RRB ALP CBT-I 2024 Official Paper (Held On: 27 Nov, 2024 Shift 1) (Previous Year Paper)

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

Take this paper as a timed mock test

Practise under exam conditions, then review your answers after you submit.

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STAGE I (CBT I)

Q1. If 60% of a number is added to 120, then the result is the number itself. 60% of this number is _____.

(a) 200
(b) 320
(c) 180
(d) 300

Q2. If x : y = 8 : 3, then (x + y) : (x - y) = ?

(a) 5 : 11
(b) 11 : 5
(c) 2 : 5
(d) 5 : 2

Q3. Triangle ABC is similar to triangle DEF with BC : EF = 1 : 4. Find the area(Δ DEF) : area(ΔABC).

(a) 1 : 4
(b) 16 : 1
(c) 1 : 16
(d) 4 : 1

Q4. 48 men can do a work in 5 days while 40 women can do the same work in 9 days. In how many days can 4 men and 6 women together do the same work?

(a) 24 days
(b) 30 days
(c) 48 days
(d) 42 days

Q5. Which of the following statements about magnetic field is correct?

(a) Its direction at any point is measured by a magnetic compass.
(b) It is a scalar quantity.
(c) It is always in the form of straight lines.
(d) It only exists outside the magnet.

Q6. Which of the following physical quantities is equivalent to the total path length covered by a moving body?

(a) Displacement
(b) Distance
(c) Velocity
(d) Speed

Q7. A person saves 30% of his monthly income. If his monthly income increases by 20%, then he saves 20% more than the previous savings. The percentage increase in his expenditure is ___.

(a) 30%
(b) 16%
(c) 20%
(d) 25%

Q8. Which of the following options should come in place of the question mark (?) in the given series to make it logically complete?

24, 33, 44, 57, 72,?

(a) 89
(b) 94
(c) 100
(d) 96

Q9. Q starts from Point A and drives 14 km towards the South. He then takes a left turn, drives 10 km, turns left and drives 9 km. He then takes a left turn and drives 7 km. He takes a final right turn, drives 5 km and stops at Point B. Towards which direction should he drive to reach Point A again? (All turns are 90 degrees.)

(a) 3 km towards the South
(b) 3 km towards the East
(c) 3 km towards the North
(d) 3 km towards the West

Q10. RV11 is related to GK18 in a certain way. In the same way, DH29 is related to SW36. To which of the following options is PT22 related, following the same logic?

(a) EJ29
(b) FJ29
(c) FI29
(d) EI29

Q11. The LCM of two numbers is 84. If the numbers are in the ratio 2 : 3, then the sum of the numbers is:

(a) 25
(b) 40
(c) 70
(d) 60

Q12. The surface area of a sphere is 256 π m2. Find its diameter.

(a) 12m
(b) 8m
(c) 4m
(d) 16m

Q13. If each vowel in the word ROMANCE is changed to the nearest consonant succeeding it in the English alphabetical order and each consonant is changed to the nearest vowel succeeding it in English alphabetical order, then which of the following letters is repeated twice in the new group of letters thus formed?

(a) F
(b) O
(c) U
(d) P

Q14. If 'P' stands for '×', 'Q' stands for '÷ ', 'R' stands for '–' and 'S' stands for '+', what will come in place of the question mark '?' in the following equation?

(32 P 4) R (21 P 5) S (9 Q 3) P 6 = ?

(a) 33
(b) 41

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(c) 47
(d) 50

Q15. 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 bike is a car.

All cars are planes.

Conclusions

(I) No plane is a bike.

(II) All planes are cars.

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

Q16. Who among the following was appointed as the Brand Ambassador of the Ministry of Ports, Shipping and Waterways of the Government of India?

(a) P.R Sreejesh
(b) Sarabjot Singh
(c) Neeraj Chopra
(d) Manu Bhaker

Q17. Read the given statements and conclusions carefully. You have to take the given statements to be true even if they seem to be at variance from commonly known facts and decide which conclusion(s) logically follow(s) from the given statements.

Statements:

Some bulbs are sands.

All bulbs are candles.

Conclusion:

(I) Some candles are bulbs.

(II) No candle is a sand.

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

Q18. What recent decision did the Union Cabinet make regarding the Ayushman Bharat PM-JAY scheme on 11 September 2024?

(a) To extend benefits to all citizens aged 70 and above
(b) To increase the coverage amount for all citizens
(c) To discontinue the scheme
(d) To limit coverage to only low-income families

Q19. 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:

Severe congestion is seen on the service road outside the apartment complex between 7.30 a.m. to 9 a.m. everyday due to many school buses from different schools picking up children from gate of the apartment complex. This is leading to a traffic jam, delaying many people travelling for work at this time.

Courses of Action:

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(I) No school buses should be permitted on the service road from 7.30 a.m. to 9 a.m.

(II) School buses should be permitted to enter the society gates.

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

Q20. If a man lifts 1 kg of load to the height of 2.5 m from the ground, then assuming acceleration due to gravity is 10 m/sec², magnitude of the work done by the man is _____.

(a) 0.25 joule
(b) 25 joules
(c) 2.5 joules
(d) 4 joules

Q21. The equivalent resistance of the series combination of R ohm and 5 ohm is 7 ohm. Here, R is _____.

(a) 5 ohm
(b) 1 ohm
(c) 7 ohm
(d) 2 ohm

Q22. Membrane bound organelles are NOT present in:

(a) Neither eukaryotic nor prokaryotic cells
(b) Only eukaryotic cells
(c) Both eukaryotic and prokaryotic cells
(d) Only prokaryotic cells

Q23. The value of (36)^(1/6) is:

(a) √36
(b) 1
(c) 2
(d) (6)^(1/3)

Q24. 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 : 192 :: 34 : Y

(a) X = 45, Y = 136
(b) X = 48, Y = 128
(c) X = 52, Y = 102
(d) X = 59, Y = 117

Q25. Which of the following animals shows the power of regeneration?

(a) Earthworm
(b) Tick
(c) Planaria
(d) Leech

Q26. 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) AK-VF
(b) XF-SC

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(c) SC-NX
(d) RB-MW

Q27. On which date did the Department of Posts launch the philately scholarship scheme in 2024?
(a) 15 August 2024
(b) 24 August 2024
(c) 5 September 2024
(d) 20 July 2024

Q28. Amita is 2 years elder than her friend Amrita. Amita's father is twice as old as Amita, and Amrita is twice as old as her sister. The ages of Amita's father and Amrita's sister differ by 43 years. The difference between the ages of Amita and Amrita is:
(a) 2
(b) 4
(c) 1
(d) 3

Q29. If the mean of a data is 65 and its mode is 23, then the median using empirical formula is:
(a) 53
(b) 51
(c) 52
(d) 54

Q30. The final match for Irani Trophy 2024-25, which was won by Mumbai, was conducted at _____.
(a) Patna
(b) Hyderabad
(c) Lucknow
(d) Ahmedabad

Q31. Which of the following receptors help in the detection of taste?
(a) Olfactory receptors
(b) Gustatory receptors
(c) Photoreceptors
(d) Phonoreceptors

Q32. Which of the following statements is/are correct?
Statements:
I) Gravitational force between two objects is independent of the distance of separation between two objects.
II) Gravitational force between two objects is inversely proportional to the square of the distance of separation between two objects.
III) Gravitational force between two objects is directly proportional to the product of their masses.
(a) Statements I and II
(b) Statements I, II and III
(c) Statements II and III
(d) Statements I and III

Q33. Which of the following options should come in place of the question mark ('?') in the given series based on the English alphabetical order?
FEB, KJG, POL, UTQ
(a) ZXS
(b) ZVU
(c) ZYV
(d) YZU

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Q34. Simplify (cos 45°)/(tan 30° + cot 60°) is equal to:

(a) √3/(√2(1 - √3))
(b) √3/√2
(c) √3/(√2(1 + √3))
(d) √3/2√2

Q35. 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) IG-EJ
(b) RP-NS
(c) OM-KP
(d) MK-IO

Q36. If each vowel in the word WEIGHT is changed to the letter immediately succeeding it in the English alphabetical order and each consonant is changed to the letter immediately preceding it in the English alphabetical order. Which of the following letters is repeated twice in the new group of letters thus formed?

(a) J
(b) F
(c) V
(d) G

Q37. Which two numbers should be interchanged to make the given equation correct?

63 - 45 + 14 + (81 ÷ 9) × 4 + 18 × 3 = 114

(Note: Interchange should be done of the entire number and not individual digits of a given number.)

(a) 4 and 3
(b) 14 and 18
(c) 45 and 81
(d) 63 and 81

Q38. There are two classrooms, A and B. If 7 students are shifted from A to B, then B will have twice the number of students as A. If 3 students are sent from B to A, then both the classrooms will have the same number of students. The positive difference between the number of students in the two classrooms is:

(a) 6
(b) 5
(c) 8
(d) 7

Q39. The Artisan Mahakumbh 2024, organised by the Government of India in Mumbai, was held to promote artisans under which of the following schemes?

(a) Pradhan Mantri Kaushal Vikas Yojana
(b) USTAAD (Upgrading the Skills and Training in Traditional Arts/Crafts for Development)
(c) Prime Minister's Employment Generation Programme
(d) Scheme of Fund for Regeneration of Traditional Industries (SFURTI)

Q40. Two people drive towards each other from two places which are 56 km apart. The speed of the first person is 12 km/h and the speed of the other is 14 km/h. After how long will they be 4 km apart if they start driving at the same time?

(a) 1 hour 30 minutes
(b) 1 hour
(c) 2 hours 10 minutes
(d) 2 hours

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Q41. Which of the following options represents the product(s) of the reaction given below?

$MnO_2 + 4HCl \rightarrow$

(a) Only $MnCl_2$
(b) $MnCl_2$, Cl_2, and $2H_2O$
(c) Only H_2O
(d) Only Cl_2

Q42. Which of the following compounds is obtained when gypsum is heated at 373 K?

(a) CaO
(b) $CaSO_4 \cdot (1/2\ H_2O)$
(c) $CaSO_4 \cdot 2H_2O$
(d) $CaSO_4 \cdot 5H_2O$

Q43. In a certain code language, 'SKATE' is coded as '35186' and 'TAKER' is coded as '51623'. What is the code for 'R' in the given code language?

(a) 1
(b) 3
(c) 2
(d) 6

Q44. Which of the following molecules acts as an information source for making proteins?

(a) Deoxyribonucleic acid
(b) Carbohydrates
(c) Ribonucleic acid
(d) Phospholipids

Q45. A, B, C, D, E and F are sitting around a circular table facing the centre. F sits second to the right of C. D is an immediate neighbour of E and F. A sits second to the left of B. What is the position of E with respect to C?

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

Q46. What is required for the synthesis of thyroxin hormones?

(a) Nickel
(b) Bromine
(c) Iodine
(d) Chlorine

Q47. Which of the following is the molecular mass of HNO_3?

(a) 63 u
(b) 64 u
(c) 67 u
(d) 60u

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Q48. All 36 students in a class are standing in a row facing north. Preeti is 12^(th) from the right end while Alisha is 22nd from the left end. How many people stand between Preeti and Alisha?

