RRB ALP CBT-I 2024 Official Paper (Held On: 28 Nov, 2024 Shift 3) (Previous Year Paper)

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

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STAGE I (CBT I)

Q1. 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:

All chairs are tables.

No table is a bed.

Conclusions:

(I) Some beds are chairs.

(II) No bed is a table.

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

Q2. Which tissue is responsible for movement in our body?

(a) Nervous tissue
(b) Muscular tissue
(c) Epithelial tissue
(d) Connective tissue

Q3. The 90^(th) edition of the Ranji Trophy started in October 2024. Which of the following games is the Ranji Trophy related to?

(a) Hockey
(b) Basketball
(c) Badminton
(d) Cricket

Q4. Which of the following options should come in place of the question mark (?) in the given series based on the English alphabetical order?

GJN, ILP, KNR, MPT, ?

(a) ORV
(b) OVR
(c) RVO
(d) ROV

Q5. The magnification produced by a spherical mirror is +0.75. The image is:

(a) Virtual, erect and diminished
(b) Virtual, erect and enlarged
(c) Real, inverted and diminished

(d) Real, inverted and enlarged

Q6. If each vowel in the word PAINTED is changed to the letter following it in the English alphabetical order and each consonant is changed to the letter preceding it in the English alphabetical order, then which letter will be in the third position from the left in the new group of letters thus formed?

(a) F
(b) J
(c) B
(d) M

Q7. 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 x P - S + T'?

(a) Mother's brother's wife's brother
(b) Mother's brother's wife's father
(c) Mother's brother
(d) Mother's father

Q8. Select the pair which follows the same pattern as that followed by the two sets of pairs given below. Both pairs follow the same pattern.

GTC: KWE

WFK: AIM

(a) LPA: KMV
(b) DGB: GLI
(c) JQP: MVW
(d) OZG: SCI

Q9. A gardener increases the area of his rectangular garden by increasing its length by 40% and decreasing its breadth by 20%. The area of the new garden is what percentage more than the area of the old garden?

(a) 0%
(b) 12%
(c) 8%
(d) 20%

Q10. Consider a parallel combination of 2 resistors with resistances 4 Ω and 6 Ω. The equivalent resistance of the circuit is:

(a) 12Ω
(b) 10Ω
(c) 4.2Ω
(d) 2.4Ω

Q11. All liquids and gases are:

(a) fluids
(b) semiconductors
(c) solids
(d) insulators

Q12. What type of reaction takes place when a single reactant breaks down into simpler products?

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

Q13. Identify the single cell organism.

(a) Amoeba
(b) Seaweed
(c) Leech
(d) Liver fluke

Q14. In a certain code language, 'MOUSE' is coded as '74651', 'SPOKE' is coded as '52418', and 'PROUD' is coded as '26394'. What is the code for 'K' in the given code language?

(a) 2
(b) 8
(c) 5
(d) 1

Q15. Which of the following is NOT a characteristic of particles of matter?

(a) Particles of matter are static.
(b) Particles of matter have space between them.
(c) Particles of matter are continuously moving.
(d) Particles of matter attract each other.

Q16. Which of the following represents the ratio by mass of hydrogen to oxygen atoms (H:O) in a water molecule?

(a) 1:4
(b) 3:8
(c) 1:8
(d) 1:2

Q17. In September 2024, which High Court of India struck down the amended Information Technology Rules 2023, which empowered the Centre to set up a fact check unit (FCU) to identify fake, false and misleading information about the government and its establishments on social media?

(a) Delhi High Court
(b) Patna High Court
(c) Bombay High Court
(d) Madras High Court

Q18. Which of the following numbers is divisible by both 7 and 11?

(a) 3014
(b) 2534
(c) 2684
(d) 1771

Q19. Town A is the north of Town B. Town C is to the east of Town B. Town D is to the west of Town C. Town A is to the north-east of Town D. Town M is to the north of Town C. What is the position of Town D with respect to Town M?

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

Q20. Two successive discounts of 10% and 5% are equivalent to a single discount of _____.

(a) 15.5%
(b) 14%
(c) 14.5%
(d) 15%

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Q21. Study the following table and answer the given question.

The table shows the expenditure of a family over the given years.

Year	Expenditure in Rs.				
Food	Clothing	Education	Rent	Others	
2011	2000	1200	3300	2000	4000
2012	2500	1100	3200	2300	4100

What is the total expenditure (in Rs.) on food by the family for the year 2011 and 2012?

(a) 5,000
(b) 5,500
(c) 4,500
(d) 6,000

Q22. If a regular polygon has 65 diagonals, then the number of sides this polygon has is:

(a) 12
(b) 14
(c) 13
(d) 10

Q23. Find the volume of a sphere whose diameter is 84 m. [Use π = 22/7]

(a) 323,434 m^3
(b) 310,464 m^3
(c) 338,808 m^3
(d) 313,418 m^3

Q24. Under the Prime Minister's Internship Scheme launched in October 2024, candidates will receive a monthly stipend of what amount for the full 12-month internship period?

(a) Rs. 1,500
(b) Rs. 5,000
(c) Rs. 6,500
(d) Rs. 2,000

Q25. If Rs. 2,400 is to be distributed between A and B in the ratio of 7 : 5, then the share of B is:

(a) Rs. 1,300
(b) Rs. 1,600
(c) Rs. 1,000
(d) Rs. 1,900

Q26. DGEH is related to ILJM in a certain way based on the English alphabetical order. In the same way, GJHK is related to LOMP. To which of the following options is PSQT related, following the same logic?

(a) UXWY
(b) UXVY
(c) UVXZ
(d) VUWY

Q27. 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:

No dogs are pigs.

All pigs are stones.

Conclusions:

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(I) Some stones are pigs.

(II) No stones are dogs.

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

Q28. If a sum amounts to 2 1/4 times the sum after 2 years on a certain rate of compound interest, compounded annually, then the rate of interest per annum is:

(a) 30%
(b) 50%
(c) 25%
(d) 40%

Q29. In which Indian state was a 1,300-year-old stupa discovered by the Archaeological Survey of India (ASI) in February 2023?

(a) Odisha
(b) West Bengal
(c) Madhya Pradesh
(d) Bihar

Q30. The Union Cabinet approved the establishment of International Big Cat Alliance (IBCA) with headquarters in India with a one-time budgetary support of Rs. 150 crore for a period of _____.

(a) 3 years
(b) 10 years
(c) 5 years
(d) 7 years

Q31. A town had a population of 50,000 in 1988. In one year, by 1989, it increased by 25%. Next year, in 1990, it decreased by 30%. The next year, in 1991, there was an increase of 40%. What is the population at the end of 1991?

(a) 62,250
(b) 61,250
(c) 60,250
(d) 66,550

Q32. If we add 1 to the numerator and subtract 1 from the denominator of a given fraction, it becomes 1. It becomes 2/3 if 1 is added to the denominator of the given fraction while the numerator is left unchanged. The positive difference of numerator and denominator of the fraction is:

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

Q33. Which of the following actions is responsible for the survival of species over time?

(a) Conservation
(b) Variation
(c) Reproduction
(d) Struggle

Q34. Refer to the following number and symbol series and answer the question that follows. Counting to be done from left to right only.

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

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

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

Q35. A class of 30 students appeared in a test. The average score of 12 students is 80, and that of the rest is 75. What is the average score of the class?
(a) 56
(b) 87
(c) 67
(d) 77

Q36. The sum of all prime numbers between 60 and 90 is:
(a) 610
(b) 523
(c) 373
(d) 460

Q37. A dishonest dealer professes to sell his goods at cost price, but uses a false weight and thus gains 25%. For 100 gm, he uses a weight of how many grams?
(a) 70gm
(b) 85gm
(c) 75gm
(d) 80gm

Q38. In a certain code language, ‘HAIR’ is coded as ‘9715’ and ‘AGED’ is coded as ‘8612’. What is the code for ‘A’ in the given code language?
(a) 1
(b) 2
(c) 8
(d) 7

Q39. If A means +, B means −, C means ×, D means ÷, then what will come in place of the question mark (?) in the following equation?
14 B 5 C 5 A 30 D 2 = ?
(a) 2
(b) 4
(c) 1
(d) 3

Q40. The value of $x^2 - 5$ at $x = -1$ is:
(a) -2
(b) -5
(c) -1
(d) -4

Q41. From a point on the ground, the angles of elevation of the top and the bottom of a flag that is mounted on an 18 m high pole, are respectively 60° and 30°. The height of the flag is :
(a) 52 m
(b) 36 m
(c) 60 m
(d) 48 m

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Q42. Which of the following options should come in place of the question mark (?) in the given series?

4 5 9 18 34 ?

(a) 59
(b) 60
(c) 54
(d) 52

Q43. Magnetic field lines around a straight current carrying conductor look like:

(a) straight lines
(b) ellipses
(c) hyperbolas
(d) concentric circles

Q44. Regarding carbon, which of the following statements is true?

(a) Carbon is trivalent.
(b) Carbon is tetravalent.
(c) Carbon is bivalent.
(d) Carbon is monovalent.

Q45. Reena runs at a speed of 8 km/h. How long will she take to cover 200 m?

(a) 175 seconds
(b) 54 seconds
(c) 90 seconds
(d) 120 seconds

Q46. When white light falls on a glass prism, it splits into seven colours. The phenomena is known as:

(a) Diffraction
(b) Dispersion
(c) Deviation
(d) Refraction

Q47. 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 : 198 :: 8 : Y

(a) X = 7, Y = 538
(b) X = 4, Y = 512
(c) X = 5, Y = 546
(d) X = 6, Y = 488

Q48. A group of people consists of men, women, and children. 40% of them are men, 35% are women and rest are children, and their average weights are 70 kg, 60 kg and 30 kg, respectively. The average weight of the group is:

(a) 45.5 kg
(b) 46.5 kg
(c) 55.5 kg
(d) 56.5 kg

Q49. Aarav can do a piece of work alone in 6 days and Babita can do it alone in 8 days. Aarav and Babita undertook to do it for Rs. 2,400. With the help of Chaitanya, they completed the work in 3 days. How much is to be paid to Babita?

(a) Rs. 1,200
(b) Rs. 900
(c) Rs. 800

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(d) Rs. 1,400

Q50. What is the use of high-performance computing systems 'Arka' and 'Arunika'?

(a) Weather forecasting
(b) Detecting the location of drugs
(c) Cyber crime detection
(d) Monitoring unwanted elements on social media

Q51. Who among the following is the author of the book 'Neeraj Chopra: The Man Who Made History'?

(a) Shamya Dasgupta
(b) Norris Pritam
(c) Navdeep Singh Gill
(d) Samir Chopra

Q52. 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 : 140.4 :: 38 : Y

(a) X = 34, Y = 225.8
(b) X = 23, Y = 240.6
(c) X = 21, Y = 218.4
(d) X = 26, Y = 205.2

Q53. 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?

