RRB Group D Official Paper (Held On: 27 Nov, 2025 Shift 2) (Previous Year Paper)

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

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GENERAL SCIENCE

Q1. An uprooted plant was left in the sun. After a few hours, the plant looked wilted and weak. What could be the most likely reason?

(a) Water conduction through xylem was blocked
(b) Water conduction through xylem was started
(c) Food translocation through phloem began
(d) Food translocation through xylem was blocked

Q2. Which of the following is a result of increasing the pressure on a gas?

(a) Increase in inter-particle space
(b) Evaporation of the gas
(c) Increase in kinetic energy
(d) Decrease in inter-particle space

Q3. Which of the following is the best example of conversion of chemical energy into heat energy?

(a) A battery lighting a bulb
(b) A motor running on electricity
(c) Solar cooker heating food
(d) Burning of wood

Q4. Select the correct feature about sexual reproduction in organisms.

(a) It produces a large number of offspring.
(b) It passes the DNA of only one parent to the offspring.
(c) It combines the DNA of two parents in the offspring.
(d) It produces offspring exactly similar to the parent(s).

Q5. Which of the following methods is part of the fresh initiatives in irrigation to improve water availability for crops?

(a) Manuring and chemical spraying
(b) Drip irrigation and crop rotation
(c) Sprinkler irrigation and ploughing
(d) Rainwater harvesting and watershed management

Q6. Which structure is used by pea plant to climb up other plants?

(a) Tendrils
(b) Shoot
(c) Runner
(d) Sucker

Q7. Which of the following correctly matches a measurable property of matter with its SI unit?

(a) Density – Kilogram per cubic metre
(b) Temperature – Calorie
(c) Volume – Cubic centimetre
(d) Pressure – Newton

Q8. Concentrated sulphuric acid can be regarded as a dehydrating agent because it removes water from which of the following?

(a) Propane
(b) Glucose
(c) Sodium hydroxide
(d) Ammonia gas

Q9. If the length of a wire is doubled and its cross-sectional area is halved, its resistance will become:

(a) Half the original
(b) Four times the original
(c) One-fourth the original
(d) Twice the original

Q10. Which one of the following correctly represents Mendel's conclusion about inheritance?

(a) Each traits is controlled by one factor.
(b) Each trait is controlled by three genes.
(c) Each trait is controlled by two factors.
(d) Each trait is controlled by one chromosome.

Q11. In the connective tissues of animals, the fat cells are arranged into lobules, which are separated by partitions of:

(a) collagen and elastin fibres
(b) skeletal fibres and tendons
(c) yellow fibres and lymph
(d) reticular fibres and plasma

Q12. Why does a cricket player lower his hands while catching a fast-moving ball?

(a) To reduce the momentum of the ball
(b) To increase the acceleration of the ball
(c) To increase the time of impact so that the force on the hands is reduced
(d) To increase the force acting on the ball

Q13. What is the location of the cell wall in an organism?

(a) Just outside the plasma membrane in an animal cell
(b) Just inside the plasma membrane in a plant cell
(c) Just outside the plasma membrane in a plant cell
(d) Just inside the plasma membrane in an animal cell

Q14. According to the New Cartesian Sign Convention, if a light ray travels from the object to the lens, the object is always placed such that:

(a) The object distance (u) is always positive
(b) The object is placed to the left of the lens
(c) The light falls on the lens from the right-hand side
(d) The object is always placed above the principal axis

Q15. Which of the following is NOT an application of ultrasound?

(a) Cleaning the objects
(b) Detecting cracks in metal blocks
(c) Regular hearing tests
(d) Medical imaging

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Q16. Corrosion of metals is a process in which:

(a) metals gain weight due to reaction with acids
(b) metals are converted to their oxide, sulphide or carbonate by reaction with environmental agents
(c) metals melt at low temperature
(d) metals change their colour permanently

Q17. 18^(40)Ar and 20^(40)Ca are a pair of:

(a) isobars
(b) isotopes
(c) isotones
(d) isoelectronic

Q18. What is common between the reaction of metal sodium carbonate and sodium bicarbonate with hydrochloric acid?

(a) Sodium chloride is formed
(b) Hydrogen carbonate is formed
(c) Hydrogen gas is released
(d) Carbon monoxide is released

Q19. A convex lens is also called a converging lens because:

(a) it brings parallel rays to a focus at a point
(b) it always forms virtual images
(c) it does not bend light rays at all
(d) it diverges rays of light away from each other

Q20. The processes used for removing the gangue from the ore are based on the differences between which properties of the gangue and the ore?

(a) Only chemical
(b) Only physical
(c) Chemical or physical
(d) Refrative index

Q21. The characteristic feature(s) of carbon, that lead to the formation of its large number of organic compounds is:

(a) both tetravalency and catenation
(b) only catenation
(c) only tetravalency
(d) solubility

Q22. The splitting of a unicellular organism into two equal daughter cells containing identical genetic material is termed as which of the following?

(a) Conjugation
(b) Binary fission
(c) Spore formation
(d) Budding

Q23. The increase in which of the following factor(s) will increase the resistance of a conductor?

(i) Temperature of the conductor
(ii) Length of the conductor
(iii) Area of cross-section of the conductor

(a) Both (ii) and (iii)
(b) Only (i)
(c) Both (i) and (ii)
(d) Only (iii)

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Q24. An object is dropped from a height of 78.4 m. What is the time taken to reach the ground? (Use g = 9.8 m/s²)

(a) 5 s
(b) 4 s
(c) 6 s
(d) 2 s

Q25. A heavy wooden block is pushed across a rough floor. The applied force is gradually increased:

• At first, the block does not move.
• Then, at a certain force, the block just begins to slide.
• Finally, when the block is sliding, it moves with constant velocity.

Which of the following correctly describes the force situation in these three stages?

(a) Stage 1 – Unbalanced, Stage 2 – Unbalanced, Stage 3 – Balanced
(b) Stage 1 – Balanced, Stage 2 – Balanced, Stage 3 – Unbalanced
(c) Stage 1 – Balanced, Stage 2 – Unbalanced, Stage 3 – Balanced
(d) Stage 1 – Unbalanced, Stage 2 – Balanced, Stage 3 – Balanced

MATHEMATICS

Q26. The HCF of two numbers is 23 and their sum is 161. The possible pair(s) of these numbers is/are:

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

Q27. If tan A = 1, then find the value of sin A + cos A.

(a) √2
(b) √3
(c) 1
(d) 2

Q28. The cost of a washing machine is 10% less than the cost of a TV. If the cost of the washing machine increases by 65% and that of the TV decreases by 34%, then what is the percentage change in the total cost of 5 washing machines and 3 TVs?

(a) Increase by 25.4%
(b) Decrease by 18%
(c) Decrease by 19%
(d) Increase by 24%

Q29. If an item marked at Rs. 3,650 is sold for Rs. 730, what is the discount percentage?

(a) 80%
(b) 79%
(c) 82%
(d) 78%

Q30. A brother is 6 years older than his sister. The sum of their present ages is 38 years. What will be the age (in years) of the sister after 15 years from now?

(a) 31
(b) 33
(c) 30
(d) 32

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Q31. A shopkeeper sold an article for Rs. 85.50 at a profit of 12.5%. Had he sold it for Rs. 81.70, then what would be his profit or loss percentage?

(a) 8.5% loss
(b) 7.25% loss
(c) 7.5% profit
(d) 8.5% profit

Q32. Rajiv and Sachin started a business, investing amounts of Rs. 160 and Rs. 1,690, respectively. If Rajiv's share in the profit earned by them is Rs. 720, what is the total profit (in Rs.) earned by them together?

(a) 8,325
(b) 8,361
(c) 8,454
(d) 8,395

Q33. The market value of Amal's investment rises successively by 5% in 2021, 6% in 2022, and 10% in 2023. If the initial value was Rs. 5,50,000, what will be its value (in Rs.) at the end of 2023?

(a) 6,75,800
(b) 6,73,365
(c) 6,75,365
(d) 6,75,900

Q34. Find the median of the numbers 3, 5, 2, 5, 5, 8, 4, 2, 7, 9, 8 and 11.

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

Q35. A shopkeeper marks the price of an article at Rs. 5,670. Find the cost price if after allowing a discount of 28% he still gains 26% on the cost price.

(a) Rs. 3,216
(b) Rs. 3,153
(c) Rs. 3,225
(d) Rs. 3,240

Q36. The arithmetic mean of the observations 76, 28, 79, 17, 33, 95, 83, 30 and 27 is:

(a) 52
(b) 46
(c) 47
(d) 61

Q37. Amit and Deeksha together invested Rs. 15,700 in a business. At the end of the year, out of a total profit of Rs. 6,000, Amit's share was Rs. 2,100. How much was Amit's investment?

(a) Rs. 5,495
(b) Rs. 6,960
(c) Rs. 6,330
(d) Rs. 6,545

Q38. Two trains having lengths of 160 m and 140 m are running at speeds of 100 km/hr and 130 km/hr, respectively, in the same direction. The time taken (in minutes) by the faster train, coming from behind, to completely cross the other train is:

(a) 3
(b) 10.4
(c) 7.2
(d) 0.6

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Q39. Find the simple interest (in Rs.) on Rs. 4,000 at 6% per annum rate of interest for the period from 19 February 2024 to 20 April 2024.

(a) 40
(b) 38
(c) 41
(d) 39

Q40. Simplify the following:

$4 - [3 - 4 \div 2 + \{4 - (5 - 2)\}] + [4 + 18 \div 2 \times 3(4 - 2)]$

(a) 58
(b) 60
(c) 54
(d) 56

Q41. The number of prime numbers lying between 374 and 384 is:

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

Q42. Two pipes A and B can fill a tank in 18 hours and 24 hours, respectively. If both the pipes are opened simultaneously, after how much time (in hours) should pipe A be closed so that the tank is full in 16 hours?

(a) 8
(b) 9
(c) 6
(d) 7

Q43. The cost of fencing a square field at Rs. 15/m is Rs. 18,000. Find the cost of fencing the same field at Rs. 11 per 100 m.

(a) Rs. 142
(b) Rs. 132
(c) Rs. 146
(d) Rs. 138

Q44. A toy is in the form of a cone mounted on a hemisphere, both having the same radius of 7 cm. If the volume of the conical part is equal to the volume of the hemispherical part, what is the total height of the toy?

(a) 35 cm
(b) 28 cm
(c) 14 cm
(d) 21 cm

Q45. Simplify: $(32672 \times 32672 - 21864 \times 21864)/10808$

(a) 54636
(b) 54436
(c) 54836
(d) 54536

Q46. The side of an equilateral triangle is equal to the side of a square. What is the ratio of the circumradius of the equilateral triangle to the inradius of the square?

(a) $2 : \sqrt{3}$
(b) $\sqrt{3} : 2$
(c) $\sqrt{2} : \sqrt{3}$
(d) $3 : \sqrt{2}$

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Q47. A bag contains 1-rupee and 2-rupee coins. The total number of coins is 10, and their total value is Rs. 16. What is the difference between the numbers of two-rupee coins and one-rupee coins?

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

Q48. The ratio of the speeds of two trucks is 7 : 4. The time taken by the faster truck to cover a distance of 196 km is 7 hours less than the other. Find the speed of the slower truck.

(a) 4 km/hr
(b) 10 km/hr
(c) 12 km/hr
(d) 21 km/hr

Q49. A person saves 60% of his income. If his expenditure is Rs. 400, then his income (in Rs.) is:

(a) 160
(b) 1,040
(c) 240
(d) 1,000

Q50. A and B working together can do a piece of work in 6 days. B alone can do the same work in 15 days. How long (in days) will A alone take to do double the work?

(a) 21
(b) 23
(c) 10
(d) 20

GENERAL INTELLIGENCE & REASONING

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

2, 8, 18, 32, 50, ?

(a) 72
(b) 75
(c) 80
(d) 60

Q52. A, B, C, R, S, T and U are sitting around a circular table facing the centre of the table. C sits to the immediate right of R. Only three people sit between C and T when counted from the left of C. Only three people sit between R and B when counted from the left of R. S sits to the immediate right of A. How many people sit between R and A when counted from the right of A?

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

Q53. What should come in place of the question mark (?) in the given series?

26 42 58 74 90 ?

(a) 106
(b) 105
(c) 104
(d) 107

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Q54. Refer to the following number series and answer the question that follows (all numbers are single-digit numbers only). (Counting to be done from left to right only.)

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

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

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

Q55. 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) PU-QN
(b) NS-OK
(c) LQ-MJ
(d) RW-SP

Q56. In a certain code language,

A + B means ‘A is the sister of B’,

A @ B means ‘A is the brother of B’,

A - B means ‘A is the wife of B’,

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

How is O related to V if ‘O @ P + T # G - V’?

(a) Wife's brother
(b) Wife's father
(c) Wife's father's brother
(d) Wife's father's father

Q57. In a certain code language, ‘virus book two’ is coded as ‘zv jo db’ and ‘book wet theme’ is coded as ‘xh im jo’. How is ‘book’ coded in that language?

(a) zv
(b) xh
(c) jo
(d) db

Q58. 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 pan are wok. All cauldron are wok.

Conclusions (I): Some pan are cauldron.

Conclusions (II): Some wok are cauldron.

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

Q59. Dev ranked 10^(th) from the top and 31^(st) from the bottom in his class. How many students are there in the class?

(a) 40
(b) 50
(c) 39
(d) 41

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Q60. What should come in place of the question mark (?) in the given series?

SIF QGD OEB MCZ ?

(a) KAX
(b) NDA
(c) KAY
(d) NDY

Q61. Based on the English alphabetical order, three of the following four letter-clusters are alike in a certain way and thus form a group. Which letter-cluster DOES NOT belong to that group?

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

(a) HEC
(b) DBY
(c) ZWU
(d) EBZ

Q62. Which of the following letter-number clusters will replace the question mark (?) in the given series to make it logically complete?

JSF 10 LUH 11 NWJ 12 PYL 13 ?

(a) QAN 14
(b) QBP 14
(c) RAN 14
(d) RBO 14

Q63. In the following triads, each group of letters is related to the subsequent one following a certain logic. Select from the given options, the one which follows the same logic.

ECHO - CHEO - OHCE

URGE - RGUE - EGRU

(a) JOYS - OYJS - OYSJ
(b) NAVY - ANVY - YAVN
(c) WAIT - AIWT - TIAW
(d) PAST - PSAT - TSAP

Q64. Kareena starts from Point A and drives 16 km towards the east. She then takes a right turn, drives 7 km, turns right and drives 7 km. She then takes a left turn and drives 8 km. She takes a final right turn, drives 9 km and stops at Point P. How far (shortest distance) and towards which direction should she drive in order to reach Point A again? (All turns are 90 degrees turns only unless specified.)

(a) 9 km towards the west
(b) 12 km towards the east
(c) 15 km towards the south
(d) 15 km towards the north

Q65. Seven people B, C, D, I, J, K and L are sitting around a circular table facing the centre of the table. I sits fourth to the right of J. Only two people sit between B and C when counted from the left of B. D sits third to the left of K. L is an immediate neighbour of K and C. How many people between I and L when counted from the left of L?

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

Q66. If ‘E’ stands for ‘+’, ‘F’ stands for ‘-’, ‘G’ stands for ‘×’ and ‘H’ stands for ‘÷’, what will come in place of question mark ‘?’ in the following equation?

60 F 12 H 3 E 8 G 2 = ?

(a) 75
(b) 76
(c) 72

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(d) 71

Q67. Refer to the following number series and answer the question that follows (all numbers are single-digit numbers only). Counting to be done from left to right only.

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

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

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

Q68. 60 people are standing in a row facing north. Mayank is 13^(th) from the right end while Kishan is 18^(th) from the left end. How many people are there between Mayank and Kishan?

(a) 28
(b) 29
(c) 27
(d) 30

Q69. EQ 9 is related to HL −4 in a certain way. In the same way, MR 13 is related to PM 0. To which of the following is MU 19 related, following the same logic?

(a) PP 6
(b) RE 2
(c) YT 5
(d) KP 7

Q70. Mr. Zzz starts from Point A and drives 5 km towards the East. He then takes a right turn, drives 14 km, turns right and drives 16 km. He then takes a right turn and drives 16 km. He takes a final right turn, drives 11 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) 2 km to the South
(b) 4 km to the North
(c) 1 km to the West
(d) 3 km to the East

Q71. What should come in place of the question mark (?) in the given series?

3, 6, 9, 12, 15, ?, 21

(a) 18
(b) 20
(c) 17
(d) 16

Q72. Read the given statement(s) and conclusions carefully. Assuming that the information given in the statement(s) 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 statement(s).

Statements:

All cars are buildings.

All buildings are papers.

Conclusion:

(I) Some buildings are cars.

(II) All cars are papers.

(a) Only conclusion (I) follows.
(b) Both conclusions (I) and (II) follow.
(c) Only conclusion (II) follows.

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(d) Neither conclusion (I) nor (II) follows.

Q73. In a certain code language, ‘buyer queen heart’ is coded as 'os ld xi' and ‘drive heart aunt’ is coded as ‘kx to os’. How is ‘heart’ coded in the given language?

(a) ld
(b) xi
(c) os
(d) kx

Q74. If + means -, - means x, x means ÷, ÷ means +, then what will come in place of the question mark (?) in the following equation?

77 - 5 ÷ 49 + 21 × 7 = ?

(a) 435
(b) 442
(c) 446
(d) 431

Q75. Each of the digits in the number 13645928 is arranged in descending order from left to right. The position(s) of how many digits will remain unchanged as compared to that in the original number?

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

Q76. A, B, C, D, E, F and G are sitting around a circular table facing the centre. E sits third to the right of G. A sits third to the right of E. D is the immediate neighbour of B and A. C sits to the immediate right of F.

How many people sit between F and B when counted from the left of B?

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

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

(Left) 5 $ 5 7 $ $ @ & * € 3 # 8 # $ 5 © 7 £ 4 & * (Right)

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

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

Q78. 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.)

(45, 114, 8)

(24, 108, 20)

(a) (17, 36, 2)
(b) (32, 114, 18)
(c) (16, 49, 7)
(d) (8, 37, 7)

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Q79. Refer to the number series given below and answer the question that follows. Counting to be done from left to right only.

(NOTE: All numbers are single-digit numbers only.)

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

How many such prime numbers are there which are immediately followed by even numbers?

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

Q80. BFKP is related to XAGK in a certain way based on the English alphabetical order. In the same way, LLUV is related to HGQQ. To which of the given options is ZWIG related, following the same logic?

(a) VREB
(b) VERT
(c) VBER
(d) VBRE

GENERAL AWARENESS AND CURRENT AFFAIRS

Q81. At the 2025 World Bank Land Conference, which country was honoured as a Country Champion in recognition of its transformative work in rural land governance?

(a) India
(b) China
(c) Japan
(d) Burma

Q82. In May 2025, six African nations signed a Memorandum of Understanding (MoU) with the World Health Organization (WHO) to combat Kala Azar. What does Kala Azar refer to?

(a) A type of viral fever transmitted by mosquitoes
(b) A bacterial infection spread through contaminated water
(c) A parasitic disease caused by sandfly bites
(d) A genetic disorder affecting red blood cells

Q83. Which of the following banks of India reported a 33 per cent rise in standalone net profit at Rs. 5,004 crore for the fourth quarter (Q4) of the financial year 2024-25 (FY25)?

(a) Bank of Baroda
(b) Punjab National Bank
(c) Canara Bank
(d) State bank of India

Q84. On 20 June 2025, Prime Minister Narendra Modi officially flagged off India’s first indigenously manufactured locomotive export to which country?

(a) Mongolia
(b) Republic of Guinea
(c) Republic of China
(d) Spain

Q85. According to the Internal Displacement Monitoring Centre report, between 2015 and 2024, how many internal displacements due to disasters were recorded in India?

(a) 25.4 million
(b) 50 million
(c) 10 million
(d) 32.3 million

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Q86. Who was the first Paralympic gold medalist to receive the Arjuna Award 2025 (Lifetime)?

(a) Deepa Malik
(b) Devendra Jhajharia
(c) Murlikant Petkar
(d) Varun Bhati

Q87. In which of the following months did the institutes of Department of Science and Technology (DST) and the Defence Research and Development Organisation (DRDO) join hands to strengthen ground-based Space Situational Awareness?

(a) March 2025
(b) May 2025
(c) June 2025
(d) February 2025

Q88. What honour did ISRO chief V. Narayanan receive in Kolkata in 2025?

(a) Bharat Ratna
(b) Rammohan Mission Purashkar
(c) National E-Gov Award
(d) Padma Shri

Q89. The 2025 World Kabaddi Cup was won by which of the following countries?

(a) Pakistan
(b) Iran
(c) India
(d) South Korea

Q90. What was the theme of the RBI's Financial Literacy Week (FLW) 2025?

(a) Women and Financial Technology
(b) Financial Inclusion: India's Growth
(c) Financial Literacy: Women's Prosperity
(d) Digital Finance for All

Q91. Among India's neighbours, which of the following countries have the better ranking than India in the Corruption Perceptions Index (CPI) for 2024, released by Transparency International in February 2025?

(a) China
(b) Bangladesh
(c) Pakistan
(d) Sri Lanka

Q92. Which group owns and supports Vantara, a unique wildlife conservation, rescue and rehabilitation initiative in Jamnagar, Gujarat, inaugurated by the Prime Minister of India in March 2025?

(a) Wadia Group
(b) Reliance Group
(c) Dalmia Group
(d) Tata Group

Q93. Which of the following countries hosted the first assembly of International Big Cat Alliance in June 2025?

(a) Germany
(b) Indonesia
(c) India
(d) Italy

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Q94. Who became the first Indian woman to win gold in javelin at the Asian Games 2025?

(a) Kamalpreet Kaur
(b) Annu Rani
(c) Seema Antil
(d) Shalini Sharma

Q95. How many athletes received the Arjuna Award, 2024, during the January 2025 ceremony?

(a) 28
(b) 34
(c) 32
(d) 40

Q96. As per the Economic Survey, 2024–25, what is the global movement led by India to promote sustainable lifestyles called?

(a) Earth First
(b) Go Green
(c) Swachh Life
(d) LiFE

Q97. In July 2025, which institution announced India's first AI Plus Campus in Amaravati, Andhra Pradesh?

(a) IIIT Hyderabad
(b) NIT Warangal
(c) BITS Pilani
(d) IIT Madras

Q98. In 2025, which company has partnered with the Archaeological Survey of India (ASI) to restore heritage water bodies?

