RRB Group D Previous Year Paper (Held on: 29 Aug 2022 Shift 1)

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

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CBT

Q1. L, M, N, O, P, Q, R and S are sitting in a straight row, facing south. R and S are at the extreme ends of the row. O and Q are immediate neighbours. Only L sits between N and P. M sits to the immediate right of N. O sits to the immediate left of P. S sits to the immediate left of Q. Who sits to the immediate left of R?

(a) O
(b) P
(c) M
(d) Q

Q2. A decision is given followed by two statements I and II. Read all the information carefully and select the correct option.

Decision:

In many cities of Country S only hybrid cars are allowed in the centre of the city in order to control pollution. Following the same, Country M has also decided to implement this in some tier-I cities.

Statements:

I. Unlike Country S, public transport is not well connected in most of the tier-I cities in Country M.

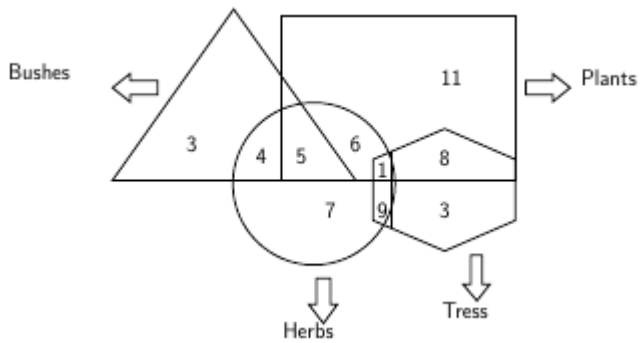
II. As per recent reports, the biggest contributor of pollution in Country M are transport trucks and two-wheelers.

(a) Statement I is a neutral statement and statement II strengthens the decision
(b) Statement I weakens the decision and statement II is a neutral statement
(c) Both statements I and II weaken the decision
(d) Both statements I and II strengthen the decision

Q3. The relationship between variable input and output, keeping all other inputs constant is called _____.

(a) law of variable proportions
(b) total product of variable input
(c) marginal product
(d) law of diminishing marginal product

Q4. Study the given diagram carefully and answer the question. The numbers in different sections indicate the number of things.



How many such trees are there that are also plants but NEITHER herbs NOR bushes?

(a) 9
(b) 1
(c) 8
(d) 3

Q5. If GCD(108, 36) = GCD(x, 72) then what is the minimum possible value of x?
(a) 72
(b) 24
(c) 12
(d) 36

Q6. Meenu alone can do a work in 16 days. Simi alone can do it in 12 days. If Raj joins them, they three together can complete the work in 4 days. How long will Raj alone take to finish the work?
(a) 48/5 days
(b) 12/7 days
(c) 23 days
(d) 111/2 days

Q7. In order to correct the situation of excess demand, which of the following monetary measures can be applied?
(A) Reduce repo rate.
(B) Reduce SLR.
(a) Only A
(b) Both A and B
(c) Neither A nor B
(d) Only B

Q8. Which of the following would not help a woman in starting her family planning?
(a) Smoking and drinking
(b) Maintaining a peaceful environment at home
(c) Consuming a high-protein diet
(d) Maintaining a healthy body weight

Q9. In which of the following states is the Pachmarhi Bio-reserve located?
(a) Punjab
(b) West Bengal
(c) Madhya Pradesh
(d) Odisha

Q10. If a person covers a distance of 90 km at a speed of 45 km/h and another distance of 150 km at a speed of 50 km/h, then his average speed for the whole journey is:
(a) 49 km/h
(b) 47 km/h
(c) 48 km/h
(d) 46 km/h

Q11. Which of the following forests is located in the state of Gujarat?
(a) Kukrail forest
(b) Molai forest
(c) Gir forest
(d) Vandalur forest

Q12. Analyze the prime factorization of 266805
(a) $3^3 \times 5^2 \times 7 \times 11^2$
(b) $3 \times 5 \times 7^3 \times 11^2$
(c) $3^2 \times 5 \times 7^2 \times 11^2$

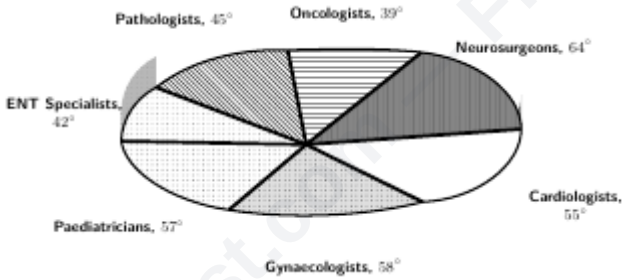
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(d) 3^4 × 5² × 7² × 11²

Q13. The Fundamental Duties were added in Constitution of India by which of the following amendments?

(a) 45^(th)
(b) 42^(nd)
(c) 43^(rd)
(d) 44^(th)

Q14. The given circle graph shows the specialists in a well-recognised private hospital during a particular year (in the form of central angle). Study the circle graph and answer the question.



If the total number of all the mentioned specialists during the year in the hospital was 120, then how many pathologists were there in the hospital?

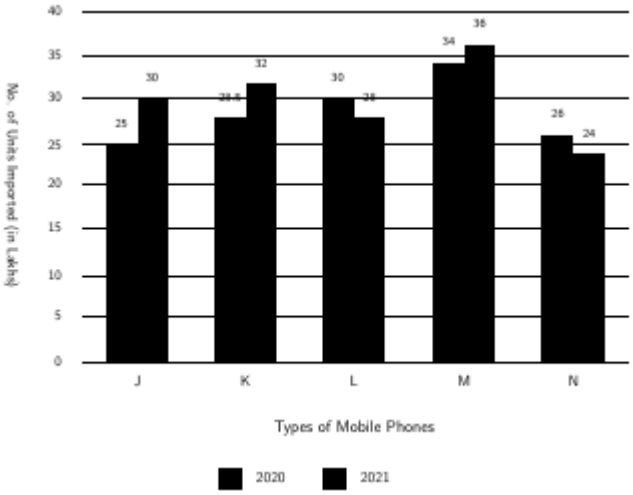
(a) 12
(b) 11
(c) 15
(d) 10

Q15. Which of the following numbers will replace the question mark (?) in the given series?

3, 8, 14, 30, 58, ?

(a) 118
(b) 122
(c) 116
(d) 120

Q16. The given bargraph shows the total number (in lakhs) of different types of mobile phones J, K, L, M and N imported by a company in 2020 & 2021. Study the bargraph and answer the questions.



No of Units Imported (in India)

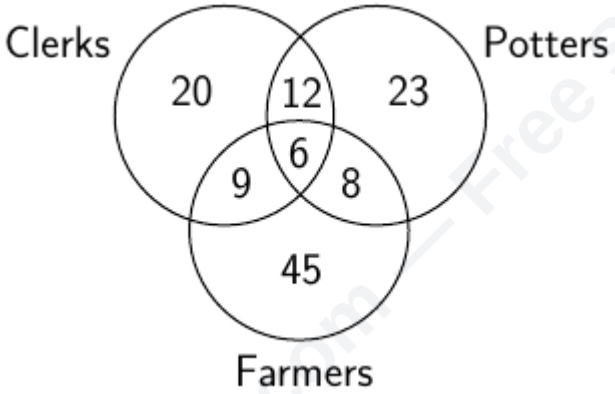
Types of mobile phone

Which of the following types of mobile phones had the least percentage change (increase or decrease) in imported mobile phones from 2020 to 2021?

(a) L
(b) M

(c) J
(d) N

Q17. Study the given diagram carefully and answer the questions. The numbers in different categories indicate the number of people in a family with different occupations.



How many clerks are there among the family members who are also potters?

(a) 20
(b) 12
(c) 48
(d) 18

Q18. Which of the following options is the closest approximate value which will come in place of question mark(?) in the following equation?

