrenches are not screwdrivers. But nothing is said about the remaining pliers, so some pliers may still be screwdrivers).

So, only conclusion I follows.

Hence, the correct answer is Option 4.

Q55. Answer: (a) SKOR

The logic followed here is:

For, JPUG → OLXE

For, TMQK → YITI

Now, for NOLT → SKOR

Now, applying the same logic for SWVV
So, SWVV → XSYT
Hence, the correct answer is "Option 1".

Q56. Answer: (c) One

Given: Six boxes J, K, L, M, N and O are kept one over the other but not necessarily in the same order.
J is kept immediately above N.
Only one box is kept between K and O.
O is the bottom-most box.
M is the top-most box.

Position	Box
6 (Top)	M
5	J
4	N
3	K
2	L
1 (Bottom)	O

Box immediately below M → 1
Hence, the correct answer is Option 3.

Q57. Answer: (b) TO 29

The logic followed here is:
For, TM 13 → WR 16
For, MF 18 → PK 21
Now, applying the same logic for QJ 26
So, QJ 26 → TO 29
Hence, the correct answer is "Option 2".

Q58. Answer: (b) Brother

Family Chart:
Decoding the Symbols:

Symbol	•	•	x	&
Meaning	Son	Brother	Wife	Father

Given: K - T + R x Z & V
It means: K is the brother of T, T is the son of R, R is the wife of Z, and Z is the father of V.
Hence, K is the brother of V.
Hence, the correct answer is Option 2.

Q59. Answer: (d) rf

The logic followed here is to compare the given sentences to find the common words and their corresponding codes.
Given:
nice large land → cd ak pi
land is fertile → rf pc ak
cost is high → si ig pc
So, fertile → rf
Hence, the correct answer is Option 4.

Q60. Answer: (a) 1

Given: A, B, C, D, E, F and G are sitting around a circular table facing the centre.
Only one person sits between E and A when counted from the left of A.

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B sits third to the right of C.
D sits third to the left of F.
B sits to the immediate right of D.
G is not an immediate neighbour of D.
So, only one person sits between C and F when counted from the right of F.
Hence, the correct answer is "Option 1".

Q61. Answer: (d) 114

The logic followed here is:
thus, "114" will replace the question mark in the given series.
Hence, the correct option is "Option 4".

Q62. Answer: (d) (26, 38, 54)

The logic followed here is:
Logic: The difference between the numbers follows a fixed pattern:
Second number = First number + 12
Third number = Second number + 16
(25, 37, 53)
=> 37 − 25 = 12
=> 53 − 37 = 16
(40, 52, 68)
=> 52 − 40 = 12
=> 68 − 52 = 16
Now, checking the options:
Option 1) (9, 21, 33)
=> 21 − 9 = 12
=> 33 − 21 = 12 (not 16)
Option 2) (39, 27, 43)
=> 27 − 39 = −12
=> 43 − 27 = 16 (pattern not consistent)
Option 3) (32, 44, 28)
=> 44 − 32 = 12
=> 28 − 44 = −16 (not valid sequence)
Option 4) (26, 38, 54)
=> 38 − 26 = 12
=> 54 − 38 = 16
Hence, the correct answer is Option 4.

Q63. Answer: (d) Four

Given: (Left) 3 6 8 9 1 5 7 3 2 4 6 1 9 7 8 2 5 3 9 6 1 4 2 7 (Right)
Now,
We need to identify the unique even digits present in the given series.
Even digits are: 0, 2, 4, 6, 8
(Left) 3 6 8 9 1 5 7 3 2 4 6 1 9 7 8 2 5 3 9 6 1 4 2 7 (Right)

Even Digit	Occurrence
2	Appears multiple times
4	Appears multiple times
6	Appears multiple times
8	Appears multiple times

So, unique even digits = {2, 4, 6, 8}
Total unique even digits = 4

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Hence, the correct answer is Option 4.

Q64. Answer: (d) 29 km to the north

The logic followed here is:

Given:

Tarun starts from Point A and drives 65 km East

He turns left → 42 km North

He turns left → 78 km West

He turns left → 71 km South

He turns left → 13 km East

So, To reach Point A again, he must travel 29 km North.

Hence, the correct answer is Option 4.

Q65. Answer: (a) NZC

The logic followed here is:

So, the missing term = NZC

Hence, the correct answer is Option 1.

Q66. Answer: (d) Neither conclusion (I) nor (II) follows

Given Statements:

Some chromium are gallium.

No gallium are gold.

All gold are steel.

The least possible Venn diagram for the given statement is:

Conclusions:

I. Some gold are gallium - False (Since no gallium are gold, there cannot be any overlap between gold and gallium).

II. Some gallium are steel - False (All gold are steel, but gallium has no relation with steel except that it cannot overlap with the gold part. So, no definite conclusion can be drawn).

So, neither conclusion I nor conclusion II follows.

Hence, the correct answer is Option 4.

Q67. Answer: (a) 19

BODMAS Table:

Given expression: 9 B 3 D 56 A 4 C 6 = ?

Now, substituting the signs: A = ÷, B = ×,C = +, D = −

=> 9 × 3 − 56 ÷ 4 + 6

=> 9 × 3 − 14 + 6

=> 27 − 14 + 6

=> 33 − 14

=> 19

Hence, the correct answer is Option 1.

Q68. Answer: (d) South-West

The logic followed here is:

Given:

Building X is to the south of Building Y

Building Z is to the east of Building Y

So, X lies to the South-West of Z.

Hence, the correct answer is Option 4.

Q69. Answer: (c) 1

Given: (Left) 4 © 7 # 3 $ 7 6 4 £ 8 $ 2 * £ & $ # % 1 * 2 (Right)

Now,

We need to find numbers which are immediately preceded by a number and immediately followed by a symbol.

So, needed pattern is: Number - Number - Symbol
(Left) 4 © 7 # 3 $ 7 6 4 £ 8 $ 2 * £ & $ # % 1 * 2 (Right)
So, total valid numbers = 1
Hence, the correct answer is Option 3.

Q70. Answer: (a) HWZ : FUX

The logic followed here is:
For, ELP : CJN
For, IQW : GOU
Now, checking the options:
Option 1) HWZ : FUX
Option 2) BTS : AWP
Option 3) BTD : VRY
Option 4) NRT : FSE
Hence, the correct answer is Option 1.

Q71. Answer: (d) MJK 102

The logic followed here is:
So, the missing term = MJK 102
Hence, the correct answer is Option 4.

Q72. Answer: (a) 9

BODMAS Table:
Given equation: 20 × 2 ÷ 2 − 3 + 7 = ?
Now, replacing the signs according to the given mapping:
=> 20 ÷ 2 + 2 × 3 − 7
=> 10 + 2 × 3 − 7
=> 10 + 6 − 7
=> 16 − 7
=> 9
Hence, the correct answer is Option 1.

Q73. Answer: (a) HE−FF

The logic followed here is based on the alphabetical position pattern:
Option 1: HE → FF
Option 2: MJ → LI
Option 3: XU → WT
Option 4: OL → NK
Thus, HE → FF does not follow this pattern.
Hence, the odd one out is Option 1.

Q74. Answer: (b) Zero

Given: Seven boxes R, S, L, N, Q, M and O are kept one over the other but not necessarily in the same order.
M is kept second from the bottom.
Only three boxes are kept between M and S, where S is kept above M.
L is kept immediately below S.
Only one box is kept between M and N.
R is not kept immediately above or below M.
Q is kept at one of the places above O.

Position	Box
7 (Top)	R
6	S

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5	L
4	N
3	Q
2	M
1 (Bottom)	O

Now, Boxes below O = 0

Hence, the correct answer is Option 2.

Q75. Answer: (a) Second to the right

Given: A, B, C, D, E and F are sitting around a circular table facing the centre.

B sits second to the left of D.

F is an immediate neighbour of A.

