RRB Group D Previous Year Paper (Held on: 30 Aug 2022 Shift 1)

RRB Group D • 2022 • 100 questions • 90 minutes • Answer key and solutions

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CBT

Q1. If the surface area of a sphere is 21244/7 cm², then what is the radius of that sphere? [Use π = 22/7]

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

Q2. Which was the first state of India to adopt the Panchayati Raj system in the year 1959?

(a) Karnataka
(b) Odisha
(c) Rajasthan
(d) Bihar

Q3. Find the LCM of 84, 105 and 140.

(a) 120
(b) 240
(c) 420
(d) 360

Q4. A statement is given followed by two possible underlying assumptions I and II. Read all the information carefully and decide which of the given assumptions can be assumed by the given statement.

Statement:

Recent marketing trends suggest that words like 'premium', ‘exquisite', 'priority' are considered prestigious by consumers of the middle income group and hence increase the chances of sale of any product advertised with these words.

Assumptions:

I. The products advertised with the said 'prestigious' words definitely cost higher than those which are not advertised with such words.

II. Such prestigious words have no impact on sales among the lower income group.

(a) Both I and II can be assumed
(b) Only I can be assumed
(c) Only II can be assumed
(d) Neither I nor II can be assumed

Q5. The valency of group 17 elements will be:

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

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Q6. The present age of a father is 11/2 times the sum of the present ages of his two sons. Six years hence, the ratio of his age to the sum of the ages of his sons will be 6 : 5. The present age of the father is:

(a) 45 years
(b) 42 years
(c) 36 years
(d) 50 years

Q7. A dishonest shopkeeper pretends to sell his goods at cost price, but uses a false weight on which 984 gm is written but which actually weighs much less. Using this false weight the shopkeeper actually makes a gain of 23%. Find the actual measure of the weight used.

(a) 900 gm
(b) 800 gm
(c) 935 gm
(d) 850 gm

Q8. The diagram of the human alimentary canal Is given below. Select the option that shows the correct matching of Column I with Column II.

[Figure: see this question online]

Column I	Column II	
a	i)	Villi absorb nutrients
b	ii)	Length depends on food the organism eats
c	iii)	Helps in emulsification of fats
d	iv)	No digestion
e	v)	Large intestine absorbs water

(a) a - ii, b - iii, c - iv, d - i
(b) a - iv, b - i, c - ii, d - iii
(c) a - i, b - ii, c - iii, d - iv
(d) a - iii, b - ii, c - i, d - iv

Q9. A certain number of people are sitting in a row, facing north. D sits to the immediate left of F. Only six people sit between S and D. K sits third to the right of F. S sits at the extreme left end of the row. If no other person is sitting in the row, what is the total number of persons seated?

(a) 12
(b) 13
(c) 11
(d) 10

Q10. The average age of a family of father, mother and 2 children is 26 years. If the sum of the ages of the father and the children is 62 years, find the age of the mother.

(a) 26 years
(b) 45 years
(c) 30 years
(d) 42 years

Q11. Starting from point A, Jagdish walks 98 m towards the west. He takes a left turn and walks 54 m. He takes a left turn again and walks 112 m. Again, he takes a left turn and walks 54 m to reach point B. How far and in which direction is point A from point B? (All turns are 90 degree turns only)

(a) 16 m, East
(b) 16 m, West
(c) 14 m, East
(d) 14 m, West

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Q12. Which of the following languages has NOT been mentioned in the 8^(th) Schedule of the Indian Constitution?

(a) Dogri
(b) Odia
(c) Maithili
(d) Awadhi

Q13. If any person is affected by a bee-sting attack, which chemical would be helpful for him to get some relief from pain?

(a) Baking soda
(b) Common salt
(c) Vinegar
(d) Curd

Q14. The value of

$(18 \div 9) \times (-7 + 9) - 7 \times 2 =$

(a) -6
(b) -12
(c) -13
(d) -10

Q15. Which is the most commonly used measure for the size of the economy?

(a) Nation Net product (NNP)
(b) Net domestic product (NDP)
(c) Gross domestic product (GDP)
(d) Gross Net product (GNP)

Q16. The prayers on _____ are supposed to be in the community mosque, and are known as the Jumma Namaz.

(a) Tuesday
(b) Thursday
(c) Friday
(d) Wednesday

Q17. Consider the below statements and identify the correct answer.

Statement-I: Sodium hydroxide is prepared by chlor-alkali process.

Statement-II: Three products chlorine gas, hydrogen gas and sodium hydroxide are produced in this process.

(a) Both the statements are true.
(b) Statement-II is true, and Statement-I is false.
(c) Both the statements are false.
(d) Statement-I is true, and Statement-II is false.

Q18. Which option is correct regarding the movement of water and mineral ions in the root cells of a plant from the soil?

(a) Ions and water are absorbed together
(b) Ions move in first by passive transport, followed by water by active transport
(c) Water moves in first by diffusion, followed by active transport of ions
(d) Ions move in first by active transport, followed by water along the concentration gradient

Q19. Which of the following is/are advantage(s) of building dams?

i) Stores water for irrigation
ii) No equitable distribution of water
iii) Stores water for generating electricity
iv) Canals from dams help in transferring water to great distances
v) Benefits only to a few people

(a) Only v
(b) ii and v
(c) Only ii

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(d) i, iii and iv

Q20. Which of the following numbers will replace the question mark (?) in the given series?

87, 66, 53, 46, 43, ?

(a) 41
(b) 42
(c) 40
(d) 44

Q21. Select the option that is related to the fifth number in the same way as the second number is related to the first number and the fourth number is related to the third number.

25 : 49 :: 42 : 36 :: 74 : ?

(a) 121
(b) 118
(c) 120
(d) 122

Q22. This question is based on the five, three-digit numbers given below.

(Left) 248 382 415 127 335 (Right)

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

NOTE - All operations to be done from left to right.

What will be the resultant if the first digit of the second smallest number is multiplied with the second digit of the largest number?

(a) 8
(b) 6
(c) 4
(d) 2

Q23. In which one of the following regions will you find "Bari Doab'?

(a) Between Ravi and Chenab
(b) Between Beas and Ravi
(c) Between Chenab and Jhelum
(d) Between Beas and Sutlej

Q24. Through which of the following places does the Standard Meridian of India pass?

(a) Jaunpur
(b) Agra
(c) Mirzapur
(d) Kannauj

Q25. The radius of curvature of a concave mirror is 12 cm. Following New Cartesian Sign Convention, the principal focus is located at x = _____.

(a) 6 cm
(b) -12 cm
(c) 12 cm
(d) -6 cm

Q26. Refer to the following number series and answer the question.

5 6 2 6 5 8 5 3 5 0 2 6 3 8 2 5 6 9 3 7

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

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

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(d) 1

Q27. The Khelo India University Games 2021 was organised in _____.

(a) Bengaluru
(b) Patna
(c) Hyderabad
(d) Jaipur

Q28. Propanone has _____ carbons and _____ functional group.

(a) 4, aldehyde
(b) 3, ketone
(c) 3, aldehyde
(d) 4, ketone

Q29. If a + b = 27 and ab = 140, then what is the value of $a^3 + b^3$?

(a) 19683
(b) 8433
(c) 11340
(d) 8343

Q30. Two train engines of same length are running in the same direction with speeds of 18 km/h and 36 km/h. If the faster engine crosses the slower one in 8 sec, what is the length of each train engine?

(a) 20 m
(b) 25 m
(c) 10 m
(d) 30 m

Q31. The table here gives the yield of wheat per hectare of 100 farmers of a village. What is the cumulative frequency of the class preceding the median class?

Production yield (Qui/Hec)	Number of farmers
30 - 40	5
40 - 50	18
50 - 60	15
60 - 70	22
70 - 80	27
80 - 90	13

(a) 43
(b) 38
(c) 35
(d) 29

Q32. Which of the following is a precipitation reaction?

(a) $CuO + H_2 \rightarrow H_2O + Cu$
(b) $CuSO_4 (aq) + BaCl_2 (aq) \rightarrow BaSO_4 (s) + CuCl_2 (aq)$
(c) $2Al_2O_3 (l) \rightarrow 4Al (l) + 3O_2 (g)$
(d) $Fe(s) + CuSO_4 (aq) \rightarrow FeSO_4 (aq) + Cu (s)$

Q33. Bharat borrowed a sum of Rs. 10,000 at a certain rate of simple interest for 2 years. If he paid an interest of Rs. 2,000 at the end of the period, then find the rate of interest per annum.

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

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(d) 10%

Q34. Refer to the following letter series and answer the question.

P Q S D A B U E H I R I A A Y E J S B R X M F G U A B U E H I R

How many such vowels are there in the series each of which is immediately preceded by a consonant and also immediately followed by a consonant?

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

Q35. Which of the following statements is NOT a myth?

(a) Foods like chips and canned snacks are low in nutrition and should be avoided during adolescence/reproductive phase
(b) During menstruation, a girl should not be permitted to work in the kitchen.
(c) If a girl looks at boys while menstruating, she becomes pregnant.
(d) The mother is ultimately accountable for her child's sexual orientation.

Q36. Some functions of lymph are given below. Select the option with the correct functions.

a) Carries digested and absorbed fat from intestine
b) Carries CO_2 to lungs
c) Carries RBCs to the lymph nodes
d) Drains excess fluid from extracellular space back into blood

(a) a and b
(b) b and c
(c) a and d
(d) c and d

Q37. The numerator of a fraction is one less than the denominator. If 6 is added to the numerator, the fraction will be equal to 5/4. Find the fraction.

(a) -21/20
(b) 20/21
(c) 19/20
(d) -20/21

Q38. Consider the following statements about an electric motor:

(a) An electric motor uses split rings.
(b) The direction of the force on the motor's coil can be found using Fleming's right-hand rule.

Which of the above statements is/are correct?

(a) Only (b)
(b) Both (a) and (b)
(c) Only (a)
(d) Neither (a) nor (b)

Q39. A 725 m long train passes through a 235 m long tunnel in 48 sec. Find the speed of the train.

(a) 66 km/h
(b) 54 km/h
(c) 72 km/h
(d) 82 km/h

Q40. Seven boxes J, K, L, M, N, O and P are kept one over the other but not necessarily in the same order. Only five boxes are kept between K and J. L is kept immediately above P. M is kept immediately below N. O is kept at one of the positions above J. N is kept immediately below K. How many boxes are kept between N and J?

(a) 1
(b) 4

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(c) 3
(d) 2

Q41. In the given letter-cluster pairs, the first letter-cluster is related to the second letter-cluster following a certain logic. Study the given pairs carefully, and from the given options, select the pair that follows the same logic.

MON : PLQ

KIT : NFW

(a) PEN : SBQ
(b) TAP : WYS
(c) LPG : OMK
(d) PET : SIW

Q42. If X is the greatest number that can divide 3808, 4798 and 5128 leaving the same remainder 13, then the sum of digits in X is:

(a) 18
(b) 16
(c) 12
(d) 14

Q43. A statement is given, followed by four conclusions given in the options. Find out which conclusion is true based on the given statement.

Statement: L = U > V > E < Z < Q

(a) Q > V
(b) L < V
(c) E = L
(d) U > E

Q44. In a certain code language, 'PUNCH' is written as 'OWMEG' and 'SHAWL' is written as 'RJZYK'. How will 'KARMA' be written in that language?

(a) JCQOZ
(b) KZQPZ
(c) KZQPY
(d) JZQOZ

Q45. India Plastics Pact, a joint initiative between which trade organisation and World-Wide Fund for Nature-India (WWF India), was launched in September 2021?

(a) Indian Association of Amusement Parks and Industries
(b) Confederation of Indian Industry
(c) Engineering Exports Promotion Council
(d) Cellular Operators Association of India

Q46. Who is the Chairman of Rajya Sabha? (As of August 12, 2022)?

(a) Shri Harivansh
(b) Shri Rajnath Singh
(c) Shri Om Birla
(d) Shri Jagdeep Dhankhar

Q47. Which of the following is NOT a part of the female reproductive system?

(a) Uterus
(b) Urethra
(c) Ovaries
(d) Fallopian tubes

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Q48. The maximum concentration of iron and steel industry is found in which region in India from following?

(a) Baghelkhand Plateau
(b) Chhotanagpur plateau
(c) Malwa Plateau
(d) Bundelkhand Plateau

Q49. A chemical that contributes to the depletion of the ozone layer is:

(a) chlorofluorocarbon
(b) methane
(c) phosphorus pentoxide
(d) carbon tetrachloride

Q50. Some of the advantages of transpiration to plants are mentioned below. Select the option that is a disadvantage.

(a) Provides water to leaf for photosynthesis
(b) Helps in transporting mineral ions
(c) causes cooling of plants by evaporation
(d) can cause wilting of plants

Q51. In Which state of India experiences winter rainfall due to retreating monsoon?

(a) Tamil Nadu
(b) West Bengal
(c) Madhya Pradesh
(d) Gujarat

Q52. Six students - 1, 2, 3, 4, 5 and 6 - are sitting around a circular table facing the centre. 4 is sitting to the immediate right of 5 and immediate left of 6. 5 is sitting second to the right of 3.6 and 3 are the immediate neighbours of 1. Who among the following is sitting to the immediate left of 2?

(a) 6
(b) 5
(c) 4
(d) 3

Q53. When is the primary deficit zero in the Government of India budget?

(a) When the fiscal deficit is equal to the revenue deficit
(b) When the net interest payments is equal to the revenue deficit
(c) When the fiscal deficit is equal to the interest payment
(d) When the revenue deficit is zero

Q54. Which of the following numbers will replace the question mark (?) in the given series?

6, 8, 15, 37,104,?

(a) 306
(b) 310
(c) 308
(d) 312

Q55. Which of the following festivals is associated with the state of Assam?

