RRB ALP CBT-I 2024 Official Paper (Held On: 28 Nov, 2024 Shift 1) (Previous Year Paper)

RRB Group D • 2024 • 75 questions • 60 minutes • Answer key and solutions

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STAGE I (CBT I)

Q1. The area of the largest triangle that can be inscribed in a semi-circle of radius 6 cm is:

(a) 36 cm²
(b) 72 cm²
(c) 38 cm²
(d) 76 cm²

Q2. Which of the following options should come in place of the question mark (?) in the given series based on the English alphabetical order?

RJZ, PMW, NPT, LSQ, ?

(a) IVN
(b) JVN
(c) JUN
(d) IVM

Q3. A sum of money, on compound interest, amounts to Rs. 578.40 in 2 years and to Rs. 614.55 in 3 years. The rate of interest per annum, in case of annual compounding, is:

(a) 8 1⁄3%
(b) 6 ¼%
(c) 4%
(d) 5%

Q4. The problem of myopia in human eye can be corrected by using:

(a) a biconvex lens of suitable power
(b) a plain glass plate
(c) a concave lens of suitable power
(d) a convex lens of suitable power

Q5. Anju ranked 18^(th) from the bottom and 15^(th) from the top in his class. How many students are there in his class?

(a) 32
(b) 33
(c) 31
(d) 21

Q6. The distance between the pole and focus of a spherical mirror, in terms of its radius of curvature R, is equal to:

(a) R/2
(b) R/4
(c) 2R
(d) R

Q7. On 26 June 2024, the Defence Research and Development Organisation (DRDO) handed over which of the following to the Indian Navy?

(a) Long Range Surface-to-Air Missile
(b) Advanced Torpedo
(c) Anti-Submarine Warfare Helicopter
(d) Medium Range-Microwave Obscurant Chaff Rocket (MR-MOCR)

Q8. Which of the following solutions is identified by smell?

(a) Sugar in water
(b) Salt in water
(c) Potassium permanganate in water
(d) Dettol in water

Q9. In the following number pairs, the second number is obtained by applying certain mathematical operations to the first number. Which numbers should replace X and Y so that the pattern followed by the two numbers on the left side of :: is the same as that on the right side of ::?

(NOTE: Operations should be performed on the whole numbers, without breaking down the numbers into its constituent digits. E.g. 13 - Operations on 13 such as adding,

subtracting, multiplying etc. to 13 can be performed. Breaking down 13 into 1 and 3 and then performing mathematical operations on 1 and 3 is not allowed.)

X : 23 : : 476 : Y

(a) X = 322, Y = 34
(b) X = 368, Y = 27
(c) X = 346, Y = 29
(d) X = 314, Y = 21

Q10. What is the least positive number that can be added to 2488 so that it is completely divisible by 3, 4, 5 and 6?

(a) 34
(b) 28
(c) 32
(d) 42

Q11. Which of the following teams was the winner of the 17^(th) Edition of Indian Premier league in 2024?

(a) Kolkata Knight Riders
(b) Mumbai Indians
(c) Delhi Capitals
(d) Gujarat Titans

Q12. If 'A' stands for '÷', 'B' stands for '×', 'C' stands for '+', and 'D' stands for '-', what will come in place of the question mark '?' in the following equation?

121 C 21 D 11 A 11 B 121 = ?

(a) 11
(b) 31
(c) 21
(d) 41

Q13. What will come in the place of '?' in the following equation, if '+' and '−' are interchanged and '×' and '÷' are interchanged?

8 × 2 + 3 − 2 ÷ 6 = ?

(a) 14
(b) 11
(c) 12
(d) 13

Q14. If the perimeters of two similar triangles ABC and DEF are 75 cm and 40 cm respectively, and if BC is 15 cm, then the length of EF is:

(a) 6 cm
(b) 10 cm
(c) 12 cm
(d) 8 cm

Q15. Which of the following formulas is used to calculate the volume by volume percentage of a solution?

(a) (Mass of solute)/(Volume of solution) × 100
(b) (Mass of solute)/(Mass of solution) × 100
(c) (Volume of solute)/(Volume of solution) × 100
(d) (Volume of solution)/(Mass of solute) × 100

Q16. A ball of mass 0.5 kg is thrown vertically upwards and rises to a height of 20 m. The approximate initial velocity of the ball is:

(a) 20 m/s
(b) 15 m/s
(c) 25 m/s
(d) 10 m/s

Q17. HD Kumaraswamy, who won from Mandya parliamentary seat in Karnataka in 2024 general elections and became Minister of Heavy Industries, belongs to which political party?

(a) Bhartiya Janata Party
(b) Janata Dal (S)
(c) Communist Party of India
(d) BSR Congress

Q18. In an election between two candidates, one got 55% of the total valid votes and 20% of the votes were invalid. If the total number of votes was 7500, then the winner won the election by a majority of _____ votes.

(a) 750
(b) 800
(c) 600
(d) 700

Q19. Which of the following is a cup-shaped part of nephron with which each capillary cluster in the kidney is associated?

(a) Proximal convoluted tubule
(b) Bowman's capsule
(c) Distal convoluted tubule
(d) Glomerulus

Q20. In an election, only two candidates contested. One candidate secured 70% of the valid votes and won by a majority of 172 votes. The total number of valid votes was:

(a) 570
(b) 560
(c) 430
(d) 480

Q21. The ___ moves water and minerals obtained from the soil while ____ transports products of photosynthesis from the leaves where they are synthesised to other parts of the plant.

(a) collenchyma, parenchyma
(b) phloem, xylem
(c) parenchyma, collenchyma
(d) xylem, phloem

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Q22. Seven people, A, B, C, D, E, F and G are sitting in a row, facing north. E sits third from the left end. Only three people sit between G and E. B is the immediate neighbour of C and F. D sits second to the left of C.

How many people sit between A and F?

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

Q23. Which of the following carbon compounds is classified as an alcohol?

(a) Propanal
(b) Propanol
(c) Propanoic
(d) Propanone

Q24. Refer to the following number and symbol series and answer the question that follows. Counting to be done from left to right only.

(Left) 9 # 1 * £ 2 & % 4 @ 6 8 $ 7 & 3 2 5 (Right)

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

(a) Two
(b) More than two
(c) Zero
(d) One

Q25. What happens when acid is mixed with water?

(a) It will increase the concentration of hydronium ions per unit volume.
(b) It will increase the concentration of hydroxyl ions per unit volume.
(c) There will be no effect on the concentration of ions.
(d) It will decrease the concentration of hydronium ions per unit volume.

Q26. FKUZ is related to CORD in a certain way based on the English alphabetical order. In the same way, QJKH is related to NNHL. To which of the following options is JIBP related, following the same logic?

(a) HOZS
(b) HMZU
(c) GMYT
(d) FNAT

Q27. What repo rate was declared by the Reserve Bank of India's Monetary Policy Committee (MPC) on 9^(th) October 2024?

(a) 6.25%
(b) 6.10%
(c) 6.75%
(d) 6.50%

Q28. If cos ^4 θ - sin ^4 θ = k, then the value of (1-k)/(1+k) is:

(a) $\tan^2\theta$
(b) $\sin^2\theta$
(c) $\cot^2\theta$
(d) $\operatorname{cosec}^2\theta$

Q29. DIJH is related to KPQO in a certain way based on the English alphabetical order. In the same way, MRSQ is related to TYZX. To which of the following options is BGHF related, following the same logic?

(a) IMQN
(b) INOM
(c) JMON

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(d) JNQM

Q30. In this question, two statements, I and II, have been given. These statements maybe independent causes, or effects of independent causes or a common cause. One of the statements maybe the effect of the other statement. Read both[1] the statements and select the correct answer.

I. Government authorities of city X are finding different solutions to reduce air pollution in the city during winter.

II. City X has seen an acute rise in asthma cases during the last winter.

(a) Both I and II are independent causes.
(b) Both I and II are effects of independent causes.
(c) I is the cause and II is its possible effect.
(d) II is the cause and I is its possible effect.

Q31. The kinetic energy possessed by a body of mass 2 kg is 100 J. The velocity of the body will be:

(a) 10 m/s
(b) 0 m/s
(c) 50 m/s
(d) 20 m/s

Q32. A man sells 320 mangoes at the cost price of 400 mangoes (Cost price of all the articles is same. Selling price of all the articles is same). His gain percentage is:

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

Q33. Select the process responsible for stability of populations of species.

(a) Reproduction
(b) Mutation
(c) Evolution
(d) Variation

Q34. The value of (0.04)^(-1.5) is:

(a) 25
(b) 250
(c) 625
(d) 125

Q35. Which of the following conditions is required to have the value of displacement of an object zero?

(a) When the initial and final position of the object is the same.
(b) When distance travelled is equal to the displacement of the object.
(c) When distance travelled is less than the displacement of the object.
(d) When distance travelled is greater than the displacement of the object.

Q36. In 2024, which program organised youth exchange visits across states, focusing on the '5 Ps'; namely Paryatan (Tourism), Parampara (Traditions), Pragati (Development), Paraspar Sampark (People-to-people connect) and Prodyogiki (Technology)?

(a) Bharat Parv
(b) Yuva Sangam
(c) India Unites
(d) National Youth Exchange

Q37. On which date did India and the USA sign their first-ever Cultural Property Agreement (CPA)?

(a) 20 June 2024
(b) 10 August 2024
(c) 26 July 2024

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(d) 15 May 2024

Q38. The sum of five consecutive even numbers is 3720. The sum of the third largest and the largest even numbers among them is:

(a) 1392
(b) 1488
(c) 1492
(d) 1388

Q39. When 0.292929..... is converted into a fraction, then the result is:

(a) 1/5
(b) 29/99
(c) 2/9
(d) 29/100

Q40. The volume of a cylinder is 5500 m^3. Find its diameter of base if the height of the cylinder is 70 m. [Use $\pi = 22/7$]

(a) 12 m
(b) 8 m
(c) 10 m
(d) 5 m

Q41. Which of the following options should come in place of the question mark (?) in the given series?

75 65 56 48 41 ?

(a) 34
(b) 31
(c) 35
(d) 33

Q42. The shopkeeper offers two successive discounts on a machine that is marked at Rs. 18,000 so that its selling price gets reduced to Rs. 12,960. If 10% and x % are the respective discounts, the value of x is:

(a) 20
(b) 10
(c) 15
(d) 12

Q43. Subtract the sum of 2x - 3y + 7z and 4z - 5x from 13x - z.

(a) 3x + 3y - 3z
(b) x + 12y - 12z
(c) 4x + 7y
(d) 16x + 3y - 12z

Q44. If a : b = 3 : 4 and b : c = 2 : 3, then a : b : c = ?

(a) 4 : 2 : 3
(b) 4 : 3 : 6
(c) 3 : 4 : 6
(d) 3 : 4 : 3

Q45. When did the Department for Promotion of Industry and Internal Trade (DPIIT) organise the Startup India Innovation Week 2024?

(a) 12 January 2024 to 20 January 2024
(b) 11 January 2024 to 19 January 2024
(c) 13 January 2024 to 21 January 2024
(d) 10 January 2024 to 18 January 2024

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Q46. Based on the English alphabetical order, three of the following four letter-cluster pairs are alike in a certain way and thus form a group. Which pair does not belong to that group?