144 C 44 D 12 A 12 B 144 = ?

(a) 54
(b) 44
(c) 34
(d) 43

Q54. Seven boxes, P, Q, R, S, X, Y and Z, are kept one over the other but not necessarily in the same order. Only P is kept above X. Only two boxes are kept between X and S. Only R is kept below Z. Y is not kept immediately above S. Which box is kept fourth from the top?

(a) Q
(b) X
(c) Z
(d) R

Q55. Based on the English alphabetical order, three of the following four letter-cluster pairs are alike in a certain way and thus form a group. Which 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) YQ - CU
(b) AS - EW
(c) DV - HZ
(d) UM - ZN

Q56. The square of the length of a space diagonal of a closed cube is 2175 cm^2. What is the total surface area (in cm^2) of the cube?

(a) 4305
(b) 4350
(c) 4530

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(d) 4272

Q57. Milk is a mixture of

(a) only protein
(b) only fat
(c) only water
(d) water, fat, protein, etc

Q58. Where does India rank on the Corruption Perceptions Index as of October 2024?

(a) 89
(b) 93
(c) 96
(d) 86

Q59. The concept of 'Prodyogiki' in the Yuva Sangam programme (2023) primarily focuses on which of the following?

(a) Economic development
(b) Technology
(c) Cultural preservation
(d) Political awareness

Q60. Select the correct sentence(s).

a. The release of energy in the aerobic process is a lot greater than in the anaerobic process.

b. ATP is broken down giving rise to a fixed amount of energy which can drive the endothermic reactions taking place in the cell.

c. The pyruvate is converted into lactic acid which is also a three-carbon molecule.

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

Q61. If each vowel in the word PLANTED is changed to the letter following it in the English alphabetical order and each consonant is changed to the letter preceding it in the English alphabetical order, then which letter will be in the third position from the left in the new group of letters thus formed?

(a) B
(b) F
(c) C
(d) K

Q62. Name the scientist who first discovered the cell in 1665.

(a) Matthias Jakob Schleiden
(b) Theodor Schwann
(c) Antonie van Leeuwenhoek
(d) Robert Hooke

Q63. In 2024, Air Marshal Tejinder Singh was appointed as the _____ at the Air Headquarters (Vayu Bhawan).

(a) Chief of Defence Staff
(b) Chief of the Air Staff
(c) Air Officer Commanding-in-Chief
(d) Deputy Chief of the Air Staff

Q64. 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) AT - EX
(b) SL - WP

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(c) KD - OF
(d) NG - RK

Q65. Seven people, A, B, C, D, E, F and G are sitting in a row, facing north. Only five people sit between A and F. G sits third to the left of F. E is the immediate neighbour of B and F. C is not the immediate neighbour of G.

How many people sit between C and E?

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

Q66. What determines the chemical properties of a carbon compound?

(a) Functional group
(b) Molecular mass
(c) Number of Hydrogen atoms
(d) Length of the carbon chain

Q67. In this question, a statement is followed by two courses of action, numbered I and II. You must assume everything in the statement to be true and on the basis of the information given in the statement, decide which of the courses of action logically follow(s) for pursuing.

Statement:

Mr. X, a teacher of a high school, often beats his students.

Courses of Action:

I. Students should complain about this matter to the principal of the school.

II. Students should quit the school and take admission in another school.

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

Q68. What happens when pea plants showing two different characteristics (the tall/short trait and the round seed/wrinkled seed trait), rather than just one are bred with each other?

(a) The tall/short trait and the round seed/wrinkled seed trait are independently inherited.
(b) They are all tall and have round seeds in F2 generation.
(c) Some F1 progeny are tall plants with round seeds, and some are short plants with wrinkled seeds.
(d) The tall/short trait and the round seed/wrinkled seed trait are dependently inherited.

Q69. Which of the following statements is INCORRECT?

(a) Tooth decay starts when the pH of the mouth is lower than 5.5.
(b) When pH of rain water is less than 5.6, it is called acid rain.
(c) Living organisms can survive only in a narrow range of pH change.
(d) When pH of rain water is more than 5.6, it is called acid rain.

Q70. Six people, A, B, C, D, E and F are sitting in a straight line, facing north.

Only three people sit to the left of E. B sits second to the right of E. Only three people sit between A and C. C sits immediately left of D.

How many people sit between D and F?

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

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Q71. The sum of five consecutive numbers is 260. The sum of the first and the last numbers is:

(a) 96
(b) 126
(c) 116
(d) 104

Q72. The value of √0.0016 × cbrt8000000 is:

(a) 8
(b) 16
(c) 0.8
(d) 1.6

Q73. Which of the following options should come in place of the question mark (?) in the given series based on the English alphabetical order?

BFW, DIS, FLO, HOK, ?

(a) JSG
(b) KQE
(c) KRF
(d) JRG

Q74. When a motorcar makes a sharp turn at a high speed, we tend to get thrown to one side. This example is based on which law of motion?

(a) Conservation of momentum
(b) Second law of motion
(c) Third law of motion
(d) First law of motion

Q75. When the force and the displacement are in the same direction, then work done will be:

(a) zero
(b) positive
(c) either positive or negative
(d) negative

ANSWER KEY

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

SOLUTIONS

Q1. Answer: (a) Only conclusion (II) follows.

Statements:

All chairs are tables.

No table is a bed.

The least possible venn diagram is given:

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Conclusions:

(I) Some beds are chairs - False(because, All chairs are tables and No table is a bed, it implies that no chair is bed as well).

(II) No bed is a table - True(because, All chairs are tables and No table is a bed, it implies that no table is bed as well).

Thus, Only conclusion (II) follows.

Hence, the correct answer is "Option 1".

Q2. Answer: (b) Muscular tissue

The correct answer is Muscular tissue.

Key Points

• Muscular tissue is responsible for the movement of the body and its parts.

• There are three types of muscular tissue: skeletal, cardiac, and smooth muscle.

• Skeletal muscles are attached to bones and cause voluntary movements.

• Cardiac muscle tissue is found only in the heart and is responsible for pumping blood throughout the body.

• Smooth muscle tissue is found in walls of internal organs such as the stomach, intestines, and blood vessels and is responsible for involuntary movements.

Additional Information

• Nervous tissue

• Nervous tissue is responsible for transmitting nerve impulses and is found in the brain, spinal cord, and nerves.

• It plays a crucial role in controlling and coordinating body activities.

• Epithelial tissue

• Epithelial tissue forms the lining of internal and external surfaces of the body, including skin and the lining of organs.

• It provides protection and is involved in absorption, secretion, and sensation.

• Connective tissue

• Connective tissue supports, binds, and protects other tissues and organs.

• It includes bone, cartilage, adipose tissue, and blood.

Q3. Answer: (d) Cricket

The correct answer is Cricket.

Key Points

• Ranji Trophy:-

• It is the premier domestic first-class cricket championship played in India. (Hence option 4 is correct)

• The Board of Control for Cricket in India (BCCI) annually organizes it.

• The teams representing regional and state cricket associations participate.

• The competition currently consists of 38 teams, with all 28 states in India and four of the eight union territories having at least one representation.

• Some of the most successful teams in the history of the Ranji Trophy:

• Mumbai (41 titles)

• Karnataka (8 titles)

• Delhi (7 titles)

• Maharashtra (7 titles)

• Tamil Nadu (6 titles)

Additional Information

• Various Sports and their related Cups and trophies:-

Sports	Cups and Trophies
Cricket	Ranji Trophy (National Championship), Irani Trophy, Dilip Trophy CK Naidu Trophy, Rani Jhansi Trophy, Deodhar Trophy, G.K. D. Birla Trophy Rohinton Baria Trophy, etc.
Badminton	Narang Cup, Chadha Cup, Nehru Cup, Amrit Diwan, etc.
Hockey	Betan Cup, Rangaswamy Cup, Aga Khan Cup, Begum Rasool Trophy (Women), Maharaj Ranjit Singh Gold Cup, Lady Ratan Tata Trophy (Women), Gurunanak, Championship (Women), Dhyanchand Trophy, Nehru Trophy, Scindia Gold Cup, Murugappa Gold Cup, Wellington Cup, Indira Gandhi Gold Cup,

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Football	DCM Trophy, Durand Cup, Rovers Cup, VC Roy Trophy (National Championship), Santosh Trophy (National Championship), IF a. Shield, Subrata Mukherjee Cup, Sir Ashutosh Mukherjee Trophy, Merdeka Cup

Q4. Answer: (a) ORV

The logic followed here is:

Hence, the correct answer is "Option 1".

Q5. Answer: (a) Virtual, erect and diminished

The correct answer is Virtual, erect and diminished.

Key Points

• The magnification produced by a spherical mirror is given as +0.75.

• A positive magnification indicates that the image is virtual and erect.

• The magnification value (0.75) is less than 1, indicating that the image is diminished.

• Virtual images formed by spherical mirrors are always erect.

• Therefore, the image is virtual, erect, and diminished.

Additional Information

• Concave Mirrors

• Concave mirrors can produce both real and virtual images depending on the position of the object.

• When the object is placed between the focal point and the mirror, a virtual, erect, and enlarged image is formed.

• Convex Mirrors

• Convex mirrors always produce virtual, erect, and diminished images regardless of the object's position.

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

• Magnification Formula

• The magnification (m) produced by a spherical mirror is given by the formula m = -v/u, where v is the image distance and u is the object distance.

• A positive value of magnification indicates a virtual and erect image, while a negative value indicates a real and inverted image.

Q6. Answer: (b) J

Given word: 'PAINTED'

After changing vowels and consonants:

Original	**P**	**A**	**I**	**N**	**T**	**E**	**D**
Modified	O	B	J	M	S	F	C

After changing vowels and consonants,

Third alphabet from the left end is: J

Hence, the correct answer is "Option 2".

Q7. Answer: (b) Mother's brother's wife's father

Given: 'M ÷ N x P - S + T'

Decoding the symbols:

signs	**÷**	**x**	**•**	**•**
Coded as	Father	wife	brother	mother

M ÷ N x P - S + T: It means M is the father of N, N is the wife of P, P is the brother of S, S is the mother of T.

Thus, M is the Mother's brother's wife's father of T.

Hence, the correct answer is "Option 2".

Q8. Answer: (d) OZG: SCI

The logic followed here is:

For, GTC: KWE

For, WFK: AIM

Let's check options one by one:

Option 1) LPA: KMV

Option 2) DGB: GLI

Option 3) JQP: MVW

Option 4) OZG: SCI

Hence, the correct answer is "Option 4".

Q9. Answer: (b) 12%

Shortcut Trick

Apply the Successive Percentage Change formula: Net Change = x + y + (x × y)/100

Here, increase in length (x) = +40 and decrease in breadth (y) = −20

Net change in Area = 40 − 20 + [40 × (−20)] / 100

Net change in Area = 20 − 8 = 12%

Therefore The correct answer is 12%.

Alternate Method

Given:

Increase in Length = 40%

Decrease in Breadth = 20%

Formula Used:

Area of Rectangle = Length × Breadth

=> Let the initial Length be 10 units and initial Breadth be 10 units.