(a) Bihu
(b) Onam
(c) Pongal
(d) Baisakhi

Q56. To reach point Q from point S, a person has to walk 83 m towards the west. He must then take a right turn and walk 240 m. He must take another right turn and walk 147 m. He must take another right turn and walk 240 m to reach the destination. How far and in which direction is point Q from point S? (All turns are 90 degree turns only)

(a) 64 m, West

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(b) 59 m, West
(c) 64 m, East
(d) 59 m, East

Q57. If carbon will form C^(4-), then the number of electrons and protons in the carbon ion will be _____ and _____ respectively.
(a) 6; 10
(b) 4; 2
(c) 2; 4
(d) 10; 6

Q58. _____ is the first 'Made in India' Petascale Supercomputer installed at IIT Roorkee under the National Supercomputing Mission (NSM) in 2022.
(a) PARAM Siddhi-AI
(b) PARAM Ganga
(c) PARAM Pravega
(d) PARAM seva

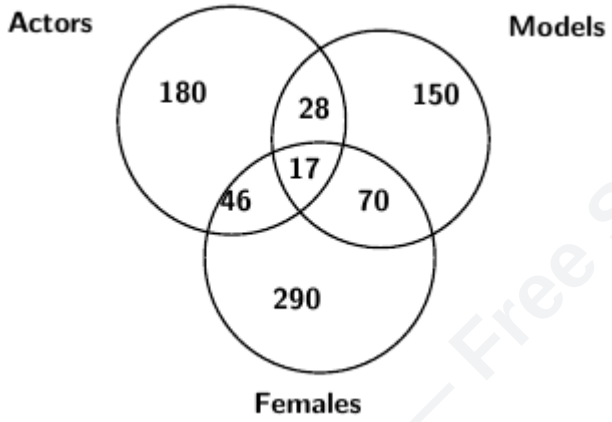
Q59. Read the given statements and conclusions carefully. Assuming that the information given in the statements is true, even if it appears to be at variance with commonly known facts, decide which of the given conclusions logically follow(s) from the statements.
Statements:
I. All B's are G's.
II. Some G's are S's.
III. Some S's are A's.
Conclusions:
I. All B's are S's.
II. Some A's are B's.
(a) Only conclusion II follows
(b) Only conclusion I follows
(c) Both conclusions I and II follow
(d) Neither conclusion I nor II follows

Q60. What kind of anti-viral face mask was being developed under the 'Nano mission project' to fight against the Covid-19 pandemic in February 2022?
(a) Copper-based nanoparticle coated anti-viral face mask
(b) Biodegradable but non-washable anti-viral face mask
(c) Non-biodegradable anti-viral face mask
(d) Self-disinfecting, non-biodegradable face mask

Q61. A statement is given below, followed by four conclusions given in the options. Find out which conclusion is true based on the given statement.
Statement: F = U ≥ P = M ≤ K < W < T.
(a) F ≥ P
(b) M > F
(c) P ≥ K
(d) T < K

Q62. Study the given diagram carefully and answer the question. The numbers in different sections indicate the number of persons working in a film industry.

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How many female actors are also models?

(a) 46
(b) 28
(c) 70
(d) 17

Q63. If two interior angles on the same side of a transversal intersecting two parallel lines are in the ratio 2 : 3, then the greater of the two angles is:

(a) 136°
(b) 54°
(c) 108°
(d) 120°

Q64. Which of the following is reducible to a quadratic equation?

A.) $(m + 1) - 1/(m+1) = 65$
B.) $(x^3 + 3x = 2x^3 - 4x^2$
C.) $(a + b)^2 = 3/b$
D.) $x + (3x - 2) = 1/(x^2) - 6$

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

Q65. Which of the following can be expressed in the form of a standard quadratic equation?

(a) $(2x + 3)^2 + 4x - 5 = (2x + 1)(2x - 3)$
(b) $(x + 1)(x + 2) = x^2 - 16$
(c) $(2x - 1)^3 = x^2 - 3x + 2$
(d) $\sqrt{(2x^2 + 3x-4)}-2x+5=0$

Q66. A 1100 W electric toaster operates at 220 V. The resistance of its coil is:

(a) 88 Ω
(b) 22 Ω
(c) 44 Ω
(d) 11 Ω

Q67. Select the set in which the numbers are related in the same way as are the numbers of the following sets.

(NOTE : Operations should be performed on the whole numbers, without breaking down the numbers into 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)

(12, 112, 9)

(6, 28, 4)

(a) (11, 99, 9)
(b) (13, 55, 4)
(c) (12, 149, 12)
(d) (18, 94, 5)

Q68. Find the perimeter of a rhombus whose diagonals are of lengths 5 cm and 12 cm.

(a) 25 cm
(b) 24 cm
(c) 20 cm
(d) 26 cm

Q69. Which of the following was declared a Fundamental Right in 2017 by the Supreme Court of India?

(a) Right to Constitutional Remedies
(b) Right against Exploitation
(c) Right to Freedom of Religion
(d) Right to Privacy

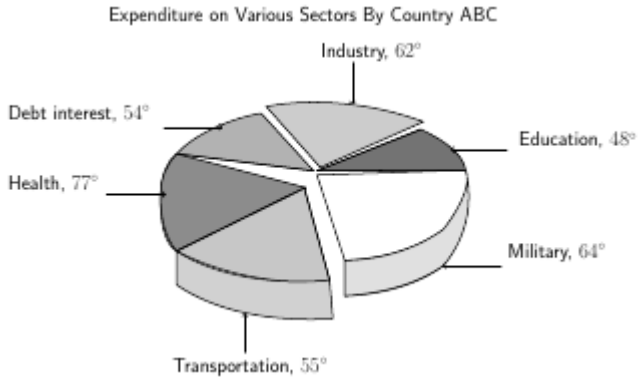
Q70. Simplify: 125 ÷ 25 × 6 + [3 + (8 - 2)] ÷ 3.

(a) 39
(b) 45
(c) 30
(d) 33

Q71. There are two classrooms A and B having a certain number of students. If 5 students are shifted from A to B, then B has twice the number of students as A. If 1 student is sent from B to A, then both classrooms will have the same number of students. How many students are there in A?

(a) 22
(b) 19
(c) 17
(d) 26

Q72. The given circle graph shows the annual spending of country “ABC' on various sectors during a particular year in the form of central angle). Study the circle graph and answer the question.



If the amount spent on industry and transportation during a year was $10 million, then what was the total approximate amount spent on all the various sectors by the country in that year?

(a) $30.8 million
(b) $20.5 million
(c) $50 million
(d) $45.5 million

Q73. The shopkeeper offers 3 successive discounts on a washing machine that costs Rs. 58,000, so that the price gets reduced to Rs. 42,000. If 5%, 10% and x% are the respective discounts, find the value of x.

(a) 9
(b) 15.3

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(c) 10
(d) 12

Q74. In this question, a group of numbers/symbols is coded using letters as per the table given below and the conditions which follow. The correct combination of codes following the condition is your answer.

Number/Symbol	6	#	4	9	@	%	2	!	?	5	8	$	3
Code	C	H	T	J	D	G	M	X	V	W	K	U	N	L

Conditions:

(i) If the first element is a symbol and the last, a number, the codes for these two are to be interchanged.

(ii) If the first element is an odd number and the last, an even number, the first and last elements are to be coded as £.

(iii) If both second and third elements are perfect squares, the third element is to be coded as the code for the second element.

How will '$ # 9 4 @ 3' be coded?

(a) N H J T D L
(b) L H J T D N
(c) £ H J T D £
(d) L H D T G N

Q75. Which of the following journals was published for the purpose of social-religious reforms among the Parsis in 1851?

(a) Rast Goftar
(b) Somaprakash
(c) Bombay Herald
(d) Bombay Post

Q76. Which of the following terms will replace the question mark (?) and complete the given alpha-numeric series?

25LN, 26OQ, 29RT, ? 41XZ

(a) 30UV
(b) 34UW
(c) 34VW
(d) 31UW

Q77. The value of (sin 16°)/(cos 74°) + tan 14°/cot 76°= is :

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

Q78. The refractive indices of mediums 1, 2 and 3 are 1.46, 1.65 and 1.31, respectively. If the speed of light in the mediums are V1, V2 and V3, respectively, which of the following relations between them is correct?

(a) V2 > V3 > V1
(b) V3 > V1 > V2
(c) V1 = V2 = V3
(d) V1 > V2 > V3

Q79. Three statements are followed by three conclusions numbered I, II and III. You have to consider these statements to be true, even if they seem to be at variance with commonly known facts. Decide which of the given conclusions logically follow(s) from the given statements.

Statements:

Some tablets are mobile phones

All mobile phones are telephones

Some laptops are tablets

Conclusions:

(I) Some laptops are mobile phones

(II) Some telephones are laptops

(III) All tablets are telephones

(a) Only conclusion I and III follows

(b) None of the conclusions follow

(c) Only conclusion II follows

(d) Only conclusion I follows

Q80. Eight clowns I, J, K, L, M, N, O and P were sitting around a square table, facing the centre. Some of them were sitting at the corners, while some were sitting at the exact centre of the sides. K was sitting to the immediate left of O. J was sitting to the immediate right of M. P was sitting second to the right of L. J was sitting fourth to the left of P. N was sitting fourth to the left of K. O was sitting to the immediate left of M. M is sitting at one of the corners. Who was sitting fourth to the left of I ?

(a) O

(b) L

(c) M

(d) P

Q81. The refractive indices of ice and glass are 1.31 and 1.52, respectively. A ray of light passes from ice to glass. The refractive index of glass with respect to ice is _____ and the ray bends _____ the normal in glass.

(a) 1.16, away from

(b) 0.86, away from

(c) 1.16, towards

(d) 0.86, towards

Q82. A certain number of people are sitting in a row, facing north. K sits to the immediate left of G. L sits to the immediate right of P. P is fourth to the right of G. L is fourth to the left of H. If no other person is sitting in the row, what is the total number of persons seated?

(a) 12

(b) 10

(c) 13

(d) 11

Q83. Ramu used to spend 72% of his income. His income is increased by 12% and he increases his expenditure by 5%. If Ramu earlier saved Rs. y and after the increases he now saves Rs. x, then what is the value of ((x-y)/y× 100)% ?

(a) 22%

(b) 25%

(c) 27%

(d) 30%

Q84. Simplify (2.46× 2.46-1.46× 1.46)/(2.46-1.46) ,giving your answer as a fraction.

(a) 392/10000

(b) 392/10

(c) 392/100

(d) 392/1000

Q85. If '+' means '-', '-' means '×', '×' means '÷' and '÷' means '+', what will come in place of the question mark (?) in the following equation ?

100 + 136 × 17 - 12 ÷ 6 = ?

(a) 14

(b) 10

(c) 8

(d) 4

Q86. Consider the V-I graphs for wires of material A and material B as described below:

Material A: It is a straight line passing through origin and is inclined at 20° to the current I axis.

Material B: It is a straight line passing through origin and is inclined at 60° to the current I axis.

Which of the following options is correct?

(a) B follows Ohm's law but A does not.
(b) Both A and B follow Ohm's law.
(c) A follows Ohms law but B does not.
(d) Neither A nor B follow Ohm's law.

Q87. A litmus paper was used to check the pH of a solution. The solution turns blue litmus red, its pH is likely to be:

(a) 5
(b) 8
(c) 9
(d) 7

Q88. What is the age group of the people benefitted under the Pradhan Mantri Jeevan Jyoti Bima Yojana (PMJJBY) (As of July 2022)?

(a) 15 to 60 years
(b) 18 to 50 years
(c) 25 to 60 years
(d) 14 to 50 years

Q89. The given table shows the production of food grains (in tonnes) in a certain state of India for the period 2016-2020. Study the table and answer the question.

Food grains	Wheat	Maize	Rice	Pulses	Beans
Year					
2016	410	680	500	390	280
2017	500	700	550	400	250
2018	510	500	580	380	300
2019	510	750	560	500	260
2020	600	800	600	510	300

In the year 2018, the total production of rice and beans is approximately what percentage of the total production of rice and beans in the year 2020?

(a) 85.5%
(b) 89.3%
(c) 90.5%
(d) 97.8%

Q90. If the time in the mirror image of a 12-hour clock is 5 : 40, what is the actual time?

(a) 6 : 20
(b) 6 : 10
(c) 2 : 50
(d) 2 : 10

Q91. In May 2021, who was appointed as the Head Coach of Indian Women's National Cricket Team?

(a) Gary Kirsten
(b) Ramesh Powar
(c) Rahul Dravid
(d) Woorkeri Raman

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Q92. Lakshman and Bharath start a business by investing Rs. 48,000 and Rs. 72,000, respectively. What is Bharath's share out of an annual profit of Rs. 6,530?

(a) Rs. 3,918
(b) Rs. 2,450
(c) Rs. 3,080
(d) Rs. 2,612

Q93. Which of the following elements has valency 3?

(a) Al
(b) S
(c) C
(d) Mg

Q94. The point of intersection of the medians of a triangle is called:

(a) Circumcentre
(b) incentre
(c) Orthocentre
(d) Centroid

Q95. The focus of a concave mirror is at a distance of 16 cm from its pole. Its centre of curvature will be at a distance of _____ from the pole.

(a) 16 cm
(b) 24 cm
(c) 32 cm
(d) 8 cm

Q96. If each of the digits in the number given below is arranged in the ascending order from left to right, the position of how many digits will remain unchanged as compared to that in the original number?

(Left) 6352897 (Right)

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

Q97. If 1 is added to each odd digit and 1 is subtracted from each even digit in the number 58132745, what will be the sum of the digits which are second from the left and third from the right?

(a) 15
(b) 8
(c) 10
(d) 5

Q98. As per the Union Budget of India 2022-23, how many kilometres wide corridor will be formed along the river Ganga for promotion of chemical free natural farming?

(a) 7.5 km
(b) 10 km
(c) 2.5 km
(d) 5 km

Q99. In an electric generator, _____ energy is used to rotate a conductor in a _____ field to produce electricity.

(a) electrical, electric
(b) mechanical, electric
(c) mechanical, magnetic
(d) electrical, magnetic

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Q100. A nichrome wire AB is made of three parts, AC, CD and DB of resistances in the ratio of 1 : 2 : 3. The wire is connected to a battery. If V1, V2 and V3 are the potential drops across AC, CD and DB, respectively, then which of the following is correct?

(a) V1 : V2 : V3 = 3 : 2 : 1
(b) V1 : V2 : V3 = 2 : 3 : 1
(c) V1 : V2 : V3 = 1 : 2 : 3
(d) V1 : V2 : V3 = 1 : 1 : 1

ANSWER KEY

1	b	2	c	3	c	4	d	5	c	6	b	7	b	8	b	9	a	10	d
11	d	12	d	13	a	14	d	15	c	16	c	17	a	18	d	19	d	20	b
21	a	22	d	23	b	24	c	25	d	26	a	27	a	28	b	29	d	30	a
31	b	32	b	33	d	34	d	35	a	36	c	37	c	38	c	39	c	40	b
41	a	42	c	43	d	44	a	45	b	46	d	47	b	48	b	49	a	50	d
51	a	52	d	53	c	54	a	55	a	56	a	57	d	58	b	59	d	60	a
61	a	62	d	63	c	64	a	65	d	66	c	67	d	68	d	69	d	70	d
71	c	72	a	73	b	74	b	75	a	76	b	77	c	78	b	79	b	80	c
81	c	82	d	83	d	84	c	85	b	86	b	87	a	88	b	89	d	90	a
91	b	92	a	93	a	94	d	95	c	96	c	97	a	98	d	99	c	100	c

SOLUTIONS

Q1. Answer: (b) 13 cm

Shortcut Trick
Surface Area = 4 × π × r²
r² = (Total Surface Area) ÷ (4 × π)
r² = (14872/7) × (1/4) × (7/22) = 14872 ÷ 88 = 169
r = √169 = 13 cm
Therefore The correct answer is 13 cm.
Alternate Method
Given:
Surface Area (S) = 21244/7 cm² = (2124 × 7 + 4) ÷ 7 = 14872 ÷ 7 cm²
π = 22/7
Formula Used:
Surface Area of Sphere = 4πr²
Calculations:
=> 4 × (22/7) × r² = 14872/7
=> 88/7 × r² = 14872/7
=> 88 × r² = 14872
=> r² = 14872 ÷ 88
=> r² = 169
=> r = √169
=> r = 13 cm
Therefore The correct answer is 13 cm.
Additional Information
Volume of a Sphere
The amount of space occupied by a sphere is given by V = (4/3)πr³.
Hemisphere Properties

Curved Surface Area = $2\pi r^2$ and Total Surface Area = $3\pi r^2$.