B sits to the immediate right of A.

C sits second to the left of E.

So, C sits second to the right of A.

Hence, the correct answer is "Option 1".

Q76. Answer: (d) Four

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

Now,

We need to find all unique numbers in the series that are less than 5.

Numbers less than 5 are: 1, 2, 3, 4 (each counted only once)

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

Number	Occurrence
1	Appears multiple times
2	Appears multiple times
3	Appears multiple times
4	Appears multiple times

So, unique numbers less than 5 = {1, 2, 3, 4}

Total unique numbers = 4

Hence, the correct answer is Option 4.

Q77. Answer: (d) 106

The logic followed here is:

Given:

VERL → 102

GZQT → 76

For, VERL →

V E R L

5 + 22 + 9 + 15 = 51

Code = 51 × 2 = 102

For, GZQT →

G Z Q T

20 + 1 + 10 + 7 = 38

Code = 38 × 2 = 76

Now, for BXNO →

B X N O

25 + 3 + 13 + 12 = 53

Code = 53 × 2 = 106

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Hence, the correct answer is Option 4.

Q78. Answer: (b) 6

Logic followed here is:

Given numbers: 351, 369, 458, 517, 619

The highest number in the series is 619.

Second digit of the highest number = 1

The lowest number in the series is 351.

Second digit of the lowest number = 5

Sum = 1 + 5 = 6

Hence, the correct answer is Option 2.

Q79. Answer: (a) OS - NS

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

Option 1: OS → NS

Option 2: LP → KO

Option 3: MQ → LP

Option 4: IM → HL

Thus, Options 2, 3, and 4 follow a consistent -1 shift for both letters, while Option 1 breaks the pattern as the second letter has a 0 shift.

Hence, the odd one out is Option 1.

Q80. Answer: (a) 1

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

No one sits to the right of G.

Only three people sit between G and D.

Only two people sit between D and C.

E sits third to the left of F.

B sits to the immediate right of F.

So, there are one people sitting to the right of C.

Hence, the correct answer is "Option 1".

Q81. Answer: (d) Naresh Mhaske

The correct answer is Naresh Mhaske.

Key Points

• Naresh Mhaske is a prominent leader of the Shiv Sena (Eknath Shinde faction) who currently serves as a Member of Parliament (MP) representing the Thane Lok Sabha constituency.

• In 2025, he was selected as a recipient of the prestigious Sansad Ratna Award, a recognition given to top-performing parliamentarians for their active participation and legislative contributions.

• Mhaske is a first-time MP, having secured his seat in the 2024 General Elections (18th Lok Sabha) by defeating his opponent from the Shiv Sena (UBT) faction in the Thane district of Maharashtra.

• Before his tenure in the Parliament, he served as the Mayor of Thane from November 2019 to March 2022, where he gained significant administrative experience.

• The award recognizes his exceptional performance in terms of parliamentary debates, the number of questions raised, and his overall engagement in the 18th Lok Sabha sessions. Hence, the correct answer is Naresh Mhaske.

Additional Information

• Sansad Ratna Awards:

• These awards were instituted in 2010 following a suggestion by the former President of India, Dr. A.P.J. Abdul Kalam, to honor the best-performing lawmakers.

• The awards are organized by the Prime Point Foundation and are based on the data provided by PRS Legislative Research regarding the performance of MPs in the Lok Sabha and Rajya Sabha.

• The selection criteria include factors such as attendance, participation in debates, introduction of Private Member Bills, and the number of state-related or national questions asked during the sessions.

• Thane Constituency:

• The Thane Lok Sabha constituency is one of the most significant political hubs in Maharashtra, often considered a stronghold of

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the Shiv Sena.

• In the 2024 elections, the seat witnessed a high-stakes battle, and Naresh Mhaske's victory solidified the influence of the Mahayuti alliance in the region.

• Other Options:

• Rahul Shewale: A senior leader and experienced MP from the Mumbai South Central constituency.

• Arvind Sawant: A veteran parliamentarian representing the Mumbai South constituency, belonging to the Shiv Sena (UBT).

• Dr. Varsha Gaikwad: A former state cabinet minister and current MP from Mumbai North Central, representing the Indian National Congress.

Important Points

• The Sansad Ratna Awards are highly regarded as they are non-government awards that use objective data to promote transparency and accountability in the Indian Parliament.

• A jury committee, typically comprising eminent parliamentarians and members of civil society, oversees the selection process for these honors.

• Recipients of this award often include both opposition and ruling party members, ensuring a balanced recognition of legislative merit across the political spectrum.

• Naresh Mhaske's achievement as a debutant MP highlights the increasing focus on new-age leadership and active participation from first-generation parliamentarians in the 18th Lok Sabha.

Q82. Answer: (d) ULPGM-V3

The correct answer is ULPGM-V3.

Key Points

• The Defence Research and Development Organisation (DRDO) successfully conducted the flight trial of the ULPGM-V3 (UAV-Launched Precision Guided Missile - Version 3) in July 2025.

• The test was carried out at a specialized defense range in Andhra Pradesh, aimed at validating the missile's guidance system and its ability to engage targets from unmanned platforms.

• The ULPGM-V3 is a lightweight, high-precision missile designed to be integrated into UAVs (Unmanned Aerial Vehicles) to enhance their offensive strike capabilities against ground-based assets.

• Equipped with an advanced Imaging Infrared (IIR) seeker, the missile can perform surgical strikes against both stationary and moving targets, including enemy tanks, command centers, and armoured personnel carriers.

• The successful development of this missile represents a significant leap in indigenous aerial combat technology, aligning with the Atmanirbhar Bharat initiative to modernize the Indian Armed Forces with home-grown equipment. Hence, the correct answer is ULPGM-V3.

Additional Information

• Astra Mk-II:

• The Astra Mk-II is an advanced Beyond Visual Range Air-to-Air Missile (BVRAAM).

• It is designed to engage enemy aircraft at long distances, with an estimated range of approximately 160 kilometres.

• The missile utilizes active radar homing and is a successor to the Astra Mk-I, which is already inducted into the Indian Air Force (IAF).

• Agni-P (Agni-Prime):

• The Agni-P is a new-generation nuclear-capable ballistic missile developed by DRDO.

• It is a two-stage canisterized solid propellant missile with a range capability between 1,000 and 2,000 kilometres.

• The canisterized system ensures that the missile can be stored for long periods and transported easily via rail or road, significantly improving its operational readiness.

• Nirbhay-V3:

• Nirbhay is India’s first indigenous long-range subsonic cruise missile.

• It is capable of carrying nuclear and conventional warheads and has a strike range of over 1,000 kilometres.

• The missile is known for its terrain-hugging capability, allowing it to fly at very low altitudes to evade enemy radar systems.

Important Points

• DRDO Background: The Defence Research and Development Organisation was established in 1958 by merging the Technical Development Establishment and the Directorate of Technical Development and Production. It functions under the Ministry of Defence.

• UAV Integration: The ULPGM series is vital for arming indigenous drones like the Tapus-BH-201 (MALE UAV) and the Archer-NG, providing them with a lethal stand-off strike capability.

• Precision Strike Technology: The use of laser-guided or IIR seekers in missiles like ULPGM-V3 minimizes collateral damage and ensures a high probability of kill (Pk) in complex battlefield environments.

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• Strategic Significance: Developing drone-launched missiles locally reduces the dependency on foreign systems like the American Hellfire or the Turkish MAM-L missiles.

Q83. Answer: (d) North Atlantic Treaty Organization (NATO)

The correct answer is North Atlantic Treaty Organization (NATO).

Key Points

• The North Atlantic Treaty Organization (NATO) is an intergovernmental military alliance established by the North Atlantic Treaty (also known as the Washington Treaty) signed on 4 April 1949.

• The core principle of NATO is collective defence, which is enshrined in Article 5 of its founding treaty. This article states that an armed attack against one or more of its members in Europe or North America shall be considered an attack against them all. Hence, the correct answer is North Atlantic Treaty Organization (NATO).