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

(a) XR - CW
(b) ZT - PG
(c) TN - YS
(d) BV - GA

Q47. The ages of Anita and Sunita differ by 30 years. If 5 years ago, Anita was 3 times as old as Sunita, then the present age of Sunita is:

(a) 30 years
(b) 25 years
(c) 20 years
(d) 35 years

Q48. Pradhan Mantri Janjatiya Unnat Gram Abhiyan will improve the socio-economic condition of tribal communities, covering around _____ villages as per Union Budget 2024-25.

(a) 76,000
(b) 63,000
(c) 56,000
(d) 53,000

Q49. In a certain code language,

'A + B' means 'A is the mother 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 M related to T if 'M - N + P ÷ S x T'?

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

Q50. If the length of a conductor is tripled, keeping other factors same, the resistance of the conductor will be:

(a) one-sixth
(b) tripled
(c) one third
(d) same

Q51. Venu starts from Point Y and drives 7 km towards south. He then takes a left turn, drives 15 km, turns right and drives 38 km. He then takes a left turn and drives 13 km. He takes a left turn, drives 31 km. He then turns left, drives 28 km, turns left and drives 13 km to stop at Point Z. How far (shortest distance) and towards which direction should he drive in order to reach Point Y again? (All turns are 90 degrees turns only unless specified)

(a) 24 km towards south
(b) 28 km towards east
(c) 20 km towards south
(d) 27 km towards north

Q52. Read the given statements and conclusions carefully. You have to take the given statements to be true even if they seem to be at variance from commonly known facts and decide which conclusion(s) logically follow(s) from the given statements.

Statements:

Some ribbons are balloons.

Some balloons are eagles.

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Conclusions:

(I) All eagles are ribbons.

(II) No ribbons are eagles.

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

Q53. Study the following table and answer the question.

The table depicts the number of cars and bikes manufactured by a company in the year 2012 and 2013.

Years	Number of cars (In Thousand)	Number of bikes (In Thousand)
2012	45	50
2013	40	60

How many cars (In Thousand) were manufactured in the year 2012 and 2013 together?

(a) 75
(b) 85
(c) 105
(d) 95

Q54. Read the given statements and conclusions carefully. You have to take the given statements to be true even if they seem to be at variance from commonly known facts and decide which conclusion(s) logically follow(s) from the given statements.

Statements:

Some trees are flowers.

All flowers are leaves.

Conclusions:

(I) All leaves are trees.

(II) All flowers are trees.

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

Q55. The atomic radius of a hydrogen atom is:

(a) 10^-¹^0 m
(b) 10^-^7 m
(c) 10^-^8 m
(d) 10^-^9 m

Q56. What type of reaction occurs when limestone gets converted into quicklime on heating?

(a) Decomposition
(b) Combination
(c) Displacement
(d) Double displacement

Q57. The sum of the first 8 prime numbers divided by 7 is equal to _____.

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

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Q58. In the following number pairs, the second number is obtained by applying certain mathematical operations to the first number. Which numbers should replace X and Y so that the pattern followed by the two numbers on the left side of :: is the same as that on the right side of ::?

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

X : 58 : : 430 : Y

(a) X = 355, Y = 85
(b) X = 295, Y = 85
(c) X = 310, Y = 70
(d) X = 260, Y = 90

Q59. According to the Economic Survey 2023-24, India's cumulative installed solar power capacity reached ____ on 30 April 2024, after adding 15.03 GW in 2023-24.

(a) 89.64 GW
(b) 86.64 GW
(c) 80.64 GW
(d) 82.64 GW

Q60. Rama walks to her office 5 km away from home. In the morning, she covers the distance in 1 hour whereas, while returning home in the evening, she takes 15 more minutes to cover the same distance. Find her average speed (in km/h) during the two-way journey.

(a) 3 3/5
(b) 4 4/9
(c) 3 1/8
(d) 4 2/3

Q61. In a certain code language, ‘MEANS’ is coded as ‘75821’, ‘RANGE’ is coded as ‘84592’, and ‘PRIME’ is coded as ‘64237’. What is the code for ‘G’ in the given code language?

(a) 5
(b) 4
(c) 9
(d) 8

Q62. For current carrying circular loop, the field strength is:

(a) maximum at the centre
(b) maximum at the periphery
(c) undetermined at the periphery
(d) minimum at the centre

Q63. Which of the following options should come in place of the question mark (?) in the given series based on the English alphabetical order?

ORN, PSO, QTP, RUQ, ?

(a) VSR
(b) SUR
(c) USR
(d) SVR

Q64. Who among the following were the co-flag bearers for India in the closing ceremony of Paris Olympics 2024?

(a) Manu Bhaker and Neeraj Chopra
(b) Swapnil Kusale and Aman Sehrawat
(c) Neeraj Chopra and PR Sreejesh
(d) Manu Bhaker and PR Sreejesh

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

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

(a) KM-PJ
(b) OQ-TN
(c) IK-NH
(d) GI-LE

Q66. A can complete a piece of work in 20 days and B can do the same work in 15 days. B worked alone for 6 days and left. In how many days can A complete the remaining work alone?

(a) 10
(b) 12
(c) 10/2
(d) 16

Q67. Refer to the following number and symbol series and answer the question that follows. Counting to be done from left to right only.

(Left) 1 $ 7 & 3 4 6 @ 8 Ω % 9 # * £ 2 & 5 (Right)

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

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

Q68. A, B, C, D, E and F are sitting around a circular table facing the centre. D sits to the immediate left of F. B is the immediate neighbour of C and F. A is the immediate neighbour of E and C.

What is the position of D with respect to E?

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

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

(Left) * 9 # 1 £ 2 4 & 3 Ω 6 @ 8 $ 7 5 & % (Right)

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

(a) One
(b) Two
(c) More than two
(d) Zero

Q70. In the food vacuole of which organism, complex substances are broken down into simpler ones which then diffuse into the cytoplasm?

(a) Amoeba
(b) Lichen
(c) Plasmodium
(d) Spirogyra

Q71. In a certain code language, ‘PING’ is coded as ‘7953’ and ‘NOSE’ is coded as ‘4638’. What is the code for ‘N’ in the given code language?

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

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(d) 4

Q72. In which organism does cell division or fission lead to the creation of new individuals?

(a) Mammals
(b) Plants
(c) Unicellular organisms
(d) Reptiles

Q73. Which of following compounds is used as an ingredient in antacids?

(a) Nitric acid
(b) Sodium chloride
(c) Copper sulphate
(d) Sodium hydrogen carbonate

Q74. The value of K, satisfying the equation 0.009/K = 0.01 is:

(a) 0.0009
(b) 0.09
(c) 0.9
(d) 9

Q75. Which of the following is the specialised cell that conducts information via electrical impulses from one part of the body to another?

(a) Nucleus
(b) Neuron
(c) Dendrite
(d) Axon

ANSWER KEY

1	a	2	b	3	b	4	c	5	a	6	a	7	d	8	d	9	a	10	c
11	a	12	c	13	d	14	d	15	c	16	a	17	b	18	c	19	b	20	c
21	d	22	b	23	b	24	d	25	d	26	c	27	d	28	a	29	b	30	d
31	a	32	b	33	a	34	d	35	a	36	b	37	c	38	c	39	b	40	c
41	c	42	a	43	d	44	c	45	d	46	b	47	c	48	b	49	d	50	b
51	d	52	a	53	b	54	a	55	a	56	a	57	c	58	b	59	d	60	b
61	c	62	a	63	d	64	d	65	d	66	b	67	d	68	d	69	d	70	a
71	c	72	c	73	d	74	c	75	b										

SOLUTIONS

Q1. Answer: (a) 36 cm²

Shortcut Trick

The area of the largest triangle that can be inscribed in a semi-circle of radius r is always r^2.

Given radius (r) = 6 cm

=> Area = 6^2

=> Area = 36 cm^2

Therefore The correct answer is 36 cm^2.

Alternate Method

Given:

Radius of the semi-circle (r) = 6 cm

Formula Used:

Area of a triangle = 1/2 × Base × Height

For a triangle inscribed in a semi-circle to have the maximum area, its base must be the diameter of the semi-circle and its height must be equal to the radius.

=> Base of triangle (b) = Diameter of semi-circle = 2 × r

=> Base (b) = 2 × 6 = 12 cm

=> Maximum Height (h) = Radius of semi-circle = 6 cm

=> Maximum Area = 1/2 × Base × Height

=> Area = 1/2 × 12 × 6

=> Area = 6 × 6

=> Area = 36 cm^2

Therefore The correct answer is 36 cm^2.

Additional Information

Angle in a Semi-circle

Any triangle inscribed in a semi-circle with the diameter as one of its sides is always a right-angled triangle (Angle = 90°).

Area and Perimeter of Semi-circle

Area = 1/2 × πr^2 and Perimeter = $\pi r + 2r$ (where 2r is the diameter).

Maximum Area of Inscribed Rectangle

The largest rectangle that can be inscribed in a semi-circle of radius r has an area of r^2.

Q2. Answer: (b) JVN

The logic followed here is:

Hence, the correct answer is "Option 2".

Q3. Answer: (b) 6 ¼%

Shortcut Trick

In annual compounding, the amount at the end of a year acts as the principal for the following year.

Interest for the 3^(rd) year = Amount (3 years) − Amount (2 years) = Rs. 614.55 − Rs. 578.40 = Rs. 36.15

Rate of Interest (R) = (Interest ÷ Principal) × 100

R = (36.15 ÷ 578.40) × 100 = (3615 ÷ 57840) × 100 = 6.25%

Therefore The correct answer is 6 ¼%.

Alternate Method

Given:

Amount after 2 years (A2) = Rs. 578.40

Amount after 3 years (A3) = Rs. 614.55

Formula Used:

$A = P(1 + R/100)^n$

Calculations:

=> A3 / A2 = $[P(1 + R/100)^3] / [P(1 + R/100)^2]$

=> 614.55 / 578.40 = 1 + R/100

=> 1 + R/100 = 1.0625

=> R/100 = 1.0625 − 1 = 0.0625

=> R = 0.0625 × 100 = 6.25%

=> R = 6 ¼%

Therefore The correct answer is 6 ¼%.

Additional Information

Compound Interest Basics

Compound interest is calculated on the principal plus any accumulated interest. Formula: A = P(1 + r/n)^(nt).

Successive Growth

In annual compounding, the growth between any two consecutive years (Year n and Year n+1) is simply the annual rate R% of the amount at Year n.

Comparison with SI

For the first year, if compounding is annual, Simple Interest and Compound Interest on the same principal at the same rate are equal.

Q4. Answer: (c) a concave lens of suitable power

The correct answer is a concave lens of suitable power.

Key Points

• Myopia, also known as nearsightedness, is a common vision condition where close objects appear clear, but distant objects are blurry.

• This condition occurs when the eye is too long relative to the focusing power of the cornea and lens of the eye.

• As a result, light rays focus at a point in front of the retina rather than directly on its surface.

• A concave lens (diverging lens) is used to correct myopia by diverging light rays before they enter the eye, allowing them to focus on the retina.