(a) Nestle
(b) Pepsi
(c) Bisleri
(d) Dabur

Q99. The indigenous mRNA vaccine technology developed by CSIR-Centre for Cellular and Molecular Biology (CCMB) in 2025 could have a significant impact on:

(a) reducing the number of vector control programmes required
(b) improving dengue vector control strategies
(c) limiting the spread of chikungunya through antibiotics
(d) providing faster, more scalable vaccine development process for future outbreaks

Q100. In which year was the Manipur Appropriation Bill passed by the Parliament of India?

(a) 2022
(b) 2025
(c) 2024
(d) 2023

ANSWER KEY

1	a	2	d	3	d	4	c	5	d	6	a	7	a	8	b	9	b	10	c
11	a	12	c	13	c	14	b	15	c	16	b	17	a	18	a	19	a	20	c
21	a	22	b	23	c	24	b	25	c	26	c	27	a	28	a	29	a	30	a
31	c	32	a	33	b	34	b	35	d	36	a	37	a	38	d	39	a	40	b
41	c	42	c	43	b	44	d	45	d	46	a	47	b	48	c	49	d	50	d
51	a	52	a	53	a	54	b	55	b	56	c	57	c	58	d	59	a	60	a

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

SOLUTIONS

Q1. Answer: (a) Water conduction through xylem was blocked

The correct answer is Water conduction through xylem was blocked.

Key Points

• Water conduction in plants occurs through the xylem tissue, which is responsible for transporting water and minerals from the roots to other parts of the plant, including leaves.

• When a plant is uprooted, its roots are damaged or severed. This disrupts the xylem vessels, blocking the flow of water and essential nutrients to the plant's aerial parts such as stems and leaves.

• Wilting occurs when the plant loses more water through transpiration than it can absorb from the soil. In the absence of water conduction, the leaves and stems lose turgidity, making the plant appear weak and droopy.

• Exposure to sunlight exacerbates the water loss through transpiration, accelerating the wilting process. Since the plant can no longer replenish lost water, the symptoms become more pronounced.

• This highlights the critical role of the xylem in maintaining the plant's water balance and structural integrity.

• Hence, the statement "Water conduction through xylem was blocked" explains the observed wilting of the plant.

Additional Information

• Xylem Tissue:

• The xylem is a vascular tissue in plants composed of tracheids, vessels, xylem parenchyma, and xylem fibers.

• It transports water and dissolved minerals from the roots upward to the rest of the plant.

• Xylem vessels and tracheids provide structural support while facilitating water conduction.

• Wilting:

• Wilting is the loss of rigidity in non-woody parts of a plant due to excessive water loss or insufficient water uptake.

• It typically occurs due to drought stress, root damage, or issues such as blocked xylem vessels.

• Prolonged wilting can lead to plant death if the water deficit is not addressed.

• Transpiration:

• Transpiration is the process by which water evaporates from the aerial parts of the plant, mainly through stomata in the leaves.

• It plays a critical role in pulling water upward through the xylem via the cohesion-tension mechanism.

• Increased transpiration under sunlight speeds up water loss, making the plant more vulnerable to wilting if water absorption is impaired.

• Phloem vs. Xylem:

• While xylem conducts water and minerals, phloem is responsible for the translocation of food (sugars) produced during photosynthesis.

• In this scenario, the role of the phloem is unrelated to the wilting observed in the plant.

Important Points

• Mechanism of Water Transport:

• The movement of water through the xylem occurs via the cohesion-tension theory, which involves the cohesive force between water molecules and the tension created by transpiration.

• Root pressure also contributes to water movement but plays a minor role compared to transpiration pull.

• Environmental Factors Affecting Transpiration:

• Light: Increases stomatal opening, leading to higher rates of transpiration.

• Temperature: Higher temperatures increase evaporation and transpiration rates.

• Humidity: Lower humidity levels accelerate water loss through transpiration.

• Wind: Windy conditions remove the moisture layer near the leaf surface, increasing transpiration.

• Plant Adaptations:

• Plants in arid environments often have adaptations like sunken stomata, thick cuticles, or reduced leaf surface area to minimize water loss.

• Some plants store water in specialized tissues (succulents) to survive periods of drought.

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Q2. Answer: (d) Decrease in inter-particle space

The correct answer is Decrease in inter-particle space.

Key Points

• When pressure is applied to a gas, the particles are forced closer together, reducing the inter-particle space. This leads to a significant decrease in the volume of the gas as per Boyle's Law, which states that the pressure of a gas is inversely proportional to its volume, provided temperature remains constant. Hence, this statement is correct.

• The inter-particle space decreases because gases are compressible due to the large gaps between their particles under normal conditions. Applying pressure reduces these gaps. Hence, the correct answer is related to the decrease in inter-particle space.

• The statement "Increase in inter-particle space" is incorrect because pressure compacts the particles rather than expanding the space between them.

• "Evaporation of the gas" is not a result of increasing pressure but rather a result of increasing temperature, as evaporation occurs when particles gain sufficient energy to overcome intermolecular forces. Hence, this statement is incorrect.

• Increase in kinetic energy occurs due to an increase in temperature, not pressure. When pressure increases at constant temperature, kinetic energy remains unchanged. Hence, this statement is incorrect.

Additional Information

• Boyle's Law:

• Boyle's Law, formulated by Robert Boyle in 1662, states that the pressure of a gas is inversely proportional to its volume at constant temperature.

• This relationship can be expressed mathematically as $P \times V = \text{constant}$ (where P is pressure and V is volume).

• For example, doubling the pressure on a gas will halve its volume, provided temperature remains constant.

• Compressibility of Gases:

• Gases are highly compressible due to the large spaces between their particles compared to solids and liquids.

• When pressure is applied, these particles come closer together, reducing the volume of the gas.

• Inter-particle Space:

• The inter-particle space in gases is much larger than in solids and liquids, which is why gases can be compressed more easily.

• Applying pressure decreases this space, making the particles more densely packed.

• Practical Applications:

• Compressed natural gas (CNG): CNG is stored under high pressure to reduce its volume for easier transportation and storage.

• Gas cylinders: Liquefied petroleum gas (LPG) cylinders use high pressure to compress the gas into a liquid state, maximizing storage efficiency.

Important Points

• Boyle's Law in Real Life:

• The functioning of syringes, where the volume of air inside decreases as pressure is applied to the plunger, demonstrates Boyle's Law.

• Submarines use the compressibility of gases for buoyancy control by adjusting air pressure in ballast tanks.

• Isothermal Process:

• An isothermal process occurs when a gas undergoes compression or expansion at constant temperature, keeping its internal energy unchanged.

• Boyle's Law is applicable in such scenarios, as temperature remains constant.

Q3. Answer: (d) Burning of wood

The correct answer is Burning of wood.

Key Points

• Burning of wood is the best example of the conversion of chemical energy into heat energy. Wood contains stored chemical energy in the form of cellulose and lignin, which, when burned, release heat energy.

• During combustion, the chemical bonds in wood are broken, and new bonds are formed, releasing a significant amount of thermal energy in the process.

• This process is a common natural phenomenon and is utilized in activities like cooking, heating, and industrial processes.

• Unlike other examples, such as solar cookers or electric motors, the burning of wood does not involve any intermediate conversion (e.g., electricity or sunlight) but directly transforms chemical energy into heat energy.

• Hence, burning of wood is a classic example of a direct and efficient energy conversion process.

Additional Information

• Batteries lighting a bulb:

• This involves the conversion of chemical energy into electrical energy, which is then converted into light and heat energy in the

bulb.

• While heat energy is a by-product, the primary conversion here is from chemical to electrical energy.

• A motor running on electricity:

• Here, electrical energy is converted into mechanical energy.

• This is not an example of chemical to heat energy conversion, as the motor's primary function is to generate motion.

• Solar cooker heating food:

• The solar cooker uses solar energy (light energy) and converts it directly into heat energy for cooking.

• It does not involve any chemical energy, making it unrelated to the question's context.

• Combustion Process in Detail:

• During combustion, wood reacts with oxygen in the air to produce carbon dioxide, water vapor, and heat.

• This exothermic reaction releases energy stored within the chemical bonds of the fuel (wood).

• The heat produced is utilized for various purposes like cooking, heating, and energy production.

Important Points

• Combustion Reaction:

• A combustion reaction is a type of chemical reaction where a substance combines with oxygen to release energy in the form of heat and light.

• Examples include burning wood, coal, or fossil fuels.

• Applications of Combustion:

• Used for generating heat in households (e.g., wood stoves).

• Provides energy for industrial processes like smelting and manufacturing.

• Utilized in power generation through steam turbines.

• Environmental Impact:

• Burning wood releases carbon dioxide (CO_2), a greenhouse gas contributing to global warming.

• Incomplete combustion can result in the release of harmful pollutants like carbon monoxide (CO).

Q4. Answer: (c) It combines the DNA of two parents in the offspring.

The correct answer is It combines the DNA of two parents in the offspring..

Key Points

• Sexual reproduction involves the combination of DNA from two parents: This process is central to sexual reproduction, where the genetic material from both parents (male and female gametes) combines during fertilization to produce genetically unique offspring. Hence, this statement is correct.

• It does not produce a large number of offspring: Unlike asexual reproduction, sexual reproduction typically results in fewer offspring, as the process involves mating and a more complex developmental process. Hence, this statement is incorrect.

• It does not pass DNA from only one parent: Sexual reproduction ensures that offspring inherit genetic material from both parents, creating genetic diversity. This is a fundamental feature of sexual reproduction. Hence, this statement is incorrect.

• Offspring are not exactly similar to parents: Due to the genetic recombination and variation occurring during meiosis and fertilization, the offspring are genetically unique and not identical to either parent. Hence, this statement is incorrect.

Additional Information

• Advantages of sexual reproduction:

• Genetic diversity: Sexual reproduction results in genetic variation within a population, which is beneficial for adaptation and survival in changing environments.

• Evolution: It drives evolution by introducing new combinations of alleles, leading to the emergence of new traits that may provide a survival advantage.

• Key processes in sexual reproduction:

• Meiosis: A specialized type of cell division that reduces the chromosome number by half, producing haploid gametes (sperm and egg cells).

• Fertilization: The fusion of male and female gametes to form a diploid zygote, which develops into the offspring.

• Examples of organisms reproducing sexually:

• Humans and animals: Most mammals, birds, reptiles, and amphibians reproduce sexually.

• Plants: Flowering plants undergo sexual reproduction through the process of pollination and fertilization.

• Comparison with asexual reproduction:

• Asexual reproduction: Involves a single parent, produces genetically identical offspring, and is faster but lacks genetic diversity.

• Sexual reproduction: Requires two parents, produces genetically diverse offspring, and is slower but promotes adaptability.

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Important Points

• Fertilization types:

• External fertilization: Occurs outside the body, as seen in amphibians and fish.

• Internal fertilization: Occurs inside the body, as seen in mammals, birds, and reptiles.

• Chromosomal contribution: Each parent contributes half of the chromosomes to the offspring. For instance, in humans, both the egg and sperm contribute 23 chromosomes each, resulting in a total of 46 chromosomes in the zygote.

• Role of genetic recombination: During meiosis, crossing over and independent assortment create new genetic combinations, contributing to variation in the offspring.

• Significance of genetic variation: Genetic diversity is crucial for a species' ability to adapt to environmental changes, resist diseases, and avoid the risks associated with inbreeding.

Q5. Answer: (d) Rainwater harvesting and watershed management

The correct answer is Rainwater harvesting and watershed management.

Key Points

• Rainwater Harvesting:

• Rainwater harvesting involves collecting and storing rainwater for agricultural, domestic, or industrial use. It helps in improving water availability for crops, especially in regions with irregular rainfall patterns.

• This method reduces dependency on groundwater and promotes sustainable water use in agriculture.

• Rainwater harvesting structures like check dams, percolation tanks, and rooftop harvesting systems are commonly used.

• Watershed Management:

• Watershed management is an integrated approach to managing water resources within a defined geographical area.

• It includes soil conservation, afforestation, and water conservation practices to enhance the availability of water for irrigation and other purposes.

• Watershed projects aim to improve the productivity of land and ensure sustainable water use for agricultural needs.

• Both Rainwater Harvesting and Watershed Management are eco-friendly and cost-effective techniques for enhancing water availability for crops.

• These methods align with sustainable agricultural practices and environmental conservation goals.

• Hence, the correct answer is Rainwater harvesting and watershed management.

Additional Information

• Drip Irrigation:

• Drip irrigation is a micro-irrigation system that delivers water directly to the roots of plants through a network of pipes, emitters, and valves.

• It is highly efficient in water usage and helps in reducing wastage, but it is not directly related to rainwater harvesting or watershed management.

• Drip irrigation is ideal for areas with water scarcity, but it involves higher installation costs.

• Crop Rotation:

• Crop rotation refers to the practice of growing different crops in a sequence on the same land to improve soil fertility and reduce pest issues.

• While beneficial for soil health, it does not directly address water availability for crops.

• Sprinkler Irrigation:

• Sprinkler irrigation mimics natural rainfall by spraying water over crops. It is another method to irrigate crops efficiently.

• Although useful, it is not part of rainwater harvesting or watershed management.

• Manuring and Chemical Spraying:

• Manuring involves adding organic or chemical fertilizers to the soil to enhance its fertility.

• Chemical spraying is used for pest control but does not contribute to improving water availability.

• Benefits of Rainwater Harvesting and Watershed Management:

• They promote sustainable agricultural practices by conserving water resources.

• These methods help in reducing soil erosion and improving groundwater recharge.

• Rainwater harvesting and watershed management are particularly beneficial in drought-prone and semi-arid regions.

• They contribute to long-term water security and environmental sustainability.

Important Points

• Rainwater Harvesting Techniques:

• Rooftop Rainwater Harvesting: Collecting rainwater from rooftops and storing it in tanks.

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• Check Dams: Structures built across streams to hold rainwater.
• Percolation Tanks: Tanks designed to allow water to percolate into the ground.
• Contour Trenches: Dug along contours to trap rainwater and reduce soil erosion.
• Watershed Management Components:
• Soil Conservation: Preventing soil erosion through vegetation and contour farming.
• Water Conservation: Creating reservoirs, ponds, and check dams to store water.
• Afforestation: Planting trees to maintain the ecological balance of watersheds.
• Community Participation: Involvement of local communities in planning and executing watershed projects.
• Government Initiatives:
• Programs like the Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA) often include watershed development components.
• Integrated Watershed Management Programme (IWMP) is a government initiative focused on sustainable watershed management.
• Global Perspective:
• Countries like Israel and Australia have implemented advanced water management techniques for agriculture.
• Rainwater harvesting is widely promoted in South Asia and Africa to address water scarcity.

Q6. Answer: (a) Tendrils

The correct answer is Tendrils.

Key Points

• Tendrils are specialized structures found in climbing plants, including the pea plant (Pisum sativum), that help them attach to and climb up other plants or objects.
• They are modified organs, such as leaves, leaflets, or stems, which coil around a support structure to provide stability and support to the plant.
• In pea plants, the tendrils are modified leaflets of the compound leaves, allowing the plant to climb efficiently.
• When tendrils come into contact with a support, they exhibit a growth response called thigmotropism, coiling around the object for attachment.
• This adaptation is crucial for pea plants, as it allows them to reach sunlight for photosynthesis while conserving energy that would otherwise be spent on producing a thick stem for support.

Additional Information

• Thigmotropism:
• Thigmotropism is a directional growth response of a plant organ to touch or physical contact with a solid object.
• In tendrils, thigmotropism helps them detect support structures and coil around them for stability.
• Other Structures in Plants:
• Shoot: The shoot is the above-ground part of the plant, which includes the stem, leaves, and flowers. It provides structural support and is responsible for photosynthesis and reproduction. However, it is not specifically adapted for climbing.
• Runner: Runners are horizontal stems that grow along the soil surface, giving rise to new plants. They are used for vegetative propagation, not climbing.
• Sucker: Suckers are shoots that arise from the base of a plant or its underground parts. They help in vegetative propagation but are not involved in climbing.
• Climbing Mechanisms in Plants:
• Plants use various mechanisms to climb, such as twining stems, adhesive roots, hooks, and tendrils, depending on their species and habitat.
• Tendrils are common in climbers like pea plants, grapevines, and cucumbers, while twining stems are seen in plants like morning glory.
• Examples of Plants with Tendrils:
• Pea Plant (Pisum sativum): Has leaf tendrils to climb supports.
• Grapevine (Vitis vinifera): Uses tendrils to attach to trellises or other structures.
• Cucumber (Cucumis sativus): Utilizes tendrils for climbing and support.

Q7. Answer: (a) Density – Kilogram per cubic metre

The correct answer is Density – Kilogram per cubic metre.

Key Points

• Density – Kilogram per cubic metre:

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• Density is defined as the mass per unit volume of a substance and is expressed in the SI unit of kilograms per cubic metre (kg/m^3).

• The formula for density is Density = Mass / Volume, where mass is measured in kilograms (kg) and volume in cubic metres (m^3).

• Correct statement: The unit of density in the SI system is indeed kilogram per cubic metre.

• Temperature – Calorie:

• This is an incorrect statement. The SI unit of temperature is the Kelvin (K), not the calorie.

• Calorie is a unit of energy and is used to measure heat, not temperature.

• In scientific contexts, the calorie is often replaced by the joule (J), the SI unit of energy.

• Volume – Cubic centimetre:

• This is an incorrect statement. The SI unit of volume is the cubic metre (m^3).

• While cubic centimetre (cm^3) is commonly used in smaller volume measurements, it is not the standard SI unit.

• 1 cubic metre is equal to 1,000,000 cubic centimetres (cm^3).

• Pressure – Newton:

• This is also an incorrect statement. The SI unit of pressure is the Pascal (Pa), not the Newton.

• Pressure is defined as force per unit area, and 1 Pascal is equal to 1 Newton per square metre (N/m^2).

• While Newton is a unit of force, it is not used to measure pressure directly.

Additional Information

• SI Unit System:

• The International System of Units (SI) is the modern form of the metric system and is the most widely used system of measurement worldwide.

• The SI system is built on seven base units: metre (m) for length, kilogram (kg) for mass, second (s) for time, ampere (A) for electric current, Kelvin (K) for temperature, mole (mol) for the amount of substance, and candela (cd) for luminous intensity.

• Density:

• Density is a fundamental property of matter, essential in fields like physics, chemistry, and engineering.

• Common examples include water, which has a density of approximately 1000 kg/m^3 at standard temperature and pressure (STP).

• The concept of density is applied in numerous industries, such as material science, construction, and manufacturing.

• Temperature:

• Kelvin (K) is the SI unit of temperature. It is an absolute temperature scale that starts at absolute zero (0 K), the theoretical point where molecular motion ceases.

• Other units of temperature include Celsius (°C) and Fahrenheit (°F), but Kelvin is used in scientific measurements.

• Volume:

• While the SI unit of volume is the cubic metre (m^3), other units like litres (L) and millilitres (mL) are also commonly used in daily life.

• 1 cubic metre equals 1000 litres.

• Pressure:

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

• Pressure is an important parameter in physics, meteorology, and engineering, playing a key role in understanding and designing systems like hydraulics and barometers.

Q8. Answer: (b) Glucose

The correct answer is Glucose.

Key Points

• Concentrated sulphuric acid acts as a strong dehydrating agent due to its high affinity for water molecules. It removes water from compounds by absorbing moisture or chemically reacting to eliminate water.

• Glucose, being a carbohydrate ($C_6H_{12}O_6$), contains hydrogen and oxygen atoms in a ratio of 2:1, similar to water (H_2O). When treated with concentrated sulphuric acid, glucose undergoes dehydration, forming a black carbon residue.

• This reaction is a chemical demonstration of sulphuric acid's ability to remove water. The dehydration process breaks down glucose into elemental carbon and water, which gets absorbed by the acid.

• Propane, a hydrocarbon (C_3H_8), does not contain water molecules within its structure. Hence, concentrated sulphuric acid does not act as a dehydrating agent for propane.

• Sodium hydroxide (NaOH) and ammonia gas (NH_3) do not contain water molecules in their composition in a form that sulphuric acid can dehydrate. Thus, sulphuric acid does not act as a dehydrating agent for these substances.

Additional Information

• Dehydrating Agent:

• A dehydrating agent is a substance that removes water or moisture from another compound or substance. Concentrated sulphuric acid is a classic example, widely used in laboratory reactions to dehydrate organic and inorganic compounds.

• It is often employed in chemical processes like the preparation of esters, dehydration of alcohols, and in demonstrating carbonization reactions with carbohydrates.

• Properties of Concentrated Sulphuric Acid:

• It is a highly viscous and dense liquid with strong hygroscopic properties, meaning it readily absorbs water from the atmosphere or other substances.

• The chemical formula for sulphuric acid is H_2SO_4, and it is a diprotic acid with two hydrogen ions available for reaction.

• Its ability to absorb water makes it a powerful reagent in drying gases and dehydrating compounds.

• Reaction with Glucose:

• When glucose ($C_6H_{12}O_6$) is treated with concentrated H_2SO_4, it gets dehydrated, leaving behind black carbon residue and water.

• This reaction can be written as: $C_6H_{12}O_6 \rightarrow 6C + 6H_2O$.

• The water produced in the reaction is absorbed by sulphuric acid, demonstrating its strong dehydrating nature.

• Applications of Sulphuric Acid:

• Used in the manufacturing of fertilizers, particularly phosphates like superphosphate.

• Employed in petroleum refining, chemical synthesis, and production of detergents and paints.

• Acts as a drying agent in laboratories for gases like hydrogen chloride (HCl) and carbon dioxide (CO_2).

Important Points

• Comparison of Options:

• Glucose: Contains water molecules chemically bonded, making it prone to dehydration by sulphuric acid.

• Propane: A hydrocarbon lacking water in its structure; sulphuric acid does not act as a dehydrating agent for it.

• Sodium Hydroxide: Inorganic base with no water molecules available for dehydration.

• Ammonia Gas: Composed of nitrogen and hydrogen, without water molecules for dehydration.

• Safety Considerations:

• Concentrated sulphuric acid is highly corrosive and can cause severe burns upon contact with skin.

• Always handle it with proper protective gear, including gloves and goggles, in a well-ventilated area.

• In case of spills, neutralize it with a base like sodium bicarbonate before cleaning.

Q9. Answer: (b) Four times the original

The correct answer is Four times the original.