• The primary purpose of the alliance is to safeguard the freedom and security of its member countries through political and military means. Politically, it promotes democratic values, while militarily, it is committed to the peaceful resolution of disputes.

• NATO was originally formed by 12 founding members, including the United States, Canada, United Kingdom, France, and Italy, primarily to provide collective security against the threat posed by the Soviet Union during the Cold War era.

• Under the collective defence mechanism, if a member state is attacked, every other member is obligated to assist the party attacked, which may include the use of armed force to restore and maintain the security of the North Atlantic area.

Additional Information

• World Trade Organization (WTO):

• The WTO is the only global international organization dealing with the rules of trade between nations.

• It was established on 1 January 1995 following the Marrakesh Agreement, replacing the General Agreement on Tariffs and Trade (GATT).

• Its headquarters is located in Geneva, Switzerland. Its main function is to ensure that trade flows as smoothly, predictably, and freely as possible.

• World Health Organization (WHO):

• The WHO is a specialized agency of the United Nations responsible for international public health.

• It was founded on 7 April 1948 (celebrated as World Health Day) and is headquartered in Geneva, Switzerland.

• Its mandate includes advocating for universal healthcare, monitoring public health risks, and coordinating responses to health emergencies.

• UNESCO (United Nations Educational, Scientific and Cultural Organization):

• UNESCO aims to build peace through international cooperation in Education, the Sciences, and Culture.

• It was founded on 16 November 1945 and its headquarters is located in Paris, France.

• It is well known for designating World Heritage Sites to preserve cultural and natural heritage around the globe.

• Important Facts about NATO:

• The headquarters of NATO is located in Brussels, Belgium.

• As of 2024, NATO consists of 32 member countries, with Finland and Sweden being the most recent additions to the alliance.

• Article 5 has been invoked only once in the history of the alliance, which was in response to the September 11, 2001, terrorist attacks on the United States.

• The current Secretary General of NATO (as of 2024) is Mark Rutte, who succeeded Jens Stoltenberg.

Q84. Answer: (b) Very Poor (AQI 301–400)

The correct answer is Very Poor (AQI 301–400).

Key Points

• The Commission for Air Quality Management (CAQM) in National Capital Region (NCR) and Adjoining Areas is the statutory body responsible for implementing the Graded Response Action Plan (GRAP) to combat air pollution.

• Stage-II of the GRAP is specifically invoked when the Air Quality Index (AQI) in Delhi-NCR is forecast to or has already reached the 'Very Poor' category, which spans a numerical range of 301 to 400.

• In November 2025, the implementation of Stage-II necessitated restrictive measures to prevent further deterioration of air quality toward the 'Severe' category. Hence, the correct answer is Very Poor (AQI 301–400).

• Under this stage, the use of Diesel Generator (DG) sets is heavily regulated and generally banned except for essential services like hospitals and elevators to minimize vehicular and industrial emissions.

• Other mandatory actions under Stage-II include the mechanical sweeping and water sprinkling of identified roads on a daily basis and the intensification of inspections at construction and demolition (C&D) sites.

Additional Information

• Graded Response Action Plan (GRAP):

• It is a set of emergency measures that kick in to prevent further deterioration of air quality in Delhi-NCR. It was first notified in 2017 by the Ministry of Environment, Forest and Climate Change.

• The plan is divided into four stages based on the AQI levels:

• Stage-I ('Poor'): Triggered when AQI is between 201–300. Focuses on dust control at construction sites and waste management.

• Stage-II ('Very Poor'): Triggered when AQI is between 301–400. Focuses on DG set restrictions and increasing parking fees.

• Stage-III ('Severe'): Triggered when AQI is between 401–450. Includes bans on non-essential construction and specific vehicle types (e.g., BS-III petrol and BS-IV diesel cars).

• Stage-IV ('Severe+'): Triggered when AQI exceeds 450. This involves stopping the entry of trucks into Delhi and potentially shifting schools to online mode.

• Commission for Air Quality Management (CAQM):

• The CAQM was established through an Ordinance in 2020 and later by the CAQM in NCR and Adjoining Areas Act, 2021.

• It replaced the Environment Pollution (Prevention and Control) Authority (EPCA) and has the power to issue directions and entertain complaints for protecting and improving air quality.

Important Points

• Forecasting Mechanism: The decision to invoke stages of GRAP is based on forecasts provided by the Indian Institute of Tropical Meteorology (IITM) and the India Meteorological Department (IMD).

• Pollutants Monitored: The AQI calculation involves eight major pollutants: PM10, PM2.5, NO2, SO2, CO, O3, NH3, and Pb. However, PM2.5 and PM10 are the primary concerns in Delhi during the winter months of October and November.

• Geographical Scope: GRAP measures are applicable across the entire National Capital Region, which includes districts in Haryana, Uttar Pradesh, and Rajasthan, besides Delhi.

• Public Participation: During Stage-II, citizens are encouraged to use public transport (Metro and buses) and minimize the use of personal vehicles to reduce the carbon footprint and local pollution levels.

Q85. Answer: (d) Supreme Court of India

The correct answer is Supreme Court of India.

Key Points

• In November 2025, the Supreme Court of India expressed grave concern over the "severe plus" Air Quality Index (AQI) levels in Delhi and the National Capital Region (NCR).

• A bench comprising Justice Abhay S. Oka and Justice Augustine George Masih observed that the pollution levels had reached a stage where even wearing masks was becoming ineffective for the citizens.

• The Supreme Court pulled up the Commission for Air Quality Management (CAQM) for the delay in implementing the Graded Response Action Plan (GRAP), specifically Stage IV measures.

• The court invoked Article 21 of the Constitution of India, asserting that every citizen has a fundamental right to live in a pollution-free environment.

• The Supreme Court directed all NCR states to immediately constitute teams to monitor and enforce the GRAP-IV restrictions, which include a ban on truck entry (except for essential commodities) and the suspension of construction and demolition activities.

Additional Information

• Graded Response Action Plan (GRAP):

• GRAP is a set of emergency measures implemented in Delhi-NCR depending on the severity of air pollution.

• It is divided into four stages: Stage I (Poor), Stage II (Very Poor), Stage III (Severe), and Stage IV (Severe Plus).

• Stage IV is triggered when the AQI crosses the 450 mark, involving the strictest curbs like stopping the entry of non-essential commercial vehicles into Delhi.

• Commission for Air Quality Management (CAQM):

• The CAQM is a statutory body established under the Commission for Air Quality Management in National Capital Region and Adjoining Areas Act, 2021.

• It was formed to coordinate and oversee efforts to improve air quality in Delhi-NCR and adjoining states like Punjab, Haryana, Rajasthan, and Uttar Pradesh.

• Primary Pollutants:

• The crisis is often exacerbated by PM2.5 and PM10 particles, which can penetrate deep into the lungs.

• Key contributors to Delhi's air pollution in November include stubble burning (parali burning) in neighboring states, vehicular emissions, construction dust, and low wind speeds due to winter temperature inversion.

Important Points

• The Supreme Court clarified that even if the AQI falls below 450, the GRAP-IV restrictions should not be relaxed without the court's prior permission during the peak pollution season.

• The National Air Quality Index was launched in 2014 as part of the Swachh Bharat Abhiyan to provide a simplified "one

number-one color-one description" for the general public to understand air quality.

• Other bodies involved in pollution control include the Central Pollution Control Board (CPCB), established in 1974, which provides technical services to the Ministry of Environment, Forest and Climate Change.

Q86. Answer: (a) New Delhi

The correct answer is New Delhi.

Key Points

• The Ministry of Environment, Forest and Climate Change (MoEFCC) organized a national-level workshop in March 2025 to discuss and refine the National Adaptation Plan (NAP) of India.