=> Initial Area = 10 × 10 = 100 units²

=> New Length = 10 + (40% of 10) = 14 units

=> New Breadth = 10 − (20% of 10) = 8 units

=> New Area = 14 × 8 = 112 units²

=> Percentage change = [(New Area − Initial Area) / Initial Area] × 100

=> Percentage change = [(112 − 100) / 100] × 100 = 12%

Therefore The correct answer is 12%.

Additional Information

Successive Percentage Change

When a value is changed by x% and then by y%, the overall percentage change is given by [x + y + (xy/100)]%.

Area and Multipliers

Percentage changes can be solved using decimal multipliers. An increase of 40% is × 1.4 and a decrease of 20% is × 0.8. The result is 1.4 × 0.8 = 1.12, representing a 12% increase.

Product Stability Rule

If the product (Area) remains constant while one factor (Length) increases by x%, the other factor (Breadth) must decrease by [x / (100 + x)] × 100%.

Q10. Answer: (d) 2.4Ω

The Correct answer is 2.4Ω.

Key Points

• When resistors are connected in a parallel combination, the reciprocal of the equivalent resistance is the sum of the reciprocals of the individual resistances.

• The formula for the equivalent resistance in a parallel circuit is:

1/R_eq = 1/R1 + 1/R2, where R1 and R2 are the resistances of the individual resistors.

• Here, the given resistances are 4Ω and 6Ω.

• Substitute the values into the formula:

1/R_eq = 1/4 + 1/6.

• Find the least common denominator (LCD) of 4 and 6, which is 12. Rewrite the fractions:

1/R_eq = 3/12 + 2/12 = 5/12.

• Reciprocate the result to find the equivalent resistance:

R_eq = 12/5 = 2.4Ω.

• Thus, the equivalent resistance of the parallel combination is 2.4Ω.

• Parallel circuits are commonly used in electrical systems to ensure that the voltage across each component is the same and to

reduce the overall resistance.

Additional Information

• 4.2Ω

• This value might be mistaken as the result if the formula for parallel resistance is applied incorrectly or if the calculation is done improperly.

• 10Ω

• This value corresponds to the sum of the resistances (4Ω + 6Ω), which is the formula for resistances in series, not parallel. This is incorrect in the context of the given question.

• 12Ω

• This value might confuse learners who think that one of the resistances directly represents the equivalent resistance, but it is not applicable in a parallel circuit.

Q11. Answer: (a) fluids

The correct answer is fluids.

Key Points

• All liquids and gases are considered fluids because they can flow.

• Fluids do not have a fixed shape and they take the shape of their container.

• Unlike solids, fluids have the ability to deform continuously under an applied shear stress.

• The molecules in fluids are not as tightly packed as in solids, allowing them to move freely past one another.

• Fluids can be characterized by their viscosity, which is a measure of their resistance to flow.

Additional Information

• Solids

• Solids have a definite shape and volume because their molecules are tightly packed and only vibrate in place.

• They do not flow like fluids and are rigid in nature.

• Semiconductors

• Semiconductors are materials that have a conductivity between conductors (metals) and insulators (non-metals).

• They are used in electronic devices to control the flow of current.

• Insulators

• Insulators are materials that do not allow the flow of electric current easily.

• They are used to protect us from the harmful effects of electricity by preventing unwanted flow of current.

Q12. Answer: (a) Decomposition

The correct answer is Decomposition.

Key Points

• A decomposition reaction is a type of chemical reaction where a single compound breaks down into two or more simpler substances.

• It generally requires an input of energy in the form of heat, light, or electricity to break the chemical bonds.

• Decomposition reactions are the opposite of combination reactions, where simpler substances combine to form a more complex compound.

• Examples of decomposition reactions include the breakdown of water into hydrogen and oxygen and the breakdown of calcium carbonate into calcium oxide and carbon dioxide.

• These reactions are important in various industrial processes and in the decomposition of organic matter in natural environments.

Additional Information

• Combination Reaction

• In a combination reaction, two or more reactants combine to form a single product.

• Example: The reaction of hydrogen and oxygen to form water.

• Displacement Reaction

• In a displacement reaction, one element replaces another element in a compound.

• Example: The reaction of zinc with hydrochloric acid to produce zinc chloride and hydrogen gas.

• Double Displacement Reaction

• In a double displacement reaction, the ions of two compounds exchange places in an aqueous solution to form two new compounds.

• Example: The reaction of sodium sulfate with barium chloride to form barium sulfate and sodium chloride.

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Q13. Answer: (a) Amoeba

The correct answer is Amoeba.

Key Points

• Amoeba is a single-celled organism commonly found in freshwater environments.
• It belongs to the protist kingdom and is known for its ability to change shape due to its flexible cell membrane.
• Amoebas move by extending their pseudopodia (false feet), which are temporary projections of the cell.
• They feed through a process called phagocytosis, where they engulf food particles with their pseudopodia.
• Amoebas reproduce asexually through a process called binary fission, where the cell divides into two identical daughter cells.

Additional Information

• Seaweed
• Seaweeds are multicellular marine algae and are not single-celled organisms.
• They play a crucial role in marine ecosystems, providing food and habitat for marine life.
• Leech
• Leeches are multicellular parasitic or predatory worms belonging to the phylum Annelida.
• They are known for their bloodsucking behavior and are used in medical treatments for bloodletting.
• Liver fluke
• Liver flukes are parasitic flatworms belonging to the class Trematoda.
• They infect the liver and bile ducts of various mammals, including humans.

Q14. Answer: (b) 8

The logic followed here is:

The code for K is "8".

Hence, the correct answer is "Option 2".

Q15. Answer: (a) Particles of matter are static.

The correct answer is Particles of matter are static..

Key Points

• Particles of matter are always in a state of continuous motion, hence they are not static.
• Particles of matter have spaces between them, which allows them to move and interact.
• The movement of particles is influenced by temperature; higher temperatures increase their kinetic energy and motion.
• Particles of matter attract each other due to intermolecular forces, which can vary in strength depending on the type of matter.
• The concept of matter being static contradicts the kinetic theory of matter which states that particles are always in motion.

Additional Information

• States of Matter
• Matter exists in different states: solid, liquid, and gas, each with distinct characteristics based on particle arrangement and movement.
• In solids, particles are closely packed and have limited movement. In liquids, they are less tightly packed and move more freely. In gases, particles move rapidly and are far apart.
• Kinetic Theory of Matter
• This theory explains that matter is made up of particles which are in constant motion.
• The energy of particles increases with temperature, affecting their state and behavior.
• Intermolecular Forces
• These are forces of attraction or repulsion between particles of matter.
• They play a crucial role in determining the physical properties of substances, such as boiling and melting points.

Q16. Answer: (c) 1:8

The correct answer is 1:8.

Key Points

• A water molecule (H_2O) consists of two hydrogen atoms and one oxygen atom.
• The atomic mass of hydrogen is approximately 1 u (atomic mass unit), and the atomic mass of oxygen is approximately 16 u.
• Therefore, the total mass of the hydrogen atoms in a water molecule is 2 u (2 hydrogen atoms × 1 u).
• The mass of the oxygen atom in a water molecule is 16 u.
• The ratio by mass of hydrogen to oxygen atoms in a water molecule is thus 2:16, which simplifies to 1:8.

Additional Information

• Water Molecule Structure

• Water is a polar molecule, with the oxygen atom having a partial negative charge and the hydrogen atoms having partial positive charges.

• This polarity leads to hydrogen bonding between water molecules, which gives water its unique properties such as high surface tension and boiling point.

• Hydrogen Bonding

• Hydrogen bonds are weak bonds that form between the hydrogen atom of one water molecule and the oxygen atom of another water molecule.

• These bonds are responsible for many of water's unusual properties, including its high specific heat capacity and its role as a universal solvent.

• Applications of Water

• Water is essential for life, serving as a solvent, a temperature buffer, and a reactant in various biochemical processes.

• It is also used in numerous industrial applications, including cooling, cleaning, and as a raw material in chemical reactions.

Q17. Answer: (c) Bombay High Court

The correct answer is Bombay High Court

Key Points

• The Bombay High Court (HC) struck down the Amended Information Technology Rules, 2023 which empowered the Centre to set up a Fact Check Unit (FCU) to identify fake, false and misleading information about the government on social media.

• The Information Technology (Intermediary Guidelines and Digital Media Ethics Code) Amendment Rules, 2023, violated Article 14 (right to equality), 19 (freedom of speech and expression) and 19(1)(g) (freedom and right to profession) of the Constitution.

• The definition of fake or misleading news remains ambiguous, lacking clarity and precision.

• In the absence of a legally established "right to the truth," the State is not obligated to ensure that citizens are provided solely with information deemed accurate by the Fact Check Unit (FCU).

• Additionally, the measures fail to meet the standard of proportionality.

Additional Information

High Court	Year of Establishment	Principal Seat	Jurisdiction	First Chief Justice
Delhi High Court	1966	New Delhi	Delhi	Justice K. S. Hegde
Madras High Court	1862	Chennai	Tamil Nadu and Puducherry	Sir Colley Harman Scotland
Patna High Court	1916	Patna	Bihar and (until 1948) Orissa	Justice Edward Maynard Des Champs Chamier

Q18. Answer: (d) 1771

Shortcut Trick

A number divisible by both 7 and 11 must be divisible by their LCM, which is 7 × 11 = 77.

Check option D: 1771 ÷ 77 = 23 (Perfectly divisible).

Divisibility of 11 for 1771: (1 + 7) − (7 + 1) = 0 (Divisible).

Divisibility of 7 for 1771: 177 − (1 × 2) = 175; 17 − (5 × 2) = 7 (Divisible).

Therefore The correct answer is 1771.

Alternate Method

Given: Numbers 3014, 2534, 2684, 1771.

Formula Used: Divisibility rules for 7 and 11.

1771

Rule 11: (1+7)−(7+1)=0

Rule 7: 177−(1×2)=175

Conclusion: Divisible by 77

=> Divisibility of 11: Sum of digits at odd places − Sum of digits at even places = 0 or multiple of 11.

=> For 1771: (1 + 7) − (7 + 1) = 8 − 8 = 0. (True)

=> Divisibility of 7: Subtract twice the last digit from the rest of the number.

=> For 1771: 177 − (1 × 2) = 175.

=> Continuing: 17 − (5 × 2) = 17 − 10 = 7. (True)

=> For 2684: (2 + 8) − (6 + 4) = 0 (Divisible by 11), but 268 − 8 = 260 (Not divisible by 7).

=> For 3014: (3 + 1) − (0 + 4) = 0 (Divisible by 11), but 301 − 8 = 293 (Not divisible by 7).

=> For 2534: (2 + 3) − (5 + 4) = −4 (Not divisible by 11).

Therefore The correct answer is 1771.

Additional Information

Divisibility by 77

A number is divisible by 77 if it is simultaneously divisible by both 7 and 11, as 7 and 11 are coprime.

Divisibility by 13

Add 4 times the last digit to the remaining part of the number. If the result is divisible by 13, the original number is also divisible.