(a) 3
(b) 1
(c) 5
(d) 2

Q49. If each consonant in the word PASTRY is changed to the letter immediately preceding it in the English alphabetical order and each vowel is changed to the letter immediately succeeding it in the English alphabetical order, then how many vowels are present in the new group of letters thus formed?

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

Q50. If the refractive index of air, water, and crown glass are n1,n2 and n3 respectively, then _____.

(a) n1 < n2 = n3
(b) n_(1)>n_(2)> n3
(c) n1 = n2 < n3
(d) n_(1)< n_(2)< n3

Q51. 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 :: ?

X : 66 :: 9 : Y

(a) X = 9, Y = 81
(b) X = 8, Y = 83
(c) X = 8, Y = 81
(d) X = 7, Y = 80

Q52. Which of the following is the highest award in the Rashtriya Vigyan Puraskar awards?

(a) Vigyan Vajra
(b) Vigyan Mahan
(c) Vigyan Shri
(d) Vigyan Ratna

Q53. A retailer would have made a profit of 18%.If he had sold an article at its marked price. If the marked price of the article is Rs. 826, then the cost price of the article is:

(a) 800
(b) 750
(c) 700
(d) 650

Q54. Simplify the following expression:

(4.32 × 4.32 - 2.64 × 2.64)/1.68

(a) 6.94
(b) 6.56
(c) 6.99
(d) 6.96

Q55. In a certain code language, ‘DOTH’ is coded as ‘3764’ and ‘HOLD’ is coded as ‘7943’. What is the code for ‘T’ in the given code language?

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

(d) 3

Q56. Why do covalently bonded compounds have low boiling point?

(a) Have strong covalent bond within molecules but weak intermolecular force
(b) Have weak covalent bond within molecules but weak intermolecular force
(c) Have strong covalent bond within molecules and also strong intermolecular force
(d) Have strong intermolecular force within molecules but weak covalent bond

Q57. Which of the following options should come in place of the question mark (?) in the given series based on the English alphabetical order?

BDF, IKM, PRT, WYA, ?

(a) CFI
(b) DGJ
(c) CEG
(d) DFH

Q58. Seven people, B, C, D, E, F, G and K are sitting in a straight line, facing north. Only five people sit between B and K. G sits to the immediate left of K. Only one person sits between G and E. D sits at some place to the left of F but at some place to the right of C.

Who sits third from the left end of the line?

(a) F
(b) C
(c) E
(d) D

Q59. The correct expression of 6.4646464646..... in the fractional form is:

(a) 646/99
(b) 640/99
(c) 6464/1000
(d) 640/100

Q60. In 2024, which country is cooperating with India to counter China's military assertiveness and has discussed technology transfer for UNICORN at the 2+2 ministerial dialogue?

(a) Japan
(b) France
(c) The United States of America
(d) Australia

Q61. Which of the following metals is more reactive towards dilute hydrochloric acid?

(a) Mg
(b) Al
(c) Zn
(d) Fe

Q62. Which of the following statements is INCORRECT?

(a) Compressed natural gas (CNG) is used as a fuel in vehicles these days.
(b) The oxygen supplied to hospitals in cylinders is not a compressed gas.
(c) The oxygen supplied to hospitals in cylinders is a compressed gas.
(d) In the gaseous state, the particles move about randomly at a high speed.

Q63. Which of the following singers was awarded the Padma Shri in 2024 for his significant contributions to Himachali folk and classical music?

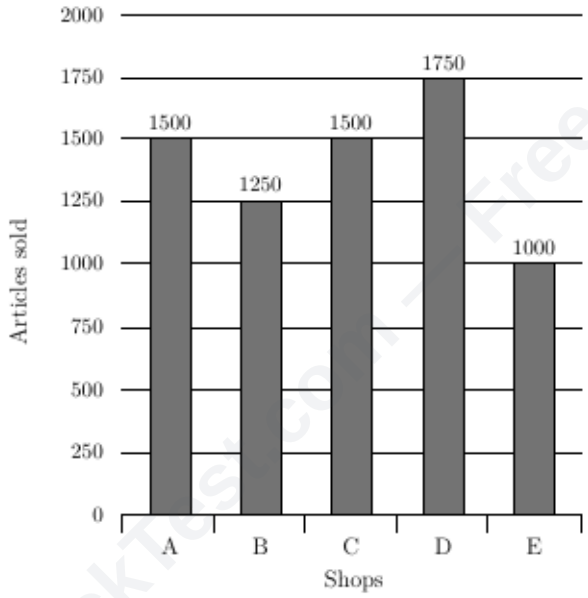
(a) Hansraj Raghuwanshi
(b) Som Datt Battu
(c) Kuldeep Sharma

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(d) Mohit Chauhan

Q64. Study the following graph and answer the given question.

The graph shows the number of articles sold in a week by different shops.



What percentage of articles did shop C sell more than shop B?

(a) 20%
(b) 50%
(c) 40%
(d) 30%

Q65. In a certain code language,

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

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

A × B means 'A is the wife of B',

A ÷ B means 'A is the father of B',

and A # B means 'A is the daughter of B'.

How is Q related to J if 'Q + R - P × S ÷ T - J + K'?

(a) Son's daughter
(b) Father's mother
(c) Mother's mother
(d) Daughter's son

Q66. Given that one cubic cm of marble weighs 25 gms, the weight of a cuboidal marble block 28 cm in width and 5 cm thick is 112 kg. The length of the block is:

(a) 26.5 cm
(b) 36 cm
(c) 32 cm
(d) 37.5 cm

Q67. A dishonest shopkeeper pretends to sell his goods at cost price. However, he uses a false weight on which 200 gm is written, but which actually weighs lesser. Using this false weight, the shopkeeper makes a gain of 25%. The actual measure of the weight used is:

(a) 150 gm
(b) 200 gm
(c) 160 gm
(d) 180gm

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Q68. Select the triad which follows the same pattern as that followed by the two triads given below. Both triads follow the same pattern.

GB-HC-JL

PK-QL-SU

(a) NI-OJ-QR
(b) SN-TO-VW
(c) QL-RM-TV
(d) RM-SN-UV

Q69. Which Indian city recorded the highest PM2.5 level in 2023, making it the most polluted metropolitan area globally?

(a) Guwahati
(b) Greater Noida
(c) Mullanpur
(d) Begusarai

Q70. A sum of money lent on simple interest becomes 7/5 of itself in 4 years. Find the rate of interest per annum.

(a) 10%
(b) 12%
(c) 6%
(d) 15%

Q71. In 2023, India imported crude oil from which country, making payments in Indian Rupees (Rs.), as part of the Rupee-Dirham trade agreement?

(a) Russia
(b) UAE
(c) Qatar
(d) Oman

Q72. Which of the following is an example of heterogeneous solution?

(a) Lemonade
(b) Tincture of iodine
(c) Mixture of ethanol and water
(d) Mixture of oil and water

Q73. The distance between the centre of curvature and pole of a convex mirror of 1 m focal length is _____.

(a) 1.5m
(b) 1m
(c) 2m
(d) 0.5m

Q74. Which cell has changing shapes?

(a) Smooth muscle
(b) Nerve cell
(c) Amoeba
(d) Ovum

Q75. The median of the observations 20, 23, 25, 30, 20, 31, 32, 35, 20, 41, 42, 43, 20, 20 and 20 is:

(a) 26
(b) 25
(c) 28
(d) 23

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ANSWER KEY

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

SOLUTIONS

Q1. Answer: (c) 180

Shortcut Trick

If 60% of a number is added to 120 to get the number itself (100%), it means the added 120 represents the remaining 40%.

=> 40% of the number = 120

=> 1% of the number = 120 ÷ 40 = 3

=> 60% of the number = 3 × 60 = 180

Therefore The correct answer is 180.

Alternate Method

Given: 60% of a number + 120 = the number.

Formula Used: Percentage value = (Percentage / 100) × Total Value

=> Let the number be x.

=> 60% of x + 120 = x

=> (60 ÷ 100) × x + 120 = x

=> 0.6x + 120 = x

=> x − 0.6x = 120

=> 0.4x = 120

=> x = 120 ÷ 0.4

=> x = 300

Now, we need to find 60% of this number:

=> 60% of 300 = (60 ÷ 100) × 300

=> 0.6 × 300 = 180

Therefore The correct answer is 180.

Additional Information

Base Value Concept

In percentage problems, the original number is always treated as the base (100%). Any addition or subtraction is relative to this base.

Fractional Equivalents

Converting percentages to fractions simplifies calculation: 60% = 3/5 and 40% = 2/5. If 2/5 of a number is 120, then 3/5 is (120 ÷ 2) × 3 = 180.

Percentage Change Formula

The percentage increase or decrease is calculated as: (Change ÷ Original Value) × 100.

Q2. Answer: (b) 11 : 5

Shortcut Trick

Directly apply the Componendo and Dividendo logic to the given ratio.

If x : y = 8 : 3, then (x + y) : (x − y) = (8 + 3) : (8 − 3).

Calculation: 11 : 5.

Therefore The correct answer is 11 : 5.

Alternate Method

Given:

The ratio x : y = 8 : 3.

Formula Used:

For any ratio x : y = a : b, we can assume x = ak and y = bk.

Let x = 8k and y = 3k, where k is a constant.

=> x + y = 8k + 3k = 11k

=> x − y = 8k − 3k = 5k

=> (x + y) : (x − y) = 11k : 5k

=> (x + y) : (x − y) = 11 : 5

Therefore The correct answer is 11 : 5.

Additional Information

Componendo and Dividendo Rule

If a/b = c/d, then (a + b) / (a − b) = (c + d) / (c − d). This property is extensively used to simplify ratios involving addition and subtraction.

Invertendo and Alternando

Invertendo: If a : b = c : d, then b : a = d : c. Alternando: If a : b = c : d, then a : c = b : d.

Duplicate and Sub-duplicate Ratio

The duplicate ratio of a : b is $a^2 : b^2$, and the sub-duplicate ratio is √a : √b.

Q3. Answer: (b) 16 : 1

Shortcut Trick

For two similar triangles, the ratio of their areas is equal to the square of the ratio of their corresponding sides.

Given side ratio BC : EF = 1 : 4.

=> Area(ΔABC) : Area(ΔDEF) = $1^2 : 4^2$ = 1 : 16.

=> Area(ΔDEF) : Area(ΔABC) = 16 : 1.

Therefore The correct answer is 16 : 1.

Alternate Method

Given:

=> ΔABC ~ ΔDEF

=> Ratio of sides BC : EF = 1 : 4

Formula Used:

=> Area(ΔABC) ÷ Area(ΔDEF) = $(BC ÷ EF)^2$

Calculations:

=> According to the Area Theorem of similar triangles:

=> Area(ΔABC) ÷ Area(ΔDEF) = $(BC)^2 ÷ (EF)^2$

=> Area(ΔABC) ÷ Area(ΔDEF) = $(1)^2 ÷ (4)^2$

=> Area(ΔABC) ÷ Area(ΔDEF) = 1 ÷ 16

=> Area(ΔABC) : Area(ΔDEF) = 1 : 16

=> Inverting the ratio to find Area(ΔDEF) : Area(ΔABC):

=> Area(ΔDEF) : Area(ΔABC) = 16 : 1

Therefore The correct answer is 16 : 1.

Additional Information

Similar Triangles Area Theorem

If two triangles are similar, the ratio of their areas is equal to the square of the ratio of any two corresponding sides, altitudes, or medians.