Ratio of Surface Area to Volume

For a sphere, the ratio of Surface Area (S) to Volume (V) is S/V = 3/r.

Q2. Answer: (c) Rajasthan

The correct answer is Rajasthan

Key Points

• Rajasthan was the first state in India to adopt the Panchayati Raj system on 2nd October 1959.

• The Panchayati Raj system was inaugurated by the then Prime Minister of India, Pt. Jawaharlal Nehru, at Nagaur in Rajasthan.

• The system aims to decentralize power and governance to the grassroots level, ensuring local self-governance.

• The adoption of the Panchayati Raj system marked a significant step towards democratic decentralization in India.

Additional Information

• The Panchayati Raj system is a three-tier structure consisting of the Gram Panchayat (village level), Panchayat Samiti (block level), and Zila Parishad (district level).

• The system was introduced based on the recommendations of the Balwant Rai Mehta Committee, which was set up in 1957.

• The 73rd Constitutional Amendment Act of 1992 provided constitutional status to the Panchayati Raj institutions, making them a mandatory feature of rural governance in India.

• The amendment also aimed to enhance the participation of women and marginalized sections of society in the decision-making process at the local level.

Q3. Answer: (c) 420

Shortcut Trick

Identify the highest common factor first to reduce numbers: 84, 105, 140 are all multiples of 7.

Numbers reduced: 12, 15, 20.

LCM of (12, 15, 20) is 60.

Final LCM = 60 × 7 = 420.

Therefore The correct answer is 420.

Alternate Method

Given: Numbers are 84, 105, and 140.

Method: Prime Factorization Method

=> $84 = 2^2 \times 3 \times 7$

=> $105 = 3 \times 5 \times 7$

=> $140 = 2^2 \times 5 \times 7$

=> $LCM = 2^2 \times 3 \times 5 \times 7$

=> $LCM = 4 \times 3 \times 5 \times 7 = 420$

Therefore The correct answer is 420.

Additional Information

LCM (Least Common Multiple)

The smallest positive integer that is divisible by each of the given numbers.

HCF and LCM Relation

For two numbers a and b, Product of numbers (a × b) = HCF(a, b) × LCM(a, b).

LCM of Fractions

LCM of fractions = (LCM of Numerators) ÷ (HCF of Denominators).

Q4. Answer: (d) Neither I nor II can be assumed

Given Statement: Recent marketing trends suggest that words like 'premium', ‘exquisite', 'priority' are considered prestigious by consumers of the middle income group and hence increase the chances of sale of any product advertised with these words.

Now,

Assumptions:

1. The products advertised with the said 'prestigious' words definitely cost higher than those which are not advertised with such words - Not Implicit (The statement does not provide information regarding the cost of the products. It only talks about the perception of these words by the middle income group and their effect on sales.)

2. Such prestigious words have no impact on sales among the lower income group - Not Implicit (The statement only discusses the impact on the middle income group and does not provide information about the lower income group.)

Here, Neither assumption I nor II is implicit.

Hence, the correct answer is "Option 4".

Q5. Answer: (c) 1

The correct answer is 1

Key Points

• The valency of group 17 elements is 1.

• Group 17 elements are also known as halogens and include fluorine, chlorine, bromine, iodine, and astatine.

• These elements have seven electrons in their outermost shell and require one more electron to achieve a stable octet configuration.

• Due to this, the valency of halogens is typically 1, as they tend to gain one electron during chemical reactions.

Additional Information

• The halogens are highly reactive, especially with alkali metals and alkaline earth metals, forming salts.

• These elements are found in various states at room temperature: fluorine and chlorine are gases, bromine is a liquid, and iodine and astatine are solids.

• The reactivity of halogens decreases down the group, with fluorine being the most reactive and astatine the least.

• Halogens have significant applications in daily life, including disinfection, pharmaceuticals, and the production of various chemicals.

Q6. Answer: (b) 42 years

Shortcut Trick

Present Ratio (Father : Sum of Sons) = 1.5 : 1 → 3 : 2

After 6 years, let the age of the Father be F + 6 and Sum of Sons be S + 12 (since there are 2 sons).

Ratio after 6 years = 6 : 5

Using the present ratio 3x : 2x => (3x + 6) / (2x + 12) = 6 / 5

15x + 30 = 12x + 72 => 3x = 42

Therefore The correct answer is 42 years.

Alternate Method

Given:

Present Age of Father = 1.5 × (Sum of Sons' ages)

Ratio after 6 years = 6 : 5

=> Let the present sum of ages of two sons be S.

=> Present age of Father (F) = 1.5S = (3/2)S => F/S = 3/2.

=> Let F = 3x and S = 2x.

=> After 6 years, Father's age = 3x + 6.

=> After 6 years, Sum of two sons' ages = S + 6 + 6 = 2x + 12.

=> According to the question: (3x + 6) / (2x + 12) = 6 / 5

=> 5(3x + 6) = 6(2x + 12)

=> 15x + 30 = 12x + 72

=> 3x = 42

=> Present age of Father = 3x = 42.

Therefore The correct answer is 42 years.

Additional Information

Ages of Multiple Persons

When calculating the sum of ages after 'n' years for 'k' persons, the sum increases by (n × k) years.

Ratio Method for Ages

Always ensure that the variable (x) is applied to the present ratio to simplify the calculation of current age values directly.

Q7. Answer: (b) 800 gm

Shortcut Trick

For a dishonest dealer, Gain% = (Error ÷ Actual Weight) × 100.

Let the actual weight be x gm. The written weight is 984 gm.

The shopkeeper makes a 23% gain by selling x gm while charging for 984 gm.

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Using the multiplier: Charged Weight = Actual Weight × (100 + Gain%) ÷ 100.
984 = x × (123 ÷ 100) => x = (984 × 100) ÷ 123 = 8 × 100 = 800 gm.
Therefore The correct answer is 800 gm.
Alternate Method
Given: Marked weight = 984 gm, Profit% = 23%.
Formula: Gain% = [(True Value − Weight Used) ÷ Weight Used] × 100
=> Let the actual measure used by the shopkeeper be x gm.
=> Profit = 984 − x.
=> Profit% = [(984 − x) ÷ x] × 100 = 23.
=> 100 × (984 − x) = 23x.
=> 98400 − 100x = 23x => 98400 = 123x.
=> x = 98400 ÷ 123 = 800 gm.
Therefore The correct answer is 800 gm.
Additional Information
Dishonest Dealer Concept
A shopkeeper gains when he uses a smaller weight than the true weight. Gain% = [Error ÷ (True Value − Error)] × 100.
Effective Gain
If a shopkeeper cheats by x% while buying and y% while selling, net gain% = [((100+x)(100+y) ÷ 100) − 100]%.

Q8. Answer: (b) a - iv, b - i, c - ii, d - iii

The correct answer is a - iv, b - i, c - ii, d - iii
Key Points
• The correct matching of Column I with Column II is as follows:
• a - iv: No digestion
• b - i: Villi absorb nutrients
• c - ii: Length depends on food the organism eats
• d - iii: Helps in emulsification of fats
Additional Information
• The human alimentary canal consists of various organs where digestion and absorption of nutrients take place.
• The small intestine is responsible for the absorption of nutrients through structures called villi.
• The length of the alimentary canal can vary depending on the diet of the organism.
• The liver produces bile which aids in the emulsification of fats, a process necessary for fat digestion.
• Some parts of the alimentary canal, such as the esophagus, do not participate in digestion but serve as passageways for food.
• The large intestine is primarily responsible for the absorption of water from the remaining indigestible food matter.

Q9. Answer: (a) 12

Given: A certain number of people are sitting in a row, facing north.
1) D sits to the immediate left of F.
2)Only six people sit between S and D.
CASE 1:
CASE 2:
3) K sits third to the right of F.
4) S sits at the extreme left end of the row.
CASE 1:
CASE 2:
As it is given that S sits at the extreme left end, so CASE 1 gets eliminated and we have the final arrangement in CASE 2
So, 12 persons are seated in a row.
Hence the correct answer is "Option 1".

Q10. Answer: (d) 42 years

Shortcut Trick
Total members in the family = 4 (Father, Mother, and 2 Children).
Total age of family = Average × Number of members = 26 × 4 = 104 years.

Sum of ages of Father and 2 Children = 62 years.

Mother's age = Total age − Sum of others = 104 − 62 = 42 years.

Therefore The correct answer is 42 years.

Alternate Method

Given:

Average age of 4 members = 26 years

Sum of ages of (Father + 2 Children) = 62 years

Formula Used:

Total Sum = Average × Number of observations

Calculations:

=> Total age of (Father + Mother + 2 Children) = 4 × 26

=> Total age = 104 years

=> Age of (Father + 2 Children) + Mother = 104

=> 62 + Mother = 104

=> Mother = 104 − 62

=> Mother = 42 years

Therefore The correct answer is 42 years.

Additional Information

Definition of Average

The average (Arithmetic Mean) is the ratio of the sum of all observations to the total number of observations.

Total Sum Formula

If the average and number of items are known, the total sum is calculated as: Sum = Average × Count.

Property of Sum

The sum of a larger group can be expressed as the addition of the sums of its constituent sub-groups.

Q11. Answer: (d) 14 m, West

Given:

Starting from point A, Jagdish walks 98 m towards the west.

He takes a left turn and walks 54 m.

He takes a left turn again and walks 112 m.

Again, he takes a left turn and walks 54 m to reach point B.

So, point B is 14 m west of point A

Hence the correct answer is "Option 4".

Q12. Answer: (d) Awadhi

The correct answer is Awadhi

Key Points

• Awadhi has not been mentioned in the 8th Schedule of the Indian Constitution.

• The 8th Schedule of the Indian Constitution lists the official languages recognized by the Constitution.

• Currently, there are 22 languages listed in the 8th Schedule.

• Languages such as Dogri, Odia, and Maithili are included in the 8th Schedule.

• The inclusion of a language in the 8th Schedule means the language is recognized by the Indian government for official purposes.

Additional Information

• The Constitution of India was adopted by the Constituent Assembly on 26th November 1949 and came into effect on 26th January 1950.

• It lays down the framework defining fundamental political principles, establishes the structure, procedures, powers, and duties of government institutions, and sets out fundamental rights, directive principles, and the duties of citizens.

• The Constitution of India is the longest written constitution of any country in the world.

• It declares India a sovereign, socialist, secular, and democratic republic, assuring its citizens justice, equality, and liberty, and endeavors to promote fraternity.

• The 8th Schedule of the Constitution initially had 14 languages, but it was expanded over time to include more languages.

• Amendments to the Schedule can be made through a process outlined in Article 368 of the Constitution.

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• The recognition of languages in the 8th Schedule helps preserve and promote linguistic diversity in India.

Q13. Answer: (a) Baking soda

The correct answer is Baking soda

Key Points

• Baking soda is effective in neutralizing the acidic venom injected by a bee sting.

• Applying a paste made of baking soda and water to the affected area can help reduce pain and swelling.

• It works by counteracting the acidity of the venom, providing relief from the discomfort caused by the sting.

• Other home remedies like vinegar (which is acidic) or common salt do not neutralize the venom as effectively as baking soda.

Additional Information

• Bee stings inject venom that can cause pain, swelling, and redness at the site of the sting.

• It's important to remove the stinger as quickly as possible to prevent more venom from entering the skin.

• Individuals who are allergic to bee stings should seek immediate medical attention as they may experience severe reactions such as anaphylaxis.

• Other treatments that can help alleviate symptoms include ice packs, antihistamines, and over-the-counter pain relievers.

Q14. Answer: (d) -10

Given:

(18 ÷ 9) × (-7 + 9) - 7 × 2

Formula used:

Follow the order of operations (PEMDAS/BODMAS): Parentheses, Exponents, Multiplication and Division (from left to right), Addition and Subtraction (from left to right).

Calculation:

(18 ÷ 9) × (-7 + 9) - 7 × 2

=> 2 × (2) - 7 × 2

=> 4 - 14

=> -10

Therefore The correct answer is option (4).

Q15. Answer: (c) Gross domestic product (GDP)

The correct answer is Gross domestic product (GDP)

Key Points

• Gross domestic product (GDP) is the most commonly used measure for the size of the economy.

• GDP represents the total monetary value of all finished goods and services produced within a country's borders in a specific time period, typically annually or quarterly.

• It includes all private and public consumption, government outlays, investments, and exports minus imports that occur within a defined territory.

• GDP is a comprehensive measure of a nation's overall economic activity and is often used to gauge the health of an economy.

• Higher GDP values typically indicate a prosperous economy, while lower GDP values may indicate economic struggles.

Additional Information

• Gross National Product (GNP) is another measure of economic activity, but it includes the value of all goods and services produced by a country's residents, regardless of the location of production.

• Net Domestic Product (NDP) is derived from GDP by subtracting depreciation on a country’s capital goods.

• Net National Product (NNP) is GNP minus depreciation.

• The GDP growth rate is an important indicator of economic performance, showing how fast an economy is growing or shrinking over time.

• GDP can be measured using three approaches: the production (or output) approach, the income approach, and the expenditure approach.

• GDP per capita is often used as an indicator of the standard of living in a country, dividing the GDP by the population size.

Q16. Answer: (c) Friday

The correct answer is Friday

Key Points

• Friday is the day when Jumma Namaz is performed in the community mosque.

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• Jumma Namaz is a congregational prayer that Muslims hold every Friday, just after noon instead of the Zuhr prayer.

• It is considered one of the most exalted Islamic rituals and one of its obligatory acts.

• The significance of Friday is highlighted in the Quran in Surah Al-Jumu'ah, verse 9, which calls for the faithful to leave off business and gather for the prayers.

Additional Information

• The term Jumma derives from the Arabic word for Friday, which is the sixth day of the Islamic week.

• Friday is considered a special day for Muslims, often referred to as the "weekly Eid".