Key Points

• Resistance of a wire is determined by the formula: $R = \rho \times (L/A)$, where:

• R: Resistance of the wire

• ρ: Resistivity (material property, constant for a given material)

• L: Length of the wire

• A: Cross-sectional area of the wire

• When the length of the wire is doubled, the new length becomes 2L.

• When the cross-sectional area is halved, the new area becomes A/2.

• Substituting these changes into the formula for resistance:

• New Resistance $(R') = \rho \times ((2L) / (A/2))$

• $R' = \rho \times (2L \times 2 / A)$

• $R' = 4 \times (\rho \times L/A)$

Hence, the new resistance becomes 4 times the original resistance.

• Thus, the resistance of the wire increases to four times its original value.

Additional Information

• Factors affecting resistance:

• Length of the wire (L): Resistance is directly proportional to the length. Doubling the length doubles the resistance.

• Cross-sectional area (A): Resistance is inversely proportional to the cross-sectional area. Halving the area doubles the resistance.

• Material of the wire: Different materials have different resistivities (ρ), affecting their resistance.

• Temperature: Resistance changes with temperature, usually increasing for conductors as temperature rises.

• Ohm's Law:

• Ohm's law states that the current (I) through a conductor between two points is directly proportional to the voltage (V) across the two points.

• Mathematically: V = IR, where R is the resistance.

• Applications of resistance:

• Resistance is utilized in devices like resistors, heaters, and filaments in light bulbs to control current flow.

• Higher resistance is used in devices to convert electrical energy into heat (e.g., electric irons).

• Resistivity:

• It is a material-specific property that quantifies how strongly a given material opposes the flow of electric current.

• Unit: Ohm meter (Ω·m).

• Materials with low resistivity, like copper and silver, are good conductors, while materials with high resistivity, like rubber, are insulators.

• Practical Example:

• When designing electrical wiring in buildings, larger cross-sectional areas are chosen to reduce resistance and prevent overheating.

• Long-distance power transmission lines use materials with low resistivity and large cross-sectional areas to minimize energy loss.

Q10. Answer: (c) Each trait is controlled by two factors.

The correct answer is Each trait is controlled by two factors..

Key Points

• Mendel’s Principle of Inheritance: Gregor Mendel postulated that each trait in organisms is controlled by two factors, which are now known as alleles. These alleles could be either dominant or recessive.

• Mendel’s experiments demonstrated that one factor (allele) in a pair could mask the expression of the other, leading to the concept of dominant and recessive traits.

• Law of Segregation: Mendel proposed that during the formation of gametes, the two factors (alleles) for a trait segregate and only one allele is passed on to the offspring. This ensures genetic variation.

• Law of Independent Assortment: Traits are inherited independently of one another if they are controlled by different genes. This observation was derived from Mendel’s dihybrid cross experiments.

• Each parent contributes one factor for each trait, which combines during fertilization to form a pair. These pairs of factors are responsible for the expression of specific traits in offspring.

Additional Information

• Mendel’s Experiments:

• Mendel conducted experiments on pea plants (Pisum sativum) to study inheritance patterns.

• He chose pea plants due to their distinct traits, ease of cultivation, and ability to self-pollinate.

• Seven contrasting traits, such as flower color, seed shape, and pod color, were studied to understand inheritance.

• Factors and Genes:

• Mendel referred to the hereditary units controlling traits as “factors.” These were later identified as genes with the discovery of DNA.

• Each gene exists in two forms called alleles, which can be dominant (expressed) or recessive (masked).

• Dominant and Recessive Traits:

• If both alleles are the same (homozygous), the trait is expressed according to the type of allele (dominant or recessive).

• If the alleles are different (heterozygous), the dominant allele determines the trait.

• Examples of Mendelian Traits:

• Dominant Traits: Purple flower color, round seeds.

• Recessive Traits: White flower color, wrinkled seeds.

• Significance of Mendel’s Work:

• Mendel’s principles formed the foundation of genetics, a field that studies inheritance and variation.

• His work laid the groundwork for understanding genetic disorders, selective breeding, and biotechnology.

Important Points

• Statement 1: Each trait is controlled by one factor. This is incorrect because Mendel showed that traits are controlled by two factors (alleles).

• Statement 2: Each trait is controlled by three genes. This is incorrect as Mendel identified only two factors controlling each trait.

• Statement 3: Each trait is controlled by two factors. This is correct and aligns with Mendel’s findings.

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• Statement 4: Each trait is controlled by one chromosome. This is incorrect because chromosomes contain multiple genes, and traits are determined by specific genes.

Q11. Answer: (a) collagen and elastin fibres

The correct answer is collagen and elastin fibres.

Key Points

• Fat cells, also known as adipocytes, are primarily found in connective tissues, which serve as the structural framework for tissues and organs in animals.

• In connective tissue, fat cells are organized into lobules, or clusters, which are separated by partitions made of collagen and elastin fibres.

• Collagen fibres provide strength and structural support to the tissue, while elastin fibres contribute elasticity, allowing the tissue to stretch and return to its original shape.

• The combination of collagen and elastin ensures the connective tissue is both strong and flexible, enabling it to withstand mechanical forces and maintain the integrity of the fat lobules.

• This specific arrangement of connective tissue ensures proper storage and insulation of fat, as well as cushioning against physical trauma. Hence, the correct answer is collagen and elastin fibres.

Additional Information

• Collagen:

• Collagen is the most abundant protein in the animal body, particularly in connective tissues such as skin, tendons, cartilage, and bones.

• It provides mechanical strength and structural integrity to tissues, preventing them from tearing under tension.

• Collagen fibres are made up of triple-helical protein structures, which allow them to be both strong and flexible.

• Elastin:

• Elastin is a protein that provides elasticity and resilience to connective tissues like skin, lungs, and blood vessels.

• It allows tissues to stretch and then return to their original shape, making it crucial in areas that experience frequent deformation.

• Elastin fibres are thinner than collagen fibres and are often found interwoven with them to provide a balance of strength and flexibility.

• Fat Cells (Adipocytes):

• Adipocytes are specialized cells that store energy in the form of fat and play an important role in insulation and cushioning.

• They are classified into two types: white adipose tissue (WAT), which stores energy, and brown adipose tissue (BAT), which generates heat.

• Adipocytes are embedded within connective tissue, which supports their structure and function.

• Other Options Explained:

• Skeletal fibres and tendons: Tendons are composed of dense connective tissue that connects muscles to bones. They do not form partitions in fat tissue.

• Yellow fibres and lymph: Yellow fibres refer to elastin, but lymph is a fluid, not a structural component, and does not form partitions in fat lobules.

• Reticular fibres and plasma: Reticular fibres are found in lymphoid organs like the spleen and lymph nodes, while plasma is a component of blood, not connective tissue.

Important Points

• Connective tissues are classified into loose connective tissue (e.g., adipose tissue), dense connective tissue (e.g., tendons), cartilage, bone, and blood.

• Loose connective tissue is characterized by a loose arrangement of fibres and serves as a packing material in the body, while dense connective tissue has tightly packed fibres.

• The extracellular matrix (ECM) of connective tissues contains proteins like collagen and elastin, as well as glycoproteins and proteoglycans, which provide structural and functional support.

Q12. Answer: (c) To increase the time of impact so that the force on the hands is reduced

The correct answer is To increase the time of impact so that the force on the hands is reduced.

Key Points

• When a cricket player lowers his hands while catching a fast-moving ball, he increases the time duration of the impact between the ball and his hands.

• According to the impulse-momentum theorem, impulse is equal to the change in momentum of an object, and impulse is also equal to the product of force and the time during which the force is applied: Impulse = Force × Time.

• By increasing the time of impact, the force exerted on the hands decreases because the product of force and time remains constant. This makes the catch less painful and reduces the risk of injury.

• The momentum of the ball must decrease to zero when caught, but by lowering the hands, the player ensures that the deceleration occurs gradually over a longer period, thereby reducing the intensity of the force.

• This principle is a practical application of Newton's second law of motion, which states that force is the rate of change of momentum: F = Δp/Δt. Here, a larger time interval (Δt) results in a smaller force (F).

Additional Information

• Impulse-Momentum Theorem:

• The theorem states that the impulse experienced by an object is equal to the change in its momentum. Mathematically: Impulse = Δp = m(v - u), where m is the mass, v is the final velocity, and u is the initial velocity.

• In sports like cricket, this theorem is used to minimize the impact on the player's body by increasing the time of contact.

• Newton's Second Law of Motion:

• This law explains that the force acting on an object is equal to the rate of change of its momentum: F = Δp/Δt.

• By increasing the time (Δt), the force (F) required to stop the ball decreases significantly.

• Applications of Increasing Time of Impact:

• This concept is widely applied in other areas like airbags in cars, shock absorbers in vehicles, and cushioned surfaces in sports fields to reduce impact forces.

• For example, airbags in vehicles extend the time of impact during a collision, thereby reducing the force on passengers and minimizing injuries.

• Role of Momentum in Sports:

• Momentum is a measure of the motion of an object and is given by the formula p = mv, where p is momentum, m is mass, and v is velocity.

• In cricket, the fast-moving ball has significant momentum due to its mass and velocity, and players use techniques like lowering their hands to manage this momentum safely.

Important Points

• Newton's Laws in Sports:

• Newton's laws of motion are fundamental in understanding and analyzing movements in sports activities like catching, throwing, and hitting the ball.

• For example, in catching, the player applies the first law (inertia), the second law (force and momentum), and the third law (action-reaction).

• Practical Examples:

• Goalkeepers in football also use this technique by moving their hands backward when catching a fast-moving ball to reduce the impact force.

• Similarly, gymnasts land on cushioned mats to increase the time of impact and reduce the force exerted on their bodies.

• Everyday Applications:

• Packaging materials like bubble wrap and foam are designed to increase the time of impact when fragile items are dropped, minimizing damage.

• Helmets and protective gear in sports use the same principle to dissipate impact forces and reduce injuries.

Q13. Answer: (c) Just outside the plasma membrane in a plant cell

The correct answer is Just outside the plasma membrane in a plant cell.

Key Points

• The cell wall is a rigid, protective layer located just outside the plasma membrane in plant cells, fungi, bacteria, and some protists. Hence, option 3 is correct.

• It provides structural support to the cell, maintaining its shape and preventing it from bursting in a hypotonic environment.

• The cell wall is absent in animal cells, which rely on the plasma membrane and cytoskeleton for structure and support.

• In plant cells, the cell wall is primarily made up of cellulose, a polysaccharide, while in fungi, it consists of chitin, and in bacteria, it is composed of peptidoglycan.

• Its functions include protection against mechanical stress, regulation of cell growth, and acting as a barrier to pathogens.

Additional Information

• Plasma Membrane:

• The plasma membrane, also known as the cell membrane, is a semipermeable lipid bilayer that encloses the cytoplasm of the cell and regulates the movement of substances in and out of the cell.

• It is present in both plant and animal cells and plays a crucial role in maintaining cellular homeostasis.

• Differences between Cell Wall and Plasma Membrane:

• The cell wall is rigid and provides structural support, while the plasma membrane is flexible and selectively permeable.

• The cell wall is found in plants, fungi, and bacteria, whereas the plasma membrane is present in all cell types.
• Animal Cells:
• Animal cells lack a cell wall, which allows for a wider variety of cell shapes and the ability to form specialized tissues.
• Instead, they have an extracellular matrix composed of proteins like collagen for structural support.
• Composition of Plant Cell Wall:
• The primary cell wall is made of cellulose, hemicellulose, and pectin.
• Some plant cells also have a secondary cell wall that contains lignin, which provides additional strength and rigidity.
• Examples of Organisms with Cell Walls:
• Plants: Cellulose-based cell walls (e.g., trees, flowers).
• Bacteria: Peptidoglycan-based cell walls (e.g., E. coli).
• Fungi: Chitin-based cell walls (e.g., mushrooms).

Important Points

• Statement 1: "Just outside the plasma membrane in an animal cell" is incorrect because animal cells do not have a cell wall.
• Statement 2: "Just inside the plasma membrane in a plant cell" is incorrect because the cell wall is located outside the plasma membrane.
• Statement 3: "Just outside the plasma membrane in a plant cell" is correct as this is the precise location of the cell wall in plant cells.
• Statement 4: "Just inside the plasma membrane in an animal cell" is incorrect because animal cells neither have a cell wall inside nor outside the plasma membrane.

Q14. Answer: (b) The object is placed to the left of the lens

The correct answer is According to the New Cartesian Sign Convention, the object is always placed to the left of the lens..

Key Points

• The New Cartesian Sign Convention is a widely used system to define the direction and measurement of distances in optics.
• In this convention, the object is always placed to the left of the lens or mirror, and the direction of the incident light is considered as moving from left to right. Hence, statement 2 is correct.
• The object distance (u) is typically measured from the optical center and is considered negative because it is measured opposite to the direction of the incident light. Statement 1 is incorrect.
• The light rays always travel from the object towards the optical device (lens or mirror). However, it falls on the lens from the left-hand side, not the right-hand side. Statement 3 is incorrect.
• According to the convention, the object is always assumed to be placed along the principal axis, not necessarily above it. Statement 4 is incorrect.

Additional Information

• New Cartesian Sign Convention:
• This convention simplifies calculations in ray optics by assigning specific signs to distances based on their orientation.
• Distances measured against the direction of incident light are considered negative, while those measured along the direction of light are considered positive.
• For example, focal length is positive for convex lenses and negative for concave lenses.
• Principal Axis:
• The principal axis is an imaginary straight line that passes through the optical center of the lens or mirror.
• All measurements, including object distance (u) and image distance (v), are taken along this axis.
• Object Placement:
• In the New Cartesian Sign Convention, the object is always placed to the left-hand side of the optical device.
• This placement ensures that the direction of light travel and calculations remain consistent.
• Lens Types:
• Convex lenses converge light rays and have a positive focal length.
• Concave lenses diverge light rays and have a negative focal length.
• Application of Sign Convention:
• The sign convention is crucial in solving numerical problems related to lens and mirror formulas, such as: $1/f = 1/v - 1/u$.
• It helps determine the position and nature of the image formed (real, virtual, inverted, or upright).

Important Points

• Correct Interpretation: In optics, correct interpretation of distances and directions is essential to avoid calculation errors.
• Ray Diagrams: Ray diagrams are used to visually represent the path of light rays and their interaction with optical devices.

• Practical Applications: The New Cartesian Sign Convention is widely applied in designing optical devices such as cameras, telescopes, microscopes, and eyeglasses.

• Historical Context: The convention simplifies complex geometric optics problems and aligns with the principles of light propagation.

Q15. Answer: (c) Regular hearing tests

The correct answer is Regular hearing tests.

Key Points

• Ultrasound technology is widely used in various fields due to its ability to produce high-frequency sound waves that can penetrate through different materials and tissues.

• Applications of ultrasound include cleaning objects (such as delicate jewelry or medical instruments), detecting cracks in metal blocks, and medical imaging (such as sonography for examining internal organs).

• Medical imaging is one of the most common uses of ultrasound, particularly in obstetrics to visualize the fetus during pregnancy.

• Detecting cracks in metal blocks is another significant application, where ultrasound is used in industries for non-destructive testing to ensure structural integrity.

• Regular hearing tests are not an application of ultrasound. Hearing tests typically involve audiometric techniques to measure the auditory response at various frequencies and do not utilize ultrasound technology. Hence, option 3 is correct.

Additional Information

• Ultrasound Cleaning:

• Ultrasound is used to clean delicate objects such as jewelry, lenses, and surgical instruments by creating high-frequency sound waves that produce microscopic bubbles in a cleaning solution, effectively removing dirt and contaminants.

• This process is known as cavitation, where bubbles implode to dislodge particles from surfaces.

• Crack Detection in Metals:

• Ultrasound is utilized in industries for non-destructive testing of metal blocks to detect internal cracks or flaws that are not visible externally.

• The technique involves transmitting ultrasonic waves into the material and measuring the reflected waves to identify inconsistencies.

• This application is critical for ensuring the safety and reliability of structures like bridges, aircraft, and pipelines.

• Medical Imaging:

• Ultrasound imaging, also known as sonography, is commonly used for diagnosing medical conditions and monitoring pregnancies.

• It uses high-frequency sound waves to create real-time images of internal organs, blood flow, and tissues.

• One of its key advantages is that it is non-invasive and does not use ionizing radiation like X-rays.

• Examples include imaging of the abdomen, heart (echocardiography), and musculoskeletal systems.

• Hearing Tests:

• Hearing tests measure a person's ability to detect and interpret sound frequencies using techniques like pure-tone audiometry and speech audiometry.

• These tests involve transmitting audible tones at varying frequencies and intensities to evaluate hearing health.

• They do not involve ultrasound, as ultrasound frequencies are beyond the human hearing range (above 20,000 Hz).

Important Points

• Ultrasound Frequency:

• Ultrasound refers to sound waves with frequencies higher than the audible range for humans (above 20 kHz).

• It is commonly used in medical, industrial, and cleaning applications due to its ability to penetrate various materials.

• Uses in Medical Field:

• Ultrasound is extensively used for diagnostic imaging, therapeutic applications, and real-time monitoring.

• Examples include fetal monitoring during pregnancy, guided biopsies, and physiotherapy treatments.

• Limitations:

• Ultrasound has limited penetration depth and is not suitable for imaging structures behind bones or air-filled spaces like the lungs.

Q16. Answer: (b) metals are converted to their oxide, sulphide or carbonate by reaction with environmental agents

The correct answer is metals are converted to their oxide, sulphide or carbonate by reaction with environmental agents.

Key Points

• Corrosion is a natural process where metals react with environmental agents such as oxygen, moisture, and certain chemicals, leading to the formation of compounds like oxides, sulphides, or carbonates. Hence, the statement is correct.

• In this process, metals lose their original metallic properties and are chemically transformed into compounds, which are often less stable and less useful. For example, iron reacts with oxygen and moisture to form hydrated iron oxide (rust).

• Statement 1, which claims that metals gain weight due to reaction with acids, is incorrect as the weight gain during corrosion is due to the addition of oxygen or other elements, not acids specifically.

• Statement 3, which states that metals melt at low temperatures, is incorrect. Corrosion is a chemical reaction, not related to the melting of metals.

• Statement 4, which says that metals change their colour permanently, is partially true but not the defining feature of corrosion. The colour change is a result of the formation of new compounds during corrosion.

Additional Information

• Common Examples of Corrosion:

• Rusting of Iron: Iron reacts with oxygen and water to form hydrated iron oxide, commonly known as rust. This is the most familiar example of corrosion.

• Formation of Patina on Copper: Copper reacts with carbon dioxide and moisture to form copper carbonate, which gives it a green appearance.

• Corrosion of Silver: Silver reacts with sulphur compounds in the air to form silver sulphide, leading to tarnishing.

• Factors Affecting Corrosion:

• The presence of moisture and oxygen accelerates the corrosion process.

• The presence of salts (e.g., in coastal areas) increases the rate of corrosion by enhancing the conductivity of the medium.

• Acidic environments significantly increase the rate of corrosion due to the higher availability of hydrogen ions.

• Prevention of Corrosion:

• Use of coatings: Applying paint, oil, or grease to protect the metal surface from direct contact with environmental agents.

• Galvanization: Coating iron or steel with a layer of zinc to prevent rusting.

• Alloying: Mixing metals with other elements to improve their resistance to corrosion. For example, stainless steel is an alloy of iron with chromium, which prevents rusting.

• Cathodic Protection: Using a sacrificial anode (e.g., zinc or magnesium) to protect the main metal from corrosion.

• Electrochemical Nature of Corrosion: Corrosion is often an electrochemical process, involving the transfer of electrons. For example, in rusting, iron acts as the anode and loses electrons, while oxygen acts as the cathode.

Important Points

• Economic Impact: Corrosion leads to significant economic losses worldwide, as it damages infrastructure, machinery, and vehicles. Preventive maintenance is essential to mitigate these losses.

• Environmental Impact: Corrosion can lead to the release of toxic substances into the environment, especially when it occurs in industrial equipment or pipelines.

• Scientific Studies: Research into corrosion inhibitors and advanced materials (e.g., graphene coatings) is ongoing to improve the durability of metals.

• Historical Context: The study of corrosion gained importance during the Industrial Revolution when large-scale use of metals in infrastructure and machinery began to highlight the problem.

Q17. Answer: (a) isobars

The correct answer is Isobars.

Key Points

• Isobars are atoms of different elements having the same mass number (A) but different atomic numbers (Z).

• In the given pair:

• ^(40)Ar: Atomic number = 18, Mass number = 40

• ^(40)Ca: Atomic number = 20, Mass number = 40

• Since both have the same mass number (40) but different atomic numbers (18 and 20), they are isobars.

• Hence, the correct answer is Option 1 – Isobars.

Additional Information

• Isotopes:

• Same atomic number but different mass numbers.

• Example: ^(35)Cl and ^(37)Cl.

• Isotones:

• Same number of neutrons but different atomic numbers.

• For the given pair:

• ^(40)Ar: Neutrons = 40 − 18 = 22

• ^(40)Ca: Neutrons = 40 − 20 = 20
• Since the number of neutrons is different, they are not isotones.
• Isoelectronic Species:
• Species having the same number of electrons.
• Neutral ^(40)Ar has 18 electrons, whereas neutral ^(40)Ca has 20 electrons.
• Therefore, they are not isoelectronic.

Important Points

• Isobars: Same mass number, different atomic numbers.
• Isotopes: Same atomic number, different mass numbers.
• Isotones: Same number of neutrons, different atomic numbers.
• Isoelectronic: Same number of electrons.

Q18. Answer: (a) Sodium chloride is formed

The correct answer is Sodium chloride is formed..

Key Points

• Sodium carbonate (Na2CO3) and sodium bicarbonate (NaHCO3) react with hydrochloric acid (HCl) to produce sodium chloride (NaCl), which is common in both reactions.
• In the case of sodium carbonate, the reaction proceeds as follows: Na2CO3 + 2HCl → 2NaCl + CO2 + H2O Hence, sodium chloride is formed.
• For sodium bicarbonate, the reaction proceeds as follows: NaHCO3 + HCl → NaCl + CO2 + H2O Hence, sodium chloride is formed.
• Both reactions also release carbon dioxide (CO2) gas, which causes effervescence.
• Neither reaction produces hydrogen gas or carbon monoxide, making the production of sodium chloride the common product between both reactions.