Perimeter Ratio

The ratio of the perimeters of two similar triangles is equal to the ratio of their corresponding sides (linear ratio).

SAS Similarity

Two triangles are similar if two sides of one triangle are proportional to two sides of another triangle and their included angles are equal.

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Q4. Answer: (b) 30 days

Shortcut Trick

Equate work to find Efficiency ratio: 48 Men × 5 days = 40 Women × 9 days.

=> 240 Men = 360 Women => 2 Men = 3 Women => 1 Man : 1 Woman = 3 : 2.

Convert 4 Men + 6 Women into Women units: 2(3W) + 6W = 12 Women.

Using M1D1 = M2D2: 40 Women × 9 days = 12 Women × D2.

=> D2 = 360 ÷ 12 = 30 days.

Therefore The correct answer is 30 days.

Alternate Method

Given:

Time taken by 48 men = 5 days

Time taken by 40 women = 9 days

Formula Used:

Total Work = Number of persons × Efficiency × Days

Person	Total Individual Days	Total Work (LCM)	Efficiency (Unit/Day)
1 Man (48 × 5)	240 days	720 units	3 units
1 Woman (40 × 9)	360 days	2 units	

Calculations:

=> Efficiency of 1 Man = 3 units/day

=> Efficiency of 1 Woman = 2 units/day

=> Efficiency of 4 Men = 4 × 3 = 12 units/day

=> Efficiency of 6 Women = 6 × 2 = 12 units/day

=> Total efficiency of (4 Men + 6 Women) = 12 + 12 = 24 units/day

=> Required Days = Total Work ÷ Combined Efficiency

=> Required Days = 720 ÷ 24 = 30 days

Therefore The correct answer is 30 days.

Additional Information

MDH Rule

For work comparison, use (M1 × D1 × H1) ÷ W1 = (M2 × D2 × H2) ÷ W2, where M is persons, D is days, H is hours, and W is work.

Efficiency and Time

Efficiency is inversely proportional to the time taken to complete the work. Ratio of efficiency A:B = x:y implies ratio of time A:B = y:x.

Combined Work

When multiple groups work together, their total efficiency is the sum of their individual efficiencies (Total E = E1 + E2 + ... + E_n).

Q5. Answer: (a) Its direction at any point is measured by a magnetic compass.

The correct answer is Its direction at any point is measured by a magnetic compass..

Key Points

• The magnetic field is a vector quantity, meaning it has both magnitude and direction.

• The direction of the magnetic field at any point can be determined using a magnetic compass.

• Magnetic field lines are not always straight; they can be curved depending on the magnetic source.

• Magnetic fields exist both inside and outside of a magnet.

• The strength of the magnetic field decreases with distance from the source.

Additional Information

• Magnetic Field Lines

• These are imaginary lines that represent the direction and strength of the magnetic field.

• They emerge from the north pole of a magnet and enter the south pole.

• Electromagnets

• These are magnets created by electric current flowing through coils of wire.

• Electromagnets are widely used in various applications, including motors and transformers.

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• Earth's Magnetic Field
• The Earth itself acts as a giant magnet with a magnetic field extending into space.
• This magnetic field protects the Earth from solar wind and cosmic radiation.

Q6. Answer: (b) Distance

The correct answer is Distance.

Key Points

• Distance is a scalar quantity that represents the total path length covered by a moving body.
• It is always positive and does not depend on the direction of motion.
• Distance gives the complete measure of the travel without considering the direction.
• Unlike displacement, distance does not have a vector property; it only has magnitude.
• Distance can be greater than or equal to the magnitude of displacement, but never less.

Additional Information

• Displacement
• Displacement is a vector quantity that refers to the change in position of an object.
• It has both magnitude and direction.
• Displacement can be zero if the object returns to its initial position.
• Velocity
• Velocity is a vector quantity that refers to the rate of change of displacement.
• It includes both speed and direction of motion.
• Speed
• Speed is a scalar quantity that refers to how fast an object is moving.
• It is the rate at which distance is covered.

Q7. Answer: (c) 20%

Shortcut Trick

If every component of a sum (Income = Expenditure + Savings) increases by the same percentage, the total sum also increases by that same percentage.

Here, the Income increases by 20% and the Savings also increases by 20%.

By the rule of uniform percentage change, the Expenditure must also increase by 20% to maintain the balance.

Therefore The correct answer is 20%.

Alternate Method

Given:

Initial Savings = 30% of Income

Increase in Income = 20%

Increase in Savings = 20%

Formula Used:

Income = Expenditure + Savings

Percentage Increase = [(New Value − Old Value) / Old Value] × 100

Calculations:

=> Let initial Income = 100

=> Initial Savings = 30% of 100 = 30

=> Initial Expenditure = 100 − 30 = 70

=> New Income = 100 + (20% of 100) = 120

=> New Savings = 30 + (20% of 30) = 30 + 6 = 36

=> New Expenditure = New Income − New Savings

=> New Expenditure = 120 − 36 = 84

=> Increase in Expenditure = 84 − 70 = 14

=> Percentage Increase = (14 / 70) × 100

=> Percentage Increase = (1 / 5) × 100 = 20%

Therefore The correct answer is 20%.

Additional Information

Fundamental Income Identity

The total monthly earnings of an individual are always distributed as Income = Expenditure + Savings.

Weighted Average Property

If Income increases by x% and Savings increases by y%, the percentage change in Expenditure is governed by the ratio of initial expenditure and savings.

Constant Proportions

If all parts of a whole increase by the same percentage, the whole and its constituent ratios remain constant relative to each other.

Q8. Answer: (a) 89

The logic followed here is:

Hence, "Option 1" is the correct answer.

Q9. Answer: (d) 3 km towards the West

Given:

Q starts from Point A and drives 14 km towards the South.

He then takes a left turn, drives 10 km, turns left and drives 9 km.

He then takes a left turn and drives 7 km.

He takes a final right turn, drives 5 km and stops at Point B.

Thus, Q should drive (10 km - 7 km) 3 km in the west direction to reach Point A again.

Hence, "Option 4" is the correct answer.

Q10. Answer: (d) EI29

The logic followed here is:

RV11 is related to GK18

And,

DH29 is related to SW36

Similarly,

PT22 is related to

Hence, "Option 4" is the correct answer.

Q11. Answer: (c) 70

Shortcut Trick

Ratio of numbers = 2 : 3

LCM of ratio parts (2 and 3) = 2 × 3 = 6 units

6 units = 84 => 1 unit = 14

Sum of numbers = (2 + 3) = 5 units

Sum = 5 × 14 = 70

Therefore The correct answer is 70.

Alternate Method

Given:

LCM of two numbers = 84

Ratio of the numbers = 2 : 3

Formula Used:

LCM of numbers ax and bx = (a × b) × x (where a and b are coprime)

Calculations:

=> Let the two numbers be 2x and 3x.

=> LCM of 2x and 3x = 6x

=> 6x = 84

=> x = 84 ÷ 6 = 14

=> Sum of the numbers = 2x + 3x = 5x

=> Sum = 5 × 14

=> Sum = 70

Therefore The correct answer is 70.

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Additional Information

Fundamental Relation of LCM and HCF

For any two numbers A and B, the product of the numbers is equal to the product of their HCF and LCM: A × B = HCF × LCM.

HCF and Ratio Relationship

If two numbers are in the ratio a : b and their HCF is x, then the numbers are ax and bx, and their LCM is a × b × x.

HCF of Coprime Numbers

The HCF of two coprime numbers is always 1, and their LCM is simply the product of the two numbers.

Q12. Answer: (d) 16m

Shortcut Trick

Surface Area = 4 π r² = 256 π

=> r² = 256 ÷ 4 = 64

=> Radius (r) = √64 = 8 m

=> Diameter = 2 × 8 = 16 m

Therefore The correct answer is 16m.

Alternate Method

Given:

Surface Area of the Sphere = 256 π m²

Formula:

Surface Area (S) = 4 π r²

Diameter (d) = 2r

Calculations:

=> 4 × π × r² = 256 × π

=> r² = 256 ÷ 4

=> r² = 64

=> r = √64

=> r = 8 m

=> Diameter = 2 × r

=> Diameter = 2 × 8 = 16 m

Therefore The correct answer is 16m.

Additional Information

Volume of a Sphere

The amount of space occupied by a sphere is calculated using the formula: V = (4/3) × π × r³.

Surface Area of a Hemisphere

For a hemisphere, the Curved Surface Area (CSA) is 2πr² and the Total Surface Area (TSA) is 3πr².

Properties of a Sphere

A sphere is a perfectly symmetrical 3D object where all points on the surface are at an equal distance (radius) from the center.

Q13. Answer: (b) O

Given word: ROMANCE

According to the question,

Given word	R	O	M	A	N	C	E
Vowel → Next Consonant Consonant → Next Vowel	U	P	O	B	O	E	F

Here, the letter 'O' is repeated twice in the new group of letters thus formed.

Hence, "Option 2" is the correct answer.

Q14. Answer: (b) 41

Given Equation: (32 P 4) R (21 P 5) S (9 Q 3) P 6 = ?

BODMAS Rule:

Decoding the given information:

Alphabet	P	Q	R	S
Meaning	×	÷	−	•

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

=> (32 × 4) − (21 × 5) + (9 ÷ 3) × 6

=> 128 − 105 + 3 × 6

=> 128 − 105 + 18

=> 146 - 105 = 41

Hence, the correct option is "Option 2".

Q15. Answer: (b) Neither conclusion (I) nor (II) follows

The least possible Venn diagram for the given statements is as shown below :

Conclusions:

(I) No plane is a bike → Does not follow (As no bike is a car and all cars are planes. As no direct relation is given between plane and bike, therefore it is false.)

(II) All planes are cars → Does not follow (As all cars are planes. So it is possible but not definite

Therefore Here, Neither conclusion (I) nor (II) follows.

Hence, the correct answer is "Option 2".

Q16. Answer: (d) Manu Bhaker

The correct answer is Manu Bhaker.

Key Points Manu Bhaker and Sarabjot Singh won bronze in the 10m air pistol mixed team event, marking India's second medal at the Paris Olympics 2024.

Additional Information

• They defeated South Korea 16-10 in the bronze medal match, with a performance that saw them come from behind and secure a strong lead.

• Manu Bhaker became the first Indian woman shooter to win an Olympic medal and the first athlete from independent India to win multiple medals at a single Olympic Games.

• Manu consistently scored high, often compensating for any lower scores from Sarabjot, showcasing their strong teamwork.

• This is India's first Olympic medal in a shooting team event, adding to the country's growing legacy in the sport.

Q17. Answer: (c) Only conclusion (I) follows.

The least possible Venn diagram for the given statements is as shown below :

Conclusions:

(I) Some candles are bulbs → Follow (As all bulbs are candles. As whole bulbs comes in candles, therefore it is false.)

(II) No candle is a sand → Does not follow (As some bulbs are sands and all bulbs are candles. As whole bulbs comes in candles and has some part common with sand, therefore it is false.)

Therefore Here, Only conclusion (I) follows.

Hence, the correct answer is "Option 3".

Q18. Answer: (a) To extend benefits to all citizens aged 70 and above

The correct answer is To extend benefits to all citizens aged 70 and above.