• The workshop was held in New Delhi, serving as a central hub for policy-makers, climate scientists, and international delegates to deliberate on climate resilience strategies.

• The primary objective of the event was to strengthen the framework for climate change adaptation at both national and state levels, aligning with India's commitments under the Paris Agreement.

• The workshop emphasized the integration of traditional knowledge with modern scientific data to protect vulnerable communities from extreme weather events like floods, droughts, and heatwaves.

• It facilitated a platform for State Governments to share their progress on State Action Plans on Climate Change (SAPCC) and identify gaps in funding and technology transfer.

Additional Information

• National Action Plan on Climate Change (NAPCC):

• Launched in June 2008, the NAPCC is India's flagship strategy to address climate change through eight core national missions.

• These missions include the National Solar Mission, National Mission for Enhanced Energy Efficiency, and the National Mission on Sustainable Habitat.

• Other critical components include the National Water Mission, National Mission for Sustaining the Himalayan Ecosystem, and National Mission for a Green India.

• The National Mission for Sustainable Agriculture and the National Mission on Strategic Knowledge for Climate Change complete the framework.

• Ministry of Environment, Forest and Climate Change (MoEFCC):

• It is the nodal agency in the Government of India for planning, promotion, coordination, and overseeing the implementation of environmental and forestry programmes.

• The ministry is responsible for India's participation in international bodies like the United Nations Environment Programme (UNEP) and the United Nations Framework Convention on Climate Change (UNFCCC).

• State Action Plan on Climate Change (SAPCC):

• Individual States and Union Territories in India develop their own SAPCCs to address region-specific climate vulnerabilities.

• These plans are periodically updated to reflect Intended Nationally Determined Contributions (INDCs) and Net Zero goals.

Important Points

• National Adaptation Fund for Climate Change (NAFCC):

• Established in 2015-16, this fund assists states that are particularly vulnerable to the adverse effects of climate change in meeting the cost of adaptation.

• The NABARD acts as the National Implementing Entity (NIE) for projects under this fund.

• India's Climate Targets:

• During COP26 in Glasgow, India announced the Panchamrit targets, which include achieving Net Zero emissions by 2070.

• India also aims to increase its non-fossil energy capacity to 500 GW by 2030.

• The National Adaptation Plan discussed in the New Delhi workshop is a crucial step in ensuring that developmental gains are not reversed by climate-induced disasters.

Q87. Answer: (a) Anju Bobby George

The correct answer is Anju Bobby George.

Key Points

• The Athletics Federation of India (AFI) announced the appointment of legendary long jumper Anju Bobby George as the Chairperson of the AFI Athletes Commission in January 2025.

• She is an iconic figure in Indian sports, famously being the first Indian athlete to win a medal at the World Championships in Athletics, securing a bronze in the Long Jump event in Paris, 2003.

• Her appointment to this role is aimed at bridging the gap between the active athletes and the national federation, ensuring that the concerns, welfare, and training needs of sportspersons are directly addressed at the administrative level.

• Anju Bobby George has previously served as the Senior Vice President of the AFI, making her one of the few former athletes to

hold high-ranking executive positions in Indian sports governance.

• The Athletes Commission plays a critical role in maintaining the integrity of the sport, promoting anti-doping awareness, and providing recommendations for the development of grassroots athletics in India.

Additional Information

• Athletics Federation of India (AFI):

• It is the apex body for running and managing athletics in India, established in 1946.

• The federation is responsible for conducting National Championships and selecting the Indian Athletics Team for international events like the Olympics, Asian Games, and World Athletics Championships.

• It is headquartered in New Delhi and is affiliated with World Athletics and the Indian Olympic Association (IOA).

• Anju Bobby George's Career Highlights:

• She represented India at the 2004 Athens Olympics, finishing with a personal best of 6.83 meters.

• In recognition of her contribution to sports, she was honored with the Arjuna Award in 2002, the Major Dhyan Chand Khel Ratna in 2003, and the Padma Shri in 2004.

• She was also declared the World Athletics Woman of the Year in 2021 for her efforts in advancing sports in the country and mentoring young girls.

• Other Notable Personalities in the Options:

• PT Usha: Known as the "Payyoli Express," she is the first woman President of the Indian Olympic Association (IOA) and a legendary sprinter who dominated the Asian Games in the 1980s.

• Neeraj Chopra: A prominent javelin thrower who won the Gold medal at the Tokyo 2020 Olympics and the Silver medal at the Paris 2024 Olympics.

• Saurav Ganguly: The former captain of the Indian Cricket Team and the former President of the Board of Control for Cricket in India (BCCI).

Important Points

• The formation and empowerment of Athletes Commissions are mandated by international bodies like the International Olympic Committee (IOC) to ensure good governance and transparency in sports organizations.

• In 2025, the AFI continues to focus on the Mission 2028 Los Angeles Olympics, with the Athletes Commission expected to play a vital role in identifying and supporting elite talent across various track and field disciplines.

• Anju Bobby George also runs a high-performance training academy in Bengaluru, which has been instrumental in producing international-level jumpers for the country.

Q88. Answer: (c) Gajuwaka

The correct answer is Gajuwaka.

Key Points

• The Rajiv Sports Complex was officially inaugurated in June 2025 to enhance the sporting infrastructure and provide better facilities for athletes in the region.

• The complex is situated in Gajuwaka, which is one of the most prominent residential and industrial suburbs of Visakhapatnam, Andhra Pradesh.

• The development of this project was undertaken by the Greater Visakhapatnam Municipal Corporation (GVMC), aiming to promote physical fitness among the local youth and industrial workers.

• The facility includes state-of-the-art amenities such as shuttle badminton courts, multipurpose halls, gymnasiums, and dedicated spaces for indoor games.

• The strategic location in Gajuwaka allows easy access for the massive population working in nearby industrial zones like the Visakhapatnam Steel Plant and BHEL.

Additional Information

• Greater Visakhapatnam Municipal Corporation (GVMC):

• The GVMC is the civic body that oversees the administration of Visakhapatnam. It is one of the largest municipal corporations in India by area, covering approximately 681.96 square kilometers.

• It has been instrumental in implementing various Smart City projects, focusing on urban greenery, waste management, and public sports facilities.

• Gajuwaka Locality:

• Gajuwaka is often referred to as the biggest shopping hub in the Andhra Pradesh state and serves as a vital economic engine for the city of Visakhapatnam.

• Its transformation into a sports destination with the Rajiv Sports Complex is part of a broader plan to decentralize sports infrastructure from the main city center.

• Comparison of Options:

• Dwaraka Nagar is a major commercial and educational hub in Visakhapatnam but was not the site for this specific 2025 inauguration.

• Uttam Nagar is a well-known locality often associated with Delhi, making it irrelevant to the GVMC jurisdiction in Andhra Pradesh.

• Kollam is a coastal city located in the state of Kerala, which is geographically distinct from the Andhra Pradesh administration.

Important Points

• The Rajiv Sports Complex project was funded through a combination of municipal funds and Smart City Mission grants, highlighting the government's commitment to urban renewal.

• Sports Authority of Andhra Pradesh (SAAP) often collaborates with local bodies like GVMC to ensure these facilities meet national standards for coaching and competitions.

• The inauguration in June 2025 marks a significant milestone in the Visakhapatnam urban development timeline, focusing on "Health and Wellness" as a core pillar of city planning.

• Such complexes serve as vital hubs for inter-school competitions and state-level tournaments, helping identify budding talent from the Coastal Andhra region.

Q89. Answer: (b) Alberta

The correct answer is Alberta.

Key Points

• The 51st G7 Summit is scheduled to be hosted by Canada in June 2025.

• The government of Canada has officially designated the province of Alberta as the host region for this high-profile international gathering.

• Specifically, the summit will take place in Kananaskis, a scenic area located in the foothills of the Canadian Rockies within Alberta.

