RRB Group D Official Paper (Held On: 27 Dec, 2025 Shift 1) (Previous Year Paper)

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

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GENERAL SCIENCE

Q1. A ball is released from rest at the top of an inclined smooth plane of length 5 cm. After reaching the bottom it travels horizontally on a smooth surface. How much distance will it travel horizontally? (Neglect the frictional forces as both the plane and surface are smooth)

(a) 5 cm
(b) 0 cm
(c) 2.5 cm
(d) Infinite.

Q2. Which of the following is NOT an example of a colloidal solution?

(a) Smoke
(b) Milk
(c) Mist
(d) Air

Q3. Which of the following statements is correct about the size of atoms?

(a) Atoms are larger than molecules.
(b) All atoms have the same size.
(c) Atoms are visible under an ordinary microscope.
(d) The size of atoms is in the range of nanometres.

Q4. In humans, which parent determines the sex of the child?

(a) Child's own choice
(b) Father
(c) Both equally
(d) Mother

Q5. The doctor feels our heartbeats with the help of an instrument called _____.

(a) stethoscope
(b) radiography
(c) reflex hammer
(d) microscope

Q6. What happens to the gravitational force between two objects, if the distance between them is doubled and everything else remains the same?

(a) The force becomes double
(b) The force becomes four times
(c) The force becomes half
(d) The force becomes one-fourth

Q7. Which of the following statements are correct in relation to the extraction of metals?

The metals which lie high in the reactivity series are extracted by the electrolysis of molten ore.

The metals of medium reactivity series exist as sulphides and carbonates in nature.

It is easier to extract a metal from its sulphide in comparison to oxides.

(a) Only b and c
(b) Only a and c
(c) All a, b, and c
(d) Only a and b

Q8. When a parallel beam of light passes through a convex lens, after refraction it:

(a) converges to a point on the principal axis
(b) forms a virtual image at infinity
(c) passes undeviated
(d) diverges away from the axis

Q9. What is the meaning of the phrase “the DNA copies generated will be similar, but may not be identical”?

(a) Each DNA copy is totally unrelated.
(b) The original DNA is destroyed after copying.
(c) DNA copies may have slight differences.
(d) All DNA copies are identical clones.

Q10. Which of the following statements correctly compares vacuoles in plant and animal cells?

(a) Both plant and animal cells have equal-sized vacuoles
(b) Animal cells have larger vacuoles than plant cells
(c) Plant cells have large vacuoles, animal cells have small ones
(d) Vacuoles are absent in both plant and animal cells

Q11. Which of the following situations represents balanced force?

(a) A ball falling freely under gravity.
(b) A moving car comes to rest when brakes are applied.
(c) Two people push a box from opposite sides with equal force.
(d) A person riding a bicycle uphill.

Q12. Which part of the human brain controls thinking and learning abilities of a person?

(a) Hypothalamus
(b) Cerebrum
(c) Cerebellum
(d) Medulla

Q13. What is the primary purpose of anodising aluminium?

(a) To enhance its corrosion resistance and appearance
(b) To make it softer and more flexible
(c) To increase its reactivity with acids
(d) To make it a better conductor

Q14. Which of the following types of reproduction ensures that offspring inherit features from both parents in animals?

(a) Cloning
(b) Binary fission
(c) Sexual reproduction
(d) Budding

Q15. In a substitution reaction involving an alkane, what happens to the hydrogen atoms of the alkane molecule?

(a) They are replaced by other atoms or groups of atoms.
(b) They are added to the molecule to form a larger chain.
(c) They are completely removed to form double bonds.

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(d) They react with oxygen to form water.

Q16. Covalent bonds are formed by the:

(a) transfer of electrons
(b) gaining of protons
(c) sharing of electrons
(d) loss of neutrons

Q17. Which of the following statements best explains why dry HCl gas does NOT change the colour of dry litmus paper, but aqueous HCl does?

(a) Water reacts with litmus, not HCl.
(b) Litmus paper only works in the presence of light.
(c) HCl only releases H^+ ions when dissolved in water.
(d) Dry HCl gas is non-acidic.

Q18. Which of the following principles helps reduce pressure on the environment and promotes sustainable living?

(a) Use and discard
(b) Reduce, Reuse, and Recycle
(c) Produce more and consume more
(d) Extract as much as possible

Q19. What is the main function of epithelial tissue in animals?

(a) It covers and protects organs and cavities of the body.
(b) It provides mechanical support and shape to organs.
(c) It connects muscles and bones for body movement.
(d) It transports gases and hormones throughout the body.

Q20. If an electric heater consumes 1000 W of power, how much electrical energy does it use in 1 hour?

(a) 1 kWh
(b) 1000 J
(c) 3600 J
(d) 1000 kWh

Q21. An image is formed at a distance of 30 cm from a convex mirror when the object is placed 40 cm from the mirror. The magnification produced by the mirror will be _____.

(a) +4/3
(b) -3/4
(c) +3/4
(d) -4/3

Q22. Which of the following statements is/are true about the loudness and softness of a sound wave?

(i) A loud sound has less amplitude as compared to a soft sound.
(ii) A loud sound has more energy associated with it as compared to a soft sound.
(iii) The loudness of a sound wave is the measure of the response of the ear to the sound.

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

Q23. Which of the following symbols represents a rheostat?

(a) An 'A' inside a circle
(b) A circle with a 'V' inside it.
(c) A zigzag line.
(d) A zigzag line with an arrow which is drawn across it.

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Q24. Which of the following is NOT a property associated with compounds?

(a) The constituents can be separated fairly easily by physical methods.
(b) The composition of each new substance is always fixed.
(c) The new substance has totally different properties.
(d) Elements react to form new compounds.

Q25. Which of the following statement(s) is /are true regarding the work done by a constant force acting on a body?

(i) The work done by the force can never be zero.
(ii) If the direction of the force and displacement of the body is same, the work done will be positive.
(iii) The S.I. unit of work done is joule.

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

MATHEMATICS

Q26. The price of fuel decreases by 35%, 55% and 35% in three successive months, but increases by 65% in the fourth month. What is the percentage increase/decrease in the price of fuel in the fourth month as compared to its original price? (Round off the answer to two decimal places.)

(a) Decreases by 68.63%
(b) Increases by 64.64%
(c) Increases by 70.61%
(d) Decreases by 65.25%

Q27. The sum of two numbers is 74 and their difference is 12. Find the ratio of the smaller number to the larger number.

(a) 31 : 43
(b) 33 : 43
(c) 33 : 47
(d) 31 : 47

Q28. In a cyclic quadrilateral ABCD, the sides are AB = 10 cm, BC = 14 cm, CD = 8 cm, and DA = 12 cm. Find the area of the quadrilateral.

(a) 8√222 cm2
(b) 10√210 cm2
(c) 8√210 cm2
(d) 10√222 cm2

Q29. Successive discounts of 9% and 6% are equivalent to a single discount of:

(a) 15.18%
(b) 17.78%
(c) 14.46%
(d) 15.62%

Q30. P and Q together can fill a cistern with water in 15 hours. If P alone can fill the cistern with water in 60 hours, then in how many hours will Q alone fill one-fourth of the same cistern with water?

(a) 10
(b) 5
(c) 6
(d) 11

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Q31. The amount on a sum of Rs. 7,500 at 6% per annum compound interest, compounded annually, in 2 years will be:

(a) Rs. 8,604
(b) Rs. 9,253
(c) Rs. 8,427
(d) Rs. 8,994

Q32. A fruit seller has 24 kg apples worth Rs. 3,600. He sells 12 kg apples at a gain of 20% and the remaining at a loss of 10%. Find his gain or loss (in Rs.).

(a) Gain Rs. 180
(b) Gain Rs. 360
(c) Loss Rs. 360
(d) Loss Rs. 180

Q33. In an election between two candidates, Dinesh received 46.5% of the total votes and lost to Rizwan by a margin of 3150 votes. If all votes cast were valid, how many votes did Rizwan secure?

(a) 25,925
(b) 20,925
(c) 24,075
(d) 25,050

Q34. If the third proportional to 50 and Z is 18, then what is the value of Z?

(a) 30
(b) 28
(c) 31
(d) 27

Q35. In a race, an athlete covers a distance of 300 m in 100 sec in the first lap. He covers the second lap of the same length in 50 sec. What is the average speed (in m/sec) of the athlete?

(a) 9
(b) 13
(c) 14
(d) 4

Q36. The sum of the present ages of two sisters is 67 years. Five years ago from now, the elder sister was twice as old as the younger one. Find the elder sister's current age.

(a) 27 years
(b) 43 years
(c) 40 years
(d) 24 years

Q37. If $\sec\theta = 17/12$, then what is the value of $\sin\theta$? ($0° < \theta < 90°$)

(a) 13/17
(b) 12/17
(c) √145/17
(d) √170/17

Q38. A man walks 430 m in 10 minutes, 470 m in 11 minutes and 620 m in 17 minutes. Then, his average speed (in m/minutes) for the whole journey is:

(a) 55
(b) 44
(c) 40
(d) 78

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Q39. For 6 innings, a cricketer had an average of 90 runs. In the 7^(th) inning, he scored 157 runs. His average score increased by _____. (Round off the answer to the nearest whole number.)

(a) 19
(b) 20
(c) 10
(d) 8

Q40. The sum of two numbers is 88 and their L.C.M. is 870. The two numbers are:

(a) 30, 58
(b) 28, 60
(c) 23, 65
(d) 35, 53

Q41. Find the value of x if $8(x)^{1}/2 = \sqrt{6889} + \sqrt{4761}$

(a) 729
(b) 361
(c) 529
(d) 289

Q42. A tank can be filled by Pipe A in 9 hours and by Pipe B in 12 hours. Pipe C can empty the tank in 18 hours. All three pipes are opened simultaneously, but Pipe C is closed after 4 hours. How much total time in all will it take to fill the tank completely?

(a) 100/11 hours
(b) 42/5 hours
(c) 22/3 hours
(d) 44/7 hours

Q43. If 8 solid spherical balls, each of radius 10 cm, are melted and recast into a single spherical ball, then what is the radius of the new ball so formed?

(a) 20 cm
(b) 15 cm
(c) 30 cm
(d) 10 cm

Q44. The arithmetic mean of the observations 78, 66, 89, 55, 73, 45, 23, 46 and 29 is:

(a) 56
(b) 52
(c) 50
(d) 48

Q45. Find a single discount (approximately) equal to three consecutive discounts of 2%, 8% and 15%.

(a) 26.77%
(b) 23.36%
(c) 22.89%
(d) 22.86%

Q46. A total profit of Rs. 21,800 is to be distributed amongst A, B and C such that A : B = 4 : 15 and B : C = 9 : 3. The share (in Rs.) of B in the profit is:

(a) 13,525
(b) 13,625
(c) 13,575
(d) 13,675

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Q47. The price of milk has increased by 20%. By how much should the consumption be reduced to maintain the monthly expenditure constant on milk?

(a) 162/7%
(b) 164/7%
(c) 161/3%
(d) 162/3%

Q48. Which of the options has the two prime numbers whose product is the biggest even number less than 30?805

(a) 3 and 11
(b) 3 and 7
(c) 2 and 13
(d) 2 and 5

Q49. The sides of a triangle are 35 cm, 44 cm and 75 cm. What is the length of its altitude corresponding to the side with the length of 44 cm?

(a) 65 cm
(b) 58 cm
(c) 14 cm
(d) 21 cm

Q50. Solve: $((100.5)^2 - (79.2)^2)/(100.5 + 79.2)$

(a) 23.5
(b) 22.4
(c) 20.2
(d) 21.3

GENERAL INTELLIGENCE & REASONING

Q51. XBNO is related to UYKL in a certain way based on the English alphabetical order. In the same way, PAQJ is related to MXNG. To which of the given options is FWOM related, following the same logic?

(a) GXPN
(b) CTLJ
(c) BSKI
(d) DUMK

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

40 47 55 64 74 ?

(a) 81
(b) 78
(c) 85
(d) 87

Q53. 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) 7 4 1 2 4 9 7 5 3 6 1 5 2 7 4 5 8 3 9 6 5 7 3 9 1 4 2 (Right)

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

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

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Q54. What should come in place of the question mark (?) in the given series based on the English alphabetical order?

LIM VSW FCG PMQ ?

(a) ZWE
(b) ZWA
(c) ZEW
(d) ZAW

Q55. Seven people, A, B, C, D, E, F and G, are sitting in a row, facing north.

Only two people sit to the left of C. Only three people sit between C and G. B sits second to the right of C. Only two people sit between B and A. E sits at some place to the right of F but at some place to the left of D.

How many people sit to the right of C?

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

Q56. Town X is to the north of Town Y. Town Z is to the west of Town Y. Town W is to the east of Town X. Town Z is to the north of Town V. What is the position of Town W with respect to Town Z?

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

Q57. If 'P' stands for '×', 'Q' stands for '÷', 'R' stands for '−' and 'S' stands for '+', what will come in place of the question mark (?) in the following equation?

(20 Q 4) P 7 S 5 P 9 R (40 Q 8) P 4 = ?

(a) 92
(b) 75
(c) 60
(d) 35

Q58. Which of the following letter-number clusters will replace the question mark (?) in the given series to make it logically complete?

YVW 58 VST 69 SPQ 80 PMN 91 ?

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

Q59. In a certain code language, 'ROUT' is coded as '1625' and 'AUTO' is coded as '1546'. What is the code for 'A' in that language?

(a) 4
(b) 6
(c) 5
(d) 1

Q60. In a certain code language,

A + B means 'A is the son of B',

A - B means 'A is the brother of B',

A x B means 'A is the wife of B' and

A & B means 'A is the father of B'.

How is T related to M if 'T + O x R - N & M'?

(a) Father's brother's son
(b) Father

(c) Brother
(d) Father's brother

Q61. DQXG is related to YUUI in a certain way based on the English alphabetical order. In the same way, GLQC is related to BPNE. To which of the given options is TKWD related, following the same logic?
(a) OOTF
(b) OPSE
(c) POTF
(d) PPSE

Q62. 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) JMO
(b) RUW
(c) CGH
(d) YBD

Q63. A, B, C, D, E, F and G are sitting around a circular table, facing the centre.
F is the immediate neighbour of both E and C. E sits second to the right of G. A is sitting to the immediate left of G. G is the immediate neighbour of both A and B. D sits to the immediate right of C.
The position(s) of how many persons will remain unchanged if all persons are arranged in the English alphabetical order in clockwise direction, starting from A (including A)?
(a) Two
(b) One
(c) Three
(d) Four

Q64. Vijaya ranked 7^(th) from the top and 13^(th) from the bottom in her class. How many students are there in the class?
(a) 18
(b) 20
(c) 19
(d) 21

Q65. Each of the digits in the number 1785643 is arranged in ascending order from left to right. What will be the sum of the digits which are third from the left and third from the right in the new number thus formed?
(a) 12
(b) 6
(c) 14
(d) 10

Q66. What should come in place of the question mark (?) in the given series?
2 3 ? 38 102 227
(a) 11
(b) 26
(c) 21
(d) 14

Q67. 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.)
(4, 7, 784)
(6, 3, 324)
(a) (4, 6, 676)

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(b) (4, 5, 380)
(c) (5, 6, 900)
(d) (9, 3, 629)

Q68. 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 caps are hats.

All caps are scarfs.

Some scarfs are mufflers.

Conclusions:

(I) Some mufflers are caps.

(II) Some scarfs are hats.

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

Q69. Refer to the following series and answer the question that follows (all numbers are single digit numbers only). Counting to be done from left to right only.

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

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

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

Q70. 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) IFY
(b) ZVP
(c) RNH
(d) GCW

Q71. If ‘A’ stands for ‘÷’, ‘B’ stands for ‘×’, ‘C’ stands for ‘+’ and ‘D’ stands for ‘−’, then what will come in place of the question mark (?) in the following equation?

8 B 2 D 15 C 25 A 5 = ?

(a) 22
(b) 6
(c) 17
(d) 12

Q72. Seven people, A, B, C, D, E, F and G, are sitting in a row, facing north. C is seated second from the left end. F is third to the right of B. G is seated to the left of C and at one of the ends. Only two people sit between G and B. Only one person is seated between D and F. E is not a neighbour of F. Who is seated second from the right end?

(a) B
(b) D
(c) A
(d) E

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Q73. In a certain code language, ‘please go on’ is coded as ‘js tk mj’ and ‘go there please’ is coded as ‘js yn tk’. How is ‘on’ coded in that language?

(a) tk
(b) mj
(c) js
(d) yn

Q74. Select the pair which follows the same pattern as that followed by the two pairs given below. Both pairs follow the same pattern.

TUG : QYD

NCA : KGX

(a) PNC : LQY
(b) BHQ : GDV
(c) UKW : WGY
(d) HKU : EOR

Q75. What should come in place of the question mark (?) in the given series?

18 24 12 30 ? 36

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

Q76. This question is based on the five, three-digit numbers given below.

(Left) 627 543 658 719 482 (Right)

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

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

What will be the resultant if the third digit of the highest number is multiplied with the second digit of the lowest number?

(a) 70
(b) 71
(c) 73
(d) 72

Q77. 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:

No stump is a ball.

Some balls are wickets.

Conclusion:

(I) No ball is a stump.

(II) No wicket is a ball.

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

Q78. All 30 students in a class are standing in a row, facing north. Meera is 10^(th) from the left end, while Arjun is 19^(th) from the right end. How many people stand between Meera and Arjun?

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

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(d) 2

Q79. Refer to the following number series and answer the question that follows (all numbers are single digit numbers only).

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

How many unique digits in the series are multiples of 4 (each digit counted only once, regardless of repetitions)?5701

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

Q80. Arman starts from point A and drives 32 km towards the south. He then takes a left turn, drives 37 km, turns left and drives 35 km. He then takes a left turn and drives 38 km. He takes a final left turn, drives 3 km and stops at point P. How far (shortest distance) and towards which direction should he drive in order to reach point A again? (All turns are 90-degree turns only, unless specified.)

(a) 2 km to the east
(b) 1 km to the east
(c) 3 km to the west
(d) 4 km to the west

GENERAL AWARENESS AND CURRENT AFFAIRS

Q81. Which of the following initiatives did the Maharashtra Government approve in September 2025 to generate employment in Tier-2 and Tier-3 cities and boost skilled job opportunities?

(a) Free Urban Transit Support Scheme for job seekers
(b) Targeted Wage Subsidy Programme for unskilled labourers
(c) Global Capability Center policy to expand centres across the state
(d) Mandatory Local Employment Reservation framework in enterprises

Q82. In March 2025, who inaugurated the two-day National Conference on ‘Environment – 2025’ in New Delhi?

(a) Prime Minister of India
(b) Vice President of India
(c) President of India
(d) Speaker of Lok Sabha

Q83. When did Larsen & Toubro (L&T) launch the Indian Navy’s Second Multi-Purpose Vessel (MPV)?

(a) September 2024
(b) December 2024
(c) March 2025
(d) January 2025

Q84. Which of the following ministries announced the fourth phase of amalgamation of RRBs in April 2025 under the 'One State, One RRB' policy to enhance the operational efficiency of regional rural banks (RRBs)?

(a) Minister of Home Affairs
(b) Ministry of Corporate Affairs
(c) Ministry of Finance
(d) Ministry of Rural Development

Q85. Which Indian city’s government conducted the first cloud seeding flight trial in October 2025 to combat severe air pollution?

(a) Delhi
(b) Lucknow
(c) Mumbai
(d) Jaipur

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Q86. India observed World No Tobacco Day on which date in 2025?

(a) 3 May
(b) 31 May
(c) 17 May
(d) 5 May

Q87. At the Taiwan Athletics Open, which took place in Taipei on 7 and 8 June 2025, how many total medals did India win?

(a) 12
(b) 14
(c) 10
(d) 16

Q88. In July 2025, DRDO successfully conducted two consecutive successful flight tests of the Pralay missile at which of the following locations?

(a) Pokhran
(b) Chandipur
(c) Balasore
(d) Dr. APJ Abdul Kalam Island

Q89. Which Indian actress was named National Ambassador for Cyber Safety by Ministry of Home Affairs in October 2024?

(a) Alia Bhatt
(b) Sara Ali Khan
(c) Janhvi Kapoor
(d) Rashmika Mandanna

Q90. Which of the following states witnessed the swearing-in of a newly elected government led by the NDA coalition in November 2025?

(a) Uttar Pradesh
(b) Jharkhand
(c) Bihar
(d) Assam

Q91. Which para-archer achieved a historic milestone by becoming the first in their discipline to be honoured with the Padma Shri in 2025?

(a) Jyoti Balyan
(b) Vivek Chikara
(c) Rakesh Kumar
(d) Harvinder Singh

Q92. At which summit did India’s NSA Ajit Doval push for a unified counter-terrorism stance in June 2025?

(a) EU Summit in Brussels
(b) G20 Summit in New Delhi
(c) ASEAN Summit in Jakarta
(d) SCO Summit in China

Q93. Who was named the Men’s Player of the Year at the All India Football Federation Awards 2025 in May 2025?

(a) Khalid Jamil
(b) Brison Fernandes
(c) Vishal Kaith
(d) Subhasish Bose

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Q94. During COP30 held in November 2025, the term Conference of the Parties (COP) refers to the meeting of the Parties under which United Nations convention?

(a) United Nations Convention on Biological Diversity (UNCBD)
(b) Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)
(c) United Nations Framework Convention on Climate Change (UNFCCC)
(d) United Nations Convention Against Corruption (UNCAC)

Q95. Which of the following cities were among the safest for women according to (National Annual Report & Index on Women's Safety) NARI 2025?

(a) Delhi, Patna, Indore
(b) Kohima, Visakhapatnam, Bhubaneswar
(c) Lucknow, Jaipur, Delhi
(d) Ranchi, Srinagar, Kolkata

Q96. Who became the oldest man to reach the semi-finals of an ATP Masters 1000 event in 2025?

(a) Novak Djokovic
(b) Andy Murray
(c) Rafael Nadal
(d) Roger Federer

Q97. Which key reform did the Economic Survey 2024-25 emphasise for long-term growth?

(a) Price control regimes
(b) Nationalisation of banks
(c) Public sector expansion
(d) Systemic deregulation

Q98. As per Human Development Index (HDI) 2025, what is the rank of India?

(a) 150th
(b) 130th
(c) 110th
(d) 90th

Q99. Who became the first athlete to throw beyond 75 m in the men's discus event, setting a world record of 75.56 m in April 2025?

(a) Matthew Denny
(b) Virgilijus Alekna
(c) Mykolas Alekna
(d) Sam Mattis

Q100. In May 2025, which of the following nodal agencies of the Union Government invited public comments on the Draft Framework of India's Climate Finance Taxonomy?

(a) National Statistical Office
(b) NITI Aayog Secretariat
(c) Department of Financial Services
(d) Department of Economic Affairs

ANSWER KEY

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

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

SOLUTIONS

Q1. Answer: (d) Infinite.

The correct answer is Infinite.