• Many Muslims prepare for Jumma prayers by taking a special bath, wearing clean clothes, and applying perfume.

• The Friday prayer is led by an Imam, who usually delivers a sermon (Khutbah) before the prayer.

• Attending the Jumma prayer is considered mandatory for adult male Muslims, while women may attend but are not required to do so.

Q17. Answer: (a) Both the statements are true.

The correct answer is Both the statements are true

Key Points

• Both the statements are true. Sodium hydroxide is indeed prepared by the chlor-alkali process.

• The chlor-alkali process produces three products: chlorine gas, hydrogen gas, and sodium hydroxide.

• This process involves the electrolysis of sodium chloride solution (brine), leading to the production of these three substances.

• The chlor-alkali process is a crucial industrial method for producing these chemicals, which have a wide range of applications in various industries.

Additional Information

• Sodium hydroxide (NaOH), also known as caustic soda, is a strong base used in various applications like soap making, paper production, and water treatment.

• Chlorine gas (Cl2) is used for disinfection, in the production of PVC, and other chemical syntheses.

• Hydrogen gas (H2) is used as a fuel, in the production of ammonia for fertilizers, and in hydrogenation reactions in the food industry.

• The chlor-alkali process is vital for the chemical industry, providing essential chemicals for numerous processes and products.

Q18. Answer: (d) Ions move in first by active transport, followed by water along the concentration gradient

The correct answer is Ions move in first by active transport, followed by water along the concentration gradient

Key Points

• Ions move in first by active transport, followed by water along the concentration gradient.

• Active transport is a process where ions are moved into the root cells against their concentration gradient using energy from ATP.

• Once the ions are inside, they create a concentration gradient that facilitates the passive movement of water into the root cells through osmosis.

• This process ensures efficient absorption of both water and nutrients essential for plant growth.

Additional Information

• Root hairs play a crucial role in increasing the surface area for absorption.

• Water and mineral ion absorption is critical for photosynthesis, growth, and overall plant health.

• Besides active transport and osmosis, plants also use other mechanisms like facilitated diffusion and endocytosis for nutrient uptake.

• Maintaining optimal soil conditions, such as pH and moisture levels, can enhance the efficiency of nutrient absorption.

Q19. Answer: (d) i, iii and iv

The correct answer is i, iii and iv

• The advantages of building dams include storing water for irrigation, generating electricity, and transferring water to great distances via canals.

• Dams provide a controlled water supply, which is crucial for agricultural activities, particularly in areas with irregular rainfall.

• They also play a vital role in hydroelectric power generation, contributing to the energy needs of a region.

• Canals that originate from dams help in distributing water over large areas, supporting both irrigation and domestic water supply.

Additional Informatio

• Some Important Dams of India

Dam name	River	Location

Baglihar Dam	Chenab	Jammu and kashmir
Tehri Dam	Bhagirathi	Uttarakhand
Bhakra Nangal	Sutlej	Himachal Pradesh
Sardar Sarovar	Narmada	Gujarat
Hirakud Dam	Mahanadi	Odisha
NagarjunaSagar	Krishna	Telangana

• "Dams are the temples of modern India" proclaimed by Jawaharlal Nehru.
• Oldest dam in India is the Kallanai dam in Tamil Nadu built on the Kaveri river.
• The largest dam in India is the Tehri dam.

Q20. Answer: (b) 42

The logic followed here is:
So, the missing term of the series is '42'
Hence, the correct answer is "Option 2".

Q21. Answer: (a) 121

The logic followed here is:
Logic: (Digit Sum 1st number)² = 2nd number.
Now,
For, 25 : 49
=> $(2 + 5)^2 = 7^2 = 49$.
For, 42 : 36
=> $(4 + 2)^2 = 6^2 = 36$.
Similarly, for 74 : ?
=> $(7 + 4)^2 = 11^2 = 121$.
Hence, the correct answer is "Option 1".

Q22. Answer: (d) 2

Given: (left) 248 382 415 127 335 (right)
The second digit of the largest number is: 1 (415)
And,
The first digit of the second smallest number is: 2 (248)
So, the multiplication of the first digit of the second smallest number and the second digit of the largest number is:
→ 2 * 1 = 2.
The correct answer is "Option 4".

Q23. Answer: (b) Between Beas and Ravi

The correct answer is Between Beas and Ravi
Key Points
• Bari Doab is the region located between the Beas and Ravi rivers.
• The term "Doab" is derived from Persian, meaning "land between two rivers".
• In Punjab, India, the area between the Beas and Ravi is known as the Bari Doab, which is one of the major divisions of the region.
• This fertile area has historically been crucial for agriculture and settlements.
Additional Information
• The Punjab region is divided into several doabs, which are named based on the rivers that bound them.
• Other well-known doabs in Punjab include the Rechna Doab (between Chenab and Ravi) and the Chaj Doab (between Jhelum and Chenab).
• The concept of doabs is significant in understanding the geographical and cultural landscape of the Punjab region.

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Q24. Answer: (c) Mirzapur

The correct answer is Mirzapur

Key Points

• The Standard Meridian of India passes through Mirzapur.

• The longitude of the Standard Meridian is 82.5° E, which is used as the reference for Indian Standard Time (IST).

• Mirzapur is located in the state of Uttar Pradesh.

• This meridian helps in maintaining a uniform time zone across the country.

Additional Information

• The Indian Standard Time (IST) is 5 hours and 30 minutes ahead of Greenwich Mean Time (GMT+5:30).

• Having a standard meridian helps in avoiding confusion and ensuring that the entire country follows the same time.

• The concept of a standard time zone is crucial for the synchronization of activities, especially in a country as vast as India.

Q25. Answer: (d) -6 cm

The correct answer is -6 cm

Key Points

• The radius of curvature (R) of a concave mirror is given as 12 cm.

• According to the New Cartesian Sign Convention, the radius of curvature for a concave mirror is taken as negative.

• The relationship between the focal length (f) and the radius of curvature (R) of a concave mirror is given by the formula: f=R/2

• Substituting the given value: f=(-12)/2=-6cm

• Hence, the principal focus is located at x = -6 cm.

Additional Information

• In the New Cartesian Sign Convention, distances measured against the direction of the incident light are taken as negative, while those measured along the direction of the incident light are taken as positive.

• For concave mirrors, the focal point and the center of curvature lie on the same side as the reflecting surface, hence their distances are considered negative.

• This sign convention helps in deriving and applying the mirror formula and magnification formula correctly.

Q26. Answer: (a) 3

Given series: 5 6 2 6 5 8 5 3 5 0 2 6 3 8 2 5 6 9 3 7

According to the question such odd numbers are there each of which is immediately preceded by an even number and also immediately followed by an even number:

Required condition: Even number - Odd number - Even number

5 6 2 6 5 8 5 3 5 0 2 6 3 8 2 5 6 9 3 7

Thus, there are three such odd numbers which is immediately preceded by and also immediately followed by an even number.

Hence, "Option 1" is the correct answer.

Q27. Answer: (a) Bengaluru

The correct answer is Bengaluru

Key Points

• Bengaluru hosted the Khelo India University Games 2021.

• The Khelo India University Games is a national-level multi-sport event for university athletes in India, aimed at promoting sports and identifying talent at the university level.

• The event is part of the Khelo India initiative, which seeks to foster a strong sports culture in the country.

• Bengaluru, the capital city of Karnataka, has a rich history of hosting various national and international sporting events, making it an ideal location for the games.

Additional Information

• The Khelo India Programme was launched by the Ministry of Youth Affairs and Sports in 2018 to revive the sports culture in India at the grassroots level.

• It includes various components such as the Khelo India School Games, Khelo India Youth Games, and Khelo India University Games.

• The programme provides financial assistance for the development of sports infrastructure and the training of athletes.

• Khelo India University Games 2021 featured a wide range of sports, including athletics, basketball, football, badminton, swimming, and more.

• The event saw participation from numerous universities across India, showcasing the sporting talent of the country's youth.

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Q28. Answer: (b) 3, ketone

The correct answer is 3, ketone

Key Points

• Propanone, also known as acetone, has 3 carbons and a ketone functional group.

• Its chemical formula is C3H6O.

• Propanone is the simplest and most important ketone.

• It is widely used as a solvent and an intermediate in organic synthesis.

• The ketone functional group is characterized by a carbonyl group (C=O) bonded to two carbon atoms.

Additional Information

• Ketones are a class of organic compounds characterized by the presence of a carbonyl group bonded to two hydrocarbon groups.

• Propanone is commonly used in nail polish removers and as a cleaning agent.

• In the body, acetone is produced during the metabolism of fats and is present in small amounts in the blood and urine.

• Propanone is a colorless, volatile, and flammable liquid with a characteristic odor.

Q29. Answer: (d) 8343

Shortcut Trick

Find two factors of ab = 140 whose sum is a + b = 27.

The factors are 20 and 7 (since 20 × 7 = 140 and 20 + 7 = 27).

Substitute these values into the expression: $a^3 + b^3 = 20^3 + 7^3$

Calculation: 8000 + 343 = 8343.

Therefore The correct answer is 8343.

Alternate Method

Given:

a + b = 27

ab = 140

Formula Used:

The algebraic identity for the sum of cubes is: $a^3 + b^3 = (a + b)^3 - 3ab(a + b)$

Calculations:

=> $a^3 + b^3 = (27)^3 - 3 \times 140 \times (27)$

=> $a^3 + b^3 = 19683 - 420 \times 27$

=> $a^3 + b^3 = 19683 - 11340$

=> $a^3 + b^3 = 8343$

Therefore The correct answer is 8343.

Additional Information

Sum of Cubes (Factored Form)

Another way to express the sum of cubes is $a^3 + b^3 = (a + b)(a^2 - ab + b^2)$.

Difference of Cubes

The identity for the difference of two cubes is $a^3 - b^3 = (a - b)(a^2 + ab + b^2)$.

Square of a Binomial

To find $a^2 + b^2$, use the identity $(a + b)^2 = a^2 + b^2 + 2ab$, which rearranges to $a^2 + b^2 = (a + b)^2 - 2ab$.

Q30. Answer: (a) 20 m

Shortcut Trick

Relative Speed in same direction = 36 − 18 = 18 km/h.

Convert speed to m/s: 18 × (5/18) = 5 m/s.

Total distance (2L) = Speed × Time = 5 × 8 = 40 m.

Length of each engine (L) = 40 ÷ 2 = 20 m.

Therefore The correct answer is 20 m.

Alternate Method

Given:

Speed of faster engine (S1) = 36 km/h

Speed of slower engine (S2) = 18 km/h
Time taken to cross (t) = 8 sec
Length of each engine = L
Formula Used:
Relative Speed (Same direction) = S1 − S2
Distance = Speed × Time
Calculations:
=> Relative Speed = 36 − 18 = 18 km/h
=> Speed in m/s = 18 × (5/18) = 5 m/s
=> Total Distance = L + L = 2L
=> 2L = 5 × 8
=> 2L = 40
=> L = 20 m
Therefore The correct answer is 20 m.
Additional Information
Relative Speed Rules
When two objects move in the same direction, relative speed is S1 − S2. When they move in opposite directions, it is S1 + S2.
Unit Conversion
To convert km/h to m/s, multiply by 5/18. To convert m/s to km/h, multiply by 18/5.
Crossing Distance
When one train crosses another train or a long object, the total distance covered is the sum of the lengths of both objects.

Q31. Answer: (b) 38

Shortcut Trick
Total frequency N = 100 => N/2 = 50.
Calculate Cumulative Frequency (CF): 5, 23, 38, 60...
The first CF ≥ 50 is 60, so the median class is 60−70.
The cumulative frequency of the class preceding 60−70 is 38.
Therefore The correct answer is 38.
Alternate Method
Given: Total number of farmers (N) = 100.
=> N/2 = 100 ÷ 2 = 50.
=> CF for 30−40 = 5
=> CF for 40−50 = 5 + 18 = 23
=> CF for 50−60 = 23 + 15 = 38
=> CF for 60−70 = 38 + 22 = 60
=> Since 60 is the first cumulative frequency greater than or equal to 50, the median class is 60−70.
=> The class preceding the median class is 50−60.
=> The cumulative frequency of the class 50−60 is 38.
Therefore The correct answer is 38.
Additional Information
Median Class Identification
The median class is the class interval whose cumulative frequency is just greater than or equal to N/2.
Median Formula for Grouped Data
Median = l + [(N/2 − cf)/f] × h, where cf is the cumulative frequency of the class preceding the median class.
Cumulative Frequency (CF)
It is the sum of all previous frequencies up to the current point. It is essential for calculating positional averages like median, quartiles, and deciles.

Q32. Answer: (b) $CuSO_4$ (aq) + $BaCl_2$ (aq) → $BaSO_4$ (s) + $CuCl_2$ (aq)

The correct answer is $CuSO_4$ (aq) + $BaCl_2$ (aq) → $BaSO_4$ (s) + $CuCl_2$ (aq)
Key Points

• $CuSO_4$ (aq) + $BaCl_2$ (aq) → $BaSO_4$ (s) + $CuCl_2$ (aq) is a precipitation reaction.

• In a precipitation reaction, two aqueous solutions react to form an insoluble solid called a precipitate.

• Here, when copper(II) sulfate solution reacts with barium chloride solution, barium sulfate, which is insoluble in water, precipitates out.

• The other product, copper(II) chloride, remains in the aqueous phase.

Additional Information

• Precipitation reactions are a type of double displacement reaction where an insoluble salt is formed as a product.

• These reactions are commonly used in various chemical analyses and separations.

• The formation of a precipitate can be used to identify the presence of specific ions in a solution.

• Other examples of precipitation reactions include the reaction between silver nitrate and sodium chloride to form silver chloride precipitate.

• Precipitation reactions are important in fields such as analytical chemistry, environmental science, and materials science.

Q33. Answer: (d) 10%

Shortcut Trick

Total simple interest for 2 years = Rs. 2,000.

Interest for 1 year = 2,000 ÷ 2 = Rs. 1,000.

Rate of interest (R) = (Interest for 1 year ÷ Principal) × 100

R = (1,000 ÷ 10,000) × 100 = 10%.

Therefore The correct answer is 10%.

Alternate Method

Given:

Principal (P) = Rs. 10,000

Time (T) = 2 years

Simple Interest (SI) = Rs. 2,000

Formula Used:

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

Calculations:

=> 2,000 = (10,000 × R × 2) ÷ 100

=> 2,000 = 100 × R × 2

=> 2,000 = 200 × R

=> R = 2,000 ÷ 200

=> R = 10%

Therefore The correct answer is 10%.

Additional Information

Simple Interest Property

In simple interest, the Principal remains constant throughout the loan period, meaning the interest earned each year is the same.