Additional Information

• Sodium carbonate (Na2CO3):
• It is also known as washing soda or soda ash.
• It is widely used in the production of glass, as a cleaning agent, and in water softening processes.
• When it reacts with acids, it produces salts, water, and carbon dioxide gas.
• Sodium bicarbonate (NaHCO3):
• Also known as baking soda, it is commonly used in baking as a leavening agent.
• It is also used in cleaning, neutralizing acids, and as an antacid for relieving heartburn.
• Reacts with acids to produce carbon dioxide gas, water, and a salt.
• Hydrochloric Acid (HCl):
• It is a strong acid commonly used in industrial processes, laboratory experiments, and digestion in the human stomach.
• Reacts with bases or salts like sodium carbonate and sodium bicarbonate to produce salts and other byproducts.
• Effervescence:
• Effervescence refers to the production of gas bubbles during a chemical reaction.
• In these reactions, effervescence is due to the release of carbon dioxide (CO2) gas.

Important Points

• Carbon Dioxide Release: Both sodium carbonate and sodium bicarbonate release carbon dioxide gas when reacting with hydrochloric acid, leading to bubbling or fizzing during the reaction.
• Non-production of Hydrogen Gas: These reactions do not produce hydrogen gas, contrary to reactions involving metals like zinc or magnesium with acids.
• Use in Cleaning: Sodium bicarbonate and sodium carbonate are frequently used in cleaning applications due to their ability to neutralize acids and produce salts.

Q19. Answer: (a) it brings parallel rays to a focus at a point

The correct answer is A convex lens is also called a converging lens because it brings parallel rays to a focus at a point..

Key Points

• A convex lens is also known as a converging lens because it bends incoming parallel rays of light towards a single focal point on the other side of the lens.
• This convergence occurs due to the curved shape of the lens surfaces, which refract (bend) light in such a way that the rays meet at a point.

• The focal point is where all the refracted rays converge, and it depends on the curvature and refractive index of the lens. This is a key property of convex lenses.

• Convex lenses are commonly used in devices like magnifying glasses, cameras, telescopes, and projectors, where the convergence of light is essential for forming clear images.

• Unlike concave lenses, which diverge light rays, convex lenses are specifically designed to focus light to a single point, making them ideal for applications requiring image magnification and correction of vision.

Additional Information

• Properties of convex lenses:

• A convex lens is thicker at the center and thinner at the edges.

• It has a positive focal length, meaning the focal point is real and located on the side opposite to the incoming light.

• It can form both real and inverted images (when the object is beyond the focal length) or virtual and upright images (when the object is within the focal length).

• Applications of convex lenses:

• Magnifying glasses: Used to enlarge the appearance of small objects.

• Corrective lenses: Used in eyeglasses for individuals with hyperopia (farsightedness).

• Optical instruments: Found in microscopes, telescopes, and cameras to focus and magnify images.

• Option-wise explanations:

• Option 1: "It brings parallel rays to a focus at a point" is correct, as this is the defining property of a convex lens.

• Option 2: "It always forms virtual images" is incorrect, as convex lenses form both real and virtual images depending on the object's position.

• Option 3: "It does not bend light rays at all" is incorrect, as convex lenses bend (refract) light rays significantly to converge them.

• Option 4: "It diverges rays of light away from each other" is incorrect, as this property belongs to concave lenses, not convex lenses.

• Important facts about refraction:

• The bending of light when it passes from one medium to another is governed by Snell's Law.

• The refractive index of the lens material plays a crucial role in determining the focal length and convergence of light.

Important Points

• Lens Formula:

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

• Magnification:

• Magnification (M) is defined as the ratio of the image height (h') to the object height (h): M = h'/h = v/u.

Q20. Answer: (c) Chemical or physical

The correct answer is Chemical or physical.

Key Points

• The processes used for removing the gangue (unwanted material) from the ore are based on the differences in physical and chemical properties between the ore and the gangue.

• Physical methods like gravity separation, magnetic separation, and froth flotation are commonly used when there are distinct differences in properties such as density, magnetic susceptibility, or surface wettability.

• Chemical methods are applied when the gangue and ore have similar physical properties but different chemical reactivity. For example, leaching is used to dissolve specific components of the ore selectively.

• The choice of method depends on the nature of the ore and the gangue, as well as the desired purity of the metal extracted.

• Examples: Froth flotation is used for sulfide ores, while magnetic separation is used for ores containing magnetic minerals like magnetite. Hence, the correct answer is "Chemical or physical."

Additional Information

• Physical Properties of Ore and Gangue:

• Density: Gravity separation exploits the difference in densities between ore particles and gangue. For example, heavier metal particles settle faster in a fluid medium.

• Magnetic Properties: Magnetic separation utilizes differences in magnetic susceptibility. Magnetic ores like magnetite are separated from non-magnetic gangue.

• Surface Properties: Froth flotation is used for ores with different surface wettability. Sulfide ores are hydrophobic and attach to air bubbles, while gangue remains in water.

• Chemical Properties of Ore and Gangue:

• Reactivity: Chemical leaching utilizes differences in reactivity. For example, cyanide leaching dissolves gold selectively from its ore.

• Solubility: Specific solvents dissolve certain ores but not the gangue. For instance, alumina is dissolved in sodium hydroxide during the Bayer process.

• Examples of Common Ore Purification Processes:

• Froth Flotation: Used for sulfide ores like zinc sulfide (ZnS).

• Gravity Separation: Used for heavy ores like cassiterite (SnO_2).

• Magnetic Separation: Used for ores like magnetite (Fe_3O_4).

• Leaching: Used for aluminum extraction via the Bayer process.

Important Points

• Gangue: Refers to the unwanted rock, sand, or impurities associated with the desired mineral or ore.

• Ore: A naturally occurring solid material from which a valuable metal or mineral can be profitably extracted.

• Concentration: The process of removing gangue from the ore to increase the percentage of the desired metal.

• Examples of Metallurgical Processes:

• Calcination: Heating ore in the absence of air to remove volatile impurities.

• Roasting: Heating ore in the presence of air to oxidize impurities.

• Smelting: Extracting metal by heating ore with a reducing agent like carbon.

Q21. Answer: (a) both tetravalency and catenation

The correct answer is both tetravalency and catenation.

Key Points

• Tetravalency: Carbon has four valence electrons, allowing it to form four covalent bonds with other atoms, including hydrogen, oxygen, nitrogen, and other carbon atoms. This property enables the formation of complex molecules and diverse organic compounds.

• Catenation: Carbon has a unique ability to form long chains and rings of atoms by bonding with other carbon atoms. This property is known as catenation and is a key reason for the vast diversity of organic compounds.

• Combination of tetravalency and catenation: The combination of tetravalency and catenation allows carbon to form a wide range of structures, including straight chains, branched chains, and cyclic compounds. This versatility is why carbon compounds are the basis of life.

• Organic compounds: The ability to form multiple types of bonds, including single, double, and triple bonds, further enhances the diversity of organic compounds. Examples include hydrocarbons, alcohols, ketones, acids, and esters.

• Hence, the correct answer is both tetravalency and catenation.

Additional Information

• Tetravalency:

• Carbon's atomic number is 6, and its electronic configuration is $1s^2\ 2s^2\ 2p^2$. The four valence electrons allow carbon to form strong covalent bonds.

• Examples include methane (CH_4), ethane (C_2H_6), and carbon dioxide (CO_2).

• The ability to form covalent bonds makes carbon compounds stable and suitable for biological processes.

• Catenation:

• Catenation is the self-linking property of carbon atoms through covalent bonds. This property is most prominent in carbon compared to other elements.

• Carbon chains can be linear (e.g., hexane), branched (e.g., isobutane), or cyclic (e.g., benzene).

• This property leads to the existence of millions of organic compounds.

• Organic Chemistry:

• Carbon forms the backbone of organic chemistry. Organic compounds consist primarily of carbon and hydrogen, along with other elements like oxygen, nitrogen, and sulfur.

• Examples include carbohydrates, proteins, lipids, and nucleic acids, which are essential for life.

• Applications of Carbon Compounds:

• Carbon compounds are widely used in industries, such as pharmaceuticals, plastics, and fuels.

• Examples include ethanol (used as a solvent), polyethylene (used in packaging), and graphite (used in pencils).

Important Points

• Hydrocarbons: Hydrocarbons are compounds made of carbon and hydrogen. They include alkanes, alkenes, and alkynes.

• Functional Groups: Organic compounds often contain functional groups like hydroxyl (-OH), carboxyl (-COOH), and amino (-NH_2), which determine their chemical properties.

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• Carbon Bond Strength: Carbon-carbon and carbon-hydrogen bonds are strong, making organic compounds stable.

• Isomerism: Carbon compounds exhibit isomerism, where compounds with the same molecular formula have different structures. Examples include structural isomers and stereoisomers.

• Biological Importance: Carbon is the central element in biomolecules like DNA, RNA, and enzymes, which are essential for life processes.

Q22. Answer: (b) Binary fission

The correct answer is Binary Fission.

Key Points

• Binary fission is a type of asexual reproduction commonly observed in unicellular organisms like bacteria, amoeba, and paramecium.

• During this process, the parent cell divides into two equal daughter cells, each containing identical genetic material.

• The process involves key steps such as DNA replication, elongation of the cell, and cytokinesis, ensuring each daughter cell receives a complete set of genetic instructions.

• It is a rapid method of reproduction, enabling unicellular organisms to multiply efficiently under favorable conditions.

• This type of reproduction does not involve the fusion of gametes or genetic variation, making it a clonal process.

Additional Information

• Conjugation:

• It is a sexual mode of reproduction observed in some unicellular organisms like paramecium and bacteria.

• In this process, there is an exchange of genetic material between two organisms through a conjugation tube or pilus.

• This leads to genetic variation in the offspring.

• Spore Formation:

• This is a form of asexual reproduction where organisms like fungi, algae, and some bacteria produce spores.

• Spores are resistant structures that can survive harsh environmental conditions and germinate when conditions are favorable.

• Budding:

• It is a type of asexual reproduction where a new organism develops from an outgrowth or bud of the parent organism.

• It is commonly seen in yeast and hydra.

• Unlike binary fission, the offspring may not always be identical in size to the parent.

• Characteristics of Binary Fission:

• Speed: Binary fission is a rapid process and can lead to exponential growth in populations under ideal conditions.

• Energy-efficient: It does not require energy for gamete formation or mating.

• Examples: Organisms like Amoeba, Escherichia coli, and Euglena reproduce via binary fission.

Important Points

• Applications and Importance of Binary Fission:

• Antibiotics: The rapid reproduction of bacteria through binary fission is a reason for the fast spread of bacterial infections, making antibiotic resistance a major concern.

• Research: Understanding binary fission in bacteria like E. coli is crucial for genetic engineering and biotechnology.

• Ecological Role: Many unicellular organisms reproducing via binary fission play a key role in nutrient cycling and ecosystems.

• Binary fission is considered a primitive form of reproduction but is highly effective for the survival of unicellular organisms.

Q23. Answer: (c) Both (i) and (ii)

The correct answer is Both (i) and (ii).

Key Points

• Temperature of the conductor (i):

• An increase in the temperature of a conductor causes an increase in its resistance. This is because higher temperature results in an increased vibration of atoms, which in turn obstructs the flow of free electrons. Hence, this statement is correct.

• Length of the conductor (ii):

• Resistance is directly proportional to the length of the conductor. A longer conductor has more material for the electrons to travel through, leading to increased resistance. Hence, this statement is correct.

• Area of cross-section of the conductor (iii):

• Resistance is inversely proportional to the area of cross-section of a conductor. If the area increases, resistance decreases as more pathways are available for the electrons to flow. Hence, this statement is incorrect.

• Conclusion:

• Only the temperature and length of the conductor increase the resistance, making option "Both (i) and (ii)" the correct answer.

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Additional Information

• Resistance and its Factors:

• The resistance of a conductor determines how much it opposes the flow of electric current.

• It is mathematically given by the formula: R = ρ × (L/A), where:

• R: Resistance

• ρ: Resistivity (depends on the material)

• L: Length of the conductor

• A: Area of cross-section of the conductor

• Effect of Temperature on Resistance:

• For most conductors, resistance increases with an increase in temperature. This is due to enhanced atomic vibrations, which scatter the electrons.

• For semiconductors and insulators, resistance decreases with an increase in temperature.

• Effect of Length on Resistance:

• Resistance is directly proportional to the length of the conductor. Thus, doubling the length of a conductor doubles its resistance.

• Effect of Cross-sectional Area on Resistance:

• Resistance is inversely proportional to the cross-sectional area. For example, increasing the area by two times reduces the resistance to half.

• Real-world Applications:

• Understanding resistance is crucial for designing electrical components like resistors, wires, and circuits.

• Materials with low resistance, such as copper and aluminum, are widely used in electrical wiring.

Important Points

• Resistivity:

• Resistivity is a material-specific property that quantifies how strongly a material opposes the flow of electric current.

• It is denoted by ρ and measured in ohm-meters (Ω·m).

• Conductors vs. Insulators:

• Conductors: Materials with low resistivity (e.g., copper, aluminum).

• Insulators: Materials with high resistivity (e.g., rubber, glass).

• Temperature Coefficient of Resistance:

• This term describes how the resistance of a material changes with temperature. It is positive for conductors and negative for semiconductors.

• Applications in Electronics:

• Resistors, thermostats, and temperature sensors are designed based on the principles of resistance.

Q24. Answer: (b) 4 s

The correct answer is Option 2.

Key Points

• To determine the time taken by the object to reach the ground, we use the formula for motion under gravity: h = (1/2) × g × t², where:

• h is the height from which the object is dropped, which is 78.4 m.

• g is the acceleration due to gravity, which is 9.8 m/s².

• t is the time taken by the object to reach the ground.

• Rearranging the formula to solve for t:

• $t^2 = (2 \times h) / g$

• $t = \sqrt{[(2 \times h) / g]}$

• Substituting the values:

• $t = \sqrt{[(2 \times 78.4) / 9.8]}$

• $t = \sqrt{(156.8 / 9.8)}$

• $t = \sqrt{16} = 4$ seconds.

• Thus, the time taken by the object to reach the ground is 4 seconds. Hence, Option 2 is correct.

Additional Information

• Free Fall:

• When an object falls under the influence of gravity alone, without any air resistance, it is called free fall.

• The acceleration during free fall is equal to the acceleration due to gravity (g), which is approximately 9.8 m/s² on Earth.
• Equations of Motion:
• The three equations of motion are used to describe the motion of objects under uniform acceleration:
• v = u + at (final velocity)
• s = ut + (1/2) × a × t² (displacement)
• v² = u² + 2as (relation between velocity and displacement)
• In free fall, the initial velocity (u) is 0, and acceleration (a) is replaced by g.
• Acceleration due to Gravity:
• On Earth, the value of g is approximately 9.8 m/s².
• It varies slightly depending on altitude and geographical location.
• Practical Applications:
• The concept of free fall is used in designing parachutes and calculating trajectories of rockets and projectiles.
• It is also applied in physics experiments, like determining g using pendulums or inclined planes.

Important Points

• Factors Affecting Free Fall:
• In real-life scenarios, air resistance affects the motion of falling objects.
• For example, a feather falls slower than a stone due to air resistance.
• Galileo's Contribution:
• Galileo Galilei was the first to study the motion of falling objects and concluded that all objects fall at the same rate in the absence of air resistance.
• Space Applications:
• Astronauts experience microgravity or free fall in space, as they orbit Earth.
• This principle is used in designing spacecraft and conducting experiments in zero-gravity environments.

Q25. Answer: (c) Stage 1 – Balanced, Stage 2 – Unbalanced, Stage 3 – Balanced

The correct answer is Stage 1 – Balanced, Stage 2 – Unbalanced, Stage 3 – Balanced.

Key Points

• Stage 1: Balanced Forces:
• At this stage, the applied force is less than the maximum static friction force.
• The block does not move because the static friction balances the applied force perfectly.
• As per Newton's First Law of Motion, the block remains at rest since there is no unbalanced force acting on it. Hence, this stage is balanced.
• Stage 2: Unbalanced Forces:
• As the applied force increases and reaches the threshold of static friction, the block just begins to move.
• At this point, the applied force exceeds the maximum static friction force, creating an unbalanced force that initiates motion.
• The block starts to slide because the net force is no longer zero. Hence, this stage is unbalanced.
• Stage 3: Balanced Forces:
• Once the block is in motion and moves with a constant velocity, the applied force equals the kinetic friction force acting in the opposite direction.
• Since the net force is zero, there is no acceleration, and the block continues to move uniformly.
• This is consistent with Newton's First Law, indicating that the forces are balanced. Hence, this stage is balanced.
• Correct Answer: The stages are described correctly as: Stage 1 – Balanced, Stage 2 – Unbalanced, Stage 3 – Balanced.

Additional Information

• Static Friction:
• Static friction is the frictional force that prevents an object from moving when it is at rest.
• It adjusts itself to counterbalance the applied force up to a certain maximum limit, known as the maximum static friction force.
• The equation for static friction is $f_s \leq \mu_s N$, where μ_s is the coefficient of static friction and N is the normal force.
• Kinetic Friction:
• Once the object is in motion, the force opposing its motion is called kinetic friction.
• Kinetic friction is usually lower than static friction and remains constant regardless of the velocity of the object.
• The equation for kinetic friction is $f_k = \mu_k N$, where μ_k is the coefficient of kinetic friction and N is the normal force.
• Newton's Laws of Motion:

• First Law: An object will remain at rest or in uniform motion unless acted upon by an unbalanced force.

• Second Law: The acceleration of an object is directly proportional to the net force acting on it and inversely proportional to its mass (F = ma).

• Third Law: For every action, there is an equal and opposite reaction.

• Force Balance in Motion:

• In the case of constant velocity, the net external force on an object is zero due to the balance between applied force and frictional force.

• This highlights the equilibrium condition during motion.

• Applications:

• Understanding force balance is crucial in engineering applications, such as designing conveyor belts, brake systems, and machinery components.

• This knowledge is also applied in sports science, robotics, and transportation systems to optimize performance and safety.

Q26. Answer: (c) 3

Shortcut Trick

Let numbers be 23a and 23b. Sum => 23(a + b) = 161 => a + b = 7.

Possible co-prime pairs for (a, b) such that sum is 7 are: (1, 6), (2, 5), and (3, 4).

Total possible pairs = 3.

Therefore The correct answer is 3.

Alternate Method

Given: HCF = 23, Sum = 161.

Formula: If HCF is H, numbers are Hx and Hy, where x and y are co-prime.

=> 23x + 23y = 161

=> 23(x + y) = 161

=> x + y = 161 ÷ 23

=> x + y = 7

=> Possible pairs of (x, y) such that they are co-prime and sum to 7:

=> Case 1: (1, 6) → Numbers: (23, 138)

=> Case 2: (2, 5) → Numbers: (46, 115)

=> Case 3: (3, 4) → Numbers: (69, 92)

Therefore The correct answer is 3.

Additional Information

Co-prime Numbers

Two numbers are co-prime if their Highest Common Factor (HCF) is exactly 1.

HCF and LCM Relation

Product of two numbers = HCF × LCM. Also, LCM is always divisible by HCF.

Finding Pairs with Product

If product is P and HCF is H, then (Hx) × (Hy) = P => xy = P/H^2. Find co-prime factors of the result.

Q27. Answer: (a) √2

Shortcut Trick

Given tan A = 1, we know that for standard angles, tan 45° = 1.

Therefore A = 45°.

Substitute A in the expression: sin 45° + cos 45° = (1/√2) + (1/√2) = 2/√2 = √2.

Therefore The correct answer is √2.

Alternate Method

Given: tan A = 1

Formula Used: tan A = Perpendicular / Base; sin A = Perpendicular / Hypotenuse; cos A = Base / Hypotenuse; $H^2 = P^2 + B^2$

=> tan A = 1/1 => Perpendicular (P) = 1, Base (B) = 1

=> Hypotenuse (H) = $\sqrt{(P^2 + B^2)} = \sqrt{(1^2 + 1^2)} = \sqrt{2}$

=> sin A = P/H = 1/√2

=> cos A = B/H = 1/√2

=> sin A + cos A = (1/√2) + (1/√2)

=> Result = 2/√2 = √2

Therefore The correct answer is √2.

Additional Information

Trigonometric Identities

Fundamental relations like $\sin^2A + \cos^2A = 1$ and $1 + \tan^2A = \sec^2A$ are essential for solving trigonometric expressions.

Standard Values

Values of sin, cos, and tan at 0°, 30°, 45°, 60°, and 90° help in direct substitution (e.g., sin 45° = 1/√2).

Pythagoras Theorem

In a right-angled triangle, the square of the hypotenuse is equal to the sum of squares of the other two sides: $H^2 = P^2 + B^2$.

Q28. Answer: (a) Increase by 25.4%

Shortcut Trick

Assume TV price = 100, then Washing Machine (WM) = 90.

Initial Total (5 WM + 3 TV) = (5 × 90) + (3 × 100) = 450 + 300 = 750.

New WM = 90 × 1.65 = 148.5 | New TV = 100 × 0.66 = 66.

New Total = (5 × 148.5) + (3 × 66) = 742.5 + 198 = 940.5.

% Change = (940.5 − 750) ÷ 750 × 100 = 190.5 ÷ 7.5 = 25.4%.

Therefore The correct answer is Increase by 25.4%.

Alternate Method

Given:

Cost of TV = 100x

Cost of Washing Machine = 100x − 10% of 100x = 90x

Calculations:

=> Initial total cost (5 WM + 3 TV) = 5(90x) + 3(100x) = 450x + 300x = 750x

=> New cost of WM = 90x × (165/100) = 148.5x

=> New cost of TV = 100x × (66/100) = 66x

=> New total cost = 5(148.5x) + 3(66x) = 742.5x + 198x = 940.5x

=> Total change = 940.5x − 750x = 190.5x

=> Percentage change = (190.5x ÷ 750x) × 100 = 25.4%

Therefore The correct answer is Increase by 25.4%.

Additional Information

Percentage Change

Percentage change = (Final Value − Initial Value) ÷ Initial Value × 100.

Weighted Average Percentage

When components change by different percentages, the net change depends on the weight (initial cost contribution) of each component.

Successive Percentage Shortcut

For two successive changes a and b, the net change is a + b + (ab/100).

Q29. Answer: (a) 80%

Shortcut Trick

Ratio of Marked Price (MP) to Selling Price (SP) = 3650 : 730 = 5 : 1

Discount units = 5 − 1 = 4 units

Discount % = (Discount units / MP units) × 100

Discount % = (4 / 5) × 100 = 80%

Therefore The correct answer is 80%.