Key Points

• The motion of the ball is governed by Newton's First Law of Motion, also known as the Law of Inertia. This law states that an object will remain in its state of rest or uniform motion in a straight line unless acted upon by an external unbalanced force.

• In the given scenario, the ball starts from rest at the top of a 5 cm long smooth inclined plane. As it moves down, potential energy is converted into kinetic energy, and the ball reaches the bottom with a specific velocity.

• Once the ball reaches the horizontal smooth surface, there is no frictional force or air resistance (as the problem states to neglect them). Because the surface is smooth, the coefficient of friction is zero.

• On a horizontal plane, the force of gravity acts vertically downwards and is balanced by the normal reaction force acting upwards. Therefore, there is no net force acting on the ball in the horizontal direction of motion.

• According to the equation of motion, if the net force is zero, the acceleration is also zero (based on Newton's Second Law, F = ma). This means the ball will maintain a constant velocity indefinitely. Since it never stops, the distance it travels horizontally is Infinite.

Additional Information

• Galileo's Experiment on Inertia:

• The concept of Inertia was first extensively studied by Galileo Galilei. He conducted experiments with double inclined planes.

• He observed that if a ball is released from one side, it climbs to the same height on the other side. If the angle of the second slope is reduced, the ball travels a longer distance to reach that same height.

• Galileo concluded that if the second plane were made horizontal (angle of 0 degrees), the ball would continue to move forever in an attempt to reach its original height, provided there is no friction.

• Newton's First Law of Motion:

• It defines Inertia, which is the inherent property of a body to resist changes in its state of motion.

• There are three types of inertia: Inertia of rest, Inertia of motion, and Inertia of direction.

• In this problem, the ball exhibits inertia of motion once it leaves the incline and enters the horizontal path.

• Role of Friction:

• In real-world conditions, surfaces are never perfectly smooth. Frictional forces and air resistance act as external unbalanced forces that eventually bring the ball to rest.

• However, in ideal physics problems where surfaces are described as smooth, we assume the frictional force is 0 Newtons, leading to theoretical infinite motion.

Important Points

• The length of the incline (5 cm) determines the final velocity at the bottom but does not affect the total distance traveled on an infinite smooth horizontal plane.

• The velocity (v) at the bottom of the incline can be calculated using v^2 = u^2 + 2as or conservation of energy (mgh = 1/2 mv^2), but since there is no deceleration on the horizontal part, this velocity remains constant.

• The horizontal distance (d) is calculated by d = velocity × time. As time (t) tends toward infinity in the absence of a stopping force, the distance also becomes Infinite.

Q2. Answer: (d) Air

The correct answer is Air.

Key Points

• Air is a homogeneous mixture of various gases, primarily consisting of Nitrogen (78%) and Oxygen (21%), along with traces of Argon, Carbon Dioxide, and other noble gases. In this mixture, the solute particles are at the molecular or atomic level (less than 1 nanometer in diameter), and they do not scatter light. Hence, statement 4 is correct as it is a true solution, not a colloid.

• Smoke is a colloidal solution where solid particles (like carbon or ash) are dispersed in a gas medium (air). This specific type of

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colloid is known as a solid aerosol. Because the particles are large enough to remain suspended but do not settle quickly, it follows the properties of a colloid. Hence, statement 1 is incorrect as it is a colloid.

• Milk is a complex colloidal system where liquid fat globules are dispersed in water. This liquid-in-liquid colloid is specifically termed an emulsion. The presence of proteins like casein acts as an emulsifier to keep the mixture stable. Hence, statement 2 is incorrect as it is a colloid.

• Mist (and Fog) is a colloidal solution where liquid water droplets are dispersed in the atmosphere (gas). It is classified as a liquid aerosol. The droplets are large enough to scatter light, which is why mist appears opaque or translucent. Hence, statement 3 is incorrect as it is a colloid.

• Therefore, the correct answer is Air.

Additional Information

• Definition of a Colloid:

• A colloid is a heterogeneous mixture in which the particle size of the dispersed phase is intermediate between that of a true solution and a suspension.

• The typical particle size ranges from 1 nanometer (nm) to 1000 nanometers.

• Unlike suspensions, colloidal particles do not settle down under the influence of gravity when left undisturbed.

• Types of Colloidal Systems:

• Aerosol: Formed when a solid or liquid is dispersed in a gas (e.g., clouds, smoke, automobile exhaust).

• Emulsion: Formed when a liquid is dispersed in another liquid (e.g., milk, face cream, mayonnaise).

• Foam: Formed when a gas is dispersed in a liquid (e.g., shaving cream, froth) or a solid (e.g., sponge, pumice stone).

• Sol: Formed when a solid is dispersed in a liquid (e.g., Milk of Magnesia, mud).

• Gel: Formed when a liquid is dispersed in a solid (e.g., jelly, cheese, butter).

• The Tyndall Effect:

• This is the phenomenon of scattering of light by colloidal particles.

• When a beam of light passes through a colloid, the path of the light becomes visible. True solutions (like Air or Saltwater) do not exhibit the Tyndall Effect because their particles are too small to scatter light.

Important Points

• Brownian Motion: Colloidal particles exhibit a continuous, zig-zag random motion known as Brownian motion. This motion is caused by the unbalanced bombardment of the particles by the molecules of the dispersion medium, which helps in keeping the colloid stable.

• Stability: Colloids are relatively stable. They can often be separated by centrifugation but not by simple filtration through ordinary filter paper, as the particles are smaller than the pores of the paper.

• Phase Components: Every colloid consists of two parts: the dispersed phase (the substance being scattered) and the dispersion medium (the substance in which the particles are scattered). In Air, there is no such distinction of phases as it is a single-phase homogeneous gas mixture.

Q3. Answer: (d) The size of atoms is in the range of nanometres.

The correct answer is The size of atoms is in the range of nanometres.

Key Points

• Atoms are the fundamental building blocks of matter and are incredibly small in size. The radius of an atom is typically measured in nanometres (nm), where 1 nanometre is equal to 1/10^9 metres (or 10^-^9 m). Hence, statement 4 is correct.

• Molecules are chemical structures consisting of at least two atoms held together by chemical bonds. Because a molecule is a collection of atoms, it is always larger than the individual atoms that compose it. Hence, statement 1 is incorrect.

• The size of an atom is not constant across all elements. It varies depending on the atomic number, the number of electron shells, and the effective nuclear charge. For instance, a Cesium atom is much larger than a Helium atom. Hence, statement 2 is incorrect.

• An ordinary optical microscope uses visible light to form images, which has a wavelength range of approximately 400 to 700 nanometres. Since atoms are much smaller (around 0.1 to 0.5 nanometres) than the wavelength of light, they cannot be resolved or seen using such devices. Hence, statement 3 is incorrect.

• To "see" or map the surface of atoms, scientists use advanced instruments like the Scanning Tunneling Microscope (STM) or the Atomic Force Microscope (AFM), which were developed in the 1980s.

Additional Information

• Atomic Radius:

• The atomic radius is generally defined as the shortest distance between the atom's nucleus and the outermost shell of electrons.

• In the Periodic Table, the atomic size generally increases as you move down a group because new electron shells are added.

• Conversely, the atomic size generally decreases as you move from left to right across a period because the increasing nuclear

charge pulls the electron cloud closer to the nucleus.

• Scale and Examples:

• The smallest atom is Hydrogen, with an atomic radius of approximately 0.037 nanometres (or 37 picometres).

• To put the scale into perspective, more than one million atoms stacked on top of each other would be roughly as thick as a single sheet of paper.

• A single drop of water contains about 2 sextillion (2×10^{21}) atoms of Oxygen and twice as many Hydrogen atoms.

• Measurement Units:

• While the nanometre (nm) is common, physicists often use the Angstrom (Å) to measure atomic scales. 1 Angstrom is equal to 10^-1^0 metres or 0.1 nanometres.

• For even smaller subatomic distances, the picometre (pm) is used, where 1,000 pm equals 1 nanometre.

Q4. Answer: (b) Father

The correct answer is Father.

Key Points

• In humans, the determination of the sex of a child is a genetic process governed by the 23rd pair of chromosomes, known as the sex chromosomes.

• Human beings have a total of 46 chromosomes or 23 pairs. Out of these, 22 pairs are autosomes (identical in both males and females), and the last pair defines the biological sex.

• The female genetic makeup consists of two X chromosomes (XX). Consequently, all gametes (eggs) produced by a mother contain only an X chromosome.

• The male genetic makeup consists of one X chromosome and one Y chromosome (XY). This means the father is heterogametic, producing two types of sperm: one carrying the X chromosome and the other carrying the Y chromosome.

• The sex of the child depends entirely on which type of sperm fertilizes the egg. If a sperm with an X chromosome fuses with the egg, the resulting child will be XX (female). If a sperm with a Y chromosome fuses with the egg, the child will be XY (male). Hence, the father is the parent who determines the sex of the child.

Additional Information

• Chromosomal Basis of Sex:

• The mechanism where specific chromosomes determine the sex of an individual is called sex determination. In humans, this is the XY system.

• During meiosis, the chromosome pairs separate so that each gamete receives only one chromosome from each pair.

• Since the ovum (egg) always contributes an X, the zygote's sex is determined at the moment of fertilization by the male gamete.

• Probability of Sex:

• Statistically, there is a 50% chance of having a boy and a 50% chance of having a girl in every pregnancy, as the ratio of X-carrying sperm to Y-carrying sperm is 1:1.

• Other Systems in Nature:

• Not all organisms follow the XY system. For instance, in birds, the system is ZW, where the female (ZW) is the heterogametic sex and determines the sex of the offspring, while the male is ZZ.

• In some reptiles, sex is determined by environmental factors like the incubation temperature of the eggs rather than genetics.

Important Points

• The SRY Gene:

• The Y chromosome contains a specific gene called the SRY gene (Sex-determining Region Y).

• This gene is responsible for the initiation of male sex determination by triggering the development of undifferentiated gonads into testes.

• In the absence of a Y chromosome (and thus the SRY gene), the biological default pathway leads to the development of ovaries and a female phenotype.

• Historical Context:

• The chromosomal theory of sex determination was discovered in the early 20th century (around 1905) by American geneticists Nettie Stevens and Edmund Beecher Wilson.

• Their work shifted the understanding of heredity from vague external factors to specific microscopic structures within the cell nucleus.

• Misconceptions:

• In many cultures historically, mothers were wrongly blamed for not bearing a male child. Scientific evidence clearly shows that the mother's genetic contribution to sex is constant (X), and the father's contribution is the variable factor.

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Q5. Answer: (a) stethoscope

The correct answer is stethoscope.

Key Points

• A stethoscope is an acoustic medical device used by healthcare professionals for auscultation, which involves listening to the internal sounds of a human or animal body.

• The instrument is primarily used to listen to the heartbeat and lung sounds, providing critical information about the rhythm of the heart and the clarity of the airways.

• It was invented in 1816 by the French physician René Laennec at the Necker-Enfants Malades Hospital in Paris. Originally, it was a simple wooden tube.

• Modern stethoscopes consist of a chest piece (comprising a diaphragm and a bell), tubing, and earpieces. The diaphragm is used for high-frequency sounds, while the bell is used for low-frequency sounds.

• When a doctor places the chest piece on a patient, the vibrations of the heart produce sound waves that travel through the hollow tubes to the doctor's ears, allowing them to monitor the heart rate and detect murmurs or gallops.

Additional Information

• Radiography:

• This is an imaging technique that uses ionizing radiation, specifically X-rays, to view the internal form of an object.

• In a medical context, it is used to diagnose bone fractures, joint dislocations, and certain infections like pneumonia.

• It was pioneered by Wilhelm Conrad Röntgen in 1895, who received the first Nobel Prize in Physics for this discovery.

• Reflex Hammer:

• This is a medical instrument used by practitioners to test deep tendon reflexes.

• Testing reflexes is an essential part of a neurological physical examination to assess the integrity of the central nervous system and peripheral nervous system.

• The first modern reflex hammer was designed by John Madison Taylor in 1888.

• Microscope:

• A microscope is a laboratory instrument used to examine objects that are too small to be seen by the naked eye.

• In medicine, it is used in pathology and hematology to observe cells, bacteria, parasites, and viruses in samples like blood or tissue biopsies.

• Antonie van Leeuwenhoek is often referred to as the "Father of Microbiology" for his improvements to the microscope in the 17th century.

Important Points

• Evolution of the Stethoscope: In 1851, Arthur Leared invented the binaural stethoscope (using both ears), and it was further refined in 1852 by George Philip Cammann for commercial production.

• Electronic Stethoscopes: Modern advancements have led to electronic or digital stethoscopes, which can amplify low-level body sounds and convert them into digital signals for recording or visual display (phonocardiogram).

• Auscultation Areas: Doctors typically listen to the heart at four specific locations on the chest: the aortic, pulmonic, tricuspid, and mitral areas to evaluate different heart valves.

• Sphygmomanometer: This device is often used in conjunction with a stethoscope to measure blood pressure by listening to Korotkoff sounds in the brachial artery.

Q6. Answer: (d) The force becomes one-fourth

The correct answer is The force becomes one-fourth.

Key Points

• The gravitational force between two bodies is determined by Newton's Universal Law of Gravitation, which states that the force is directly proportional to the product of their masses and inversely proportional to the square of the distance between them.

• Mathematically, the formula is expressed as $F = G (m1m2 / r^2)$, where F is the gravitational force, G is the universal gravitational constant, m1 and m2 are the masses of the two objects, and r is the distance between their centers.

• According to the Inverse Square Law relationship, if the distance r is doubled (becomes 2r), the new force F' becomes proportional to $1 / (2r)^2$, which simplifies to $1 / 4r^2$.

• This calculation shows that the new force is exactly one-fourth (1/4) of the original force. Hence, the statement that the force becomes one-fourth is correct.

• Conversely, if the distance were halved, the force would increase by four times, illustrating the significant impact of distance on gravitational attraction compared to mass.

Additional Information

• Newton's Universal Law of Gravitation: Formulated by Sir Isaac Newton and published in 1687 in his work "Philosophiæ Naturalis Principia Mathematica". It provides a mathematical description of the gravitational pull that every object in the universe

exerts on every other object.

• The Gravitational Constant (G): This is a fundamental physical constant. Its value was first accurately measured by Henry Cavendish in 1798. The modern accepted value is approximately 6.674 x 10^-11 N·m²/kg².

• Mass and Force Relationship: While distance has an inverse square relationship, the force is directly proportional to the masses. If the mass of one object is doubled, the gravitational force also doubles, provided the distance remains constant.

• Range of Gravity: Gravity is a long-range force that exists between all objects with mass, regardless of how far apart they are, though it becomes negligibly small at extreme astronomical distances.

• Significance in the Solar System: This law explains why planets orbit the Sun and why the Moon orbits the Earth. It also accounts for the phenomenon of tides, which are caused by the gravitational pull of the Moon and the Sun on Earth's oceans.

Important Points

• Weight vs. Gravitational Force: The weight of an object on Earth is actually the gravitational force exerted by the Earth on that object. It is calculated using W = mg, where g is the acceleration due to gravity (approximately 9.8 m/s²).

• Vector Nature: Gravitational force is a vector quantity, meaning it has both magnitude and direction. The direction of the force is always along the line joining the centers of the two masses and is always attractive.

• Universal Applicability: It is called a "Universal" law because it applies to everything from small terrestrial objects to massive celestial bodies like stars and galaxies.

• Center of Mass: For spherical objects with uniform density, the distance r is measured specifically from the center of mass of one object to the center of mass of the other.

Q7. Answer: (d) Only a and b

The correct answer is Only a and b.

Key Points

• The extraction of metals depends on their position in the reactivity series. Metals at the top of the series, such as Potassium (K), Sodium (Na), Calcium (Ca), Magnesium (Mg), and Aluminium (Al), are highly reactive and cannot be reduced by carbon because their affinity for oxygen is higher than that of carbon. These metals are extracted by the electrolysis of their molten ores (usually chlorides or oxides). Hence, statement a is correct.

• Metals located in the middle of the reactivity series, such as Iron (Fe), Zinc (Zn), and Lead (Pb), are moderately reactive. In nature, these metals are predominantly found as sulphides or carbonates rather than pure oxides or free elements. Hence, statement b is correct.

• During the metallurgical process, it is significantly more difficult to obtain a metal directly from its sulphide or carbonate form. It is much easier to extract a metal from its oxide via reduction. Therefore, ores are first converted into oxides before the actual extraction happens. Hence, statement c is incorrect.

• Consequently, sulphide ores are converted into oxides by roasting, and carbonate ores are converted into oxides by calcination to facilitate easier reduction.

• Hence, the correct answer is Only a and b.

Additional Information

• Roasting:

• It is the process of heating sulphide ores strongly in the presence of excess air.

• For example, Zinc sulphide (Zinc blende) is heated in air to produce Zinc oxide and Sulphur dioxide gas.

• This process helps in removing volatile impurities and preparing the ore for reduction.

• Calcination:

• It is the process of heating carbonate ores strongly in limited air or the absence of air.

• For example, Zinc carbonate (Calamine) decomposes into Zinc oxide and Carbon dioxide when heated.

• This is an essential step for ores like Limestone and Magnesite.

• Reduction of Metal Oxides:

• Once the metal oxide is obtained through roasting or calcination, it is reduced to the metal using reducing agents like Carbon (Coke), Carbon monoxide, or sometimes highly reactive metals like Sodium or Aluminium.

• In the case of Iron, it is reduced in a blast furnace using coke.

Important Points

• Low Reactivity Metals: Metals at the bottom of the series, like Gold (Au) and Platinum (Pt), are found in the native state (uncombined). Metals like Mercury (Hg) and Copper (Cu) are found as sulphides but can be reduced to metal by simply heating in air (auto-reduction).

• Electrolytic Refining: The metals obtained by reduction processes are often impure. They are purified using electrolytic refining, where the impure metal is made the anode and a thin strip of pure metal is made the cathode in a suitable salt solution.

• Aluminium Extraction: Since Aluminium has a very high melting point, it is extracted from Bauxite using the Hall-Heroult process, where Cryolite is added to lower the melting point and increase conductivity.

Q8. Answer: (a) converges to a point on the principal axis

The correct answer is converges to a point on the principal axis.

Key Points

• A convex lens is also known as a converging lens because of its ability to bring parallel rays of light together at a single point.

• When a beam of light consisting of rays parallel to the principal axis strikes the surface of a convex lens, the rays undergo refraction twice—once when entering the lens and once when exiting it.

• After passing through the lens, these refracted rays converge and intersect at a specific point on the principal axis. Hence, statement 1 is correct.

• This specific point where the parallel rays meet is called the Principal Focus (denoted by F). Since the rays actually meet at this point, the focus of a convex lens is considered a real focus.

• The converging action occurs because the lens is thicker at the center than at the edges, causing the light rays to bend more toward the thicker part of the glass.

• Conversely, a concave lens would cause a parallel beam to diverge away from the axis, making them appear as if they are coming from a virtual focus. Hence, statement 4 is incorrect.

• Only light rays that pass directly through the Optical Center of the lens will pass undeviated. Hence, statement 3 is incorrect.

Additional Information

• Characteristics of Convex Lenses:

• A convex lens is thicker in the middle and tapers off at the edges.

• It can form both real and virtual images depending on the position of the object relative to the focal point.

• When the object is placed at infinity, the image formed is a point-sized, real, and inverted image at the focus.

• Focal Length and Power:

• The distance between the Optical Center (O) and the Principal Focus (F) is known as the focal length (f).

• The Power of a lens is the reciprocal of its focal length (P = 1/f), measured in Dioptres (D). For a convex lens, the power is always positive.

• Applications:

• Human Eye: The natural lens in the human eye is a convex lens that focuses light on the retina.

• Correction of Vision: Convex lenses are used to correct Hypermetropia (farsightedness), where the image of near objects is formed behind the retina.

• Optical Instruments: They are extensively used in microscopes, telescopes, cameras, and magnifying glasses to produce enlarged or focused images.

• Types of Convex Lenses:

• Double Convex (Biconvex): Both surfaces are curved outward.

• Plano-Convex: One surface is flat and the other is curved outward.

• Concavo-Convex (Meniscus): One surface is curved inward and the other outward, with the center being thicker than the edges.

Important Points

• The behavior of light through a lens is governed by Snell's Law of refraction, which relates the angle of incidence to the angle of refraction based on the refractive index of the material.

• The Lens Formula is given by 1/f = 1/v - 1/u, where v is the image distance and u is the object distance.

• The Magnification (m) produced by a lens is the ratio of the height of the image to the height of the object, also expressed as m = v/u.

• A virtual image is formed by a convex lens only when the object is placed between the optical center and the focus; this image is erect and magnified.

Q9. Answer: (c) DNA copies may have slight differences.

The correct answer is DNA copies may have slight differences.

Key Points

• The process of DNA replication is a biochemical reaction. In biology, no chemical reaction is 100% absolutely reliable or accurate every single time.

• When a cell reproduces, it creates a copy of its DNA through these chemical processes. Because of the inherent nature of these reactions, the resulting DNA strands are very similar to the original but may contain minor alterations. Hence, the statement that DNA copies may have slight differences is correct.

• If each DNA copy were totally unrelated, the offspring would not belong to the same species as the parent, which contradicts the fundamental principles of heredity. Hence, option 1 is incorrect.

• During replication, the original DNA acts as a template. It is not destroyed; rather, it provides the structural information for the synthesis of the new strand. Hence, option 2 is incorrect.

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• The idea that all DNA copies are identical clones is biologically improbable due to the occurrence of mutations and copying errors. These "errors" are actually the basis for diversity in a population. Hence, option 4 is incorrect.

• The phrase “similar, but may not be identical” acknowledges the existence of biological variations that occur during the transfer of genetic information from one generation to the next.

Additional Information

• DNA (Deoxyribonucleic Acid): It is the genetic material found in the nucleus of almost all living organisms. It carries the blueprints for the body design and functioning of the cell.

• DNA Replication: This is the process by which a double-stranded DNA molecule is copied to produce two identical DNA molecules. It is a critical part of cell division (mitosis and meiosis).

• The Role of Variations: Variations are the differences that exist between individuals of the same species. These variations are necessary for evolution. If an environment changes drastically (e.g., global warming), these slight differences might allow some individuals to survive while others perish.

• Historical Context: The double helix structure of DNA was famously proposed by James Watson and Francis Crick in 1953, which helped scientists understand how DNA could "unzip" and replicate itself.

• Genetic Stability: While variation is important, stability is also required. If the DNA copying process had too many errors, the resulting cellular apparatus would fail to function, leading to the death of the new cell.

Important Points

• Mutation: A mutation is a permanent change in the nucleotide sequence of DNA. These can be caused by copying errors, UV radiation, or chemicals.

• Niche and Adaptation: DNA copying consistency allows organisms to occupy a specific ecological niche. Variations allow them to adapt when that niche undergoes environmental shifts.

• Asexual vs Sexual Reproduction: In asexual reproduction, the variation is minimal because there is only one parent, whereas in sexual reproduction, variations are increased because genetic material from two different individuals is combined.

• Enzymatic Control: The replication process is managed by enzymes like DNA polymerase, which has a proofreading function to minimize errors, though it is not perfect.