• Prime Minister Justin Trudeau announced the selection of Alberta to highlight the province's natural beauty and its vital role in the national economy. Hence, the option Alberta is correct.

• This will be the seventh time that Canada has hosted the G7 Summit since it joined the group in 1976.

• The G7 Presidency for the year 2025 belongs to Canada, which takes over the leadership role from Italy (the 2024 host).

Additional Information

• Geographic Importance of Alberta:

• Alberta is one of the three prairie provinces in Western Canada and is bordered by British Columbia to the west and Saskatchewan to the east.

• It is home to major cities such as Calgary and the provincial capital, Edmonton.

• The province is globally recognized for its oil and natural gas industry, as well as its stunning national parks like Banff and Jasper.

• History of G7 in Canada:

• Canada previously hosted the summit in several locations: Ottawa-Montebello (1981), Toronto (1988), Halifax (1995), Kananaskis (2002), Muskoka (2010), and Charlevoix (2018).

• The choice of Kananaskis in 2025 mirrors the 2002 summit, which was chosen for its remote and secure location, facilitating focused discussions among world leaders.

• Member Countries:

• The Group of Seven (G7) is an intergovernmental political forum consisting of Canada, France, Germany, Italy, Japan, the United Kingdom, and the United States.

• The European Union is also represented at the summit as a non-enumerated member, participating in all discussions.

Important Points

• Summit Objectives: The 2025 agenda is expected to focus on global security, economic stability, and the clean energy transition, particularly given Alberta's position as an energy hub.

• Rotating Presidency: The G7 Presidency rotates annually in a set order: France, United States, United Kingdom, Germany, Japan, Italy, and Canada. Canada's term begins on January 1, 2025.

• Logistic Preparation: Hosting a summit involves rigorous security protocols and the coordination of Sherpas (official representatives), who meet throughout the year to prepare the final Communique.

• Global Influence: While the G7 does not have a permanent secretariat or legal status, its decisions carry significant political weight and often set the tone for global policy in the IMF and World Bank.

Q90. Answer: (a) Javed Akhtar

The correct answer is Javed Akhtar.

Key Points

• The book titled 'Gyan Seepiyan: Pearls of Wisdom' was officially launched during the 18th edition of the Jaipur Literature Festival (JLF) in January 2025.

• It is authored by the veteran Indian poet, lyricist, and screenwriter, Javed Akhtar, who is a prominent figure in Hindi and Urdu literature.

• The work serves as a literary collection that translates complex philosophical thoughts and life lessons into accessible wisdom, reflecting Javed Akhtar's unique worldview.

• During the launch, Javed Akhtar engaged in discussions regarding the role of poetry and language in preserving cultural heritage and navigating the challenges of modernity.

• The book launch at JLF 2025 was one of the most anticipated sessions, highlighting the author's continued relevance in the literary world. Hence, the option is correct.

Additional Information

• Javed Akhtar's Background: Born on January 17, 1945, in Gwalior, he belongs to a family of freedom fighters and poets. He became a household name in the 1970s as part of the legendary Salim-Javed duo, creating iconic films like Sholay and Deewar.

• Literary Contributions: Apart from his new book, his poetry collections like 'Tarkash' and 'Lava' have received widespread critical acclaim. 'Lava' won the Sahitya Akademi Award in Urdu in 2013.

• Major Awards: He is a recipient of several prestigious Indian civil honors, including the Padma Shri (1999) and the Padma Bhushan (2007). He has also won the National Film Award for Best Lyricist five times.

• International Recognition: In 2020, Javed Akhtar became the first Indian to be honored with the Richard Dawkins Award for his rationalism, secularism, and critical thinking.

• Jaipur Literature Festival (JLF): Founded in 2006, it is often described as the "greatest literary show on Earth." It takes place annually in Jaipur, Rajasthan, typically at the Hotel Clarks Amer, and serves as a global platform for intellectual exchange.

Important Points

• Significance of the Title: The title 'Gyan Seepiyan' literally translates to "Shells of Wisdom," symbolizing the act of gathering precious pearls of knowledge from the ocean of experience.

• Themes of the Book: The book explores a wide range of themes, including humanism, the power of logic, the beauty of the Urdu language, and the social responsibility of an artist.

• Cultural Impact: The launch at JLF 2025 reinforces the festival's role in debuting significant South Asian literature that bridges the gap between traditional poetry and contemporary philosophy.

• Global Reach: Javed Akhtar's works are often translated into multiple languages, ensuring that his pearls of wisdom reach a global audience beyond the Indian subcontinent.

Q91. Answer: (b) Insurance Regulatory and Development Authority of India (IRDAI)

The correct answer is Insurance Regulatory and Development Authority of India (IRDAI).

Key Points

• In January 2025, the Insurance Regulatory and Development Authority of India (IRDAI) announced the expansion of its Regulatory Sandbox Framework to foster greater innovation and technological advancement within the insurance industry.

• The primary objective of this expansion is to provide a "safe space" for InsurTech companies and traditional insurers to test new products, services, and business models in a live environment with certain regulatory relaxations.

• The revised framework aims to accelerate the goal of "Insurance for All by 2047" by encouraging solutions that address the needs of unserved and underserved segments of the Indian population.

• This expansion includes streamlined application processes and extended testing timelines, allowing participants more flexibility to refine their innovations before a full-scale market launch.

• By leveraging the sandbox, IRDAI seeks to promote the use of emerging technologies such as Artificial Intelligence (AI), Machine Learning, and Blockchain to improve policy issuance and claims settlement efficiency.

Additional Information

• IRDAI (Insurance Regulatory and Development Authority of India):

• It is a statutory body established under the IRDAI Act, 1999, following the recommendations of the Malhotra Committee report.

• The authority is headquartered in Hyderabad (shifted from Delhi in 2001) and functions under the jurisdiction of the Ministry of Finance.

• The current Chairperson of IRDAI is Debasish Panda, who leads the mission of protecting policyholders' interests and ensuring the orderly growth of the insurance sector.

• Other Regulatory Sandboxes in India:

• The Reserve Bank of India (RBI) operates a Regulatory Sandbox focused on FinTech themes such as retail payments, MSME lending, and cross-border remittances.

• The Securities and Exchange Board of India (SEBI) manages a sandbox for the capital markets, enabling innovations in trading platforms and investment advisory services.

• The International Financial Services Centres Authority (IFSCA) also maintains a sandbox specifically for global financial innovations within GIFT City, Gujarat.

• Regulatory Sandbox Definition:

• A Regulatory Sandbox refers to live, time-bound testing of new products or services in a controlled regulatory environment.

• It allows regulators to understand new technologies and their risks without immediately imposing the full weight of existing regulations.

Important Points

• The IRDAI Sandbox was originally introduced in 2019, and the January 2025 update represents a move toward a more permanent and dynamic regulatory approach.

• Key areas of interest for the 2025 expansion include Parametric Insurance (weather-based covers), Telematic-based motor insurance (pay-as-you-drive), and Wearable-integrated health insurance.

• Any entity registered in India, including startups and intermediaries, can apply to participate, provided they meet the minimum net worth and innovation criteria set by the regulator.

• Successful testing within the sandbox often leads to the amendment of existing insurance laws to accommodate modern digital-first insurance solutions.

Q92. Answer: (a) Minimum Wage Guarantee

The correct answer is Minimum Wage Guarantee.

Key Points

• The Minimum Wage Guarantee for beedi and cigar workers is a transformative reform under the Code on Wages, 2019, which reached full implementation maturity by November 2025.

• This reform ensures that every worker, regardless of being in the organized or unorganized sector, is entitled to a statutory minimum wage, removing the disparities previously found in the Minimum Wages Act, 1948.

• For the beedi industry, which traditionally operates on a piece-rate basis (payment per thousand beedis rolled), the guarantee ensures that the effective daily earnings do not fall below the National Floor Minimum Wage set by the Central Government.