Key Points

• The Ayushman Bharat Pradhan Mantri Jan Arogya Yojana (AB PM-JAY) was introduced by PM Modi on September 23, 2018.

• The scheme has completed six years of implementation as of September 2024.

• As of September 9, 2024, over 35.4 crore Ayushman cards have been issued across 33 states and UTs, except in NCT Delhi, West Bengal, and Odisha.

• The scheme has led to a 21% reduction in out-of-pocket healthcare expenditures and an 8% reduction in the incidence of emergency loans for healthcare.

• It is the world’s largest publicly funded health assurance scheme, providing health cover of Rs 5 lakh per family per year for secondary and tertiary care hospitalization.

Additional Information

• Recent Developments

• On September 11, 2024, the Cabinet approved health coverage for all senior citizens aged 70 and above, irrespective of their

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socio-economic status.

• In January 2022, the government revised the beneficiary base under “AB PM-JAY” from 10.74 crore to 12 crore families.

• The scheme was expanded to cover 37 lakh ASHAs/AWWs/AWHs working across the country and their families for free benefits.

Q19. Answer: (d) Neither I nor II follows

Statement: Severe congestion is seen on the service road outside the apartment complex between 7.30 a.m. to 9 a.m. everyday due to many school buses from different schools picking up children from gate of the apartment complex. This is leading to a traffic jam, delaying many people travelling for work at this time.

Courses of Action I: No school buses should be permitted on the service road from 7.30 a.m. to 9 a.m - Doesn't follow Because ,It implies that Banning school buses from the service road during peak hours would solve the traffic issue temporarily but creates a bigger problem for children who depend on these buses.

Courses of Action II: School buses should be permitted to enter the society gates - Doesn't follow Because, it implies that allowing buses to enter the society gates. While this could alleviate congestion, the feasibility is uncertain since there’s no information on whether the apartment complex can accommodate buses.

Thus, Neither I nor II follows

Hence, the correct answer is "Option 4".

Q20. Answer: (b) 25 joules

Given:

Mass (m) = 1 kg

Height (h) = 2.5 m

Acceleration due to gravity (g) = 10 m/s^2

Concept:

The work done by a force is given by the formula:

$W = m \times g \times h$

Where:

• W = Work done

• m = Mass of the object

• g = Acceleration due to gravity

• h = Height to which the object is lifted

Calculation:

$\Rightarrow W = 1 \times 10 \times 2.5$

$\Rightarrow W = 25$ joules

Therefore The magnitude of the work done by the man is 25 joules.

Q21. Answer: (d) 2 ohm

The correct answer is 2 ohm.

Key Points

• In a series combination, the total resistance is the sum of the individual resistances.

• The formula for the equivalent resistance in a series combination is: R_(eq) = R1 + R2.

• Here, the equivalent resistance is given as 7 ohm, and one of the resistances is 5 ohm.

• Using the formula: 7 = R + 5.

• Rearranging the equation gives: R = 7 - 5, which equals 2 ohm.

• Hence, the missing resistance value (R) is 2 ohm.

• This concept is fundamental in understanding electric circuits and is used to calculate the total resistance in a series connection.

Additional Information

• Series Combination

• In a series circuit, the current flowing through each resistor is the same, but the total voltage is divided across the resistors.

• The total resistance in a series circuit is always greater than the resistance of any individual resistor.

• Series circuits are commonly used in applications like string lights and simple electronic devices.

• Parallel Combination

• In a parallel circuit, the voltage across each resistor is the same, but the current is divided among the resistors.

• The equivalent resistance in a parallel circuit is always less than the resistance of any individual resistor.

• Parallel circuits are widely used in household electrical wiring to ensure consistent voltage across all devices.
• Applications of Resistance Calculations
• Resistance calculations are crucial in designing electrical circuits, ensuring safety, and optimizing performance.
• They are used in industries like electronics, automobiles, and power generation.

Q22. Answer: (d) Only prokaryotic cells

The correct answer is Only prokaryotic cells.

Key Points

• Prokaryotic cells lack membrane-bound organelles such as the nucleus, mitochondria, and endoplasmic reticulum.
• Prokaryotes have a simple cell structure with no internal compartmentalization.
• Instead of a nucleus, prokaryotic cells have a nucleoid region where their genetic material is located.
• Prokaryotic cells include bacteria and archaea, which are unicellular organisms.
• Eukaryotic cells, in contrast, have complex structures with membrane-bound organelles, which allow for compartmentalized and specialized functions within the cell.

Additional Information

• Lysosomes
• These are membrane-bound organelles that contain enzymes responsible for breaking down waste materials and cellular debris.
• Chloroplast
• These are organelles found in plant cells and eukaryotic algae that conduct photosynthesis.
• Chloroplasts capture light energy and convert it into chemical energy in the form of glucose through the process of photosynthesis.
• Endoplasmic Reticulum (ER)
• It is a network of membranes within the cytoplasm of eukaryotic cells, involved in protein and lipid synthesis.
• The ER is divided into two types: rough ER (with ribosomes) and smooth ER (without ribosomes).
• Rough ER is involved in protein synthesis and folding, while smooth ER is associated with lipid synthesis and detoxification processes.

Q23. Answer: (d) (6)^(1/3)

Given:

The value of (36)^(1/6) is:

Formula used:

(a^(1/b) = b√a)

Calculation:

(36)^(1/6) = 6^(2/6)

=> (6^(1/3))

=> (6^(1/3))

Therefore The correct answer is option (4).

Q24. Answer: (d) X = 59, Y = 117

The logic followed here is:

Given: X : 192 :: 34 : Y

So, checking each option one by one:

Option 1) X = 45, Y = 136 → 45 : 192 :: 34 : 136

45 × 3 + 15 = 192

135 + 15 = 192

150 ≠ 192 (LHS ≠ RHS);

34 × 3 + 15 = 136

102 + 15 = 136

117 ≠ 136 (LHS ≠ RHS)

Option 2) X = 48, Y = 128 → 48 : 192 :: 34 : 128

48 × 3 + 15 = 192

144 + 15 = 192

159 ≠ 192 (LHS ≠ RHS);

34 × 3 + 15 = 128
102 + 15 = 128
117 ≠ 128 (LHS ≠ RHS)
Option 3) X = 52, Y = 102 → 52 : 192 :: 34 : 102
52 × 3 + 15 = 192
156 + 15 = 192
171 ≠ 192 (LHS ≠ RHS);
34 × 3 + 15 = 102
102 + 15 = 102
117 ≠ 102 (LHS ≠ RHS)
Option 4) X = 59, Y = 117 → 59 : 192 :: 34 : 117
59 × 3 + 15 = 192
177 + 15 = 192
192 = 192 (LHS = RHS);
34 × 3 + 15 = 117
102 + 15 = 117
117 = 117 (LHS = RHS)
Hence, "Option 4" is the correct answer.

Q25. Answer: (c) Planaria

The correct answer is Planaria.
Key Points
• Planaria are well-known for their remarkable regenerative capabilities.
• They can regenerate any part of their body, making them a subject of extensive biological research.
• This regeneration is possible due to the presence of a large number of stem cells called neoblasts.
• Planaria can regenerate not only their body parts but also their nervous system, including the brain.
• Their regenerative ability is an example of asexual reproduction, specifically through a process called fission.
Additional Information
• Earthworm
• Earthworms also have regenerative abilities but to a lesser extent than planaria.
• They can regenerate lost segments, but the extent of regeneration is limited and varies among species.
• Tick
• Ticks do not have significant regenerative abilities.
• They primarily rely on their hardy exoskeleton and parasitic lifestyle for survival.
• Leech
• Leeches have some regenerative capabilities, particularly in their nervous system.
• However, their regenerative abilities are not as advanced as those of planaria.

Q26. Answer: (b) XF-SC

The logic followed here is:
Option 1) AK-VF
Option 2) XF-SC
Option 3) SC-NX
Option 4) RB-MW
Hence, the correct answer is "Option 2".

Q27. Answer: (b) 24 August 2024

The correct answer is 24 August 2024.
Key Points
• The Department of Posts has launched a philately scholarship scheme under the Deen Dayal SPARSH Yojana to promote philately among students from Class VI to IX.
Additional Information
• Eligible candidates must be students of a recognized school with a Philately Club or have a Philately Deposit Account, and must

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have a good academic record with at least 60% marks in their recent final exams (55% for SC/ST students).

• The selection process includes two levels: a regional Philately Written Quiz and a Philately Project submission.

• The Philately Written Quiz consists of 50 multiple-choice questions covering various subjects including Current Affairs, History, Science, Sports, Culture, Geography, and Philately.

• For the Philately Project, students must create a project of 4-5 pages, using up to 16 stamps and no more than 500 words.

Q28. Answer: (a) 2

Shortcut Trick

The difference between the ages of Amita and Amrita is directly mentioned in the question.

The first statement of the question states: "Amita is 2 years elder than her friend Amrita."

Therefore, the difference between their ages is directly equal to 2 years.

Therefore The correct answer is 2 years.

Alternate Method

Given:

Let the age of Amita = A

Let the age of Amrita = B

Let the age of Amita's father = F

Let the age of Amrita's sister = S

Formula/Equations:

Formulating linear equations from the given statements:

Calculations:

=> A − B = 2 => A = B + 2 ----(Equation 1)

=> F = 2 × A ----(Equation 2)

=> B = 2 × S => S = B ÷ 2 ----(Equation 3)

=> F − S = 43 ----(Equation 4)

Substitute the values of F and S from Equation 2 and Equation 3 into Equation 4:

=> 2 × A − B ÷ 2 = 43

Substitute the value of A from Equation 1 into the equation:

=> 2 × (B + 2) − B ÷ 2 = 43

=> 2 × B + 4 − 0.5 × B = 43

=> 1.5 × B + 4 = 43

=> 1.5 × B = 39

=> B = 39 ÷ 1.5 = 26 years

=> A = B + 2 = 26 + 2 = 28 years

Thus, the difference between the ages of Amita and Amrita is:

=> A − B = 28 − 26 = 2 years

Therefore The correct answer is 2 years.

Additional Information

Linear Equation in Two Variables

Solving problems on ages generally requires setting up linear equations representing relations between individuals' ages.

Invariance of Age Difference

The difference between the ages of two people remains constant throughout their lives, regardless of how many years pass.

Ratio and Proportion in Ages

If the ratio of ages of two persons is x : y, and after n years the ratio becomes a : b, we can solve for their present ages using: (x × k + n) ÷ (y × k + n) = a ÷ b.

Q29. Answer: (b) 51

Shortcut Trick

The empirical relation is: 3 × Median = Mode + 2 × Mean

Given Mean = 65 and Mode = 23

3 × Median = 23 + 2 × 65 = 23 + 130 = 153

Median = 153 ÷ 3 = 51

Therefore The correct answer is 51.

Alternate Method

Given:

Mean = 65

Mode = 23

Formula Used:

For a moderately skewed frequency distribution, the empirical formula is:

Mode = 3 × Median − 2 × Mean

Calculations:

=> 23 = 3 × Median − 2 × 65

=> 23 = 3 × Median − 130

=> 3 × Median = 23 + 130

=> 3 × Median = 153

=> Median = 153 ÷ 3

=> Median = 51

Therefore The correct answer is 51.

Additional Information

Symmetric Distribution

In a perfectly symmetrical distribution, the Mean, Median, and Mode are identical (Mean = Median = Mode).