Q10. Answer: (c) Plant cells have large vacuoles, animal cells have small ones

The correct answer is Plant cells have large vacuoles, animal cells have small ones.

Key Points

• Vacuoles are membrane-bound organelles found in the cells of plants, animals, fungi, and some protists, acting primarily as storage bubbles.

• In plant cells, there is typically one very large central vacuole that can occupy up to 90% of the cell's total volume. This large size is a defining characteristic of mature plant cells.

• In animal cells, vacuoles are much smaller in size and often temporary. They are distributed throughout the cytoplasm and are frequently involved in transport or short-term storage.

• The large central vacuole in plants is essential for maintaining turgor pressure, which provides structural support and keeps the plant upright by pushing the cytoplasm against the cell wall.

• The statement that plant cells have large vacuoles and animal cells have small ones accurately describes the morphological difference between the two. Hence, statement 3 is correct.

Additional Information

• Tonoplast: The specialized membrane that surrounds the central vacuole in plant cells is known as the tonoplast. It facilitates the active transport of ions and other materials into the vacuole, maintaining a concentration gradient.

• Cell Sap: The fluid contained within the plant vacuole is called cell sap. It is a mixture of water, amino acids, sugars, waste products, and vital mineral salts.

• Anthocyanins: Some plant vacuoles contain pigments like anthocyanins, which are responsible for the red, purple, and blue colors seen in many flowers and fruits, aiding in pollination and seed dispersal.

• Functions in Animals: In animal cells, vacuoles (often called vesicles) are involved in exocytosis (expelling waste) and endocytosis (bringing materials into the cell). They play a key role in the digestive processes of simple organisms.

• Contractile Vacuoles: Some freshwater protists like Amoeba possess contractile vacuoles, which collect and pump out excess water to prevent the cell from bursting, a vital process for osmoregulation.

Important Points

• Structural Difference: Unlike plant cells which have a permanent large central vacuole, the vacuoles in animal cells are often transient and can form or disappear based on the cell's metabolic needs.

• Discovery: Vacuoles were first observed by Antonie van Leeuwenhoek in 1676, though their specific functions in plant turgidity were understood much later.

• Waste Management: In plants, the vacuole acts as a waste disposal site, isolating materials that might be harmful or toxic to the

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rest of the cell's organelles.

• Growth Mechanism: Plants grow by absorbing water into the central vacuole, which expands the cell with minimal investment in new cytoplasm, allowing for rapid cell elongation.

Q11. Answer: (c) Two people push a box from opposite sides with equal force.

The correct answer is Two people push a box from opposite sides with equal force.

Key Points

• Balanced forces occur when the resultant force or net force acting on an object is zero. This means the forces acting from all directions cancel each other out perfectly.

• In the case of two people pushing a box from opposite sides with equal force, the forces are equal in magnitude but opposite in direction. Because they act along the same line, they neutralize each other, resulting in no change in the box's state of motion. Hence, statement 3 is correct.

• When a ball is falling freely under gravity, the only significant force acting on it (ignoring air resistance) is the force of gravity. Since there is no upward force to balance it, the ball undergoes acceleration at a rate of approximately 9.8 m/s^2. Hence, statement 1 is incorrect.

• When a moving car comes to rest upon applying brakes, the frictional force exerted by the brakes creates an unbalanced force in the direction opposite to the motion. This causes negative acceleration or deceleration. Hence, statement 2 is incorrect.

• A person riding a bicycle uphill is subject to the component of gravity pulling them backward and friction. Unless the rider's pedaling force exactly matches these resistive forces to maintain a constant velocity, the forces are typically unbalanced, especially as the rider usually has to exert extra effort to overcome the incline. Hence, statement 4 is incorrect.

Additional Information

• Newton’s First Law of Motion: Often called the Law of Inertia, it states that an object will remain at rest or continue to move at a constant velocity unless acted upon by an unbalanced external force. Balanced forces do not trigger a change in motion.

• Net Force (Fnet): This is the vector sum of all forces acting on an object. For balanced forces, Fnet = 0. For unbalanced forces, Fnet ≠ 0, which leads to acceleration as defined by Newton’s Second Law (F = ma).

• State of Equilibrium: An object under balanced forces is said to be in equilibrium. This can be Static Equilibrium (object is at rest, like a book on a table) or Dynamic Equilibrium (object is moving at a constant speed in a straight line, like a plane flying at constant altitude and velocity).

• Characteristics of Balanced Forces:

• They do not change the speed of an object.

• They do not change the direction of a moving object.

• They may, however, change the shape or size of an object (e.g., squeezing a rubber ball from opposite sides).

Important Points

• Gravity and Normal Force: A common example of balanced forces is an object resting on a horizontal surface. The downward force of gravity is balanced by the upward normal force exerted by the surface.

• Terminal Velocity: When an object falls through a fluid (like air), it eventually reaches a point where the drag force equals the gravitational force. At this terminal velocity, the forces are balanced, and the object stops accelerating, falling at a constant speed.

• Units of Force: The standard SI unit for measuring force is the Newton (N). Force is a vector quantity, meaning it has both magnitude and direction, which is why the direction of "opposite sides" is crucial for forces to be balanced.

Q12. Answer: (b) Cerebrum

The correct answer is Cerebrum.

Key Points

• The Cerebrum is the largest and most prominent part of the human brain, located in the forebrain region. It is the primary center for intelligence, memory, and imagination.

• It specifically controls a person's thinking and learning abilities, along with other complex cognitive functions such as reasoning, problem-solving, speech, and emotions.

• Structurally, the Cerebrum is divided into two halves known as the left and right cerebral hemispheres. These hemispheres are connected by a thick bundle of nerve fibers called the corpus callosum, which allows communication between both sides.

• The outer layer of the cerebrum is called the cerebral cortex (also known as grey matter), which contains a high concentration of neurons. This layer is highly folded into gyri (ridges) and sulci (grooves) to increase the surface area for processing information.

• The Cerebrum is further categorized into four lobes: the frontal lobe (associated with decision-making and personality), the parietal lobe (sensory perception), the temporal lobe (auditory processing), and the occipital lobe (visual processing).

Additional Information

• Hypothalamus:

• Located below the thalamus, it plays a crucial role in maintaining homeostasis.

• It regulates vital body functions such as body temperature, hunger, thirst, sleep-wake cycles, and emotional responses. It also controls the pituitary gland, linking the nervous system to the endocrine system.

• Cerebellum:

• Often referred to as the "little brain," it is located at the back of the skull, beneath the cerebrum.

• Its primary function is to coordinate voluntary muscle movements, maintain posture, and ensure physical balance and equilibrium during activities like walking or running.

• Medulla Oblongata:

• This is the lowest part of the brainstem and connects the brain to the spinal cord.

• It is responsible for regulating involuntary functions essential for survival, including heartbeat, breathing (respiration), blood pressure, and reflexes like swallowing, coughing, and sneezing.

Important Points

• The human brain is broadly divided into three main parts: the Forebrain (comprising the Cerebrum and Diencephalon), the Midbrain, and the Hindbrain (comprising the Pons, Cerebellum, and Medulla).

• While the Cerebrum handles high-level cognitive tasks, the Brainstem (Midbrain, Pons, and Medulla) acts as a relay station for sensory and motor signals and manages life-sustaining autonomic functions.

• Damage to the Cerebrum can lead to significant impairments in cognitive function, memory loss, or paralysis, whereas damage to the Medulla is often fatal because it controls the circulatory and respiratory systems.

Q13. Answer: (a) To enhance its corrosion resistance and appearance

The correct answer is To enhance its corrosion resistance and appearance.

Key Points

• Anodising is an electrochemical process that converts the metal surface into a decorative, durable, corrosion-resistant, anodic oxide finish.

• While several non-ferrous metals, such as magnesium and titanium, can be anodized, aluminium is ideally suited to the process due to its specific chemical properties.

• The primary purpose of this process is to enhance corrosion resistance. Aluminium naturally forms a thin layer of oxide upon exposure to air, but anodising creates a much thicker and more robust protective layer that prevents the underlying metal from reacting with the environment. Hence, option 1 is correct.

• Another major objective is to improve the aesthetic appearance of the metal. The structure of the anodic coating is highly porous, which allows for the absorption of dyes and pigments, enabling aluminium to be finished in a wide variety of colors.

• Anodising increases the surface hardness of the aluminium, making it more resistant to wear and tear compared to untreated metal. Hence, statement 2 is incorrect as it makes the surface harder, not softer.

• The process effectively seals the metal, which actually decreases its reactivity with acids and other chemicals by providing a physical barrier. Hence, statement 3 is incorrect.

• Since aluminium oxide is an electrical insulator, an anodized layer does not make the metal a better conductor; in fact, it can act as an insulating barrier. Hence, statement 4 is incorrect.

Additional Information

• The Electrolytic Process: To anodize aluminium, the metal is submerged in an acid electrolyte bath (typically sulphuric acid) and an electric current is passed through the medium. The aluminium part acts as the anode (the positive electrode), which is where the term "anodising" originates.

• Chemical Reaction: Oxygen ions are released from the electrolyte and combine with the aluminium atoms at the surface to form Aluminium Oxide (Al_2O_3). This layer is fully integrated with the underlying aluminium substrate, so it cannot peel or chip like paint.

• Applications: Because of its durability and beauty, anodized aluminium is widely used in architecture (window frames, roofs), aerospace (aircraft components), automotive parts, and consumer electronics like smartphones and laptops.

• Maintenance: Anodized surfaces are easy to maintain; they generally require only periodic cleaning with mild soap and water to preserve their original appearance for decades.

Important Points

• Hard Anodising: This is a variation of the process (also known as Type III) performed at lower temperatures and higher current densities to produce a much thicker and denser oxide layer, specifically for industrial applications requiring extreme abrasion resistance.

• Sealing Process: After the oxide layer is formed and colored, the pores must be sealed to prevent corrosion and staining. This is usually done by immersing the part in hot deionized water or a nickel acetate solution, which converts the oxide into a hydrated form that swells and closes the pores.

• Environmental Impact: Anodising is considered an environmentally stable process. It does not produce heavy metal toxins and the by-products are generally recyclable or easily neutralized in wastewater treatment plants.

• Date and History: The first industrial anodising process was patented in 1923 by Bengough and Stuart to protect seaplane parts

from salt-water corrosion using chromic acid.

Q14. Answer: (c) Sexual reproduction

The correct answer is Sexual reproduction.

Key Points

• Sexual reproduction is a biological process that involves the fusion of specialized reproductive cells called gametes from two different parents, typically a male and a female.

• During this process, the offspring inherit approximately 50% of their DNA or genetic material from each parent, leading to a unique combination of traits.

• The process of Meiosis is fundamental to sexual reproduction, as it reduces the chromosome number by half to produce haploid gametes (sperm and egg), ensuring the chromosome number remains stable across generations.

• A critical feature of this mode of reproduction is genetic variation, which occurs due to crossing over and independent assortment during meiosis, helping populations adapt to changing environments.

• The fusion of these gametes results in a diploid zygote, which eventually develops into an embryo and then a complete organism that displays features from both parents.

Additional Information

• Asexual Reproduction:

• In contrast to sexual reproduction, asexual reproduction involves only a single parent, and the resulting offspring are genetically identical to the parent.

• Since there is no fusion of gametes, there is no inheritance of features from "both" parents, and the offspring are referred to as clones.

• Binary Fission:

• This is a common method of asexual reproduction found in unicellular organisms such as Amoeba, Bacteria, and Paramecium.

• In Binary fission, the parent cell divides into two equal halves, each growing into a new individual, ensuring that the genetic code remains exactly the same as the original cell.

• Budding:

• Budding is a form of asexual reproduction where a small outgrowth or bud develops on the body of the parent organism due to repeated cell division at one specific site.

• Once the bud matures, it detaches from the parent body to become an independent individual; common examples include Hydra and Yeast.

• Cloning:

• Cloning is the process of producing individuals with identical DNA, either naturally (like identical twins) or artificially through biotechnology.

• The most famous historical example of artificial cloning in animals is Dolly the sheep, who was born in July 1996 and was the first mammal cloned from an adult somatic cell.

Important Points

• Heredity and Variation: Sexual reproduction is the primary driver of biodiversity within a species, as it constantly shuffles the genetic deck through recombination.

• Evolutionary Advantage: While asexual reproduction is faster and requires less energy, sexual reproduction provides a survival advantage in unstable environments because genetic diversity increases the likelihood that some individuals will survive disease or climate changes.

• Gametes: In most animals, the male gamete is the sperm (small and motile) and the female gamete is the ovum or egg (large and non-motile), both of which are haploid.

Q15. Answer: (a) They are replaced by other atoms or groups of atoms.

The correct answer is They are replaced by other atoms or groups of atoms.

Key Points

• A substitution reaction is a fundamental type of chemical reaction where one functional group or atom in a chemical compound is replaced by another atom or group of atoms.

• In the case of alkanes, which are saturated hydrocarbons, the carbon atoms are already bonded to the maximum number of hydrogen atoms through single covalent bonds.

• During a substitution reaction involving an alkane, one or more hydrogen atoms are removed and replaced by atoms of another element, most commonly halogens (Chlorine, Bromine, etc.). Hence, statement 1 is correct.

• These reactions do not result in the growth of the carbon chain length through simple addition, which is a characteristic of addition reactions found in unsaturated hydrocarbons like alkenes. Hence, statement 2 is incorrect.

• The hydrogen atoms are not simply removed to form double bonds; the formation of double bonds from alkanes is typically

classified as a dehydrogenation or elimination reaction, which usually requires high temperatures or specific catalysts. Hence, statement 3 is incorrect.

• While alkanes do react with oxygen to form water and carbon dioxide, this process is known as combustion (an oxidation reaction), not a substitution reaction. Hence, statement 4 is incorrect.

Additional Information

• Nature of Alkanes: Alkanes are often called paraffins (Latin: parum affinis = little affinity) because they are relatively unreactive under normal conditions due to the stability of C-C and C-H sigma bonds.

• Halogenation of Alkanes: This is the most common substitution reaction for alkanes. It typically occurs in the presence of ultraviolet (UV) light or diffused sunlight, which provides the energy needed to break the bonds of the halogen molecules.

• Reaction Mechanism: The substitution reaction in alkanes follows a free-radical mechanism. This process involves three distinct steps: initiation (creation of radicals), propagation (reaction of radicals with alkanes), and termination (radicals combining to form stable molecules).

• Example: When Methane (CH_4) reacts with Chlorine (Cl_2) in sunlight, a hydrogen atom is replaced by a chlorine atom to form Chloromethane (CH_3Cl) and Hydrogen Chloride (HCl). If chlorine is in excess, the reaction can continue until all four hydrogen atoms are replaced, resulting in Carbon Tetrachloride (CCl_4).

Important Points

• Reactivity Order: The reactivity of halogens toward alkanes in substitution reactions follows the order: Fluorine > Chlorine > Bromine > Iodine. Fluorination is often too explosive to control, while iodination is very slow and reversible.

• Homologous Series: Alkanes form a homologous series with the general formula C_nH_{2n+2}. As the molecular mass increases in the series, the boiling point and melting point also increase due to stronger Van der Waals forces.

• Industrial Use: Substitution reactions are vital in the chemical industry for producing alkyl halides, which serve as precursors for manufacturing polymers, refrigerants, and pharmaceuticals.

Q16. Answer: (c) sharing of electrons

The correct answer is sharing of electrons.

Key Points

• Covalent bonds are a type of chemical link that involves the sharing of electron pairs between atoms. These electron pairs are also known as bonding pairs or shared pairs.

• The stable balance of attractive and repulsive forces between atoms, when they share electrons, is known as covalent bonding. This allows each atom involved to reach the equivalent of a full outer shell, corresponding to a stable electronic configuration.

• This type of bonding primarily occurs between non-metal atoms. Since non-metals typically have high electronegativity, they prefer to share electrons rather than lose them entirely to another atom.

• The formation of these bonds is driven by the Octet Rule, which states that atoms are most stable when they have eight electrons in their valence shell, similar to the electron configuration of noble gases.

• Depending on the number of shared pairs, covalent bonds can be classified as single bonds (sharing one pair), double bonds (sharing two pairs), or triple bonds (sharing three pairs).

Additional Information

• Ionic Bonding: Unlike covalent bonding, this involves the complete transfer of electrons from one atom to another, usually from a metal to a non-metal. This results in the formation of oppositely charged ions (cations and anions) that attract each other.

• Polar Covalent Bonds: When electrons are shared unequally between two atoms due to differences in electronegativity, the bond is polar. A common example is the water molecule (H_2O), where oxygen attracts electrons more strongly than hydrogen.

• Non-polar Covalent Bonds: These are formed when electrons are shared equally between atoms, typically occurring between two atoms of the same element, such as in Oxygen (O_2), Nitrogen (N_2), or Hydrogen (H_2).

• Properties: Covalent compounds generally exhibit lower melting and boiling points compared to ionic compounds. They are typically poor conductors of electricity because they do not contain free-moving ions or electrons in their molecular form.

• Coordinate Covalent Bond: This is a special subtype where both electrons in the shared pair originate from the same atom. It is also frequently referred to as a dative bond.

Important Points

• Lewis Structures: Proposed by Gilbert N. Lewis in 1916, these diagrams represent the valence electrons of atoms within a molecule and help visualize how sharing occurs.

• Bond Strength and Length: There is an inverse relationship between bond length and strength. Triple bonds are the shortest and strongest, followed by double bonds, while single bonds are the longest and weakest among covalent types.

• VSEPR Theory: The Valence Shell Electron Pair Repulsion theory is used to predict the three-dimensional geometry of molecules based on the repulsion between shared and unshared electron pairs around a central atom.

• Electronegativity Difference: If the difference in electronegativity between two atoms is less than 1.7, the bond is generally considered covalent; if it is greater than 1.7, the bond is typically ionic.

Q17. Answer: (c) HCl only releases H^+ ions when dissolved in water.

The correct answer is HCl only releases H+ ions when dissolved in water.

Key Points

• Acids are defined by their ability to produce Hydrogen ions (H+) when dissolved in a solvent like water. In the case of Hydrogen Chloride (HCl), the dry gas consists of covalent molecules that do not contain free ions.

• When dry HCl gas is passed over dry litmus paper, there is no water present to facilitate the ionization process. Consequently, no H+ ions are released, and the litmus paper does not change its color.

• In an aqueous solution, HCl molecules react with water (H2O) to form Hydronium ions (H3O+) and Chloride ions (Cl-). This process is known as dissociation. Hence, statement 3 is the correct explanation.

• The acidic properties of a substance are solely manifested through these H+ ions. Litmus paper, which is a plant-based indicator, requires the presence of these ions to undergo a chemical change from blue to red.

• Water reacts with litmus, not HCl: This is incorrect because water alone is neutral (pH 7) and does not change the color of litmus paper; it is the HCl that provides the acidic nature once dissolved. Hence, statement 1 is incorrect.

• Litmus paper only works in the presence of light: The reaction of litmus is a chemical acid-base reaction, not a photochemical one, meaning it does not depend on light. Hence, statement 2 is incorrect.

• Dry HCl gas is non-acidic: While dry HCl does not show acidic behavior, it is technically still an acidic gas by chemical nature (it is a proton donor). The lack of moisture simply prevents the manifestation of its acidity. Hence, statement 4 is partially misleading and not the best scientific explanation.

Additional Information

• The Arrhenius Theory: This scientific theory proposed by Svante Arrhenius in 1884 states that acids are substances that dissociate in aqueous solutions to yield hydrogen ions.

• Litmus: It is a natural indicator extracted from Lichens (specifically species like Roccella tinctoria). It turns red in acidic conditions (pH below 4.5) and blue in alkaline conditions (pH above 8.3).

• Hydrogen Chloride (HCl): It is a colorless gas at room temperature. When dissolved in water, it forms Hydrochloric Acid, which is a strong mineral acid widely used in industries for pickling steel and regulating pH.

• Polarity of Water: Water is a polar solvent. The electrostatic attraction between the partial charges of water molecules and the HCl molecules is what pulls the H and Cl apart, allowing ionization to occur.

Important Points

• Hydronium Ion: It is important to note that H+ ions do not exist alone in water. They quickly combine with water molecules to form Hydronium ions (H3O+). The equation is represented as: HCl + H2O → H3O+ + Cl-.

• Moisture Requirement: If you use moist litmus paper with dry HCl gas, the gas will dissolve in the water present on the paper, forming ions and causing the color to change to red immediately.

• Safety: HCl gas is highly corrosive and toxic. It can react with the moisture in the human respiratory system to form acid, which can cause severe irritation or burns.

Q18. Answer: (b) Reduce, Reuse, and Recycle

The correct answer is Reduce, Reuse, and Recycle.

Key Points

• The principle of Reduce, Reuse, and Recycle, often referred to as the 3Rs, is the foundation of environmental conservation and sustainable living. It aims to minimize waste and the depletion of natural resources. Hence, statement 2 is correct.

• The "Use and discard" approach is a linear consumption model that leads to massive waste generation and environmental degradation. It encourages the "throwaway culture" which fills up landfills rapidly. Hence, statement 1 is incorrect.

• The mantra of "Produce more and consume more" is linked to over-exploitation of resources. This principle prioritizes industrial growth over ecological balance, leading to a higher carbon footprint and habitat loss. Hence, statement 3 is incorrect.

• The idea to "Extract as much as possible" promotes the exhaustive removal of minerals, forest products, and water without considering the regeneration rate of the Earth. This leads to ecosystem collapse. Hence, statement 4 is incorrect.

• Implementing the 3Rs helps in energy conservation because manufacturing products from recycled materials typically requires significantly less energy than producing them from raw materials.

Additional Information

• Reduce:

• This is the most effective way to help the environment. It involves buying fewer products and using them for a longer duration.

• Examples include reducing the use of single-use plastics, opting for minimal packaging, and decreasing water and electricity consumption at home.

• Reuse:

• Instead of throwing items away, finding new ways to use them extends their life cycle.

• Common practices include using refillable glass bottles, donating old clothes, and repurposing containers for storage. This

prevents the need for new resource extraction.

• Recycle:

• This involves the processing of waste materials into new products. In India, the Solid Waste Management Rules (2016) mandate the segregation of waste at the source to facilitate effective recycling.

• Materials like paper, glass, aluminum, and certain plastics can be recycled to save raw materials and reduce pollution.

• Circular Economy:

• The 3Rs are central to the concept of a Circular Economy, where waste is "designed out" of the system. This model is being adopted globally to achieve United Nations Sustainable Development Goals (SDGs), specifically SDG 12 (Responsible Consumption and Production).

Important Points

• Impact on Climate Change: By practicing Reduce, Reuse, and Recycle, we can lower greenhouse gas emissions. For instance, recycling aluminum saves about 95% of the energy required to make the same amount of aluminum from its virgin source, bauxite ore.

• Resource Management: The Earth's resources are finite. Principles of sustainability help in maintaining biodiversity and ensuring that future generations have access to necessary resources.