• The power of the concave lens is chosen based on the degree of myopia, ensuring that the light is focused correctly on the retina for clear vision.

Additional Information

• Hyperopia (Farsightedness)

• In hyperopia, distant objects can be seen more clearly than close ones.

• This condition is corrected using a convex lens (converging lens) to focus light correctly on the retina.

• Astigmatism

• Astigmatism is a condition where the cornea or lens is irregularly shaped, causing blurred or distorted vision.

• It can be corrected with cylindrical lenses that compensate for the irregular shape of the cornea or lens.

• Presbyopia

• Presbyopia is an age-related condition where the eye's lens loses its flexibility, making it difficult to focus on close objects.

• This condition is typically corrected with reading glasses or bifocals.

Q5. Answer: (a) 32

Given:

Anju's rank from the top = 15th

Anju's rank from the bottom = 18th

Total number of students = Anju's rank from the top + Anju's rank from the bottom - 1

(15 + 18) - 1 = 33 - 1 = 32

Hence, The total number of students is "32".

Q6. Answer: (a) R/2

The correct answer is R/2.

Key Points

• The distance between the pole and the focus of a spherical mirror is known as the focal length (f).

• The radius of curvature (R) is the distance between the pole and the center of curvature of the mirror.

• The focal length of a spherical mirror is half of its radius of curvature.

• Mathematically, this relationship is expressed as f=R/2

• This applies to both concave and convex mirrors.

Additional Information

• Concave Mirrors

• These mirrors curve inward like a spoon and can form real or virtual images depending on the position of the object.

• They are often used in applications like telescopes and shaving mirrors.

• Convex Mirrors

• These mirrors curve outward and always form virtual, diminished, and upright images.

• They are commonly used as rear-view mirrors in vehicles.

• Mirror Formula

• The mirror equation 1/f=1/v+1/u relates the focal length (f), image distance (v), and object distance (u) for spherical mirrors.

• This formula is applicable to both concave and convex mirrors.

Q7. Answer: (d) Medium Range-Microwave Obscurant Chaff Rocket (MR-MOCR)

The correct answer is Medium Range-Microwave Obscurant Chaff Rocket (MR-MOCR)

Key Points

• On June 26, 2024, the Defence Research and Development Organisation (DRDO) handed over the Medium Range-Microwave

Obscurant Chaff Rocket (MR-MOCR) to the Indian Navy.

• The ceremony was held in New Delhi.

• DRDO, Indian Navy successfully test vertical launch short range surface-to-air missile

• The MR-MOCR is a rocket that creates a microwave shield around assets and platforms to obscure radar signals.

• The rocket is fired into space, where it forms a cloud that can shield against threats that use radio frequency seekers.

Additional Information

• DRDO was formed in 1958 from the amalgamation of the then already functioning Technical Development Establishment (TDEs) of the Indian Army and the Directorate of Technical Development & Production (DTDP) with the Defence Science Organisation (DSO).

• Defence Research & Development Organisation (DRDO) is an agency under the Ministry of Defence.

• Headquartered of DRDO in New Delhi,

• DRDO is India's largest research organisation.

Q8. Answer: (d) Dettol in water

The correct answer is Dettol in water.

Key Points

• Dettol is a well-known antiseptic liquid that has a distinctive smell, making it easily identifiable.

• The smell of Dettol is due to the presence of chloroxylenol, which is its active ingredient.

• When Dettol is dissolved in water, its characteristic smell remains, allowing it to be identified by olfactory senses.

• Other solutions like sugar in water, salt in water, and potassium permanganate in water do not have a strong smell, making them harder to identify by smell alone.

• Dettol is commonly used for cleaning and disinfecting surfaces, as well as for first aid purposes due to its antiseptic properties.

Additional Information

• Salt in Water

• Salt (sodium chloride) dissolved in water does not have any significant odor.

• It is commonly used in cooking and food preservation.

• Sugar in Water

• Sugar dissolved in water is sweet to taste but does not have any specific smell.

• It is widely used in beverages and culinary preparations.

• Potassium Permanganate in Water

• Potassium permanganate in water has a pink or purple color, but it does not have a strong smell.

• It is often used as a disinfectant and in water treatment processes.

Q9. Answer: (a) X = 322, Y = 34

The logic followed here is:

Logic: 1st number ÷ 14 = 2nd number.

For, 476 : Y

=> 476 ÷ 14 = 34.

Similarly, X : 23

=> X ÷ 14 = 23, => X = 23 × 14 = 322.

Thus, X = 322, Y = 34

Hence, the correct answer is "Option1".

Q10. Answer: (c) 32

Shortcut Trick

Find the LCM of 3, 4, 5, and 6, which is 60.

Divide the given number 2488 by the LCM (60).

2488 ÷ 60 → Remainder = 28.

Least number to add = LCM − Remainder = 60 − 28 = 32.

Therefore The correct answer is 32.

Alternate Method

Given: Number = 2488, Divisors = 3, 4, 5, and 6.

Formula: Least number to add = LCM(divisors) − (Number % LCM)

=> Step 1: Calculate the Least Common Multiple (LCM) of 3, 4, 5, and 6.

=> 3 = 3^1

=> 4 = 2^2

=> 5 = 5^1

=> 6 = $2^1 \times 3^1$

=> LCM = $2^2 \times 3^1 \times 5^1 = 4 \times 3 \times 5 = 60$.

=> Step 2: Perform division to find the current remainder.

=> 2488 ÷ 60 = 41 with a remainder of 28 (since 60 × 41 = 2460, 2488 − 2460 = 28).

=> Step 3: Find the number needed to reach the next multiple of 60.

=> Required Number = Divisor − Remainder = 60 − 28 = 32.

Therefore The correct answer is 32.

Additional Information

Divisibility Rule of LCM

A number is divisible by a group of integers if and only if it is divisible by their LCM. For 3, 4, 5, and 6, the combined condition is divisibility by 60.

Addition vs Subtraction for Divisibility

To make a number N divisible by D: subtract the remainder (N % D) or add (D − remainder).

Divisibility by 60

A number is divisible by 60 if it ends in 0 and the remaining digits are divisible by both 3 and 4.

Q11. Answer: (a) Kolkata Knight Riders

The correct answer is Kolkata Knight Riders

Key Points

• The Kolkata Knight Riders (KKR) won the 17th edition of the Indian Premier League (IPL) in 2024.

• The KKR beat the Sunrisers Hyderabad by eight wickets in the final match on May 26, 2024.

• The 17th edition of the IPL was held from March 22 to May 26, 2024.

• The tournament was played across 13 cities in India, with Chennai hosting the opening ceremony and the final.

• The KKR won their third IPL title with this victory.

• Mitchell Starc, a player for the KKR, was named the player of the match.

Additional Information

• The first edition of the Indian Premier League (IPL) cricket tournament was held in the year 2008.

• The IPL is a professional Twenty20 cricket league in India, founded by the Board of Control for Cricket in India (BCCI).

• The league has gained immense popularity and has become one of the most-watched cricket leagues in the world.

• The inaugural season of the IPL featured eight teams representing different cities in India.

• The league format includes a round-robin group stage followed by playoffs and a final match to determine the champion.

Q12. Answer: (c) 21

Given Equation: 121 C 21 D 11 A 11 B 121 = ?

BODMAS Rule:

Decoding the given information:

Alphabet	A	B	C	D
Meaning	÷	×	•	−

Now replacing the signs from left to right using BODMAS Rule, we get:

=> 121 + 21 - 11 ÷ 11 × 121

=> 121 + 21 - 1 × 121

=> 121 + 21 - 121

=> 21

Hence, the correct option is "Option 3".

Q13. Answer: (d) 13

Given: 8 × 2 + 3 − 2 ÷ 6 = ?

According to the question, '+' and '−' are interchanged and '×' and '÷' are interchanged

=> 8 ÷ 2 - 3 + 2 × 6 = ?

=> 4 - 3 + 12 = ?

=> 16 - 3 = 13

Hence, the correct answer is "Option 4".

Q14. Answer: (d) 8 cm

Shortcut Trick

For similar triangles, the ratio of their perimeters is equal to the ratio of their corresponding sides.

Ratio of Perimeters = Ratio of Sides

75 ÷ 40 = 15 ÷ EF

=> EF = (15 × 40) ÷ 75

=> EF = 600 ÷ 75 = 8 cm

Therefore The correct answer is 8 cm.

Alternate Method

Given:

Perimeter of triangle ABC = 75 cm

Perimeter of triangle DEF = 40 cm

Length of side BC = 15 cm

Formula Used:

If triangle ABC ~ triangle DEF, then:

Perimeter of triangle ABC ÷ Perimeter of triangle DEF = AB ÷ DE = BC ÷ EF = AC ÷ DF

Calculations:

=> Perimeter(triangle ABC) ÷ Perimeter(triangle DEF) = BC ÷ EF

=> 75 ÷ 40 = 15 ÷ EF

=> EF = (15 × 40) ÷ 75

=> EF = 600 ÷ 75

=> EF = 8 cm

Therefore The correct answer is 8 cm.

Additional Information

Properties of Similar Triangles

The ratio of the areas of two similar triangles is equal to the square of the ratio of their corresponding sides or perimeters: $Area1/Area2 = (Side1/Side2)^2$.

Similarity Criteria

Two triangles are similar if they satisfy the AAA (Angle-Angle-Angle), SSS (Side-Side-Side ratio), or SAS (Side-Angle-Side ratio) criteria.

Linear Ratios

The ratio of any linear components (medians, altitudes, angle bisectors, or circumradii) of two similar triangles is equal to the ratio of their corresponding sides.

Q15. Answer: (c) (Volume of solute)/(Volume of solution) × 100

The correct answer is Volume of solute / Volume of solution × 100.

Key Points

• Volume by volume percentage (v/v %) is used to express the concentration of a solution when both the solute and the solution are measured in terms of volume.

• The formula for calculating volume by volume percentage is:

Volume by Volume % = (Volume of solute / Volume of solution) × 100

• In this formula:

• Volume of solute = Amount of substance dissolved.

• Volume of solution = Total volume after mixing solute and solvent.

• This method is commonly used for liquid-liquid solutions, such as alcohol in water.

• Option-wise Analysis:

• Mass of solute / Volume of solution × 100 – Used for mass by volume percentage, not v/v percentage.

• Mass of solute / Mass of solution × 100 – Used for mass by mass percentage.

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• Volume of solute / Volume of solution × 100 – Correct.

• Volume of solution / Mass of solute × 100 – Incorrect formula.

• Hence, the correct answer is Volume of solute / Volume of solution × 100.

Additional Information

• Mass by Mass Percentage (w/w %):

(Mass of solute / Mass of solution) × 100

• Mass by Volume Percentage (w/v %):

(Mass of solute / Volume of solution) × 100

• Molarity: Number of moles of solute dissolved per litre of solution.

• Solute: The substance that gets dissolved in a solvent.

• Solvent: The substance that dissolves the solute to form a solution.

Important Points

• Example: If 20 mL alcohol is mixed to make 100 mL solution, then:

v/v % = (20 / 100) × 100 = 20%

• Volume percentage is widely used in pharmaceuticals, beverages, perfumes, and chemical industries.