Coprime Product Rule

If a number is divisible by two coprime numbers a and b, then it is necessarily divisible by their product (a × b).

Q19. Answer: (a) South-west

Given:

Town A is the north of Town B.

Town C is to the east of Town B.

Town D is to the west of Town C.

Town A is to the north-east of Town D.

Town M is to the north of Town C.

Thus, Town D is South-west to Town M.

Hence, the correct answer is "Option 1".

Q20. Answer: (c) 14.5%

Shortcut Trick

For two successive discounts x% and y%, the single equivalent discount is calculated as:

Equivalent Discount = (x + y − (x × y / 100))%

Here, x = 10 and y = 5.

=> Discount = (10 + 5 − (10 × 5 / 100))% = 15 − 0.5 = 14.5%

Therefore The correct answer is 14.5%.

Alternate Method

Given: First discount = 10%, Second discount = 5%.

Formula Used: Selling Price = Marked Price × (100 − d1)/100 × (100 − d2)/100

=> Let the Marked Price be 100 units.

=> Price after the first 10% discount = 100 − (10% of 100) = 100 − 10 = 90 units.

=> Price after the second 5% discount = 90 − (5% of 90) = 90 − 4.5 = 85.5 units.

=> Total Discount = 100 − 85.5 = 14.5 units.

=> Equivalent Discount Percentage = (14.5 / 100) × 100 = 14.5%.

Therefore The correct answer is 14.5%.

Additional Information

Marked Price and Discount

Marked Price (MP) is the price listed on a product. Discount is always calculated on the MP. Selling Price (SP) = MP − Discount.

Three Successive Discounts

For three successive discounts a%, b%, and c%, the final multiplier for SP is (1 − a/100) × (1 − b/100) × (1 − c/100). The single discount is 1 − (Product of multipliers).

Successive Percentage Change

This concept also applies to population growth or depreciation. If a value decreases by x% and then by y%, the net decrease is [x + y − (xy/100)]%.

Q21. Answer: (c) 4,500

Given:

The table shows the expenditure of a family over the years 2011 and 2012. We need to find the total expenditure on food for both years.

Formula used:

Total expenditure on food = Expenditure on food in 2011 + Expenditure on food in 2012

Calculation:

Expenditure on food in 2011 = Rs. 2000

Expenditure on food in 2012 = Rs. 2500

Total expenditure on food:

=> Rs. 2000 + Rs. 2500 = Rs. 4500

Therefore The total expenditure on food for 2011 and 2012 is Rs. 4500.

Q22. Answer: (c) 13

Shortcut Trick

For a regular polygon with n sides, the number of diagonals is given by the formula: n(n − 3) ÷ 2.

=> n(n − 3) ÷ 2 = 65

=> n(n − 3) = 130

We need to find two factors of 130 that differ by 3.

=> 130 = 13 × 10

Comparing n(n − 3) with 13(10), we get n = 13.

Therefore The correct answer is 13 sides.

Alternate Method

Given:

Number of diagonals in the regular polygon = 65.

Formula Used:

Number of diagonals in an n-sided polygon = n(n − 3) ÷ 2

Calculations:

=> 65 = n(n − 3) ÷ 2

=> 130 = n^2 − 3n

=> n^2 − 3n − 130 = 0

To solve this quadratic equation, we split the middle term:

=> n^2 − 13n + 10n − 130 = 0

=> n(n − 13) + 10(n − 13) = 0

=> (n − 13)(n + 10) = 0

Possible values for n are:

=> n = 13 or n = −10

Since the number of sides (n) cannot be negative, we take n = 13.

The polygon is a Tridecagon (a 13-sided polygon).

Therefore The correct answer is 13 sides.

Additional Information

Diagonal Formula Derivation

The number of ways to pick 2 vertices from n is $^nC2$. Subtracting the n outer sides gives the diagonals: [n(n − 1) ÷ 2] − n = n(n − 3) ÷ 2.

Sum of Interior Angles

The sum of all interior angles of an n-sided polygon is (n − 2) × 180°. For a tridecagon, it is 11 × 180° = 1980°.

Sum of Exterior Angles

For any convex polygon, the sum of all exterior angles is always constant and equal to 360°.

Each Interior Angle of a Regular Polygon

Each interior angle of a regular polygon is calculated as [(n − 2) × 180°] ÷ n.

Q23. Answer: (b) 310,464 m^3

Shortcut Trick

The Volume of a sphere with π (22/7) must be a multiple of 11.

Check the options for divisibility by 11: For 310,464, (3+0+6) − (1+4+4) = 9 − 9 = 0. It is divisible by 11.

Calculation: Radius (r) = 42 m => Volume = 4/3 × 22/7 × 42 × 42 × 42 = 310,464 m^3.

Therefore The correct answer is 310,464 m³.

Alternate Method

Given:

Diameter (d) of the sphere = 84 m

π = 22/7

Formula Used:

Volume of a Sphere (V) = 4/3 × π × r³

Calculations:

=> Radius (r) = Diameter ÷ 2

=> r = 84 ÷ 2 = 42 m

=> Volume = 4/3 × 22/7 × (42)³

=> Volume = 4/3 × 22/7 × 42 × 42 × 42

=> Volume = 4 × 22 × (42 ÷ 21) × 42 × 42

=> Volume = 88 × 2 × 1764

=> Volume = 176 × 1764

=> Volume = 310,464 m³

Thus, the volume of the sphere is 310,464 m³, which corresponds to Option 2.

Therefore The correct answer is 310,464 m³.

Additional Information

Surface Area of a Sphere

The total surface area is given by the formula 4πr². For this sphere, it would be 4 × 22/7 × 42 × 42 = 22,176 m².

Volume of a Hemisphere

A hemisphere is half of a sphere. Its volume is calculated as 2/3 πr³.

Total Surface Area of a Hemisphere

The TSA of a solid hemisphere includes the curved surface and the flat base, given by 3πr².

Q24. Answer: (b) Rs. 5,000

The correct answer is Rs. 5,000

Key Points

• Under the Prime Minister's Internship Scheme launched in October 2024, selected candidates will receive a monthly stipend of Rs. 5,000 for the full 12-month internship period.

• This stipend comprises Rs. 4,500 provided by the government and an additional Rs. 500 contributed by participating companies from their Corporate Social Responsibility (CSR) fund

• The scheme aims to provide young graduates with practical experience, skill development opportunities, and industry exposure.

• This aligns with the government's goal of enhancing youth employability and bridging the gap between academic learning and industry requirements.

Q25. Answer: (c) Rs. 1,000

Shortcut Trick

Total ratio parts = 7 (A) + 5 (B) = 12 units.

Given total amount: 12 units = Rs. 2,400.

Value of 1 unit = 2,400 ÷ 12 = Rs. 200.

Share of B = 5 units × 200 = Rs. 1,000.

Therefore The correct answer is Rs. 1,000.

Alternate Method

Given:

Total amount to be distributed = Rs. 2,400

Ratio of distribution (A : B) = 7 : 5

Formula Used:

Share of a person = (Personal Ratio ÷ Total Ratio) × Total Amount

Calculations:

=> Sum of ratios = 7 + 5 = 12

=> Share of B = (5 ÷ 12) × 2,400

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=> Share of B = 5 × (2,400 ÷ 12)

=> Share of B = 5 × 200

=> Share of B = Rs. 1,000

Based on the calculations, the share of B is Rs. 1,000, which corresponds to Option (3).

Therefore The correct answer is Rs. 1,000.

Additional Information

Ratio and Proportion

A ratio is a comparison of two quantities by division. If a quantity X is divided in the ratio a : b, the parts are [a/(a+b)] × X and [b/(a+b)] × X.

Compound Ratio

The compound ratio of two ratios (a : b) and (c : d) is found by multiplying the antecedents and the consequents together, resulting in (ac : bd).

Duplicate and Triplicate Ratios

The duplicate ratio of a : b is $a^2 : b^2$, and the triplicate ratio of a : b is $a^3 : b^3$.

Mean Proportional

The mean proportional between two numbers a and b is given by the formula √(a × b).

Q26. Answer: (b) UXVY

The logic followed here is:

Logic: + 5 in the positional value of letters.

For, DGEH : ILJM

For, GJHK : LOMP

Similarly,

PSQT : ?

Thus, PSQT : UXVY

Hence, the correct answer is "Option 2".

Q27. Answer: (b) Only conclusion (I) follows

Statements:

No dogs are pigs.

All pigs are stones.

The least possible venn diagram is given:

Conclusions:

(I) Some stones are pigs - True(because, All pigs are stones, it implies that the some stones are pigs also).

(II) No stones are dogs - False(because, there is no direct relation is given between stones and dogs, so it can be possible only).

Thus, Only conclusion (I) follows

Hence, the correct answer is "Option 2".

Q28. Answer: (b) 50%

Shortcut Trick

For Compound Interest over n years, the ratio of Amount (A) to Principal (P) is given by $(1 + r/100)^n$.

Here, A/P = 2 1/4 = 9/4 and n = 2 years.

To find the 1-year multiplier, take the square root: √(9/4) = 3/2.

Interest rate = (Multiplier − 1) × 100 = (3/2 − 1) × 100 = 1/2 × 100 = 50%.

Therefore The correct answer is 50%.

Alternate Method

Given:

Time (t) = 2 years

Amount (A) = 2 1/4 × Principal (P) = 9/4 P

Formula Used:

A = P(1 + r/100)^t

Calculations:

=> $9/4\ P = P(1 + r/100)^2$

=> 9/4 = (1 + r/100)²

=> √(9/4) = 1 + r/100

=> 3/2 = 1 + r/100

=> r/100 = 3/2 − 1

=> r/100 = 1/2

=> r = 100 / 2

=> r = 50%

Therefore The correct answer is 50%.

Additional Information

Compound Interest (CI)

CI is calculated on the principal amount and also on the accumulated interest of previous periods. CI = A − P.

Effective Rate for 2 Years

If the rate is r%, the effective compound interest rate for 2 years is (r + r + r²/100)%.

Different Compounding Periods

For half-yearly compounding, the rate is halved (r/2) and the time is doubled (2n).

Q29. Answer: (a) Odisha

The correct answer is Odisha

Key Points

• In February 2023, the Archaeological Survey of India (ASI) discovered a 1,300-year-old Buddhist stupa in the Jajpur district of Odisha.

• The stupa was found in a Khondalite stone mining site.

• The Khondalite mining site supplies stones for the beautification of the 12th-century Shree Jagannath Temple in Puri.

• The ASI also found a stone carving piece during the excavation.

Additional Information

• Khondalite stones, widely used in ancient temple architectures, were proposed by the Odisha State government for extensive use in the Augmentation of Basic Amenities and Development of Heritage and Architecture (ABADHA) scheme.

• The government had set aside a whopping Rs. 3,208 crore for this project in Puri with the vision of transforming it into a world heritage city.

• Several projects under the ABADHA scheme, including the heritage security zone, the Jagannath Ballav pilgrim centre, the Puri lake development project, the Atharnala heritage project, and the Matha Development Initiative, were slated to utilize Khondalite stones to uphold the aesthetic appeal.