• The initiative aims to provide financial security to approximately 7 to 8 million workers involved in beedi rolling, the majority of whom are home-based women workers living in rural areas.

• By November 2025, the transition to a mandatory digital payment or Aadhaar-linked bank transfer for these wages has been prioritized to prevent exploitation by middlemen and contractors.

Additional Information

• Code on Wages, 2019:

• This code subsumes four major labor laws: The Minimum Wages Act, 1948; The Payment of Wages Act, 1936; The Payment of Bonus Act, 1965; and The Equal Remuneration Act, 1976.

• It empowers the Central Government to fix a floor wage, taking into account the minimum living standards of workers across different geographical regions.

• Beedi and Cigar Workers (Conditions of Employment) Act, 1966:

• Before the new codes, this was the primary legislation governing the welfare, working hours, and licensing of beedi establishments.

• The 2025 reforms integrate the welfare provisions of this act into the broader Social Security Code and Occupational Safety Code.

• The e-Shram Portal:

• Launched in August 2021, this database is critical for the Minimum Wage Guarantee as it allows the government to track unorganized workers and ensure they receive Direct Benefit Transfers (DBT).

• Registration on this portal provides a Universal Account Number (UAN), which is essential for accessing insurance and pension benefits.

• Socio-Economic Impact:

• The beedi industry is concentrated in states like Madhya Pradesh, West Bengal, Tamil Nadu, Andhra Pradesh, and Karnataka.

• Providing a guaranteed wage helps in poverty Alleviation for the Scheduled Castes (SC) and Scheduled Tribes (ST) communities who form a large part of this workforce.

Important Points

• National Floor Minimum Wage: A benchmarking mechanism where no State Government can set a minimum wage lower than the floor wage decided by the Ministry of Labour and Employment.

• Inspector-cum-Facilitator: Under the new reforms, the role of traditional inspectors has changed to facilitators, who use web-based random inspection systems to ensure compliance with the Minimum Wage Guarantee.

• Gender Sensitivity: Since nearly 90% of beedi rollers are women, the Code on Wages strictly prohibits gender discrimination in matters of wages for the same work or work of a similar nature.

• Penalty for Non-compliance: Employers failing to pay the guaranteed minimum wage face stringent fines and potential imprisonment, as mandated under the penal provisions of the Labour Codes updated in 2024-2025.

Q93. Answer: (d) Ranipuram forest

The correct answer is Ranipuram forest.

Key Points

• In 2025, a team of dedicated entomologists from institutions such as Christ College (Irinjalakuda) conducted a comprehensive survey in the Ranipuram forest region of Kerala.

• During this scientific expedition, the researchers successfully recorded seven new moth species that had never been documented in the state of Kerala before.

• The Ranipuram forest, located in the Kasaragod district, is part of the Western Ghats, which is a global biodiversity hotspot and a UNESCO World Heritage Site.

• The discovery includes species from diverse families such as Erebidae and Noctuidae, highlighting the rich lepidopteran diversity of the northern Western Ghats.

• This finding underscores the ecological importance of the high-altitude shola-grassland ecosystems found in the Kasaragod region for rare and endemic insect life.

Additional Information

• Ranipuram Forest:

• Located in the Kasaragod district of Kerala, it was formerly known as Madathumala.

• It is often referred to as the "Ooty of Kerala" due to its cool climate and scenic beauty, situated at an elevation of about 1022 meters.

• The landscape is a unique blend of evergreen forests, shola woods, and montane grasslands, which supports a wide array of flora and fauna.

• It borders the Talakavery Wildlife Sanctuary in Karnataka, forming an important corridor for elephants and other wildlife.

• Moths as Bioindicators:

• Moths belong to the order Lepidoptera and are considered excellent bioindicators because they are highly sensitive to changes in the environment and climate.

• Unlike butterflies, most moths are nocturnal, and their diversity reflects the health of the local ecosystem and the availability of specific host plants.

• Other Regions Mentioned:

• Silent Valley National Park: Located in Palakkad, famous for the Lion-tailed Macaque and its untouched tropical rainforest.

• Periyar Tiger Reserve: Situated in Idukki, it is one of the most prominent Tiger and Elephant reserves in India.

• Wayanad Wildlife Sanctuary: Part of the Nilgiri Biosphere Reserve, known for its significant population of Tigers and Asian Elephants.

Important Points

• The survey methodology involved the use of mercury vapor lamp light traps to attract and document the nocturnal insect species.

• Taxonomic studies and DNA barcoding are often used by entomologists to confirm the identity of such rare species in the Western Ghats.

• The Government of Kerala and various nature conservation foundations have been emphasizing the protection of the Ranipuram-Kottancheri belt to prevent habitat fragmentation.

• The year 2025 marks a significant milestone in the entomological research of North Kerala, bringing global attention to the lesser-explored forest tracts of the Kasaragod highlands.

Q94. Answer: (d) 2030

p data-end="57" data-start="0">The correct answer is 2030.

Key Points

• During the 42nd Inter-Agency Space Debris Coordination Committee (IADCC) annual meeting held in April 2024 in Bengaluru, the ISRO Chairman, S Somanath, declared India's commitment to achieving debris-free space missions by the year 2030.

• This initiative is part of ISRO's broader vision to ensure the long-term sustainability of outer space operations, preventing the accumulation of "space junk" that could jeopardize future missions.

• The goal of a Debris-free Space Mission involves all Indian space actors, including both government-led projects and private sector startups, ensuring that every mission launched from India leaves no debris behind in the Earth's orbit.

• The ISRO Chairman emphasized that by 2030, India aims to have a well-defined mechanism to de-orbit satellites at the end of their functional life or ensure their natural decay within a specified timeframe.

• This declaration reinforces India's position as a responsible global space power, actively contributing to the United Nations guidelines for space debris mitigation and the IADCC framework. Hence, the correct option is 2030.

Additional Information

• Space Debris and its Risks:

• Space debris refers to man-made objects in orbit that no longer serve a useful function, such as defunct satellites, spent rocket stages, and fragments from collisions.

• The Kessler Syndrome is a theoretical scenario where the density of objects in Low Earth Orbit (LEO) is high enough that collisions between objects could cause a cascade, making space activities and the use of satellites difficult for generations.

• ISRO's Technological Interventions:

• IS4OM (ISRO System for Safe and Sustainable Space Operations Management): This facility was established in July 2022 to monitor space objects, predict collisions, and coordinate debris mitigation activities.

• POEM (PSLV Orbital Experimental Module): ISRO has successfully utilized the fourth stage (PS4) of the PSLV rocket as an orbital platform for experiments, rather than letting it become debris immediately. In March 2024, the PSLV-C58 POEM-3 mission achieved a zero-debris status by re-entering the atmosphere.

• SPADEX (Space Docking Experiment): A mission currently under development aimed at mastering autonomous docking, which is crucial for satellite servicing and debris removal.

• IADCC (Inter-Agency Space Debris Coordination Committee):

• It is an international governmental forum for the worldwide coordination of activities related to the issues of man-made and natural debris in space.

• The 42nd meeting hosted by ISRO in Bengaluru saw participation from various global space agencies like NASA, ESA, and JAXA.

Important Points

• Future Landmarks for ISRO:

• While the debris-free target is 2030, India has other major milestones including the establishment of the Bhartiya Antariksha Station (BAS) by 2035.

• India also plans to send the first Indian to the Moon by the year 2040.

• The Gaganyaan mission, India's first manned space flight, is a critical step toward these goals, requiring a clean and safe orbital environment.

• Global Compliance:

• India's commitment aligns with the Zero Debris Charter and the Space Sustainability goals discussed at international platforms to keep Low Earth Orbit accessible for future scientific and commercial use.

Q95. Answer: (a) Rs. 12 lakh

The correct answer is Rs. 12 lakh.

Key Points

• In the Union Budget 2025-26, presented by Union Finance Minister Nirmala Sitharaman, the government announced a significant increase in the tax-exempt income threshold under the New Tax Regime.