15.95 - 4.01 + 13.99 × 5.13 ?

(a) 82
(b) 77
(c) 75
(d) 80

Q19. Refer to the given letter, number and symbol series and answer the question that follows.

(Left) * Y S 2 # C 2 4 & 7 F & 2 @ R 4 € G 4 £ 9 (Right)

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

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

Q20. What is the excretory products of aquatic animals?

(a) Creatinine
(b) Ammonia
(c) Urea
(d) Uric acid

Q21. Select correct combination of mathematical signs to sequentially replace the @ signs and balance the following equation.

28 @ 7 @ 12 @ 6 @ 8

(a) ×, =, -, ÷
(b) ×, ÷, =, -
(c) ÷, ×, =, ×
(d) ÷, ×, =, -

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Q22. P, Q and R can do a piece of work in 9 days, 18 days and 12 days, respectively. They start the work, with P working on Day 1, Q working on Day 2 and R working on Day 3, and then continuing with this cycle till the work got is completed. How many days will be needed to complete this work in this manner?

(a) 12 days
(b) 15 days
(c) 16 days
(d) 11 days

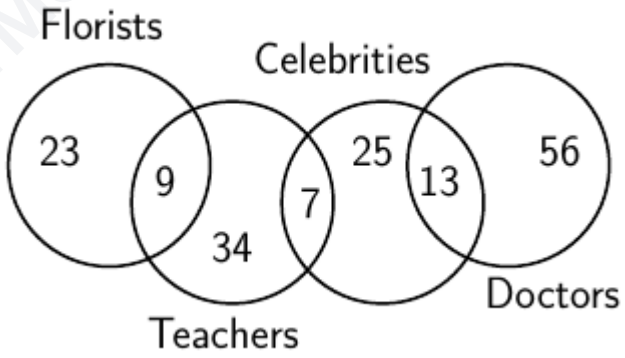
Q23. Second Online National Conference on 'Sickle Cell Disease' in India was organized by which Ministry in June 2021?

(a) Ministry of Tribal Affairs
(b) Ministry of AYUSH
(c) Ministry of Women and Child Development
(d) Ministry of Health and Family Welfare

Q24. Identify the language which is declared as a 'classical language' by the Government of India in the year 2004 from following?

(a) Sanskrit
(b) Odia
(c) Tamil
(d) Telugu

Q25. Study the given diagram carefully and answer the questions. The numbers in the different categories indicate the number of individuals.



How many people are there who are teachers and florists?

(a) 34
(b) 43
(c) 9
(d) 7

Q26. In which of the following situations will the potential difference induced in the coil be the maximum?

(a) A bar magnet moving with a speed of 2 m/s towards a stationary coil
(b) A coil moving with a speed of 2 m/s towards a stationary bar magnet
(c) A coil and a bar magnet moving in the same direction with the speed of 2 m/s.
(d) A coil and a bar magnet moving towards each other with the speed of 2 m/s.

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

Q27. Which of the following is true for a square?

a) All angles equal
b) All sides parallel
c) Diagonals equal

d) All sides equal

(a) a, c, d
(b) a, b
(c) a, b, c
(d) b, c, d

Q28. Which of the following has the maximum electrical resistivity?

Aluminium, Mercury, Glass, Manganin

(a) Aluminium
(b) Mercury
(c) Manganin
(d) Glass

Q29. Which of the following festivals is associated with the state of Odisha?

(a) Ambubachi
(b) Porag
(c) Raja Parba
(d) Pongtu

Q30. A dishonest shopkeeper claims to sell rice at the cost price of Rs. 95 per kg, but the weight he uses has 1 kg written on it, while it actually weighs 950 gms. The profit he thus earns on selling rice having an actual weight of 100 kg rice is:

(a) Rs. 475
(b) Rs. 375
(c) Rs. 275
(d) Rs. 500

Q31. Two coils, A and B, such that A is connected to a battery through a key and B is connected to a galvanometer, are arranged parallel and close to each other. During which of the following duration will the phenomenon of electromagnetic induction be observed?

(a) Two minutes after closing the key.

(b) During the interval the key is taken out.

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

Q32. Deficiency of which hormone is responsible for diabetes mellitus?

(a) Thyroxin
(b) Oxytocin
(c) Adrenalin
(d) Insulin

Q33. The value of $1/4 + 2/5 \div [\{21/5 - 2\} \times 5] - 2/3 \times 3/5$ is :

(a) 2/3
(b) 3/5
(c) 5/6
(d) 1/4

Q34. A beam of white light passes through a glass prism and a spectrum is obtained. The colour component that bends the least is _____.

(a) violet
(b) yellow
(c) red
(d) green

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Q35. Each of D, E, G, H, S, T, and Y has an exam on a different day of a week starting from Monday and ending on Sunday of the same week. G's exam is on one of the days before H. E has the exam on Thursday. Only two person have exams between S and E. D has the exam on the day immediately after S. T has the exam on the day immediately before Y, but not on Saturday. G does not have the exam on Sunday. Who among the following has the exam on Friday?

(a) Y
(b) H
(c) T
(d) G

Q36. If $a + b = 48$ and $ab = 56$, then what is the value of $a^3 + b^3$?

(a) 1,02,528
(b) 1,20,528
(c) 1,02,258
(d) 1,20,825

Q37. In which sport did the Indian men's team win a medal at the Olympics in 2021?

(a) Hockey
(b) Volleyball
(c) Football
(d) Handball

Q38. In Hinduism the god/goddess _____ was the integral form of the “Lord of Trees”, healer of disease and bestower of wealth.

(a) Yama
(b) Som
(c) Usha
(d) Varuni

Q39. If the roots of quadratic equation $(2 - p)x^2 + 2px - (p + 1) = 0$ are equal, then the value of p is:

(a) 2
(b) 1
(c) -2
(d) -1

Q40. _____ can be used for composting.

(a) Kitchen waste
(b) Medical waste
(c) E-waste
(d) Industrial waste

Q41. Sheena steps out from her apartment and walks 9 m towards the south. She takes a right turn and walks 43 m. She takes a right turn again and walks 38 m. Again, she takes a right turn and walks 43 m. She takes a right turn again and walks 12 m. Again, she takes a right turn again and walks 26 m. She then takes a left turn and walks 17 m. She takes a left turn again and walks 12 m to reach point A. How far and in which direction is point A from Sheena's apartment? (All turns are 90 degree turns only)

(a) 14 m, West
(b) 17 m, East
(c) 17 m, West
(d) 14 m, East

Q42. Who has been awarded the Padma Shri in the year 2022 in the field of Science and Engineering?

(a) Dr. Belle Monappa Hegde
(b) Virender Gupta
(c) N.V.Ramana
(d) Subbanna Ayyappan

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Q43. A 200 W bulb is connected to a 220 V source. The current through the bulb is:

(a) 0.91 A
(b) 1.1 A
(c) 0.45 A
(d) 2.2 A

Q44. Find the sum of the roots of the quadratic equation $7x^2 + 28x + 1 = 0$.

(a) 1
(b) • 1/7
(c) -4
(d) 28

Q45. If 9 May 2016 was a Monday, then what day of the week was 2 September 2016?

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

Q46. Five boxes G, T, Y, R and U are placed one over the other but not necessarily in the same order. Exactly two boxes are placed between T and Y, but T is neither at the bottom nor at the top. What are the probable positions that T can take from the bottom?

(a) Third and Fourth
(b) First and Third
(c) Second and Fourth
(d) Second and Third

Q47. The ratio of milk to water in 10 litres of a mixture is 3 : 2. If this ratio is to be made 2 : 3, then the quantity of water to be added further to the mixture is:

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

Q48. The fraction equivalent to 0.4363636..... is:

(a) 24/55
(b) 42/99
(c) 236/99
(d) 42/100

Q49. Which of the following is a double-displacement reaction?