Positively Skewed Distribution

If the data is skewed to the right, the values follow the order: Mean > Median > Mode.

Negatively Skewed Distribution

If the data is skewed to the left, the values follow the order: Mode > Median > Mean.

Applicability of Empirical Formula

This formula is an approximation and works best for moderately skewed unimodal distributions.

Q30. Answer: (c) Lucknow

The correct answer is Lucknow.

Key Points

• The Mumbai Cricket team, led by Ajinkya Rahane, won the 2024–25 Irani Cup by defeating the Rest of India Team.

• This victory marks Mumbai's 15th Irani Cup title and their first since 1997.

• The tournament was held from 1st to 5th October 2024 at the Bharat Ratna Atal Bihari Vajpayee Eakana Stadium in Lucknow, Uttar Pradesh.

• Mumbai Cricket Team received a cash prize of Rs 50 Lakhs from the BCCI and an additional Rs 1 crore from the Mumbai Cricket Association (MCA).

• The Rest of India team was captained by Ruturaj Gaikwad.

Additional Information

• Irani Cup

• Inception - 1959-60 to honor Z.R. Irani, a prominent cricket administrator

• Format - First-class cricket match held annually between the Ranji Trophy winners and the Rest of India

• Mumbai Cricket Team

• Record - 15 Irani Cup titles, renowned for a strong cricketing legacy in Indian domestic cricket

• Captain (2024–25) - Ajinkya Rahane

• Bharat Ratna Atal Bihari Vajpayee Eakana Stadium

• Location - Lucknow, Uttar Pradesh

• Significance - One of India's premier cricket venues, hosting national and international matches

Q31. Answer: (b) Gustatory receptors

The correct answer is Gustatory receptors.

Key Points

• Gustatory receptors are specialized sensory receptors responsible for detecting taste.

• These receptors are located on the taste buds found on the tongue, soft palate, and epiglottis.

• Taste buds contain gustatory cells that respond to different taste stimuli such as sweet, sour, salty, bitter, and umami.

• When gustatory cells are stimulated by tastants, they send signals to the brain via the gustatory pathway to interpret different

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tastes.

• The detection and differentiation of tastes play a crucial role in dietary choices, nutrition, and overall health.

Additional Information

• Olfactory receptors

• These receptors are responsible for the detection of smell.

• Located in the olfactory epithelium within the nasal cavity, they respond to odor molecules.

• Photoreceptors

• These are specialized cells in the retina that respond to light.

• Photoreceptors include rods and cones, which are essential for vision.

• Phonoreceptors

• These receptors are involved in detecting sound.

• They are primarily found in the cochlea of the inner ear and are crucial for hearing.

Q32. Answer: (c) Statements II and III

The correct answer is option 3.

Key Points

• Gravitational force between two objects is given by Newton's law of gravitation.

• According to this law, the gravitational force between two objects is directly proportional to the product of their masses: F prop. to m1?m2F prop. to m1?m2F prop. to m1?m2F prop. to m1?m2F prop. to m1?m2F prop. to m1?m2F prop. to m1?m2F prop. to m1?m2F prop. to m1?m2F prop. to m1?m2F prop. to m1?m2F prop. to m1?m2

.

• The gravitational force is inversely proportional to the square of the distance between the two objects: F prop. to 1r2F prop. to 1r2F prop. to 1r2F prop. to 1r2F prop. to 1r2F prop. to 1r2.

• Therefore, Statement I is incorrect as the gravitational force is dependent on the distance of separation.

• Statements II and III are correct as they accurately describe the relationships involved in gravitational force.

Additional Information

• Electromagnetic Force

• This is another fundamental force that acts between charged particles.

• It is much stronger than the gravitational force and can be attractive or repulsive.

• Strong Nuclear Force

• This force acts between protons and neutrons in an atomic nucleus.

• It is the strongest of the four fundamental forces and is responsible for holding the nucleus together.

• Weak Nuclear Force

• This force is responsible for radioactive decay and other subatomic processes.

• It has a very short range and is weaker than both the electromagnetic and strong nuclear forces.

Q33. Answer: (c) ZYV

The logic followed here is:

Hence, "Option 3" is the correct answer.

Q34. Answer: (d) √3/2√2

Shortcut Trick

Substitute standard values: cos 45° = 1/√2, tan 30° = 1/√3, and cot 60° = 1/√3.

The denominator sum is 1/√3 + 1/√3 = 2/√3.

The expression becomes (1/√2) ÷ (2/√3) = (1/√2) × (√3/2) = √3 / 2√2.

Therefore The correct answer is √3 / 2√2.

Alternate Method

Given: The expression to simplify is (cos 45°) / (tan 30° + cot 60°).

Formula Used: Standard Trigonometric Ratios for specific angles.

=> cos 45° = 1/√2

=> tan 30° = 1/√3

=> cot 60° = 1/√3

=> Denominator = tan 30° + cot 60° = 1/√3 + 1/√3 = 2/√3

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=> Expression = (1/√2) / (2/√3)

=> Expression = (1/√2) × (√3/2)

=> Expression = √3 / (2 × √2)

=> Expression = √3 / 2√2

Therefore The correct answer is √3 / 2√2.

Additional Information

Trigonometric Complementary Angles

Values of tan θ and cot (90° − θ) are always equal. Thus, tan 30° = cot 60° = 1/√3 and tan 60° = cot 30° = √3.

Ratios of 45 Degrees

For 45°, the primary ratios are sin 45° = 1/√2, cos 45° = 1/√2, and tan 45° = 1.

Rationalization

To simplify expressions with square roots in the denominator, multiply the numerator and denominator by the conjugate or the root itself, such as 1/√2 = √2/2.

Q35. Answer: (d) MK-IO

The logic followed here is:

Option 1) IG-EJ

Option 2) RP-NS

Option 3) OM-KP

Option 4) MK-IO

Thus, out of all the options, 'MK-IO' is the odd one out.

Hence, "Option 4" is the correct answer.

Q36. Answer: (b) F

Given word: WEIGHT

According to the question,

Given word	W	E	I	G	H	T
Vowel → (+1) Consonant → (-1)	(-1)	(+1)	(+1)	(-1)	(-1)	(-1)
Resultant	V	F	J	F	G	S

Thus, the new formed letter cluster → V F J F G S

Here, letter 'F' is repeated twice in the new group of letters thus formed.

Hence, "Option 2" is the correct answer.

Q37. Answer: (b) 14 and 18

Given: 63 - 45 + 14 + (81 ÷ 9) × 4 + 18 × 3 = 114

According to the question, after interchanging the numbers:

Option 1) 4 and 3

63 - 45 + 14 + (81 ÷ 9) × 4 + 18 × 3 = 114 => 63 - 45 + 14 + (81 ÷ 9) × 3 + 18 × 4 = 114

=> 63 - 45 + 14 + (81 ÷ 9) × 3 + 18 × 4 = 114

=> 63 - 45 + 14 + 9 × 3 + 18 × 4 = 114

=> 63 + 14 + 27 + 72 - 45 = 114

=> 176 - 45 = 114

=> 131 ≠ 114 (LHS ≠ RHS)

Option 2) 14 and 18

63 - 45 + 14 + (81 ÷ 9) × 4 + 18 × 3 = 114 => 63 - 45 + 18 + (81 ÷ 9) × 4 + 14 × 3 = 114

=> 63 - 45 + 18 + (81 ÷ 9) × 4 + 14 × 3 = 114

=> 63 - 45 + 18 + 9 × 4 + 14 × 3 = 114

=> 63 + 18 + 36 + 42 - 45 = 114

=> 159 - 45 = 114

=> 114 = 114 (LHS = RHS)

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Option 3) 45 and 81

63 - 45 + 14 + (81 ÷ 9) × 4 + 18 × 3 = 114 => 63 - 81 + 14 + (45 ÷ 9) × 4 + 18 × 3 = 114

=> 63 - 81 + 14 + (45 ÷ 9) × 4 + 18 × 3 = 114

=> 63 - 81 + 14 + 5 × 4 + 18 × 3 = 114

=> 63 + 14 + 20 + 54 - 81 = 114

=> 151 - 81 = 114

=> 70 ≠ 114 (LHS ≠ RHS)

Option 4) 63 and 81

63 - 45 + 14 + (81 ÷ 9) × 4 + 18 × 3 = 114 => 81 - 45 + 14 + (63 ÷ 9) × 4 + 18 × 3 = 114

=> 81 - 45 + 14 + (63 ÷ 9) × 4 + 18 × 3 = 114

=> 81 - 45 + 14 + 7 × 4 + 18 × 3 = 114

=> 81 + 14 + 28 + 54 - 45 = 114

=> 177 - 45 = 114

=> 132 ≠ 114 (LHS ≠ RHS)

Hence, "Option 2" is the correct answer.

Q38. Answer: (a) 6

Shortcut Trick

From the second condition, shifting 3 students from Classroom B to Classroom A makes them equal.

If moving 'x' amount from one group to another makes them equal, the initial difference is 2 × x.

Here, the shift is 3, so the difference = 2 × 3 = 6.

We can verify with the first condition: if A = 27 and B = 33, then 33 + 7 = 2(27 − 7) => 40 = 2 × 20 (Correct).

Therefore The correct answer is 6 students.

Alternate Method

Given:

Let the number of students in Classroom A be x and in Classroom B be y.

Case 1: (y + 7) = 2(x − 7)

Case 2: (x + 3) = (y − 3)

Calculations:

From the second equation:

=> x + 3 = y − 3

=> y − x = 3 + 3

=> y − x = 6

Now, substitute y = x + 6 in the first equation to verify:

=> (x + 6) + 7 = 2(x − 7)

=> x + 13 = 2x − 14

=> 2x − x = 13 + 14

=> x = 27

=> y = 27 + 6 = 33

The positive difference is y − x = 33 − 27 = 6.

Therefore The correct answer is 6 students.

Additional Information

Linear Equations in Two Variables

When solving for two unknowns, you need at least two independent equations to find unique values for each variable.

Equality through Transfer

If a transfer of 'k' units from a larger value (B) to a smaller value (A) results in equality, the initial gap is always 2k.

Algebraic Balancing

Always ensure that operations like "twice" or "thrice" are applied to the smaller side of the equation to maintain balance: Smaller × Factor = Larger.

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Q39. Answer: (b) USTAAD (Upgrading the Skills and Training in Traditional Arts/Crafts for Development)

The correct answer is USTAAD (Upgrading the Skills and Training in Traditional Arts/Crafts for Development).

Key Points

• The Artisan Mahakumbh 2024 was a significant event organized by the Government of India in Mumbai to promote artisans under the Ustad Scheme.

• The Ustad Scheme, officially known as the "USTTAD" (Upgrading the Skills and Training in Traditional Arts/Crafts for Development) scheme, is an initiative of the Ministry of Minority Affairs. It aims to preserve and promote traditional arts and crafts by providing training and support to master artisans and their apprentices.

• The Artisan Mahakumbh 2024 served as a platform to showcase the skills and creations of artisans trained under the Ustad Scheme. The event provided a valuable opportunity for artisans to connect with potential buyers, market their products, and gain recognition for their craftsmanship. It also helped to raise awareness about the importance of preserving traditional arts and crafts.