• Economic Benefits: Sustainable living is not just good for nature but also for the economy. It creates jobs in the recycling and upcycling industries and reduces the cost of waste management for municipalities.

Q19. Answer: (a) It covers and protects organs and cavities of the body.

The correct answer is It covers and protects organs and cavities of the body.

Key Points

• Epithelial tissue is the simplest tissue in the animal body and serves as a primary protective layer.

• Its main function is to cover the external surface of the body and line the internal organs and body cavities. Hence, statement 1 is correct.

• It acts as a barrier to keep different body systems separate, ensuring that the internal environment of various organs remains distinct.

• The cells of epithelial tissue are tightly packed and form a continuous sheet. They have almost no intercellular spaces between them, which enhances their protective capability.

• Anything entering or leaving the body must cross at least one layer of the epithelium. Because of this, the permeability of the cells of various epithelia plays a critical role in regulating the exchange of materials between the body and the external environment.

• Common examples of locations where epithelial tissue is found include the skin, the lining of the mouth, the lining of blood vessels, lung alveoli, and kidney tubules.

Additional Information

• Types of Epithelial Tissue:

• Simple Squamous Epithelium: These cells are extremely thin and flat, forming a delicate lining. They are found in sites where transport of substances occurs through a selectively permeable surface, such as the oesophagus and the lining of the mouth.

• Stratified Squamous Epithelium: Found in the skin, these cells are arranged in many layers to prevent wear and tear.

• Ciliated Columnar Epithelium: Found in the respiratory tract, these cells have hair-like projections called cilia that move to clear mucus forward.

• Cuboidal Epithelium: These cube-shaped cells provide mechanical support and are found in kidney tubules and the ducts of salivary glands. Hence, statement 2 is incorrect as mechanical support is a secondary function specific to cuboidal types, not the primary general function of all epithelial tissues.

• Glandular Epithelium: Sometimes a portion of epithelial tissue folds inward to form a multicellular gland for secretion.

• Other Animal Tissues:

• Connective Tissue: This tissue connects different organs and provides structural support. For example, tendons connect muscles to bones, and ligaments connect bones to bones. Hence, statement 3 is incorrect.

• Fluid Connective Tissue: Blood is a type of connective tissue that has a fluid matrix called plasma. It is responsible for transporting gases, digested food, hormones, and waste materials to different parts of the body. Hence, statement 4 is incorrect.

• Muscular Tissue: Responsible for movement in our body, consisting of elongated cells called muscle fibres.

• Nervous Tissue: Specialized for being stimulated and then transmitting the stimulus very rapidly from one place to another within the body.

Important Points

• All epithelium is usually separated from the underlying tissue by an extracellular fibrous basement membrane.

• The skin, which protects the body, is also made of squamous epithelium arranged in patterns of layers.

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• In the intestine, where absorption and secretion occur, tall epithelial cells called columnar epithelium are present to facilitate movement across the epithelial barrier.

• The study of tissues is known as Histology.

Q20. Answer: (a) 1 kWh

The correct answer is 1 kWh.

Key Points

• The electrical energy consumed by an appliance can be calculated using the formula: Energy = Power x Time.

• In this problem, the power (P) of the electric heater is given as 1000 W and the time (t) is given as 1 hour.

• Multiplying these values, we get: 1000 Watts x 1 hour = 1000 Watt-hours (Wh).

• By definition, 1000 Watt-hours is equal to 1 kilowatt-hour (1 kWh), which is the standard unit for measuring energy consumption. Hence, the correct answer is 1 kWh.

• If we were to convert this into the SI unit of energy (Joules), 1 kWh would be equal to 1000 Watts x 3600 seconds, which results in 3,600,000 Joules.

Additional Information

• Kilowatt-hour (kWh):

• The kilowatt-hour is the commercial unit of electrical energy used by electricity boards to calculate bills.

• One unit of electricity consumed in a household refers to 1 kWh of energy used.

• It represents the amount of energy dissipated by a 1000-watt appliance working continuously for one hour.

• Power and its Units:

• Power is defined as the rate at which work is done or energy is consumed.

• The SI unit of power is the Watt (W), named after James Watt. 1 Watt is equivalent to 1 Joule per second (1 J/s).

• For high-power devices like heaters, motors, and engines, power is often measured in kilowatts (kW) or Horsepower (hp), where 1 hp is approximately 746 Watts.

• Joule (J):

• The Joule is the SI unit of energy. It is a very small unit compared to the kilowatt-hour.

• To convert kWh to Joules, you multiply by 3.6 million (3,600,000) because there are 3600 seconds in an hour and 1000 Watts in a kilowatt.

• Practical Examples:

• An LED bulb rated at 10 W would take 100 hours to consume 1 kWh of energy.

• In contrast, a heavy-duty air conditioner rated at 2000 W (2 kW) would consume 1 kWh in just 30 minutes.

• Understanding these ratings helps in managing household energy efficiency and reducing electricity costs.

Q21. Answer: (c) +3/4

The correct answer is +3/4.

Key Points

• Magnification (m) produced by a spherical mirror is the ratio of the height of the image to the height of the object, which is also related to the object distance (u) and image distance (v).

• According to the New Cartesian Sign Convention, the object distance (u) is always taken as negative because the object is placed in front of the mirror. In this case, u = -40 cm.

• For a convex mirror, the image is always virtual, erect, and formed behind the mirror. Therefore, the image distance (v) is taken as positive. In this case, v = +30 cm.

• The formula for magnification (m) for a mirror is given by m = -v / u. Substituting the given values into the formula: m = -(30) / (-40).

• The negative signs in the denominator and the numerator (from the formula) cancel out, resulting in m = 30 / 40, which simplifies to +3/4 or +0.75. Hence, the calculated magnification is +3/4.

• The positive sign in the magnification value indicates that the image formed is virtual and erect, which is a characteristic property of all images formed by a convex mirror.

Additional Information

• Convex Mirror Properties:

• A convex mirror is also known as a diverging mirror because it diverges light rays that strike its reflective surface.

• The focal length (f) and the radius of curvature (R) of a convex mirror are always considered positive.

• Regardless of the position of the object, a convex mirror always forms a diminished, virtual, and erect image between the pole and the focus.

• Uses of Convex Mirrors:

• They are widely used as rear-view mirrors in vehicles because they provide a wider field of view and always form an erect image.

• Used in security mirrors in shops and hallways to see around corners and monitor large areas.

• Sign Convention Rules:

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

• Distances measured against the direction of incident light are negative.

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

Important Points

• Magnitude of Magnification:

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

• If |m| < 1, the image is diminished (smaller than the object). In this problem, 0.75 < 1, confirming the image is diminished.

• If |m| = 1, the image is the same size as the object, which typically happens with a plane mirror or when an object is at the Center of Curvature of a concave mirror.

• Nature of Image from Sign:

• A positive sign (+) for magnification indicates a virtual and erect image.

• A negative sign (-) for magnification indicates a real and inverted image.

• Since a convex mirror cannot form a real image of a real object, the magnification will always be positive and less than 1.

Q22. Answer: (b) Both (ii) and (iii)

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

Key Points

• Loudness and Amplitude: The loudness of a sound is determined by the amplitude of the sound wave. A sound wave with a larger amplitude results in a louder sound, whereas a wave with a smaller amplitude produces a soft or feeble sound. Because a loud sound requires a greater displacement of particles, it possesses a higher amplitude than a soft sound. Hence, statement (i) is incorrect.

• Energy in Sound Waves: Sound is a form of mechanical energy that propagates through a medium. The energy carried by a sound wave is directly proportional to the square of its amplitude. Since loud sounds have larger amplitudes, they carry significantly more energy compared to soft sounds. Hence, statement (ii) is correct.

• Response of the Ear: Loudness is a physiological sensation rather than just a physical measurement. It is the measure of the response of the human ear to the intensity of sound. Even if two sounds have the same physical intensity, our ears might perceive one as louder than the other if it falls within a frequency range where the ear is more sensitive. Hence, statement (iii) is correct.

• Decibel Scale: The level of loudness is expressed in a unit called the decibel (dB). On this scale, a sound of 80 dB or above is physically painful to the human ear, while normal conversation typically occurs at around 60 dB.

• Proportionality: The loudness of sound is proportional to the square of the amplitude of the vibration producing the sound. For example, if the amplitude becomes twice as large, the loudness increases by a factor of four.

Additional Information

• Intensity vs. Loudness: While often used interchangeably, they are different. Intensity is an objective physical quantity representing the sound energy passing per unit area per unit time (measured in Watts per square meter). Loudness is a subjective sensation that depends on the sensitivity of the listener's ear.

• Pitch and Frequency: The pitch of a sound depends on its frequency. A high-frequency sound (like a whistle) has a high pitch, while a low-frequency sound (like a drum) has a low pitch. Loudness and pitch are independent characteristics of sound.

• Quality or Timbre: This is the characteristic of sound that enables us to distinguish between two sounds of the same loudness and pitch produced by different sources, such as a violin and a flute.

• Human Auditory Range: The human ear can typically hear sounds in the frequency range of 20 Hz to 20,000 Hz. Sounds below this are infrasonic, and sounds above this are ultrasonic.

Important Points

• Factors Affecting Loudness:

• Surface Area: A larger vibrating surface area (like a large bell) produces a louder sound than a smaller one.

• Distance from Source: As the distance between the listener and the source increases, the loudness decreases because the sound energy spreads out over a larger spherical area.

• Density of Medium: Loudness also depends on the density of the medium through which the sound travels; denser media generally transmit sound energy more efficiently.

• Threshold of Hearing: The quietest sound a healthy human ear can detect is assigned a value of 0 dB. This corresponds to an intensity of 10 to the power of minus 12 Watts per square meter.

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• Noise Pollution: Persistent exposure to sounds above 85 to 90 dB can lead to permanent hearing loss and other health issues like hypertension and stress.

Q23. Answer: (d) A zigzag line with an arrow which is drawn across it.

The correct answer is A zigzag line with an arrow which is drawn across it.

Key Points

• A rheostat is an electrical instrument used to control current by varying the resistance in a circuit without changing the voltage source.

• The standard circuit symbol for a rheostat is a zigzag line (which represents resistance) with a diagonal arrow drawn across it or an arrow pointing down onto the zigzag. Hence, option 4 is correct.

• It functions as a variable resistor and is typically constructed using a resistive wire (like manganin or constantan) wrapped around an insulating ceramic core, with a sliding contact.

• By moving the slider (the arrow in the symbol), the effective length of the wire through which the current passes changes, thereby altering the total resistance of the circuit according to the formula R = ρ(L/A).

• In Ohm's Law experiments, a rheostat is frequently used to adjust the current flowing through a conductor to observe the corresponding change in potential difference.

Additional Information

• Ammeter:

• Represented by an 'A' inside a circle.

• It is a device used to measure the electric current in a circuit in Amperes.

• It has low resistance and is always connected in series with the circuit component. Hence, statement 1 is incorrect.

• Voltmeter:

• Represented by a circle with a 'V' inside it.

• It is used to measure the potential difference (voltage) between two points in an electrical circuit.

• It has high resistance and is always connected in parallel across the points where the voltage is to be measured. Hence, statement 2 is incorrect.

• Fixed Resistor:

• Represented by a simple zigzag line.

• It provides a specific, unchanging amount of electrical resistance to the flow of current.

• The unit of measurement for resistance is the Ohm (Ω). Hence, statement 3 is incorrect.

• Galvanometer:

• Represented by a 'G' inside a circle.

• It is an electromechanical instrument used for detecting and indicating the presence and direction of small electric currents.

Important Points

• Potentiometer vs. Rheostat: While both are variable resistors, a potentiometer is typically used as a voltage divider using three terminals, whereas a rheostat is used to control current using only two terminals.

• Applications: Rheostats are used in motor speed control, light dimmers, and older volume control knobs in radio sets.

• Ohm’s Law: The relationship V = IR dictates that if voltage (V) is constant, increasing the resistance (R) using a rheostat will decrease the current (I).

• Safety: When using a rheostat in laboratory experiments, it is vital to ensure it can handle the wattage or heat generated by the current to prevent damage to the component.

Q24. Answer: (a) The constituents can be separated fairly easily by physical methods.

The correct answer is The constituents can be separated fairly easily by physical methods..

Key Points

• A compound is a substance composed of two or more different elements that are chemically bonded together in a fixed proportion by mass.

• The constituents of a compound cannot be separated by physical methods such as filtration, evaporation, or distillation. They can only be separated into their constituent elements by chemical or electrochemical reactions. Hence, statement 1 is incorrect (and thus the correct answer).

• In a compound, the composition of the elements is always fixed. For example, in Water (H2O), the ratio of the mass of hydrogen to the mass of oxygen is always 1:8, regardless of the source. Hence, statement 2 is correct.

• A compound possesses totally different properties from its constituent elements. For instance, Sodium (Na) is a highly reactive metal and Chlorine (Cl) is a poisonous gas, but their compound, Sodium Chloride (NaCl), is a harmless table salt used in food. Hence, statement 3 is correct.

• Compounds are formed only when elements react chemically with each other. During this process, chemical bonds are formed or broken, leading to the creation of a new substance. Hence, statement 4 is correct.

Additional Information

• Chemical Substances:

• Elements: Pure substances consisting of only one type of atom (e.g., Gold, Oxygen).

• Compounds: Substances formed by the chemical combination of two or more elements (e.g., Carbon Dioxide, Glucose).

• Mixtures vs. Compounds:

• In a mixture, substances are physically blended but not chemically combined. They retain their individual properties and can be separated by physical methods like magnetization or sieving.

• In a compound, the identity of the individual elements is lost, and a new chemical identity is formed.

• Homogeneity: Compounds are always homogeneous, meaning they have a uniform composition and properties throughout the sample.

• Energy Changes: The formation of a compound is usually accompanied by a significant energy change, typically in the form of heat or light being absorbed or released.

Important Points

• Law of Definite Proportions: This law, also known as Proust's Law, states that a chemical compound always contains exactly the same proportion of elements by mass.

• Electrolysis: This is a common electrochemical method used to separate compounds. For example, electrolysis of water produces Hydrogen and Oxygen gases.

• Melting and Boiling Points: Compounds have sharp and fixed melting and boiling points, which is a characteristic feature that distinguishes them from mixtures.

• Representation: Every compound is represented by a chemical formula (like H_2SO_4 for Sulphuric Acid), which indicates the fixed number of atoms of each element present in one molecule of that compound.

Q25. Answer: (c) Both (ii) and (iii)

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

Key Points

• Work Done Definition: In physics, work is said to be done when a force acts upon an object to cause a displacement. It is mathematically expressed as $W = Fs\cos\theta$, where F is the force, s is the displacement, and θ is the angle between the force and displacement vectors.

• Analysis of Statement (i): The work done by a force can be zero under three conditions: if the force applied is zero, if the displacement is zero, or if the force acts perpendicularly (at an angle of 90 degrees) to the direction of motion (since $\cos 90 = 0$). Examples include a person standing still with a heavy load or a satellite moving in a circular orbit where the gravitational force is perpendicular to the velocity. Hence, statement (i) is incorrect.

• Analysis of Statement (ii): If the force and the displacement are in the same direction, the angle θ is 0 degrees. Because the value of cos 0 is 1, the work done is positive. This is common when pushing an object across a floor in the direction of the push. Hence, statement (ii) is correct.

• Analysis of Statement (iii): The Standard International (S.I.) unit of work is the Joule (J). One Joule is defined as the amount of work done when a force of 1 Newton displaces an object by 1 meter in the direction of the force. Hence, statement (iii) is correct.

• Hence, the correct answer is Both (ii) and (iii).

Additional Information

• Nature of Work:

• Work is a scalar quantity, meaning it has only magnitude and no direction, even though it is the dot product of two vector quantities (force and displacement).

• Negative Work: Work is considered negative when the force acts in the opposite direction of displacement (angle $\theta = 180$ degrees). A primary example is the force of friction acting against a moving object.

• Units and Conversions:

• In the CGS system, the unit of work is the erg.

• The relationship between the Joule and the Erg is 1 Joule = 10^7 ergs.

• The dimensional formula for work is $[M^1 L^2 T^{-2}]$, which is identical to the dimensional formula for energy and torque.

• Types of Work in Different Contexts:

• Mechanical Work: Moving an object against a force.

• Thermodynamic Work: Often represented as $P\Delta V$ (pressure times change in volume) in gases.

• Electrical Work: Done when a charge is moved through a potential difference.

Important Points

• Work-Energy Theorem: This theorem states that the net work done on an object is equal to the change in its kinetic energy. If the work done is positive, the kinetic energy increases; if negative, the kinetic energy decreases.

• Zero Work Examples:

• A coolie carrying a luggage on his head and walking on a horizontal platform does zero work against gravity because the force (upward) is perpendicular to the displacement (horizontal).

• The centripetal force acting on a body in uniform circular motion does no work because it is always directed towards the center, perpendicular to the instantaneous displacement.

• Constant vs. Variable Force: While the question specifies a constant force, it is important to note that if the force varies with position, the work done is calculated as the integral of force over the displacement (the area under a Force-Displacement graph).

Q26. Answer: (a) Decreases by 68.63%

Shortcut Trick

Use the multiplying factor method for successive changes.

Net Factor = (1 − 0.35) × (1 − 0.55) × (1 − 0.35) × (1 + 0.65)

Net Factor = 0.65 × 0.45 × 0.65 × 1.65 ≈ 0.3137

Percentage change = (0.3137 − 1) × 100 = −68.63%

Therefore The correct answer is Decreases by 68.63%.

Alternate Method

Given: Successive changes of −35%, −55%, −35% and +65%.

Formula: Final Price = Initial Price × (100 ± r1)/100 × (100 ± r2)/100 ...

=> Let the original price be 100 units.

=> Price after 1st month = 100 × (65/100) = 65

=> Price after 2nd month = 65 × (45/100) = 29.25

=> Price after 3rd month = 29.25 × (65/100) = 19.0125

=> Price after 4th month = 19.0125 × (165/100) = 31.370625

=> Net change = 31.370625 − 100 = −68.629375

=> Percentage decrease ≈ 68.63%

Therefore The correct answer is Decreases by 68.63%.

Additional Information

Successive Percentage Formula

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

Percentage Increase/Decrease

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

Multiplying Factor (MF)

For an x% increase, MF = (1 + x/100). For an x% decrease, MF = (1 − x/100).

Q27. Answer: (a) 31 : 43

Shortcut Trick

Larger number = (Sum + Difference) ÷ 2 = (74 + 12) ÷ 2 = 43

Smaller number = (Sum − Difference) ÷ 2 = (74 − 12) ÷ 2 = 31

Required Ratio (Smaller : Larger) = 31 : 43

Therefore The correct answer is 31 : 43.

Alternate Method

Given: Sum of numbers = 74, Difference = 12

Formula: If x + y = S and x − y = D, then x = (S+D)/2 and y = (S−D)/2

=> Let the numbers be x (larger) and y (smaller).

=> x + y = 74

=> x − y = 12

=> Adding both equations: 2x = 86 => x = 43

=> Subtracting both equations: 2y = 62 => y = 31

=> Ratio y : x = 31 : 43

Therefore The correct answer is 31 : 43.

Additional Information

Linear Equations in Two Variables

When the sum (S) and difference (D) are known, the values are (S+D)/2 and (S−D)/2.

Ratio and Proportion

A ratio compares two quantities by division; always ensure the order (smaller to larger) matches the question.

Q28. Answer: (c) 8√210 cm2

Shortcut Trick

For a cyclic quadrilateral with sides a, b, c, and d, the area is given by Brahmagupta's Formula:

Area = √((s − a)(s − b)(s − c)(s − d))

where s is the semi-perimeter: s = (a + b + c + d) ÷ 2

Given: a = 10 cm, b = 14 cm, c = 8 cm, d = 12 cm

=> s = (10 + 14 + 8 + 12) ÷ 2 = 22 cm

=> Area = √((22 − 10)(22 − 14)(22 − 8)(22 − 12)) = √(12 × 8 × 14 × 10) = √(13440) = 8√210 cm²

Therefore The correct answer is 8√210 cm².

Alternate Method

Given:

Sides of the cyclic quadrilateral ABCD:

=> AB = a = 10 cm

=> BC = b = 14 cm

=> CD = c = 8 cm

=> DA = d = 12 cm

Formula Used:

Area of a cyclic quadrilateral = √((s − a)(s − b)(s − c)(s − d))

where s = (a + b + c + d) ÷ 2

Calculations:

Step 1: Find the semi-perimeter (s) of the cyclic quadrilateral:

=> s = (10 + 14 + 8 + 12) ÷ 2

=> s = 44 ÷ 2

=> s = 22 cm

Step 2: Substitute the values of s, a, b, c, and d into Brahmagupta's formula:

=> Area = √((22 − 10) × (22 − 14) × (22 − 8) × (22 − 12))

=> Area = √(12 × 8 × 14 × 10)

=> Area = √(96 × 140)

=> Area = √(13440)

Step 3: Simplify the square root:

=> Area = √(64 × 210)

=> Area = 8√210 cm²

Verification of Options:

=> Option (1): 8√222 cm² = √(64 × 222) = √(14208) ≠ √(13440) (Incorrect)

=> Option (2): 10√210 cm² = √(100 × 210) = √(21000) ≠ √(13440) (Incorrect)

=> Option (3): 8√210 cm² = √(64 × 210) = √(13440) (Correct)

=> Option (4): 10√222 cm² = √(100 × 222) = √(22200) ≠ √(13440) (Incorrect)

Therefore The correct answer is 8√210 cm².

Additional Information

Brahmagupta's Formula

This formula is a generalization of Heron's formula for the area of a triangle and is specifically used to find the area of any cyclic quadrilateral given only its side lengths.

Ptolemy's Theorem

For any cyclic quadrilateral ABCD, the product of the diagonals is equal to the sum of the products of the opposite sides: AC × BD = AB × CD + BC × DA.

Opposite Angles Property

In a cyclic quadrilateral, the sum of opposite angles is always supplementary, i.e., angle A + angle C = 180° and angle B + angle

D = 180°.

Q29. Answer: (c) 14.46%

Shortcut Trick

For two successive discounts of a% and b%, the equivalent single discount is given by the formula: (a + b − ab ÷ 100)%.

Here, a = 9% and b = 6%.

Equivalent discount = (9 + 6 − (9 × 6) ÷ 100)%.

Equivalent discount = (15 − 54 ÷ 100)% = (15 − 0.54)% = 14.46%.

Therefore The correct answer is 14.46%.

Alternate Method

Given → First discount (d1) = 9%, Second discount (d2) = 6%.

Formulas: Single Equivalent Discount = 100 − [100 × (100 − d1)/100 × (100 − d2)/100]

=> Let the Marked Price (MP) be 100.

=> Price after 9% discount = 100 − 9 = 91.

=> Price after 6% discount on 91 = 91 − (6% of 91) = 91 − 5.46 = 85.54.

=> Total discount = 100 − 85.54 = 14.46.

=> Single equivalent discount % = (14.46 ÷ 100) × 100 = 14.46%.

Therefore The correct answer is 14.46%.