Q16. Answer: (a) 20 m/s

Concept:

Equations of Motion under Gravity:

• The motion of objects under the influence of gravity can be described using the equations of motion.

• For an object thrown vertically upward, the final velocity at the highest point is zero.

• Formula: $v^2 = u^2 + 2as$

• Here, v is the final velocity, u is the initial velocity, a is acceleration (due to gravity), and s is the displacement.

• Acceleration due to gravity (g): The acceleration imparted to objects due to the gravitational force. SI unit: m/s^2. Dimensional Formula: [LT^(-2)]. $g \approx 9.8\ m/s^2$.

Calculation:

Given,

Mass of the ball, m = 0.5 kg (Not required for calculation)

Maximum height, s = 20 m

Final velocity at the highest point, v = 0 m/s

Acceleration due to gravity, $a = -9.8\ m/s^2$ (negative as it is upward motion)

Using the equation of motion:

$v^2 = u^2 + 2as$

Substitute the given values:

$0 = u^2 + 2(-9.8)(20)$

$\Rightarrow 0 = u^2 - 392$

$\Rightarrow u^2 = 392$

$\Rightarrow u = \sqrt{392}$

$\Rightarrow u \approx 19.8\ m/s$

Therefore The initial velocity of the ball is approximately 20 m/s.

Q17. Answer: (b) Janata Dal (S)

The correct answer is Janata Dal (S)

Key Points

• H.D. Kumaraswamy is a senior leader of the Janata Dal (Secular) (JD(S)) and has served as the Chief Minister of Karnataka in the past.

• In the 2024 general elections, he contested from the Mandya parliamentary seat in Karnataka and secured a victory.

• Subsequently, he was appointed as the Minister of Heavy Industries in the Union Government.

• This marked a significant milestone for the JD(S), as the party secured representation in the central government, which is relatively rare for a regional party primarily focused on Karnataka.

Additional Information

Aspect	Bhartiya Janata Party (BJP)	Communist Party of India (CPI)	BSR Congress

Founded	1980	1925	2011
Political Ideology	Right-wing, Hindu nationalism	Left-wing, Marxism-Leninism	Regionalism, pro-development
Key Focus	Economic development, Hindutva	Social equality, workers' rights	Development of Karnataka (focus on Bellary region)
Leadership	Narendra Modi (prominent leader)	Various leaders, decentralized structure	B. Sreeramulu (founder and key leader)
Presence	National (dominant in many states)	Limited to select states, e.g., Kerala	Regional (primarily Karnataka)
Recent Performance	Major party in Lok Sabha and state govts	Limited representation in Parliament	Small-scale influence, no recent victories
Symbol	Lotus	Ears of corn and sickle	Hut

Q18. Answer: (c) 600

Shortcut Trick

Valid votes = 80% of 7500 = 6000.

Winner gets 55% of valid votes, so Loser gets 45%.

Majority = (55% − 45%) = 10% of valid votes.

Majority = 10% of 6000 = 600.

Therefore The correct answer is 600 votes.

Alternate Method

Given:

Total votes = 7500

Invalid votes = 20%

Winner's share = 55% of valid votes

Calculations:

=> Valid votes = 7500 × (100% − 20%)

=> Valid votes = 7500 × 80/100 = 6000

=> Winner's votes = 55/100 × 6000 = 3300

=> Loser's votes = 45/100 × 6000 = 2700

=> Majority = Winner's votes − Loser's votes

=> Majority = 3300 − 2700 = 600

Therefore The correct answer is 600 votes.

Additional Information

Valid Votes Concept

Valid Votes = Total Votes − (Invalid Votes + Votes not cast). All win/loss percentages are usually calculated on valid votes unless stated otherwise.

Majority/Margin

The majority or winning margin is the absolute difference between the votes obtained by the winner and the runner-up.

Percentage Change Base

In multi-step percentage problems, always identify the correct base for each percentage (e.g., 20% of total vs 55% of valid).

Q19. Answer: (b) Bowman's capsule

The correct answer is Bowman's capsule.

Key Points

• The Bowman's capsule is a cup-shaped structure that encases the glomerulus in the nephron of the kidney.

• It is the first part of the nephron where the filtration of blood takes place to form urine.

• The Bowman's capsule collects the filtrate from the glomerulus and channels it into the proximal convoluted tubule.

• The structure of the Bowman's capsule allows it to efficiently filter blood plasma while preventing the passage of blood cells and large proteins.

• The interaction between the Bowman's capsule and the glomerulus is crucial for the kidney's function of removing waste and excess substances from the bloodstream.

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Additional Information

• Proximal Convoluted Tubule

• This is the section of the nephron that follows the Bowman's capsule.

• It is responsible for the reabsorption of water, ions, and nutrients back into the bloodstream.

• Distal Convoluted Tubule

• This is the portion of the nephron that follows the loop of Henle.

• It is involved in the regulation of potassium, sodium, calcium, and pH balance in the body.

• Glomerulus

• A network of capillaries located within the Bowman's capsule.

• It is responsible for the filtration of blood to form the initial urine filtrate.

Q20. Answer: (c) 430

Shortcut Trick

Winner gets 70%, so the Loser gets 100% − 70% = 30%.

The Majority difference = 70% − 30% = 40%.

According to the question: 40% = 172.

Total valid votes (100%) = (172 ÷ 40) × 100 = 430.

Therefore The correct answer is 430.

Alternate Method

Given:

Percentage of votes for the Winner = 70%

Majority of votes = 172

Let the total number of valid votes be V.

=> Votes secured by Winner = 70% of V = 0.70V

=> Votes secured by Loser = (100% − 70%) of V = 30% of V = 0.30V

=> Majority = Votes of Winner − Votes of Loser

=> 172 = 0.70V − 0.30V

=> 172 = 0.40V

=> V = 172 ÷ 0.40

=> V = 1720 ÷ 4

=> V = 430

Therefore, the total valid votes are 430, which corresponds to option 3.

Therefore The correct answer is 430.

Additional Information

Concept of Majority

In a two-candidate election, Majority = (Votes of Winner) − (Votes of Runner-up). If expressed in percentage, Majority % = (Winner %) − (Loser %).

Valid vs. Invalid Votes

Total Votes Polled = Valid Votes + Invalid Votes. Percentages are usually calculated based on valid votes unless stated otherwise.

Winning Margin Formula

Total Valid Votes = (Majority × 100) ÷ (Difference in percentage points between candidates).

Q21. Answer: (d) xylem, phloem

The correct answer is xylem, phloem.

Key Points

• Xylem is responsible for the transport of water and minerals from the roots to other parts of the plant.

• Phloem is responsible for the transport of the products of photosynthesis, primarily sugars, from the leaves to other parts of the plant.

• Xylem consists of vessels and tracheids, which are tubular structures that facilitate the upward movement of water and minerals.

• Phloem consists of sieve tubes and companion cells, which work together to transport nutrients throughout the plant.

• The process of water transport in xylem is largely driven by transpiration and root pressure, whereas phloem transport is driven by the pressure-flow mechanism.

Additional Information

• Collenchyma
• It is a type of plant tissue that provides support and flexibility to growing parts of the plant such as stems and leaves.
• Collenchyma cells have thicker cell walls compared to parenchyma cells and are often found under the epidermis.
• Parenchyma
• It is the most common type of plant tissue, involved in various functions including photosynthesis, storage, and tissue repair.
• Parenchyma cells have thin cell walls and large vacuoles, making them versatile in function.
• Sclerenchyma
• It is a type of plant tissue that provides structural support due to its thick, lignified cell walls.
• Sclerenchyma cells are usually dead at maturity and include fibers and sclereids.

Q22. Answer: (b) Four

Given: Seven people, A, B, C, D, E, F and G are sitting in a row, facing north.
E sits third from the left end. Only three people sit between G and E.
D sits second to the left of C. B is the immediate neighbour of C and F.
Final arrangement,
Thus, the only four people sit between A and F.
Hence, the correct answer is "Option 2".

Q23. Answer: (b) Propanol

The correct answer is Propanol.
Key Points
• An alcohol is an organic compound with a hydroxyl group (-OH) attached to a carbon atom.
• Propanol, also known as propyl alcohol, has the chemical formula C3H7OH.
• Propanol is a three-carbon alcohol, specifically a primary alcohol.
• It is commonly used as a solvent and in the manufacture of other chemicals.
• In contrast, Propanal (an aldehyde), Propanoic (a carboxylic acid), and Propanone (a ketone) do not contain the hydroxyl group characteristic of alcohols.
Additional Information
• Aldehydes
• These compounds have a carbonyl group (C=O) bonded to at least one hydrogen atom.
• Propanal is an example of an aldehyde with the formula CH3CH2CHO.
• Carboxylic Acids
• These compounds contain a carboxyl group (-COOH).
• Propanoic acid, also known as propionic acid, has the formula C2H5COOH.
• Ketones
• These compounds have a carbonyl group (C=O) bonded to two carbon atoms.
• Propanone, commonly known as acetone, has the formula (CH3)2CO.

Q24. Answer: (d) One

Given series:
9 # 1 * £ 2 & % 4 @ 6 8 $ 7 & 3 2 5
Condition to be checked:
Numbers which are immediately preceded by a number and also immediately followed by a symbol.
Number → Number → Symbol
Checking the given series:
9 # 1 * £ 2 & % 4 @ 6 8 $ 7 & 3 2 5
Thus, there is one such pattern (6 8 $) that follows the above condition.
Hence, the correct answer "Option 4".
Mistake Points
Immediately preceded by means immediately before or to come just before.
Immediately followed by means immediately after or to come just after.

Q25. Answer: (d) It will decrease the concentration of hydronium ions per unit volume.

The correct answer is It will decrease the concentration of hydronium ions per unit volume.

Key Points

• When an acid is mixed with water, it undergoes ionization and produces hydronium ions (H3O^+).

• However, since the acid solution is diluted by adding water, the concentration of hydronium ions per unit volume decreases, even though the total number of hydronium ions may increase.

• This dilution makes the acidic solution less concentrated and increases its pH.

• Hence, the correct answer is Option 4 – It will decrease the concentration of hydronium ions per unit volume.

Additional Information

• Dilution of an acid is an exothermic process, meaning heat is released.

• For safety, acid should always be added to water, and never water to acid, to avoid violent splashing due to the heat evolved.

Important Points

• Adding water to an acid dilutes the solution.

• The concentration of hydronium ions (H3O^+) per unit volume decreases.

• Correct Answer: Option 4 – It will decrease the concentration of hydronium ions per unit volume.

Q26. Answer: (c) GMYT

The logic followed here is:

FKUZ is related to CORD

For, 'QJKH is related to NNHL

Similarly, for 'JIBP '

So, 'JIBP' will be related to 'GMYT'

Hence, the correct answer is "Option 3".

Q27. Answer: (d) 6.50%

The correct answer is '6.50%.'

Key Points

• Monetary Policy Committee (MPC) Decision:

• In 2024, the Monetary Policy Committee (MPC) of the Reserve Bank of India (RBI) decided to keep the policy repo rate unchanged at 6.50% under the liquidity adjustment facility (LAF) for the 9th consecutive time.