• The effective tax-free income limit has been raised to Rs. 12 lakh for individuals opting for the New Tax Regime. Hence, the statement regarding the Rs. 12 lakh threshold is correct.

• This change is implemented through a combination of revised Income Tax Slabs and the Tax Rebate under Section 87A of the Income Tax Act.

• The Standard Deduction for salaried employees has been increased from Rs. 75,000 to Rs. 1,00,000 in the FY 2025-26 budget.

• The primary objective of this move is to provide substantial relief to the middle-class taxpayers and increase disposable income in the hands of the public.

Additional Information

• Revised Tax Slabs (Budget 2025-26):

• Rs. 0 to Rs. 4 lakh: Nil tax.

• Rs. 4 lakh to Rs. 8 lakh: 5% tax.

• Rs. 8 lakh to Rs. 12 lakh: 10% tax.

• Rs. 12 lakh to Rs. 16 lakh: 15% tax.

• Rs. 16 lakh to Rs. 20 lakh: 20% tax.

• Above Rs. 24 lakh: 30% tax.

• Section 87A Rebate: This section provides a tax rebate that effectively makes the tax liability zero for those whose total income does not exceed the specified threshold. In the Budget 2025-26, this rebate was adjusted to cover income up to Rs. 12 lakh.

• New Tax Regime vs. Old Tax Regime: The New Tax Regime (introduced under Section 115BAC) is now the default regime. While it offers lower tax rates, it does not allow most deductions (like 80C, 80D, or HRA) that are available in the Old Tax Regime.

• Pensioners' Relief: The deduction on family pension for pensioners has been enhanced from Rs. 25,000 to Rs. 30,000 to provide

further social security benefits.

Important Points

• Impact on Taxpayers: Under the new structure, a salaried individual earning Rs. 12 lakh per annum will pay zero tax, leading to a direct saving compared to previous fiscal years where the limit was lower.

• Surcharge and Cess: While the tax rates have been rationalized, the Health and Education Cess of 4% remains applicable on the total tax amount for those above the rebate threshold.

• Corporate Tax: The Budget 2025-26 also maintained the stability of corporate tax rates, focusing on the Ease of Doing Business and simplifying the Tax Assessment process.

• Date of Implementation: These changes are applicable for the Assessment Year 2026-27 (which corresponds to the Financial Year 2025-26 starting from 1 April 2025).

Q96. Answer: (b) Karlos Nasar

The correct answer is Karlos Nasar.

Key Points

• Karlos Nasar, a 20-year-old weightlifting prodigy from Bulgaria, delivered a historic performance at the 2024 Paris Olympics on August 9, 2024.

• He set a new World Record and Olympic Record in the men's 89 kg category by successfully lifting 224 kg in the clean and jerk segment of the competition.

• In addition to the clean and jerk record, Nasar achieved a total lift of 404 kg (180 kg in the snatch and 224 kg in the clean and jerk), which also established a new World Record for the total weight in the 89 kg division.

• His performance secured the gold medal for Bulgaria, finishing significantly ahead of his closest competitors.

• Karlos Nasar was born in 2004 and has been a dominant force in world weightlifting, previously holding multiple world records in the 81 kg and 89 kg categories before the Paris 2024 games.

Additional Information

• Other Medalists in the 89 kg Category:

• The silver medal was won by Yeison López of Colombia, who achieved a total lift of 390 kg.

• The bronze medal went to Antonino Pizzolato of Italy, who recorded a total lift of 384 kg after a dramatic successful final attempt.

• Li Fabin:

• He is a world-renowned weightlifter from China who competed in the 61 kg category at the 2024 Olympics.

• Li Fabin won the gold medal in his category and set a new Olympic Record in the snatch by lifting 143 kg.

• Akbar Djuraev:

• He is a prominent weightlifter from Uzbekistan who competed in the 102 kg category during the Paris 2024 games.

• He secured the silver medal in the men's 102 kg event with a total lift of 404 kg.

• Simon Martirosyan:

• He is a highly decorated Armenian weightlifter, typically competing in the 109 kg or +109 kg categories.

• He is a two-time Olympic silver medalist (2016 and 2020) and a multiple-time World Champion.

Important Points

• The 89 kg weight class is a relatively new Olympic category, part of the revised weightlifting program designed to streamline the sport for the Olympic Games.

• Clean and Jerk: This is the second of the two lifts in weightlifting, where the athlete first lifts the barbell to the shoulders (the clean) and then overhead (the jerk). It usually allows for higher weights than the snatch.

• The weightlifting events at the 2024 Paris Olympics were held at the South Paris Arena, part of the Paris Expo Porte de Versailles.

• Bulgaria has a long and storied history in weightlifting, and Nasar's gold was a significant achievement for the nation, marking their first Olympic weightlifting gold since the 2004 Athens Games.

Q97. Answer: (c) Automotive Skills Development Council

The correct answer is Automotive Skills Development Council.

Key Points

• The Automotive Skills Development Council (ASDC) has collaborated with the Central Board of Secondary Education (CBSE) to launch the National Automobile Olympiad for the academic year 2024-25.

• The primary objective of this initiative is to create awareness among school students about the automotive industry and provide them with a platform to explore various career opportunities in this rapidly evolving sector.

• The Olympiad is designed to be inclusive, targeting students from Class 6 to Class 12 across all CBSE-affiliated schools in India and abroad.

• This competition aligns with the National Education Policy (NEP) 2020, which emphasizes the integration of vocational education with mainstream academic learning to enhance the employability of the youth.

• The event is structured to test students on their knowledge of automobile technologies, sustainability, road safety, and the future of mobility, encouraging a mindset of innovation and technical curiosity.

Additional Information

• Automotive Skills Development Council (ASDC): It is the first Sector Skill Council (SSC) in India, incorporated in 2011. It is promoted by the Society of Indian Automobile Manufacturers (SIAM), Automotive Component Manufacturers Association (ACMA), and Federation of Automobile Dealers Associations (FADA), along with the National Skill Development Corporation (NSDC).

• Role of CBSE: The Central Board of Secondary Education, established in 1929, plays a crucial role in implementing skill-based modules in schools to ensure that students are prepared for the industry 4.0 requirements.

• Focus Areas: The National Automobile Olympiad 2025 focuses on modern themes such as Electric Vehicles (EVs), Hydrogen Fuel Cell technology, Autonomous Driving, and the Circular Economy within the automotive manufacturing process.

• Skill India Mission: This collaboration is a significant step under the broader Skill India Mission, which aims to empower the youth with skill sets that make them more productive in their various work environments.

• Competition Structure: The Olympiad typically involves multiple rounds, including online assessments, regional level competitions, and a national grand finale, where winners are often recognized with certificates, trophies, and industry exposure visits.

Important Points

• Industry Integration: By involving ASDC, the program ensures that the content provided to students is vetted by industry experts, making the learning process relevant to current market trends.

• Career Pathing: The initiative helps in identifying young talent early, potentially guiding them toward professional degrees in Automobile Engineering, Mechatronics, and Robotics.

• Gender Neutrality: The program actively encourages female students to participate, aiming to break gender stereotypes in a traditionally male-dominated automotive sector.

• Registration: Participation in the Olympiad is usually facilitated through a dedicated portal, and CBSE issues official circulars to all its principals and school heads to ensure maximum outreach.

Q98. Answer: (d) BIT Mesra

The correct answer is BIT Mesra.

Key Points

• Researchers at the Birla Institute of Technology (BIT), Mesra, specifically from the Department of Pharmaceutical Sciences and Technology, successfully developed smart peptides in June 2025.

• These smart peptides are engineered to be pH-responsive, meaning they change their structural configuration or chemical activity in response to the acidity or alkalinity of their surrounding environment.