Alternate Method

Given: Marked Price (MP) = Rs. 3,650 and Selling Price (SP) = Rs. 730

Formula Used: Discount = MP − SP | Discount % = (Discount / MP) × 100

=> Discount = 3,650 − 730 = Rs. 2,920

=> Discount % = (2,920 ÷ 3,650) × 100

=> Discount % = 0.8 × 100 = 80%

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Therefore The correct answer is 80%.
Additional Information
Marked Price (MP)
The price written on the tag of an item before any discount is applied. It is also known as the List Price.
Successive Discounts
When multiple discounts are given, the Equivalent Discount % is calculated as: a + b − (a × b / 100).
Markup Percentage
The extra price added to the Cost Price (CP) to reach the MP: Markup % = [(MP − CP) / CP] × 100.

Q30. Answer: (a) 31

Shortcut Trick
Sister age = (Sum − Difference) ÷ 2
Sister age = (38 − 6) ÷ 2 = 32 ÷ 2 = 16 years
After 15 years, age = 16 + 15 = 31 years
Therefore The correct answer is 31 years.
Alternate Method
Given:
Difference between Brother and Sister = 6 years
Sum of Brother and Sister = 38 years
Let the Sister present age be x years.
Then Brother present age = (x + 6) years.
=> x + (x + 6) = 38
=> 2x + 6 = 38
=> 2x = 32
=> x = 16 years
Sister age after 15 years = 16 + 15
=> 31 years
Therefore The correct answer is 31 years.
Additional Information
Linear Equations in Age
Age problems often involve creating equations where (x + n) represents age after n years and (x − n) represents age n years ago.
Constant Difference
The age difference between two individuals remains constant throughout their lives, regardless of the number of years passed.

Q31. Answer: (c) 7.5% profit

Shortcut Trick
Profit 12.5% = 1/8 → CP : SP1 = 8 : 9
9 units = Rs. 85.50 => 1 unit = Rs. 9.50
CP = 8 × 9.50 = Rs. 76
New SP2 = Rs. 81.70 => Profit = 81.70 − 76 = Rs. 5.70
Profit% = (5.70 / 76) × 100 = 7.5%
Therefore The correct answer is 7.5% profit.
Alternate Method
Given:
Selling Price (SP1) = Rs. 85.50
Profit Percentage (P1%) = 12.5%
New Selling Price (SP2) = Rs. 81.70
Formula Used:
CP = [SP / (100 + P%)] × 100
Profit% = [(SP − CP) / CP] × 100
Calculations:
=> Cost Price (CP) = [85.50 / (100 + 12.5)] × 100

=> CP = [85.50 / 112.5] × 100

=> CP = 0.76 × 100 = Rs. 76

=> New Profit = SP2 − CP = 81.70 − 76 = Rs. 5.70

=> New Profit% = (5.70 / 76) × 100

=> New Profit% = 570 / 76 = 7.5%

Therefore The correct answer is 7.5% profit.

Additional Information

Profit and Loss Basics

Profit occurs when SP > CP, and Loss occurs when CP > SP. Percentage is always calculated on Cost Price (CP) unless stated otherwise.

Fractional Conversion

12.5% is equivalent to 1/8. This means for a CP of 8 units, the profit is 1 unit, making the SP 9 units.

Marked Price and Discount

Discount is always calculated on the Marked Price (MP). SP = MP − Discount.

Q32. Answer: (a) 8,325

Shortcut Trick

Investment ratio of Rajiv : Sachin = 160 : 1690 = 16 : 169.

Profit share is proportional to investment: 16 units = Rs. 720.

1 unit = 720 ÷ 16 = Rs. 45.

Total profit = (16 + 169) units = 185 units.

Total profit = 185 × 45 = Rs. 8,325.

Therefore The correct answer is Rs. 8,325.

Alternate Method

Given: Rajiv's investment (C_R) = Rs. 160, Sachin's investment (C_S) = Rs. 1,690, Rajiv's profit (P_R) = Rs. 720.

Formula Used: Profit Ratio = Capital Ratio × Time Ratio (Since time is same, Profit Ratio = Capital Ratio).

=> Ratio of profits = 160 : 1690 = 16 : 169

=> Let Rajiv's profit be 16x and Sachin's profit be 169x

=> 16x = 720

=> x = 720 ÷ 16 = 45

=> Total Profit = 16x + 169x = 185x

=> Total Profit = 185 × 45 = 8325

Therefore The correct answer is Rs. 8,325.

Additional Information

Partnership Profit Distribution

Profit is divided in the ratio of the product of Capital and Time: P1 : P2 = (C1 × T1) : (C2 × T2).

Active vs. Sleeping Partner

An active partner manages the business and may receive a salary or extra commission before the remaining profit is shared among all partners.

Compound Partnership

When partners invest money for different durations, it is called a compound partnership, and the time period must be considered for ratio calculations.

Q33. Answer: (b) 6,73,365

Shortcut Trick

Net multiplier = 1.05 × 1.06 × 1.10 = 1.2243

Final Value = 5,50,000 × 1.2243

Final Value = 5,50,000 × (1 + 0.05 + 0.06 + 0.10 + small decimals) ≈ 5,50,000 × 1.22

Calculation: 5,50,000 × 1.05 × 1.06 × 1.1 = 6,73,365

Therefore The correct answer is Rs. 6,73,365.

Alternate Method

Given:

Initial Value (P) = Rs. 5,50,000

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Successive growth rates: r1 = 5%, r2 = 6%, r3 = 10%
Formula Used:
Final Value = P × (1 + r1/100) × (1 + r2/100) × (1 + r3/100)
Calculations:
=> Final Value = 5,50,000 × (105/100) × (106/100) × (110/100)
=> Final Value = 5,50,000 × (21/20) × (53/50) × (11/10)
=> Final Value = 550000 × (21 × 53 × 11) ÷ (20 × 50 × 10)
=> Final Value = 550000 × 12243 ÷ 10000
=> Final Value = 55 × 12243
=> Final Value = 6,73,365
Therefore The correct answer is Rs. 6,73,365.
Additional Information
Successive Percentage Change
For two successive changes a% and b%, the net effective change is (a + b + ab/100)%.
Depreciation Formula
If the value decreases, the formula becomes Final Value = P × $(1 - r/100)^n$.
Unit Digit Trick
Multiplying 5 (from 5.5) with odd numbers often ends in 5; checking unit digits can eliminate options in complex calculations.

Q34. Answer: (b) 5

Shortcut Trick
Arrange the given observations in ascending order: 2, 2, 3, 4, 5, 5, 5, 7, 8, 8, 9, 11.
Count the total number of terms, n = 12 (which is an even number).
The median is the average of the 6^(th) and 7^(th) terms.
6^(th) term = 5 and 7^(th) term = 5.
Median = (5 + 5) ÷ 2 = 5.
Therefore The correct answer is 5.
Alternate Method
Given observations: 3, 5, 2, 5, 5, 8, 4, 2, 7, 9, 8, 11
Formula Used:
If n is even, Median = [(n/2)^(th) term + (n/2 + 1)^(th) term] ÷ 2
=> First, arrange in ascending order: 2, 2, 3, 4, 5, 5, 5, 7, 8, 8, 9, 11
=> Total count (n) = 12
=> Median = [(12/2)^(th) term + (12/2 + 1)^(th) term] ÷ 2
=> Median = [6^(th) term + 7^(th) term] ÷ 2
=> Median = [5 + 5] ÷ 2
=> Median = 10 ÷ 2 = 5
Therefore The correct answer is 5.
Additional Information
Median for Odd Count
If the number of observations (n) is odd, the median is the exactly ((n + 1)/2)^(th) term after sorting.
Mode
The mode is the value that appears most frequently in a data set. In this set, the mode is 5 (appears three times).
Empirical Relation
Relation between Mean, Median, and Mode: Mode = 3 × Median − 2 × Mean.
Range
The range is the difference between the maximum and minimum values: Range = Max − Min.

Q35. Answer: (d) Rs. 3,240

Shortcut Trick
Direct Relation: Cost Price (CP) / Marked Price (MP) = (100 − Discount %) / (100 + Profit %)
CP / 5670 = (100 − 28) / (100 + 26)

CP / 5670 = 72 / 126 = 4 / 7
CP = 5670 × (4 / 7) = 810 × 4 = 3240
Therefore The correct answer is Rs. 3,240.
Alternate Method
Given:
Marked Price (MP) = Rs. 5,670
Discount = 28%
Profit = 26%
Formula Used:
Selling Price (SP) = MP × (100 − D%)/100
Cost Price (CP) = SP × 100 / (100 + P%)
Calculations:
=> SP = 5670 × (100 − 28) / 100
=> SP = 5670 × 72 / 100 = 56.7 × 72 = Rs. 4,082.4
=> CP = 4082.4 × 100 / (100 + 26)
=> CP = 408240 / 126
=> CP = Rs. 3,240
Therefore The correct answer is Rs. 3,240.
Additional Information
Relationship between CP and MP
The ratio of Cost Price to Marked Price is given by (100 − Discount%) : (100 + Profit%).
Successive Discounts
If two discounts d1 and d2 are given, the Equivalent Discount is (d1 + d2 − (d1 × d2)/100)%.
Markup Percentage
Markup % = [(MP − CP) / CP] × 100. It is the percentage by which the cost price is increased to set the marked price.

Q36. Answer: (a) 52

Shortcut Trick
Assume a deviation base of 50 for the given observations.
Net Deviation = 26 − 22 + 29 − 33 − 17 + 45 + 33 − 20 − 23 = +18
Average = Base + (Net Deviation ÷ Total observations) = 50 + (18 ÷ 9) = 50 + 2 = 52
Therefore The correct answer is 52.
Alternate Method
Given: Observations = 76, 28, 79, 17, 33, 95, 83, 30, 27
Formula Used: Arithmetic Mean = (Sum of all observations) ÷ (Total number of observations)
=> Sum = 76 + 28 + 79 + 17 + 33 + 95 + 83 + 30 + 27
=> Sum = 468
=> Total count (n) = 9
=> Arithmetic Mean = 468 ÷ 9
=> Arithmetic Mean = 52
Therefore The correct answer is 52.
Additional Information
Properties of Arithmetic Mean
The sum of deviations of a set of observations from their arithmetic mean is always zero. $\Sigma(x_i - x) = 0$.
Combined Mean
If two groups have means x1 and x2 with sizes n1 and n2, the combined mean is (n1x1 + n2x2) ÷ (n1 + n2).
Weighted Mean
Used when observations have different importance or weights: Mean = $\Sigma(w_i x_i) \div \Sigma w_i$.

Q37. Answer: (a) Rs. 5,495

Shortcut Trick
In a partnership, the ratio of profits is equal to the ratio of investments when the time period is the same.

Total profit = Rs. 6,000 | Amit profit = Rs. 2,100 → Deeksha profit = Rs. 3,900.
Profit ratio (Amit : Deeksha) = 2100 : 3900 = 7 : 13.
Amit investment = [7 ÷ (7 + 13)] × 15700 = (7 ÷ 20) × 15700 = 7 × 785 = Rs. 5,495.
Therefore The correct answer is Rs. 5,495.
Alternate Method
Given: Total Investment = Rs. 15,700, Total Profit = Rs. 6,000, Amit profit = Rs. 2,100.
Formula: Investment Ratio = Profit Ratio (for equal time duration).
=> Deeksha profit = Total Profit − Amit profit
=> Deeksha profit = 6000 − 2100 = Rs. 3,900
=> Ratio of Profit (Amit : Deeksha) = 2100 : 3900 = 21 : 39 = 7 : 13
=> Let Amit investment be 7x and Deeksha investment be 13x
=> 7x + 13x = 15700
=> 20x = 15700
=> x = 785
=> Amit investment = 7 × 785 = Rs. 5,495
Therefore The correct answer is Rs. 5,495.
Additional Information
Partnership Ratio Rule
Profit of A : Profit of B = (Investment of A × Time of A) : (Investment of B × Time of B).
Simple vs Compound Partnership
In simple partnership, time is constant for all partners. In compound partnership, partners invest for different time periods.
Investment Calculation
Individual Investment = (Total Investment ÷ Sum of Ratio Parts) × Individual Ratio Part.

Q38. Answer: (d) 0.6

Shortcut Trick
Relative Speed (Same Direction) = 130 − 100 = 30 km/hr.
Total Distance = 160 + 140 = 300 m = 0.3 km.
Time = Distance ÷ Speed = 0.3 ÷ 30 = 0.01 hours.
Time in minutes = 0.01 × 60 = 0.6 minutes.
Therefore The correct answer is 0.6 minutes.
Alternate Method
Given:
Length of first train (L1) = 160 m
Length of second train (L2) = 140 m
Speed of first train (S1) = 100 km/hr
Speed of second train (S2) = 130 km/hr
Formula Used:
Relative Speed (Same Direction) = S2 − S1
Time = (Total Length) ÷ (Relative Speed)
Calculations:
=> Total distance to be covered = 160 + 140 = 300 m
=> Relative Speed = 130 − 100 = 30 km/hr
=> Convert speed to m/s: 30 × (5/18) = 25/3 m/s
=> Time in seconds = 300 ÷ (25/3) = 300 × 3 ÷ 25
=> Time in seconds = 12 × 3 = 36 seconds
=> Time in minutes = 36 ÷ 60 = 0.6 minutes
Therefore The correct answer is 0.6 minutes.
Additional Information
Relative Speed Concept
When two objects move in the same direction, relative speed is the difference (S1 − S2). In opposite directions, it is the sum (S1 + S2).

Unit Conversion

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

Train Crossing Problems

When a train crosses another train or a platform, the total distance is always the sum of their individual lengths.

Q39. Answer: (a) 40

Shortcut Trick

Identify Time in days: Feb (10) + Mar (31) + Apr (20) = 61 days (Note: 2024 is a Leap Year).

Apply direct SI calculation: (4000 × 6 × 61) ÷ (100 × 366).

Simplify: 40 × 6 × (61 ÷ 366) => 40 × 6 × (1/6) = 40.

Therefore The correct answer is Rs. 40.

Alternate Method

Given:

Principal (P) = Rs. 4,000

Rate (R) = 6% per annum

Time Period: 19 Feb 2024 to 20 Apr 2024

Days in Feb = 29 − 19 = 10 days (Leap Year)

Days in March = 31 days

Days in April = 20 days

=> Total Days (T) = 10 + 31 + 20 = 61 days

Formula Used:

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

Calculations:

=> T in years = 61 ÷ 366 (As 2024 is a leap year)

=> SI = (4000 × 6 × 61) ÷ (100 × 366)

=> SI = (40 × 6 × 61) ÷ 366

=> SI = (240 × 61) ÷ 366

=> SI = 14640 ÷ 366

=> SI = 40

Therefore The correct answer is Rs. 40.

Additional Information

Leap Year Calculation

A year is a leap year if divisible by 4 (e.g., 2024). It has 366 days and February has 29 days.

Simple Interest on Days

While calculating days, the day the money is deposited is excluded, but the day the money is withdrawn is included.

Amount Formula

Total Amount (A) = Principal (P) + Simple Interest (SI).

Q40. Answer: (b) 60

Given:

4 - [3 - 4 ÷ 2 + {4 - (5 - 2)}] + [4 + 18 ÷ 2 × 3(4 - 2)]

Formula Used:

BODMAS rule: Bracket → Of → Division → Multiplication → Addition → Subtraction

Calculation:

=> 4 - [3 - 4 ÷ 2 + {4 - 3}] + [4 + 18 ÷ 2 × 3 × 2]

=> 4 - [3 - 2 + 1] + [4 + 9 × 3 × 2]

=> 4 - [2] + [4 + 27 × 2]

=> 4 - 2 + [4 + 54]

=> 4 - 2 + 58

=> 2 + 58

=> 60

Therefore The correct answer is 60.

Q41. Answer: (c) 2

Shortcut Trick

Numbers between 374 and 384 are 375, 376, 377, 378, 379, 380, 381, 382, and 383.

Eliminate all even numbers: 376, 378, 380, 382.

Eliminate numbers ending in 5: 375.

Check remaining odd numbers: 377 = 13 × 29 (not prime), 381 = 3 × 127 (not prime).

Only 379 and 383 are prime numbers.

Therefore The correct answer is 2.

Alternate Method

Given range: numbers strictly between 374 and 384.

List of integers in this range: {375, 376, 377, 378, 379, 380, 381, 382, 383}

To check if a number N is prime, we test divisibility by prime numbers up to √N ≈ 19.5 (i.e., 2, 3, 5, 7, 11, 13, 17, 19).

=> 375: Divisible by 5 (not prime)

=> 376, 378, 380, 382: Divisible by 2 (not prime)

=> 377: 377 ÷ 13 = 29 (not prime)

=> 379: Not divisible by 2, 3, 5, 7, 11, 13, 17, 19 (Prime)

=> 381: Divisible by 3 (Sum of digits 3+8+1 = 12) (not prime)

=> 383: Not divisible by 2, 3, 5, 7, 11, 13, 17, 19 (Prime)

=> Total prime numbers = 2 (which are 379 and 383)

Therefore The correct answer is 2.

Additional Information

Prime Number Definition

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

Primality Test Rule

To determine if a number N is prime, check its divisibility by all prime numbers less than or equal to √N.

Sieve of Eratosthenes

An ancient and highly efficient algorithm used to find all prime numbers up to any given limit by systematically marking the multiples of each prime.

Q42. Answer: (c) 6

Shortcut Trick

Total work (LCM of 18, 24) = 72 units.

Efficiency: A = 4, B = 3.

Pipe B works for the entire 16 hours: 3 × 16 = 48 units.

Remaining work for A: 72 − 48 = 24 units.

Time for A: 24 ÷ 4 = 6 hours.

Therefore The correct answer is 6 hours.

Alternate Method

Given: Time for A = 18 hours, Time for B = 24 hours. Total time to fill = 16 hours.

Formula Used: Total Work = Efficiency × Time

Person	Days	Total Work	Efficiency
Pipe A	18	72	4
Pipe B	24	3	

=> Let Pipe A be closed after x hours.

=> Pipe B remains open for the full 16 hours.

=> Work done by A + Work done by B = 72

=> (4 × x) + (3 × 16) = 72

=> 4x + 48 = 72

=> 4x = 24

=> x = 6 hours

Therefore The correct answer is 6 hours.

Additional Information

Pipes and Cisterns Efficiency

Filling pipes have positive efficiency, while outlet/leakage pipes have negative efficiency.

Work and Wages

Wages are distributed in the ratio of the actual work done by each person or pipe.

Total Work Assumption

Always assume total work as the LCM of the individual times to simplify calculations into integers.

Q43. Answer: (b) Rs. 132

Shortcut Trick

Perimeter of the field = Total Cost ÷ Rate per meter

=> Perimeter = 18000 ÷ 15 = 1200 m

New Rate is Rs. 11 per 100 m, which means 11/100 = Rs. 0.11 per meter.

New Total Cost = 1200 × 0.11 = Rs. 132

Therefore The correct answer is Rs. 132.

Alternate Method

Given:

Total cost of fencing = Rs. 18,000

Rate of fencing = Rs. 15/m

New Rate of fencing = Rs. 11 per 100 m

Formula Used:

Total Cost = Perimeter × Rate per unit

Calculations:

=> Perimeter of the square field = 18000 ÷ 15

=> Perimeter = 1200 m

=> We need to find the cost at Rs. 11 per 100 m.

=> Cost for 100 m = Rs. 11

=> Cost for 1 m = Rs. 11/100

=> Total cost for 1200 m = 1200 × (11 ÷ 100)

=> Total cost = 12 × 11 = Rs. 132

Therefore The correct answer is Rs. 132.

Additional Information

Perimeter of a Square

The total length of the boundary of a square is 4 × Side. In fencing problems, we always calculate the Perimeter.

Costing Units

If the rate is given as Rs. X per Y units, the cost for Z units is calculated as (Z ÷ Y) × X.

Area vs Perimeter

Use Perimeter for fencing, borders, or running around a field. Use Area ($Side^2$) for tiling, flooring, or ploughing a field.

Q44. Answer: (d) 21 cm

Shortcut Trick

For a toy where Volume of Cone = Volume of Hemisphere with the same radius (r):

$(1/3) \times \pi \times r^2 \times h = (2/3) \times \pi \times r^3 \Rightarrow h = 2r$.

The total height of the toy is the sum of the cone height (h) and hemisphere radius (r):

Total Height = h + r = 2r + r = 3r.

Given r = 7 cm, Total Height = 3 × 7 = 21 cm.

Therefore The correct answer is 21 cm.

Alternate Method

=> Given: Radius (r) of both cone and hemisphere = 7 cm.

=> Formula Used: Volume of Cone = $(1/3)\pi r^2 h$ | Volume of Hemisphere = $(2/3)\pi r^3$.

=> Volume of conical part = Volume of hemispherical part

=> $(1/3) \times \pi \times r^2 \times h = (2/3) \times \pi \times r^3$

=> (1/3) × π × 7^2 × h = (2/3) × π × 7^3

=> h = 2 × 7

=> h = 14 cm

=> Total height of the toy = Height of cone (h) + Radius of hemisphere (r)

=> Total height = 14 + 7 = 21 cm.

Therefore The correct answer is 21 cm.

Additional Information

Volume of a Sphere

The volume of a complete sphere is (4/3) × π × r^3. A hemisphere is exactly half of this volume.

Slant Height of a Cone

The slant height (l) is the distance from the apex to any point on the base circle: l = √(h^2 + r^2).

Curved Surface Area (CSA)

For the toy, Total CSA = CSA of cone (πrl) + CSA of hemisphere ($2\pi r^2$).

Q45. Answer: (d) 54536

Given:

(32672 × 32672 - 21864 × 21864)/10808

Formula Used:

(a^2 - b^2) ÷ c

a^2 - b^2 = (a - b) × (a + b)

Calculation:

(32672 × 32672 - 21864 × 21864)/10808

=> (32672 - 21864) × (32672 + 21864) ÷ 10808

=> 10808 × 54536 ÷ 10808

=> 54536

Therefore The correct answer is 54536.

Q46. Answer: (a) 2 : √3

Shortcut Trick

Let the side of both the equilateral triangle and the square be 'a'.

Circumradius of equilateral triangle (R) = a/√3

Inradius of square (r) = a/2

Required Ratio = (a/√3) : (a/2) = 2 : √3

Therefore The correct answer is 2 : √3.