• The repo rate is the rate at which the RBI lends short-term funds to commercial banks. Keeping the rate unchanged reflects the RBI's stance on controlling inflation while supporting economic growth.

• By keeping the rate steady, the MPC aims to manage inflationary pressures without dampening economic activity in the country.

• The MPC's decision to keep the repo rate unchanged was made by a majority of 5 out of 6 members.

Additional Information

Monetary Policy tool	Description
Repo Rate	The (fixed) interest rate at which the Reserve Bank provides overnight liquidity to banks against the collateral of government and other approved securities under the liquidity adjustment facility (LAF).
Reverse Repo Rate	The (fixed) interest rate at which the Reserve Bank absorbs liquidity, on an overnight basis, from banks against the collateral of eligible government securities under the LAF.
Marginal Standing Facility	A facility under which scheduled commercial banks can borrow an additional amount of overnight money from the Reserve Bank by dipping into their Statutory Liquidity Ratio (SLR) portfolio up to a limit at a penal rate of interest
Open Market Operation	Open market operations are the sale and purchase of government securities and treasury bills by RBI

Q28. Answer: (a) $\tan^2\theta$

Shortcut Trick

Substitute a standard angle $\theta = 60°$ into the given equation.

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k = cos^4 60° − sin^4 60° = (1/2)^4 − (√3/2)^4 = 1/16 − 9/16 = −8/16 = −1/2.

Now, calculate (1 − k) / (1 + k) = [1 − (−1/2)] / [1 + (−1/2)] = (3/2) / (1/2) = 3.

From the options, only tan² 60° = (√3)² = 3 matches this result.

Therefore The correct answer is tan²θ.

Alternate Method

Given: cos^4 θ − sin^4 θ = k

Formula Used: a² − b² = (a − b)(a + b) and sin² θ + cos² θ = 1.

=> k = (cos² θ − sin² θ)(cos² θ + sin² θ)

=> k = (cos² θ − sin² θ) × (1)

=> k = cos² θ − sin² θ

=> 1 − k = 1 − (cos² θ − sin² θ) = (1 − cos² θ) + sin² θ = sin² θ + sin² θ = 2 sin² θ

=> 1 + k = 1 + (cos² θ − sin² θ) = (1 − sin² θ) + cos² θ = cos² θ + cos² θ = 2 cos² θ

=> (1 − k) / (1 + k) = (2 sin² θ) / (2 cos² θ)

=> (1 − k) / (1 + k) = sin² θ / cos² θ = tan² θ

Therefore The correct answer is tan²θ.

Additional Information

Double Angle Identities

The term cos 2θ can be written as cos² θ − sin² θ, 2 cos² θ − 1, or 1 − 2 sin² θ.

Pythagorean Trigonometric Identity

The fundamental identity sin² θ + cos² θ = 1 is used to simplify higher-power trigonometric expressions.

Half-Angle Relationship

The expression (1 − cos 2θ) / (1 + cos 2θ) is a standard identity for tan² θ.

Q29. Answer: (b) INOM

The logic followed here is:

For, DIJH : KPQO

For, MRSQ : TYZX

Similarly, BGHF : ?

Thus, BGHF : INOM

Hence, the correct answer is "Option 2".

Q30. Answer: (d) II is the cause and I is its possible effect.

Statements:

I. Government authorities of city X are finding different solutions to reduce air pollution in the city during winter - Effect(because, The government taking steps to reduce pollution).

II. City X has seen an acute rise in asthma cases during the last winter - cause(because increased air pollution during winter (an external cause) could have led to a rise in asthma cases).

Thus, Statement I is the effect, and Statement II is the cause.

Hence, the correct answer is "Option 4".

Q31. Answer: (a) 10 m/s

Concept:

Principle of Conservation of Energy:

• The principle states that energy cannot be created or destroyed, only transformed from one form to another.

• In the context of this problem, the potential energy (PE) at the maximum height will be equal to the initial kinetic energy (KE).

Important terms:

• Potential Energy (PE): Energy possessed by a body due to its position or height.

SI Unit: Joule (J)

Dimensional Formula: [M L2 T-2]

• Kinetic Energy (KE): Energy possessed by a body due to its motion.

SI Unit: Joule (J)

Dimensional Formula: [M L2 T-2]

Calculation:

Given:

Mass of the ball (m) = 2 kg

Kinetic energy (KE) = 100 J

We know,

Kinetic Energy = 1/2 mv^2

=> 100 = 1/2 × 2 × v^2

=> 100 = v^2

=> v = √100 = 10 m/s

Therefore The velocity of the body will be 10 m/s.

Q32. Answer: (b) 25%

Shortcut Trick

For problems where Cost Price (CP) of 'y' items = Selling Price (SP) of 'x' items:

Gain % = [(y − x) ÷ x] × 100

Gain % = [(400 − 320) ÷ 320] × 100

Gain % = [80 ÷ 320] × 100 = (1 ÷ 4) × 100 = 25%

Therefore The correct answer is 25%.

Alternate Method

Given:

Selling Price (SP) of 320 mangoes = Cost Price (CP) of 400 mangoes.

Let the CP of 1 mango be Rs. 1.

=> CP of 400 mangoes = Rs. 400

=> SP of 320 mangoes = CP of 400 mangoes = Rs. 400

Formula Used:

Profit = SP − CP

Profit % = (Profit ÷ CP) × 100

Calculations:

=> CP of 320 mangoes = 320 × Rs. 1 = Rs. 320

=> Profit on 320 mangoes = SP − CP = Rs. 400 − Rs. 320 = Rs. 80

=> Gain % = (80 ÷ 320) × 100

=> Gain % = (1 ÷ 4) × 100

=> Gain % = 25%

Therefore The correct answer is 25%.

Additional Information

Profit/Loss on Number of Articles

If the CP of 'A' articles equals the SP of 'B' articles, then the gain or loss percent is [(A − B) ÷ B] × 100. A positive value implies Profit, while a negative value implies Loss.

Relation between CP and SP

SP = CP × [(100 + Gain %) ÷ 100] when there is a profit, and SP = CP × [(100 − Loss %) ÷ 100] when there is a loss.

Marked Price and Discount

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

Q33. Answer: (a) Reproduction

The correct answer is Reproduction.

Key Points

• Reproduction is the biological process by which new individual organisms are produced from their parents.

• It is essential for the continuation and stability of species, ensuring that populations can be maintained over generations.

• There are two main types of reproduction: asexual and sexual. Asexual reproduction involves a single organism or cell, while sexual reproduction involves the combination of genetic material from two parents.

• Reproduction allows for the transfer of genetic information from one generation to the next, which is vital for the survival of a species.

• It plays a crucial role in natural selection and evolution, as it introduces genetic variation within a population.

Additional Information

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• Mutation
• Mutations are changes in the DNA sequence that can lead to genetic variation within a population.
• They can be beneficial, neutral, or harmful and play a role in the process of evolution.
• Evolution
• Evolution is the process by which different kinds of living organisms develop and diversify from earlier forms over generations.
• It involves mechanisms such as natural selection, mutation, gene flow, and genetic drift.
• Variation
• Variation refers to the differences in the genetic makeup and characteristics within and among populations of organisms.
• It is essential for the process of natural selection and the overall adaptability of a species.

Q34. Answer: (d) 125

Given:
The value of (0.04)^(-1.5) is:
Formula used:
$x^{(-n)} = 1 / x^n$
Calculation:
(0.04)^(-1.5)
=> 1 / (0.04)^(1.5)
=> $1 / (0.2)^3$
=> 1 / 0.008
=> 125
Therefore The correct answer is option (4).

Q35. Answer: (a) When the initial and final position of the object is the same.

The correct answer is When the initial and final position of the object is the same.
Key Points
• Displacement is defined as the shortest distance between the initial and final positions of an object.
• For displacement to be zero, the object must return to its initial position.
• Distance is a scalar quantity and can be greater than or equal to displacement but never less.
• When the initial and final positions are the same, the path taken does not matter for calculating displacement.
• Displacement takes into account the direction of motion, making it a vector quantity, unlike distance.
Additional Information
• Distance
• It is the total path length traveled by an object, irrespective of the direction.
• Distance is a scalar quantity and only has magnitude.
• Vector Quantity
• Vector quantities have both magnitude and direction.
• Examples include displacement, velocity, and acceleration.
• Scalar Quantity
• Scalar quantities have only magnitude and no direction.
• Examples include distance, speed, and mass.

Q36. Answer: (b) Yuva Sangam

The correct answer is Yuva Sangam
Key Points
• The Yuva Sangam program organized youth exchange visits across states in 2024, focusing on the '5 Ps'.
• The 5 Ps are:
• Paryatan: Tourism
• Parampara: Traditions
• Pragati: Development
• Paraspar Sampark: People-to-people connect
• Prodyogiki: Technology
• Yuva Sangam is a program by the Government of India that aims to strengthen connections between people, especially among

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young people.

• The program involves exposure tours for students and other young people from one state to another.

• The program is part of the Centre's “Ek Bharat Shreshth Bharat” vision, which aims to promote cultural unity and collaboration among India's youth.

• The program provides a platform for young people to meet, interact, and learn from each other.

Additional Information

• National Youth Exchange

• The National Youth Exchange Program is an initiative aimed at fostering cultural understanding, unity, and national integration among the youth of India.

• It is typically organized by the Nehru Yuva Kendra Sangathan (NYKS) under the Ministry of Youth Affairs and Sports, Government of India.

• Benefits:

• Builds a sense of unity in diversity among the youth.

• Encourages understanding and appreciation of India’s cultural richness.

• Strengthens leadership skills and enhances teamwork.

• Facilitates networking among participants from different parts of the country.

• India Unites

• The phrase “India Unites” often symbolizes the idea of national integration and unity in diversity, which aligns with India’s ethos of coexisting harmoniously despite its linguistic, religious, and cultural diversity.

• This concept is reflected in initiatives such as:

• National Integration Day (November 19): Celebrated to promote unity.

• Ek Bharat Shreshtha Bharat Program: A Government of India initiative to enhance cultural exchanges between states and UTs.

Q37. Answer: (c) 26 July 2024

The correct answer is 26 July 2024

Key Points

• The Government of India and the Government of the United States of America signed the first ever 'Cultural Property Agreement' to prevent and curb the illicit trafficking of antiquities from India to the USA, today, the 26th July, 2024 on the sidelines of the 46th World Heritage Committee, at Bharat Mandapam, New Delhi.

• The agreement was signed by Shri Govind Mohan, Secretary, Ministry of Culture and H.E. Eric Garcetti, Ambassador of the United States of America to India in the august presence of Union Minister of Culture and Tourism, Shri Gajendra Singh Shekhawat.

• The Cultural Property Agreement (CPA) is aligned with the 1970 UNESCO Convention on the Means of Prohibiting and Preventing the Illicit Import, Export and Transfer of Ownership of Cultural Property, to which both countries are States party.

• CPA is another step towards securing India’s rich and diverse cultural heritage and invaluable artifacts of our grand history

Q38. Answer: (c) 1492

Shortcut Trick

In a set of consecutive numbers, the Average is always the Middle Number.

Average (3^(rd) number) = 3720 ÷ 5 = 744.