Amount Formula

The total Amount (A) repaid after the time period is the sum of the Principal and the Interest: A = P + SI.

Effective Rate of Interest

The total percentage interest paid over the whole period is R × T. In this case, 10% × 2 = 20% of the Principal.

Q34. Answer: (d) 4

Given series: 5P Q S D A B U E H I R I A A Y E J S B R X M F G U A B U E H I R

According to the question such vowels are there in the series each of which is immediately preceded by a consonant and also immediately followed by a consonant:

Required condition: Consonant - Vowel - Consonant

P Q S D A B U E H I R I A A Y E J S B R X M F G U A B U E H I R

Thus, there are four such vowels which are immediately preceded by and also immediately followed by a consonant.

Hence, "Option 4" is the correct answer.

Q35. Answer: (a) Foods like chips and canned snacks are low in nutrition and should be avoided during adolescence/reproducti...

The correct answer is Foods like chips and canned snacks are low in nutrition and should be avoided during adolescence/reproductive phase

Explanation:

• Foods like chips and canned snacks are low in nutrition and should be avoided during adolescence/reproductive phase - This is a factual statement and not a myth.

• Adolescence and the reproductive phase are crucial periods for growth and development, where balanced nutrition is essential.

• Chips and canned snacks are often high in unhealthy fats, sugars, and sodium, while being low in essential nutrients.

• Consuming these foods regularly can lead to poor health outcomes, including obesity, cardiovascular disease, and nutrient deficiencies.

• During menstruation, a girl should not be permitted to work in the kitchen - This is a myth.

• Menstruating does not affect a girl's ability to work in the kitchen or perform any day-to-day activities.

• Restricting her from normal activities is based on societal taboos and misconceptions rather than scientific evidence.

• If a girl looks at boys while menstruating, she becomes pregnant - This is clearly a myth.

• Pregnancy can only occur through fertilization of the egg by sperm. Looking at someone cannot result in pregnancy. This statement is based on misconceptions and lacks any scientific basis.

• The mother is ultimately accountable for her child's sexual orientation - This is a myth.

• A child's sexual orientation is not determined by the mother or any other parental influence. Sexual orientation is complex interplay of genetic, hormonal, and environmental factors. During reproduction, each parent contributes one of their two sex chromosomes to the offspring:

• The mother can only provide an X chromosome.

• The father can provide either an X or a Y chromosome.

The combination of these chromosomes determines the sex of the offspring:

• XX (female): If the offspring inherits an X chromosome from both parents.

• XY (male): If the offspring inherits an X chromosome from the mother and a Y chromosome from the father.

Q36. Answer: (c) a and d

The correct answer is a and d

Key Points

• Lymph carries digested and absorbed fat from the intestine.

• Lymph drains excess fluid from the extracellular space back into the blood.

• Lymph does not carry CO_2 to the lungs or RBCs to the lymph nodes.

Additional Information

• The lymphatic system is a network of tissues and organs that help rid the body of toxins, waste, and other unwanted materials.

• The primary function of the lymphatic system is to transport lymph, a fluid containing infection-fighting white blood cells, throughout the body.

• The lymphatic system includes lymphatic vessels, lymph nodes, and other lymphoid organs such as the spleen and thymus.

• Maintaining fluid balance in the body and filtering out harmful substances are critical roles of the lymphatic system.

Q37. Answer: (c) 19/20

Given:

The numerator is 1 less than the denominator.

If 6 is added to the numerator, the fraction becomes 5/4.

Formula used:

Let the denominator be x, then the numerator is x - 1.

When 6 is added to the numerator:

$(x - 1 + 6)/x = 5/4$

Calculation:

$\Rightarrow (x + 5)/x = 5/4$

$\Rightarrow 4(x + 5) = 5x$

$\Rightarrow 4x + 20 = 5x$

$\Rightarrow 20 = 5x - 4x$

$\Rightarrow x = 20$

=> Numerator = x - 1 = 20 - 1 = 19

Therefore The fraction is 19/20.

Q38. Answer: (c) Only (a)

The correct answer is Only (a)

Key Points

• Option 3 is correct because an electric motor uses split rings for the commutator, which helps in reversing the direction of current in the coil every half rotation to ensure continuous rotation in the same direction.

• Statement (b) is incorrect because the direction of the force on the motor's coil is found using Fleming's left-hand rule, not the right-hand rule.

• Fleming's right-hand rule is used to find the direction of induced current in generators, not in motors.

Additional Information

• An electric motor converts electrical energy into mechanical energy.

• The split ring commutator ensures that the direction of current through the coil is reversed every half turn, which keeps the coil rotating in the same direction.

• Fleming's left-hand rule states that if the thumb, forefinger, and middle finger of the left hand are stretched mutually perpendicular to each other, with the forefinger in the direction of the magnetic field, the middle finger in the direction of the current, then the thumb points in the direction of the force or motion of the conductor.

Q39. Answer: (c) 72 km/h

Shortcut Trick

Total Distance = Train Length + Tunnel Length = 725 + 235 = 960 m.

Speed in m/s = 960 ÷ 48 = 20 m/s.

Convert to km/h: 20 × (18/5) = 72 km/h.

Therefore The correct answer is 72 km/h.

Alternate Method

Given:

Length of train (L1) = 725 m

Length of tunnel (L2) = 235 m

Time taken (t) = 48 sec

Formula Used:

Speed = Total Distance ÷ Total Time

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

Calculations:

=> Total Distance = 725 + 235 = 960 m

=> Speed (m/s) = 960 ÷ 48

=> Speed (m/s) = 20 m/s

=> Speed (km/h) = 20 × (18/5)

=> Speed (km/h) = 4 × 18 = 72 km/h

Therefore The correct answer is 72 km/h.

Additional Information

Unit Conversion

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

Relative Speed

When two objects move in the same direction, relative speed is S1 − S2. In opposite directions, it is S1 + S2.

Train Crossing Objects

When a train crosses a pole or man, distance = length of train. When it crosses a platform or tunnel, distance = length of train + length of object.

Q40. Answer: (b) 4

Given: Seven boxes J, K, L, M, N, O and P are kept one over the other

1) Only five boxes are kept between K and J.

2) L is kept immediately above P.

3) M is kept immediately below N.

CASE 1		CASE 2
PERSONS	BOX	PERSONS
K	1	J
	2	
	3	
	4	
	5	
	6	
J	7	K

4) O is kept at one of the positions above J.

5) N is kept immediately below K.

CASE 1		CASE 2
PERSONS	BOX	PERSONS
K	1	J
N	2	
M	3	
	4	
	5	
	6	
J	7	K

As O is kept above J and N is kept immediately below K, so is is not possible in CASE 2 so it gets eliminated.

CASE 1	
PERSONS	BOX
K	1
N	2
M	3
L/P/O	4
L/P/O	5
L/P/O	6
J	7

So, 4 boxes are kept between N and J

Hence the correct answer is "Option 2".

Q41. Answer: (a) PEN : SBQ

The logic followed here is:

For, MON : PLQ

For, KIT : NFW

Similarly for, PEN : SBQ

Hence the correct answer is "Option 1".

Q42. Answer: (c) 12

Shortcut Trick

Subtract the remainder 13 from each number: 3795, 4785, and 5115.

Find the HCF of (4785 − 3795 = 990) and (5115 − 4785 = 330).

HCF(990, 330) = 330. Since 3795 ÷ 330 leaves remainder 165 (not 0), the HCF of all three is 165.

Sum of digits of X = 165 is 1 + 6 + 5 = 12.

Therefore The correct answer is 12.

Alternate Method

Given: Numbers are 3808, 4798, 5128 and remainder is 13.

Formula Used: X = HCF(Number1 − Remainder, Number2 − Remainder, Number3 − Remainder)

=> First number = 3808 − 13 = 3795

=> Second number = 4798 − 13 = 4785

=> Third number = 5128 − 13 = 5115

=> X = HCF(3795, 4785, 5115)

=> 3795 = 5 × 3 × 11 × 23

=> 4785 = 5 × 3 × 11 × 29

=> 5115 = 5 × 3 × 11 × 31

=> Common factors are 5, 3, and 11. X = 5 × 3 × 11 = 165

=> Sum of digits = 1 + 6 + 5 = 12

Therefore The correct answer is 12.

Additional Information

HCF with same remainder

To find the greatest number that divides a, b, c leaving the same remainder 'r', find HCF(a−r, b−r, c−r).

HCF with unknown same remainder

If the remainder is not given, the greatest number is HCF(|a−b|, |b−c|, |c−a|).

LCM Application

The smallest number divisible by a, b, c leaving remainder 'r' in each case is LCM(a, b, c) + r.

Q43. Answer: (d) U > E

Given Statement: L = U > V > E < Z < Q

Now,

Conclusions:

Option 1: Q > V → False (V > E < Z < Q No definite relation can be possible between Q and V)

Option 2: L < V → False (L = U > V It gives L > V)

Option 3: E = L → False (L = U > V > E It gives E < L)

Option 4: U > E → True (U > V > E It gives U > E)

Hence, the correct answer is "Option 4".

Q44. Answer: (a) JCQOZ

The logic followed here is:

For 'PUNCH' is coded as 'OWMEG'

For 'SHAWL' is coded as 'RJZYK'

Similarly 'KARMA' will be coded as 'JCQOZ'

Hence the correct answer is "Option 1".

Q45. Answer: (b) Confederation of Indian Industry

The correct answer is Confederation of Indian Industry

Key Points

• The India Plastics Pact was launched in September 2021 as a joint initiative between the Confederation of Indian Industry (CII) and the World-Wide Fund for Nature-India (WWF India).

• The pact aims to bring together businesses, governments, and NGOs to work towards a circular economy for plastics, reducing the environmental impact of plastic waste.

• It focuses on four targets: eliminating unnecessary plastic packaging, ensuring all plastic packaging is reusable or recyclable,

increasing the recycling of plastic packaging, and ensuring an average of 25% recycled content in plastic packaging.

• The India Plastics Pact is the first of its kind in Asia and is part of a global network of Plastics Pacts that are working towards a shared vision of a world where plastics never become waste.

Additional Information

• The Confederation of Indian Industry (CII) is a non-government, not-for-profit, industry-led, and industry-managed organization, playing a proactive role in India's development process.

• World-Wide Fund for Nature-India (WWF India) is one of the largest conservation organizations in India, working to promote harmony between human beings and nature.

• The India Plastics Pact aligns with the principles of a circular economy, which is aimed at eliminating waste and the continual use of resources.

• By bringing together stakeholders across the value chain, the pact seeks to drive systemic change and create a sustainable approach to plastic use and waste management.

Q46. Answer: (d) Shri Jagdeep Dhankhar

The correct answer is Shri Jagdeep Dhankhar

Key Points

• Shri Jagdeep Dhankhar is the current Chairman of Rajya Sabha as of August 12, 2022.

• The Chairman of Rajya Sabha is also the Vice President of India.

• The role of the Chairman includes presiding over the sessions of the Rajya Sabha, maintaining order, and ensuring the rules of the house are followed.

• The Chairman has the authority to decide on points of order and can also cast a deciding vote in case of a tie.

Additional Information

• The Rajya Sabha, also known as the Council of States, is the upper house of India's bicameral Parliament.

• The Rajya Sabha is a permanent body and is not subject to dissolution, but one-third of its members retire every two years.

• The Vice President of India is elected by an electoral college consisting of members of both houses of Parliament.

• The Vice President serves as the ex-officio Chairman of Rajya Sabha.

• The current Vice President and Chairman of Rajya Sabha, Shri Jagdeep Dhankhar, took office on August 11, 2022.

Q47. Answer: (b) Urethra

The correct answer is Urethra

Key Points

• The Urethra is part of the urinary system and not the female reproductive system.

• The female reproductive system includes structures such as the Uterus, Ovaries, and Fallopian tubes.

• The Uterus is where a fertilized egg implants and develops into a fetus.

• The Ovaries produce eggs and hormones like estrogen and progesterone.

• The Fallopian tubes transport the eggs from the ovaries to the uterus.

Additional Information

• The Urethra serves the role of expelling urine from the body.

• In females, the urethra is shorter and opens just above the vaginal opening.

• Understanding the distinction between the reproductive and urinary systems is crucial for comprehending human anatomy.

Q48. Answer: (b) Chhotanagpur plateau

The correct answer is Chhotanagpur plateau

Key Points

• The Chhotanagpur plateau is the region with the maximum concentration of iron and steel industry in India.

• This area is rich in mineral resources, particularly iron ore, coal, and limestone, which are essential for iron and steel production.

• Major steel plants like Tata Steel in Jamshedpur, Bokaro Steel Plant, and others are located in this region.

• The presence of these resources and industries has made the Chhotanagpur plateau a hub for the iron and steel industry.

Additional Information

• The Chhotanagpur plateau spans across the states of Jharkhand, Odisha, West Bengal, and Chhattisgarh.

• The region's extensive coal deposits are crucial for the steel industry as they provide the necessary fuel for steel production.

• Besides iron and steel, the region also supports other industries such as aluminum and cement due to its rich mineral base.

• This industrial concentration has also led to the development of infrastructure and urbanization in the region.

Q49. Answer: (a) chlorofluorocarbon

The correct answer is chlorofluorocarbon

Key Points

• Chlorofluorocarbons (CFCs) are the primary chemical compounds that contribute to the depletion of the ozone layer.

• CFCs are used in various applications such as refrigerants, propellants in aerosol sprays, and solvents in the manufacturing industry.

• When CFCs are released into the atmosphere, they eventually reach the stratosphere where they are broken down by ultraviolet radiation, releasing chlorine atoms.

• Chlorine atoms react with ozone (O3) molecules, causing the ozone molecules to break apart into oxygen molecules (O2), thus depleting the ozone layer.

• The depletion of the ozone layer increases the amount of harmful ultraviolet (UV) radiation reaching the Earth's surface, which can lead to adverse environmental and health effects.

Additional Information

• The Montreal Protocol, adopted in 1987, is an international treaty designed to phase out the production and consumption of ozone-depleting substances, including CFCs.

• Since the implementation of the Montreal Protocol, there has been a significant reduction in the emission of CFCs, and the ozone layer is showing signs of recovery.

• Other chemicals that contribute to ozone depletion include halons, carbon tetrachloride, and methyl chloroform, but CFCs are the most well-known and widely used.

• It is crucial to continue monitoring and regulating these substances to ensure the continued recovery and protection of the ozone layer.

Q50. Answer: (d) can cause wilting of plants

The correct answer is can cause wilting of plants

Key Points

• Can cause wilting of plants is a disadvantage of transpiration.

• Transpiration is the process of water movement through a plant and its evaporation from aerial parts, especially from the leaves.

• While transpiration has several advantages, such as providing water for photosynthesis, transporting mineral ions, and cooling the plant through evaporation, it can also lead to wilting if the water loss exceeds the water uptake.