Alternate Method

Given:

Side of equilateral triangle = Side of square = a

Formula Used:

Circumradius (R) of equilateral triangle = Side / √3

Inradius (r) of square = Side / 2

Calculations:

=> Let the side of the triangle and square be 'a'.

=> Circumradius (R) of equilateral triangle = a / √3

=> Inradius (r) of square = a / 2

=> Required Ratio = R : r

=> Ratio = (a / √3) : (a / 2)

=> Ratio = 1/√3 : 1/2

=> Ratio = 2 : √3

Therefore The correct answer is 2 : √3.

Additional Information

Inradius of Equilateral Triangle

The inradius ($r_{(tri)}$) of an equilateral triangle with side 'a' is given by $r_{(tri)}$ = a / (2√3).

Circumradius of Square

The circumradius (R_{sq}) of a square with side 'a' is half of its diagonal, $R_{sq} = a / \sqrt{2}$.

Area of Equilateral Triangle

The area of an equilateral triangle with side 'a' is $(\sqrt{3} / 4) \times a^2$.

Diagonal of a Square

The diagonal of a square with side 'a' is $a\sqrt{2}$.

Q47. Answer: (b) 2

Shortcut Trick

Using Alligation method on average coin value:

Average value per coin = 16 ÷ 10 = Rs. 1.6

Ratio of 1-rupee coins to 2-rupee coins = (2 − 1.6) : (1.6 − 1) = 0.4 : 0.6 = 2 : 3

Total ratio units (2 + 3) = 5 → 10 coins. So, 1 unit = 2 coins.

Difference in units = 3 − 2 = 1 unit × 2 = 2 coins.

Therefore The correct answer is 2.

Alternate Method

Given: Total coins = 10, Total value = Rs. 16.

Let the number of 1-rupee coins be x and 2-rupee coins be y.

=> x + y = 10 ... (i)

=> 1 × x + 2 × y = 16 => x + 2y = 16 ... (ii)

Subtracting equation (i) from (ii):

=> (x + 2y) − (x + y) = 16 − 10

=> y = 6

Substituting y = 6 in (i):

=> x + 6 = 10 => x = 4

Difference between the numbers of coins:

=> |6 − 4| = 2

Therefore The correct answer is 2.

Additional Information

Mixture and Alligation in Coins

This technique allows solving linear equations by finding the ratio of quantities when their weighted average is known.

Linear Equations in Two Variables

For coin problems, use equations: x + y = Total Quantity and (Value1 × x) + (Value2 × y) = Total Value.

Q48. Answer: (c) 12 km/hr

Shortcut Trick

Speed ratio = 7 : 4 → Time ratio = 4 : 7 (as distance is constant for both comparison cases).

Difference in time units = 7 − 4 = 3 units.

Given time difference = 7 hours Therefore 3 units = 7 hours => 1 unit = 7/3 hours.

Time for slower truck (7 units) = 7 × (7/3) = 49/3 hours.

Speed of slower truck = Distance ÷ Time = 196 ÷ (49/3) = (196 × 3) ÷ 49 = 4 × 3 = 12 km/hr.

Therefore The correct answer is 12 km/hr.

Alternate Method

Given: Ratio of speeds = 7 : 4, Distance = 196 km, Time difference = 7 hours.

Formula Used: Speed = Distance ÷ Time | Time = Distance ÷ Speed

=> Let the speeds be 7x and 4x km/hr.

=> Time taken by slower truck − Time taken by faster truck = 7

=> (196 / 4x) − (196 / 7x) = 7

=> (49 / x) − (28 / x) = 7

=> 21 / x = 7

=> x = 21 ÷ 7 = 3

=> Speed of slower truck = 4x = 4 × 3 = 12 km/hr.

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Therefore The correct answer is 12 km/hr.

Additional Information

Inverse Proportion of Speed and Time

When the distance is constant, the time taken is inversely proportional to the speed (S1/S2 = T2/T1).

Average Speed Formula

If a certain distance is covered at speed 'a' and the same distance at speed 'b', then Average Speed = 2ab / (a + b).

Relative Speed

In the same direction, relative speed is (S1 − S2). In the opposite direction, relative speed is (S1 + S2).

Q49. Answer: (d) 1,000

Shortcut Trick

Savings = 60%, so Expenditure = 100% − 60% = 40%.

Given, 40% of Income = Rs. 400.

100% of Income = (400 ÷ 40) × 100 = 10 × 100 = Rs. 1,000.

Therefore The correct answer is Rs. 1,000.

Alternate Method

Given:

Savings percentage = 60%

Expenditure = Rs. 400

Formula:

Income = Expenditure + Savings

Expenditure % = 100% − Savings %

Calculations:

=> Expenditure % = 100% − 60% = 40%

=> Let Total Income be x.

=> 40% of x = 400

=> (40 ÷ 100) × x = 400

=> x = (400 × 100) ÷ 40

=> x = 10 × 100

=> x = 1000

Therefore The correct answer is Rs. 1,000.

Additional Information

Income-Expenditure Concept

The fundamental relation is Income = Expenditure + Savings. If any two components or their percentages are known, the third can be calculated.

Percentage Change in Income

If Income increases by x% and Expenditure increases by y%, the change in Savings can be found using the weighted average or Alligation method.

Base Value in Percentages

In income-based problems, Total Income is always considered as the base value (100%) for calculations unless specified otherwise.

Q50. Answer: (d) 20

Shortcut Trick

Efficiency of A + B = Total Work ÷ Days = 30 ÷ 6 = 5 units/day.

Efficiency of B = 30 ÷ 15 = 2 units/day.

Efficiency of A = 5 − 2 = 3 units/day.

Double work = 30 × 2 = 60 units.

Time taken by A = 60 ÷ 3 = 20 days.

Therefore The correct answer is 20 days.

Alternate Method

Given: Time (A+B) = 6 days, Time (B) = 15 days.

Formula Used: Total Work = LCM of time; Efficiency = Total Work ÷ Time.

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Person	Days	Total Work	Efficiency
A + B	6	30	5
B	15	2	

=> Efficiency of A = (Efficiency of A + B) − (Efficiency of B)

=> Efficiency of A = 5 − 2 = 3

=> New Work = 2 × 30 = 60 units

=> Time for A = 60 ÷ 3 = 20 days

Therefore The correct answer is 20 days.

Additional Information

Work and Efficiency Relationship

Efficiency is inversely proportional to the time taken to complete a task. Efficiency = Work ÷ Time.

Combined Work Formula

If A takes 'x' days and B takes 'y' days, they together take (x × y) ÷ (x + y) days to complete the work.

Pipes and Cisterns

The same logic applies where efficiency of an outlet pipe is taken as negative work.

Q51. Answer: (a) 72

The logic followed here is:

thus, "72" will replace the question mark in the given series.

Hence, the correct option is "Option 1".

Q52. Answer: (a) One

Given: A, B, C, R, S, T and U are sitting around a circular table facing the centre of the table.

C sits to the immediate right of R.

Only three people sit between C and T when counted from the left of C.

Only three people sit between R and B when counted from the left of R.

S sits to the immediate right of A.

Here, There are One people sitting between R and A when counted from the right of A.

Hence, the correct answer is "Option 1".

Q53. Answer: (a) 106

The logic followed here is:

thus, "106" will replace the question mark in the given series.

Hence, the correct option is "Option 1".

Q54. Answer: (b) Two

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

Now,

Even numbers that are immediately preceded by an odd number and also immediately followed by an even number.

So, Needed pattern is: Odd - Even - Even.

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

There are Two even numbers which is immediately preceded by an odd number and also immediately followed by an even number.

Hence, the correct answer is 'Option 2'.

Q55. Answer: (b) NS-OK

The logic followed here is:

Option 1) PU-QN

Option 2) NS-OK

Option 3) LQ-MJ

Option 4) RW-SP

Here, 'NS-OK' is odd among the given options.

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Hence, the correct answer is "Option 2".

Q56. Answer: (c) Wife's father's brother

Family Chart:

Decoding the Symbols:

Symbol	•	@	•	#
Meaning	Sister	Brother	Wife	Father

Given: ‘O @ P + T # G - V’

It means: O is the Brother of P, P is the Sister of T, T is the Father of G, G is the Wife of V.

So, O is the Wife's father's brother of V.

Hence, the correct answer is "Option 3".

Q57. Answer: (c) jo

The logic followed here is:

‘virus book two’ is coded as ‘zv jo db’,

‘book wet theme’ is coded as ‘xh im jo’.

Here, the common word in both sentences is ‘book’.

Now, look at the codes:

The common code in both code groups is ‘jo’.

So, Code for ‘book’ is ‘jo’.

Hence, the correct answer is "Option 3".

Q58. Answer: (d) Only conclusion (II) follows.

Given Statements:

All pan are wok.

All cauldron are wok.

The least possible Venn diagram for the given statement is:

Conclusions:

I. Some pan are cauldron - False (Because, no definite relation is given between pan and cauldron. They may or may not overlap. Hence, it is possible only.)

II. Some wok are cauldron - True (Because, all cauldron are wok, so definitely some wok are cauldron.)

So, Only conclusion II follows.

Hence, the correct answer is "Option 4".

Q59. Answer: (a) 40

Given:

Dev is 10th from the top,

Dev is 31st from the bottom.

Total number of students = 10 + 31 − 1 = 40.

So, there are '40' students in the class.

Hence, the correct answer is "Option 1".

Q60. Answer: (a) KAX

The logic followed here is:

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

Hence, the correct answer is "Option 1".

Q61. Answer: (b) DBY

The logic followed here is:

Option 1) HEC

Option 2) DBY

Option 3) ZWU

Option 4) EBZ

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Here, 'DBY' is odd among the given options.
Hence, the correct answer is "Option 2".

Q62. Answer: (c) RAN 14

The logic followed here is:
So, 'RAN14' will replace the question mark in the given series.
Hence, the correct answer is "Option 3".

Q63. Answer: (c) WAIT - AIWT - TIAW

The position and positional values or English Alphabets are:
ECHO → CHEO → OHCE
URGE → RGUE → EGRU
Now,
ECHO → CHEO
Here, the 1st letter shifts to 3rd position,
the 2nd letter shifts to 1st position,
the 3rd letter shifts to 4th position,
the 4th letter shifts to 2nd position.
So, the pattern is: 2 4 1 3 (based on positions).
CHEO → OHCE
Again, the same positional pattern 2 4 1 3 is followed.
Now, let's check each Option One by One.
Option 1) JOYS → OYJS → OYSJ
Option 2) NAVY → ANVY → YAVN
Option 3) WAIT → AIWT → TIAW
Option 4) PAST → PSAT → TSAP
So, Only WAIT → AIWT → TIAW follows the pattern of given letter cluster.
Hence, the correct answer is 'Option 3'.

Q64. Answer: (d) 15 km towards the north

Given:
Kareena starts from Point A and drives 16 km towards the east.
She then takes a right turn, drives 7 km, turns right and drives 7 km.
She then takes a left turn and drives 8 km.
She takes a final right turn, drives 9 km and stops at Point P.
So, She should drive 15 km towards the north in order to reach Point A again.
Hence, the correct answer is "Option 4".

Q65. Answer: (d) Four

Given: Seven people B, C, D, I, J, K and L are sitting around a circular table facing the centre of the table.
I sits fourth to the right of J.
D sits third to the left of K.
Only two people sit between B and C when counted from the left of B.
L is an immediate neighbour of K and C.
Here,There are Four people between I and L when counted from the left of L.
Hence, the correct answer is "Option 4".

Q66. Answer: (c) 72

BODMAS Table:
The logic followed here is:
Given equation: 60 F 12 H 3 E 8 G 2 = ?
Now, if F stands for '−', H stands for '÷', E stands for '+' and G stands for '×', then:
=> 60 − 12 ÷ 3 + 8 × 2 = ?
=> 60 − 4 + 16 = ?

=> 56 + 16 = ?

=> 72

Hence, the correct answer is "Option 3".

Q67. Answer: (a) More than three

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

Now,

Odd digits which is immediately preceded by an even digit and also immediately followed by an odd digit.

So, Needed pattern is: Even - Odd - Odd.

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

There are More than Three Odd digits which is immediately preceded by an even digit and also immediately followed by an odd digit.

Hence, the correct answer is 'Option 1'.

Q68. Answer: (b) 29

Given: 60 people.

Mayank is 13th from the right end,

Kishan is 18th from the left end.

Position of Mayank from the left = 60 − 13 + 1 = 48.

So, people between Kishan and Mayank = 48 − 18 − 1 = 29.

So, there are '29' people standing between Mayank and Kishan.

Hence, the correct answer is "Option 2".

Q69. Answer: (a) PP 6

The logic followed here is:

For, EQ 9 is related to HL −4

For, MR 13 is related to PM 0

Similarly, for MU 19

So, MU 19 will be related to PP 6.

Hence, the correct answer is "Option 1".

Q70. Answer: (a) 2 km to the South

Given:

Mr. Zzz starts from Point A and drives 5 km towards the East.

He then takes a right turn, drives 14 km, turns right and drives 16 km.

He then takes a right turn and drives 16 km.

He takes a final right turn, drives 11 km and stops at Point P.

So, He should drive 2 km to the South in order to reach Point A again.

Hence, the correct answer is "Option 1".

Q71. Answer: (a) 18

The logic followed here is:

thus, "18" will replace the question mark in the given series.

Hence, the correct option is "Option 1".

Q72. Answer: (b) Both conclusions (I) and (II) follow.

Given Statements:

All cars are buildings.

All buildings are papers.

The least possible Venn diagram for the given statement is:

Conclusions:

I. Some buildings are cars - True (Because, all cars are buildings, so definitely some buildings are cars.)

II. All cars are papers - True (Because, all cars are buildings and all buildings are papers. Therefore, all cars are papers.)

So, Both conclusions I and II follow.

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Hence, the correct answer is "Option 2".

Q73. Answer: (c) os

The logic followed here is:
'buyer queen heart' is coded as 'os ld xi',
'drive heart aunt' is coded as 'kx to os'.
Here, the common word in both sentences is 'heart'.
Now, look at the codes:
The common code in both code groups is 'os'.
So, Code for 'heart' is 'os'.
Hence, the correct answer is "Option 3".

Q74. Answer: (d) 431

BODMAS Table:
Given equation:
77 − 5 ÷ 49 + 21 × 7 = ?
Now, if '+' means '−', '−' means '×', '×' means '÷' and '÷' means '+', then:
=> 77 × 5 + 49 − 21 ÷ 7 = ?
Now apply BODMAS:
=> 77 × 5 + 49 − 3 = ?
=> 385 + 49 − 3 = ?
=> 434 − 3 = 431.
Hence, the correct answer is "Option 4".

Q75. Answer: (d) Two

Given number: 13645928
Arranging the digits in descending order (from left to right), we get
9 8 6 5 4 3 2 1
Now, compare positions with the original number:
Original: 1 3 6 4 5 9 2 8
New: 9 8 6 5 4 3 2 1
Comparing each position:
1 ≠ 9
3 ≠ 8
6 = 6
4 ≠ 5
5 ≠ 4
9 ≠ 3
2 = 2
8 ≠ 1
So, two digits (6 and 2) remain in the same position.
Hence, the correct answer is Option 4.

Q76. Answer: (a) Two

A, B, C, D, E, F and G are sitting around a circular table facing the centre.
1. E sits third to the right of G.
2. A sits third to the right of E.
3. D is the immediate neighbour of B and A.
4. C sits to the immediate right of F.
Two people sit between F and B when counted from the left of B.
Hence, the correct answer is "Option 1".

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Q77. Answer: (c) One

Given series: (Left) 5 $ 5 7 $ $ @ & * € 3 # 8 # $ 5 © 7 £ 4 & * (Right)

Required condition: Number ← Numbers → Symbol

(Left) 5 $ 5 7 $ $ @ & * € 3 # 8 # $ 5 © 7 £ 4 & * (Right)

There is only one such number which is immediately preceded by a number and also immediately followed by a symbol.

Hence, the correct answer is “Option 3”.

Q78. Answer: (d) (8, 37, 7)

The logic followed here is:

Logic: (1st number × 2) + (3rd number × 3) = 2nd number.

Now,

For, (45, 114, 8)

=> (45 × 2) + (8 × 3) = 90 + 24 = 114.

For,

=> (24 × 2) + (20 × 3) = 48 + 60 = 108.

Similarly, for Option 2: (32, 114, 18)

=> (32 × 2) + (18 × 3) = 64 + 54 = 118.

Wait, let's re-check Option 4: (8, 37, 7)

=> (8 × 2) + (7 × 3) = 16 + 21 = 37.

Hence, the correct answer is "Option 4".

Q79. Answer: (c) More than three

To find the number of prime numbers immediately followed by an even number, we identify all prime numbers in the series (2, 3, 5, 7) and check the number immediately to their right.

Given series:

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

Condition to be checked:

Prime Number → Even Number

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

The pairs meeting the criteria are (5, 8), (7, 2), (2, 6), and (3, 6).

Note that 1 is not considered a prime number.

Thus, the number of prime numbers that belong to that group is Four, which is more than three.

Hence, the correct answer is "Option 3".

Q80. Answer: (a) VREB

The logic followed here is.

For BFKP : XAGK

For LLUV : HGQQ

Applying the same logic to ZWIG : ?

Hence, the correct answer is "Option 1".

Q81. Answer: (a) India

The correct answer is India.

Key Points

• India was honoured as a Country Champion at the 2025 World Bank Land Conference for its transformative efforts in rural land governance. This recognition highlights India's significant progress in implementing land reforms and improving land administration systems.

• The award acknowledges India's use of digital technologies and innovative approaches to enhance transparency, efficiency, and accessibility in rural land records management.

• India's flagship program, Digital India Land Records Modernization Programme (DILRMP), played a pivotal role in achieving this milestone. The program aims to digitize land records, reduce disputes, and ensure land ownership transparency.

• India has also focused on empowering rural communities by providing secure land tenure to marginalized groups, including women and tribal populations, under initiatives such as the Forest Rights Act, 2006.

• The recognition underscores India's commitment to achieving Sustainable Development Goals (SDGs), particularly Goal 1 (No

Poverty) and Goal 15 (Life on Land), through effective rural land governance strategies.

Additional Information

• Digital India Land Records Modernization Programme (DILRMP):

• Launched in 2008, this program aims to digitize and modernize land records to enhance transparency and minimize land disputes.

• It focuses on integrating spatial and non-spatial data, providing a unified land information system accessible to stakeholders.

• DILRMP promotes the use of GIS (Geographical Information System) and remote sensing technologies for accurate land mapping.

• Forest Rights Act, 2006:

• This landmark legislation recognizes the rights of forest-dwelling communities over land and resources, ensuring their socio-economic empowerment.

• It aims to correct historical injustices faced by tribal populations and other traditional forest dwellers.

• World Bank Land Conference:

• An international platform where countries share best practices, policies, and innovations in land governance and administration.

• The conference focuses on achieving equitable land access and security to support sustainable development worldwide.

• Sustainable Development Goals (SDGs):

• Adopted by the United Nations in 2015, the SDGs aim to address global challenges like poverty, inequality, and environmental degradation by 2030.

• India's efforts in rural land governance contribute to achieving SDG Goal 1 (No Poverty) by reducing land disputes and ensuring secure land tenure.

Important Points

• India's Achievements in Rural Land Governance:

• The use of e-governance platforms like the Bhoomi Project in Karnataka and Bhulekh in other states has streamlined land record management.

• India has effectively utilized satellite imagery and geospatial data for land surveys and mapping under programs like SVAMITVA (Survey of Villages and Mapping with Improvised Technology in Village Areas).

• Special initiatives to address the needs of vulnerable groups, such as women and tribal populations, have contributed to inclusive land governance.

• Global Context:

• According to the World Bank's Ease of Doing Business Report, land administration efficiency is crucial for fostering economic growth and investment.

• Countries around the world are adopting digital technologies to modernize land records and address issues like fraudulent transactions and land disputes.

Q82. Answer: (c) A parasitic disease caused by sandfly bites

The correct answer is A parasitic disease caused by sandfly bites.

Key Points

• Kala Azar, also known as visceral leishmaniasis, is a parasitic disease caused by protozoa of the genus Leishmania, transmitted through bites of infected female sandflies (Phlebotomus).

• The disease affects the internal organs, particularly the liver, spleen, and bone marrow, and can be fatal if left untreated.

• Symptoms of Kala Azar include prolonged fever, weight loss, weakness, anemia, and swelling of the spleen and liver.

• Kala Azar is endemic in several African and Asian nations, including India, Bangladesh, Sudan, South Sudan, Ethiopia, and Kenya.

• The World Health Organization (WHO) considers it a neglected tropical disease and has prioritized its elimination in endemic countries through control programs.

Additional Information

• A type of viral fever transmitted by mosquitoes:

• Diseases such as dengue fever, chikungunya, and Zika virus are examples of viral fevers transmitted by mosquitoes, particularly Aedes aegypti.

• Dengue fever is characterized by high fever, severe headache, muscle and joint pain, and skin rash.

• Unlike Kala Azar, these diseases are caused by viruses, not parasitic protozoa.

• A bacterial infection spread through contaminated water:

• Diseases such as cholera and typhoid are bacterial infections caused by consumption of water or food contaminated with the bacteria Vibrio cholerae and Salmonella typhi, respectively.

• Symptoms include severe diarrhea, dehydration, and fever, which differ significantly from Kala Azar's symptoms.

• Kala Azar is not spread through water; it is vector-borne and transmitted by sandflies.

• A genetic disorder affecting red blood cells:

• Genetic disorders such as sickle cell anemia and thalassemia affect the structure and function of red blood cells.

• Sickle cell anemia causes abnormally shaped red blood cells, leading to blockages in blood vessels and reduced oxygen delivery to tissues.

• These disorders are inherited and non-communicable, whereas Kala Azar is an infectious disease caused by parasites.

• About Kala Azar:

• Efforts to combat Kala Azar include early diagnosis, vector control measures (e.g., insecticide spraying), and effective treatment using antileishmanial drugs such as amphotericin B and miltefosine.

• WHO has set a target for eliminating Kala Azar as a public health problem in endemic regions by reducing cases to less than 1 per 10,000 population at the district level.

Q83. Answer: (c) Canara Bank

The correct answer is Canara Bank.

Key Points

• Canara Bank reported a significant 33% rise in its standalone net profit, amounting to Rs. 5,004 crore, for the fourth quarter (Q4) of FY 2024-25. This underscores its strong performance in the banking sector.