(a) $Fe(s) + CuSO_4 (aq) \rightarrow FeSO_4 (aq) + Cu (s)$
(b) $Pb(s) + CuCl_2 (aq) \rightarrow PbCl_2 (aq) + Cu (s)$
(c) $Zn(s) + CuSO_4 (aq) \rightarrow ZnSO_4 (aq) + Cu (s)$
(d) $Na_2SO_4 (aq) + BaCl_2 (aq) \rightarrow BaSO_4 (s) + 2NaCl (aq)$

Q50. By what per cent does the curved surface area of a cylinder decrease, if the radius is increased by 10% and the height is decreased by 40%?

(a) 24.3%
(b) 20%
(c) 34%
(d) 51.6%

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Q51. 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**	**8**	**<**	**?**	**/**	**2**	**5**	**!**	**@**	**7**	**3**	**^**
Code	G	L	F	M	E	N	D	P	C	R	T	B	V	A

Conditions:

(i) If the first element is a symbol and the last a number, then the first and last elements are to be coded as C and ¥, respectively.

(ii) If the first element is an odd number and the last an even number, the codes for these two are to be interchanged.

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

How will '5 $ = 2 ^ 8' be coded?

(a) M L G P A C
(b) C L G P A ¥
(c) C L G P A M
(d) M G L P A C

Q52. Consider the below statements and identify the correct answer.

Statement - I: The chemical formula Washing soda is Na2CO3.

Statement - II: It is used for removing permanent hardness of water.

(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.

Q53. Which of the following metals are more reactive than hydrogen?

Mg, Zn, Hg, Ag, Sn, Pb, Au, Fe, Na

(a) Mg, Zn, Sn, Pb, Au, Na
(b) Mg, Zn, Sn, Pb, Fe, Na
(c) Mg, Zn, Hg, Pb, Fe, Na
(d) Mg, Zn, Ag, Pb, Fe, Na

Q54. Periodicity among elements in Newlands Octaves was observed up to _____ only.

(a) Co
(b) Cr
(c) Ca
(d) C

Q55. Subtract the sum of 2x - 3y + 7z and 4z - 5x from 12x - z

(a) 1x + 12y - 12z
(b) 4x + 7y
(c) 15x + 3y - 12z
(d) 3x + 3y - 3z

Q56. Which of the following is not a 3-tier Panchayati Raj system?

(a) Village Level Panchayat
(b) District Level Panchayat
(c) Block Level Panchayat
(d) Tehsil Level Panchayat

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Q57. A 2.5-cm-tall object is placed on the principal axis of a concave lens of focal length 16 cm, at a distance of 24 cm. The height of the image formed is _____.

(a) 2.0 cm
(b) 2.5 cm
(c) 1.0 cm
(d) 1.5 cm

Q58. Which of the identities given below is NOT true?

(a) $\tan^2\theta + \cot^2\theta = 1$
(b) $\sin^2\theta + \cos^2\theta = 1$
(c) $\text{cosec}^2\theta - \cot^2\theta = 1$
(d) $\sec^2\theta - \tan^2\theta = 1$

Q59. What is the order of K, L and M cells in terms of total number of electrons?

(a) L > M > K
(b) M > L > K
(c) K > M > L
(d) L > K > M

Q60. Which river originates at Mahabaleswar in Maharashtra, passes through Sangli and meets the sea in the Bay of Bengal at Hamasaladeevi in Andhra Pradesh?

(a) Godavari
(b) Tapti
(c) Narmada
(d) Krishna

Q61. Using $\pi = 22/7$, find the total surface area of a cylinder whose radius of base is 7 cm and height is 8 cm.

(a) 625 cm^2
(b) 665 cm^2
(c) 710 cm^2
(d) 660 cm^2

Q62. The population of a village was 4,00,000. It increased by 20% in the first year and increased by 30% in the second year. Its population after these two years is _____.

(a) 6,25,000
(b) 5,40,000
(c) 5,20,000
(d) 6,24,000

Q63. Who among the following is the head of Nuclear Command Authority, NITI Aayog, Appointments Committee of the Cabinet, Department of Atomic Energy, Department of Space and Ministry of Personnel, Public Grievances and Pensions?

(a) Prime Minister
(b) Vice President
(c) Chief Minister
(d) President

Q64. Which of the following terms will replace the question mark (?) and complete the given alpha-numeric series?

I2, J3, L7, O16, S32, ?

(a) W55
(b) X60
(c) X57
(d) Y60

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Q65. What causes migrating birds to travel to far-off lands?

(a) They fly to change their habitat.
(b) They fly to see their family.
(c) They fly to lay eggs.
(d) They fly to get some exercise.

Q66. Find the negative root of $3x^2 + 12x - 15 = 0$.

(a) x = 1
(b) x = -1
(c) x = 5
(d) x = -5

Q67. Without photosynthesis, _____ removal is the main exchange activity at night.

(a) water
(b) carbon dioxide
(c) hydrogen
(d) oxygen

Q68. The value of {(234^5 - 243^8 + 1/72)^(- 8)}^0 + 8 =

(a) 234
(b) 10
(c) 243
(d) 9

Q69. Which of the following terms define the Real National Income?

(a) GDP at factors price
(b) GDP at average price
(c) GDP at current amount
(d) GDP at constant price

Q70. What is the measurement of an ostrich egg?

(a) 170 µm × 130 µm
(b) 170 cm × 130 cm
(c) 170 m × 130 m
(d) 170 mm × 130 mm

Q71. A, B, C, D, E, F, G and H are sitting around a square table facing the centre of the table. Some of them are sitting at the corners, while some are sitting at the exact centre of the sides. E is sitting at one of the corners and to the immediate left of F and immediate right of A. H, G and C are exactly sitting opposite to E, A and F, respectively. D is sitting to the immediate right of C. Who among the following is sitting to the immediate right of B?

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

Q72. Which of the following movements is also known as the 'Salt Satyagraha'?

(a) Non-Cooperation Movement
(b) Quit India Movement
(c) Indian Self Rule Movement
(d) Civil Disobedience Movement

Q73. The Bharat Heavy Electricals Limited (BHEL) was incorporated in which year from following?

(a) 1960
(b) 1962
(c) 1964

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(d) 1958

Q74. The internal bisectors of angle B and angle C of ΔABC meet at D. If angle A = 75°, the angle BDC is:

(a) 102.5°
(b) 105.5°
(c) 112.5°
(d) 127.5°

Q75. The resistance of a wire of length L. and area of cross-section A is 0.2 Ω. The resistance of a wire of the same material, but of length 2L and area of cross-section 4A will be:

(a) 0.4 Ω
(b) 0.1 Ω
(c) 10 Ω
(d) 0.2 Ω

Q76. 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, 9, 4)

(25, 25, 5)

(a) (12, 16, 3)
(b) (15, 12, 7)
(c) (14, 10, 7)
(d) (20, 12, 10)

Q77. Which of the following numbers will replace the question mark (?) in the given series?

15, 21, 33, 51, 75,?

(a) 105
(b) 95
(c) 78
(d) 108

Q78. Amit steps out of his house and walks 76 m towards the north. He takes a right turn and walks 23 m. He takes a right turn again and walks 61 m. Then he takes a left turn and walks 20 m. Then he takes a right turn and walks 34 m. He takes a final right turn and walks 43 m to reach a library. How far and in which direction is the library from Amit's house? (All turns are 90 degree turns only)

(a) 34 m, South
(b) 34 m, North
(c) 19 m, North
(d) 19 m, South

Q79. If T denotes the sum of money, M denotes the number of years and P denotes the rate of interest, then the compound interest is given by:

(a) T(1 + P/100)^M - T
(b) M(1 + M/100)^P
(c) M(1 + T/100)^P - T
(d) T(1 + P/100)^M

Q80. In this question, a group of numbers/symbols is coded using letters as per table given below and the conditions which follow. The correct combination of codes following the condition is your answer.