Additional Information

Successive Discounts

When a series of discounts are allowed one after another, they are called successive discounts. The net discount is always less than the sum of individual discount rates.

Effective Discount for 3 values

For three successive discounts a%, b%, and c%, first calculate the equivalent of a and b, then use that result with c.

Q30. Answer: (b) 5

Shortcut Trick

Combined efficiency (P+Q) = 1/15, P efficiency = 1/60.

Efficiency of Q = (1/15) − (1/60) = (4 − 1)/60 = 3/60 = 1/20.

Time for Q to fill 1/4th of cistern = (1/4) ÷ (1/20) = 20 ÷ 4 = 5 hours.

Therefore The correct answer is 5 hours.

Alternate Method

Person	Days/Hours	Total Work	Efficiency
P + Q	15	60 units	60 ÷ 15 = 4
P	60	60 ÷ 60 = 1	

=> Total capacity of cistern = LCM of 15 and 60 = 60 units.

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

=> Efficiency of Q = 4 − 1 = 3 units/hour.

=> One-fourth of cistern capacity = 60 × (1/4) = 15 units.

=> Time taken by Q = Work ÷ Efficiency = 15 ÷ 3 = 5 hours.

Therefore The correct answer is 5 hours.

Additional Information

Combined Efficiency Rule

If two pipes fill a tank in T1 and T2 hours respectively, their combined work rate is 1/T1 + 1/T2.

Pipes and Cisterns Logic

Inlet pipes have positive efficiency, while outlet (leakage) pipes have negative efficiency. Total Work = Time × Efficiency.

Q31. Answer: (c) Rs. 8,427

Shortcut Trick

For Compound Interest at 6% for 2 years, the Effective Interest Rate = x + y + (xy/100)

Effective Rate = 6 + 6 + (6 × 6)/100 = 12.36%

Total Amount = 100% (Principal) + 12.36% (Interest) = 112.36% of Principal

Amount = 7500 × 112.36/100 = 75 × 112.36 = Rs. 8,427

Therefore The correct answer is Rs. 8,427.

Alternate Method

Given: Principal (P) = Rs. 7,500, Rate (R) = 6% per annum, Time (n) = 2 years.

Formula Used: Amount (A) = $P(1 + R/100)^n$

=> $A = 7500 \times (1 + 6/100)^2$

=> $A = 7500 \times (106/100) \times (106/100)$

=> $A = 7500 \times (1.06) \times (1.06)$

=> $A = 7500 \times 1.1236$

=> A = Rs. 8,427

Therefore The correct answer is Rs. 8,427.

Additional Information

CI vs SI Difference

The difference between Compound Interest and Simple Interest for 2 years is given by the formula: $D = P(R/100)^2$.

Half-Yearly Compounding

When interest is compounded half-yearly, the rate becomes R/2% and the time period becomes 2n.

Effective Rate for 3 Years

The effective rate for 3 years can be calculated by applying the successive formula [x + y + (xy/100)] twice or using $3R.3R^2R^3$ shortcut.

Q32. Answer: (a) Gain Rs. 180

Shortcut Trick

Total Cost Price (CP) of 24 kg = 3,600 => CP per kg = 3,600 ÷ 24 = 150.

First 12 kg (half) gain: 12 × 150 × 20% = +360.

Remaining 12 kg (half) loss: 12 × 150 × 10% = −180.

Net Profit/Loss = 360 − 180 = 180 (Positive value indicates Gain).

Therefore The correct answer is Gain Rs. 180.

Alternate Method

Given → Total CP = 3,600 | 1st half gain = 20% | 2nd half loss = 10%.

Formulas: Profit = SP − CP | Profit% = (Profit ÷ CP) × 100 | SP = CP × (100 + P%) ÷ 100.

=> Total Cost Price = 3,600. CP of 12 kg = 1,800.

=> SP of first 12 kg = 1,800 × (120/100) = 2,160.

=> SP of remaining 12 kg = 1,800 × (90/100) = 1,620.

=> Total Selling Price = 2,160 + 1,620 = 3,780.

=> Net Gain = Total SP − Total CP = 3,780 − 3,600 = 180.

Therefore The correct answer is Gain Rs. 180.

Additional Information

Net Gain/Loss on Equal Parts

When two equal parts are sold at x% gain and y% loss, the net percentage change is (x − y) ÷ 2.

Selling Price Calculation

SP = CP × (100 ± Change%) ÷ 100. This is the basic multiplier for profit or loss adjustments.

Q33. Answer: (c) 24,075

Shortcut Trick

Let the total votes be 100%.

Dinesh got 46.5%, so Rizwan got 100% − 46.5% = 53.5%.

Difference in percentage = 53.5% − 46.5% = 7%.

Given 7% ≡ 3150 votes.

Rizwan's votes (53.5%) = (3150 ÷ 7) × 53.5 = 450 × 53.5 = 24075.

Therefore The correct answer is 24,075 votes.

Alternate Method

Given: Votes for Dinesh = 46.5% | Margin = 3150 votes | All votes are valid.
=> Total Votes = 100%
=> Votes obtained by Rizwan = 100% − 46.5% = 53.5%
=> Difference between Rizwan and Dinesh = 53.5% − 46.5% = 7%
=> According to the question, 7% of Total Votes = 3150
=> 1% of Total Votes = 3150 ÷ 7 = 450
=> Rizwan's share = 53.5 × 450
=> Rizwan's share = 24075
Therefore The correct answer is 24,075 votes.
Additional Information
Percentage Change
Percentage change is calculated as (Difference ÷ Original Value) × 100.
Valid and Invalid Votes
Total Cast Votes = Valid Votes + Invalid Votes. Winners and losers are usually calculated based on Valid Votes.
Winning Margin
Margin = Votes of Winner − Votes of Loser. It represents the number of votes by which the winner defeated the opponent.

Q34. Answer: (a) 30

Shortcut Trick
For third proportional to a and b, the formula is $c = b^2/a$.
Given: a = 50, b = Z, and c = 18.
=> $18 = Z^2 \div 50$
=> $Z^2 = 18 \times 50 = 900$
=> $Z = \sqrt{900} = 30$
Therefore The correct answer is 30.
Alternate Method
Given:
First number (a) = 50
Second number (b) = Z
Third proportional (c) = 18
Formula Used:
In continued proportion a, b, c => a/b = b/c
Calculations:
=> 50 / Z = Z / 18
=> Z × Z = 50 × 18
=> $Z^2 = 900$
=> $Z = \sqrt{900}$
=> Z = 30
Therefore The correct answer is 30.
Additional Information
Mean Proportional
The mean proportional between two numbers a and b is $\sqrt{(a \times b)}$.
Fourth Proportional
If a : b :: c : d, then d is the fourth proportional and d = (b × c) ÷ a.
Continued Proportion
Three quantities a, b, c are in continued proportion if the ratio of first to second equals second to third (a/b = b/c).

Q35. Answer: (d) 4

Shortcut Trick
Average Speed = Total Distance ÷ Total Time
Total Distance = 300 + 300 = 600 m
Total Time = 100 + 50 = 150 sec

Average Speed = 600 ÷ 150 = 4 m/sec

Therefore The correct answer is 4 m/sec.

Alternate Method

Given:

Distance of first lap = 300 m, Time taken = 100 sec

Distance of second lap = 300 m, Time taken = 50 sec

Formula Used:

Average Speed = (Total Distance) ÷ (Total Time)

Calculations:

=> Total Distance = 300 + 300 = 600 m

=> Total Time = 100 + 50 = 150 sec

=> Average Speed = 600 ÷ 150

=> Average Speed = 4 m/sec

Therefore The correct answer is 4 m/sec.

Additional Information

Average Speed (Equal Distances)

When two equal distances are covered at speeds x and y, the average speed is 2xy ÷ (x + y).

Unit Conversion

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

Q36. Answer: (b) 43 years

Shortcut Trick

Sum of ages 5 years ago → 67 − (5 × 2) = 57 years.

Age ratio 5 years ago (Elder : Younger) = 2 : 1.

Elder sister's age 5 years ago = (2/3) × 57 = 38 years.

Current age of elder sister = 38 + 5 = 43 years.

Therefore The correct answer is 43 years.

Alternate Method

Given: Sum of present ages = 67 years. Ratio 5 years ago = 2 : 1.

Formula: Age after 'n' years = Age 'n' years ago + (n × 2 for two people).

=> Let ages 5 years ago be 2x and x.

=> Present ages = (2x + 5) and (x + 5).

=> (2x + 5) + (x + 5) = 67

=> 3x + 10 = 67

=> 3x = 57 => x = 19.

=> Elder sister's current age = 2x + 5 = (2 × 19) + 5 = 38 + 5 = 43.

Therefore The correct answer is 43 years.

Additional Information

Age Difference Constant

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

Sum of Ages Change

If there are 'n' people, the sum of their ages increases or decreases by (n × number of years).

Ratio Method

When a constant number of years is added to both parts of a ratio, the difference between ratio units should be balanced if the age difference is known.

Q37. Answer: (c) √145/17

Shortcut Trick

Given sec θ = Hypotenuse / Base = 17 / 12.

Using Pythagoras Theorem: Perpendicular² = Hypotenuse² − Base².

$P^2 = 17^2 - 12^2 = 289 - 144 = 145 \Rightarrow P = \sqrt{145}$.

sin θ = Perpendicular / Hypotenuse = √145 / 17.

Therefore The correct answer is √145/17.

Alternate Method

Given: sec θ = 17/12

Formula Used: $\sin^2\theta + \cos^2\theta = 1$ OR $\sec\theta = 1 / \cos\theta$

=> $\cos\theta = 1 / \sec\theta = 12 / 17$

=> $\sin^2\theta = 1 - \cos^2\theta$

=> $\sin^2\theta = 1 - (12/17)^2$

=> $\sin^2\theta = 1 - 144 / 289$

=> $\sin^2\theta = (289 - 144) / 289 = 145 / 289$

=> $\sin\theta = \sqrt{(145 / 289)} = \sqrt{145} / 17$

Therefore The correct answer is √145/17.

Additional Information

Trigonometric Identities

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

Right Angled Triangle Ratios

In a right triangle: $\sin\theta = P/H$, $\cos\theta = B/H$, $\tan\theta = P/B$, where P is perpendicular, B is base, and H is hypotenuse.

Pythagoras Theorem

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

Q38. Answer: (c) 40

Shortcut Trick

Average Speed = Total Distance ÷ Total Time

Total Distance = 430 + 470 + 620 = 1520 m

Total Time = 10 + 11 + 17 = 38 minutes

Average Speed = 1520 ÷ 38 = 40 m/minutes

Therefore The correct answer is 40 m/minutes.

Alternate Method

Given:

Distance 1 (d1) = 430 m, Time 1 (t1) = 10 minutes

Distance 2 (d2) = 470 m, Time 2 (t2) = 11 minutes

Distance 3 (d3) = 620 m, Time 3 (t3) = 17 minutes

Formula Used:

Average Speed = (d1 + d2 + d3) ÷ (t1 + t2 + t3)

Calculations:

=> Total Distance = 430 + 470 + 620 = 1520 m

=> Total Time = 10 + 11 + 17 = 38 minutes

=> Average Speed = 1520 ÷ 38

=> Average Speed = 40 m/minutes

Therefore The correct answer is 40 m/minutes.

Additional Information

Average Speed for Equal Distances

If a person covers two equal distances at speeds x and y, the average speed is given by (2xy) ÷ (x + y).

Relative Speed

Speed of two bodies moving in the same direction is (u − v) and in opposite directions is (u + v).

Unit Conversion

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

Q39. Answer: (c) 10

Shortcut Trick

Deviation = New Score − Old Average = 157 − 90 = 67 runs.

Increase in Average = Deviation ÷ Total Innings = 67 ÷ 7 ≈ 9.57 runs.

Rounding 9.57 to the nearest whole number gives 10 runs.

Therefore The correct answer is 10 runs.
Alternate Method
Given:
Average for 6 innings = 90 runs
Runs in 7^(th) inning = 157 runs
Formula Used:
Average = Total Runs ÷ Number of Innings
Calculations:
=> Total runs in 6 innings = 6 × 90 = 540 runs
=> Total runs in 7 innings = 540 + 157 = 697 runs
=> New average = 697 ÷ 7 = 99.5714... runs
=> Increase in average = 99.57... − 90 = 9.57... runs
=> Rounding 9.57 to the nearest whole number ≈ 10
Therefore The correct answer is 10 runs.
Additional Information
Average Change Formula
When a new value is added, New Average = Old Average + (Extra Runs ÷ New Total Innings).
Weighted Average
Weighted Avg = (n1 × A1 + n2 × A2) ÷ (n1 + n2), where n is the number of items and A is the average.
Batting Average in Cricket
Batting Average = (Total Runs Scored) ÷ (Number of times Out). In simple problems, innings played is often treated as times out.

Q40. Answer: (a) 30, 58

Shortcut Trick
Check options for Sum = 88 and LCM = 870.
Option (1): 30 + 58 = 88. LCM of 30 and 58: 30 = 2 × 3 × 5; 58 = 2 × 29. LCM = 2 × 3 × 5 × 29 = 870.
Option (2): 28 + 60 = 88. LCM ends in 0 but 28 is not a factor of 870.
Option (3): 23 + 65 = 88. 23 is prime, 870 is not divisible by 23.
Therefore The correct answer is 30, 58.
Alternate Method
Given: Sum of numbers (x + y) = 88, LCM(x, y) = 870.
Formula: Product of two numbers = HCF × LCM.
=> Let the numbers be x and y.
=> x + y = 88
=> LCM(x, y) = 870
=> Prime factors of 870 = 2 × 3 × 5 × 29
=> Since sum is 88, one number must be 2 × 29 = 58 (as 29 is a large prime factor).
=> If one number is 58, then the other number = 88 − 58 = 30.
=> Verification: LCM(30, 58) = LCM(2 × 3 × 5, 2 × 29) = 2 × 3 × 5 × 29 = 870.
Therefore The correct answer is 30, 58.
Additional Information
Product Rule
For any two numbers a and b, a × b = HCF(a, b) × LCM(a, b).
HCF of Sum and LCM
The HCF of two numbers also divides their sum and their LCM.
Prime Factorization Method
LCM is the product of the highest powers of all prime factors involved in the numbers.

Q41. Answer: (b) 361

Shortcut Trick
Identify square roots by looking at unit digits and nearest tens.
√6889 → ends in 9 (3 or 7), between 80^2 and 90^2 → 83.

√4761 → ends in 1 (1 or 9), between 60^2 and 70^2 → 69.
8√x = 83 + 69 = 152 => √x = 19 => x = 361.
Therefore The correct answer is 361.
Alternate Method
Given: 8(x)^(1/2) = √6889 + √4761
Step 1: Calculate √6889
=> $80^2 = 6400$ and $90^2 = 8100$. Since 6889 ends in 9, the square root must be 83 or 87.
=> $85^2 = 7225$. Since 6889 < 7225, √6889 = 83.
Step 2: Calculate √4761
=> $60^2 = 3600$ and $70^2 = 4900$. Since 4761 ends in 1, the square root must be 61 or 69.
=> $65^2 = 4225$. Since 4761 > 4225, √4761 = 69.
Step 3: Substitute values back into the equation
=> 8√x = 83 + 69
=> 8√x = 152
=> √x = 152 ÷ 8
=> √x = 19
Step 4: Squaring both sides to find x
=> $x = 19^2$
=> x = 361
Therefore The correct answer is 361.
Additional Information
Square Root Extraction
For a perfect square ending in 9, the unit digit of the root is 3 or 7; for 1, it is 1 or 9.
Squaring trick for 5
A number $(n5)^2$ can be calculated as [n × (n+1)] followed by 25. e.g., $65^2 = (6×7)25 = 4225$.
BODMAS Rule
Always solve operations in the order: Brackets, Orders (powers/roots), Division, Multiplication, Addition, Subtraction.

Q42. Answer: (d) 44/7 hours

Shortcut Trick
Let Total Capacity be LCM(9, 12, 18) = 36 units.
Efficiencies: A = 4, B = 3, C = −2. Combined efficiency (A+B−C) = 4 + 3 − 2 = 5.
Work in first 4 hours = 5 × 4 = 20 units. Remaining work = 36 − 20 = 16 units.
Time for A+B to finish = 16 ÷ 7 hours. Total time = 4 + 16/7 = (28 + 16)/7 = 44/7 hours.
Therefore The correct answer is 44/7 hr.
Alternate Method
Given: Filling time Pipe A = 9 hr, Pipe B = 12 hr, Emptying time Pipe C = 18 hr.

Person	Days	Total Work	Efficiency
Pipe A	9	36	4
Pipe B	12	3	
Pipe C	18	−2	

=> Total capacity of tank = 36 units (LCM of 9, 12, 18).
=> Efficiency of (A + B + C) = 4 + 3 − 2 = 5 units/hr.
=> Water filled in 4 hours = 5 × 4 = 20 units.
=> Remaining capacity to be filled = 36 − 20 = 16 units.
=> Time taken by (A + B) to fill remaining part = 16 ÷ (4 + 3) = 16/7 hours.
=> Total time taken = 4 + 16/7 = 44/7 hours.
Therefore The correct answer is 44/7 hr.
Additional Information
Inlet and Outlet Pipes

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Inlet pipes add water (positive efficiency) while outlet pipes remove water (negative efficiency). Net work per hour is the algebraic sum of efficiencies.

Time and Work Relation

Total Work = Efficiency × Time. If a pipe can fill a tank in 'x' hours, its 1-hour work is 1/x of the total capacity.

Q43. Answer: (a) 20 cm

Shortcut Trick

When multiple identical spheres are melted to form a single sphere, the volume remains constant.

Relationship: $R^3 = n \times r^3$, where R is the new radius, n is the count, and r is the old radius.

$R^3 = 8 \times 10^3$

$R^3 = 8 \times 1000 = 8000 \Rightarrow R = 20$ cm

Therefore The correct answer is 20 cm.

Alternate Method

Given:

Number of spherical balls (n) = 8

Radius of each small ball (r) = 10 cm

Formula Used:

Volume of a Sphere = $4/3 \times \pi \times \text{radius}^3$

Calculations:

=> Total volume of 8 small balls = $8 \times (4/3 \times \pi \times 10^3)$

=> Volume of the new single large ball = $4/3 \times \pi \times R^3$

=> According to the principle of conservation of volume:

=> $4/3 \times \pi \times R^3 = 8 \times 4/3 \times \pi \times 1000$

=> $R^3 = 8 \times 1000$

=> $R^3 = 8000$

=> $R = \sqrt[3]{8000}$

=> R = 20 cm

Therefore The correct answer is 20 cm.

Additional Information

Volume Conservation

When a solid is melted and recast into another shape, the total volume remains identical unless specified otherwise.

Surface Area of Sphere

The Total Surface Area (TSA) of a sphere is given by $4 \times \pi \times r^2$. Note that TSA changes during recasting.

Radius Ratio

If n spheres are melted into 1, the ratio of radii is R/r = n^(1/3). For n=8, R/r = 8^(1/3) = 2.

Q44. Answer: (a) 56

Shortcut Trick

Assume a base mean of 50 and find deviations: +28, +16, +39, +5, +23, −5, −27, −4, −21.

Calculate Net Deviation: 28 + 16 + 39 + 5 + 23 − 5 − 27 − 4 − 21 = +54.

Average Deviation = 54 ÷ 9 = +6.

Final Mean = Assumed Mean + Average Deviation = 50 + 6 = 56.

Therefore The correct answer is 56.

Alternate Method

Given observations: 78, 66, 89, 55, 73, 45, 23, 46, 29

Number of observations (n) = 9

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

=> Total Sum = 78 + 66 + 89 + 55 + 73 + 45 + 23 + 46 + 29

=> Total Sum = 504

=> Arithmetic Mean = 504 ÷ 9

=> Arithmetic Mean = 56

Therefore The correct answer is 56.

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Additional Information

Properties of Arithmetic Mean

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

Effect of Operations

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

Combined Mean Formula

For two groups with sizes n1, n2 and means x1, x2, the combined mean is (n1x1 + n2x2) ÷ (n1 + n2).

Q45. Answer: (b) 23.36%

Shortcut Trick

Total multiplier for consecutive discounts of 2%, 8%, and 15%.

Effective Multiplier = 0.98 × 0.92 × 0.85 = 0.76636.

Equivalent Discount% = (1 − 0.76636) × 100 = 23.364%.

Rounding to two decimal places, we get 23.36%.

Therefore The correct answer is 23.36%.

Alternate Method

Given → Discounts are 2%, 8%, and 15%.

Formulas: Successive Discount = a + b − (a × b) ÷ 100.

=> First, combine 2% and 8%: 2 + 8 − (2 × 8) ÷ 100 = 10 − 0.16 = 9.84%.

=> Now, combine 9.84% and 15%: 9.84 + 15 − (9.84 × 15) ÷ 100.

=> Total = 24.84 − (147.6 ÷ 100) = 24.84 − 1.476.

=> Total Discount = 23.364%.

Therefore The correct answer is 23.36%.

Additional Information

Single Equivalent Discount

It is the total reduction offered on the Marked Price through multiple stages. For three discounts a, b, and c, use the formula iteratively or the Multiplier Method.

Marked Price and Selling Price

The Selling Price (SP) after discount is: SP = MP × (100 − D1)/100 × (100 − D2)/100...

Q46. Answer: (b) 13,625

Shortcut Trick

Combine Ratio: A : B : C = (4 × 9) : (15 × 9) : (15 × 3) = 36 : 135 : 45.

Simplified Ratio: 12 : 45 : 15 => 4 : 15 : 5.

Total units = 4 + 15 + 5 = 24 units => Rs. 21,800.

B's share = (15 ÷ 24) × 21,800 = (5 ÷ 8) × 21,800 = 5 × 2725 = Rs. 13,625.

Therefore The correct answer is Rs. 13,625.

Alternate Method

Given: Total Profit = Rs. 21,800, A : B = 4 : 15, B : C = 9 : 3.

Formula: Combined Ratio A : B : C = (A × B1) : (B1 × B2) : (B2 × C).

=> To equalize B, multiply A : B by 3 and B : C by 5.

=> A : B = 12 : 45.

=> B : C = 45 : 15.

=> A : B : C = 12 : 45 : 15 = 4 : 15 : 5.

=> Sum of ratio parts = 4 + 15 + 5 = 24.

=> B's share = (15 ÷ 24) × 21,800.

=> B's share = 0.625 × 21,800 = Rs. 13,625.

Therefore The correct answer is Rs. 13,625.

Additional Information

Compound Ratio

When two or more ratios are multiplied together (a/b × c/d), the result is the compound ratio (ac/bd).

Partnership Profit Distribution

Profit is distributed in the ratio of (Capital × Time). If time is constant, profit ratio equals the investment ratio.

Proportion Rule

If a : b = c : d, then the product of extremes equals the product of means (a × d = b × c).

Q47. Answer: (d) 162/3%

Shortcut Trick

Use the direct formula for reduction in consumption: [r / (100 + r)] × 100%

Here, increase rate r = 20%.