• Wilting occurs when the plant loses more water through transpiration than it can absorb from the soil, leading to a loss of turgor pressure and causing the plant to droop.

Additional Information

• Transpiration plays a crucial role in the water cycle and helps in nutrient uptake from the soil.

• It also helps in maintaining the temperature of the plant by cooling it through the evaporation process.

• However, excessive transpiration can lead to water stress, especially in arid conditions or during periods of drought.

• Plants have evolved various mechanisms to minimize water loss, such as closing their stomata, developing thick cuticles, and having reduced leaf surface area.

Q51. Answer: (a) Tamil Nadu

The correct answer is Tamil Nadu

Key Points

• Tamil Nadu experiences winter rainfall due to the retreating monsoon.

• The retreating monsoon, also known as the northeast monsoon, occurs when the monsoon winds reverse direction and blow from the northeast to the southwest.

• This phenomenon typically happens during the months of October to December.

• During this period, Tamil Nadu and parts of Andhra Pradesh receive significant rainfall.

• This rainfall is crucial for the agricultural activities in these regions.

Additional Information

• The retreating monsoon is influenced by the shifting of the Intertropical Convergence Zone (ITCZ) towards the south.

• During the southwest monsoon, the ITCZ is positioned over the Indian subcontinent, bringing heavy rainfall to the region.

• As the ITCZ moves southwards, the southwest monsoon winds weaken, and the northeast monsoon winds begin to dominate.

• These winds pick up moisture from the Bay of Bengal and bring rainfall to the southeastern coast of India.

• The northeast monsoon is relatively less intense compared to the southwest monsoon but is vital for the water resources in Tamil Nadu.

Q52. Answer: (d) 3

Given: Six students - 1, 2, 3, 4, 5 and 6 - are sitting around a circular table facing the centre.

1) 4 is sitting to the immediate right of 5 and immediate left of 6.

2) 5 is sitting second to the right of 3.

3) 6 and 3 are the immediate neighbours of 1.

So, '3' is sitting to the immediate left of '2'

Hence the correct answer is "Option 4".

Q53. Answer: (c) When the fiscal deficit is equal to the interest payment

The correct answer is When the fiscal deficit is equal to the interest payment

Key Points

• The primary deficit is defined as the fiscal deficit of the current year minus interest payments on previous borrowings.

• When the fiscal deficit is equal to the interest payment, the primary deficit is zero.

• This implies that the government is only borrowing to pay interest on existing debt and not for other expenditures.

• The concept of primary deficit helps in understanding the extent to which the government is borrowing to meet expenses other than interest payments.

Additional Information

• The fiscal deficit is the difference between the total revenue and total expenditure of the government.

• Interest payments are a major component of the fiscal deficit, particularly for countries with high levels of debt.

• Managing the primary deficit is crucial for maintaining fiscal sustainability and ensuring that debt levels do not become unmanageable.

• A zero primary deficit indicates that the government's current income is sufficient to cover its current expenditures, excluding interest payments.

Q54. Answer: (a) 306

The logic followed here is:

So, the missing term of the series is '306'

Hence the correct answer is "Option 1".

Q55. Answer: (a) Bihu

The correct answer is Bihu

Key Points

• Bihu is a set of three important Assamese festivals celebrated in the state of Assam: Rongali or Bohag Bihu, Kongali or Kati Bihu, and Bhogali or Magh Bihu.

• These festivals mark the Assamese New Year and are considered very significant in Assamese culture.

• Bihu is celebrated with traditional dance, music, and feasting, and is a time for joy and community bonding.

• Rongali Bihu, celebrated in April, is the most popular and marks the beginning of the Assamese New Year.

• Kongali Bihu, observed in October, is more solemn and marks the time of growing crops.

• Bhogali Bihu, celebrated in January, is a harvest festival and marks the end of the harvesting season.

Additional Information

• Onam is a festival celebrated in Kerala.

• Pongal is a festival celebrated in Tamil Nadu.

• Baisakhi is a festival celebrated in Punjab.

Q56. Answer: (a) 64 m, West

Given: To reach point Q from point S, a person has to walk 83 m towards the west.

He must then take a right turn and walk 240 m.

He must take another right turn and walk 147 m.

He must take another right turn and walk 240 m to reach the destination

So, point Q is 64m west from point S.

Hence the correct answer is "Option 1".

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Q57. Answer: (d) 10; 6

The correct answer is 10; 6

Key Points

• If carbon forms a C4- ion, it gains 4 additional electrons to its neutral state.

• Neutral carbon has 6 protons and 6 electrons.

• Therefore, a C4- ion will have 10 electrons (6 + 4) and 6 protons.

• Hence, the number of electrons and protons in the carbon ion will be 10 and 6 respectively.

Additional Information

• A neutral carbon atom has an atomic number of 6, which means it has 6 protons.

• In its ionized state as C4-, carbon has gained 4 extra electrons, leading to a total of 10 electrons.

• Protons remain unchanged during ionization, thus the number of protons in C4- is still 6.

• This ionization process impacts the electrical charge balance but not the number of protons in the nucleus.

Q58. Answer: (b) PARAM Ganga

The correct answer is PARAM Ganga

Key Points

• PARAM Ganga is the first 'Made in India' Petascale Supercomputer installed at IIT Roorkee under the National Supercomputing Mission (NSM) in 2022.

• The National Supercomputing Mission (NSM) is an initiative by the Government of India to empower national academic and R&D institutions by installing a vast network of supercomputers.

• PARAM Ganga enhances the research capabilities of IIT Roorkee in various fields including weather forecasting, drug discovery, and computational fluid dynamics.

• The supercomputer is built with indigenous technology and components, marking a significant step towards self-reliance in high-performance computing.

• PARAM Ganga's installation aligns with the vision of the Digital India program and aims to make India a global leader in supercomputing.

Additional Information

• The National Supercomputing Mission (NSM) was launched in 2015 with an aim to connect national academic and research institutions with a grid of supercomputing facilities.

• Under the NSM, India plans to build a network of over 70 high-performance computing facilities with a computing capacity of 450 Petaflops.

• PARAM Ganga is part of the larger PARAM series of supercomputers developed by the Centre for Development of Advanced Computing (C-DAC).

• The mission is jointly steered by the Ministry of Electronics and Information Technology (MeitY) and the Department of Science and Technology (DST).

• NSM also aims to develop a skilled workforce in supercomputing technologies through specialized training programs and collaborations with global leaders in the field.

Q59. Answer: (d) Neither conclusion I nor II follows

The least possible Venn diagram for the above statement is as follows:

Conclusions:

I. All B's are S's - FALSE (Because all B are G and some G are S it implies some B are S but all is not definite)

II. Some A's are B's - FALSE (Because, no definite relation is given between A and B, so it is possible only)

So, 'Neither conclusion I nor II follows'.

Hence, the correct answer is "Option 4".

Q60. Answer: (a) Copper-based nanoparticle coated anti-viral face mask

The correct answer is Copper-based nanoparticle coated anti-viral face mask

Key Points

• A copper-based nanoparticle coated anti-viral face mask was being developed under the 'Nano mission project' to fight against the Covid-19 pandemic in February 2022.

• Copper nanoparticles are known for their strong anti-microbial properties, which can effectively neutralize viruses and bacteria.

• The development of such masks aimed to provide enhanced protection against the spread of Covid-19.

• The 'Nano mission project' focuses on harnessing the potential of nanotechnology to address critical health challenges.

Additional Information

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• Nanotechnology involves manipulating matter at the nanoscale to create materials with unique properties and functions.
• The use of nanoparticles in face masks can enhance filtration efficiency and provide additional anti-viral protection.
• Face masks have been a crucial tool in mitigating the spread of Covid-19, and innovations in this area continue to evolve.
• The 'Nano mission project' is an initiative by the Government of India to promote and support research in nanoscience and nanotechnology.
• Such initiatives aim to leverage advanced technology to address public health crises and improve overall healthcare outcomes.

Q61. Answer: (a) F ≥ P

Given Statement: F = U ≥ P = M ≤ K < W < T

Now,

Conclusions:

Option 1: F ≥ P → True (F = U ≥ P It gives F ≥ P)

Option 2: M > F → False (F = U ≥ P = M It gives M ≤ F)

Option 3: P ≥ K → False (P = M ≤ K It gives P ≤ K)

Option 4: T < K → False (K < W < T It gives T > K)

Hence, the correct answer is "Option 1".

Q62. Answer: (d) 17

According to the given Venn diagram:

The shaded area shows the 'total number of female actors who are also models'

So, 'the total number of female actors who are models is 17'

Hence the correct answer is "Option 4".

Q63. Answer: (c) 108°

Shortcut Trick

Sum of consecutive interior angles on the same side of a transversal is always 180°.

Given ratio = 2 : 3 => Total parts = 2 + 3 = 5 units.

5 units = 180° => 1 unit = 36°.

Greater angle = 3 units = 3 × 36° = 108°.

Therefore The correct answer is 108°.

Alternate Method

Given: Ratio of two interior angles on the same side of a transversal = 2 : 3.

Formula Used: When two parallel lines are intersected by a transversal, the sum of consecutive interior angles is 180°.

Let the two angles be 2x and 3x.

=> 2x + 3x = 180°

=> 5x = 180°

=> x = 180° ÷ 5

=> x = 36°

=> Smaller angle = 2 × 36° = 72°

=> Greater angle = 3 × 36° = 108°

Therefore The correct answer is 108°.

Additional Information

Alternate Interior Angles

Angles on opposite sides of the transversal and between the parallel lines are equal.

Q64. Answer: (a) A

Shortcut Trick

An equation is reducible to a quadratic if, after clearing denominators or applying substitution, the highest power of the variable is 2.

In Option A, substituting (m + 1) = y gives $y - 1/y = 65$, which results in $y^2 - 65y - 1 = 0$ (a second-degree equation).

Options B and D involve x^3 terms upon simplification, making them cubic equations.

Option C involves multiple variables and results in a higher-degree term (b^3) when simplified.

Therefore The correct answer is $(m + 1) - 1/(m + 1) = 65$.

Alternate Method

Given Equations:

A) $(m + 1) - 1/(m + 1) = 65$

B) $x^3 + 3x = 2x^3 - 4x^2$

C) $(a + b)^2 = 3/b$

D) $x + (3x - 2) = 1/x^2 - 6$

Simplification and Analysis:

For Option A:

=> Let $(m + 1) = y$

=> $y - 1/y = 65$

=> $(y^2 - 1) / y = 65$

=> $y^2 - 1 = 65y$

=> $y^2 - 65y - 1 = 0$

Since the highest degree is 2, it is a quadratic equation.

For Option B:

=> $x^3 + 3x = 2x^3 - 4x^2$

=> $2x^3 - x^3 - 4x^2 - 3x = 0$

=> $x^3 - 4x^2 - 3x = 0$ (Highest degree is 3, so it is Cubic).

For Option D:

=> $4x - 2 = 1/x^2 - 6$

=> $(4x - 2) \times x^2 = 1 - 6x^2$

=> $4x^3 - 2x^2 + 6x^2 - 1 = 0$

=> $4x^3 + 4x^2 - 1 = 0$ (Highest degree is 3, so it is Cubic).

Therefore The correct answer is $(m + 1) - 1/(m + 1) = 65$.

Additional Information

Standard Form of Quadratic Equation

A quadratic equation is expressed as $ax^2 + bx + c = 0$, where a, b, and c are constants and $a \neq 0$.

Degree of an Equation

The degree is the highest exponent of the variable in the polynomial. Degree 1 is linear, degree 2 is quadratic, and degree 3 is cubic.

Reducible Equations

Equations that are not polynomials in their given form but can be converted to standard quadratic form through algebraic manipulation or substitution.

Discriminant Rule

For $ax^2 + bx + c = 0$, the discriminant $D = b^2 - 4ac$ determines the nature of the roots (real or imaginary).

Q65. Answer: (d) $\sqrt{(2x^2 + 3x-4)}-2x+5=0$

Shortcut Trick

Identify the highest power (degree) of the variable x after simplification.

Options (1) and (2) are linear because the x^2 terms cancel out upon expansion.

Option (3) is cubic because it contains an x^3 term from $(2x)-1)^3$.

Option (4) is quadratic because the x^2 term remains and the highest power is 2.

Therefore The correct answer is $\sqrt{2x^2 + 3x - 4 - 2x + 5 = 0}$.

Alternate Method

Given: $\sqrt{2x^2 + 3x - 4 - 2x + 5 = 0}$

Method: A standard quadratic equation is of the form $ax^2 + bx + c = 0$, where $a \neq 0$.

=> $\sqrt{2x^2 + (3x - 2x) + (-4 + 5) = 0}$

=> $\sqrt{2x^2 + 1x + 1 = 0}$

=> Here, $a = \sqrt{2}$, $b = 1$, and $c = 1$.

=> Since the coefficient of x^2 is not zero and the highest degree is 2, it is a quadratic equation.

Therefore The correct answer is $\sqrt{2x^2 + 3x - 4 - 2x + 5 = 0}$.

Additional Information

Standard Form

Any equation that can be rearranged into the form $ax^2 + bx + c = 0$ is quadratic.

Discriminant

The nature of roots is determined by $D = b^2 - 4ac$.

Nature of Roots

If $D > 0$, roots are real and distinct; if $D = 0$, roots are real and equal; if $D < 0$, roots are imaginary.

Q66. Answer: (c) 44 Ω

The correct answer is 44 Ω.

Key Points

• The toaster has a power rating of 1100 W and operates at a voltage of 220 V.

• Using the formula $P = V^2 / R$, we can calculate the resistance of the toaster coil.

• Rearranging the formula to solve for resistance: $R = V^2 / P$.

• Substituting the given values: $R = 220^2 / 1100 = 48400 / 1100 = 44$ Ω.

Additional Information

• Power (P): The rate at which energy is consumed or generated, measured in watts (W), calculated as $P = V^2 / R$ for resistive loads.

• Voltage (V): The electrical potential difference that drives current through a circuit, measured in volts (V).

• Resistance (R): The opposition to the flow of electric current in a circuit, measured in ohms (Ω).

• Ohm's Law: It defines the relationship between voltage, current, and resistance as $V = IR$, where V is voltage, I is current, and R is resistance.

• Watt (W): The unit of power, calculated as the product of voltage and current, or in the case of resistive circuits, $P = V^2 / R$.

Q67. Answer: (d) (18, 94, 5)

The logic followed here is:

Logic: (1st number × 3rd number) + 4 = 2nd number.

Now,

For, (12, 112, 9)

=> (12 × 9) + 4 = 108 + 4 = 112.

For, (6, 28, 4)

=> (6 × 4) + 4 = 24 + 4 = 28.