Number/symbol	**3**	**#**	**4**	**7**	**@**	**%**		**2**	**!**	**?**	**5**	**8**	**$**	**9**
Code	S	F	T	J	D	G	E	X	V	W	K	U	P	M

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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 the last elements are to be coded as Ø.

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

How will '3 @ 2 % 8' be coded?

(a) Ø D X G Ø
(b) S D X G U
(c) S G V E U
(d) Ø G V E Ø

Q81. Which of the following is the first World Bank supported programme for minority welfare that is being implemented by the Ministry of Minority Welfare, Government of India?

(a) Nai Manzil
(b) Naya Savera
(c) Nai Udaan
(d) Padho Pardesh

Q82. In this question, the statement is followed by two conclusions. Which of the two conclusion(s) is/are true based on the given statement?

Statement: Z > G ≥ W < Y = V > L < N

Conclusions:

I. V < G

II. Z < W

(a) Only conclusion II is true
(b) Neither conclusion I nor II is true
(c) Only conclusion I is true
(d) Both conclusions I and II are true

Q83. Shreya adds some calcium hydroxide in a test tube containing concentrated sulphuric acid. The main product of the reaction will be:

(a) calcium hydroxide
(b) calcium chloride
(c) calcium sulphate
(d) calcium acetate

Q84. Find the median of the given frequency distribution.

Class Interval	0-10	10-20	20-30	30-40	40-50
f	10	8	7	9	12

(a) 250/7
(b) 150/7
(c) 190/7
(d) 290/7

Q85. If each letter of the word 'ABDUCT' is arranged in English alphabetical order, how many letter positions will remain unchanged?

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

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Q86. The number of σ-bonds, π-bonds and the total bonds in benzene molecule, respectively, are:

(a) 6, 3, 15
(b) 6, 6, 12
(c) 6, 6, 18
(d) 12, 3, 15

Q87. Professor Narayan Pradhan has been selected for the 31^(st) GD Birla Award as of March 2022 for the Scientific Research for his major contribution in the field of _____.

(a) astrophysics
(b) environmental biology
(c) mathematical modelling
(d) material sciences

Q88. This question is based on the five, three-digit numbers given below.

(Left) 248 382 425 127 335 (Right)

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

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

If 3 is added to the first digit of every number, in how many numbers will the first digit be exactly divisible by the second digit?

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

Q89. Which Indian player won the Swiss Open 2022?

(a) Srikanth Kidambi
(b) PV Sindhu
(c) Lakshya Sen
(d) Saina Nehwal

Q90. 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.

BLG : DHM

GMQ : IIW

(a) YPJ : ATP
(b) ULF : WGL
(c) CNH : EJN
(d) QDR : TZX

Q91. The total number of shared electrons in N2 are _____.

(a) 8
(b) 4
(c) 6
(d) 3

Q92. If the opposite angles of a cyclic quadrilateral are in the ratio 3 : 7, then the measure of the bigger angle among the two is.

(a) 126°
(b) 70°
(c) 105°
(d) 140°

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Q93. 1, 2, 3, 4, 5 and 6 are six cakes with different weights in a bakery. Only two cakes are heavier than 4. 2 is heavier than 1 but lighter than 6. 6 is lighter than 4. 3 is not the heaviest cake. Which of the following cakes is the heaviest?

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

Q94. The radius of curvature of a convex mirror is 15 cm. Following New Cartesian Sign Convention, the principal focus is located at x = _____.

(a) -7.5 cm
(b) 7.5 cm
(c) -15 cm
(d) 15 cm

Q95. Seven boxes, A, B, C, D, E, F and G, are kept one over the other, but not necessarily in the same order. G is kept fourth from the bottom and immediately below E and immediately above B. There are three boxes between C and F. D is kept at the bottom-most position. Which among the following can be the number of boxes kept between A and F?

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

Q96. Which of the following is/are NOT an endocrine gland in our body?

(a) Pituitary gland
(b) Salivary glands
(c) Adrenal gland
(d) Thyroid gland

Q97. 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)

(4, 50, 6)

(2, 18, 4)

(a) (12, 60, 5)
(b) (5, 62, 7)
(c) (2, 125, 3)
(d) (15, 162, 3)

Q98. A man brought some fruits at 14 for Rs. 30 and sold them at 7 for Rs. 20. What is his profit percentage?

(a) 36.33%
(b) 20%
(c) 30%
(d) 33.33%

Q99. If each digit of the number 243978615 is arranged in order of value from left to right, how many digits will remain unchanged relative to the original number?

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

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Q100. A convex mirror is made from a part of the surface of a sphere of radius 10.0 cm. Its principal focus will be at a distance of ..... from its pole.

(a) 5.0 cm
(b) 40.0 cm
(c) 10.0 cm
(d) 20.0 cm

ANSWER KEY

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

SOLUTIONS

Q1. Answer: (c) M

Given: L, M, N, O, P, Q, R and S are sitting in a straight row, facing south.

1) R and S are at the extreme ends of the row.

2) S sits to the immediate left of Q.

3) O and Q are immediate neighbours.

4) O sits to the immediate left of P.

5) Only L sits between N and P.

6) M sits to the immediate right of N.

Thus, according to the final arrangement M sits to the immediate left of R.

Hence, "Option 3" is the correct answer.

Q2. Answer: (c) Both statements I and II weaken the decision

Given,

Decision:

In many cities of Country S only hybrid cars are allowed in the centre of the city in order to control pollution. Following the same, Country M has also decided to implement this in some tier-I cities.

Statements:

I. Unlike Country S, public transport is not well connected in most of the tier-I cities in Country M - Weakens the decision (Because, if public transport is not well connected, restricting cars to only hybrid ones might cause inconvenience to the public and may not be as effective in controlling pollution).

II. As per recent reports, the biggest contributor of pollution in Country M are transport trucks and two-wheelers - Weakens the decision (Because, if the main contributors to pollution are transport trucks and two-wheelers, focusing on hybrid cars alone may not significantly reduce pollution levels).

So, Both statements I and II weaken the decision.

Hence, the correct answer is "Option 3".

Q3. Answer: (a) law of variable proportions

The correct answer is law of variable proportions

Key Points

• Law of variable proportions explains the relationship between variable input and output, keeping all other inputs constant.
• This law is crucial in the short-run production analysis where one input is variable while others are fixed.
• It highlights how output changes when the quantity of one input is varied, holding other inputs constant.
• The law is divided into three stages: increasing returns, diminishing returns, and negative returns.
• Understanding this law helps businesses optimize resource allocation and maximize production efficiency.

Additional Information

• The total product of a variable input is the total output produced by varying the quantity of the input.
• Marginal product refers to the additional output produced by using an extra unit of the variable input.
• The law of diminishing marginal product states that as more units of a variable input are added, the additional output (marginal product) eventually declines.
• These concepts are fundamental in microeconomics and help in understanding production functions and cost structures.

Q4. Answer: (c) 8

According to the given Venn diagram:

The shaded region represents the trees are there that are also plants but neither herbs nor bushes.

So, the trees are there that are also plants but neither herbs nor bushes = '8'

Hence, the correct answer is "Option 3".

Q5. Answer: (d) 36

Shortcut Trick

Step 1: Calculate GCD(108, 36). Since 108 is a multiple of 36 (36 × 3 = 108), the GCD is 36.

Step 2: We need GCD(x, 72) = 36.

Step 3: For GCD(x, 72) to be 36, x must be a multiple of 36.

Step 4: The smallest positive multiple of 36 is 36 itself.

Therefore The correct answer is 36.