The series of even numbers is: 740, 742, 744 (3^(rd) largest), 746, 748 (largest).

Required Sum = 744 + 748 = 1492.

Therefore The correct answer is 1492.

Alternate Method

Given: Sum of 5 consecutive even numbers = 3720.

Let the five consecutive even numbers be x, x + 2, x + 4, x + 6, and x + 8.

=> x + (x + 2) + (x + 4) + (x + 6) + (x + 8) = 3720

=> 5x + 20 = 3720

=> 5x = 3720 − 20

=> 5x = 3700

=> x = 3700 ÷ 5 = 740

Calculating required values:

=> Third largest number = x + 4 = 740 + 4 = 744

=> Largest number = x + 8 = 740 + 8 = 748

=> Sum = 744 + 748 = 1492

Therefore The correct answer is 1492.

Additional Information

Arithmetic Progression Property

Consecutive even or odd numbers form an Arithmetic Progression (AP) with a common difference (d) of 2. The sum can be calculated using $S_n = (n/2) \times [2a + (n - 1)d]$.

Middle Term Shortcut

For an odd number of terms (n) in an AP, the average is always equal to the middle term. Middle Term = Total Sum ÷ n.

Sum of First n Even Numbers

The sum of the first 'n' even natural numbers starting from 2 is given by the formula: $n \times (n + 1)$.

Q39. Answer: (b) 29/99

Given:

0.292929.....

Formula used:

Let x = 0.292929.....

Then, 100x = 29.292929.....

Calculation:

Let x = 0.292929.....

Then, 100x = 29.292929.....

=> 100x - x = 29.292929..... - 0.292929.....

=> 99x = 29

=> x = 29/99

Therefore The correct answer is option 2.

Q40. Answer: (c) 10 m

Shortcut Trick

Apply the Volume of Cylinder formula: Volume = $\pi r^2 h$

Substitute values: $5500 = (22/7) \times r^2 \times 70$

Simplify: $5500 = 220 \times r^2$

=> $r^2 = 25$ => Radius (r) = 5 m

Diameter (d) = 2 × Radius = 2 × 5 = 10 m

Therefore The correct answer is 10 m.

Alternate Method

Given:

Volume of the cylinder (V) = 5500 m^3

Height of the cylinder (h) = 70 m

Value of $\pi = 22/7$

Formula Used:

Volume (V) = $\pi \times r^2 \times h$

Diameter (d) = 2 × r

Calculations:

=> Volume = $\pi r^2 h$

=> $5500 = (22/7) \times r^2 \times 70$

=> $5500 = 22 \times r^2 \times (70 \div 7)$

=> $5500 = 22 \times r^2 \times 10$

=> $5500 = 220 \times r^2$

=> $r^2 = 5500 \div 220$

=> $r^2 = 25$

=> $r = \sqrt{25} = 5$ m

=> Diameter (d) = 2 × 5

=> Diameter = 10 m

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Therefore The correct answer is 10 m.

Additional Information

Curved Surface Area (CSA)

The area of the curved surface of a cylinder is given by the formula $2\pi rh$.

Total Surface Area (TSA)

The total surface area including the top and bottom circular bases is $2\pi r(h + r)$.

Area of Base

The base area of a cylinder is circular and is calculated as πr^2.

Volume of Cone

The volume of a cone with the same base radius and height is $(1/3)\pi r^2h$, which is one-third the volume of the cylinder.

Q41. Answer: (c) 35

The logic followed here is:

Hence, the correct answer is "Option 3".

Q42. Answer: (a) 20

Shortcut Trick

Total discount multiplier = 12960 ÷ 18000 = 0.72

First discount multiplier (10%) = 0.90

Second discount multiplier (x) = 0.72 ÷ 0.90 = 0.80

Discount percentage x = (1 − 0.80) × 100 = 20%

Therefore The correct answer is 20.

Alternate Method

Given:

Marked Price (MP) = Rs. 18,000

First Discount = 10%

Final Selling Price (SP) = Rs. 12,960

Formula Used:

Price after discount = MP × (100 − d1)/100 × (100 − d2)/100

Calculations:

=> Price after 10% discount = 18,000 × (90/100)

=> Intermediate Price = 18,000 × 0.9 = Rs. 16,200

=> Now, SP = Intermediate Price × (100 − x)/100

=> 12,960 = 16,200 × (100 − x)/100

=> 12,960 ÷ 16,200 = (100 − x)/100

=> 1296 ÷ 1620 = (100 − x)/100

=> 0.8 = (100 − x)/100

=> 80 = 100 − x

=> x = 100 − 80 = 20

Therefore The correct answer is 20.

Additional Information

Successive Discount Formula

A single equivalent discount for two successive discounts a% and b% is given by: (a + b − ab/100)%.

Marked Price and Selling Price

Selling Price = Marked Price × (1 − d1/100) × (1 − d2/100) ... × (1 − d_n/100).

Discount vs. Profit

Discount is always calculated on the Marked Price (MP), whereas Profit or Loss is calculated on the Cost Price (CP).

Q43. Answer: (d) 16x + 3y - 12z

Shortcut Trick

Find the combined sum of the first two expressions by adding coefficients of like terms: (2 − 5)x − 3y + (7 + 4)z = −3x − 3y + 11z.

Subtract this sum from (13x − z) by changing signs of the sum: (13x − z) + (3x + 3y − 11z).

Group and solve: (13 + 3)x + 3y + (−1 − 11)z = 16x + 3y − 12z.

Therefore The correct answer is 16x + 3y − 12z.

Alternate Method

Given:

First expression (E1) = 2x − 3y + 7z

Second expression (E2) = 4z − 5x

Third expression (E3) = 13x − z

Calculations:

=> Step 1: Calculate the sum (S) of E1 and E2.

=> S = (2x − 3y + 7z) + (4z − 5x)

=> S = (2x − 5x) − 3y + (7z + 4z)

=> S = −3x − 3y + 11z

=> Step 2: Subtract S from E3.

=> Result = E3 − S

=> Result = (13x − z) − (−3x − 3y + 11z)

=> Result = 13x − z + 3x + 3y − 11z

=> Result = (13x + 3x) + 3y + (−z − 11z)

=> Result = 16x + 3y − 12z

Therefore The correct answer is 16x + 3y − 12z.

Additional Information

Like Terms

Terms that have the same variables raised to the same powers. Only like terms can be added or subtracted.

Subtraction of Polynomials

To subtract a polynomial, change the sign of each term in the polynomial being subtracted and then combine the like terms.

Algebraic Sum

The sum is found by grouping the coefficients of identical variables: a×x + b×x = (a + b)×x.

Q44. Answer: (c) 3 : 4 : 6

Shortcut Trick

Use the Zig-zag multiplication method for combining ratios.

Arrange the terms: a : b = 3 : 4 and b : c = 2 : 3.

Multiply vertically for a (3 × 2 = 6), diagonally for b (4 × 2 = 8), and vertically for c (4 × 3 = 12).

The resulting ratio is 6 : 8 : 12.

Simplify by dividing all terms by 2 => 3 : 4 : 6.

Therefore The correct answer is 3 : 4 : 6.

Alternate Method

Given:

a : b = 3 : 4

b : c = 2 : 3

Formula Used:

To combine two ratios, the common variable (b) must have the same value in both expressions.

Calculations:

=> In ratio a : b, value of b = 4.

=> In ratio b : c, value of b = 2.

=> To make b equal, multiply the second ratio (b : c) by 2.

=> b : c = (2 × 2) : (3 × 2) = 4 : 6.

=> Now b = 4 is common to both ratios.

=> a : b : c = 3 : 4 : 6.

Therefore The correct answer is 3 : 4 : 6.

Additional Information

Compound Ratio

The compound ratio of two ratios a : b and c : d is calculated as (a × c) : (b × d).

Duplicate and Sub-duplicate Ratio

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The duplicate ratio of a : b is $a^2 : b^2$, and the sub-duplicate ratio is $\sqrt{a} : \sqrt{b}$.

Mean Proportional

If a, b, and c are in continued proportion such that a : b = b : c, then b is the mean proportional where $b^2 = ac$.

Q45. Answer: (d) 10 January 2024 to 18 January 2024

The correct answer is 10 January 2024 to 18 January 2024

Key Points

• According to available information, the Department for Promotion of Industry and Internal Trade (DPIIT) organised the Startup India Innovation Week 2024 from January 10th to 18th, 2024.

• During the Innovation Week 2024, Secretary, DPIIT, Shri Rajesh Kumar Singh delivered the inaugural address in the Startup Seminar: ‘

• The event aimed to promote innovation and entrepreneurship in India by fostering a supportive ecosystem for startups.

• The Theme was "Innovation for Transformation."

Additional Information About the Department for promotion of Industry & Internal Trade:

• It is a central government department under the Ministry of Commerce and Industry.

• It was established in the year 1995.

• The department was earlier called the Department of Industrial Policy & Promotion and was renamed as DPIIT in January 2019.

• The role of DPIIT is to promote/accelerate industrial development of the country by facilitating investment in new and upcoming technology, foreign direct investment, and support the balanced development of industries.

Q46. Answer: (b) ZT - PG

The logic followed here is:

Option 1) XR - CW

Option 2) ZT - PG

Option 3) TN - YS

Option 4) BV - GA

Hence, the correct answer is "Option 2".

Q47. Answer: (c) 20 years

Shortcut Trick

The age difference between two people always remains constant (30 years).

Ratio 5 years ago (Anita : Sunita) = 3 : 1

Difference in ratio parts = 3 − 1 = 2 units

2 units → 30 years => 1 unit = 15 years

Sunita's age 5 years ago = 1 unit = 15 years

Present age of Sunita = 15 + 5 = 20 years

Therefore The correct answer is 20 years.

Alternate Method

Given: Age difference = 30 years; 5 years ago, Anita was 3 times as old as Sunita.

Let the present age of Sunita be S years and Anita be A years.

=> A − S = 30

=> A = S + 30

5 years ago:

=> (A − 5) = 3 × (S − 5)

=> (S + 30 − 5) = 3S − 15

=> S + 25 = 3S − 15

=> 3S − S = 25 + 15

=> 2S = 40

=> S = 20

Therefore The correct answer is 20 years.

Additional Information

Constant Age Difference

The difference between the ages of two individuals remains the same at any point in time, whether in the past, present, or future.

Age Ratio Property

While the absolute difference is constant, the ratio of ages changes every year as both individuals grow older by the same number of years.

General Age Formulation

If the current age is x, then the age n years ago is (x − n) and the age n years hence is (x + n).

Q48. Answer: (b) 63,000

The correct answer is 63,000

Key Points

• As per the Union Budget 2024-25, the Pradhan Mantri Janjatiya Unnat Gram Abhiyan aims to improve the socio-economic condition of tribal communities and will cover around 63,000 villages.

• Pradhan Mantri Janjatiya Unnat Gram Abhiyan (PMJUGA) is an initiative launched by the Government of India aimed at bringing socio-economic development to tribal communities residing in rural areas.

• The scheme will adopt saturation coverage for tribal families in tribal-majority villages and aspirational districts.

• The Ministry of Tribal Affairs will act as the nodal ministry for the overall monitoring and implementation of the scheme.