For, (18, 94, 5)

=> (18 × 5) + 4 = 90 + 4 = 94.

Hence, the correct answer is "Option 4".

Q68. Answer: (d) 26 cm

Shortcut Trick

Side of rhombus (a) = $1/2 \times \sqrt{(d1^2 + d2^2)}$

$a = 1/2 \times \sqrt{(5^2 + 12^2)} = 1/2 \times \sqrt{(25 + 144)} = 1/2 \times 13 = 6.5$ cm

Perimeter = 4 × side = 4 × 6.5 = 26 cm

Therefore The correct answer is 26 cm.

Alternate Method

Given: Diagonal 1 (d1) = 5 cm, Diagonal 2 (d2) = 12 cm.

Formula Used: Diagonals of a rhombus bisect each other at 90°. $Side^2 = (d1/2)^2 + (d2/2)^2$.

=> In the right-angled triangle formed by the half-diagonals:

=> $Side^2 = (5/2)^2 + (12/2)^2$

=> $Side^2 = (2.5)^2 + (6)^2$

=> $Side^2 = 6.25 + 36 = 42.25$

=> $Side = \sqrt{42.25} = 6.5$ cm

=> Perimeter = 4 × Side = 4 × 6.5 = 26 cm

Therefore The correct answer is 26 cm.

Additional Information

Area of Rhombus

The area is calculated using the product of diagonals: Area = 1/2 × d1 × d2.

Properties of Rhombus

All four sides are equal, opposite angles are equal, and diagonals bisect each other at 90 degrees.

Relation between Side and Diagonals

The sum of squares of diagonals is equal to four times the square of the side: $d1^2 + d2^2 = 4a^2$.

Q69. Answer: (d) Right to Privacy

The correct answer is Right to Privacy

Key Points

• Right to Privacy was declared a Fundamental Right by the Supreme Court of India in 2017.

• This landmark decision came from the case Justice K.S. Puttaswamy (Retd.) vs Union of India.

• The judgment held that the right to privacy is protected under Article 21 of the Indian Constitution, which guarantees the right to life and personal liberty.

• This ruling has significant implications for various aspects of individual privacy, including data protection and personal freedom.

Additional Information

• The Supreme Court of India plays a crucial role in interpreting and upholding the Constitution.

• The judgment on the right to privacy overturned previous rulings that did not recognize privacy as a fundamental right.

• This decision aligns India with other democracies that recognize the right to privacy as an essential human right.

• The ruling has paved the way for the development of comprehensive data protection laws in India.

Q70. Answer: (d) 33

Given:

125 ÷ 25 × 6 + [3 + (8 - 2)] ÷ 3

Formula used:

Order of operations (BODMAS/BIDMAS): Brackets, Orders (i.e., powers and square roots, etc.), Division and Multiplication, Addition and Subtraction

Calculation:

125 ÷ 25 × 6 + [3 + (8 - 2)] ÷ 3

=> 125 ÷ 25 × 6 + [3 + 6] ÷ 3

=> 125 ÷ 25 × 6 + 9 ÷ 3

=> 5 × 6 + 3

=> 30 + 3

=> 33

Therefore The correct answer is option (4).

Q71. Answer: (c) 17

Shortcut Trick

From the second condition, if 1 student moves from B to A they become equal, which means the difference between B and A is 2 (B − A = 2).

Test the correct answer 17 for A: If A = 17, then B = 19 (since B is 2 more than A).

Apply the first condition: Shift 5 students from A to B.

A becomes 17 − 5 = 12; B becomes 19 + 5 = 24.

Since 24 is twice 12, the condition is satisfied.

Therefore The correct answer is 17.

Alternate Method

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

Case 1: 5 students shifted from A to B.

=> New students in A = x − 5

=> New students in B = y + 5

=> y + 5 = 2 × (x − 5)

=> y + 5 = 2x − 10 => y − 2x = −15 => 2x − y = 15 --- (Equation 1)

Case 2: 1 student shifted from B to A.

=> New students in A = x + 1

=> New students in B = y − 1

=> x + 1 = y − 1 => y − x = 2 --- (Equation 2)

Solving the equations:

=> From Equation 2: y = x + 2

=> Substitute y in Equation 1: 2x − (x + 2) = 15

=> 2x − x − 2 = 15

=> x = 15 + 2

=> x = 17

Therefore The correct answer is 17.

Additional Information

Framing Linear Equations

Linear equations are used to represent relationship constraints between two or more unknown quantities. Keywords like 'shifted', 'twice', and 'same' translate to arithmetic operations and equality.

Substitution Method

This involves expressing one variable in terms of the other from one equation (e.g., y = x + 2) and substituting it into the second equation to reduce it to a single-variable equation.

Checking Balance

When 1 item moves from B to A to make them equal, the initial difference is always 2. Generally, if moving 'n' items creates equality, the initial difference is 2n.

Q72. Answer: (a) $30.8 million

Given:

Angle for industry = 62^o

Angle for transportation = 55^o

Total amount spent on industry and transportation = $10 million

Total angle of the circle = 360^o

Formula used:

Total expenditure = (Amount spent on industry and transportation / (Angle of industry + Angle of transportation)) × Total angle

Calculation:

=> Total expenditure = (10 / (62 + 55)) × 360

=> Total expenditure = (10 / 117) × 360

=> Total expenditure ≈ 30.8 million

Therefore The total approximate amount spent by the country on all sectors is $30.8 million.

Q73. Answer: (b) 15.3

Shortcut Trick

Net Selling Price (SP) = Marked Price (MP) × (100−d1)% × (100−d2)% × (100−d3)%

42000 = 58000 × 0.95 × 0.90 × (1 − x/100)

42000 = 58000 × 0.855 × (1 − x/100) => 42000 = 49590 × (1 − x/100)

(1 − x/100) = 42000 ÷ 49590 ≈ 0.8469

x/100 = 1 − 0.8469 = 0.1531 => x ≈ 15.3

Therefore The correct answer is 15.3.

Alternate Method

Given → Marked Price (MP) = Rs. 58,000, Final SP = Rs. 42,000, d1 = 5%, d2 = 10%, d3 = x%.

Formulas: SP = MP × (100 − d1)/100 × (100 − d2)/100 × (100 − d3)/100

=> Price after first discount (5%) = 58000 − (5/100 × 58000) = 58000 − 2900 = Rs. 55,100.

=> Price after second discount (10%) = 55100 − (10/100 × 55100) = 55100 − 5510 = Rs. 49,590.

=> Discount amount required for third discount = 49590 − 42000 = Rs. 7,590.

=> x = (7590 ÷ 49590) × 100 ≈ 15.3055%.

Therefore The correct answer is 15.3.

Additional Information

Successive Discounts

When multiple discounts are applied one after another, the base for the next discount is the value after the previous discount.

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Single equivalent discount for a and b is (a + b − ab/100)%.

Marked Price vs Selling Price

Marked Price is the list price, while Selling Price is the actual price after subtracting all discounts. Discount = MP − SP.

Q74. Answer: (b) L H J T D N

Given Table:

Number/Symbol	6	#	4	9	@	%		2	!	?	5	8	$	3
Code	C	H	T	J	D	G	M	X	V	W	K	U	N	L

According to the given condition:

Rule no.	Condition	Result
1.	First element is a symbol and the last is a number	Codes of both are to be interchanged
2.	First element is an odd number and the last is an even number	Both are to be coded as £
3.	Both second and third elements are perfect squares	Third element is to be coded as the code for the second element

Given: $ # 9 4 @ 3

Here, 1st rule applies i.e. 1st element is a symbol and the last is a number.

$ → coded as L (as interchanged with code of 3)

→ coded as H

9 → coded as J

4 → coded as T

@ → coded as D

3 → coded as N (as interchanged with code of $)

So, $ # 9 4 @ 3 → Coded as L H J T D N

Hence, "Option 2" is the correct answer.

Q75. Answer: (a) Rast Goftar

The correct answer is Rast Goftar

Key Points

• Rast Goftar was a journal published in 1851 for the purpose of social-religious reforms among the Parsis.

• The journal played a significant role in the reformist movement within the Parsi community, advocating for modernization and social change.

• It was part of the broader 19th-century reform movements in India that aimed at addressing social issues and promoting progressive values.

• The publication helped in spreading new ideas and encouraging debates on various social and religious topics among the Parsis.

Additional Information

• The Parsi community, originally from Persia (modern-day Iran), is a small yet influential minority in India, particularly in Mumbai.

• The 19th century saw a wave of social and religious reform movements across various communities in India, aiming at modernization and addressing social evils.

• Other significant journals of the time included Somaprakash, Bombay Herald, and Bombay Post, each catering to different audiences and purposes.

• The reformist movements often intersected with the broader Indian independence movement, with many reformers also being active in the struggle against British colonial rule.

Q76. Answer: (b) 34UW

The logic followed here is:

So, the missing term of the series is '34UW'

Hence, the correct answer is "Option 2".

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Q77. Answer: (c) 2

Shortcut Trick

Using the complementary angle properties: if A + B = 90°, then sin A = cos B and tan A = cot B.

Here, 16° + 74° = 90° => sin 16°/cos 74° = 1.

Also, 14° + 76° = 90° => tan 14°/cot 76° = 1.

Sum = 1 + 1 = 2.

Therefore The correct answer is 2.

Alternate Method

Given:

The expression is (sin 16°)/(cos 74°) + tan 14°/cot 76°

Formula Used:

=> sin(90° − θ) = cos θ

=> tan(90° − θ) = cot θ

Calculations:

Convert the numerator terms using complementary angles:

=> sin 16° = sin(90° − 74°) = cos 74°

=> tan 14° = tan(90° − 76°) = cot 76°

Substitute these values back into the expression:

=> (cos 74°)/(cos 74°) + (cot 76°)/(cot 76°)

=> 1 + 1 = 2

Therefore The correct answer is 2.

Additional Information

Complementary Angle Trigonometric Identities

For any acute angle θ, sin(90° − θ) = cos θ, cos(90° − θ) = sin θ, tan(90° − θ) = cot θ, and sec(90° − θ) = cosec θ.

Reciprocal Identities

cosec θ = 1/sin θ, sec θ = 1/cos θ, and cot θ = 1/tan θ.

Q78. Answer: (b) V3 > V1 > V2

The correct answer is V3 > V1 > V2

Key Points

• Option 2 is correct because the speed of light in a medium is inversely proportional to the refractive index of the medium.

• The refractive indices of mediums 1, 2, and 3 are 1.46, 1.65, and 1.31, respectively.

• Since the refractive index is inversely proportional to the speed of light, the medium with the highest refractive index will have the lowest speed of light.

• Thus, the correct relation is V3 > V1 > V2, corresponding to Option 2.

Additional Information

• Refractive Index is a measure of how much the speed of light is reduced inside a medium compared to the vacuum.

• The speed of light in vacuum is approximately 3 x 10^8 m/s.

• For a medium with refractive index n, the speed of light in that medium is given by V = c/n, where c is the speed of light in vacuum.

• Therefore, higher the refractive index, lower the speed of light in that medium.

Q79. Answer: (b) None of the conclusions follow

The least possible Venn diagram for the given statement is as follows:

Conclusions:

(I) Some laptops are mobile phones - FALSE (Because there is no definite relation given between laptop and mobile phones it is a possible case only)

(II) Some telephones are laptops - FALSE (Because no definite relation is given between telephones and laptop it is a possible case only)

(III) All tablets are telephones - FALSE (Because, all mobile is laptop and some tablet is telephone is given in the statement and all mobile is telephone is a possibility but not definite)

So, 'None of the conclusions follows'

Hence, the correct answer is "Option 2".

Q80. Answer: (c) M

Given: Eight clowns I, J, K, L, M, N, O and P were sitting around a square table, facing the centre.

M is sitting at one of the corners

1) K was sitting to the immediate left of O.

2) J was sitting to the immediate right of M.

3) P was sitting second to the right of L.

4) J was sitting fourth to the left of P.

5) N was sitting fourth to the left of K.

6) O was sitting to the immediate left of M.

So, M was sitting fourth to the left of I.

Hence, the correct answer is "Option 3".

Q81. Answer: (c) 1.16, towards

The correct answer is Option 3: 1.16, towards

Key Points

• The refractive index of glass with respect to ice is calculated by dividing the refractive index of glass by that of ice, which gives a value of 1.16.

• As given in the question, the ray of light passes from ice to glass, and the refractive index of ice is less than that of glass.

• When light passes from a medium of lower refractive index to a higher refractive index, the ray bends towards the normal.

• In this case, since the refractive index of glass is higher than that of ice, the ray bends towards the normal in glass.

• This bending of light is governed by Snell’s law, which relates the angle of incidence and refraction to the refractive indices of the two media.

Additional Information

• Refractive Index: The refractive index (n) of a material is the ratio of the speed of light in a vacuum to the speed of light in the material. It indicates how much light is bent or refracted when entering the material from another medium.

• Snell's Law: Snell’s law states that the ratio of the sine of the angle of incidence to the sine of the angle of refraction is constant and equals the ratio of the refractive indices of the two media.

• Light Behavior: When light moves from a less dense medium to a denser one (lower to higher refractive index), it bends towards the normal. Conversely, it bends away from the normal when it moves from a denser to a less dense medium.

• Applications of Refraction: Refraction plays a significant role in optics, such as in lenses, eyeglasses, microscopes, and other optical instruments.

Q82. Answer: (d) 11

Given: A certain number of people are sitting in a row, facing north.

1) K sits to the immediate left of G.

2)L sits to the immediate right of P.

3) P is fourth to the right of G.

4) L is fourth to the left of H.

So, total 11 persons are seated in the row

Hence, the correct answer is "Option 4".

Q83. Answer: (d) 30%

Shortcut Trick

Let Initial Income = 100 units. Initial Expenditure = 72 units → Initial Savings (y) = 28 units.

New Income = 112 units. New Expenditure = 72 + 5% of 72 = 72 + 3.6 = 75.6 units.

New Savings (x) = 112 − 75.6 = 36.4 units.

Change in savings = 36.4 − 28 = 8.4 units.

Required percentage = (8.4 ÷ 28) × 100 = 30%.

Therefore The correct answer is 30%.

Alternate Method

Given: Initial expenditure = 72% of income, Income increase = 12%, Expenditure increase = 5%.

Formula: Income = Expenditure + Savings

=> Let initial Income = 100.

=> y (Initial Savings) = 100 − 72 = 28.

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=> New Income = 100 × (112/100) = 112.

=> New Expenditure = 72 × (105/100) = 75.6.

=> x (New Savings) = 112 − 75.6 = 36.4.

=> Required value = ((x-y)/y× 100)%

=> Value = [(36.4 − 28) ÷ 28] × 100 = (8.4 ÷ 28) × 100 = 0.3 × 100 = 30%.

Therefore The correct answer is 30%.