Reduction = [20 / (100 + 20)] × 100 = (20 / 120) × 100 = 1/6 × 100

Calculation: 100 / 6 = 16(2/3)%

Therefore The correct answer is 16(2/3)%.

Alternate Method

Given:

Initial Price of milk = 100 units

Increased Price = 100 + 20% of 100 = 120 units

Formula Used:

Expenditure = Price × Consumption

To keep Expenditure constant, the new consumption must be brought back to the base of the new price.

=> Required reduction in consumption = New Price − Old Price = 120 − 100 = 20 units

=> Percentage reduction = (Reduction / New Price) × 100

=> Percentage reduction = (20 / 120) × 100

=> Percentage reduction = (1 / 6) × 100

=> Percentage reduction = 16.66% or 16(2/3)%

Therefore The correct answer is 16(2/3)%.

Additional Information

Price-Consumption Relationship

When Expenditure is constant, Price is inversely proportional to Consumption (P prop. to 1/C).

Price Decrease Case

If price decreases by r%, the increase in consumption to keep expenditure constant is [r / (100 − r)] × 100%.

Fraction Conversion

20% increase is 1/5. For constant product, if one factor increases by 1/n, the other must decrease by 1/(n+1). Here, 1/(5+1) = 1/6 = 16(2/3)%.

Q48. Answer: (c) 2 and 13

Shortcut Trick

The biggest even number less than 30 is 28.

Check products from options: (1) 33, (2) 21, (3) 26, (4) 10.

The largest even product less than 28 (or specifically less than 30) among options is 26.

Therefore The correct answer is 2 and 13.

Alternate Method

Given: Product must be an even number less than 30.

Property: To get an even product from two prime numbers, one of the numbers must be the only even prime, which is 2 (since Odd × Odd = Odd and Even × Any = Even).

=> Target: Largest product P < 30 where P is even.

=> Option 1: 3 × 11 = 33 (Odd, > 30) ×

=> Option 2: 3 × 7 = 21 (Odd) ×

=> Option 3: 2 × 13 = 26 (Even, < 30) Yes

=> Option 4: 2 × 5 = 10 (Even, < 30) × [26 is larger than 10]

Therefore The correct answer is 2 and 13.

Additional Information

Even Prime Number

The number 2 is the only even prime number. All other prime numbers are odd.

Product Parity Rules

Odd × Odd = Odd; Even × Odd = Even; Even × Even = Even.

Prime Number Definition

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

Q49. Answer: (d) 21 cm

Shortcut Trick

Calculate the semi-perimeter (s) of the triangle: s = (35 + 44 + 75) ÷ 2 = 77 cm.

Find the Area using Heron's Formula: Area = √(77 × (77−35) × (77−44) × (77−75)) = √(77 × 42 × 33 × 2).

Area = √(7 × 11 × 7 × 6 × 3 × 11 × 2) = 7 × 11 × 6 = 462 cm².

Altitude (h) corresponding to the 44 cm base = (2 × Area) ÷ base = (2 × 462) ÷ 44 = 21 cm.

Therefore The correct answer is 21 cm.

Alternate Method

Given: Sides of the triangle are a = 35 cm, b = 44 cm, and c = 75 cm.

Formula Used:

1. Semi-perimeter (s) = (a + b + c) ÷ 2
2. Area = √(s(s − a)(s − b)(s − c))
3. Area = (1 ÷ 2) × base × altitude

Calculations:

=> s = (35 + 44 + 75) ÷ 2

=> s = 154 ÷ 2 = 77 cm

=> Area = √(77 × (77 − 35) × (77 − 44) × (77 − 75))

=> Area = √(77 × 42 × 33 × 2)

=> Area = √((7 × 11) × (7 × 6) × (11 × 3) × 2)

=> Area = √(7² × 11² × 6²) = 7 × 11 × 6 = 462 cm²

=> 462 = (1 ÷ 2) × 44 × altitude

=> 462 = 22 × altitude

=> altitude = 462 ÷ 22 = 21 cm

Therefore The correct answer is 21 cm.

Additional Information

Heron's Formula for Area

Used to find the area of a triangle when all three sides are known: Area = √(s(s−a)(s−b)(s−c)), where s is the semi-perimeter.

Relationship between Area and Altitude

For any side taken as the base, the area is always 1/2 × base × corresponding height. Thus, height = (2 × Area) ÷ base.

Triangle Inequality Theorem

A triangle is valid only if the sum of any two sides is greater than the third side (e.g., 35 + 44 = 79, which is > 75).

Q50. Answer: (d) 21.3

Shortcut Trick

The given expression follows the algebraic identity (a² − b²) / (a + b) = (a − b).

Here, let a = 100.5 and b = 79.2.

The solution is simply the difference between the two numbers: 100.5 − 79.2 = 21.3.

Therefore The correct answer is 21.3.

Alternate Method

Given:

Expression: ((100.5)² − (79.2)²) / (100.5 + 79.2)

Formula Used:

Algebraic Identity: a² − b² = (a + b)(a − b)

Calculations:

=> Let a = 100.5 and b = 79.2.

=> Numerator = (100.5)² − (79.2)² = (100.5 + 79.2) × (100.5 − 79.2)

=> Substituting this into the main expression:

=> [(100.5 + 79.2) × (100.5 − 79.2)] / (100.5 + 79.2)

=> 100.5 − 79.2 (Cancelling the common term 100.5 + 79.2)

=> 21.3

The calculated value corresponds to option (4).

Therefore The correct answer is 21.3.

Additional Information

Difference of Squares

The identity $a^2 - b^2 = (a + b)(a - b)$ is used to simplify expressions involving squares of two numbers.

Square of a Sum

The formula $(a + b)^2 = a^2 + 2ab + b^2$ expands the square of the sum of two variables.

Square of a Difference

The formula $(a - b)^2 = a^2 - 2ab + b^2$ expands the square of the difference between two variables.

Fraction Simplification

If the numerator and denominator share a common factor, they can be cancelled: $(x \times y) / x = y$, provided $x \neq 0$.

Q51. Answer: (b) CTLJ

Logic followed here is:

Logic: Each letter in the first word is shifted backward by 3 positions in the English alphabetical series to obtain the corresponding letter of the second word.

XBNO is related to UYKL →

PAQJ is related to MXNG →

The pattern observed is: (Positional value of letter - 3) = Resulting letter.

Similarly, let's find the related word for FWOM:

Therefore, the word related to 'FWOM' is CTLJ.

Hence, the correct answer is "Option 2".

Q52. Answer: (c) 85

Logic followed here is:

The series follows a pattern where the difference between consecutive terms increases by 1 at each step.

Next term in series = 74 + 11 = 85

Therefore, the number that should come in place of the question mark is 85.

Hence, the correct answer is "Option 3".

Q53. Answer: (b) Two

Given Series:

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

We need to find the even numbers which are:

→ Immediately preceded by an odd number

→ Immediately followed by an even number

Required pattern: Odd → Even → Even

Checking the series:

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

The even numbers satisfying the condition are:

2 in (1 2 4)

4 in (1 4 2)

Therefore, the number of such even numbers is 2.

Hence, the correct answer is "Option 2".

Q54. Answer: (b) ZWA

Logic followed here is: Each letter in a group is moving forward by 10 positions in the English alphabetical order to obtain the corresponding letter of the next group.

Therefore, the term that comes in place of the question mark is ZWA.

Hence, the correct answer is "Option 2".

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Q55. Answer: (c) 4

Given:

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

Only two people sit to the left of C.

Only three people sit between C and G.

B sits second to the right of C.

Only two people sit between B and A.

E sits somewhere to the right of F but somewhere to the left of D.

Find how many people sit to the right of C.

To the right of C are: E, B, D and G

Total people to the right of C = 4

Hence, the correct answer is "Option 3".

Q56. Answer: (c) North East

Given:

Town X is to the north of Town Y.

Town Z is to the west of Town Y.

Town W is to the east of Town X.

Town Z is to the north of Town V.

Now find the position of W with respect to Z.

W is to the east of Z and also north of Z.

Therefore, W is in the North-East direction with respect to Z.

Hence, the correct answer is "Option 3".

Q57. Answer: (c) 60

Given Mapping:

Letter	Operation
P	×
Q	÷
R	−
S	•

Given Equation:

(20 Q 4) P 7 S 5 P 9 R (40 Q 8) P 4 = ?

Replace the letters with symbols:

=> (20 ÷ 4) × 7 + 5 × 9 − (40 ÷ 8) × 4

=> (5 × 7) + (5 × 9) − (5 × 4)

=> 35 + 45 − 20

=> 80 − 20

=> 60

Therefore, the value that comes in place of the question mark is 60.

Hence, the correct answer is "Option 3".

Q58. Answer: (b) MJK 102

Logic followed here is: The series follows a pattern where each cluster's letters are shifted backwards by 3 positions in the English alphabetical order, and the numbers increase by a constant value of 11.

Therefore, the cluster that replaces the question mark is MJK 102.

Hence, the correct answer is "Option 2".

Q59. Answer: (a) 4

Given:

“ROUT” is coded as “1625”

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“AUTO” is coded as “1546”

Therefore, the code for “A” is 4.

Hence, the correct answer is "Option 1".

Q60. Answer: (a) Father's brother's son

Given Coding:

A is | Symbol | + | - | × | & | | --- | --- | --- | --- | --- | | Meaning | son | brother | wife | father | to B	Symbol	•	•	×	&	Meaning	son	brother	wife	father
Symbol	•	•	×	&						
Meaning	son	brother	wife	father						

Given Expression:

T + O × R - N & M: T is is the son of O. O is the wife of R. R is the brother of N. N is the father of M.

So, T is M’s father’s brother’s son.

Therefore, T is related to M as Father's brother's son.

Hence, the correct answer is "Option 1".

Q61. Answer: (a) OOTF

Logic followed here is:

The relationship between the letter clusters is established by applying a specific arithmetic sequence (-5, +4, -3, +2) to the positional values of the letters in the English alphabet.

For

DQXG is related to YUUI →

GLQC is related to BPNE →

The pattern observed is: -5, +4, -3, +2 applied to the positional values.

Similarly, let's find the code for TKWD:

Therefore, 'TKWD' is related to 'OOTF'.

Hence, the correct answer is "Option 1".

Q62. Answer: (c) CGH

Checking Option 1: JMO

Checking Option 2: RUW

Checking Option 3: CGH

Checking Option 4: YBD

The pattern for JMO, RUW, and YBD is (+3, +2). However, for CGH, the pattern is (+4, +1).

Therefore, the letter-cluster 'CGH' does not belong to the group.

Hence, the correct answer is "Option 3".

Q63. Answer: (d) Four

Given:

A, B, C, D, E, F and G are sitting around a circular table facing the centre.

F is the immediate neighbour of both E and C.

E sits second to the right of G.

A is sitting to the immediate left of G.

G is the immediate neighbour of both A and B.

D sits to the immediate right of C.

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Final Arrangement:

A	**D**	**C**	**F**	**E**	**B**	**G**

Step 5:

Now arrange all persons in alphabetical order clockwise starting from A:

Step 6:

Compare both arrangements:

Original	**A**	**D**	**C**	**F**	**E**	**B**	**G**
Alphabetical	A	B	C	D	E	F	G

Persons remaining in the same positions:

A, E, F and D

Total unchanged positions = 4

Hence, the correct answer is "Option 4".

Q64. Answer: (c) 19

Given:

Vijaya ranked 7^(th) from the top and 13^(th) from the bottom in her class.

Formula:

Total students = Rank from top + Rank from bottom − 1

Calculation:

Total students = 7 + 13 − 1

= 20 − 1

= 19

Therefore, the total number of students in the class is 19.

Hence, the correct answer is "Option 3".

Q65. Answer: (d) 10

Logic followed here is:

Arrange the digits of the given number in ascending order and then identify the digits at the specified positions to calculate their sum.

The given number is 1785643

1	**7**	**8**	**5**	**6**	**4**	**3**

Arranging the digits in ascending order (from left to right):

1	**3**	**4**	**5**	**6**	**7**	**8**

In the new arrangement (1345678):

1) The digit which is third from the left is: 4

2) The digit which is third from the right is: 6

Sum of the digits:

Sum = 4 + 6 = 10

Therefore, the sum of the digits which are third from the left and third from the right is 10.

Hence, the correct answer is "Option 4".

Q66. Answer: (a) 11

Logic followed here is: The difference between the consecutive numbers in the series follows the pattern of cubes of successive natural numbers starting from 1.

Therefore, the number that should come in place of the question mark is 11.

Hence, the correct answer is "Option 1".

Q67. Answer: (c) (5, 6, 900)

Logic followed here is: (1st Number × 2nd Number)2 = 3rd Number.

For (4, 7, 784) →

Calculation: $(4 \times 7)^2 = (28)^2 = 784$

For (6, 3, 324) →

Calculation: $(6 \times 3)^2 = (18)^2 = 324$

Similarly, let's check the options:

Option (3): (5, 6, 900) →

Calculation: $(5 \times 6)^2 = (30)^2 = 900$

Therefore, the set that follows the same logic is (5, 6, 900).

Hence, the correct answer is "Option 3".

Q68. Answer: (c) Only conclusion (II) follows.

Statements:

All caps are hats.

All caps are scarfs.

Some scarfs are mufflers.

Venn Diagram Logic:

Conclusions:

(I) Some mufflers are caps: Does not follows (Because “Some scarfs are mufflers” does not guarantee that mufflers are caps.)

(II) Some scarfs are hats: Follows (Because all caps are both scarfs and hats. Therefore, at least some scarfs are hats.)

Therefore, only conclusion (II) follows.

Hence, the correct answer is "Option 3".

Q69. Answer: (c) Four

Given Series:

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

We need to find the odd digits which are:

→ Immediately preceded by an odd digit

→ Immediately followed by an odd digit

Required pattern: Odd → Odd → Odd

Checking the series:

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

The odd digits satisfying the condition are:

3 in (1 3 1)

5 in (1 5 1)

7 in (1 7 1)

1 in (1 1 1)

Total such odd digits = 4

Therefore, the number of such odd digits is 4.

Hence, the correct answer is "Option 3".

Q70. Answer: (a) IFY

Logic followed here is: (Letter 1 - 4 = Letter 2) and (Letter 2 - 6 = Letter 3).

1) For IFY:

2) For ZVP →

3) For RNH →

4) For GCW →

Therefore, the letter-cluster 'IFY' does not belong to the group as it follows a -3, -7 pattern instead of -4, -6.

Hence, the correct answer is "Option 1".

Q71. Answer: (b) 6

Given Mapping:

Letter	Operation
A	÷

B	×
C	•
D	–

Given Equation:

8 B 2 D 15 C 25 A 5 = ?

Replace the letters with symbols:

=> 8 × 2 − 15 + 25 ÷ 5

=> (8 × 2) − 15 + 5

=> 16 − 15 + 5

=> 21 - 15

=> 6

Therefore, the value that comes in place of the question mark is 6.

Hence, the correct answer is "Option 2".

Q72. Answer: (c) A

Given:

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

C is seated second from the left end.

F is third to the right of B.

G is seated to the left of C and at one of the ends.

Only two people sit between G and B.

Only one person is seated between D and F.

E is not a neighbour of F.

The person seated second from the right end is A.

Hence, the correct answer is "Option 3".

Q73. Answer: (b) mj

Given:

“please go on” is coded as “js tk mj”

“go there please” is coded as “js yn tk”

Therefore, the code for “on” is “mj”.

Hence, the correct answer is "Option 2".

Q75. Answer: (b) 6

Logic followed here is: Logic: The series follows a pattern where consecutive multiples of 6 (6, 12, 18, 24, 30...) are alternately added and subtracted to the previous term.

Therefore, the missing number in place of the question mark (?) is 6.

Hence, the correct answer is "Option 2".

Q76. Answer: (d) 72

Logic followed here is:

To find the resultant, identify the highest and lowest numbers from the given set, extract the specific digits as mentioned in the question, and then multiply them.

The given numbers are: 627, 543, 658, 719, 482

Highest number is 719 →

Third digit of the highest number = 9

Lowest number is 482 →

Second digit of the lowest number = 8

Resultant = 9 × 8 = 72

Therefore, the resultant is 72.

Hence, the correct answer is "Option 4".

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Q77. Answer: (c) Only conclusion (I) follows.

Statements:

No stump is a ball.

Some balls are wickets.

Venn Diagram Logic:

Conclusions:

(I) No ball is a stump: Follows (Because “No stump is a ball” also means “No ball is a stump”.)

(II) No wicket is a ball: Does not follows (Because the statement says “Some balls are wickets”, which means some wickets are definitely balls.)

Therefore, only conclusion (I) follows.

Hence, the correct answer is "Option 3".

Q78. Answer: (a) 1

Given:

Total students = 30

Meera is 10^(th) from the left end.

Arjun is 19^(th) from the right end.

Step 1:

Find Arjun’s position from the left end.

Position from left = Total students − Position from right + 1

= 30 − 19 + 1

= 12

So, Arjun is 12^(th) from the left end.

Step 2:

Meera’s position from the left = 10

Arjun’s position from the left = 12

People between them = 12 − 10 − 1 = 1

Therefore, 1 person stands between Meera and Arjun.

Hence, the correct answer is "Option 1".

Q79. Answer: (a) Two

Given Series:

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

We need to find the unique digits which are multiples of 4.

Multiples of 4 among single-digit numbers are: 4, 8

Checking the series:

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

Unique digits that are multiples of 4: 4, 8

Total unique digits = 2

Therefore, the number of unique digits which are multiples of 4 is 2.

Hence, the correct answer is "Option 1".

Q80. Answer: (b) 1 km to the east

Given:

Arman starts from point A and drives 32 km towards the south.

He then takes a left turn and drives 37 km.

Again, he takes a left turn and drives 35 km.

He then takes another left turn and drives 38 km.

Finally, he takes a left turn and drives 3 km and stops at point P.

Facing west, left turn means south.

Moves 3 km south.

Final Position P = 1 km West of point A

To reach point A again, Arman must move 1 km towards the east.

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Hence, the correct answer is "Option 2".

Q81. Answer: (c) Global Capability Center policy to expand centres across the state

The correct answer is Global Capability Center policy to expand centres across the state.

Key Points

• The Maharashtra Government, in September 2025, approved the Global Capability Center (GCC) Policy to position the state as a leading destination for high-value technical and administrative operations.

• The policy specifically targets the development of Tier-2 and Tier-3 cities like Nagpur, Nashik, Chhatrapati Sambhajinagar, and Pune to decentralize industrial growth away from the saturated Mumbai Metropolitan Region. Hence, the correct answer is Global Capability Center policy to expand centres across the state.

• The initiative aims to generate approximately 1 million (10 lakh) high-skilled jobs by the year 2030, focusing on knowledge-based industries.

• Under this policy, the state offers significant incentives, including stamp duty exemptions, electricity duty waivers, and investment subsidies to multinational corporations (MNCs) setting up their centers of excellence.

• The focus of these centers will be on cutting-edge technologies such as Artificial Intelligence (AI), Machine Learning (ML), Data Analytics, and Blockchain.

Additional Information

• Understanding Global Capability Centers (GCCs):

• GCCs are offshore units established by multinational corporations to handle specialized tasks including Research and Development (R&D), IT support, and Finance/HR operations.

• India has evolved from being a "back-office" hub to a "global innovation hub," currently housing over 1,600 GCCs that contribute significantly to the GDP.

• Economic Significance:

• The GCC sector in India is projected to reach a market size of $110 billion by 2030.

• Maharashtra's policy is a strategic move to capture a lion's share of this market, contributing to India's goal of becoming a $5 trillion economy.

• Urban Development:

• By focusing on Tier-2 and Tier-3 cities, the government aims to improve infrastructure, real estate, and the local service economy in these regions.

• This shift helps in reducing the cost of operations for companies while providing local employment to graduates within their home districts.

Important Points

• Skill Integration: The policy involves collaboration with the Maharashtra State Skill Development Society (MSSDS) to create a curriculum tailored to the specific needs of GCCs.

• Plug-and-Play Facilities: To attract fast-paced investments, the state is developing IT parks and Knowledge Parks with plug-and-play infrastructure, allowing companies to start operations immediately.

• Sustainability: The policy encourages green building practices and the use of renewable energy within these new capability centers to align with ESG (Environmental, Social, and Governance) goals.

• Single-Window Clearance: To improve the Ease of Doing Business, a dedicated cell has been established to provide single-window clearances for all regulatory requirements related to GCCs.

Q82. Answer: (c) President of India

The correct answer is President of India.

Key Points

• The President of India, Smt. Droupadi Murmu, inaugurated the two-day National Conference on 'Environment – 2025' held in New Delhi in March 2025.

• The conference was organized to address the pressing global environmental challenges and to formulate a roadmap for sustainable development in the coming decade.

• During the inauguration, the President highlighted the urgent need for climate justice and the protection of biodiversity, emphasizing that humanity's survival depends on a healthy planet.

• The event served as a high-level forum bringing together environmentalists, scientists, policymakers, and judicial experts to discuss the integration of traditional ecological knowledge with modern science.

• The conference focused on India's progress toward achieving its Nationally Determined Contributions (NDCs) under the Paris Agreement and the country's commitment to reaching Net Zero carbon emissions.

Additional Information

• Ministry of Environment, Forest and Climate Change (MoEFCC):

• This is the nodal agency of the Central Government responsible for the planning and coordination of India's environmental policies.

• The ministry oversees the implementation of various acts such as the Environment (Protection) Act, 1986 and the Wildlife Protection Act, 1972.

• Constitutional Mandate:

• Article 48A: A Directive Principle of State Policy which states that the State shall endeavor to protect and improve the environment and to safeguard the forests and wildlife of the country.

• Article 51A(g): A Fundamental Duty of every citizen to protect and improve the natural environment including forests, lakes, rivers, and wildlife.

• Mission LiFE (Lifestyle for Environment):

• Launched by the Prime Minister of India, this initiative promotes a circular economy and encourages individuals to adopt sustainable lifestyles to mitigate climate change.

• It aims to replace the prevalent 'use-and-dispose' economy with a 'circular economy' defined by mindful and deliberate utilization.

• National Green Tribunal (NGT):

• Established in 2010 under the NGT Act, it is a specialized body equipped with the necessary expertise to handle environmental disputes involving multi-disciplinary issues.

• It provides a fast-track mechanism for cases related to environmental protection and conservation of forests.

• International Solar Alliance (ISA):

• Headquartered in Gurugram, India, this alliance was jointy launched by India and France to mobilize efforts against climate change through the deployment of solar energy solutions.

Important Points

• Panchamrit Strategy: At COP26, India announced five nectar elements (Panchamrit) to deal with climate change, including reaching 500 GW of non-fossil energy capacity by 2030.

• Carbon Credit Trading Scheme: India is developing its own carbon market to incentivize greenhouse gas emission reductions and promote green technology.

• World Environment Day: Celebrated annually on June 5, it serves as the principal vehicle of the United Nations for encouraging awareness and action for the protection of the environment.

Q83. Answer: (d) January 2025

The correct answer is January 2025.