• It has various objectives, features which can have a far reaching impact towards the goal of tribal empowerment.

Additional Information

• Objectives of Pradhan Mantri Janjatiya Unnat Gram Abhiyan (PMJUGA)

• Integrated Development: To ensure holistic development of tribal villages by addressing infrastructure gaps and improving basic amenities.

• Livelihood Opportunities: Enhancing livelihood opportunities for tribal communities through skill development, employment generation, and promoting traditional livelihoods.

• Health and Education: Improving access to healthcare facilities and promoting education among tribal populations.

• Cultural Preservation: Preservation and promotion of tribal culture, traditions, and heritage

Q49. Answer: (d) Wife's father's mother's brother

Given: 'M - N + P ÷ S x T

Signs	•	•	×	÷
Codes as	Mother	Brother	Wife	Father

'M - N + P ÷ S x T - It means that M is brother of N, N is Mother of P, P is father of S, S is the wife of T.

Thus, M is Wife's father's mother's brother of T.

Hence, the correct answer is "Option 4".

Q50. Answer: (b) tripled

The correct answer is tripled.

Key Points

• The resistance (R) of a conductor is given by the formula: R = ρ(L/A), where:

• ρ is the resistivity of the material (a constant for a given material).

• L is the length of the conductor.

• A is the cross-sectional area of the conductor.

• From the formula, resistance is directly proportional to the length of the conductor. This means that if the length of the conductor increases, its resistance also increases proportionally.

• In this case, when the length (L) is tripled and other factors such as material and cross-sectional area remain constant, the resistance will also be tripled.

• This relationship can be written mathematically as: R2/R1 = L2/L1, where:

• R2 and R1 are the final and initial resistances, respectively.

• L2 and L1 are the final and initial lengths, respectively.

• Here, if L2 = 3L1, then R2 = 3R1, meaning the resistance is tripled.

• This principle is based on the Ohm's Law and the properties of materials when electricity flows through them.

Additional Information

• Key properties of resistance:

• Resistance depends on the material of the conductor; materials like copper and silver have low resistance compared to other materials.

• It is also affected by temperature. For most conductors, resistance increases with an increase in temperature.
• The cross-sectional area is inversely proportional to resistance; a thicker conductor has lower resistance.
• Resistivity and its significance:
• Resistivity (ρ) is a property of the material and determines how much the material opposes the flow of electric current.
• It is measured in ohm-meters (Ω·m).
• Applications of resistance principles:
• Used in designing electrical circuits and ensuring safety by selecting appropriate materials.
• Helps in manufacturing resistors for various applications in electronic devices.

Q51. Answer: (d) 27 km towards north

Given:
Venu starts from Point Y and drives 7 km towards south.
He then takes a left turn, drives 15 km, turns right and drives 38 km.
He then takes a left turn and drives 13 km. He takes a left turn, drives 31 km.
He then turns left, drives 28 km, turns left and drives 13 km to stop at Point Z.
Thus, he drive 27 km towards north in order to reach Point Y again.
Hence, the correct answer is "Option 4".

Q52. Answer: (a) Neither conclusion (I) nor (II) follows

Statements:
Some ribbons are balloons.
Some balloons are eagles.
The least possible venn diagram is given:
Conclusions:
(I) All eagles are ribbons - False(because, the is no direct relation between ribbon and eagle is given, so it can be possible only).
(II) No ribbons are eagles - False(because, the is no direct relation between ribbon and eagle is given, so it can be possible only).
Thus, Neither conclusion (I) nor (II) follows
Hence, the correct answer is "Option 1".

Q53. Answer: (b) 85

Given:
Number of cars manufactured in 2012 = 45 (in thousand)
Number of cars manufactured in 2013 = 40 (in thousand)
Formula used:
Total cars manufactured = Cars in 2012 + Cars in 2013
Calculation:
Total cars manufactured = 45 + 40
=> Total cars manufactured = 85 (in thousand)
Therefore The correct answer is 85 (in thousand).

Q54. Answer: (a) Neither conclusion (I) nor (II) follows.

Statements:
Some trees are flowers.
All flowers are leaves.
The least possible venn diagram is given below:
Conclusions:
(I) All leaves are trees - False(because, Some flower are trees and all flower is leaves it implies that some leaves are trees, so it can be possible only).
(II) All flowers are trees - False(because, Some flower are trees, so it can be possible only).
Thus, Neither conclusion (I) nor (II) follows.
Hence, the correct answer is "Option 1".

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Q55. Answer: (a) 10^-¹^0 m

The correct answer is 10^-¹^0 m.

Key Points

• The atomic radius is a measure of the size of an atom, typically the mean or typical distance from the nucleus to the boundary of the surrounding cloud of electrons.

• Hydrogen is the lightest and most abundant chemical element, consisting of only one proton and one electron.

• The atomic radius of a hydrogen atom is approximately 10^-¹^0 meters.

• This value is also known as 1 angstrom (Å), a common unit of length used in the field of atomic-scale measurements.

• Understanding the atomic radius is crucial for studying atomic structures, chemical bonding, and molecular interactions.

Additional Information

• Atomic Radii Trends

• Atomic radii generally decrease across a period from left to right due to increasing nuclear charge.

• Atomic radii increase down a group as additional electron shells are added.

• Ionic Radius

• Ionic radius is the radius of an atom's ion.

• Cations are smaller than their parent atoms due to the loss of electron(s) and a resultant increase in nuclear charge.

• Anions are larger than their parent atoms due to the gain of electron(s) leading to increased electron-electron repulsion.

• Van der Waals Radius

• This is a measure of the size of an atom or molecule that includes its electron cloud.

• It is larger than the covalent radius because it accounts for the space occupied by the electron cloud during non-bonded interactions.

Q56. Answer: (a) Decomposition

The correct answer is Decomposition.

Key Points

• Limestone (CaCO3) decomposes into quicklime (CaO) and carbon dioxide (CO2) when heated.

• This type of reaction is known as a thermal decomposition reaction.

• In a decomposition reaction, a single compound breaks down into two or more simpler substances.

• Thermal decomposition usually requires the input of heat energy.

• Quicklime (CaO) is widely used in the construction industry and for making cement.

Additional Information

• Combination Reaction

• Involves two or more substances combining to form a single compound.

• Example: 2H2 + O2 → 2H2O (Formation of water from hydrogen and oxygen).

• Displacement Reaction

• Involves an element displacing another element from a compound.

• Example: Zn + CuSO4 → ZnSO4 + Cu (Zinc displaces copper from copper sulfate).

• Double Displacement Reaction

• Involves the exchange of ions between two compounds to form new compounds.

• Example: Na2SO4 + BaCl2 → 2NaCl + BaSO4 (Sodium sulfate reacts with barium chloride).

Q57. Answer: (c) 11

Shortcut Trick

List the first 8 prime numbers: 2, 3, 5, 7, 11, 13, 17, and 19.

Calculate the sum: 2 + 3 + 5 + 7 + 11 + 13 + 17 + 19 = 77.

Perform the division: 77 ÷ 7 = 11.

Therefore The correct answer is 11.

Alternate Method

Given: First 8 prime numbers and a divisor of 7.

Formula Used: Result = (Sum of first 8 primes) ÷ 7

=> First 8 prime numbers = 2, 3, 5, 7, 11, 13, 17, 19

=> Sum = 2 + 3 + 5 + 7 + 11 + 13 + 17 + 19

=> Sum = 77

=> Required Value = 77 ÷ 7

=> Result = 11

Therefore The correct answer is 11.

Additional Information

Prime Numbers

A prime number is a natural number greater than 1 that has no positive divisors other than 1 and itself. The smallest prime number is 2, which is also the only even prime.

Sum of Primes

There is no general formula to find the sum of the first 'n' prime numbers; they must be listed and summed manually. For the first 10 primes, the sum is 129.

Twin Primes

Twin primes are pairs of prime numbers that differ by exactly 2, such as (3, 5), (5, 7), and (11, 13).

Q58. Answer: (b) X = 295, Y = 85

The logic followed here is:

Logic: (1st number - 5) ÷ 5 = 2nd number,

For, 430 : Y.

Y = (430 - 5) ÷ 5

Y = 425 ÷ 5 = 85

Y = 85

Similarly, X : 58

X = 58 × 5 + 5

X = 290 + 5

X = 295.

Thus, X = 295, Y = 85.

Hence, the correct answer is "Option 2".

Q59. Answer: (d) 82.64 GW

The correct answer is 82.64 GW.

Key Points

• India's cumulative installed solar power capacity reached 82.64 GW as of 30 April 2024.

• In the financial year 2023-24, India added 15.03 GW of solar power capacity.

• This substantial increase signifies India's continuous progress in renewable energy adoption, particularly solar energy.

• The solar energy sector in India has been rapidly expanding, contributing significantly to the nation's renewable energy targets.

• These figures are in alignment with the goals set by the Indian government to enhance solar power infrastructure and capacity.

Additional Information

• National Solar Mission

• Launched in 2010, it aims to promote the development and use of solar energy for power generation and other uses.

• The mission targets installing 100 GW of grid-connected solar power projects by 2022.

• It includes both solar photovoltaic (PV) and solar thermal technologies.

• The mission is a major part of India's commitment to combat climate change and promote sustainable energy.

• Renewable Energy Targets

• India aims to achieve 175 GW of renewable energy capacity by 2022, which includes 100 GW from solar, 60 GW from wind, 10 GW from biomass, and 5 GW from small hydro.

• The country is working towards an even more ambitious target of 450 GW of renewable energy capacity by 2030.

• These targets are part of India's commitment under the Paris Agreement to reduce carbon emissions.

• Solar Power Advantages

• Solar power is a clean and renewable source of energy, contributing to the reduction of greenhouse gas emissions.

• It helps in reducing dependence on fossil fuels and enhances energy security.

• Solar energy systems have low operating costs and can be installed on various scales, from small rooftop systems to large solar farms.

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Q60. Answer: (b) 4 4/9

Shortcut Trick

Total distance covered in the two-way journey = 5 + 5 = 10 km.

Total time taken = 1 hr + (1 hr + 15 min) = 2 hr 15 min = 2.25 hours or 9/4 hours.

Average Speed = Total Distance ÷ Total Time = 10 ÷ (9/4) = 40/9 km/h.

40/9 km/h = 4 4/9 km/h.

Therefore The correct answer is 4 4/9 km/h.

Alternate Method

Given:

Distance from home to office = 5 km

Morning time (t1) = 1 hour

Evening time (t2) = 1 hour + 15 minutes = 1.25 hours

Formula Used:

Average Speed = Total Distance / Total Time

Calculations:

=> Total Distance = 5 km (going) + 5 km (returning) = 10 km

=> Total Time = 1 hr + (1 + 15/60) hr

=> Total Time = 1 + 1.25 = 2.25 hours

=> Converting 2.25 to a fraction: 225/100 = 9/4 hours

=> Average Speed = 10 ÷ (9/4)

=> Average Speed = (10 × 4) / 9 = 40/9 km/h

=> 40/9 = 4 4/9 km/h

Therefore The correct answer is 4 4/9 km/h.