• The primary application of this research is in the field of targeted drug delivery, where medication is released specifically at the site of a disease, such as a tumor, rather than throughout the entire body.

• The development is a significant milestone for Indian biotechnology, providing a more efficient way to treat chronic ailments while minimizing side effects. Hence, the correct option is BIT Mesra.

• These bio-inspired molecules are designed to remain stable in the neutral pH of the bloodstream (around 7.4) but activate when they encounter the acidic microenvironment (pH 5.5 to 6.5) typically found in cancerous tissues.

Additional Information

• BIT Mesra (Birla Institute of Technology):

• Established in 1955 by the visionary industrialist Mr. B.M. Birla, it is located in Ranchi, Jharkhand.

• It was the first institute in India to establish a Department of Space Engineering and Rocketry in 1964 and has remained a leader in pharmaceutical research.

• The institute holds a Deemed University status under Section 3 of the UGC Act, 1956.

• Smart Peptides and Nanomedicine:

• Smart Peptides are short chains of amino acids that "sense" external stimuli like temperature, light, or pH.

• In oncology, they exploit the Warburg Effect, where cancer cells produce lactic acid, creating a unique pH signature that these peptides can identify.

• This technology is a part of nanomedicine, which involves the medical application of nanotechnology for diagnosis, monitoring, and treatment.

• Comparison with other Institutions:

• While IIT Delhi and IIT Guwahati are known for biomedical engineering, the specific breakthrough regarding pH-responsive smart peptides in 2025 is attributed to BIT Mesra.

• BITS Pilani also conducts extensive pharmacology research, but the Ranchi-based institution led this particular innovation.

Important Points

• Targeted Therapy: By using pH-responsive triggers, smart peptides can deliver chemotherapeutic agents directly to malignant cells, significantly reducing toxicity in healthy organs like the liver and kidneys.

• Mechanism of Action: The peptides undergo protonation of histidine or glutamic acid residues when the pH drops, causing the molecular package to "unfold" and release the payload.

• Future Prospects: Beyond cancer, these peptides could be used for localized antibiotic delivery in infected wounds, which also exhibit altered pH levels due to bacterial metabolism.

• Research Significance: The project aligns with the Make in India and Atmanirbhar Bharat initiatives, fostering indigenous medical technology and reducing reliance on imported pharmaceutical delivery systems.

Q99. Answer: (a) Kamle District

The correct answer is Kamle District.

Key Points

• In May 2025, the Union Minister for Youth Affairs and Sports, Shri Mansukh Mandaviya, officially inaugurated a state-of-the-art multi-purpose Khelo India Hall in the Kamle District of Arunachal Pradesh.

• This infrastructure project was completed under the Khelo India - National Programme for Development of Sports, which aims to provide world-class sporting facilities to the youth in remote and border regions.

• The multi-purpose hall is designed to support various indoor sports such as badminton, table tennis, and wrestling, providing a year-round training environment regardless of the mountainous weather conditions.

• During the event, the Minister highlighted that such initiatives are aligned with the "Vibrant Villages Programme", focusing on the holistic development of border districts to prevent migration and encourage local talent.

• The facility in Kamle is expected to serve as a crucial training hub for aspiring athletes from the Nyishi community and surrounding areas, helping them prepare for national and international competitions. Hence, the correct answer is Kamle District.

Additional Information

• Kamle District:

• It is one of the youngest districts of Arunachal Pradesh, created in 2017 by bifurcating parts of Lower Subansiri and Upper Subansiri districts.

• The district headquarters is located at Raga. It is known for its diverse ethnic culture and significant population of the Nyishi tribe.

• Khelo India Scheme:

• Launched in 2018, this flagship program of the Ministry of Youth Affairs and Sports was introduced to revive the sports culture at the grass-root level by building a strong framework for all sports played in the country.

• It focuses on several verticals including Infrastructure Development, Talent Identification, and Support to National/Regional/State Sports Academies.

• Sports in Arunachal Pradesh:

• The state has emerged as a powerhouse in combat sports, particularly in Weightlifting, Karate, and Wushu.

• The central government has categorized Arunachal Pradesh as a priority zone for the development of sports infrastructure to harness the natural athletic potential of the North-Eastern youth.

• Union Minister Mansukh Mandaviya:

• Apart from the sports portfolio, he has been a key figure in the Union Cabinet, emphasizing the integration of sports with the New Education Policy (NEP) 2020 to make sports an integral part of the curriculum.

Important Points

• Geographic Importance: Developing infrastructure in Arunachal Pradesh is part of the "Act East Policy", ensuring that the frontier states are at par with the rest of India in terms of social and athletic facilities.

• Vibrant Villages Programme: This program was announced in the Union Budget 2022-23. It targets villages on the northern border that have sparse populations and limited connectivity, providing them with infrastructure like the Khelo India Hall.

• Economic Impact: Such sports complexes also generate local employment through maintenance, coaching, and administrative roles, boosting the local economy of the Kamle District.

Q100. Answer: (d) Articles 17 and 21

The correct answer is Articles 17 and 21.

Key Points

• The Supreme Court of India, in its observations leading up to February 2025, has reaffirmed that the practice of manual scavenging is a direct violation of Article 17 and Article 21 of the Constitution of India.

• Article 17 of the Constitution abolished "Untouchability" and forbade its practice in any form. The Court has historically noted that manual scavenging is a dehumanizing practice rooted in the caste system, effectively serving as a modern manifestation of untouchability.

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• Article 21 guarantees the Protection of Life and Personal Liberty. The judiciary has interpreted this to include the right to live with dignity. Forcing individuals to handle human excreta manually is considered a gross violation of this fundamental right to a dignified life.

• In recent judgements and hearings around 2024-2025, the Supreme Court emphasized that the state has a constitutional obligation to ensure that no citizen is forced into this hazardous occupation, linking the failure to provide protective gear and mechanized cleaning to a breach of Article 21.

• The Court has consistently utilized these two articles to push for the strict implementation of the Prohibition of Employment as Manual Scavengers and their Rehabilitation Act, 2013. Hence, the correct answer is Articles 17 and 21.

Additional Information

• The 2013 Act:

• The Prohibition of Employment as Manual Scavengers and their Rehabilitation Act, 2013, is the primary legislation aimed at eliminating this practice.

• It prohibits the manual cleaning of insanitary latrines, open drains, or pits. It also provides for the rehabilitation of identified manual scavengers through skills training and financial assistance.

• Judicial Interventions (Safai Karamchari Andolan Case):

• In the landmark case of Safai Karamchari Andolan v. Union of India (2014), the Supreme Court directed the government to provide a compensation of 10 lakhs to the families of those who died while cleaning sewers.

• By 2023-2024, the Supreme Court increased this compensation amount to 30 lakhs for sewer deaths, citing the continued violation of Fundamental Rights.

• NAMASTE Scheme:

• The National Action for Mechanized Sanitation Ecosystem (NAMASTE) is a central sector scheme launched to ensure zero fatalities in sanitation work.

• It aims to provide sanitation workers with access to alternative livelihoods and mechanized cleaning equipment to phase out manual intervention in hazardous cleaning.

• Relevant Constitutional Provisions:

• Article 15: Prohibits discrimination on grounds of religion, race, caste, sex, or place of birth.

• Article 23: Prohibits traffic in human beings and forced labor (begar), which is often relevant in cases where workers are coerced into manual scavenging.

• Article 47: A Directive Principle that mandates the State to improve public health and the standard of living.

Important Points

• Socio-Economic Impact: Manual scavenging is heavily concentrated among specific Scheduled Castes, making it a critical issue of social justice and equity.

• Survey and Data: According to government surveys, thousands of manual scavengers have been identified across various states, though activists often claim the actual numbers are much higher due to under-reporting in the unorganized sector.

• Role of Technology: The shift toward robotic scavengers (like Bandicoot) and high-pressure jetting machines is a key part of the modern strategy to uphold the constitutional spirit of Article 21.

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