Alternate Method

Given:

GCD(108, 36) = GCD(x, 72)

Formula Used:

GCD (Greatest Common Divisor) is the largest positive integer that divides each of the integers.

Calculations:

=> 108 = 36 × 3

=> 36 = 36 × 1

=> GCD(108, 36) = 36

=> Now, we have GCD(x, 72) = 36

=> This implies 36 must divide x, and GCD(x/36, 72/36) = 1

=> GCD(x/36, 2) = 1

=> For x to be minimum, let x/36 = 1

=> x = 36 × 1 = 36

Therefore The correct answer is 36.

Additional Information

Relation between GCD and LCM

For any two numbers a and b, GCD(a, b) × LCM(a, b) = a × b.

GCD of Multiple Numbers

If a is a divisor of b, then GCD(a, b) = a.

Co-prime Numbers

Two numbers are said to be co-prime if their GCD is 1.

Q6. Answer: (a) 48/5 days

Shortcut Trick

Assume Total Work = LCM(16, 12, 4) = 48 units.

Meenu's efficiency = 48 ÷ 16 = 3 units/day.

Simi's efficiency = 48 ÷ 12 = 4 units/day.

Combined efficiency (Meenu + Simi + Raj) = 48 ÷ 4 = 12 units/day.

Raj's efficiency = 12 − (3 + 4) = 5 units/day.

Time taken by Raj = 48 ÷ 5 days.

Therefore The correct answer is 48/5 days.

Alternate Method

Given:

Time taken by Meenu = 16 days

Time taken by Simi = 12 days

Time taken by Meenu, Simi, and Raj together = 4 days

Person	Days	Total Work	Efficiency
Meenu	16	48	3
Simi	12	4	
Meenu + Simi + Raj	4	12	

Calculations:

=> Total efficiency of Meenu, Simi, and Raj = 12

=> Efficiency of Raj = (Efficiency of all three) − (Efficiency of Meenu + Efficiency of Simi)

=> Efficiency of Raj = 12 − (3 + 4)

=> Efficiency of Raj = 12 − 7 = 5 units/day

=> Time taken by Raj alone = Total Work ÷ Raj's Efficiency

=> Time = 48 ÷ 5 days

Therefore The correct answer is 48/5 days.

Additional Information

Efficiency and Time Relationship

Efficiency is inversely proportional to the time taken to complete a work. If a person finishes work in D days, their efficiency is 1/D per day.

Combined Work Formula

For three people with individual times A, B, and C, the combined time T is given by 1/T = 1/A + 1/B + 1/C.

Work and Wages

Wages are generally distributed in the ratio of the efficiencies of the workers if they work for the same amount of time.

Q7. Answer: (c) Neither A nor B

The correct answer is Neither A nor B

Key Points

• Excess demand in an economy can lead to inflationary pressures.

• Monetary measures to correct excess demand typically involve tightening the money supply.

• Reducing the repo rate (Option A) would make borrowing cheaper, potentially increasing demand further, which is not desirable in a situation of excess demand.

• Reducing the SLR (Statutory Liquidity Ratio) (Option B) would increase the funds available with banks to lend, again potentially increasing demand.

• Therefore, neither reducing the repo rate nor reducing the SLR would help in correcting the situation of excess demand.

Additional Information

• To correct excess demand, the central bank might consider increasing the repo rate or increasing the SLR, which would reduce the money supply and help in controlling inflation.

• Other measures such as increasing the Cash Reserve Ratio (CRR) or conducting open market operations (selling government securities) can also be employed to reduce excess liquidity in the economy.

Q8. Answer: (a) Smoking and drinking

The correct answer is Smoking and drinking

Key Points

• Smoking and drinking can have detrimental effects on a woman's reproductive health and overall well-being, making it harder for her to start family planning effectively.

• Maintaining a peaceful environment at home, consuming a high-protein diet, and maintaining a healthy body weight are all

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positive steps that can support a woman in her family planning journey.

• Smoking and drinking are known to negatively impact fertility and can lead to complications during pregnancy.

Additional Information

• Family planning involves making informed decisions about the number and spacing of children, including the use of contraception and other reproductive health services.

• Healthy lifestyle choices, such as avoiding smoking and excessive alcohol consumption, play a critical role in improving reproductive health and increasing the chances of a successful pregnancy.

• It's important for women to have access to accurate information and healthcare services to support their family planning goals.

Q9. Answer: (c) Madhya Pradesh

The correct answer is Madhya Pradesh

Key Points

• The Pachmarhi Bio-reserve is located in the state of Madhya Pradesh, India.

• It is a UNESCO World Heritage Site and is home to a diverse range of plant and animal life.

• The bio-reserve includes the Satpura National Park, which is home to a variety of mammals, including tigers, leopards, bears, and deer.

• The bio-reserve also includes the Bori Wildlife Sanctuary, which is home to a variety of birds, including the great Indian bustard.

• The Pachmarhi Bio-reserve is a popular tourist destination and is known for its beautiful scenery and rich biodiversity.

Q10. Answer: (c) 48 km/h

Shortcut Trick

Total Distance = 90 + 150 = 240 km

Total Time = (90 ÷ 45) + (150 ÷ 50) = 2 + 3 = 5 hours

Average Speed = Total Distance ÷ Total Time = 240 ÷ 5 = 48 km/h

Therefore The correct answer is 48 km/h.

Alternate Method

Given:

Distance1 = 90 km, Speed1 = 45 km/h

Distance2 = 150 km, Speed2 = 50 km/h

Formula Used:

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

Time = Distance ÷ Speed

Calculations:

=> Time taken for first part (t1) = 90 ÷ 45 = 2 hours

=> Time taken for second part (t2) = 150 ÷ 50 = 3 hours

=> Total Distance = 90 + 150 = 240 km

=> Total Time = 2 + 3 = 5 hours

=> Average Speed = 240 ÷ 5 = 48 km/h

Therefore The correct answer is 48 km/h.

Additional Information

Average Speed for Equal Distances

If two equal distances are covered at speeds u and v, then Average Speed = (2 × u × v) ÷ (u + v).

Average Speed for Equal Time Intervals

If a person travels at speed u for time 't' and speed v for the same time 't', then Average Speed = (u + v) ÷ 2.

Unit Conversion

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

Q11. Answer: (c) Gir forest

The correct answer is Gir forest

Key Points

• Gir forest is located in the state of Gujarat.

• It is the only natural habitat of Asiatic lions in the world.

• The forest is part of the larger Gir National Park and Wildlife Sanctuary, established in 1965.

• Gir forest covers a total area of approximately 1,412 square kilometers.
• The region is also home to a variety of other wildlife, including leopards, antelopes, and numerous bird species.

Additional Information

• Kukrail forest is located in Uttar Pradesh and is known for its crocodile nursery.
• Molai forest is an artificial forest located in Assam, created by Jadav Payeng.
• Vandalur forest is located in Tamil Nadu and is famous for the Arignar Anna Zoological Park.
• Gujarat is a state on the western coast of India with a rich cultural and historical heritage.
• The Gir forest is a significant conservation area and attracts numerous tourists and wildlife enthusiasts.

Q12. Answer: (c) $3^2 \times 5 \times 7^2 \times 11^2$

Shortcut Trick

Check divisibility of 266805 by prime numbers.

Sum of digits: 2+6+6+8+0+5 = 27. Divisible by 9 (3^2).

Ends in 5: Divisible by 5 once (266805 ÷ 5 = 53361).

53361 ÷ 9 = 5929. √5929 = 77 (7 × 11).

Therefore The correct answer is $3^2 \times 5 \times 7^2 \times 11^2$.