Q30. Answer: (c) 5 years

The correct answer is 5 years

Key Points

• The Union Cabinet approved the International Big Cat Alliance (IBCA) with a one-time budgetary support of Rs. 150 crore for a period of five years from 2023-24 to 2027-28.

• The IBCA is an alliance of 96 countries that aims to conserve big cats like tigers, lions, leopards, snow leopards, cheetahs, jaguars, and pumas.

• The IBCA's goals include creating a global network, stopping illegal wildlife trade, and curbing poaching in Asia.

• The IBCA will use a variety of methods to achieve its goals, including knowledge-sharing, capacity-building, networking, advocacy, and financial and resource support.

Additional Information

• Significance of protecting big cats and their habitats

• Balances ecosystem: By acting as top predators in the food chain.

• Water security: For example, the Himalayas (habitat of Snow Leopards) are the source of many major rivers in Asia.

• Mitigate Climate Change: Protecting Forest landscapes that store carbon.

• Cultural Icons: Culturally significant with faiths and folktales built around them across the world.

• Supports economy: Providing livelihood opportunities and promoting ecotourism.

Q31. Answer: (b) 61,250

Shortcut Trick

Use the Multiplying Factor method for successive changes.

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Net Multiplier = (1 + 25/100) × (1 − 30/100) × (1 + 40/100)

Net Multiplier = 1.25 × 0.7 × 1.4 = 1.225

Final Population = 50,000 × 1.225 = 61,250

Therefore The correct answer is 61,250.

Alternate Method

Given: Initial population in 1988 = 50,000. Changes: +25% in 1989, −30% in 1990, and +40% in 1991.

=> Population in 1989 = 50,000 × (125/100) = 62,500

=> Population in 1990 = 62,500 × (70/100) = 43,750

=> Population at the end of 1991 = 43,750 × (140/100)

=> Final Population = 43,750 × 1.4 = 61,250

Therefore The correct answer is 61,250.

Additional Information

Successive Percentage Change

When a value changes by a% and then by b%, the net change is (a + b + ab/100)%. For multiple changes, use the multiplier method.

Population Growth Formula

Final value = Initial value × (1 ± r1/100) × (1 ± r2/100) ... where r is the rate of increase (+) or decrease (−).

Fraction Equivalents

Converting percentages to fractions simplifies calculations: 25% = 1/4 (factor 5/4), 30% = 3/10 (factor 7/10), 40% = 2/5 (factor 7/5).

Q32. Answer: (b) 2

Shortcut Trick

From the first condition, adding 1 to the numerator and subtracting 1 from the denominator makes the fraction equal to 1.

This implies that the modified numerator and denominator are equal: (x + 1) = (y − 1).

By rearranging, we get y − x = 1 + 1 = 2.

Since y − x represents the difference between the denominator and numerator, the result is obtained directly.

Therefore The correct answer is 2.

Alternate Method

Let the numerator of the fraction be x and the denominator be y. The original fraction is x/y.

Given:

Condition 1: (x + 1) / (y − 1) = 1

Condition 2: x / (y + 1) = 2/3

Formula Used:

Cross-multiplication of linear equations to find unknown variables.

Calculations:

=> From Condition 1: x + 1 = y − 1

=> y − x = 2 → (Equation 1)

=> From Condition 2: 3 × x = 2 × (y + 1)

=> 3x = 2y + 2 → (Equation 2)

=> From Eq 1, substitute y = x + 2 in Eq 2:

=> 3x = 2(x + 2) + 2

=> 3x = 2x + 4 + 2

=> x = 6

=> Substituting x = 6 in Eq 1: y = 6 + 2 = 8

=> Positive difference = |x − y| = |6 − 8| = 2

Therefore The correct answer is 2.

Additional Information

Types of Fractions

A proper fraction has a numerator smaller than the denominator (e.g., 3/4). An improper fraction has a numerator larger than or equal to the denominator (e.g., 8/6).

Simplest Form

A fraction is in its simplest form when the numerator and denominator have no common factors other than 1. For example, 6/8 simplifies to 3/4.

Reciprocal of a Fraction

The reciprocal is found by interchanging the numerator and denominator. The reciprocal of x/y is y/x.

Q33. Answer: (b) Variation

The correct answer is Variation.

Key Points

• Variation is crucial for the survival of species as it provides a pool of different traits that can be beneficial in changing environments.

• Genetic variation increases the likelihood that some individuals in a population will possess traits suited to new or altered conditions.

• Natural selection acts on variations within a population, leading to the survival and reproduction of individuals with advantageous traits.

• Over time, these advantageous traits become more common in the population, aiding in the species' adaptation and survival.

• Without variation, a species may not be able to adapt to environmental changes, leading to extinction.

Additional Information

• Conservation

• Conservation involves protecting and preserving natural resources and the environment.

• It helps in maintaining biodiversity and preventing the extinction of species.

• Reproduction

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

• It ensures the continuation of species but does not alone guarantee the survival of species over time.

• Struggle for Existence

• The struggle for existence refers to the competition between individuals of a species for limited resources.

• It is a driving force in natural selection, leading to the survival of the fittest.

Q34. Answer: (b) One

Given series:

5 3 % 4 6 & 8 S 7 * Ω 9 # 1 2 & @ £

Condition to be checked:

1. Symbols which are immediately preceded by a symbol.

2. Symbols which are immediately followed by a symbol.

Symbol → Symbol → Symbol

5 3 % 4 6 & 8 S 7 * Ω 9 # 1 2 & @ £

Thus there are one such patterns that are following the above conditions.

Hence, "1" is the correct answer.

Mistake Points

Immediately preceded by means immediately before or to come just before.

Immediately followed by means immediately after or to come just after.

Q35. Answer: (d) 77

Shortcut Trick

Ratio of students = 12 : (30 − 12) = 12 : 18 = 2 : 3.

Using deviation method: Assume base average = 75.

Extra points from 2 parts = 2 × (80 − 75) = +10.

Net increase in average = 10 ÷ (2 + 3) = 2.

Final average score = 75 + 2 = 77.

Therefore The correct answer is 77.

Alternate Method

Given:

Total students = 30

Number of Group 1 students = 12, Average = 80

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Number of Group 2 students = 30 − 12 = 18, Average = 75

Formula Used:

Weighted Average = (n1 × A1 + n2 × A2) ÷ (n1 + n2)

Calculations:

=> Sum of scores of 12 students = 12 × 80 = 960

=> Sum of scores of remaining 18 students = 18 × 75 = 1350

=> Total sum of scores for 30 students = 960 + 1350 = 2310

=> Average score of the class = 2310 ÷ 30

=> Average score = 77

Therefore The correct answer is 77.

Additional Information

Weighted Average Formula

When two or more groups are combined, the combined average is calculated as $A_w = \Sigma(n_i \times a_i) \div \Sigma n_i$, where n is the number of items and a is the average.

Properties of Average

If every value in a set is increased or decreased by a constant k, the average also increases or decreases by k.

Combined Average with Ratio

If the number of elements in two groups are in ratio x : y, the combined average depends only on this ratio, not the absolute number of elements.

Q36. Answer: (b) 523

Shortcut Trick

List all prime numbers in the range 60 to 90: 61, 67, 71, 73, 79, 83, 89.

Apply grouping method for faster addition:

(61 + 89) + (67 + 83) + (71 + 79) + 73

=> 150 + 150 + 150 + 73 => 450 + 73 = 523.

Therefore The correct answer is 523.

Alternate Method

Given: Numbers in the range (60, 90).

A prime number is a natural number greater than 1 that is divisible only by 1 and itself. We check every odd number in the range (since even numbers > 2 are composite):

=> Identify primes between 60 and 70: 61, 67

=> Identify primes between 70 and 80: 71, 73, 79

=> Identify primes between 80 and 90: 83, 89

=> Sum = 61 + 67 + 71 + 73 + 79 + 83 + 89

=> Sum = (61 + 67) + (71 + 73 + 79) + (83 + 89)

=> Sum = 128 + 223 + 172

=> Sum = 523.

Therefore The correct answer is 523.

Additional Information

Prime Numbers

Numbers that have exactly two factors: 1 and the number itself. 2 is the only even prime number.

Composite Numbers

Numbers having more than two factors. 1 is neither prime nor composite.

Twin Primes

Pairs of prime numbers that have a difference of 2 (e.g., 71 and 73 in this range).

Testing Primality

To check if a number N is prime, divide it by primes up to √N. If no prime divides N, then N is prime.

Q37. Answer: (d) 80gm

Shortcut Trick

Profit percentage of 25% is equivalent to a fraction of 1/4.

In terms of weight, the ratio of Actual Weight to True Weight is inverse to the cost.

→ Ratio = 4 : (4 + 1) = 4 : 5 (where 5 represents the True Weight).

=> 5 units = 100 gm

=> 1 unit = 20 gm

=> 4 units = 4 × 20 = 80 gm

Therefore The correct answer is 80 gm.

Alternate Method

Given:

True Weight (labeled weight) = 100 gm

Profit Percentage (gain) = 25%

Formula Used:

Profit % = [(True Weight − False Weight) ÷ False Weight] × 100

Calculations:

Let the False Weight used by the dealer be x gm.

=> 25 = [(100 − x) ÷ x] × 100

=> 25 ÷ 100 = (100 − x) ÷ x

=> 1 ÷ 4 = (100 − x) ÷ x

=> x = 4 × (100 − x)

=> x = 400 − 4x

=> x + 4x = 400

=> 5x = 400

=> x = 400 ÷ 5

=> x = 80 gm

Therefore The correct answer is 80 gm.

Additional Information

Dishonest Dealer Concept

When a dealer sells goods at cost price but uses less weight, the Profit % = [Error ÷ (True Value − Error)] × 100.

Weight and Price Relationship

For a constant expenditure, the weight is inversely proportional to the effective price. Profit occurs when the weight delivered is less than the weight charged.

Successive Gains

If a dealer marks up the price by a% and also uses a false weight cheating by b%, the Total Profit % = {[(100 + a) × (True Weight ÷ False Weight)] − 100}%.

Q38. Answer: (a) 1

The logic followed here is:

The code for A is "1".

Hence, the correct answer is "Option 1".

Q39. Answer: (b) 4

Given Equation: 14 B 5 C 5 A 30 D 2 = ?

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:

=> 14 − 5 × 5 + 30 ÷ 2

=> 14 − 25 + 15

=> 29 -25 = 4

Hence, the correct option is "Option 2".

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Q40. Answer: (d) -4

Shortcut Trick

Directly substitute x = −1 into the given expression.

The square of a negative number is always positive: $(-1)^2 = 1$.

Expression value = 1 − 5 = −4.

Therefore The correct answer is -4.

Alternate Method

Given:

Algebraic expression: $x^2 - 5$

Value of the variable: x = −1

Calculation:

=> Value = $(-1)^2 - 5$

=> Value = (−1 × −1) − 5

=> Value = 1 − 5

=> Value = −4

Therefore The correct answer is -4.