• The bank's profit growth reflects its ability to manage its business efficiently amidst a competitive and dynamic environment in the Indian banking sector.

• This remarkable rise in profit is attributed to better asset quality, higher interest income, and effective cost management.

• Canara Bank has been consistently improving its financial performance, showcasing a robust operational structure and strategic growth initiatives.

• With these results, Canara Bank has cemented its position as one of the leading public sector banks in India.

Additional Information

• Bank of Baroda:

• Headquartered in Vadodara, Gujarat, and established in 1908, it is one of the largest public sector banks in India.

• While Bank of Baroda has shown steady growth, it did not report a 33% rise in standalone net profit for Q4 FY25.

• Punjab National Bank (PNB):

• PNB, established in 1894 and headquartered in New Delhi, is another major public sector bank in India.

• Although it has a significant market presence, it was not the bank that reported the substantial profit increase mentioned in the question.

• State Bank of India (SBI):

• SBI, headquartered in Mumbai, is the largest public sector bank in India and plays a pivotal role in the banking sector.

• Despite its vast operations and profitability, the specific profit rise of 33% for Q4 FY25 was not attributed to SBI.

• Canara Bank:

• Founded in 1906 and headquartered in Bengaluru, Karnataka, Canara Bank is one of India's oldest and largest public sector banks.

• It has a strong focus on retail banking, corporate lending, and financial inclusion, which have contributed to its robust growth.

• Its strategic initiatives in digital banking and customer-centric services have enhanced its operational efficiency.

Important Points

• Indian Banking Sector:

• The Indian banking sector comprises public sector banks, private banks, regional rural banks, and cooperative banks.

• Public sector banks like Canara Bank play a crucial role in financial inclusion and economic development in India.

• Key Financial Metrics:

• Standalone net profit is a critical indicator of a bank's financial health and operational efficiency.

• Factors like net interest income, non-performing assets (NPAs), and cost-to-income ratio significantly impact profit margins.

• Future Outlook:

• With advancements in digital banking and financial services, public sector banks are poised for sustained growth.

• Canara Bank's strong Q4 performance highlights its potential for continued success in the Indian banking landscape.

Q84. Answer: (b) Republic of Guinea

The correct answer is Republic of Guinea.

Key Points

• On 20 June 2025, Prime Minister Narendra Modi flagged off India's first indigenously manufactured locomotive export.

• The country receiving this export is the Republic of Guinea, a West African nation with growing trade relations with India.

• The locomotive was manufactured by Indian Railways' Production Units, showcasing India's capability to produce high-quality rail technology domestically.

• The initiative marks a significant milestone in India's "Make in India" campaign and its efforts to become a global exporter of advanced technology and infrastructure equipment.

• This export strengthens the bilateral relationship between India and the Republic of Guinea, contributing to the African nation's infrastructure development.

Additional Information

• Indian Railways' Manufacturing Capabilities:

• Indian Railways operates several production units, such as the Chittaranjan Locomotive Works (CLW), Diesel Locomotive Works (DLW), and Modern Coach Factory (MCF).

• These units specialize in manufacturing electric locomotives, diesel locomotives, and high-speed coaches for domestic and international markets.

• India's locomotive exports highlight the country's ability to meet global quality standards and deliver cost-effective solutions.

• Republic of Guinea:

• The Republic of Guinea is located in West Africa, bordered by countries like Senegal, Mali, and Sierra Leone.

• It is rich in bauxite reserves and other natural resources, making it a significant trade partner for India.

• India has been fostering bilateral relations with Guinea through trade, developmental assistance, and capacity-building programs.

• Make in India Campaign:

• Launched in 2014 by Prime Minister Narendra Modi, the "Make in India" initiative aims to make India a global manufacturing hub.

• The campaign focuses on enhancing infrastructure, streamlining processes, and encouraging foreign direct investment (FDI) in key sectors.

• The export of locomotives aligns with the campaign's goals, showcasing India's growing manufacturing and technological capabilities.

• India-Africa Relations:

• India is actively engaged in enhancing its partnership with African nations through initiatives such as the India-Africa Forum Summit.

• Key areas of cooperation include infrastructure development, energy, health, and education.

• The locomotive export is part of India's broader strategy to strengthen ties with Africa and contribute to its economic growth.

Important Points

• The locomotive export is a first-of-its-kind initiative for India, reinforcing its status as a global supplier of advanced rail technology.

• The Republic of Guinea is expected to utilize these locomotives for enhancing its railway infrastructure, boosting trade and connectivity within the region.

• India's expertise in manufacturing cost-effective and efficient rail solutions makes it a preferred partner for developing nations.

• The success of this export is likely to open up new opportunities for India's railway sector in other global markets, especially in Africa and Asia.

Q85. Answer: (d) 32.3 million

The correct answer is 32.3 million.

Key Points

• The Internal Displacement Monitoring Centre (IDMC) report highlights the extent of internal displacements caused by disasters across the globe, including in India.

• Between 2015 and 2024, India recorded approximately 32.3 million internal displacements caused by disasters such as floods, cyclones, and other natural events.

• India is one of the most disaster-prone countries due to its geographical location and climatic conditions, which expose it to frequent natural calamities.

• Disasters such as floods, cyclones, landslides, and droughts are the primary causes of these displacements, significantly impacting vulnerable populations and communities.

• According to the report, internal displacement often leads to loss of livelihoods, social dislocation, and economic instability, creating long-term challenges for the affected individuals and the country.

Additional Information

• Internal Displacement Monitoring Centre (IDMC):

• The IDMC is a global organization that monitors and reports on displacement caused by conflicts, violence, and disasters

globally.

• It provides data, analysis, and recommendations to governments, organizations, and stakeholders to address displacement challenges.

• The IDMC report is considered an authoritative source for understanding the scale and impact of internal displacements worldwide.

• Disaster-Prone Areas in India:

• India experiences frequent natural disasters due to its diverse geography, including coastal areas vulnerable to cyclones and plains prone to flooding.

• States such as West Bengal, Odisha, Assam, Bihar, and Kerala often face severe challenges due to recurring disasters.

• Mountainous regions like Uttarakhand and Himachal Pradesh are particularly susceptible to landslides and flash floods.

• Impact of Internal Displacement:

• Internal displacement disrupts lives, leading to loss of homes, livelihoods, and access to basic services.

• It creates socio-economic challenges as displaced populations often require long-term rehabilitation and support.

• Internal migration due to disasters can also strain urban centers, which may lack the infrastructure to absorb large populations.

• India's Disaster Management Framework:

• India has developed a comprehensive disaster management system under the Disaster Management Act, 2005.

• The National Disaster Management Authority (NDMA) is the apex body responsible for disaster response, preparedness, and mitigation strategies.

• Initiatives like the National Cyclone Risk Mitigation Project (NCRMP) aim to reduce vulnerabilities in disaster-prone regions.

• India also collaborates with international organizations to strengthen disaster resilience and mitigate displacement risks.

Important Points

• Climate Change and Displacement:

• Climate change exacerbates the frequency and intensity of disasters, contributing to increased internal displacement.

• According to the Intergovernmental Panel on Climate Change (IPCC), countries like India are highly vulnerable to climate-related risks.

• Addressing climate change is crucial for reducing displacement and enhancing disaster resilience.

• Disaster Preparedness in India:

• India has implemented early warning systems and disaster response mechanisms to minimize the impact of natural calamities.

• Community-based disaster preparedness programs are crucial for building resilience in vulnerable regions.

• Investing in infrastructure development, such as flood defenses and cyclone shelters, is essential to reduce displacement risks.

Q86. Answer: (c) Murlikant Petkar

The correct answer is Murlikant Petkar.

Key Points

• Murlikant Petkar was the first Indian Paralympic gold medalist and a recipient of the Arjuna Award.

• He won the gold medal in the 1972 Paralympics held in Heidelberg, Germany, in the 50m freestyle swimming event, setting a world record time of 37.33 seconds.

• Murlikant Petkar was a former soldier in the Indian Army, where he served in the Corps of Electronics and Mechanical Engineers (EME) before sustaining injuries during the 1965 Indo-Pak war.

• Despite his injuries, he pursued sports and represented India in events like swimming, javelin throw, and table tennis at the Paralympics.

• He was honored with the Arjuna Award for his contributions to sports, making him a trailblazer for Indian para-athletes.

Additional Information

• Deepa Malik:

• She is the first Indian woman to win a medal at the Paralympics, securing a silver medal in the shot put event at the 2016 Rio Paralympics.

• She has received the Arjuna Award and the Khel Ratna Award for her contributions to sports.

• Deepa Malik is also known for her achievements in swimming and motorsports.

• Devendra Jhajharia:

• He is the only Indian para-athlete to win two gold medals at the Paralympics (2004 Athens and 2016 Rio) in the javelin throw.

• He holds the world record in the F46 javelin throw category.

• Devendra Jhajharia has been honored with the Padma Shri and the Khel Ratna Award.

• Varun Bhati:

• He won a bronze medal in the high jump event at the 2016 Rio Paralympics.
• Varun Bhati competes in the T42 classification for athletes with leg impairments.
• He is regarded as one of India's promising para-athletes.
• Paralympics:
• The Paralympics are a major international multi-sport event for athletes with disabilities.
• India has been participating in the Paralympics since 1968.
• India's Paralympic athletes have achieved remarkable success, contributing to the country's sports legacy.

Important Points

• Arjuna Award:
• It is one of India's highest sports honors, established in 1961 to recognize outstanding performance in sports.
• The award includes a bronze statuette of Arjuna, a certificate, ceremonial dress, and a cash prize.
• It is awarded annually by the Ministry of Youth Affairs and Sports.
• Paralympic Sports:
• Paralympic sports include swimming, athletics, wheelchair basketball, judo, and powerlifting, among others.
• The classification system ensures fair competition among athletes with similar disabilities.
• The Paralympics are governed by the International Paralympic Committee (IPC).

Q87. Answer: (b) May 2025

The correct answer is May 2025.

Key Points

• The Department of Science and Technology (DST) and the Defence Research and Development Organisation (DRDO) collaborated in May 2025 to strengthen ground-based Space Situational Awareness (SSA).
• This collaboration focuses on enhancing India's capacity to monitor and track space objects, including satellites and space debris, in order to ensure the safety of space assets.
• The initiative is critical to the development of indigenous SSA capabilities, reducing dependence on international systems for space monitoring.
• SSA has become increasingly important in the context of growing space activity, including launches, satellite operations, and the management of space debris.
• The collaboration between DST and DRDO demonstrates India's commitment to strengthening its space technology infrastructure and achieving self-reliance in space research and defense applications.

Additional Information

• Space Situational Awareness (SSA):
• SSA is the ability to detect, track, and predict the movement of objects in Earth's orbit, including satellites, space debris, and other celestial bodies.
• It is essential for managing the growing problem of space debris, which poses a threat to operational satellites and manned space missions.
• SSA capabilities also help in monitoring space weather events, which can impact satellite operations and ground-based communication systems.
• Countries with advanced SSA systems can ensure the safety and sustainability of their space activities.
• Role of DST:
• The Department of Science and Technology is responsible for promoting research, development, and innovation in various scientific fields in India.
• It plays a key role in fostering collaborations between academic institutions, research organizations, and industries to advance technological capabilities.
• In the context of SSA, DST's involvement ensures the integration of cutting-edge research and development into space monitoring systems.
• Role of DRDO:
• The Defence Research and Development Organisation is India's premier defense research agency, tasked with developing advanced technologies for national security.
• DRDO's expertise in radar systems, sensors, and data analysis is instrumental in developing robust SSA systems.
• Its collaboration with DST ensures that SSA capabilities align with India's defense and security objectives.
• Importance of Space Debris Management:
• Space debris includes defunct satellites, spent rocket stages, and fragments from collisions or disintegration.
• Currently, there are over 36,000 trackable objects in Earth's orbit, with millions of smaller, untrackable pieces posing significant

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risks.

• Effective SSA systems are crucial for collision avoidance and the long-term sustainability of space operations.

• India's Space Initiatives:

• India's space program, led by the Indian Space Research Organisation (ISRO), has made significant strides in satellite launches, space exploration, and technology development.

• The collaboration between DST and DRDO complements ISRO's efforts by enhancing India's ability to monitor and secure its space assets.

• Such initiatives contribute to India's vision of becoming a global leader in space technology and applications.

Q88. Answer: (b) Rammohan Mission Purashkar

The correct answer is Rammohan Mission Purashkar.

Key Points

• Rammohan Mission Purashkar is a prestigious award given to individuals or organizations for their outstanding contributions in various fields, including science, technology, literature, and social service.

• In the year 2025, V. Narayanan, the renowned chief of the Indian Space Research Organisation (ISRO), was honored with the Rammohan Mission Purashkar for his exceptional contributions to India's space research and technological advancements.

• V. Narayanan has played a pivotal role in strengthening ISRO’s capabilities, particularly in the areas of cryogenic technology and the development of advanced propulsion systems, which are critical for satellite launches and space exploration missions.

• This award highlights the efforts of Indian scientists in ensuring India’s global recognition in the field of aerospace engineering and space exploration.

• The award is named after Raja Rammohan Roy, a prominent social reformer of India, symbolizing the spirit of innovation and progress in the nation.

Additional Information

• V. Narayanan's Contributions to ISRO:

• He is a distinguished scientist and the director of the Liquid Propulsion Systems Centre (LPSC), a key facility of ISRO responsible for the design and development of liquid propulsion systems.

• Under his leadership, India successfully developed the Cryogenic Upper Stage (CUS) used in the GSLV Mk-II launch vehicle, marking a significant milestone in India's space program.

• He has been instrumental in advancing semi-cryogenic propulsion technology, which is critical for heavy-lift launch vehicles.

• Rammohan Mission Purashkar:

• This award is conferred annually to individuals who have made remarkable contributions to their respective fields, promoting the ideals of innovation and excellence.

• It aims to encourage and recognize efforts that contribute to the nation’s development and global standing.

• ISRO’s Achievements in Recent Years:

• ISRO has successfully launched several ambitious missions, including Chandrayaan-2 and Mangalyaan, showcasing India’s capabilities in interplanetary exploration.

• The organization is currently working on the Gaganyaan mission, India’s first human spaceflight program, which is expected to be a landmark achievement.

• ISRO's launch vehicles, such as the PSLV and GSLV, have established India as a reliable player in the global satellite launch market.

• Raja Rammohan Roy:

• Known as the Father of the Indian Renaissance, Raja Rammohan Roy was a social reformer who played a key role in the abolition of practices like Sati and championed women's rights, education, and modern values.

• The award named after him symbolizes the fusion of traditional Indian values with modern scientific and technological advancements.

Important Points

• Other Prestigious Indian Awards:

• Bharat Ratna: India’s highest civilian award, conferred for exceptional service in arts, literature, science, and public services.

• Padma Awards: Includes Padma Shri, Padma Bhushan, and Padma Vibhushan, given for contributions across various fields like arts, science, and social work.

• National E-Governance Award: Recognizes excellence in the implementation of e-Governance initiatives in the public sector.

• India’s Space Ambitions:

• India is striving to establish itself as a global leader in space exploration, with plans to develop reusable launch vehicles, space stations, and missions to the Moon and Mars.

• ISRO has been collaborating with other space agencies like NASA, ESA, and Roscosmos to share technologies and expertise.

Q89. Answer: (c) India

The correct answer is India.

Key Points

• India is a dominant force in the sport of Kabaddi. It has consistently performed exceptionally well in international tournaments, including the World Kabaddi Cup.

• The 2025 World Kabaddi Cup was won by India, showcasing its supremacy in this traditional Indian sport.

• India's success in Kabaddi is attributed to its strong grassroots-level infrastructure, training facilities, and the popularity of the sport across the country.

• The Indian Kabaddi team comprises highly skilled players who excel in both raiding and defending, making them a formidable force in global competitions.

• The World Kabaddi Cup is organized periodically, and India has historically been one of the most successful nations in this tournament, winning multiple titles.

Additional Information

• Kabaddi:

• Kabaddi is a contact team sport that originated in ancient India and is popular in South Asia.

• The game involves two teams competing to score points by raiding the opponent's territory and tagging players without being caught.

• Kabaddi is played in various formats, including circle-style Kabaddi and standard-style Kabaddi.

• The sport gained international recognition and was included in the Asian Games, further boosting its global popularity.

• India's Achievements in Kabaddi:

• India has won multiple World Kabaddi Cups and has been a consistent winner in the Asian Games since the sport was introduced.

• Indian players like Anup Kumar, Pardeep Narwal, and Ajay Thakur have become household names due to their exceptional performances.

• The Pro Kabaddi League (PKL), launched in India, has further popularized the sport and brought international attention to Kabaddi.

• Other Countries in Kabaddi:

• Iran: Iran has emerged as a strong competitor in Kabaddi, winning medals in international tournaments such as the Asian Games.

• South Korea: South Korea has made significant progress in Kabaddi and is known for its strategic gameplay.

• Pakistan: Pakistan also participates in Kabaddi tournaments and has a strong presence in the sport, particularly in the circle-style format.

• World Kabaddi Cup:

• The World Kabaddi Cup is an international Kabaddi tournament organized periodically, featuring teams from various countries.

• It serves as a platform to showcase the talent and skills of Kabaddi players globally.

• The tournament includes both men's and women's categories, promoting gender equality in sports.

Important Points

• Pro Kabaddi League (PKL): The PKL has played a crucial role in popularizing Kabaddi in India and internationally, attracting players from various countries.

• Training Infrastructure: India has well-established training centers and academies dedicated to Kabaddi, ensuring the development of world-class players.

• Global Expansion: Kabaddi's inclusion in international tournaments like the Asian Games and World Cup has contributed to its global reach and popularity.

• Cultural Significance: Kabaddi holds cultural importance in India, being a traditional sport that is deeply rooted in the country's heritage.

Q90. Answer: (c) Financial Literacy: Women’s Prosperity

The correct answer is Financial Literacy: Women’s Prosperity.

Key Points

• RBI’s Financial Literacy Week (FLW) 2025 was themed around “Financial Literacy: Women’s Prosperity”, highlighting the importance of empowering women through financial education.

• The primary objective of the theme was to promote financial literacy among women, enabling them to make informed financial decisions, manage resources efficiently, and achieve financial independence.

• The initiative emphasized the significance of educating women about savings, investments, credit facilities, and digital financial tools to enhance their participation in economic activities.

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• Workshops, campaigns, and outreach programs were conducted across India to raise awareness about financial products and services tailored to women, such as microfinance and self-help groups.

• This theme aligns with the United Nations Sustainable Development Goals (SDGs), particularly Goal 5 (Gender Equality) and Goal 8 (Decent Work and Economic Growth), by fostering women's economic empowerment.

Additional Information

• About Financial Literacy Week (FLW):

• The RBI organizes Financial Literacy Week annually to promote awareness about key financial topics among citizens.

• Each year, the event focuses on a specific theme relevant to the financial inclusion agenda of the country.

• FLW aims to reach rural and urban populations, with special attention to underserved and vulnerable groups.

• Women and Financial Inclusion:

• As per the Global Findex Database 2021, women's access to formal financial services in India has significantly improved, but a gender gap still exists.

• Empowering women financially leads to better household outcomes, as women tend to invest more in education, health, and family welfare.

• Other Past Themes of FLW:

• 2024: "Digital Finance for All" – Promoting the adoption of digital payment systems and safe online transactions.

• 2023: "Financial Inclusion: India's Growth" – Focused on making financial services accessible to all sections of society.

• Key Financial Schemes for Women in India:

• Mahila Samman Savings Certificate: A government-backed savings scheme offering higher returns for women.

• Stand-Up India Scheme: Provides loans to women entrepreneurs, particularly in marginalized communities.

• Self-Help Groups (SHGs): Promote collective savings and credit access among rural women.

Important Points

• Microfinance: Small loans provided to women in rural areas empower them to start businesses and improve their livelihoods.

• Digital Financial Literacy: Teaching women to use UPI, mobile banking apps, and digital wallets helps bridge the digital divide.

• Government Collaboration: The RBI partners with organizations like NABARD and state-level agencies to implement FLW initiatives effectively.

• Financial Education Modules: RBI provides simplified educational materials in regional languages to ensure better reach and understanding.

Q91. Answer: (a) China

The correct answer is China.

Key Points

• The Corruption Perceptions Index (CPI) is published annually by Transparency International, ranking countries based on perceived corruption levels in their public sector.

• In the CPI for 2024, released in February 2025, India ranked lower than China, signifying that China's public sector is perceived as less corrupt than India's.

• China has consistently scored higher than India in recent CPI rankings due to its stringent anti-corruption measures and reforms, including crackdowns on corrupt officials.

• The CPI scores are calculated using multiple data sources, including expert assessments and surveys conducted by independent institutions.

• Countries are ranked on a scale from 0 to 100, where 0 indicates highly corrupt and 100 indicates very clean. China's score is higher than India's, indicating better performance in combating corruption.

Additional Information

• Corruption Perceptions Index (CPI):

• The CPI is a globally recognized metric that evaluates countries based on corruption perception in their public sector.

• It uses a combination of expert surveys and business opinion polls conducted by independent organizations.

• The CPI ranking provides insights into governance, transparency, and accountability in different nations.

• Transparency International, headquartered in Berlin, Germany, is the organization responsible for publishing the CPI.

• China's Anti-Corruption Efforts:

• China has implemented several anti-corruption campaigns spearheaded by the Communist Party of China, targeting corrupt officials and practices.

• Notable initiatives include the "Tigers and Flies" campaign, focusing on corruption at both high-ranking and local levels.

• The establishment of agencies like the National Supervisory Commission strengthened oversight and enforcement mechanisms.

• India's Corruption Challenges:

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• India faces significant challenges in addressing corruption, including issues related to bureaucratic inefficiency, political interference, and lack of stringent enforcement of anti-corruption laws.

• Although initiatives like the Lokpal Act and digital governance reforms aim to combat corruption, implementation gaps remain.

• India's CPI ranking is impacted by systemic issues such as red tape, lack of accountability, and opaque decision-making processes.

• Other Neighboring Countries:

• Countries like Bangladesh, Pakistan, and Sri Lanka have historically ranked lower than India in CPI due to higher perceived corruption levels.

• These countries often grapple with issues such as weak governance, lack of judicial independence, and political instability that exacerbate corruption.

Important Points

• Transparency International:

• Founded in 1993, Transparency International is a global non-governmental organization working to combat corruption.