Additional Information

Income-Expenditure Alligation

You can use alligation between Expenditure % change and Savings % change to find the Income % change, where the ratio of parts is Expenditure : Savings.

Percentage Change Formula

Percentage Change = [(Final Value − Initial Value) ÷ Initial Value] × 100. This is used to find the growth or decline of a quantity relative to its base.

Q84. Answer: (c) 392/100

Shortcut Trick

Identify the expression as the Difference of Squares identity: $(a^2 − b^2) ÷ (a − b) = (a + b)$.

Here, a = 2.46 and b = 1.46.

Applying the trick: 2.46 + 1.46 = 3.92.

Converting the decimal to a fraction: 3.92 = 392/100.

Therefore The correct answer is 392/100.

Alternate Method

Given:

Expression = (2.46 × 2.46 − 1.46 × 1.46) ÷ (2.46 − 1.46)

Formula Used:

Algebraic Identity: $a^2 − b^2 = (a + b)(a − b)$

Calculations:

=> Let a = 2.46 and b = 1.46

=> Expression = $(a^2 − b^2) ÷ (a − b)$

=> Expression = $[(a − b)(a + b)] ÷ (a − b)$

=> Expression = (a + b)

=> Expression = 2.46 + 1.46

=> Result = 3.92

=> To express as a fraction: 3.92 = 392/100

Therefore The correct answer is 392/100.

Additional Information

Algebraic Identities (Squares)

Standard square identities include $(a + b)^2 = a^2 + 2ab + b^2$ and $(a − b)^2 = a^2 − 2ab + b^2$.

Algebraic Identities (Cubes)

For cubic terms: $a^3 − b^3 = (a − b)(a^2 + ab + b^2)$ and $a^3 + b^3 = (a + b)(a^2 − ab + b^2)$.

Decimal to Fraction Conversion

To convert a decimal to a fraction, place the number over a power of 10 corresponding to the number of decimal places (e.g., 0.x = x/10, 0.xx = xx/100).

Q85. Answer: (b) 10

Given Equation: 100 + 136 × 17 - 12 ÷ 6 = ?

BODMAS Rule:

Decoding the given information:

Symbol	•	•	×	÷
Meaning	•	×	÷	•

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

=> 100 - 136 ÷ 17 × 12 + 6 = ?

=>100 - 8 × 12 + 6 = ?

=> 100 - 96 + 6 = ?

=> 106 - 96 = 10.

Hence, the correct option is "Option 2".

Q86. Answer: (b) Both A and B follow Ohm's law.

The correct answer is Both A and B follow Ohm's law

Key Points

• Both materials A and B follow Ohm's law. Ohm's law states that the current through a conductor between two points is directly proportional to the voltage across the two points, provided the temperature remains constant.

• The V-I graph of a material following Ohm's law is a straight line passing through the origin.

• Material A: The graph is a straight line passing through the origin and inclined at 20º to the current I axis, indicating that it follows Ohm's law.

• Material B: The graph is a straight line passing through the origin and inclined at 60º to the current I axis, also indicating that it follows Ohm's law.

• The different inclinations represent different resistances, with Material A having a lower resistance (less steep graph) compared to Material B (steeper graph).

Additional Information

• Ohm's law is mathematically expressed as V = IR, where V is the voltage, I is the current, and R is the resistance.

• The slope of the V-I graph represents the resistance (R) of the material.

• A steeper slope indicates a higher resistance, while a gentler slope indicates a lower resistance.

• Ohm's law is fundamental in understanding electrical circuits and is widely used in various applications of electrical engineering.

Q87. Answer: (a) 5

The correct answer is 5

Key Points

• The solution turns blue litmus red, indicating that the solution is acidic.

• Acidic solutions have a pH value less than 7.

• Among the given options, only option 1 (pH 5) is less than 7 and thus, correctly indicates an acidic solution.

Additional Information

• Litmus paper is a tool used to test whether a solution is acidic or basic.

• Blue litmus paper turns red under acidic conditions, while red litmus paper turns blue under basic or alkaline conditions.

• A pH value of 7 is considered neutral, values less than 7 indicate acidity, and values greater than 7 indicate alkalinity.

Q88. Answer: (b) 18 to 50 years

The correct answer is 18 to 50 years

Key Points

• 18 to 50 years is the age group of the people benefitted under the Pradhan Mantri Jeevan Jyoti Bima Yojana (PMJJBY) as of July 2022.

• PMJJBY is a government-backed life insurance scheme in India.

• It offers a renewable one-year term life cover of Rs. 2 lakh to all subscribing bank account holders.

• The scheme aims to increase the penetration of life insurance among the masses, especially the underprivileged and unorganized sector workers.

• The annual premium for the policy is very affordable, making it accessible to a large number of people.

Additional Information

• The scheme was launched by the Government of India on 9th May 2015.

• It is available to people in the age group of 18 to 50 years having a bank account.

• People who join the scheme before completing 50 years can continue to have the risk of life cover up to the age of 55 years upon payment of a premium.

• The premium amount is auto-debited from the insured's bank account.

• In case of the policyholder's death, the nominee will receive the death benefit.

• This scheme is part of the government's efforts to promote financial inclusion and social security.

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Q89. Answer: (d) 97.8%

Given:

Total production of rice in 2018 = 580 tonnes

Total production of beans in 2018 = 300 tonnes

Total production of rice in 2020 = 600 tonnes

Total production of beans in 2020 = 300 tonnes

Formula used:

Percentage = (Production in 2018 / Production in 2020) × 100

Calculation:

Total production in 2018 = 580 + 300 = 880 tonnes

Total production in 2020 = 600 + 300 = 900 tonnes

=> Percentage = (880 / 900) × 100

=> Percentage = 97.8%

Therefore The total production in 2018 is approximately 97.8% of the total production in

Q90. Answer: (a) 6 : 20

Given time: 5 : 40

Now,

For every mirror image based on a clock,

If it is 12 hrs clock, then subtract given timing from 11:60 hrs,

and if it is 24 hrs clock, then subtract given timing from 23:60 hrs.

here, it is 12-hour clock,

So, 11:60 - 5:40 = 6:20

Hence, the correct answer is "Option 1".

Q91. Answer: (b) Ramesh Powar

The correct answer is Ramesh Powar

Key Points

• Ramesh Powar was appointed as the Head Coach of the Indian Women's National Cricket Team in May 2021.

• Ramesh Powar is a former Indian cricketer and has previously served as the head coach of the Indian women's team.

• He replaced Woorkeri Raman, who was the head coach before him.

• Powar's appointment was made by the Board of Control for Cricket in India (BCCI).

Additional Information

• Ramesh Powar has also been a coach at the National Cricket Academy (NCA) in Bangalore.

• As a player, Powar was an off-spinner and played for the Indian national team in both Test and One-Day International (ODI) formats.

• His coaching career includes a stint with the Mumbai cricket team in domestic cricket.

• Powar's experience and previous success with the women's team were key factors in his reappointment.

Q92. Answer: (a) Rs. 3,918

Shortcut Trick

Ratio of investments of Lakshman and Bharath = 48,000 : 72,000 = 2 : 3.

Since the time period is same, Profit Ratio = Investment Ratio = 2 : 3.

Total units = 2 + 3 = 5 units.

5 units = Rs. 6,530 => 1 unit = 6,530 ÷ 5 = Rs. 1,306.

Bharath's share = 3 units = 3 × 1,306 = Rs. 3,918.

Therefore The correct answer is Rs. 3,918.

Alternate Method

Given: Lakshman's investment (I_L) = Rs. 48,000, Bharath's investment (I_B) = Rs. 72,000, Total Profit = Rs. 6,530.

Formula: Profit Share = Total Profit × (Individual Ratio ÷ Sum of Ratios)

=> Ratio of Lakshman to Bharath = 48,000 : 72,000 = 2 : 3.

=> Bharath's share = 6,530 × (3 ÷ (2 + 3))

=> Bharath's share = 6,530 × (3 ÷ 5)

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=> Bharath's share = 1,306 × 3 = 3,918.

Therefore The correct answer is Rs. 3,918.

Additional Information

Partnership Principle

In a partnership, the profit is distributed in the ratio of (Investment × Time). If time is constant, profit is proportional to investment.

Simple vs Compound Partnership

Simple partnership involves same time duration for all; Compound involves different time durations for different partners.

Q93. Answer: (a) Al

The correct answer is Al

Key Points

• Al (Aluminium) has a valency of 3.

• Valency is the ability of an atom to combine with other atoms, determined by the number of electrons that can be lost, gained, or shared in forming chemical bonds.

• Aluminium, being in Group 13 of the periodic table, has three valence electrons, which it can lose to form a +3 ion.

• This property makes Aluminium useful in various chemical reactions and industrial applications.

Additional Information

• S (Sulfur) typically has a valency of 2 or 6 depending on the compound it forms.

• C (Carbon) has a valency of 4.

• Mg (Magnesium) has a valency of 2.

• Understanding valency is crucial in predicting how elements will interact in chemical reactions.

Q94. Answer: (d) Centroid

Shortcut Trick

The point where all three medians of a triangle intersect is by definition the Centroid.

A median connects a vertex to the midpoint of the opposite side.

The Centroid always divides each median in the ratio 2 : 1.

Therefore The correct answer is Centroid.

Alternate Method

Given: A triangle with its medians intersecting at a single point.

Concept: In geometry, the concurrency point of different types of lines in a triangle has specific names (Centroid, Incentre, Orthocentre, Circumcentre).

=> A median is a line segment joining a vertex to the midpoint of the opposite side.

=> In the diagram, AD, BE, and CF are the three medians of ΔABC.

=> These medians are concurrent, meaning they all pass through a single point G.

=> This point of intersection G is called the Centroid.

Therefore The correct answer is Centroid.

Additional Information

Incentre

The point of intersection of the internal angle bisectors of a triangle. It is the center of the incircle.

Circumcentre

The point of intersection of the perpendicular bisectors of the sides of a triangle. It is the center of the circumcircle.

Orthocentre

The point of intersection of the altitudes (perpendiculars drawn from vertices to the opposite sides) of a triangle.

Euler Line

In any non-equilateral triangle, the Orthocentre, Centroid, and Circumcentre are collinear, and the Centroid divides the distance between the Orthocentre and Circumcentre in a 2 : 1 ratio.

Q95. Answer: (c) 32 cm

The correct answer is 32 cm

Key Points

• The distance of the focus from the pole of a concave mirror is known as the focal length (f).

• In a concave mirror, the distance from the pole to the center of curvature is twice the focal length.

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• Given that the focal length is 16 cm, the distance to the center of curvature will be 2 * 16 cm = 32 cm.

• Therefore, the center of curvature is at a distance of 32 cm from the pole of the concave mirror.

Additional Information

• The formula relating the focal length (f) and the radius of curvature (R) of a concave mirror is R = 2f.

• This formula is derived from the mirror equation and the geometry of spherical mirrors.

• Concave mirrors are used in various applications such as telescopes, headlights of vehicles, and shaving mirrors due to their ability to converge light.

• Understanding the properties of concave mirrors is essential in the study of optics and various practical applications in physics.

Q96. Answer: (c) Two

Given number: '6352897'

After arranged in ascending order:

Digits	6	3	5	2	8	9	7
Ascending order	2	3	5	6	7	8	9

After arranged in ascending order,

The position of digit 3 and 5 remains unchanged,

Hence, the correct answer is "Option 3".

Q97. Answer: (a) 15

Given: 58132745

If 1 is added to each odd digit and 1 is subtracted from each even digit:

• 5 (odd) + 1 = 6

• 8 (even) - 1 = 7

• 1 (odd) + 1 = 2

• 3 (odd) + 1 = 4

• 2 (even) - 1 = 1

• 7 (odd) + 1 = 8

• 4 (even) - 1 = 3

• 5 (odd) + 1 = 6

The new number is 67241836.

The digit which is second from the left: 7

The digit which is third from the right: 8

So, the sum of the digits which are second from the left and third from the right is:

→ 7 + 8 = 15.

The correct answer is "Option 1".

Q98. Answer: (d) 5 km

The correct answer is 5 km

Key Points

• A 5 km wide corridor will be formed along the river Ganga for the promotion of chemical-free natural farming.

• This initiative is part of the Union Budget of India for the fiscal year 2022-23.

• The corridor aims to enhance sustainable agricultural practices and protect the environment by reducing the use of chemical fertilizers and pesticides.

• Natural farming will help in improving soil health and fertility, ensuring better yield and quality of crops.

Additional Information

• The Union Budget 2022-23 focuses on various sectors including agriculture, infrastructure, and digital economy to drive holistic development.

• Natural farming is a method of farming that relies on natural processes such as composting, crop rotation, and biological pest control.

• This approach aligns with the government's vision of doubling farmers' income and promoting sustainable agriculture.

• The Ganga river basin is one of the most fertile and densely populated regions in India, making it a strategic choice for implementing natural farming practices.

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Q99. Answer: (c) mechanical, magnetic

The correct answer is mechanical, magnetic

Key Points

• Mechanical energy is used to rotate the conductor in an electric generator.

• The rotation occurs within a magnetic field to produce electricity.

• This process is fundamental to the working of many power generation systems, including those in power plants.

• The conversion of mechanical energy to electrical energy is a key principle in electromagnetic induction.

Additional Information

• Michael Faraday is credited with the discovery of electromagnetic induction, which is the working principle behind electric generators.

• Electric generators are essential in converting mechanical energy obtained from various sources such as steam turbines, water turbines, or internal combustion engines into electrical energy.

• The efficiency of an electric generator depends on several factors, including the strength of the magnetic field, the speed of rotation, and the design of the conductor coils.

• Modern electric generators are used in a wide range of applications, from small portable generators to large power plant generators.

Q100. Answer: (c) V1 : V2 : V3 = 1 : 2 : 3

The correct answer is V1 : V2 : V3 = 1 : 2 : 3

Key Points

• If a nichrome wire AB is divided into three parts, AC, CD, and DB with resistances in the ratio of 1 : 2 : 3, the potential drop across these sections will be proportional to their resistances.

• Since the resistances are in the ratio of 1 : 2 : 3, the potential drops V1, V2, and V3 across AC, CD, and DB respectively will also be in the same ratio.

• Therefore, the correct ratio of potential drops V1 : V2 : V3 is 1 : 2 : 3.

Additional Information

• The potential drop (V) across a resistor in a series circuit is directly proportional to the resistance (R) of that resistor.

• This principle is derived from Ohm's Law which states V = IR, where I is the current. Since the current (I) is the same through all resistors in series, V prop. to R.

• Nichrome is commonly used in heating elements due to its high resistivity and ability to withstand high temperatures.

• In practical applications, ensuring the correct ratio of resistances is crucial for the desired distribution of potential drops in a circuit.

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