• During the Mahakumbh, a wide range of traditional crafts were showcased, including textiles, pottery, metalwork, wood carving, and more. The event also featured cultural performances, workshops, and seminars, providing a comprehensive experience of India's rich artistic heritage.

• The Artisan Mahakumbh 2024 was a resounding success, attracting a large number of visitors and generating significant interest in traditional crafts. It played a crucial role in promoting the Ustad Scheme and empowering artisans across the country.

Q40. Answer: (d) 2 hours

Shortcut Trick

Relative Speed when moving towards each other = 12 + 14 = 26 km/h.

Total distance to be reduced = 56 − 4 = 52 km.

Time required = Distance covered ÷ Relative Speed = 52 ÷ 26 = 2 hr.

Therefore The correct answer is 2 hr.

Alternate Method

Given:

Total distance between two places = 56 km

Speed of the first person (S1) = 12 km/h

Speed of the second person (S2) = 14 km/h

Required gap between them = 4 km

Formula Used:

Relative Speed (Opposite direction) = S1 + S2

Time = Distance ÷ Relative Speed

Calculations:

=> Total initial distance = 56 km

=> Target distance apart = 4 km

=> Effective distance covered by both = 56 − 4 = 52 km

=> Relative Speed = 12 + 14 = 26 km/h

=> Time taken = 52 ÷ 26 = 2 hr

Therefore The correct answer is 2 hr.

Additional Information

Relative Speed in Opposite Direction

When two objects move toward each other or away from each other, their relative speed is the sum of their individual speeds (S1 + S2).

Relative Speed in Same Direction

When two objects move in the same direction, their relative speed is the difference between their individual speeds (S1 − S2).

Time of Meeting

The time taken to meet is calculated as Total Distance ÷ Relative Speed, provided they start at the same time.

Q41. Answer: (b) $MnCl_2$, Cl_2, and $2H_2O$

The correct answer is $MnCl_2$, Cl_2, and $2H_2O$.

Key Points

• The reaction given is: $MnO_2+4HCl \rightarrow MnCl_2+Cl_2+2H_2O$ $MnO_2+4HCl \rightarrow MnCl_2+Cl_2+2H_2O$ $MnO_2+4HCl \rightarrow MnCl_2+Cl_2+2H_2O$.

• Manganese dioxide (MnO_2) reacts with hydrochloric acid (HCl) to produce manganese(II) chloride ($MnCl_2$), chlorine gas (Cl_2), and water (H_2O).

• This is a type of redox reaction where MnO2 is reduced and HCl is oxidized.
• The balanced chemical equation confirms the products as MnCl2, Cl2, and H2O.
• In the context of redox reactions, MnO2 acts as an oxidizing agent, and HCl acts as a reducing agent.

Additional Information

• Oxidation-Reduction Reactions (Redox Reactions)
• These reactions involve the transfer of electrons between two species.
• Oxidation refers to the loss of electrons, while reduction refers to the gain of electrons.
• Balancing Chemical Equations
• Balancing involves making sure that the number of atoms for each element is the same on both sides of the equation.
• It ensures that the law of conservation of mass is obeyed.
• Properties of Chlorine Gas (Cl2)
• Chlorine gas is greenish-yellow and has a pungent odor.
• It is used in water treatment and as a disinfectant.

Q42. Answer: (b) CaSO4·(1/2 H2O)

The correct answer is CaSO4·(1/2 H2O).

Key Points

• Gypsum is chemically known as calcium sulfate dihydrate, with the formula CaSO4 · 2H2O.
• When gypsum is heated to 373 K, it loses water molecules and forms plaster of Paris, which has the formula CaSO4 · 1/2H2O.
• This process is known as the calcination of gypsum.
• The obtained compound, plaster of Paris, is a white powder that hardens when mixed with water.
• Plaster of Paris is widely used in construction, medical applications (for making casts), and art.

Additional Information

• Gypsum
• It is a naturally occurring mineral composed of calcium sulfate dihydrate.
• Gypsum is used in the manufacturing of cement, wallboard, and as a soil conditioner in agriculture.
• Plaster of Paris
• It sets quickly and is used for making sculptures, molds, and castings.
• When plaster of Paris is mixed with water, it reverts to gypsum, releasing heat in the process.
• Calcination
• It is a thermal treatment process applied to ores and other solid materials to bring about a thermal decomposition, phase transition, or removal of a volatile fraction.
• Calcination is carried out in furnaces or reactors at high temperatures.

Q43. Answer: (c) 2

The logic followed here is:

‘SKATE’ is coded as ‘35186’

‘TAKER’ is coded as ‘51623’

Thus, code for ‘R’ is '2'.

Hence, "Option 3" is the correct answer.

Q44. Answer: (a) Deoxyribonucleic acid

The correct answer is Deoxyribonucleic acid.

Key Points

• Deoxyribonucleic acid (DNA) serves as the primary information source for making proteins in the cell.
• DNA contains the genetic instructions necessary for the development, functioning, and reproduction of all known living organisms and many viruses.
• The sequences of nucleotides in DNA are transcribed into messenger RNA (mRNA) which is then translated into protein by ribosomes.
• DNA is composed of two strands that coil around each other to form a double helix, carrying the genetic instructions.
• DNA replication is essential for cell division, ensuring that each new cell receives an exact copy of the DNA.

Additional Information

• Ribonucleic acid (RNA)

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• RNA is involved in various roles such as coding, decoding, regulation, and expression of genes.
• Messenger RNA (mRNA) conveys genetic information from DNA to the ribosome, where it directs protein synthesis.
• Proteins
• Proteins are large, complex molecules that play many critical roles in the body, such as catalyzing metabolic reactions and DNA replication.
• They are made up of amino acids and are essential for the structure, function, and regulation of the body's tissues and organs.
• Genes
• Genes are segments of DNA that carry hereditary information and are responsible for guiding the process of creating proteins.
• Each gene provides instructions for making a specific protein or set of proteins.

Q45. Answer: (d) Second to the left

Given: A, B, C, D, E and F are sitting around a circular table facing the centre.
1) F sits second to the right of C.
2) D is an immediate neighbour of E and F.
3) A sits second to the left of B.
Thus, according to the final arrangement, E sits second to the left of C.
Hence, "Option 4" is the correct answer.

Q46. Answer: (c) Iodine

The correct answer is Iodine.
Key Points
• Thyroxin hormones (T4 and T3) are synthesized in the thyroid gland.
• Iodine is an essential component for the production of these hormones, as each molecule of thyroxin contains iodine atoms.
• The thyroid gland absorbs iodine from the bloodstream and combines it with the amino acid tyrosine to produce thyroxin (T4) and triiodothyronine (T3).
• A deficiency of iodine can lead to reduced synthesis of thyroxin, causing disorders like hypothyroidism and goiter.
• The synthesis process is regulated by the thyroid-stimulating hormone (TSH) secreted by the pituitary gland.
• Proper iodine intake through diet or iodized salt is critical for maintaining thyroid health.
• The hormones produced regulate metabolic rate, growth, and development in the body.
Additional Information
• Nickel
• Nickel is not involved in thyroid hormone synthesis but is used in enzymes and metalloproteins.
• Bromine
• Bromine is not essential for hormone synthesis; excessive bromine can interfere with iodine absorption.
• Chlorine
• Chlorine is primarily used in maintaining water balance and is not required for thyroid hormone production.

Q47. Answer: (a) 63 u

The correct answer is 63 u.
Key Points
• The molecular mass of a compound is calculated by summing the atomic masses of its constituent elements.
• For HNO_3, the atomic masses are: H (1 u), N (14 u), and O (16 u).
• The total molecular mass is calculated as follows:
$1u+14u+3\times16u=63u1u+14u+3\times16u=63u1u+14u+3\times16u=63u1u+14u+3\times16u=63u1u+14u+3\times16u=63u$.
• This makes the molecular mass of HNO_3 equal to 63 u.
• Therefore, the correct option is 1, which corresponds to 63 u.
Additional Information
• Atomic Mass Unit (u)
• It is a standard unit of mass that quantifies mass on an atomic or molecular scale (atomic mass).
• One atomic mass unit is defined as one twelfth of the mass of a single carbon-12 atom.
• Molecular Mass
• The molecular mass of a substance is the mass of one molecule of that substance, measured in atomic mass units (u).
• It is the sum of the atomic masses of all the atoms in a molecule.

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• Calculation of Molecular Mass
• To calculate the molecular mass, identify the number of atoms of each element in the molecule.
• Multiply the atomic mass of each element by the number of atoms of that element.
• Add the results to obtain the molecular mass.

Q48. Answer: (d) 2

Given: All 36 students in a class are standing in a row facing north.
Preeti is 12th from the right end while Alisha is 22nd from the left end.
Position of Preeti from the left = (Total number of people - Position of Preeti from the right + 1)
Position of Preeti from the left = 36 - 12 + 1 = 25
Position of Alisha from the left = 22
Number of people between Alisha and Preeti = Position of Preeti from the left - Position of Alisha from the left - 1
Number of people between Alisha and Preeti = 25 - 22 - 1 = 2
Hence, the correct answer is "Option 4".

Q49. Answer: (b) One

Given word: PASTRY
According to the question,

Given word	P	A	S	T	R	Y
Vowel → (+1) Consonant → (-1)	(-1)	(+1)	(-1)	(-1)	(-1)	(-1)
Resultant	O	B	R	S	Q	X

Thus, the new formed letter cluster → O B R S Q X
Now, the vowel(s) in the new group of letters thus formed: O B R S Q X => O
Thus, there is 1 vowel in the new group of letters thus formed.
Hence, "Option 2" is the correct answer.

Q50. Answer: (d) n_(1)< n_(2)< n3

The correct answer is n1 < n2 < n3.
Key Points
• The refractive index is a measure of how much light slows down as it passes through a medium.
• The refractive index of air is the lowest among the three, as air is the least optically dense medium, denoted by n1
• Water has a higher refractive index compared to air, denoted by n2
• Crown glass, being more optically dense than both air and water, has the highest refractive index, denoted by n3
• Thus, the relationship between the refractive indices is n1 < n2 < n3.
Additional Information
• Snell's Law
• It relates the angles of incidence and refraction to the refractive indices of the two media using the formula:
• The light bends towards the normal when entering a denser medium (higher refractive index).
• Critical Angle
• The critical angle is the angle of incidence above which total internal reflection occurs.
• It is given by
• Applications
• Refractive indices are used in designing lenses, optical fibers, and other optical instruments.
• They are also used in determining the purity of substances in analytical chemistry.

Q51. Answer: (b) X = 8, Y = 83

The logic followed here is:
Given: X : 66 :: 9 : Y
So, checking each option one by one:
Option 1) X = 9, Y = 81 → 9 : 66 :: 9 : 81

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$9^2 + 2 = 66$

81 + 2 = 66

83 ≠ 66 (LHS ≠ RHS);

92 + 2 = 81

81 + 2 = 81

83 ≠ 81 (LHS ≠ RHS)

Option 2) X = 8, Y = 83 → 8 : 66 :: 9 : 83

$8^2 + 2 = 64$

64 + 2 = 64

64 = 64 (LHS = RHS);

$9^2 + 2 = 83$

81 + 2 = 83

83 = 83 (LHS = RHS)

Option 3) X = 8, Y = 81 → 8 : 66 :: 9 : 81

82 + 2 = 66

64 + 2 = 66

66 = 66 (LHS = RHS);

92 + 2 = 81

81 + 2 = 81

83 ≠ 81 (LHS ≠ RHS)

Option 4) X = 7, Y = 80 → 7 : 66 :: 9 : 80

72 + 2 = 66

49 + 2 = 66

51 ≠ 66 (LHS ≠ RHS);

92 + 2 = 80

81 + 2 = 80

83 ≠ 80 (LHS ≠ RHS)

Hence, "Option 2" is the correct answer.