Additional Information

Average Speed (Equal Distances)

If an object covers two equal distances with speeds x and y, the average speed is given by (2 × x × y) / (x + y).

Average Speed (Equal Time Intervals)

If an object travels at speed x for time t and speed y for the same time t, the average speed is (x + y) / 2.

Unit Conversion

To convert speed from km/h to m/s, multiply by 5/18. To convert from m/s to km/h, multiply by 18/5.

Q61. Answer: (c) 9

The logic followed here is:

‘MEANS’ is coded as ‘75821’

‘RANGE’ is coded as ‘84592’

‘PRIME’ is coded as ‘64237’

Thus, code for 'G' is '9'.

Hence, "Option 3" is the correct answer.

Q62. Answer: (a) maximum at the centre

The correct answer is maximum at the centre.

Key Points

• The magnetic field strength in a current-carrying circular loop is maximum at the center of the loop.

• At the center of the loop, the magnetic field lines are most concentrated, leading to the highest field strength.

• As you move towards the periphery of the loop, the magnetic field strength decreases.

• The magnetic field strength at the center of a circular loop is given by the formula B = (μ0I)/(2R), where B is the magnetic field, μ0 is the permeability of free space, I is the current, and R is the radius of the loop.

• This concept is based on the Biot-Savart law which describes the magnetic field generated by a steady current.

Additional Information

• Biot-Savart Law

• This law helps in calculating the magnetic field generated by a steady current.

• It states that the magnetic field at a point is directly proportional to the current and inversely proportional to the distance from the current element.

• Right Hand Rule

• This rule is used to determine the direction of the magnetic field around a current-carrying conductor.

• According to this rule, if you point the thumb of your right hand in the direction of the current, the direction in which your fingers curl gives the direction of the magnetic field.

• Magnetic Field Lines

• These are imaginary lines used to represent the magnetic field.

• The density of these lines indicates the strength of the magnetic field.

• Closer lines represent stronger magnetic fields, while lines further apart indicate weaker fields.

Q63. Answer: (d) SVR

The logic followed here is:

Hence, "Option 4" is the correct answer.

Q64. Answer: (d) Manu Bhaker and PR Sreejesh

The correct answer is Manu Bhaker and PR Sreejesh

Key Points

• Manu Bhaker and PR Sreejesh were the co-flag bearers for India at the closing ceremony of the 2024 Paris Olympics.

• Manu Bhaker

• A shooter who won two bronze medals at the 2024 Paris Olympics.

• She was the first Indian woman to win a medal in shooting at the Olympics.

• PR Sreejesh

• A goalkeeper for the Indian men's hockey team who won a bronze medal at the 2024 Paris Olympics.

• He is also a hockey legend.

Additional Information

• The host city of the 2024 Summer Olympics is Paris, France.

• The Motto is Made for Sharing.

• Skateboarding, sport climbing, surfing, and breaking have been confirmed as the additional sports proposed for inclusion at the Paris Olympic Games in 2024.

• Los Angeles, California, United States will host the 2028 Summer Olympics.

• The Tokyo Summer Olympic Games will be held from July 23 to August 8, 2021.

• They were originally set to take place from July 24 to August 9, 2020, but were postponed because of the COVID-19 pandemic

Q65. Answer: (d) GI-LE

The logic followed here is:

Option 1) KM-PJ

Option 2) OQ-TN

Option 3) IK-NH

Option 4) GI-LE

Thus, out of all the options 'GI-LE is the odd one out.

Hence, "Option 4" is the correct answer.

Q66. Answer: (b) 12

Shortcut Trick

Assume Total Work = LCM(20, 15) = 60 units.

Efficiency of A = 3 units/day and Efficiency of B = 4 units/day.

Work done by B in 6 days = 6 × 4 = 24 units.

Remaining work = 60 − 24 = 36 units.

Time taken by A = 36 ÷ 3 = 12 days.

Therefore The correct answer is 12 days.

Alternate Method

Given:

Time taken by A to complete work = 20 days

Time taken by B to complete work = 15 days

B worked alone for = 6 days

Formula Used:

Total Work = Efficiency × Time

Remaining Work = Total Work − Completed Work

Person	Days	Total Work	Efficiency
A	20	60	3
B	15	4	

Calculations:

=> Total Work (LCM of 20 and 15) = 60 units

=> Work done by B in 6 days = 6 × 4 = 24 units

=> Remaining work to be done by A = 60 − 24 = 36 units

=> Time taken by A alone = Remaining Work ÷ Efficiency of A

=> Time taken by A = 36 ÷ 3 = 12 days

Therefore The correct answer is 12 days.

Additional Information

Efficiency and Time Relationship

Efficiency is inversely proportional to the time taken to complete a work. If the ratio of time is x:y, the ratio of efficiency is y:x.

Work and Wages

Wages are always distributed among workers in the ratio of the actual work done by them or their efficiencies (if they work for the same duration).

Fractional Method

Work done by B in 1 day = 1/15. In 6 days, work done = 6/15 = 2/5. Remaining work = 1 − 2/5 = 3/5. Time for A = (3/5) × 20 = 12 days.

Q67. Answer: (d) Four

Given terms: (Left) 1 $ 7 & 3 4 6 @ 8 Ω % 9 # * £ 2 & 5 (Right)

Required pattern: Symbol - Numbers - Symbol

(Left) 1 $ 7 & 3 4 6 @ 8 Ω % 9 # * £ 2 & 5 (Right)

Thus, the only four pairs follow the pattern.

Hence, the correct answer is "Option 4".

Q68. Answer: (d) Immediate right

Given: A, B, C, D, E and F are sitting around a circular table facing the centre.

D sits to the immediate left of F. B is the immediate neighbour of C and F.

A is the immediate neighbour of E and C.

Thus, the position of D with respect to E is Immediate right of E.

Hence, the correct answer is "Option 4".

Q69. Answer: (d) Zero

Given terms: (Left) * 9 # 1 £ 2 4 & 3 Ω 6 @ 8 $ 7 5 & % (Right)

Required pattern: Symbol - Symbol - Number

(Left) * 9 # 1 £ 2 4 & 3 Ω 6 @ 8 $ 7 5 & % (Right)

Thus, there is zero pair of given pattern.

Hence, the correct answer is "Option 4".

Q70. Answer: (a) Amoeba

The correct answer is Amoeba.

Key Points

• Amoeba is a single-celled organism that uses a food vacuole for digestion.

• The food vacuole in Amoeba engulfs food particles through a process called phagocytosis.

• Inside the food vacuole, complex substances are broken down into simpler ones by digestive enzymes.

• The simpler substances then diffuse into the cytoplasm to be used by the cell.

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• This process ensures that Amoeba can efficiently obtain nutrients from its environment.

Additional Information

• Plasmodium

• Plasmodium is a parasitic protozoan, known for causing malaria in humans.

• It has a complex life cycle involving both humans and mosquito hosts.

• Spirogyra

• Spirogyra is a filamentous green alga, known for its spiral chloroplasts.

• It reproduces both sexually and asexually through fragmentation and conjugation.

• Lichen

• Lichen is a symbiotic association between a fungus and a photosynthetic partner, usually algae or cyanobacteria.

• They are known for their ability to colonize harsh environments, including bare rocks.

Q71. Answer: (c) 3

The logic followed here is:

'PING' is coded as '7953'

'NOSE' is coded as '4638'

Thus, code for 'N' is '3'.

Hence, "Option 3" is the correct answer.

Q72. Answer: (c) Unicellular organisms

The correct answer is Unicellular organisms.

Key Points

• Unicellular organisms are single-celled organisms that perform all necessary functions within one cell.

• Cell division in unicellular organisms, such as bacteria and protozoa, is typically asexual and occurs through processes like binary fission or budding.

• During binary fission, the cell duplicates its genetic material and divides into two equal-sized daughter cells.

• This type of reproduction is efficient and rapid, allowing for quick population growth under favorable conditions.

• Unicellular organisms do not require a mate for reproduction, which simplifies the process and ensures the generation of new individuals.

Additional Information

• Multicellular Organisms

• In multicellular organisms, cell division is used for growth, development, and repair, rather than creating new individuals.

• These organisms reproduce through sexual reproduction, involving the fusion of gametes (sperm and egg cells).

• Mitosis and Meiosis

• Mitosis is a type of cell division resulting in two daughter cells with identical genetic material, used for growth and repair in multicellular organisms.

• Meiosis is a specialized form of cell division that produces gametes with half the genetic material, essential for sexual reproduction.

• Cell Cycle

• The cell cycle includes stages of cell growth, DNA replication, and cell division, ensuring the proper distribution of genetic material to daughter cells.

• Regulation of the cell cycle is crucial for preventing uncontrolled cell division, which can lead to diseases like cancer.

Q73. Answer: (d) Sodium hydrogen carbonate

The correct answer is Sodium hydrogen carbonate.

Key Points

• Sodium hydrogen carbonate, also known as baking soda, is commonly used as an ingredient in antacids.

• It helps to neutralize stomach acid, providing relief from heartburn and indigestion.

• Antacids containing sodium hydrogen carbonate are effective in treating acid reflux and peptic ulcers.

• Sodium hydrogen carbonate reacts with hydrochloric acid in the stomach to produce carbon dioxide, water, and salt, reducing acidity.

• It is preferred in antacid formulations because it works quickly to relieve symptoms of hyperacidity.

Additional Information

• Hydrochloric acid

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• It is a strong acid produced in the stomach to aid in digestion.
• Excess production of hydrochloric acid can lead to conditions like acid reflux and ulcers.
• Calcium carbonate
• It is another compound often used in antacids to neutralize stomach acid.
• Calcium carbonate is effective in providing longer-lasting relief compared to sodium hydrogen carbonate.
• Magnesium hydroxide
• Commonly known as milk of magnesia, it is used in antacids to neutralize stomach acid and relieve constipation.
• Magnesium hydroxide works by drawing water into the intestines, making it easier to pass stool.

Q74. Answer: (c) 0.9

Given:
0.009/K = 0.01
Formula used:
K = 0.009/0.01
Calculation:
0.009/K = 0.01
=> K = 0.009/0.01
=> K = 0.9
Therefore The correct answer is option (3).

Q75. Answer: (b) Neuron

The correct answer is Neuron.
Key Points
• Neurons are the fundamental units of the brain and nervous system, responsible for receiving sensory input from the external world.
• They conduct information via electrical impulses, known as action potentials, throughout the body.
• Neurons connect with each other to form networks that perform various functions such as motor coordination, sensory perception, and cognitive processes.
• Each neuron consists of a cell body, dendrites, and an axon, which help in the transmission of electrical signals.
• The synapse is the junction between two neurons where information is transmitted from one neuron to another through neurotransmitters.
Additional Information
• Nucleus
• The nucleus is the membrane-bound organelle that contains the cell's chromosomes.
• It acts as the control center of the cell, regulating gene expression and mediating the replication of DNA during the cell cycle.
• Dendrite
• Dendrites are the branched projections of a neuron that receive electrochemical signals from other neural cells.
• They conduct the electrical impulses toward the cell body of the neuron.
• Axon
• The axon is a long, slender projection of a neuron that typically conducts electrical impulses away from the cell body.It is responsible for transmitting information to different neurons, muscles, and glands.

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