Alternate Method

Given: Number = 266805

Step-by-step factorization:

=> 266805 ÷ 5 = 53361

=> 53361 ÷ 3 = 17787

=> 17787 ÷ 3 = 5929

=> 5929 ÷ 7 = 847

=> 847 ÷ 7 = 121

=> 121 ÷ 11 = 11

=> 11 ÷ 11 = 1

Combining the factors:

=> 266805 = 3 × 3 × 5 × 7 × 7 × 11 × 11

=> 266805 = $3^2 \times 5^1 \times 7^2 \times 11^2$

Therefore The correct answer is $3^2 \times 5 \times 7^2 \times 11^2$.

Additional Information

Fundamental Theorem of Arithmetic

Every composite number can be expressed as a unique product of primes, regardless of the order of the factors.

Divisibility Rule for 3 and 9

A number is divisible by 3 or 9 if the sum of its digits is divisible by 3 or 9 respectively.

Prime Factorization Method

Successive division by the smallest prime numbers (2, 3, 5, 7, 11...) until the quotient becomes 1.

Q13. Answer: (b) 42^(nd)

The correct answer is 42nd

Key Points

• The Fundamental Duties were added to the Constitution of India by the 42nd Amendment Act in 1976.
• This amendment added a new part, Part IVA, to the Constitution, which consists of a single article, Article 51A.
• Article 51A lists ten fundamental duties for Indian citizens, which include respecting the Constitution, the national flag, and the national anthem, and promoting harmony and the spirit of common brotherhood.
• The idea of Fundamental Duties was borrowed from the Constitution of the former Soviet Union.
• The inclusion of Fundamental Duties aimed to remind citizens that while they enjoy rights, they also have duties to perform.

Additional Information

• The 42nd Amendment is also known as the "Mini-Constitution" due to its wide-ranging changes to the Constitution.
• This amendment also brought about significant changes in the Preamble, the Seventh Schedule, and various other parts of the Constitution.
• The Fundamental Duties are not enforceable by law, but they serve as a constant reminder to citizens of their responsibilities.
• Originally, there were ten fundamental duties; an eleventh duty was added by the 86th Amendment Act in 2002, which obligates

parents to provide education to their children between the ages of 6 and 14 years.

Q14. Answer: (c) 15

Given:

Total number of specialists = 120

Central angle for pathologists = 45^o

Total angle = 360^o

Formula used:

Number of pathologists = (Angle for pathologists / Total angle) × Total number of specialists

Calculation:

=> Number of pathologists = (45 / 360) × 120

=> Number of pathologists = 15

Therefore The number of pathologists in the hospital is 15.

Q15. Answer: (a) 118

The logic followed here is:

Hence, "Option 1" is the correct answer.

Q16. Answer: (b) M

Given:

No. of units imported (in lakhs) for different types of mobile phones J, K, L, M, and N in 2020 and 2021.

J: 25 (2020), 30 (2021)

K: 32 (2020), 28.5 (2021)

L: 30 (2020), 28 (2021)

M: 34 (2020), 36 (2021)

N: 26 (2020), 24 (2021)

Formula used:

Percentage Change = ((New Value - Old Value) / Old Value) × 100

Calculation:

For J: => ((30 - 25) / 25) × 100 = 20% increase

For K: => ((28.5 - 32) / 32) × 100 = -10.94% decrease

For L: => ((28 - 30) / 30) × 100 = -6.67% decrease

For M: => ((36 - 34) / 34) × 100 = 5.88% increase

For N: => ((24 - 26) / 26) × 100 = -7.69% decrease

Therefore The mobile phone type with the least percentage change is M, with a 5.88% increase.

Q17. Answer: (d) 18

According to the given Venn diagram:

The shaded region represents the clerks among the family members who are also potters: (12 + 6) => 18

So, the clerks among the family members who are also potters = '18'

Hence, the correct answer is "Option 4".

Q18. Answer: (a) 82

Given:

15.95 - 4.01 + 13.99 × 5.13 = ?

Formula used:

Basic arithmetic operations

Calculation:

15.95 - 4.01 + 13.99 × 5.13 = ?

Approximate value-

15.95 = 16, 13.99 = 14, 4.01 = 4 and 5.13 = 5

According to question,

15.95 - 4.01 + 13.99 × 5.13 = ?

=> 16 - 4 + 14 × 5 = ?

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=> 16 - 4 + 70 = ?

=> (16 + 70) - 4 = ?

=> 86 - 4 = ?

=> ? = 82

Therefore The correct answer is option (1).

Q19. Answer: (b) 3

Given: (Left) * Y S 2 # C 2 4 & 7 F & 2 @ R 4 € G 4 £ 9 (Right)

Now, according to the question:

Letters which is/are immediately preceded by a symbol and also immediately followed by a number.

So, the Needed pattern is Symbol - Letter - Number.

There are 3 Letters which are immediately preceded by a symbol and also immediately followed by a number.

Hence, the correct answer is 'Option 2'.

Q20. Answer: (b) Ammonia

The correct answer is Ammonia

Key Points

• Ammonia is the primary excretory product of aquatic animals.

• Aquatic animals, especially those living in freshwater, excrete ammonia directly into the surrounding water.

• This process is efficient for these animals because ammonia is highly soluble in water and can be easily diluted and removed from their bodies.

• Excreting ammonia requires less energy compared to converting it into other nitrogenous wastes like urea or uric acid.

Additional Information

• In contrast, terrestrial animals often convert ammonia into less toxic compounds such as urea or uric acid before excretion.

• Urea is excreted by mammals and some amphibians, while uric acid is excreted by birds, reptiles, and some insects.

• The conversion of ammonia to urea or uric acid requires additional energy but helps conserve water, which is crucial for survival in terrestrial environments.

• This adaptation is essential for maintaining osmotic balance and preventing dehydration in land-dwelling animals.

Q21. Answer: (c) ÷, ×, =, ×

Given : 28 @ 7 @ 12 @ 6 @ 8

According to the question, after replacing the signs :

Option 1): ×, =, -, ÷

28 @ 7 @ 12 @ 6 @ 8 => 28 × 7 = 12 - 6 ÷ 8

28 × 7 = 12 - 6 ÷ 8

196 = 12 - 0.75

196 ≠ 11.25 (LHS ≠ RHS)

Option 2): ×, ÷, =, -

28 @ 7 @ 12 @ 6 @ 8 => 28 × 7 ÷ 12 = 6 - 8

28 × 7 ÷ 12 = 6 - 8

28 × 0.58 = -2

16.24 ≠ -2 (LHS ≠ RHS)

Option 3): ÷, ×, =, ×

28 @ 7 @ 12 @ 6 @ 8 => 28 ÷ 7 × 12 = 6 × 8

28 ÷ 7 × 12 = 6 × 8

4 × 12 = 48

48 = 48 (LHS = RHS)

Option 4): ÷, ×, =, -

28 @ 7 @ 12 @ 6 @ 8 => 28 ÷ 7 × 12 = 6 - 8

28 ÷ 7 × 12 = 6 - 8

4 × 12 = -2

48 ≠ -2 (LHS ≠ RHS)

Hence, "Option 3" is the correct answer.

Q22. Answer: (a) 12 days

Shortcut Trick

Total Work (LCM of 9, 18, 12) = 36 units.

Efficiencies: P = 4, Q = 2, R = 3 units/day.

1 Cycle (P+Q+R) = 3 days = 4 + 2 + 3 = 9 units.

To finish 36 units: (36 ÷ 9) = 4 cycles.

Total time = 4 cycles × 3 days/cycle = 12 days.

Therefore The correct answer is 12 days.

Alternate Method

Given: Time taken by P = 9 days, Q = 18 days, R = 12 days.