Q52. Answer: (d) Vigyan Ratna

The correct answer is Vigyan Ratna.

Key Points

• Vigyan Ratna: This award is the highest individual honor for lifetime contributions to science.

• Vigyan Shri: This category honors scientists for notable achievements in specific fields of science.

• Vigyan Yuva Shanti Swarup Bhatnagar: Recognizes young scientists who have made significant contributions in their early careers.

• Vigyan Team Award: Given to teams for their collective achievements and contributions to scientific progress.

Additional Information

• Prof. Govindarajan Padmanabhan was honored with the Rashtriya Vigyan Puraskar 2024 in the category of Vigyan Ratna.

• The Vigyan Ratna is one of the highest honors in the scientific community in India.

• Prof. Govindarajan Padmanabhan is recognized for his outstanding contributions to science.

• The awards were presented by the President of India to acknowledge significant achievements in various scientific disciplines.

Q53. Answer: (c) 700

Shortcut Trick

When an article is sold at its Marked Price without any discount, the ratio of Cost Price to Marked Price is 100 : (100 + Profit%).

CP : MP = 100 : 118

Here, Marked Price = Rs. 826 (which corresponds to 118 units in our ratio).

CP = (826 ÷ 118) × 100

CP = 7 × 100 = Rs. 700

Therefore The correct answer is Rs. 700.

Alternate Method

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CP = ?

MP = Rs. 826

+18% Profit

(Selling at MP)

Cost Price & Marked Price Relation

Given:

Marked Price (MP) of the article = Rs. 826

Profit earned if sold at MP = 18%

Since the retailer is selling at the Marked Price, Selling Price (SP) = Marked Price (MP) = Rs. 826

Formula Used:

Cost Price (CP) = [Selling Price × 100] ÷ (100 + Profit%)

Calculations:

=> CP = [826 × 100] ÷ (100 + 18)

=> CP = (826 × 100) ÷ 118

=> CP = 7 × 100

=> CP = 700

Therefore The correct answer is Rs. 700.

Additional Information

Marked Price & Discount Relation

Selling Price (SP) = Marked Price (MP) × [1 − (Discount% ÷ 100)]. When discount is not offered, Selling Price directly equals the Marked Price.

Universal CP to MP Ratio

The most efficient way to link Cost Price and Marked Price is using the ratio CP : MP = (100 − Discount%) : (100 + Profit%). If Discount = 0, this simplifies directly to CP : MP = 100 : (100 + Profit%).

Successive Discounts

If an item with a Marked Price is sold after two consecutive discounts of a% and b%, the Effective Discount is given by the formula: a + b − (a × b) ÷ 100.

Q54. Answer: (d) 6.96

Given:

(4.32 × 4.32 - 2.64 × 2.64)/1.68

Formula used:

$(a^2 - b^2) = (a + b)(a - b)$

Calculation:

(4.32 × 4.32 - 2.64 × 2.64)/1.68

=> (4.32 + 2.64)(4.32 - 2.64)/1.68

=> (6.96 × 1.68)/1.68

=> 6.96

Therefore The correct answer is option (4).

Q55. Answer: (a) 6

The logic followed here is:

‘DOTH’ is coded as ‘3764’

‘HOLD’ is coded as ‘7943’

Thus, code for ‘T’ is '6'.

Hence, "Option 1" is the correct answer.

Q56. Answer: (a) Have strong covalent bond within molecules but weak intermolecular force

The correct answer is Have strong covalent bond within molecules but weak intermolecular force.

Key Points

• Covalently bonded compounds have strong covalent bonds within the molecules, which keep the atoms together in a molecule.

• Despite strong intramolecular forces, these compounds exhibit weak intermolecular forces between different molecules.

• The weak intermolecular forces (like van der Waals forces) require less energy to break, leading to a lower boiling point.

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• These compounds usually exist in the form of gases or liquids at room temperature due to their low boiling points.

• Examples of covalently bonded compounds with low boiling points include molecular hydrogen (H2), nitrogen (N2), and methane (CH4).

Additional Information

• Intermolecular Forces

• These are forces of attraction or repulsion which act between neighboring particles (atoms, molecules, or ions).

• Types of intermolecular forces include dipole-dipole interactions, London dispersion forces, and hydrogen bonding.

• Boiling Point

• The boiling point of a substance is the temperature at which its vapor pressure equals the external pressure surrounding the liquid.

• Strong intermolecular forces result in a higher boiling point as more energy is required to separate the molecules.

• Polar and Non-Polar Covalent Bonds

• Polar covalent bonds occur when electrons are shared unequally between atoms, leading to a distribution of charge.

• Non-polar covalent bonds occur when electrons are shared equally, resulting in no overall charge distribution.

Q57. Answer: (d) DFH

The logic followed here is:

Hence, "Option 4" is the correct answer.

Q58. Answer: (d) D

Given: Seven people, B, C, D, E, F, G and K are sitting in a straight line, facing north.

1) Only five people sit between B and K.

2) G sits to the immediate left of K.

3) Only one person sits between G and E.

4) D sits at some place to the left of F but at some place to the right of C.

Thus, according to the final arrangement, D sits third from the left end of the line.

Hence, "Option 4" is the correct answer.

Q59. Answer: (b) 640/99

Given:

The correct expression of 6.4646464646..... in the fractional form is:

Formula used:

Let x = 6.4646464646.....

Multiply both sides by 100:

Calculations:

=> 100x = 646.4646464646.....

Subtract the original x from this equation:

=> 100x - x = 646.4646464646..... - 6.4646464646.....

=> 99x = 640

=> x = 640/99

Therefore The correct answer is option (2).

Q60. Answer: (a) Japan

The correct answer is Japan.

Key Points

• The Indian Army is stepping up its efforts to counter China's increasing military presence along the border with a new tactical response, the Integrated Battle Groups (IBGs).

• According to sources, the draft proposal for IBG formation has already been sent to the government and the implementation could begin as early as 2025.

• This comes after India, on October 21, announced that it reached an agreement with China on patrolling along the Line of Actual Control (LAC), marking a breakthrough in ending the over four-year-long military standoff, which began following the deadly clashes between the troops of both countries in June 2020 in Galwan Valley.

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Q61. Answer: (a) Mg

The correct answer is Mg.

Key Points

• Magnesium (Mg) is more reactive towards dilute hydrochloric acid compared to aluminum (Al), zinc (Zn), and iron (Fe).

• When magnesium reacts with dilute hydrochloric acid, it produces hydrogen gas and forms magnesium chloride:

• Mg + 2HCl → MgCl2 + H2

• This reaction is faster and more vigorous than the reactions of Al, Zn, and Fe with dilute hydrochloric acid.

• Magnesium is higher in the reactivity series compared to aluminum, zinc, and iron, making it more reactive.

Additional Information

• Reactivity Series

• The reactivity series is a series of metals arranged in order of decreasing reactivity.

• It helps to predict how metals will react with acids, water, and other substances.

• Hydrogen Gas Test

• Hydrogen gas can be tested by bringing a lit splint near the mouth of the test tube; a 'pop' sound confirms the presence of hydrogen.

• Reactions of Other Metals

• Aluminum reacts with dilute hydrochloric acid to form aluminum chloride and hydrogen gas, but it is less vigorous due to the formation of a protective oxide layer.

• Zinc reacts more readily than iron but less than magnesium, forming zinc chloride and hydrogen gas.

• Iron reacts with dilute hydrochloric acid to form iron(II) chloride and hydrogen gas, but the reaction is slower compared to magnesium and zinc.

Q62. Answer: (b) The oxygen supplied to hospitals in cylinders is not a compressed gas.

The correct answer is Option 2.

Key Points

• Compressed natural gas (CNG) is indeed used as a fuel in vehicles due to its environmental benefits and cost-effectiveness.

• The oxygen supplied to hospitals in cylinders is typically in a compressed gaseous form to ensure a continuous and reliable supply for medical use.

• Gaseous state particles move about randomly at high speeds, which is a fundamental characteristic of gases as described by the kinetic molecular theory.

• Option 2 is incorrect because it contradicts the common practice and knowledge regarding the state of oxygen supplied in medical cylinders.

• Understanding the nature and properties of gases is crucial in various applications, including medical, industrial, and environmental fields.

Additional Information

• Compressed Natural Gas (CNG)

• CNG is used as an alternative to gasoline and diesel due to its lower emissions and higher efficiency.

• It consists primarily of methane and is stored in high-pressure containers.

• Oxygen Cylinders

• Oxygen cylinders are used in medical facilities to provide supplemental oxygen to patients with respiratory issues.

• These cylinders contain oxygen in a compressed gaseous form to ensure a stable supply.

Q63. Answer: (b) Som Datt Battu

The correct answer is Som Datt Battu.

Key Points

• The singer awarded the Padma Shri in 2024 for his significant contributions to Himachali folk and classical music is Som Dutt Battu.

• Som Dutt Battu is a renowned Hindustani classical vocalist from Shimla, Himachal Pradesh. He has dedicated his life to preserving and promoting the rich musical heritage of the region.

• Battu's contributions to music are multifaceted:

• Master of Hindustani Classical Music: He is a highly accomplished vocalist in the Hindustani classical tradition, particularly known for his expertise in the Patiala Gharana.

• Champion of Himachali Folk Music: He has diligently researched and revived many traditional Himachali folk songs, ensuring their continued existence for future generations.

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• Dedicated Teacher and Mentor: Battu has nurtured numerous aspiring musicians through his dedicated teaching, passing on his knowledge and passion for music.

• The Padma Shri award is a prestigious civilian honor bestowed by the Government of India.

• It recognizes individuals who have made exceptional contributions in various fields, including art, literature, and social service.

• The award to Som Dutt Battu is a well-deserved recognition of his lifetime dedication to the preservation and promotion of Indian music.

Q64. Answer: (a) 20%

Given:

Articles sold by:

Shop B = 1250

Shop C = 1500

Formula used:

Percentage increase = [(Difference in articles sold) / Articles sold by Shop B] × 100

Calculation:

Difference in articles sold = 1500 - 1250 = 250

Percentage increase = (250 / 1250) × 100 = 20%

Answer: Shop C sold 20% more articles than Shop B.

Q65. Answer: (c) Mother's mother

Decoding symbols:

A is				
Symbol	•	•	×	÷
Meaning	Mother	Brother	Wife	Father
to B				

Given: Q + R - P × S ÷ T - J + K

Q + R → Q is the mother of R.

R - P → R is the brother of P.

P × S → P is the wife of S.

S ÷ T → S is the father of T.

T - J → T is the brother of J.

J + K → J is the mother of K.

Thus, Q is J's maternal grandmother or mother's mother.