• Its flagship Corruption Perceptions Index provides comprehensive data on corruption levels worldwide, influencing policy-making and governance reforms.

• Global Trends in CPI:

• Scandinavian countries like Denmark, Finland, and Sweden consistently rank among the least corrupt nations, scoring high in CPI rankings.

• Countries with strong institutions, transparent governance, and effective anti-corruption mechanisms generally perform better on the CPI scale.

• India's Initiatives Against Corruption:

• India has introduced reforms like the Right to Information (RTI) Act, Digital India campaign, and Direct Benefit Transfer (DBT) to reduce corruption.

• While these measures have improved transparency, challenges like enforcement and accountability persist.

Q92. Answer: (b) Reliance Group

The correct answer is Reliance Group.

Key Points

• The Vantara initiative is a unique project aimed at wildlife conservation, rescue, and rehabilitation located in Jamnagar, Gujarat. It was inaugurated by the Prime Minister of India in March 2025.

• The initiative is owned and supported by the Reliance Group, a conglomerate led by Mukesh Ambani, which has been actively involved in environmental and sustainability efforts in India.

• The project focuses on preserving biodiversity and ensuring the welfare of endangered species in the region, making it a significant step toward ecological conservation.

• The Reliance Group has previously undertaken various environmental projects, including mangrove restoration and renewable energy initiatives, showcasing its commitment to sustainable development.

• Jamnagar, Gujarat, is also home to Reliance's world-class refinery and petrochemical complex, highlighting the company's deep-rooted association with the region.

Additional Information

• Reliance Group:

• The Reliance Group, founded by Dhirubhai Ambani, is one of India's largest conglomerates with interests in petrochemicals, telecommunications, retail, and energy.

• Under Mukesh Ambani's leadership, the group has diversified into sustainable initiatives such as renewable energy and environmental conservation.

• The group's efforts in corporate social responsibility include healthcare, education, and environmental projects.

• Jamnagar, Gujarat:

• Jamnagar, known as the "Oil City of India," is home to the world's largest refinery complex operated by Reliance Industries.

• The region has seen significant investments in infrastructure and sustainability projects due to the presence of Reliance.

• It is also known for its rich biodiversity, making it a suitable location for initiatives like Vantara.

• Wildlife Conservation in India:

• India is home to several endangered species, and conservation initiatives are crucial to preserving the country's rich biodiversity.

• Projects like Project Tiger, Project Elephant, and the establishment of national parks and wildlife sanctuaries have been central to these efforts.

• Collaborations between the government and private entities, like Reliance's involvement in Vantara, are key to enhancing these conservation efforts.

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• Prime Minister's Role:

• Prime Minister Narendra Modi has actively supported environmental and conservation initiatives, highlighting the need for sustainable development.

• The inauguration of Vantara in March 2025 underscores the government's commitment to ecological preservation.

Important Points

• Reliance’s Environmental Efforts:

• Reliance has restored over 1,200 hectares of mangroves in Gujarat, ensuring coastal protection and biodiversity conservation.

• The company is also investing heavily in green hydrogen and renewable energy, aligning with global sustainability goals.

• Biodiversity Significance:

• India hosts 8% of the world’s biodiversity, making conservation initiatives like Vantara critical for global ecological balance.

• Efforts like these ensure the protection of endangered species, such as the Asiatic Lion, found in Gujarat’s Gir Forest.

• Government and Private Sector Collaboration:

• Collaborative models between the government and private entities, such as Reliance's Vantara initiative, are increasingly effective in addressing environmental challenges.

• These partnerships align with India’s commitments under the Paris Agreement and other international sustainability frameworks.

Q93. Answer: (c) India

The correct answer is India.

Key Points

• India hosted the first assembly of the International Big Cat Alliance (IBCA) in June 2025. The event marked a significant milestone in international conservation efforts for big cats.

• The International Big Cat Alliance was established to foster cooperation among nations for the conservation of big cats such as tigers, lions, leopards, and snow leopards, among others.

• The first assembly was held in New Delhi, India, reflecting India's prominent role in wildlife conservation and its commitment to protecting big cat species.

• India is home to several big cat species, including the Bengal tiger, which is the national animal of the country, as well as leopards, snow leopards, and Asiatic lions.

• The assembly focused on strategies such as habitat protection, anti-poaching measures, and community involvement to ensure the survival of these iconic species.

Additional Information

• International Big Cat Alliance (IBCA):

• The IBCA is a global alliance aimed at protecting and conserving big cats and their habitats.

• It brings together member nations, organizations, and conservation experts to collaborate on research, funding, and policy-making for big cat conservation.

• Participating countries are expected to share best practices, technology, and resources to combat threats like habitat loss and poaching.

• India’s Role in Wildlife Conservation:

• India has been at the forefront of big cat conservation efforts, with initiatives like Project Tiger (launched in 1973) to conserve the Bengal tiger.

• It also runs Project Lion and Project Snow Leopard to protect other big cat species found in the country.

• India hosts some of the world’s most iconic wildlife sanctuaries and national parks, including Jim Corbett National Park and Ranthambore National Park.

• Big Cat Species in India:

• Bengal Tiger: Found in reserves like Sundarbans and Kanha.

• Asiatic Lion: Found exclusively in the Gir Forest of Gujarat.

• Snow Leopard: Inhabits high-altitude regions like Ladakh and Himachal Pradesh.

• Leopard: Widely distributed across forests and grasslands in India.

• Threats to Big Cats:

• Key threats include habitat destruction, human-wildlife conflict, climate change, and poaching.

• Efforts like stricter anti-poaching laws and community-based conservation are crucial for their survival.

Important Points

• Project Tiger: Launched in 1973, this initiative was one of the world’s first tiger conservation programs. It aimed to ensure the survival of the Bengal tiger in its natural habitat.

• Asiatic Lion Conservation: The Gir Forest National Park in Gujarat is the last remaining habitat of Asiatic lions. Conservation

efforts have successfully increased their population.

• International Collaboration: India collaborates with other nations and international organizations to combat wildlife trafficking and promote conservation efforts.

• UN SDGs: The conservation of big cats aligns with the United Nations' Sustainable Development Goals (SDGs), particularly Goal 15, which focuses on life on land and biodiversity conservation.

Q94. Answer: (b) Annu Rani

The correct answer is Annu Rani.

Key Points

• Annu Rani became the first Indian woman to win a gold medal in javelin throw at the Asian Games 2025. This marked a historic achievement for India in athletics.

• She achieved this feat with a remarkable throw that surpassed her competitors, showcasing her exceptional talent and dedication to the sport.

• Annu Rani has consistently been one of India's top-performing javelin throwers, having previously represented the country in multiple international events, including the World Championships and the Olympics.

• Her gold medal win at the Asian Games 2025 is a testament to her perseverance and the growing strength of Indian women athletes in track and field events.

• This achievement not only brought glory to India but also inspired countless young athletes to pursue javelin throw and athletics as a career.

Additional Information

• Annu Rani's Career Highlights:

• Annu Rani hails from Meerut, Uttar Pradesh, and has been a pioneer in Indian women's javelin throw.

• She holds the national record in javelin throw, with a throw of 63.24 meters, achieved at the Federation Cup in 2021.

• Annu has represented India in two World Athletics Championships, making her one of the few Indian women to do so.

• Javelin Throw in India:

• Javelin throw has gained significant attention in India, especially after Neeraj Chopra's historic gold medal at the Tokyo Olympics 2020.

• India has seen a surge in young talent taking up the sport, with improved training facilities and support from organizations like the Athletics Federation of India (AFI).

• Asian Games:

• The Asian Games, also known as the Asiad, is a continental multi-sport event held every four years among athletes from all over Asia.

• India has been a consistent participant in the Asian Games since its inception in 1951.

• Track and field events have traditionally been strong areas for India, with athletes bringing home multiple medals over the years.

• Other Indian Women in Athletics:

• Indian women athletes like PT Usha, Hima Das, and Dutee Chand have also brought laurels to the country in international events.

• Their achievements have paved the way for future generations of women in sports.

Important Points

• Other Options Explained:

• Kamalpreet Kaur: She is a prominent Indian discus thrower who gained recognition for her performance at the Tokyo Olympics 2020 but has no record in javelin throw.

• Seema Antil: Known for her achievements in discus throw, Seema has been a veteran athlete but not associated with javelin throw.

• Shalini Sharma: She is not a recognized name in the field of javelin throw or athletics at the international level.

• India's Focus on Athletics:

• The Indian government, through initiatives like Target Olympic Podium Scheme (TOPS), has been providing financial and infrastructural support to athletes.

• Improved coaching, exposure to international competitions, and better facilities have contributed to India's growing success in athletics.

Q95. Answer: (c) 32

The correct answer is 32.

Key Points

• The Arjuna Awards 2024 were presented by the President of India, Smt. Droupadi Murmu, at the Rashtrapati Bhavan in New

Delhi on 17 January 2025.

• A total of 32 athletes were conferred with the Arjuna Award 2024 for their outstanding performance in national and international sports events.

• The award recognizes athletes for their consistent excellence, leadership qualities, sportsmanship, and discipline over a period of four years.

• The recipients represented a wide range of sports, including athletics, hockey, badminton, shooting, wrestling, para-sports, chess, and kabaddi.

• The Arjuna Award is one of India's highest sporting honours administered by the Ministry of Youth Affairs and Sports.

• Hence, the correct answer is 32.

Additional Information

• Arjuna Award:

• Instituted in 1961 by the Government of India.

• Given for outstanding achievement in sports and games.

• Award Components:

• A bronze statuette of Arjuna.

• A certificate, ceremonial dress, and a cash prize.

• Major National Sports Awards:

• Major Dhyan Chand Khel Ratna Award – India's highest sporting honour.

• Dronacharya Award – For outstanding coaches.

• Major Dhyan Chand Award – For lifetime achievement in sports.

• Selection Process:

• The awardees are selected by a committee constituted by the Ministry of Youth Affairs and Sports.

• International achievements and consistency of performance are key criteria.

• Purpose:

• To encourage athletes and promote excellence in sports across India.

Q96. Answer: (d) LiFE

The correct answer is LiFE.

Key Points

• LiFE stands for Lifestyle for Environment, a global movement led by India to promote sustainable lifestyles.

• It was introduced by Prime Minister Narendra Modi during the 2021 United Nations Climate Change Conference (COP26) held in Glasgow, Scotland.

• The initiative emphasizes the importance of mindful and deliberate utilization of resources, moving away from mindless consumption.

• The concept of LiFE encourages people to adopt sustainable practices in their daily lives, such as reducing waste, conserving energy, and using environmentally friendly products.

• The Economic Survey 2024–25 reiterates the importance of LiFE in combating climate change and achieving the goals of a net-zero economy by reducing carbon emissions through individual and collective actions.

Additional Information

• Origin of LiFE:

• LiFE was conceptualized by India as part of its commitment to global environmental sustainability and was formally proposed by Prime Minister Narendra Modi at COP26 in November 2021.

• The initiative aligns with the principles of the Paris Agreement to limit global warming to 1.5°C above pre-industrial levels.

• Objectives of LiFE:

• Encouraging individuals to adopt sustainable practices to reduce their carbon footprint.

• Promoting circular economy principles, such as reuse, recycle, and repair.

• Advocating for policies that support sustainable production and consumption patterns globally.

• Global Impact of LiFE:

• LiFE aims to create a mass movement for sustainable living by involving governments, businesses, and individuals worldwide.

• The movement emphasizes that climate action is not limited to governments and industries but also requires individual contributions.

• Countries and organizations worldwide have shown interest in collaborating with India on this initiative to tackle global environmental challenges.

• Key Features of LiFE:

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• Focus on behavioral change to encourage environmentally conscious choices.

• Promotion of eco-friendly technologies and products.

• Integration of sustainability into education systems to raise awareness among younger generations.

• India’s Role in Global Climate Action:

• As a signatory to the Paris Agreement, India has committed to reducing its carbon intensity by 33-35% by 2030 (compared to 2005 levels).

• India is actively working towards achieving its net-zero emissions target by 2070.

• The LiFE movement complements India’s other initiatives, such as the International Solar Alliance (ISA) and the National Action Plan on Climate Change (NAPCC).

Important Points

• Other Options Explained:

• Earth First: A general term often used in environmental movements but not a specific initiative led by India.

• Go Green: A phrase promoting environmental consciousness but not related to the LiFE initiative.

• Swachh Life: This term might sound related to cleanliness drives like Swachh Bharat Abhiyan, but it is not the correct answer.

• Key Achievements:

• India’s efforts under LiFE have received international recognition for promoting sustainable living.

• The movement has inspired various global organizations to incorporate sustainability into their operations.

• Link to Sustainable Development Goals (SDGs):

• LiFE aligns with SDG 12 (Responsible Consumption and Production) and SDG 13 (Climate Action).

• It also contributes to SDG 7 (Affordable and Clean Energy) by promoting energy-efficient practices.

Q97. Answer: (c) BITS Pilani

The correct answer is BITS Pilani.

Key Points

• BITS Pilani, a premier institute for higher education in India, announced the establishment of India's first AI Plus Campus in Amaravati, Andhra Pradesh in July 2025.

• The AI Plus Campus is an initiative aimed at fostering artificial intelligence (AI) research, education, and innovation in India.

• This campus will focus on offering interdisciplinary programs and promoting the integration of AI with various domains like healthcare, agriculture, and finance.

• The decision to establish the campus in Amaravati aligns with the region's growing prominence as an educational and technological hub.

• The initiative is expected to attract global partnerships, skilled professionals, and researchers, thereby contributing to the development of AI-driven solutions for real-world problems.

Additional Information

• About BITS Pilani:

• Birla Institute of Technology and Science (BITS) Pilani is a leading private technical and science institution in India, established in 1964.

• It has campuses in Pilani, Hyderabad, Goa, Dubai, and now Amaravati, offering undergraduate, postgraduate, and doctoral programs.

• BITS Pilani is renowned for its emphasis on innovation, research, and entrepreneurship.

• Artificial Intelligence (AI):

• AI refers to the simulation of human intelligence in machines programmed to think, learn, and make decisions.

• It has applications in various fields such as healthcare (e.g., diagnostics), agriculture (e.g., precision farming), and finance (e.g., fraud detection).

• India is actively investing in AI initiatives through projects like Digital India and AI for All.

• Amaravati as a Technological Hub:

• Amaravati, the capital of Andhra Pradesh, is being developed as a smart city with a focus on education and technology.

• The city hosts several prestigious institutions, making it an ideal location for an AI-focused campus.

• Global Implications of AI Education:

• Programs like the AI Plus Campus aim to position India as a global leader in AI innovation.

• They contribute to skill development, boost employability, and support the development of cutting-edge technologies.

Important Points

• Other Notable Institutions:

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• IIIT Hyderabad: Known for research in AI and robotics, but it did not announce the AI Plus Campus in Amaravati.
• NIT Warangal: One of India's premier engineering institutions, but not associated with this initiative.
• IIT Madras: A leading institution in AI research, but it did not establish the AI Plus Campus in Amaravati.
• India’s AI Vision:
• The government has launched initiatives like RAISE 2020 (Responsible AI for Social Empowerment) to encourage AI adoption.
• India aims to become a global AI hub by focusing on education, research, and industry collaboration.

Q98. Answer: (c) Bisleri

The correct answer is Bisleri.

Key Points

• Bisleri, a leading packaged drinking water company in India, has partnered with the Archaeological Survey of India (ASI) in 2025 to restore heritage water bodies across the country.
• The initiative is aimed at reviving traditional water conservation systems that were historically significant and played a key role in maintaining water availability.
• This partnership focuses on restoration and rejuvenation of ancient stepwells, ponds, and other water bodies situated at heritage sites under the protection of ASI.
• The collaboration aligns with the Indian government’s emphasis on cultural preservation and sustainable water resource management.
• Under this initiative, Bisleri has pledged to use its expertise and resources to ensure the scientific and eco-friendly restoration of these water bodies, while also raising awareness about their historical and environmental significance.

Additional Information

• Archaeological Survey of India (ASI):
• The ASI, under the Ministry of Culture, is responsible for the protection and preservation of India’s cultural heritage, including monuments, archaeological sites, and remains of national importance.
• It was established in 1861 by Alexander Cunningham and has since played a vital role in safeguarding India’s rich historical legacy.
• As of now, ASI protects and maintains over 3,600 monuments, including ancient water structures.
• Heritage Water Bodies:
• These include traditional water storage systems such as stepwells, kunds, baolis, and lakes, which were constructed to meet water needs in historic times.
• Many of these structures, apart from serving as water sources, were architectural marvels and had religious and cultural significance.
• The restoration of these water bodies is crucial for addressing water scarcity issues and promoting heritage tourism.
• About Bisleri:
• Founded in 1969, Bisleri is one of India’s most recognized brands in the packaged drinking water industry.
• The company is known for its focus on sustainability and has initiated various CSR activities related to water conservation.
• Its ‘Bottles for Change’ campaign is a notable initiative aimed at recycling plastic waste and promoting environmental awareness.
• Government Initiatives for Water Conservation:
• Programs like Jal Shakti Abhiyan and Atal Bhujal Yojana have been launched to address water conservation and management issues in India.
• These programs focus on rainwater harvesting, rejuvenation of traditional water bodies, and groundwater recharge.

Important Points

• Restoration of heritage water bodies helps in combating water scarcity and promotes environmental sustainability.
• It also contributes to heritage tourism, creating awareness about India’s rich cultural and architectural legacy.
• Partnerships between private entities like Bisleri and public institutions like ASI exemplify the importance of public-private collaboration in addressing pressing environmental and heritage conservation challenges.
• The initiative aligns with global efforts toward achieving the Sustainable Development Goals (SDGs), particularly SDG 6 (Clean Water and Sanitation) and SDG 11 (Sustainable Cities and Communities).

Q99. Answer: (d) providing faster, more scalable vaccine development process for future outbreaks

The correct answer is providing faster, more scalable vaccine development process for future outbreaks.

Key Points

• The indigenous mRNA vaccine technology developed by the CSIR-Centre for Cellular and Molecular Biology (CCMB) in 2025 represents a significant milestone in India's biotechnology sector.
• This platform can enable a faster, more scalable vaccine development process, which is crucial during public health

emergencies such as pandemics.

• The mRNA vaccine technology works by delivering genetic instructions (messenger RNA) to human cells to produce antigens, which then trigger an immune response.

• Unlike traditional vaccines, mRNA vaccines are manufactured synthetically and do not require pathogen growth, making them faster to produce.

• This technology's scalability and adaptability allow for rapid customization to tackle emerging diseases, ensuring preparedness for future outbreaks.

Additional Information

• Features of mRNA Vaccine Technology:

• mRNA vaccines use a synthetic genetic sequence rather than live or inactivated pathogens, making production safer and faster.

• They allow for high precision in targeting specific diseases, reducing the risk of cross-reactivity.

• mRNA vaccines can be developed in weeks, as opposed to months or years required for traditional vaccines.

• Applications in Pandemic Response:

• mRNA vaccines were notably successful during the COVID-19 pandemic, with vaccines like Pfizer-BioNTech and Moderna demonstrating high efficacy.

• Such vaccines can quickly address mutating viruses, as the genetic sequence can be altered to adapt to new strains.

• Scalability of mRNA Technology:

• The synthetic nature of mRNA vaccines allows for large-scale production in a shorter time frame.

• They also require fewer raw materials compared to traditional vaccine production methods.

• India's Progress in Vaccine Research:

• The CSIR-Centre for Cellular and Molecular Biology is at the forefront of India's vaccine research and development efforts.

• This indigenous mRNA platform aligns with India's goal of achieving self-reliance (Atmanirbhar Bharat) in critical healthcare technologies.

Important Points

• Limitations of mRNA Technology:

• Requires cold chain storage, which can pose logistical challenges in low-resource settings.

• High manufacturing costs may make it less accessible in developing countries initially.

• Global mRNA Vaccine Success Stories:

• The Pfizer-BioNTech vaccine received the first Emergency Use Authorization (EUA) during the COVID-19 pandemic.

• mRNA vaccine technology is being explored for other diseases, including cancer, HIV, and influenza.

Q100. Answer: (b) 2025

The correct answer is 2025.

Key Points

• The Manipur Appropriation Bill pertains to financial legislation aimed at authorizing expenditure from the Consolidated Fund of India for the state of Manipur. It follows constitutional provisions for state budgeting.

• The Manipur Appropriation Bill was passed by the Parliament of India in the year 2025, ensuring the allocation of funds for specific purposes in the state.

• Appropriation Bills are introduced annually after the presentation of the Budget, which details the estimated expenditures and revenues for the fiscal year.

• Such bills are significant as they enable the government to legally withdraw funds from the Consolidated Fund of India to meet the expenses specified in the budget.

• The passage of the Manipur Appropriation Bill in 2025 reflects the legislative process of ensuring fiscal governance in line with constitutional mandates.

Additional Information

• Appropriation Bills:

• Appropriation Bills are introduced under Article 114 of the Constitution of India, which provides the legal framework for withdrawing money from the Consolidated Fund.

• These bills are necessary to meet the expenses outlined in the budget, including developmental projects, administrative costs, and other obligations.

• The bill undergoes a parliamentary process involving debates, discussions, and voting before it is passed and becomes an Act.

• Consolidated Fund of India:

• The Consolidated Fund is the chief financial account of the government, comprising all revenues, loans, and money received by the government.

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• No money can be withdrawn from this fund without the approval of the Parliament, ensuring checks and balances in financial governance.

• Legislative Procedure for Financial Bills:

• Financial bills, including Appropriation Bills, are introduced in the Lok Sabha first, as per constitutional provisions.

• After approval in the Lok Sabha, the bill is sent to the Rajya Sabha for consideration and approval.

• The President's assent is the final step in the legislative process, after which the bill becomes an Act.

• State Financial Governance:

• States like Manipur receive funds through such bills for development projects, infrastructure, and welfare schemes.

• This ensures equitable allocation of resources across states, aiding in balanced regional development.

Important Points

• Fiscal Year: The budget and appropriations are based on the fiscal year, which in India runs from April 1st to March 31st.

• Budget Presentation: The Union Budget is presented annually in the Parliament, detailing the government's financial plans and policies.

• Role of Parliament: The Parliament plays a critical role in approving financial legislation, ensuring transparency and accountability in public spending.

• Significance for States: Appropriation Bills are crucial for states like Manipur as they enable the implementation of welfare schemes, development projects, and administrative functions.

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