Additional Information

Squaring Negative Numbers

The square of any real number (whether positive or negative) is always non-negative. Formula: $(-a)^2 = a^2$.

Order of Operations (BODMAS)

When evaluating algebraic expressions, Exponents (Powers) must be calculated before addition or subtraction.

Variable Substitution

Always use parentheses when substituting negative values into an expression to ensure signs are handled correctly.

Q41. Answer: (b) 36 m

Shortcut Trick

In Height and Distance, for a fixed base, the heights are proportional to tan θ.

For 30°, Ratio = 1 : √3 => Pole Height = 1 unit = 18 m.

For 60°, Ratio = √3 : 1. To equate the base, multiply by √3 => Total Height = 3 units.

Flag Height = Total Height − Pole Height = 3 units − 1 unit = 2 units.

Since 1 unit = 18 m, Flag Height = 2 × 18 m = 36 m.

Therefore The correct answer is 36 m.

Alternate Method

Given:

Height of the pole (BT) = 18 m

Angle of elevation of bottom of flag (T) = 30°

Angle of elevation of top of flag (F) = 60°

Formula Used:

tan θ = Perpendicular / Base

Calculations:

Let PB be the distance from the point on the ground to the pole, and h be the height of the flag (TF).

=> In triangle TBP, tan 30° = BT / PB

=> 1 / √3 = 18 / PB

=> PB = 18√3 m

=> In triangle FBP, tan 60° = FB / PB

=> √3 = (BT + TF) / PB

=> √3 = (18 + h) / 18√3

=> 18√3 × √3 = 18 + h

=> 18 × 3 = 18 + h

=> 54 = 18 + h

=> h = 54 − 18 = 36 m

Therefore The correct answer is 36 m.

Additional Information

Angle of Elevation

The angle between the horizontal line and the line of sight when looking up at an object.

Tangent Relation in Heights

For two objects on the same vertical line, $h1/h2 = \tan \theta1/\tan \theta2$ when measured from the same point on the ground.

Complementary Angles

If the angles of elevation from two points at distances 'a' and 'b' are complementary, the height of the tower is $H = \sqrt{(ab)}$.

Q42. Answer: (a) 59

Given:

Series: 4, 5, 9, 18, 34, ?

Formula used:

Identify the pattern or relationship between consecutive terms.

Calculations:

Difference between terms:

5 - 4 = 1

9 - 5 = 4

18 - 9 = 9

34 - 18 = 16

Pattern in differences: 1, 4, 9, 16 (squares of 1, 2, 3, 4)

Next difference = $5^2 = 25$

Next term = 34 + 25 = 59

Therefore The missing term is 59.

Q43. Answer: (d) concentric circles

The correct answer is concentric circles.

Key Points

• Magnetic field lines around a straight current-carrying conductor form concentric circles.

• The direction of these magnetic field lines can be determined using the Right-Hand Rule.

• As the distance from the conductor increases, the spacing between the concentric circles increases, indicating that the magnetic field strength decreases.

• The magnetic field lines are perpendicular to the current-carrying conductor.

• This phenomenon is described by Ampere's Circuital Law, which relates the magnetic field around a conductor to the current passing through it.

Additional Information

• Magnetic Field

• A magnetic field is a vector field that describes the magnetic influence on moving electric charges, electric currents, and magnetic materials.

• Magnetic fields are produced by electric currents, which can be macroscopic currents in wires, or microscopic currents associated with electrons in atomic orbits.

• Electromagnetism

• Electromagnetism is a branch of physics involving the study of the electromagnetic force, a type of physical interaction that occurs between electrically charged particles.

• It encompasses various phenomena such as electricity, magnetism, and light.

• Faraday's Law of Induction

• Faraday's Law states that a change in the magnetic field within a closed loop induces an electromotive force (EMF) in the wire.

• This principle is the working mechanism behind electric generators and transformers.

Q44. Answer: (b) Carbon is tetravalent.

The correct answer is Carbon is tetravalent.

Key Points

• Carbon has four valence electrons, allowing it to form four covalent bonds with other atoms.

• This tetravalent nature of carbon is fundamental to the chemistry of life, as it enables the formation of complex molecules like carbohydrates, proteins, lipids, and nucleic acids.

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• Carbon can form single, double, and triple bonds, increasing the diversity and complexity of carbon-based compounds.
• The ability to form long carbon chains and rings is unique to carbon, making it the backbone of organic chemistry.
• Carbon's tetravalency allows it to bond with various elements, including hydrogen, oxygen, nitrogen, and sulfur, further expanding the range of possible organic molecules.

Additional Information

• Allotropes of Carbon
• Carbon exists in several allotropes, including diamond, graphite, graphene, and fullerenes, each with distinct properties.
• In diamond, carbon atoms are arranged in a tetrahedral lattice, making it extremely hard.
• In graphite, carbon atoms are arranged in layers of hexagonal lattices, making it a good conductor of electricity.
• Carbon Cycle
• The carbon cycle is the process by which carbon moves through the atmosphere, hydrosphere, biosphere, and geosphere.
• It plays a crucial role in regulating Earth's climate and supporting life by recycling carbon dioxide and organic carbon.
• Carbon Dating
• Carbon dating, or radiocarbon dating, is a method used to determine the age of ancient artifacts and fossils.
• It is based on the decay of carbon-14, a radioactive isotope of carbon, to nitrogen-14 over time.

Q45. Answer: (c) 90 seconds

Shortcut Trick

Convert Speed to m/s: 8 × 5/18 = 20/9 m/s.

Time = Distance ÷ Speed

Time = 200 ÷ (20/9) = 10 × 9 = 90 sec.

Therefore The correct answer is 90 sec.

Alternate Method

Given:

Speed (S) of Reena = 8 km/h

Distance (D) = 200 m

Formula Used:

1. Speed Conversion: 1 km/h = 5/18 m/s

2. Time = Distance ÷ Speed

Calculations:

=> Speed in m/s = 8 × (5/18) m/s

=> Speed = 40/18 = 20/9 m/s

=> Time = 200 ÷ (20/9)

=> Time = 200 × (9/20)

=> Time = 10 × 9 = 90 sec

Therefore, Reena will take 90 seconds to cover the distance, which corresponds to Option 3.

Therefore The correct answer is 90 sec.

Additional Information

Unit Conversion for Speed

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

Time, Speed, and Distance Relation

The fundamental relation is Distance = Speed × Time. Ensure all units are consistent (e.g., m and m/s, or km and km/h) before calculation.

Average Speed

Average Speed = (Total Distance Covered) ÷ (Total Time Taken). For two equal distances at speeds x and y, Average Speed = 2xy/(x + y).

Q46. Answer: (b) Dispersion

The correct answer is Dispersion.

Key Points

• Dispersion is the phenomenon where white light splits into its constituent colors when it passes through a prism.
• This occurs because different colors of light bend by different amounts when they pass through the prism.
• The seven colors observed are red, orange, yellow, green, blue, indigo, and violet.

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• The angle of deviation is different for each color, leading to the separation of colors.
• Dispersion is a result of the variation of the refractive index of the material with the wavelength of light.
Additional Information
• Diffraction
• Diffraction is the bending of light waves around obstacles and openings.
• This phenomenon is more pronounced when the size of the obstacle or opening is comparable to the wavelength of light.
• Refraction
• Refraction is the bending of light as it passes from one medium to another with different densities.
• This change in direction occurs due to a change in the speed of light in different media.
• Deviation
• Deviation refers to the change in direction of light when it passes through a prism or other optical device.
• The angle of deviation depends on the angle of incidence and the refractive index of the material.

Q47. Answer: (d) X = 6, Y = 488

The logic followed here is:
Logic: (1st number)^3 - 1st number × 3 = 2nd number.
For, 8 : Y
=> 8^3 - (8 × 3) = Y
=> 512 - 24 = 488.
Y = 488.
Similarly, X : 198
By using Option Y = 488, X = 6.
=> 63 - (6 × 3) = X
=> 216 - 18 = 198.
X = 6
Thus, X = 6, Y = 488.
Hence, the correct answer is "Option 4".

Q48. Answer: (d) 56.5 kg

Shortcut Trick
Assume the total group size is 100 people.
Total Weight = (40 × 70) + (35 × 60) + (25 × 30)
Total Weight = 2800 + 2100 + 750 = 5650 kg
Average weight = 5650 ÷ 100 = 56.5 kg.
Therefore The correct answer is 56.5 kg.
Alternate Method
Given:
Percentage of Men = 40%, Average weight = 70 kg
Percentage of Women = 35%, Average weight = 60 kg
Percentage of Children = Rest, Average weight = 30 kg
Calculations:
=> Percentage of Children = 100% − (40% + 35%) = 25%
=> Let the total number of people in the group be n = 100.
=> Number of Men = 40, Women = 35, and Children = 25.
=> Sum of weights of Men = 40 × 70 = 2800 kg
=> Sum of weights of Women = 35 × 60 = 2100 kg
=> Sum of weights of Children = 25 × 30 = 750 kg
=> Total weight of the group = 2800 + 2100 + 750 = 5650 kg
=> Average weight of the group = Total weight ÷ Total people
=> Average weight = 5650 ÷ 100 = 56.5 kg
Therefore, the correct option is 4.
Therefore The correct answer is 56.5 kg.

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Additional Information

Weighted Average Formula

The average of a group consisting of multiple sub-groups is given by: Average = (n1w1 + n2w2 + ... + n_kw_k) ÷ (n1 + n2 + ... + n_k), where n is the quantity and w is the weight/value.

Deviation Method for Averages

You can assume a base average (e.g., 50) and calculate the net deviation from this base for each part of the group to find the final average quickly.

Percentage Representation

When parts of a whole are given in percentages, the sum must always equal 100%. This is useful to find any missing component.

Q49. Answer: (b) Rs. 900

Shortcut Trick

Total work (LCM of 6, 8, 3) = 24 units.

Efficiency of Babita = 24 ÷ 8 = 3 units/day.

Total efficiency of (Aarav + Babita + Chaitanya) = 24 ÷ 3 = 8 units/day.

Babita's share = (3 ÷ 8) × Rs. 2400 = 3 × Rs. 300 = Rs. 900.

Therefore The correct answer is Rs. 900.

Alternate Method

Given:

Time taken by Aarav = 6 days

Time taken by Babita = 8 days

Time taken by Aarav, Babita, and Chaitanya together = 3 days

Total amount to be paid = Rs. 2,400

Formula Used:

Efficiency = Total Work ÷ Time

Wage of a person = (Efficiency of the person ÷ Total efficiency) × Total wage (when all work for the same time)

Person	Days	Total Work	Efficiency
Aarav	6	24	4
Babita	8	3	
A + B + C	3	8	

Calculations:

=> Efficiency of Aarav = 4

=> Efficiency of Babita = 3

=> Total efficiency of Aarav, Babita, and Chaitanya = 8

=> Since everyone worked for the same duration (3 days), the wage is divided in the ratio of their efficiencies.