Key Points

• Larsen & Toubro (L&T) achieved a significant milestone by launching the second Multi-Purpose Vessel (MPV) for the Indian Navy on January 16, 2025.

• The vessel, named ‘Samarthak’, was launched at L&T’s Kattupalli Shipyard located near Chennai, Tamil Nadu.

• The launch ceremony was graced by Smt. Tanvi Singh, who performed the traditional honors, in the presence of Vice Admiral Krishna Swaminathan, the Vice Chief of Naval Staff.

• This vessel is the second in a series of two MPVs being constructed by L&T under a contract signed with the Ministry of Defence in March 2022.

• The first vessel of this class, named ‘Vayan’, was launched earlier in September 2024, demonstrating the rapid pace of construction at the shipyard.

Additional Information

• Vessel Role and Capabilities:

• The Multi-Purpose Vessels (MPVs) are designed to perform a wide array of roles including maritime surveillance, towing of targets, and acting as a platform for naval training.

• They are also equipped to provide Humanitarian Assistance and Disaster Relief (HADR), making them vital assets for non-combat maritime operations.

• The ships feature advanced indigenous equipment and systems, aligning with the ‘Aatmanirbhar Bharat’ (Self-reliant India) initiative.

• Technical Specifications:

• The vessels are approximately 106 meters in length and 15 meters in width.

• They are capable of reaching a maximum speed of 15 knots and have an endurance suited for prolonged deployments in the Indian Ocean Region (IOR).

• The contract for these two vessels was valued at approximately Rs. 887 crore.

• L&T Shipbuilding:

• L&T is a major private player in India's defense manufacturing sector, specifically in naval shipbuilding.

• The Kattupalli Shipyard is a state-of-the-art facility that has delivered several Interceptor Boats, Offshore Patrol Vessels (OPVs), and Floating Docks to the Indian Navy and Indian Coast Guard.

Important Points

• Strategic Significance: The induction of MPVs like Samarthak will allow the Indian Navy to phase out aging auxiliary ships and enhance its auxiliary fleet's operational efficiency.

• Launch vs Commissioning: While the launch occurred in January 2025, the vessel will now undergo a series of sea trials and equipment fit-outs before being formally commissioned into active service.

• Timeline: The delivery of both vessels is planned to be completed within a 36-month window from the start of the project, highlighting the efficiency of indigenous private shipyards.

Q84. Answer: (c) Ministry of Finance

The correct answer is Ministry of Finance.

Key Points

• The Ministry of Finance has officially set the stage for the fourth phase of Regional Rural Banks (RRBs) amalgamation, which is scheduled to commence in April 2025.

• This initiative is driven by the 'One State, One RRB' policy, aiming to consolidate multiple RRBs operating within the same state into a single, robust entity to reduce administrative overheads.

• The primary objective of this reorganization is to enhance operational efficiency, improve cost-to-income ratios, and leverage economies of scale to better serve the rural population.

• Under this plan, the total number of RRBs in India is projected to be reduced from the existing 43 to approximately 28, ensuring a more streamlined banking structure.

• The Department of Financial Services (DFS), under the Ministry of Finance, is the nodal agency coordinating with Sponsor Banks and State Governments to finalize the roadmap for this consolidation.

Additional Information

• History of RRBs: Regional Rural Banks were established under the provisions of an Ordinance passed in September 1975 and the RRB Act of 1976, following the recommendations of the Narasimham Committee. The first RRB, Prathama Bank, was established on October 2, 1975.

• Shareholding Pattern: The equity of an RRB is held by three parties in a fixed proportion: the Central Government (50%), the Sponsor Bank (35%), and the concerned State Government (15%).

• Phases of Consolidation:

• Phase 1 (2005): Amalgamation of RRBs sponsored by the same bank within a state.

• Phase 2 (2012): Amalgamation of RRBs across different sponsor banks within a state.

• Phase 3 (2019): Further consolidation reduced the count to 43 to improve financial viability.

• Regulation and Supervision: While RRBs are regulated by the Reserve Bank of India (RBI), their supervisory powers are vested in the National Bank for Agriculture and Rural Development (NABARD).

• Mandate: RRBs are required to provide 75% of their total credit to the Priority Sector Lending (PSL) categories, which is higher than the 40% requirement for Scheduled Commercial Banks.

Important Points

• Operational Efficiency: The 'One State, One RRB' model helps in technology integration and uniform banking practices across the state, making it easier for the Sponsor Banks to manage operations.

• Financial Health: Consolidation often leads to better Capital to Risk-weighted Assets Ratio (CRAR) and helps weaker RRBs benefit from the financial strength of stronger ones within the same geography.

• Geographic Presence: Despite the reduction in the total number of banks, the branch network in rural and semi-urban areas remains intact or expands, ensuring that financial inclusion goals are not compromised.

Q85. Answer: (a) Delhi

The correct answer is Delhi.

Key Points

• The Delhi Government initiated the first comprehensive flight trials for cloud seeding in October 2025 to address the perennial problem of winter smog and severe air pollution in the national capital.

• This project was a collaborative effort between the Department of Environment (Delhi) and scientists from IIT Kanpur, who provided the technical expertise and the specialized Cessna aircraft required for the mission.

• The primary goal of the trial was to induce artificial rain to facilitate the "washout" effect, which helps in settling Particulate Matter (PM2.5 and PM10) and other pollutants suspended in the atmosphere.

• The October 2025 trials were strategically timed to coincide with the onset of the stubble burning season in neighboring states and the falling temperatures that trap pollutants near the ground.

• The trial involved the dispersal of silver iodide and other seeding agents into cumulus clouds to encourage moisture condensation and subsequent precipitation.

Additional Information

• Cloud Seeding Technology:

• It is a weather modification technique that changes the amount or type of precipitation that falls from clouds by dispersing substances into the air that serve as cloud condensation or ice nuclei.

• Commonly used agents include Silver Iodide (AgI), Potassium Iodide, and Dry Ice (Solid Carbon Dioxide).

• The process requires specific meteorological conditions, such as a minimum cloud cover of 40% and a certain humidity level, to be successful.

• Air Quality Index (AQI) in Delhi:

• The AQI in Delhi often enters the "Severe" (401-500) or "Severe Plus" (>500) category during the months of October and November.

• The Graded Response Action Plan (GRAP) is implemented by the Commission for Air Quality Management (CAQM) to tackle these levels through various restrictions on construction and vehicle movement.

• Role of IIT Kanpur:

• IIT Kanpur has been working on indigenous cloud seeding solutions for several years, having successfully conducted smaller-scale trials in Uttar Pradesh in 2023.

• Their research focuses on using flares attached to aircraft wings to release salts into the clouds during flight maneuvers.

• Environmental Impact:

• While artificial rain provides immediate relief by clearing the air, it is considered a temporary emergency measure rather than a long-term solution to industrial emissions or vehicular pollution.

• The cost of such operations is significant, often estimated in crores of rupees per attempt, necessitating precise meteorological forecasting.

Important Points

• Legal and Regulatory Approvals: For the 2025 trial, the Delhi Government had to obtain clearances from various central agencies, including the Directorate General of Civil Aviation (DGCA), the Ministry of Defence, and the Airport Authority of India (AAI) for use of airspace.

• Geographical Context: Delhi is landlocked, and during winter, it experiences temperature inversion, which acts as a lid, preventing pollutants from escaping vertically.

• Smog Towers: In addition to cloud seeding, Delhi has previously experimented with smog towers in locations like Connaught Place and Anand Vihar to filter the air at the ground level.

Q86. Answer: (b) 31 May

The correct answer is 31 May.

Key Points

• World No Tobacco Day is observed globally every year on 31 May to create awareness about the harmful and deadly effects of tobacco use and exposure to second-hand smoke.

• The initiative was first started by the World Health Organization (WHO) in 1987 to draw global attention to the tobacco epidemic and the preventable death and disease it causes.

• The World Health Assembly passed Resolution WHA42.19 in 1988, which formally called for the celebration of World No Tobacco Day every year on 31 May.

• In 2025, India continues its active participation in this global campaign, led by the Ministry of Health and Family Welfare (MoHFW), to strengthen tobacco control measures and protect the younger generation from nicotine addiction.

• The day serves as a call to action, advocating for effective policies to reduce tobacco consumption and engaging stakeholders across various sectors to join the fight against the tobacco industry.

Additional Information

• Tobacco Control Legislation in India:

• The Cigarettes and Other Tobacco Products Act (COTPA), passed in 2003, is the primary law that regulates the advertisement, production, and distribution of tobacco products in India.

• Section 4 of COTPA prohibits smoking in public places, while Section 6 prohibits the sale of tobacco products to minors (below 18 years of age) and within 100 yards of educational institutions.

• Health and Economic Impact:

• Tobacco use is a major risk factor for non-communicable diseases (NCDs) including lung cancer, cardiovascular diseases, and chronic obstructive pulmonary disease (COPD).

• According to the Global Adult Tobacco Survey (GATS), India has one of the highest numbers of tobacco users globally, which imposes a massive economic burden due to healthcare costs and lost productivity.

• Government Initiatives:

• The National Tobacco Control Programme (NTCP) was launched by the Government of India in 2007-08 with the aim of creating awareness and ensuring effective implementation of COTPA provisions.

• In September 2019, the Indian government enacted the Prohibition of Electronic Cigarettes Act to ban the production, import, sale, and advertisement of e-cigarettes to prevent health risks to the youth.

• WHO MPOWER Measures:

• The WHO introduced the MPOWER package to help countries implement the WHO Framework Convention on Tobacco Control (WHO FCTC).

• This includes Monitoring tobacco use, Protecting people from smoke, Offering help to quit, Warning about dangers, Enforcing bans on advertising, and Raising taxes on tobacco.

Important Points

• Global Statistics: Tobacco kills more than 8 million people each year, including an estimated 1.3 million non-smokers who are exposed to second-hand smoke.

• Tobacco Cultivation: India is the second-largest producer of tobacco in the world, with states like Andhra Pradesh, Gujarat, and Karnataka being the primary hubs for its cultivation.

• Constitutional Provision: Article 47 of the Constitution of India directs the State to endeavor to bring about the prohibition of the consumption of intoxicating drinks and of drugs which are injurious to health, providing a basis for tobacco control.

Q87. Answer: (d) 16

The correct answer is 16.

Key Points

• The Indian athletics contingent concluded their campaign at the Taiwan Athletics Open, held in Taipei on 7 and 8 June 2025, with a total of 16 medals.

• Out of the total 16 medals, the Indian athletes secured 7 Gold, 6 Silver, and 3 Bronze medals across various track and field events.

• The event took place at the Taipei Municipal Stadium in Chinese Taipei, serving as a significant international exposure for the athletes to improve their world rankings.

• On the opening day of the competition, India made a strong start by clinching seven medals, which set the tone for the final tally of 16.

• Leading the charge were prominent athletes such as D.P. Manu in javelin and Jyothi Yarraji in hurdles, both of whom secured top podium finishes.

Additional Information

• Individual Gold Medalists:

• D.P. Manu won the Gold medal in the men's javelin throw with a best effort of 81.58 meters, reaffirming his position as one of India's top throwers.

• Jyothi Yarraji clinched the Gold in the women's 100m hurdles, clocking a time of 13.23 seconds to dominate the field.

• Kiran Pahal secured the Gold in the women's 400m race with a timing of 52.51 seconds.

• In the shot put events, Tajinderpal Singh Toor (men) and Abha Khatua (women) both brought home Gold medals with throws of 19.17 meters and 17.56 meters respectively.

• Silver and Bronze Contributions:

• Nithya Ramraj finished just behind Jyothi Yarraji to take the Silver medal in the women's 100m hurdles, making it a 1-2 finish for India.

• The men's 4x400m relay team and other specialized track athletes contributed significantly to the 6 Silver and 3 Bronze count, ensuring India finished high in the overall standings.

Important Points

• Significance of the Event: The Taiwan Athletics Open is a World Athletics Continental Tour Bronze level meet, which is crucial for athletes aiming to accumulate ranking points for major championships like the World Athletics Championships and the Olympics.

• Performance Consistency: The 16-medal haul reflects the growing depth in Indian athletics, particularly in technical events like javelin throw and shot put, as well as sprint hurdles.

• Key Participants: Other notable participants included Nayana James, who won Gold in the women's long jump, contributing to the dominant 7 Gold medal tally.

• Administrative Body: The participation was facilitated by the Athletics Federation of India (AFI) to ensure that elite athletes maintain competitive rhythm during the international season.

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Q88. Answer: (d) Dr. APJ Abdul Kalam Island

The correct answer is Dr. APJ Abdul Kalam Island.

Key Points

• In July 2025, the Defence Research and Development Organisation (DRDO) successfully carried out two consecutive flight tests of the Pralay missile.

• The tests were conducted from the Integrated Test Range (ITR) located at Dr. APJ Abdul Kalam Island, off the coast of Odisha.

• Pralay is a surface-to-surface, short-range ballistic missile (SRBM) developed for battlefield use by the Indian Army.

• The missile was tested for different ranges and demonstrated high-level accuracy by hitting the designated target with precision, meeting all mission objectives.

• During these flight tests, all subsystems performed satisfactorily, and the missile's trajectory was monitored by various range sensors, including Radar, Electro-Optical Tracking System, and Telemetry stations.

Additional Information

• Missile Specifications and Features:

• Pralay is a solid-fuel, quasi-ballistic missile that has been developed to follow a path that makes it difficult for enemy interceptor missiles to track and destroy.

• It has a strike range of 150 to 500 kilometers and can carry a payload of 350 kg to 1000 kg.

• The missile is powered by a solid-propellant rocket motor and incorporates several new technologies, including state-of-the-art navigation and integrated avionics.

• It is designed to be launched from a mobile launcher, providing high strategic flexibility to the armed forces.

• Geographic Location of the Test Site:

• Dr. APJ Abdul Kalam Island, formerly known as Wheeler Island, is situated in the Bay of Bengal, approximately 10 kilometers off the coast of Odisha in the Bhadrak district.

• It serves as the primary missile testing facility for India, where most of the Agni and Prithvi series missiles are flight-tested.

• The island was renamed in September 2015 to honor the late Indian President and scientist, Dr. APJ Abdul Kalam.

• Defence Research and Development Organisation (DRDO):

• DRDO is the premier R&D organization under the Ministry of Defence, Government of India.

• It was established in 1958 by merging the Technical Development Establishment (TDEs) of the Indian Army and the Directorate of Technical Development & Production (DTDP) with the Defence Science Organisation (DSO).

• The organization is headquartered in New Delhi and works toward achieving self-reliance in critical defense technologies and systems.

Important Points

• Strategic Importance: The Pralay missile is intended to provide India with a significant counter-force capability against long-range artillery and tactical ballistic missiles of adversaries.

• Comparison: Experts often compare Pralay to the Russian Iskander and Chinese Dongfeng 12 missiles due to its ability to change its path mid-air to evade defense systems.

• Other Locations Mentioned:

• Chandipur: Another prominent site of the Integrated Test Range (ITR) in Odisha, typically used for testing short-range missiles, rockets, and surface-to-air missiles like Akash.

• Pokhran: Located in the Jaisalmer district of Rajasthan, it is famous as the site for India’s nuclear tests (1974 and 1998) and is also used for testing artillery guns and tanks.

• Balasore: The district in Odisha that houses the Integrated Test Range facilities at Chandipur.

• Technology: The Pralay missile uses a canister-based launch system, which allows for faster deployment and longer shelf-life by protecting the missile from environmental degradation.

Q89. Answer: (d) Rashmika Mandanna

The correct answer is Rashmika Mandanna.

Key Points

• In October 2024, the Ministry of Home Affairs (MHA) appointed popular Indian actress Rashmika Mandanna as the National Ambassador for Cyber Safety.

• The appointment was facilitated through the Indian Cyber Crime Coordination Centre (I4C), which is the specialized wing of the MHA tasked with handling cyber-related offenses.

• The primary objective of this collaboration is to strengthen the fight against cybercrime by raising awareness about online safety, digital hygiene, and the dangers of deepfake technology.

• As the National Ambassador, she will lead various nationwide campaigns to educate citizens on how to protect their digital identity and navigate the internet securely.

• The initiative specifically focuses on reaching the youth and vulnerable sections of society who are increasingly targeted by cyber fraudsters and malicious AI-generated content.

Additional Information

• Indian Cyber Crime Coordination Centre (I4C):

• Established in 2018 by the Ministry of Home Affairs, I4C provides a framework and ecosystem for Law Enforcement Agencies (LEAs) to deal with cybercrimes in a coordinated manner.

• It operates the National Cybercrime Reporting Portal (www.cybercrime.gov.in), which allows victims to report financial frauds and crimes against women and children online.

• The centre also manages the National Cybercrime Helpline Number 1930, which provides immediate assistance to victims of cyber financial fraud.

• Context of the Appointment:

• Rashmika Mandanna became a vocal advocate for cyber legislation after she was targeted by a viral deepfake video in late 2023.

• Her personal experience with identity theft and AI misuse makes her a relatable figure for the CyberSafe India campaign, emphasizing the importance of legal protection and strict reporting.

• Ministry of Home Affairs (MHA) Role:

• Under the leadership of Union Home Minister Shri Amit Shah, the MHA has prioritized cybersecurity as a critical component of national security.

• The ministry runs the 'Cyber Dost' handles on various social media platforms to provide real-time tips and advisories on avoiding phishing, vishing, and ransomware attacks.

Important Points

• Cybersecurity Statistics: According to data from I4C, India witnesses a high volume of cybercrime complaints daily, with a significant portion being financial scams and social media-related harassment.

• Deepfake Technology: This refers to Artificial Intelligence (AI) tools used to create realistic but fake audio or video clips. The Government of India has issued several advisories to social media intermediaries under the IT Rules, 2021, to curb the spread of such content.

• Digital Hygiene: This involves practices such as using Two-Factor Authentication (2FA), setting strong passwords, avoiding suspicious links, and keeping software updated to prevent hacking.

• National Importance: By appointing a National Ambassador, the government aims to create a Jan Andolan (People's Movement) for a Cyber-Secure India, ensuring that the digital economy remains robust and safe for all users.

Q90. Answer: (c) Bihar

The correct answer is Bihar.

Key Points

• The state of Bihar held its Legislative Assembly elections in late 2025, resulting in the formation of a new government led by the NDA (National Democratic Alliance).

• The NDA coalition, primarily comprising the Bharatiya Janata Party (BJP) and the Janata Dal (United) [JD(U)] along with other regional partners, secured a majority in the 243-member house.

• The swearing-in ceremony took place in November 2025, marking the commencement of a new term for the state executive in Patna.

• The Election Commission of India (ECI) conducted the polls in multiple phases across the state to ensure a smooth democratic process. Hence, the correct answer is Bihar.

• The formation of the government followed the formal invitation by the Governor of Bihar to the leader of the single largest coalition that proved its majority on the floor of the house.

Additional Information

• Bihar Legislative Assembly (Vidhan Sabha):

• The Bihar Vidhan Sabha consists of 243 seats. A party or coalition requires a minimum of 122 seats to claim a simple majority.

• The state also has a Legislative Council (Vidhan Parishad), making it one of the few states in India with a bicameral legislature.

• Election Cycles of Other States:

• Uttar Pradesh: The last assembly elections were held in 2022, and the next elections are scheduled for 2027.

• Jharkhand: Elections in Jharkhand were scheduled for late 2024, making the 2025 timeframe specific to Bihar.

• Assam: The Assam assembly elections were held in 2021, with the next cycle due in 2026.

• Constitutional Role of the Governor:

• Under Article 164 of the Constitution of India, the Chief Minister is appointed by the Governor, and other ministers are appointed on the advice of the Chief Minister.

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• The Governor administers the oath of office and secrecy to the members of the council of ministers.

Important Points

• National Democratic Alliance (NDA): It is a center-right political alliance in India led by the BJP. It was originally formed in 1998.

• Model Code of Conduct (MCC): During the 2025 elections, the ECI enforced the MCC to ensure free and fair polling, prohibiting the ruling government from announcing new schemes once the election dates were declared.

• Anti-Defection Law: Provisions under the 10th Schedule of the Constitution remain critical during government formation to prevent floor-crossing by elected MLAs.

• Voter Turnout: The Bihar elections are historically significant for high political engagement and the use of EVMS (Electronic Voting Machines) with VVPAT (Voter Verifiable Paper Audit Trail) across all polling stations.

Q91. Answer: (d) Harvinder Singh

The correct answer is Harvinder Singh.

Key Points

• Harvinder Singh scripted history in 2025 by becoming the first-ever para-archer from India to be conferred with the Padma Shri, the nation's fourth-highest civilian award.

• This recognition came after his monumental achievement at the Paris 2024 Paralympic Games, where he won the Gold medal in the Men's Individual Recurve Open category.

• His victory in Paris was particularly significant as it marked India's first-ever gold medal in archery at either the Olympic or Paralympic Games.

• Prior to his 2024 success, Singh had already established himself as a pioneer by winning a Bronze medal at the Tokyo 2020 Paralympic Games, which was the first-ever Paralympic medal for India in the discipline of archery.

• The Government of India announced this honor on the eve of the 76th Republic Day in January 2025, recognizing his exceptional contribution to sports and his role in elevating the profile of para-archery in the country.

Additional Information

• Other Para-Archers:

• Rakesh Kumar is a world-class para-archer who won a Bronze medal in the Mixed Team Compound event at the Paris 2024 Paralympics alongside Sheetal Devi.

• Jyoti Balyan is a prominent female para-archer who represented India at the Tokyo 2020 Paralympics and has won several medals at the Asian Para Games and World Championships.

• Vivek Chikara is an accomplished recurve archer who won a Gold medal at the 2019 Asian Para Archery Championships and reached the quarterfinals at the Tokyo Paralympics.

• Harvinder Singh's Career Milestones:

• He won a Gold medal at the 2018 Asian Para Games held in Jakarta, which was a turning point in his international career.

• He also secured a Bronze medal at the 2022 Asian Para Games (held in 2023) in Hangzhou, China.

• In 2021, he was bestowed with the Major Dhyan Chand Khel Ratna Award, India's highest sporting honor, for his outstanding performance in the Tokyo Paralympics.

Important Points

• Personal Background: Harvinder Singh hails from Kaithal, Haryana. Despite facing physical challenges due to a dengue treatment side effect in his childhood that affected his legs, he pursued both sports and academics with excellence.

• Academic Excellence: He is not only a top-tier athlete but also a highly educated individual, holding a Ph.D. in Economics from Punjabi University, Patiala.

• Padma Awards 2025: The Padma Shri is awarded for "distinguished service" in any field. In 2025, the list included several sportspersons, but Singh's inclusion was historic for the archery community in India, as no other archer (para or able-bodied) had previously reached this specific milestone within the para-discipline category for this award year.

Q92. Answer: (d) SCO Summit in China

The correct answer is SCO Summit in China.

Key Points

• During the meeting of the National Security Advisers (NSAs) of the Shanghai Cooperation Organisation (SCO) held in China in June 2025, India’s NSA Ajit Doval strongly advocated for a unified counter-terrorism stance among member nations.