Person	Days	Total Work	Efficiency
P	9	36	4
Q	18	2	
R	12	3	

The work is done in a cycle of 3 days where they work alternately:

=> Work done in Day 1 (P) = 4 units

=> Work done in Day 2 (Q) = 2 units

=> Work done in Day 3 (R) = 3 units

=> Total work in 1 cycle (3 days) = 4 + 2 + 3 = 9 units

=> Number of cycles required = Total Work ÷ Work per cycle

=> Number of cycles = 36 ÷ 9 = 4 cycles

=> Total days = 4 × 3 days = 12 days

Therefore The correct answer is 12 days.

Additional Information

Alternate Day Work

When people work on alternate days, calculate the work done in one complete rotation (cycle) and then divide the total work by this cycle sum.

LCM Method for Total Work

Total Work is assumed as the Least Common Multiple (LCM) of individual time periods to ensure efficiencies result in whole numbers.

Efficiency Formula

Efficiency = Total Work ÷ Time Taken. Total time to complete work = Total Work ÷ Combined Efficiency.

Q23. Answer: (a) Ministry of Tribal Affairs

The correct answer is Ministry of Tribal Affairs

Key Points

• The Second Online National Conference on 'Sickle Cell Disease' was organized by the Ministry of Tribal Affairs in June 2021.

• The conference aimed to address the challenges faced by tribal populations in India due to Sickle Cell Disease.

• It brought together experts, policymakers, and stakeholders to discuss strategies for better management and awareness of the disease.

• The Ministry of Tribal Affairs plays a crucial role in the welfare and development of tribal communities in India.

Additional Information

• Sickle Cell Disease is a genetic blood disorder that predominantly affects tribal populations in India.

• The disease leads to the production of abnormal hemoglobin, causing the red blood cells to assume a sickle shape and leading to various health complications.

• The Ministry of Tribal Affairs has been actively involved in screening, diagnosing, and providing medical support to individuals affected by Sickle Cell Disease.

• Collaborative efforts with other ministries and healthcare organizations are essential for a comprehensive approach to tackling this health issue.

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Q24. Answer: (c) Tamil

The correct answer is Tamil

Key Points

• Tamil was declared as a classical language by the Government of India in the year 2004.

• A classical language is recognized for its rich heritage and independent tradition, and Tamil meets these criteria with its ancient literature and historical significance.

• The status of a classical language provides financial assistance for setting up centers for its study and promotion, and for creating special awards for scholars of eminence.

• Other languages that have been declared classical include Sanskrit, Kannada, Telugu, Malayalam, and Odia.

Additional Information

• Sanskrit was the first language to be declared classical in 2005.

• The criteria for declaring a language as classical include its antiquity, a body of ancient literature, and the original literary tradition that is considered valuable heritage.

• The recognition of a language as classical aims to highlight and preserve the rich cultural and linguistic heritage of India.

• Languages declared as classical are eligible for two major annual international awards for scholars of eminence in classical Indian languages.

Q25. Answer: (c) 9

According to the given Venn diagram:

The shaded region represents the number of people who are teachers and florists.

So, the number of people who are teachers and florists = '9'

Hence, the correct answer is "Option 3".

Q26. Answer: (a) (d)

The correct answer is (d)

Key Points

• The maximum potential difference is induced in the coil when the relative speed between the coil and the bar magnet is the highest.

• In option (d), both the coil and the bar magnet are moving towards each other with a speed of 2 m/s each, resulting in a relative speed of 4 m/s.

• In options (a) and (b), the relative speed is 2 m/s as only one of the objects (coil or magnet) is moving.

• In option (c), both the coil and the bar magnet are moving in the same direction with the same speed of 2 m/s, resulting in a relative speed of 0 m/s.

• Therefore, the potential difference induced in the coil is maximum in option (d).

Additional Information

• According to Faraday's Law of Electromagnetic Induction, the induced electromotive force (EMF) in any closed circuit is equal to the negative of the time rate of change of the magnetic flux through the circuit.

• The relative motion between the coil and the magnet changes the magnetic flux through the coil, inducing a potential difference.

• Higher relative speeds result in a greater rate of change of magnetic flux and hence a higher induced potential difference.

Q27. Answer: (a) a, c, d

Shortcut Trick

A square is a regular quadrilateral with highly symmetric properties:

1. All angles equal: Each interior angle is exactly 90° (Statement a is true).

2. Diagonals equal: Both diagonals are equal in length (Statement c is true).

3. All sides equal: All four sides have the same length (Statement d is true).

4. Sides parallel: Only opposite sides are parallel. Adjacent sides are perpendicular, so 'all sides parallel' is false (Statement b is false).

Thus, statements a, c, and d are true.

Therefore The correct answer is a, c, d.

Alternate Method

Let ABCD be a square with side length a.

Let us evaluate each statement mathematically:

=> Statement a: All angles equal

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In a square, the sum of interior angles is 360°. Since it is a regular quadrilateral, each interior angle is:

=> angle A = angle B = angle C = angle D = 360° ÷ 4 = 90°.

Since all four angles are equal to 90°, this statement is true.

=> Statement b: All sides parallel

By definition, parallel lines never intersect. In a square:

=> AB is parallel to CD (AB || CD) and AD is parallel to BC (AD || BC).

However, adjacent sides intersect at a 90° angle (e.g., AB is perpendicular to BC). Therefore, all sides are not parallel to one another. This statement is false.

=> Statement c: Diagonals equal

Using the Pythagorean theorem in right-angled triangle ABC:

=> Diagonal AC = $\sqrt{(AB^2 + BC^2)} = \sqrt{(a^2 + a^2)} = a\sqrt{2}$

Similarly, in right-angled triangle ABD:

=> Diagonal BD = $\sqrt{(AD^2 + AB^2)} = \sqrt{(a^2 + a^2)} = a\sqrt{2}$

Since AC = BD = $a\sqrt{2}$, the diagonals are equal in length. This statement is true.

=> Statement d: All sides equal

A square is defined as a regular quadrilateral, which means it is equilateral:

=> AB = BC = CD = DA = a.

Since all four sides are equal in length, this statement is true.

=> Thus, statements a, c, and d are correct.

Therefore The correct answer is a, c, d.

Additional Information

Diagonals of a Square

The diagonals of a square are equal, bisect each other at right angles (90°), and bisect the interior angles into 45° angles.

Area and Perimeter Formulas

For a square of side length a and diagonal d, the Area = $a^2 = d^2 \div 2$, and the Perimeter = 4 × a.

Symmetry of a Square

A square has 4 lines of symmetry (2 diagonal lines and 2 lines passing through the midpoints of opposite sides) and rotational symmetry of order 4.

Q28. Answer: (d) Glass

The correct answer is Glass

Key Points

• Glass has the highest electrical resistivity among the given options.

• Electrical resistivity is a measure of how strongly a material opposes the flow of electric current.

• Materials with high resistivity are poor conductors of electricity.

• Glass is an insulator and has a much higher resistivity compared to metals like Aluminium and Mercury or alloys like Manganin.

Additional Information

• Aluminium and Mercury are metals with relatively low resistivity, making them good conductors of electricity.

• Manganin is an alloy with moderate resistivity, often used in precision resistors.

• Materials with high resistivity are often used as insulators to prevent unwanted flow of current.

• Understanding the electrical resistivity of materials is crucial in designing electrical and electronic systems.

Q29. Answer: (c) Raja Parba

The correct answer is Raja Parba

Key Points

• Raja Parba is a major festival celebrated in the state of Odisha.

• This festival is dedicated to the worship of the Earth Goddess and womanhood.

• It is a three-day-long festival marking the onset of the monsoon and the advent of the agricultural year.

• The first day is called Pahili Raja, the second day is Mithuna Sankranti, and the third day is Bhu Daaha or Basi Raja.

• During these days, women take a break from household work and enjoy various indoor and outdoor games.

Additional Information

• Odisha, formerly known as Orissa, is an eastern Indian state on the Bay of Bengal known for its tribal cultures and many ancient Hindu temples.