=> Babita's share = (Efficiency of Babita ÷ Total Efficiency) × Total Amount

=> Babita's share = (3 ÷ 8) × 2400

=> Babita's share = 3 × 300

=> Babita's share = Rs. 900

Therefore The correct answer is Rs. 900.

Additional Information

Work and Wages Principle

Wages are always distributed in proportion to the work done by each individual. If they work for the same time, wages are proportional to their efficiencies.

Efficiency and Time Relation

Efficiency is inversely proportional to the time taken to complete the work (Efficiency = 1 ÷ Time).

Combined Efficiency

The individual efficiency of a person in a group can be found by subtracting the efficiencies of the other members from the total efficiency: E_C = E_(Total) − (E_A + E_B).

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Q50. Answer: (a) Weather forecasting

The correct answer is Weather forecasting

Key Points

• The primary use of high-performance computing systems 'Arka' and 'Arunika' is for weather forecasting.

• Both systems are specifically designed to enhance the accuracy and lead time of weather predictions, including tropical cyclones, heavy precipitation, heat waves, and other extreme weather events, by leveraging advanced computational power.

• These systems are specifically tailored for climate and weather research, allowing scientists to analyze large datasets with high computational power.

• The Indian Ministry of Earth Sciences is responsible for developing and deploying these HPC systems.

Additional Information Weather forecasting requires analyzing terabytes of data from satellites, radars, and observation stations. This involves solving highly complex mathematical equations related to atmospheric physics. Systems like ‘Arka’ and ‘Arunika’ can:

• Perform millions of calculations per second.

• Model simulations with high spatial and temporal resolution for better accuracy.

Q51. Answer: (b) Norris Pritam

The correct answer is Norris Pritam

Key Points

• Norris Pritam is the author of Neeraj Chopra: The Man Who Made History,

• It is a book about the life of India's first Olympic gold medalist in track and field.

• Pritam is a sports journalist based in New Delhi.

• He has covered six Olympic Games, six Asian Games, Commonwealth Games, and World Championships.

• The book chronicles Neeraj Chopra's journey from a village boy to an Olympic gold medalist.

• It also describes how his family supported him in his pursuit of sports.

Additional Information

• Some recently released books:

Books	Authors
The Legend of Birsa Munda	Tuhin A. Sinha and Ankita Verma
Bose: The Untold Story of An Inconvenient Nationalist	Chandrachur Ghose
Gajapati: A king without a kingdom	Ashok Bal
India's Ancient Legacy of Wellness	Rekha Chaudhari
Gandhitopi Governor	Yarlagadda Lakshmi Prasad
Public Service Ethics	Prabhat Kumar
Cooking to Save Your Life	Abhijit Banerjee
Resolved: Uniting Nations in a Divided World	Ban Ki-moon
Nehru: The Debates that Defined India	Tripurdaman Singh and Adeel Hussain
The Cinema of Satyajit Ray	Bhaskar Chattopadhyay

Q52. Answer: (d) X = 26, Y = 205.2

The logic followed here is:

Logic: 1st number × 5.4 = 2nd number.

For, 38 : Y

Y = 38 × 5.4 = 205.2.

Y = 205.2

Similarly, X : 140.4

X = 140.4 ÷ 5.4 = 26.

X = 26.

Thus, X = 26, Y = 205.2

Hence, the correct answer is "Option 4".

Q53. Answer: (b) 44

Given Equation: 144 C 44 D 12 A 12 B 144 = ?

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:

=> 144 + 44 - 12 ÷ 12 × 144

=> 188 - 1 × 144

=> 188 - 144 = 44

Hence, the correct option is "Option 2".

Q54. Answer: (a) Q

Given: Seven boxes, P, Q, R, S, X, Y and Z, are kept one over the other but not necessarily in the same order.

Only P is kept above X.

P
X

Only two boxes are kept between X and S.

P
X
S

Only R is kept below Z.

P
X
S
Z
R

Y is not kept immediately above S

P
X
Y

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S
Z
R

Final Arrangement,

P
X
Y
Q
S
Z
R

Thus, Q kept fourth from the top.

Hence, the correct answer is "Option 1".

Q55. Answer: (d) UM - ZN

The logic followed here is:

Option 1) YQ - CU

Option 2) AS - EW

Option 3) DV - HZ

Option 4) UM - ZN

Thus, UM - ZN doesn't follow the pattern.

Hence, the correct answer is "Option 4".

Q56. Answer: (b) 4350

Shortcut Trick

Square of the space diagonal of a cube = $3a^2$.

Total Surface Area (TSA) of a cube = $6a^2$.

Relation: TSA = 2 × (Square of Space Diagonal).

TSA = 2 × 2175 = 4350 cm^2.

Therefore The correct answer is 4350 cm^2.

Alternate Method

Given: Square of the length of the space diagonal = 2175 cm^2.

Formula used: Space Diagonal (d) = $a\sqrt{3}$ | Total Surface Area = $6a^2$.

=> $d^2 = (a\sqrt{3})^2 = 3a^2$

=> $3a^2 = 2175\ cm^2$

=> $a^2 = 2175 \div 3 = 725\ cm^2$

=> Total Surface Area = $6a^2$

=> Total Surface Area = $6 \times 725 = 4350\ cm^2$

Therefore The correct answer is 4350 cm^2.

Additional Information

Face Diagonal of a Cube

The length of the diagonal of any one face is given by $a\sqrt{2}$, where 'a' is the side of the cube.

Volume of a Cube

The total space occupied by the cube is Volume (V) = a^3 cubic units.

Lateral Surface Area

The area of the four vertical faces of the cube is Lateral Surface Area (LSA) = $4a^2$ sq. units.

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Q57. Answer: (d) water, fat, protein, etc

The correct answer is water, fat, protein, etc.

Key Points

• Milk is a complex mixture containing water, proteins, fats, lactose, minerals, and vitamins.

• The main protein in milk is casein, which constitutes about 80% of the protein content in cow's milk.

• Milk fat is present in the form of emulsified globules and is a significant source of energy.

• Lactose, also known as milk sugar, is the primary carbohydrate found in milk.

• Minerals like calcium and phosphorus are abundant in milk, making it essential for bone health.

Additional Information

• Protein Types in Milk

• Casein and whey are the two primary types of proteins found in milk.

• Whey protein is a by-product of cheese production and is often used in protein supplements.

• Milk Processing

• Milk undergoes various processing steps like pasteurization to ensure it is safe for consumption.

• Homogenization is another process that breaks down fat molecules so that they remain integrated rather than separating as cream.

• Milk Varieties

• There are different types of milk available such as whole milk, skim milk, and lactose-free milk.

• Each type caters to specific dietary needs and preferences.

Q58. Answer: (c) 96

The correct answer is 93

Key Points

• According to the latest Corruption Perceptions Index, India ranks 96rd out of 180 countries.

• This reflects a slight decline from the previous year, where India was ranked 85th with a score of 40.

• The CPI is published annually by Transparency International and assesses perceived levels of public sector corruption worldwide.

• A score of 0 indicates a highly corrupt nation, while a score of 100 signifies a very clean one

• Denmark ranked as the least corrupt country globally.

• Somalia, South Sudan, and Syria were ranked among the most corrupt.

Additional Information

Index	India's Rank (2024)	Remarks	Publishing Organization
Global Hunger Index (GHI)	111th	India remains in the "serious" hunger category.	Concern Worldwide & Welthungerhilfe
Human Development Index (HDI)	132nd (2023)	Reflects medium human development; issues include education and health.	United Nations Development Programme (UNDP)
Global Innovation Index (GII)	40th	India ranks as the top innovator in the lower-middle-income group.	World Intellectual Property Organization
Global Gender Gap Index	127th	Reflects significant gaps in economic, political, and educational gender equality.	World Economic Forum
Ease of Doing Business (EoDB)	No recent data	The World Bank discontinued the EoDB ranking in 2021.	World Bank
Climate Change Performance Index (CCPI)	8th	High ranking due to ambitious renewable energy and emission reduction targets.	Germanwatch, CAN, and NewClimate Institute
Sustainable Development Goals Index	124th	India lags in achieving several SDG targets.	UN Sustainable Development Solutions Network

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Q59. Answer: (b) Technology

The correct answer is Technology

Key Points

• The concept of "Prodyogiki" in the Yuva Sangam program focuses on technology.

• Prodyogiki is one of the five key areas, or the 5 Ps, of the Yuva Sangam program.

• Yuva Sangam

• A program by the Government of India that focuses on exposure tours for young people.

• The Yuva Sangam program aims to strengthen connections between young people from different states and union territories of India

Additional Information

• 5 Ps

• The five key areas of the Yuva Sangam program:

• Paryatan: Tourism

• Parampara: Traditions

• Pragati: Development

• Paraspar Sampark: People-to-people connection

• Prodyogiki: Technolog

• The program provides an immersive experience of the host state, including its development landmarks, architecture, engineering marvels, and industrial progress.

Q60. Answer: (c) a, b and c

The correct answer is option 3.

Key Points

• The release of energy in the aerobic process is significantly greater than in the anaerobic process.

• ATP (Adenosine Triphosphate) is broken down to release a fixed amount of energy which can drive the endothermic reactions taking place in the cell.

• Pyruvate, a three-carbon molecule, is converted into lactic acid, which is also a three-carbon molecule during anaerobic respiration.

• In aerobic respiration, glucose is fully oxidized to carbon dioxide and water, producing a high yield of ATP.

• Anaerobic respiration is less efficient and results in the production of less ATP and byproducts like lactic acid or ethanol.

Additional Information

• Cellular Respiration

• This is a set of metabolic reactions and processes that take place in the cells of organisms to convert biochemical energy from nutrients into ATP.

• It involves both aerobic and anaerobic pathways depending on the presence of oxygen.

• Glycolysis

• It is the first step in both aerobic and anaerobic respiration, taking place in the cytoplasm of the cell.

• Glycolysis breaks down glucose into two molecules of pyruvate, yielding a net gain of two ATP molecules.

• Fermentation

• It is an anaerobic process by which cells generate energy through the conversion of glucose to lactic acid or ethanol.

• Fermentation allows cells to produce ATP without oxygen, though it is much less efficient compared to aerobic respiration.

Q61. Answer: (a) B

Given word: 'PLANTED'

After changing vowels and consonants:

Original	**P**	**L**	**A**	**N**	**T**	**E**	**D**
Changed	O	K	B	M	S	F	C

The third position from the left in the new group of letters is: B

Hence, the correct answer is "Option 1".

Q62. Answer: (d) Robert Hooke

The correct answer is Robert Hooke.

Key Points

• Robert Hooke was the first scientist to discover cells in 1665.

• He made this discovery while observing a thin slice of cork under a microscope.

• Hooke coined the term "cell" because the cork cells reminded him of the cells (small rooms) in a monastery.

• This discovery was published in his book "Micrographia".

• Hooke's work laid the foundation for the development of cell theory.

Additional Information

• Matthias Jakob Schleiden

• He was a German botanist who co-founded the cell theory.