Hence, the correct answer is "Option 3"

Q66. Answer: (c) 32 cm

Shortcut Trick

Total Weight in grams = 112 × 1000 = 112,000 g

Weight = Length × Width × Thickness × Density

112,000 = Length × 28 × 5 × 25

112,000 = Length × 3,500

Length = 112,000 ÷ 3,500 = 1120 ÷ 35 = 32 cm

Therefore The correct answer is 32 cm.

Alternate Method

Given:

Weight of 1 cm^3 marble = 25 g

Total weight of cuboidal marble block = 112 kg

Width of the block = 28 cm

Thickness of the block = 5 cm

Formula Used:

Volume of a cuboid = Length × Width × Thickness

Mass = Volume × Density

Calculations:

=> Total Weight in grams = 112 × 1000 = 112,000 g

=> Total Volume of the block = Total Weight ÷ Density per cm^3

=> Total Volume = 112,000 ÷ 25 = 4,480 cm^3

=> Volume = Length × Width × Thickness

=> 4,480 = Length × 28 × 5

=> 4,480 = Length × 140

=> Length = 4,480 ÷ 140

=> Length = 32 cm

Therefore The correct answer is 32 cm.

Additional Information

Volume of a Cuboid

The amount of space occupied by a three-dimensional cuboid is calculated as Volume = Length × Breadth × Height.

Relation between Mass, Density and Volume

Mass is the product of the volume of the object and its density (Mass = Volume × Density). Ensure units are consistent (e.g., g and cm^3).

Unit Conversion

To convert kilograms to grams, multiply by 1000 (1 kg = 1000 g). This is essential when the density is given in g/cm^3.

Q67. Answer: (c) 160 gm

Shortcut Trick

A gain of 25% means the ratio of Cost Price (CP) to Selling Price (SP) is 100 : 125 = 4 : 5.

In false weight problems, the ratio of Actual Weight to Marked Weight is the same as the CP to SP ratio when sold at cost price.

Ratio of weights = 4 : 5 → (Actual Weight) : (200 gm) = 4 : 5.

5 units = 200 gm => 1 unit = 40 gm.

Actual Weight (4 units) = 4 × 40 gm = 160 gm.

Therefore The correct answer is 160 gm.

Alternate Method

Given:

Marked Weight (True Value) = 200 gm

Percentage Gain = 25%

Formula Used:

Gain % = [(True Weight − Actual Weight) ÷ Actual Weight] × 100

Calculations:

=> Let the Actual Weight used by the shopkeeper be 'x' gm.

=> 25 = [(200 − x) ÷ x] × 100

=> 25 ÷ 100 = (200 − x) ÷ x

=> 1 ÷ 4 = (200 − x) ÷ x

=> x = 4 × (200 − x)

=> x = 800 − 4x

=> 5x = 800

=> x = 800 ÷ 5

=> x = 160 gm

Therefore The correct answer is 160 gm.

Additional Information

Dishonest Shopkeeper Concept

When a shopkeeper sells goods at cost price but uses a false weight, the profit is calculated on the actual weight delivered, not the marked weight.

Combined Profit Formula

If a shopkeeper marks up the price by k% and also uses a false weight, Total Profit % = [((100+k) × True Weight) ÷ Actual Weight] − 100.

Multiplier Method

The effective multiplier for profit is (True Weight ÷ Actual Weight). If Actual Weight is 160g for 200g, multiplier = 200/160 = 1.25, which represents a 25% gain.

Q68. Answer: (c) QL-RM-TV

The logic followed here is:

GB-HC-JL

PK-QL-SU

So, checking each option one by one:

Option 1) NI-OJ-QR

Option 2) SN-TO-VW

Option 3) QL-RM-TV

Option 4) RM-SN-UV

Thus, out of all the options, 'QL-RM-TV' follows the same logic as given.

Hence, "Option 3" is the correct answer.

Q69. Answer: (d) Begusarai

• The correct answer is Begusarai.

Additional Information

• Begusarai, Bihar was the most polluted city in India in 2023, with an average PM2.5 concentration of 118.9 micrograms per cubic meter of air (μg/m³).

• This made it the most polluted metropolitan area in the world.

• India was the third-most polluted country in the world in 2023, after Bangladesh and Pakistan.

• The main sources of particulate air pollution in India are vehicle exhaust, wood burning, soil, road, and construction dust

Q70. Answer: (a) 10%

Shortcut Trick

Let the Principal (P) be 5 units (denominator of the fraction).

The Amount (A) becomes 7 units (numerator of the fraction).

Simple Interest (SI) = Amount − Principal = 7 − 5 = 2 units.

Rate (R) = (Interest ÷ Principal) × (100 ÷ Time).

Rate = (2 ÷ 5) × (100 ÷ 4) = 0.4 × 25 = 10%.

Therefore The correct answer is 10%.

Alternate Method

Given:

Amount (A) = 7/5 of Principal (P)

Time period (T) = 4 years

Formula Used:

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

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

Calculations:

=> SI = A − P

=> SI = (7/5)P − P = (2/5)P

=> SI = (P × R × T) ÷ 100

=> (2/5)P = (P × R × 4) ÷ 100

=> 2/5 = 4R ÷ 100

=> 2/5 = R ÷ 25

=> R = (2 × 25) ÷ 5

=> R = 10%

Therefore The correct answer is 10%.

Additional Information

Relation between Amount and Rate

The amount in simple interest can be directly calculated using the formula A = P(1 + RT/100), where R is the annual rate and T is

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the time in years.

Effective Rate of Interest

The effective rate for the entire duration is (R × T)%. In this case, 10% × 4 = 40%, which matches the interest being 2/5 (or 40%) of the principal.

Simple Interest vs Compound Interest

In Simple Interest, the interest remains constant every year as it is always calculated on the original Principal, unlike Compound Interest where interest is earned on interest.

Q71. Answer: (b) UAE

The correct answer is UAE.

Key Points

• In 2023, India imported crude oil from the United Arab Emirates (UAE), making payments in Indian Rupees (Rs.) as part of the Rupee-Dirham trade agreement.

• This marked a significant development in India's foreign trade policy. Traditionally, international trade transactions are typically conducted in US dollars. However, the Rupee-Dirham trade agreement allows for the settlement of trade between India and the UAE using their respective local currencies.

• This shift towards local currency settlements offers several potential benefits:

• Reduced reliance on the US dollar: By reducing reliance on the US dollar, India can mitigate risks associated with fluctuations in the dollar exchange rate.

• Increased trade efficiency: Local currency settlements can streamline trade transactions and reduce transaction costs.

• Strengthened bilateral ties: The agreement fosters closer economic ties between India and the UAE.

• The successful implementation of the Rupee-Dirham trade agreement for crude oil imports has paved the way for expanding the use of local currencies for other trade transactions between the two countries.

• This initiative is part of India's broader efforts to promote the internationalization of the Indian Rupee.

Q72. Answer: (d) Mixture of oil and water

The correct answer is Mixture of oil and water.

Key Points

• A heterogeneous solution is one in which the components are not uniformly distributed and can be easily distinguished.

• In a mixture of oil and water, the oil and water do not mix and form separate layers, clearly showing a heterogeneous nature.

• Oil, being less dense than water, floats on top, creating a distinct boundary between the two substances.

• This type of mixture can be physically separated by methods such as decantation or using a separating funnel.

• Other examples of heterogeneous mixtures include sand in water and a salad with different ingredients mixed together.

Additional Information

• Lemonade

• This is a homogeneous mixture where the lemon juice, sugar, and water are uniformly distributed throughout the solution.

• Tincture of iodine

• This is a homogeneous mixture where iodine is dissolved in alcohol, forming a uniform solution.

• Mixture of ethanol and water

• This is also a homogeneous mixture as ethanol and water mix completely and uniformly.

Q73. Answer: (c) 2m

The Correct answer is 2m.

Key Points

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

• The focal length (f) of a spherical mirror is related to its radius of curvature (R) by the formula: f = R/2.

• In the given question, the focal length of the convex mirror is 1m.

• Using the formula f = R/2, we can calculate the radius of curvature as: R = 2f = 2 × 1 = 2m.

• Thus, the distance between the centre of curvature and the pole of the convex mirror is 2m.

Additional Information

• Focal Length (f)

• The focal length of a mirror is the distance between its pole and its focus.

• For spherical mirrors, the focal length is always half of the radius of curvature.

• Convex mirrors are widely used in applications like rear-view mirrors in vehicles because they provide a wider field of view.

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• Convex Mirror
• A convex mirror is a spherical mirror with the reflecting surface bulging outward.
• It always forms a virtual, erect, and diminished image irrespective of the object's position.
• It is commonly used in security mirrors and traffic mirrors for its property of diverging light rays.
• Practical Applications of Radius of Curvature
• The radius of curvature is crucial in designing optical systems, including telescopes, cameras, and mirrors used in vehicles.
• It determines the focusing ability of a mirror or lens.

Q74. Answer: (c) Amoeba

The correct answer is Amoeba.
Key Points
• Amoebas are unicellular organisms known for their ability to change shape.
• They move and ingest food by extending their cell membrane to form pseudopodia (false feet).
• The constant change in shape helps them navigate through their environment.
• Amoebas use their flexible shape to engulf food particles in a process called phagocytosis.
• Their shape-shifting ability is crucial for their survival, allowing them to adapt to varying conditions.
Additional Information
• Smooth Muscle
• Found in the walls of internal organs such as the stomach and intestines.
• They contract and relax to facilitate bodily functions like digestion.
• Nerve Cell (Neuron)
• Specialized cells that transmit nerve impulses throughout the body.
• They have a unique structure including dendrites, axons, and synapses.
• Ovum
• Also known as the egg cell, it's the female reproductive cell in animals.
• It's typically a large, immobile cell that, when fertilized by a sperm, leads to the development of a new organism.

Q75. Answer: (b) 25

Shortcut Trick
Total number of observations (n) = 15 (which is an odd number).
Arrange in ascending order: 20, 20, 20, 20, 20, 20, 23, 25, 30, 31, 32, 35, 41, 42, 43.
For odd n, Median = ((n + 1) ÷ 2)^(th) observation.
Median = (16 ÷ 2)^(th) = 8^(th) term.
Scanning the sorted list, the 8^(th) term is 25.
Therefore The correct answer is 25.
Alternate Method
Given observations: 20, 23, 25, 30, 20, 31, 32, 35, 20, 41, 42, 43, 20, 20, 20
Formula Used:
If n is odd: Median = Value of ((n + 1) ÷ 2)^(th) term.
=> Step 1: Arrange the data in ascending order:
20, 20, 20, 20, 20, 20, 23, 25, 30, 31, 32, 35, 41, 42, 43
=> Step 2: Count the number of observations (n):
n = 15
=> Step 3: Calculate Median position:
Position = (15 + 1) ÷ 2 = 16 ÷ 2 = 8^(th) term
=> Step 4: Identify the 8^(th) term in the sorted list:
Sorted Data [8] = 25
Therefore The correct answer is 25.
Additional Information
Median for Even Data
If the number of observations (n) is even, the median is the average of the (n ÷ 2)^(th) and ((n ÷ 2) + 1)^(th) terms.
Mode of Data

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The mode is the observation that appears most frequently. In the given set, the mode is 20 (appears 6 times).

Empirical Relationship

The relationship between central tendencies is given by: Mode = 3 × Median − 2 × Mean.

Mean Calculation

The Mean is calculated as the Sum of all observations divided by the total number of observations (n).

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