• He emphasized that the SCO must strictly adhere to the principle of zero tolerance for terrorism in all its forms and manifestations, including cross-border terrorism and the financing of terror activities.

• NSA Ajit Doval called for the strengthening of the Regional Anti-Terrorist Structure (RATS), which is the permanent organ of the SCO headquartered in Tashkent, to enhance intelligence sharing and technical cooperation.

• He also highlighted the rising threat of cyber-terrorism and the use of emerging technologies like drones and artificial intelligence by terror groups, urging the SCO to develop a collaborative framework to counter these asymmetric threats.

• The June 2025 summit served as a platform where India reiterated its stand on territorial integrity and sovereignty, particularly concerning connectivity projects within the Eurasian region.

Additional Information

• Shanghai Cooperation Organisation (SCO):

• Established in June 2001 in Shanghai, it is a permanent intergovernmental international organization.

• The current members include China, Russia, India, Pakistan, Kazakhstan, Kyrgyzstan, Tajikistan, Uzbekistan, and Iran.

• India and Pakistan became permanent members in 2017 during the Astana Summit. The headquarters of the SCO Secretariat is located in Beijing.

• G20 Summit:

• The G20 is a premier forum for international economic cooperation. India successfully hosted the 18th G20 Summit in New Delhi in September 2023 under the theme Vasudhaiva Kutumbakam.

• The 2025 G20 Summit is scheduled to be hosted by South Africa, not New Delhi. Hence, option 2 is incorrect.

• ASEAN Summit:

• The Association of Southeast Asian Nations (ASEAN) is a regional grouping that promotes economic, political, and security cooperation among its 10 member states in Southeast Asia.

• While India is a dialogue partner, the ASEAN Summit focuses primarily on Indo-Pacific stability and maritime security. Hence, option 3 is incorrect.

• EU Summit:

• The European Union (EU) Summit (or European Council) is held in Brussels, Belgium, where heads of state of EU members meet to define political directions.

• India engages with the EU through India-EU Summits, but the primary security focus for NSA Ajit Doval in June 2025 was the Eurasian security architecture. Hence, option 1 is incorrect.

Important Points

• SECURE Strategy: At various SCO meetings, India has proposed the SECURE acronym: Security for citizens, Economic development, Connectivity in the region, Unity, Respect for sovereignty and integrity, and Environment protection.

• Counter-Terrorism Mechanisms: The RATS-SCO remains the most vital mechanism for counter-terror cooperation, where India has consistently pushed for the adoption of a Comprehensive Convention on International Terrorism (CCIT) at the United Nations level.

• NSA's Role: The National Security Advisor is the primary advisor to the Prime Minister of India on national and international security policy, currently held by Ajit Doval, an IPS officer of the 1968 batch.

Q93. Answer: (d) Subhasish Bose

The correct answer is Subhasish Bose.

Key Points

• Subhasish Bose, the veteran defender and captain of Mohun Bagan Super Giant, was named the AIFF Men’s Player of the Year for the 2024-25 season. The announcement was made during the All India Football Federation (AIFF) annual awards ceremony held in May 2025.

• He was recognized for his stellar defensive performances and his leadership in guiding Mohun Bagan Super Giant to significant success in domestic competitions, including the Indian Super League (ISL).

• In the women's category, the prestigious AIFF Women’s Player of the Year award was conferred upon Indumathi Kathiresan for her exceptional display of skill and consistency in the national team midfield.

• The Men’s Coach of the Year award was won by Khalid Jamil, who has been instrumental in the progress of Jamshedpur FC. He remains one of the most prominent Indian coaches in the top flight of Indian football.

• The awards are based on performances during the 2024-25 footballing calendar, taking into account contributions to both club and the Indian National Team.

Additional Information

• Emerging Players:

• Brison Fernandes, who plays for FC Goa, was named the AIFF Men’s Emerging Player of the Year for his breakthrough season in the midfield.

• The Women’s Emerging Player of the Year award was given to Neha, acknowledging her rising potential in the Indian Women's League (IWL).

• Goalkeeping Excellence:

• Vishal Kaith, the goalkeeper for Mohun Bagan Super Giant, was honored with the Best Goalkeeper award for his remarkable number of clean sheets and vital saves throughout the season.

• Coaching Awards:

• While Khalid Jamil took the men's coaching honors, Sukla Dutta was recognized as the Women's Coach of the Year for her tactical contributions to women's football development in the country.

• About AIFF:

• The All India Football Federation (AIFF) is the governing body for football in India. It was founded in 1937 and is headquartered in Dwarka, New Delhi.

• The federation manages the Indian National Team, the Indian Super League (ISL), the I-League, and the Indian Women's League. It became affiliated with FIFA in 1948.

• The AIFF Awards serve as the highest official recognition for football players and officials in India, celebrating excellence across various tiers of the sport.

Q94. Answer: (c) United Nations Framework Convention on Climate Change (UNFCCC)

The correct answer is United Nations Framework Convention on Climate Change (UNFCCC).

Key Points

• The Conference of the Parties (COP) serves as the supreme decision-making body of the United Nations Framework Convention on Climate Change (UNFCCC). It is responsible for reviewing the implementation of the Convention and any other legal instruments adopted by the body.

• COP30 is scheduled to be held in November 2025. The host city for this milestone event is Belém, Brazil, marking a significant return of the climate summit to the Amazon region.

• The primary mandate of the UNFCCC is to achieve the stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system.

• During these annual meetings, representatives from 198 Parties (197 countries plus the European Union) gather to negotiate climate actions, assess progress, and refine strategies such as the Paris Agreement.

• The designation COP30 specifically refers to the 30th session of the Conference of the Parties to the UNFCCC. While other conventions like UNCBD also use the term COP, their numbering and meeting cycles differ. Hence, the correct answer is United Nations Framework Convention on Climate Change (UNFCCC).

Additional Information

• UNFCCC Origins: The convention was adopted on May 9, 1992, and was opened for signature at the Earth Summit in Rio de Janeiro, Brazil. It officially entered into force on March 21, 1994.

• Major Agreements: The UNFCCC provides the framework for two major international treaties: the Kyoto Protocol (1997) and the Paris Agreement (2015). The Paris Agreement aims to limit the global temperature increase to well below 2 degrees Celsius above pre-industrial levels.

• UNCBD (United Nations Convention on Biological Diversity): This is a separate "Rio Convention" focused on the conservation of biological diversity and the sustainable use of its components. Its COPs usually occur biennially (every two years).

• CITES: The Convention on International Trade in Endangered Species of Wild Fauna and Flora is an international agreement between governments to ensure that international trade in specimens of wild animals and plants does not threaten the survival of the species.

• UNCAC: The United Nations Convention Against Corruption is the only legally binding universal anti-corruption instrument, managed by the UNODC.

Important Points

• Significance of COP30: COP30 in 2025 is considered a critical juncture because parties are expected to submit their updated Nationally Determined Contributions (NDCs), which are the climate action plans to cut emissions and adapt to climate impacts.

• Historical Context: The first-ever COP (COP1) was held in Berlin, Germany, in 1995. Since then, the meeting has rotated annually among the five recognized UN regions: Africa, Asia-Pacific, Eastern Europe, Latin America and the Caribbean, and Western Europe and Others.

• The Secretariat: The UN Climate Change Secretariat is the United Nations entity tasked with supporting the global response to the threat of climate change. It is located in Bonn, Germany.

• Financial Mechanisms: To support developing countries, the UNFCCC operates financial mechanisms including the Global Environment Facility (GEF) and the Green Climate Fund (GCF).

Q95. Answer: (b) Kohima, Visakhapatnam, Bhubaneswar

p>The correct answer is Kohima, Visakhapatnam, Bhubaneswar.

Key Points

• The National Annual Report & Index on Women's Safety (NARI) 2025 is a significant analytical tool used to gauge the safety landscape for women in major Indian urban centers. According to the report, Kohima, Visakhapatnam, and Bhubaneswar have been identified as the safest cities for women.

• The index evaluates cities based on various performance indicators, including the Crime Rate against Women, the effectiveness of Police Patrolling, and the availability of Safe Public Transport.

• Kohima, located in Nagaland, secured a top position due to its low incidence of reported violent crimes and high levels of community-based security. Hence, statement 2 is correct.

• Visakhapatnam in Andhra Pradesh demonstrated excellence in urban safety infrastructure, specifically in the implementation of CCTV surveillance and emergency response systems.

• Bhubaneswar, the capital of Odisha, was praised for its urban planning initiatives that prioritize well-lit streets and dedicated help desks for women in public areas.

• Cities like Delhi, Patna, and Lucknow often rank lower in such indices due to higher crime reporting numbers and challenges in maintaining safe public spaces during night hours. Hence, statements 1, 3, and 4 are incorrect.

Additional Information

• NARI 2025 Methodology:

• The NARI index employs a multi-dimensional approach, combining quantitative data from the National Crime Records Bureau (NCRB) with qualitative surveys on women's perception of safety.

• The 2025 edition placed a 40% weightage on infrastructure (lighting, transport, and last-mile connectivity) and 30% on institutional frameworks (police-to-population ratio and specialized women's cells).

• City-Specific Features:

• Kohima: Known for its high literacy rate and social structure where women feel safer in public spaces even during evening hours.

• Visakhapatnam: Often called the 'City of Destiny', it has integrated Smart City technology into its 'Dish' initiative to ensure rapid police intervention.

• Bhubaneswar: The city has focused on gender-sensitive urban design, ensuring that parks and transit hubs are accessible and safe for all.

• Comparison with Metros:

• While metropolitan hubs like Mumbai and Bengaluru have advanced systems, the NARI 2025 highlights that tier-2 cities are becoming safer due to less urban sprawl and more efficient community monitoring.

Important Points

• Safety Initiatives: The Safe City Project, a central government initiative, has provided funding to cities to install Panic Buttons and GPRS-integrated systems in public transport.

• Reporting vs. Incidence: High ranks in the index often correlate with cities that have established one-stop centers (Sakhi Centers) where women can report issues without social stigma.

• Year 2025 Trends: The NARI 2025 report observed a 15% improvement in the overall safety score of Indian cities compared to 2020, largely attributed to increased digital surveillance and better lighting in suburban areas.

Q96. Answer: (a) Novak Djokovic

The correct answer is Novak Djokovic.

Key Points

• Novak Djokovic achieved a historic milestone in 2025 by becoming the oldest man to reach the semi-finals of an ATP Masters 1000 event.

• At the age of 37, the Serbian tennis legend surpassed the previous record for longevity at this elite level of competition, which was notably held by Roger Federer.

• This feat was accomplished during the early season of 2025, reinforcing his position as one of the most durable athletes in the history of professional tennis.

• His progression to the semi-finals at such an advanced age demonstrates his exceptional physical conditioning, tactical intelligence, and ability to compete against much younger opponents on the ATP Tour.

• By reaching this stage, Djokovic continues to extend his own records within the Masters 1000 category, where he already holds the record for the most titles won in history.

Additional Information

• ATP Masters 1000 Tournaments:

• These are a series of nine annual tennis tournaments that are considered the most prestigious events on the ATP Tour after the four Grand Slams and the ATP Finals.

• The series includes iconic tournaments such as Indian Wells, Miami Open, Monte-Carlo Masters, Madrid Open, Italian Open, Canadian Open, Cincinnati Masters, Shanghai Masters, and Paris Masters.

• Winners of these tournaments are awarded 1,000 ranking points, making them vital for maintaining a high world ranking.

• Novak Djokovic's Career Records:

• As of 2025, Djokovic holds the record for the most Grand Slam titles won by a man (24 or more) and has spent the most weeks as world number 1 in tennis history.

• He is the only player to achieve the "Career Golden Masters," which involves winning all nine ATP Masters 1000 tournaments; remarkably, he has completed this feat twice.

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• Comparison with Peers:

• The "Big Three"—consisting of Novak Djokovic, Rafael Nadal, and Roger Federer—dominated the sport for over two decades.

• While Roger Federer was previously the benchmark for late-career success, reaching Masters 1000 finals in his late 30s, Djokovic has now set a new standard for longevity and consistency in the 2025 season.

Important Points

• Significance of the Record: Reaching the semi-finals of a Masters 1000 event requires winning multiple matches against top-ranked players in a best-of-three-sets format, which demands high intensity and stamina.

• Age and Performance: In the modern era of tennis, very few players remain competitive in the Top 10 beyond the age of 35. Djokovic's success in 2025 is attributed to his plant-based diet, flexibility training, and mental resilience.

• 2025 Season Context: The 2025 season is a pivotal year for the transition of power in tennis, as younger stars like Carlos Alcaraz and Jannik Sinner challenge the established veterans, making Djokovic's record even more impressive.

Q97. Answer: (d) Systemic deregulation

The correct answer is Systemic deregulation.

Key Points

• The Economic Survey 2023-24 (which provides the outlook for 2024-25), presented by Union Finance Minister Nirmala Sitharaman on July 22, 2024, identifies systemic deregulation as a pivotal reform for India's long-term growth trajectory.

• The survey highlights that the previous "license-permit-quota raj" has transitioned into a compliance burden, which continues to stifle the growth of the Private Sector and MSMEs.

• It emphasizes the need to remove the "triad of constraints"—namely regulatory burdens at the sub-national level, land availability, and labour market rigidities—to unlock the "animal spirits" of Indian entrepreneurs. Hence, statement 4 is correct.

• The document argues that Price control regimes often lead to market distortions and are not advocated as a primary long-term growth engine in the current liberalized economic framework. Hence, statement 1 is incorrect.

• The survey does not focus on the Nationalisation of banks; instead, it discusses the health of the Banking Sector and the role of Public Sector Banks (PSBs) in financing the Capital Expenditure (Capex) cycle. Hence, statement 2 is incorrect.

• Rather than Public sector expansion in terms of administrative growth, the survey advocates for the Private Sector to take the lead in investment and employment generation while the government acts as a facilitator. Hence, statement 3 is incorrect.

Additional Information

• GDP Growth Projections: The Economic Survey 2024-25 projects a real GDP growth rate of 6.5% to 7%, noting that the Indian economy is on a steady path despite global geopolitical uncertainties and supply chain disruptions.

• Viksit Bharat 2047: The survey lays out the roadmap for India to become a Developed Nation by the year 2047, emphasizing structural reforms in Agriculture, Energy Transition, and Digital Public Infrastructure (DPI).

• Capital Expenditure (Capex): The Government of India has significantly increased its Capex outlay, which has been a major driver of domestic demand and infrastructure development in FY24 and FY25.

• Employment Generation: A critical theme of the 2024-25 outlook is the requirement for the private sector to create approximately 7.85 million jobs annually in the non-farm sector to absorb the growing workforce.

• Inflation Management: The survey notes that Retail Inflation has been brought down to 5.4% in FY24, staying within the Reserve Bank of India's (RBI) comfort zone of 2% to 6%.

Important Points

• Sub-national Reforms: The survey stresses that while central reforms have been significant, the next wave of deregulation must happen at the State Government level to truly improve the Ease of Doing Business.

• Agriculture Sector: It calls for a "productive" shift in agriculture, moving from subsidy-based support to innovation-led growth to ensure food security and higher rural incomes.

• Green Growth: India's commitment to Net Zero emissions is highlighted through the National Green Hydrogen Mission and the promotion of Electric Vehicles (EVs), which are seen as new pillars of industrial growth.

• Digital Transformation: The India Stack (Aadhaar, UPI, DigiLocker) is recognized as a global model for Financial Inclusion and reducing transaction costs for the common man and businesses alike.

Q98. Answer: (b) 130th

The correct answer is 130th.

Key Points

• India has been ranked 130th in the Human Development Index (HDI) for the year 2025.

• The Human Development Index (HDI) is a composite statistical tool used to rank countries by level of "human development" and is released annually by the United Nations Development Programme (UNDP).

• The ranking is based on a score that reflects achievements in key dimensions of human development, placing India within the Medium Human Development category among the 193 countries and territories evaluated.

• The index considers several critical indicators, including life expectancy at birth, expected years of schooling, mean years of schooling, and Gross National Income (GNI) per capita.

• India's position at 130th signifies the ongoing transition and progress in social and economic parameters, though it highlights the need for further improvements in healthcare and educational infrastructure compared to global leaders.

Additional Information

• Dimensions of HDI:

• Long and Healthy Life: This is measured by Life Expectancy at Birth. It reflects the overall health and quality of the medical system in a country.

• Knowledge: This dimension is measured by a combination of Mean Years of Schooling (for adults aged 25 years and older) and Expected Years of Schooling (for children of school-entering age).

• Decent Standard of Living: This is measured by Gross National Income (GNI) per capita adjusted for Purchasing Power Parity (PPP) in US Dollars.

• The United Nations Development Programme (UNDP):

• The UNDP was formed on November 22, 1965, and is headquartered in New York City. It is the leading agency of the United Nations focused on international development.

• The Human Development Report (HDR) has been published by the UNDP since 1990 to emphasize that people and their capabilities should be the ultimate criteria for assessing the development of a country.

• Scoring System:

• The HDI value ranges between 0 and 1. Countries with a score of 0.800 or above are categorized as Very High Human Development, while those below 0.550 are categorized as Low Human Development.

Important Points

• Origin of HDI: The index was created by Pakistani economist Mahbub ul Haq and Indian economist Amartya Sen in 1990 to shift the focus of development economics from national income accounting to people-centered policies.

• Complementary Indices: The HDR also features other indices such as the Inequality-adjusted HDI (IHDI), the Gender Development Index (GDI), the Gender Inequality Index (GII), and the Multidimensional Poverty Index (MPI).

• India's Historical Trend: Since 1990, India's HDI value has shown a consistent upward trend, largely driven by significant increases in life expectancy and GNI per capita, despite periodic fluctuations in global rankings.

Q99. Answer: (c) Mykolas Alekna

The correct answer is Mykolas Alekna.

Key Points

• Mykolas Alekna, a prominent Lithuanian athlete, etched his name in sports history by becoming the first individual to throw a discus beyond the 75-meter mark.

• In April 2025, during a specialized throwing competition, he recorded a phenomenal distance of 75.56 m, effectively setting a new World Record in the men’s discus event.

• The record-breaking performance took place in Ramona, Oklahoma, a location frequently chosen by elite throwers for its favorable wind conditions that aid in achieving maximum flight for the discus.

• This achievement broke a barrier that had long been considered nearly impossible to reach, solidifying Alekna's position as one of the greatest talents in modern Track and Field history.

• At the time of this record, Mykolas Alekna was representing the University of California, Berkeley in collegiate competitions while competing on the international stage for Lithuania.

Additional Information

• Family Legacy in Athletics:

• Mykolas Alekna is the son of the legendary Virgilijus Alekna, who is a two-time Olympic champion (2000 Sydney and 2004 Athens) and a former world record contender himself.

• Before Mykolas broke the record, Virgilijus Alekna held the second-longest throw in history with a mark of 73.88 m, set in the year 2000.

• The Previous World Record:

• The men’s discus world record was previously held by Jürgen Schult of East Germany, who threw 74.08 m on June 6, 1986.

• Schult's record was one of the longest-standing records in men's athletics, lasting for nearly 39 years before being eclipsed by the 75.56 m mark.

• Technical Specifications of the Discus:

• In international senior men's competitions, the discus is a circular plate made of metal or wood with a metal rim, weighing exactly 2 kilograms (approximately 4.4 lbs).

• The diameter of the men's discus is mandated to be between 219 mm and 221 mm according to World Athletics regulations.

• Significance of the 75-Meter Barrier:

• Much like the sub-4-minute mile or the 9.6-second 100m sprint, the 75-meter mark in discus was a significant psychological and physical milestone that had eluded athletes for decades.

• Achieving this distance requires a perfect combination of explosive power, rotational speed, and aerodynamic precision.

Important Points

• Geography of the Record: The town of Ramona in Oklahoma, USA, has become famous in the athletics world for "The Oklahoma Throw Series," where the open fields and steady updrafts provide ideal conditions for records to fall.

• Career Highlights: Before setting the world record, Mykolas Alekna had already secured a Silver medal at the 2022 World Athletics Championships at the age of 19 and a Bronze medal at the 2023 World Championships.

• Competition: Other top athletes mentioned in the options, such as Matthew Denny (Australia) and Sam Mattis (USA), are also world-class competitors who have consistently reached the finals of major Olympic and World Championship events.

Q100. Answer: (d) Department of Economic Affairs

The correct answer is Department of Economic Affairs.

Key Points

• The Department of Economic Affairs (DEA), which operates under the Ministry of Finance, is the nodal agency that invited public comments on the Draft Framework of India's Climate Finance Taxonomy in May 2025.

• The primary objective of this framework is to provide a comprehensive classification system that defines which economic activities can be labeled as "sustainable" or "green" within the Indian economy.

• By establishing a clear taxonomy, the Union Government aims to mobilize large-scale capital toward climate-friendly projects while significantly reducing the risk of greenwashing in the financial markets.

• The draft was developed through extensive consultation with a task force that included representatives from the Ministry of Environment, Forest and Climate Change (MoEFCC), the Reserve Bank of India (RBI), and the Securities and Exchange Board of India (SEBI).

• This initiative is a critical step in aligning India's financial sector with its international commitments, such as those made under the Paris Agreement and the Panchamrit targets announced at COP26. Hence, the correct answer is the Department of Economic Affairs.

Additional Information

• Understanding Climate Finance Taxonomy:

• A Taxonomy acts as a dictionary for investors, banks, and policymakers to identify projects that contribute to environmental objectives like climate change mitigation and adaptation.

• The India-specific taxonomy focuses on sectors such as Renewable Energy, Energy Efficiency, Sustainable Transport, Water and Waste Management, and Afforestation.

• It helps in the issuance of Sovereign Green Bonds, which the Government of India began issuing in the 2022-23 financial year to fund green infrastructure.

• Net Zero Target 2070:

• India has committed to reaching Net Zero emissions by the year 2070. Achieving this requires an estimated investment of trillions of dollars over the coming decades.

• The taxonomy ensures that global and domestic investors have the transparency needed to invest in low-carbon technologies and resilient infrastructure.

• Roles of Other Agencies:

• NITI Aayog: Acts as the premier policy think tank of the Government of India, providing strategic and technical advice but is not the lead for financial regulatory frameworks like the taxonomy.

• National Statistical Office (NSO): Responsible for the collection and analysis of statistical data and the implementation of the National Sample Survey.

• Department of Financial Services (DFS): Handles issues related to Banking, Insurance, and Pension Reforms, supporting the broader fiscal goals of the Ministry of Finance.

Important Points

• Regulatory Convergence: The Draft Framework ensures that ESG (Environmental, Social, and Governance) reporting by Indian companies is standardized and consistent with global best practices like the EU Taxonomy.

• Institutional Support: The Reserve Bank of India (RBI) has also been active in this space, having released a Framework for Acceptance of Green Deposits in 2023 to encourage sustainable finance at the retail level.

• Economic Impact: By creating a regulated green finance ecosystem, India hopes to attract Foreign Direct Investment (FDI) into clean energy sectors, which is vital for maintaining an 8% plus GDP growth rate while decarbonizing the grid.

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