• Schleiden proposed that all plants are made of cells.

• Theodor Schwann

• He was a German physiologist who also co-founded the cell theory.

• Schwann extended the cell theory to animals, proposing that all living things are composed of cells.

• Antonie van Leeuwenhoek

• He is often referred to as the "Father of Microbiology".

• Van Leeuwenhoek was the first to observe and describe single-celled organisms (protozoa and bacteria) using a microscope.

Q63. Answer: (d) Deputy Chief of the Air Staff

The correct answer is Deputy Chief of the Air Staff

Key Points

• In 2024, Air Marshal Tejinder Singh was appointed as the Deputy Chief of the Air Staff at the Air Headquarters (Vayu Bhawan).

• The role of the Deputy Chief of the Air Staff (DCAS) is crucial within the Indian Air Force (IAF).

• The DCAS is responsible for planning, procurement, and overseeing the modernization of the Air Force, including the induction of advanced technologies and equipment.

• This position is critical in maintaining the operational readiness of the IAF.

• The Air Headquarters (Vayu Bhawan), located in New Delhi, is the central administrative office of the IAF, where key decisions regarding the force's operations, strategy, and modernization are taken.

Q64. Answer: (c) KD - OF

The logic followed here is:

Option 1) AT - EX

Option 2) SL - WP

Option 3) KD - OF

Option 4) NG - RK

Thus, KD - OF doesn't follow the pattern.

Hence, the correct answer is "Option 3".

Q65. Answer: (c) Three

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

Only five people sit between A and F.

G sits third to the left of F.

E is the immediate neighbour of B and F. C is not the immediate neighbour of G.

Final arrangement,

Thus, The only three people sit between C and E.

Hence, the correct answer is "Option 3".

Q66. Answer: (a) Functional group

The correct answer is Functional group.

Key Points

• The functional group in a carbon compound is primarily responsible for its chemical properties.

• Functional groups are specific groups of atoms within molecules that have their own characteristic properties, regardless of the other atoms present in a molecule.

• Examples of functional groups include hydroxyl groups (-OH), carboxyl groups (-COOH), and amino groups (-NH2).

• The reactivity of a carbon compound can be significantly altered by the presence of different functional groups.

• Functional groups are key determinants in the chemical reactions that a molecule can undergo.

Additional Information

• Molecular Mass

• Molecular mass is the sum of the masses of all the atoms in a molecule.

• It influences the physical properties of a substance, such as boiling and melting points, but not the chemical properties directly.

• Number of Hydrogen Atoms

• The number of hydrogen atoms in a carbon compound can affect its saturation level, but is not a primary determinant of its chemical properties.

• Length of the Carbon Chain

• The length of the carbon chain can influence the physical properties of the compound, such as solubility and boiling point, but the functional group is more critical in determining chemical reactivity.

Q67. Answer: (d) Only I follows.

Given:

Statement: Mr. X, a teacher of a high school, often beats his students.

I. Students should complain about this matter to the principal of the school. - True (Because, This directly addresses the root cause of the problem – addressing the issue with the principal is a constructive way to resolve the matter. The principal has the authority to investigate the matter and take necessary actions to stop the teacher's abusive behavior).

II. Students should quit the school and take admission in another school. - False (Because, Quitting the school might not be the best solution as it avoids addressing the root cause of the problem and may not stop such incidents from happening in the new school. It is better to report the issue and seek a resolution rather than avoid it).

So, Only I follows.

Hence, the correct answer is "Option 4".

Q68. Answer: (a) The tall/short trait and the round seed/wrinkled seed trait are independently inherited.

The correct answer is The tall/short trait and the round seed/wrinkled seed trait are independently inherited..

Key Points

• When pea plants showing two different characteristics are bred, each trait is inherited independently of the other.

• This observation is consistent with Mendel's Law of Independent Assortment, which states that alleles of different genes assort independently of one another during gamete formation.

• The F1 progeny will all be heterozygous, exhibiting the dominant traits for both characteristics.

• In the F2 generation, a 9:3:3:1 phenotypic ratio is typically observed, showing independent assortment.

• This means that the combination of traits can vary, resulting in plants that may be tall with round seeds, tall with wrinkled seeds, short with round seeds, or short with wrinkled seeds.

Additional Information

• Law of Segregation

• Mendel's first law states that the two alleles for a heritable character segregate (separate) during gamete formation and end up in different gametes.

• This law ensures that offspring acquire one allele from each parent for each trait.

• Law of Dominance

• According to this law, in a heterozygote, one trait will conceal the presence of another trait for the same characteristic.

• The dominant allele is expressed in the phenotype, while the recessive allele is masked in the presence of the dominant allele.

• Monohybrid Cross

• A cross between individuals focusing on a single trait, which illustrates the inheritance of one characteristic.

• It typically results in a 3:1 phenotypic ratio in the F2 generation.

Q69. Answer: (d) When pH of rain water is more than 5.6, it is called acid rain.

The correct answer is option 4.

Key Points

• Tooth decay starts when the pH of the mouth is lower than 5.5. This is because acidic conditions can erode the enamel on teeth.

• When the pH of rainwater is less than 5.6, it is referred to as acid rain. This occurs due to the presence of sulfuric and nitric acids in the atmosphere.

• Living organisms can survive only in a narrow range of pH change, as extreme pH levels can disrupt biological processes.

• When the pH of rainwater is more than 5.6, it is not considered acid rain. Therefore, option 4 is incorrect.

• The pH scale ranges from 0 to 14, with 7 being neutral. Below 7 is acidic, and above 7 is basic (alkaline).

Additional Information

• Acid Rain

• Acid rain can have harmful effects on plants, aquatic animals, and infrastructure.

• It is primarily caused by emissions of sulfur dioxide (SO2) and nitrogen oxides (NO_x) which react with water molecules in the atmosphere to produce acids.

• pH in Human Body

• The human body maintains a tightly regulated pH level in the blood, typically around 7.4, which is slightly alkaline.

• Enzymatic activities within the body are highly sensitive to changes in pH.

• Buffer Solutions

• Buffer solutions are used to maintain a stable pH in a system, even when small amounts of acid or base are added.

• They are essential in many biochemical and industrial processes.

Q70. Answer: (c) None

Given: Six people, A, B, C, D, E and F are sitting in a straight line, facing north.

Only three people sit to the left of E. B sits second to the right of E.

C sits immediately left of D. Only three people sit between A and C.

Final arrangement,

Thus, None is between the D and F.

Hence, the correct answer is "Option 3".

Q71. Answer: (d) 104

Shortcut Trick

In a set of consecutive numbers, the Average is always the middle term.

Average = Total Sum ÷ Number of terms = 260 ÷ 5 = 52

For any set of numbers in Arithmetic Progression, the sum of the 1^(st) and last terms is equal to twice the average.

Sum of first and last = 2 × Average = 2 × 52 = 104

Therefore The correct answer is 104.

Alternate Method

Given: Sum of 5 consecutive numbers = 260.

Formula Used: Let the five consecutive numbers be x, (x + 1), (x + 2), (x + 3), and (x + 4).

Calculations:

=> Sum = x + (x + 1) + (x + 2) + (x + 3) + (x + 4) = 260

=> 5x + 10 = 260

=> 5x = 260 − 10

=> 5x = 250

=> x = 50

=> First number = x = 50

=> Last number = x + 4 = 50 + 4 = 54

=> Sum of first and last numbers = 50 + 54 = 104

Therefore The correct answer is 104.

Additional Information

Arithmetic Progression (AP)

Consecutive numbers form an Arithmetic Progression with a common difference of 1. The sum of such a series is given by S = n ÷ 2 × (a + l), where a is the first term and l is the last term.

Middle Term Property

For an odd number of terms (n), the Average is exactly equal to the middle term. For a set of 5 numbers, the 3^(rd) number is the average.

Equidistant Sum Rule

In any AP, the sum of terms equidistant from the beginning and the end is constant. Thus, First + Last = Second + Second Last = 2 × Middle term.

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Q72. Answer: (a) 8

Given:

The value of √(0.0016) × cbrt(8000000)

Formula used:

√x = x^(1/2)

cbrtx = x^(1/3)

Calculation:

√(0.0016) × cbrt(8000000)

=> (0.0016)^(1/2) × (8000000)^(1/3)

=> 0.04 × 200

=> 8

Therefore The correct answer is option (1).

Q73. Answer: (d) JRG

The logic followed here is:

Hence, the correct answer is "Option 4".

Q74. Answer: (d) First law of motion

The correct answer is First law of motion.

Key Points

• The tendency to get thrown to one side when a motorcar makes a sharp turn at high speed is explained by Newton's First Law of Motion.

• Newton's First Law of Motion states that an object will remain at rest or in uniform motion in a straight line unless acted upon by an external force.

• This law is also known as the law of inertia, where inertia is the resistance of any physical object to any change in its velocity.

• When the car turns, the passengers inside experience a force due to inertia that makes them feel as if they are being thrown outward.

• This outward force is actually the inertia of the passengers trying to keep them moving in a straight line while the car changes direction.

Additional Information

• Second Law of Motion

• This law states that the acceleration of an object is directly proportional to the net force acting on it and inversely proportional to its mass.

• It is expressed by the equation F=maF=maF=maF=maF=maF=maF=maF=maF=maF=ma

, where F is the net force, m is the mass, and a is the acceleration.

• Third Law of Motion

• This law states that for every action, there is an equal and opposite reaction.

• This means that forces always come in pairs; if one object exerts a force on another, the second object exerts a force of equal magnitude but in the opposite direction on the first object.

• Conservation of Momentum

• This principle states that the total momentum of a closed system is conserved if no external forces are acting on it.Momentum is the product of an object's mass and its velocity.

Q75. Answer: (b) positive

The Correct answer is positive.

Key Points

• When the force and displacement are in the same direction, the angle between force and displacement is 0 degrees.

• The mathematical expression for work done is given as: Work (W) = Force (F) × Displacement (d) × cos(θ), where θ is the angle between the force and displacement.

• When θ = 0°, the value of cos(θ) = 1, so the formula simplifies to: W = F × d × 1 = F × d.

• Since both force and displacement are in the same direction, their magnitudes are positive, leading to a positive value for work done.

• This signifies that the energy is being transferred to the object, causing displacement in the direction of the applied force.

• Examples include pushing a box forward or lifting an object upwards, where the displacement occurs in the same direction as the

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applied force.

Additional Information

• Zero

• If the angle between force and displacement is 90 degrees, then the cos(90°) = 0, resulting in zero work done.

• This happens when the force does not contribute to the displacement, such as carrying an object horizontally without vertical displacement.

• Negative

• If the force and displacement are in opposite directions, the angle θ = 180°, and cos(180°) = -1, leading to negative work done.

• Negative work is observed when a force opposes the motion, such as friction slowing down a moving object.

• Either Positive or Negative

• This option is incorrect as the work done depends on the specific relationship between the force and displacement directions.

• It cannot be both positive and negative at the same time; it depends on the angle θ.

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