• The state is also famous for its classical dance form, Odissi, and its distinct cuisine.
• Other important festivals celebrated in Odisha include Durga Puja, Rath Yatra, and Makar Sankranti.
• Odisha's capital, Bhubaneswar, is often referred to as the "Temple City" of India.

Q30. Answer: (d) Rs. 500

Shortcut Trick
Profit per 1 kg claimed weight = Cost Price of (1000g − 950g) = Cost Price of 50g.
Profit on selling 950g actual weight = 50g Rice value.
For 100 kg (100,000g) of actual rice sold, profit = (50 ÷ 950) × Total Weight Value.
Effective Profit = (Error ÷ Actual Weight) × (Actual Weight × CP per unit).
Total Profit = (50 ÷ 950) × (100 × 95) = 500.
Therefore The correct answer is Rs. 500.
Alternate Method
Given → Cost Price (CP) = Rs. 95/kg, Claimed Weight = 1000g, Actual Weight = 950g.
Formulas: Profit = SP − CP | Profit% = (Error ÷ True Value − Error) × 100
=> The shopkeeper charges Rs. 95 for 950g but provides it as 1kg.
=> Actual Cost Price of 1 kg rice = Rs. 95.
=> Selling Price (SP) of 950g rice = Rs. 95 (since he claims to sell at CP).
=> CP of 950g rice = (95 ÷ 1000) × 950 = Rs. 90.25.
=> Profit on 950g = SP − CP = 95 − 90.25 = Rs. 4.75.
=> Total profit on 100 kg (actual weight) = (Profit on 950g ÷ 950) × 100,000.
=> Total profit = (4.75 ÷ 0.95) × 100 = 5 × 100 = 500.
Therefore The correct answer is Rs. 500.
Additional Information
Dishonest Dealer Concept
When a dealer sells at Cost Price but uses False Weight, Profit% = [Error ÷ (True Value − Error)] × 100.
Profit Calculation
Total Profit can be calculated by multiplying the Profit per unit by the Total units sold.

Q31. Answer: (b) Only (b)

The correct answer is Only (b)
Key Points
• Electromagnetic induction is observed when there is a change in the magnetic flux linked with a coil.
• In the given scenario, electromagnetic induction will not occur two minutes after closing the key because the system would have reached a steady state by then.
• However, during the interval when the key is taken out, there is a change in the current through coil A, which changes the magnetic flux linked with coil B, thus inducing a current in coil B.
• Therefore, the phenomenon of electromagnetic induction is observed only during the interval the key is taken out.
Additional Information
• Electromagnetic induction was discovered by Michael Faraday and is described by Faraday's Law of Induction.
• Faraday's Law states that the induced electromotive force in any closed circuit is equal to the rate of change of the magnetic flux through the circuit.
• This principle is the working mechanism behind many electrical devices such as transformers, inductors, and many types of electrical generators and motors.
• The direction of the induced current is given by Lenz's Law, which states that the induced current will flow in such a direction as to oppose the change in magnetic flux that produced it.
• This phenomenon is crucial in the functioning of various technologies, including power generation and electromagnetic braking systems.

Q32. Answer: (d) Insulin

The correct answer is Insulin
Key Points
• Insulin is a hormone produced by the pancreas that regulates glucose levels in the blood.
• Deficiency or ineffectiveness of insulin leads to diabetes mellitus, a condition characterized by high blood sugar levels.

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• There are two main types of diabetes mellitus: Type 1, where the body does not produce insulin, and Type 2, where the body does not use insulin effectively.

• Proper management of diabetes includes insulin therapy, dietary changes, and regular physical activity.

Additional Information

• Diabetes mellitus is a chronic condition that can lead to serious health complications such as heart disease, kidney failure, and nerve damage if not managed properly.

• Regular monitoring of blood sugar levels is crucial for individuals with diabetes to prevent complications.

• Research is ongoing to find better treatments and potential cures for diabetes mellitus.

Q33. Answer: (d) 1/4

Given:

The expression is:

1/4 + 2/5 ÷ [{21/5 - 2} × 5] - 2/3 × 3/5

Step 1: Simplify the mixed fraction:

21/5 = 11/5

So, the expression inside the curly brackets becomes:

11/5 - 2 = 11/5 - 10/5 = 1/5

Step 2: Multiply by 5:

1 / 5 × 5 = 1

Step 3: Substitute back into the expression:

1/4 + 2/5 ÷ 1 - 2/3 × 3/5

Step 4: Simplify the division and multiplication:

2/5 ÷ 1 = 2/5

2/3 × 3/5 = 6/15 = 2/5

Step 5: Now the expression becomes:

1/4 + 2/5 - 2/5

=> 1 / 4

Therefore The value of the expression is 1 /4.

Q34. Answer: (c) red

The correct answer is red

Key Points

• When a beam of white light passes through a glass prism, it gets dispersed into its constituent colors, forming a spectrum.

• The spectrum consists of the colors violet, indigo, blue, green, yellow, orange, and red (VIBGYOR), arranged in order of increasing wavelength.

• Among these colors, red light has the longest wavelength and bends the least when passing through the prism.

• Conversely, violet light has the shortest wavelength and bends the most.

• This bending of light occurs due to the phenomenon of refraction, where light changes its speed and direction when it passes from one medium to another.

Additional Information

• The dispersion of light by a prism is an example of how light can be separated into its component colors.

• This phenomenon was first explained by Sir Isaac Newton, who demonstrated that white light is composed of different colors.

• The refractive index of the prism material varies with the wavelength of light, causing different colors to bend by different amounts.

• In practical applications, prisms are used in devices like spectrometers and cameras to analyze and manipulate light.

Q35. Answer: (c) T

Given: Each of D, E, G, H, S, T, and Y has an exam on a different day of a week starting from Monday and ending on Sunday of the same week.

1) E has the exam on Thursday.

2) Only two person have exams between S and E.

3) D has the exam on the day immediately after S.

Weekdays	Person

Monday	S
Tuesday	D
Wednesday	
Thursday	E
Friday	
Saturday	
Sunday	

4) T has the exam on the day immediately before Y, but not on Saturday.

Weekdays	Person
Monday	S
Tuesday	D
Wednesday	
Thursday	E
Friday	T
Saturday	Y
Sunday	

5) G does not have the exam on Sunday.

6) G's exam is on one of the days before H.

Weekdays	Person
Monday	S
Tuesday	D
Wednesday	G
Thursday	E
Friday	T
Saturday	Y
Sunday	H

Thus, according to the final arrangement T's exam is on Friday.

Hence, "Option 3" is the correct answer.

Q36. Answer: (a) 1,02,528

Shortcut Trick

Use the algebraic identity: $a^3 + b^3 = (a + b)[(a + b)^2 - 3ab]$

Substitute the given values: $a^3 + b^3 = 48 \times [48^2 - 3 \times 56]$

=> $a^3 + b^3 = 48 \times [2304 - 168]$

=> $a^3 + b^3 = 48 \times 2136 = 1,02,528$

Therefore The correct answer is 1,02,528.

Alternate Method

Given:

Sum of numbers (a + b) = 48

Product of numbers (ab) = 56

Formula Used:

$(a + b)^3 = a^3 + b^3 + 3ab(a + b)$

Calculations:

=> $(48)^3 = a^3 + b^3 + 3 \times 56 \times 48$

=> $1,10,592 = a^3 + b^3 + 168 \times 48$

=> $1,10,592 = a^3 + b^3 + 8064$

=> $a^3 + b^3 = 1,10,592 - 8064$

=> $a^3 + b^3 = 1,02,528$

Therefore The correct answer is 1,02,528.

Additional Information

Sum of Cubes Identity

The factorized form is $a^3 + b^3 = (a + b)(a^2 - ab + b^2)$.

Difference of Cubes Identity

The factorized form is $a^3 - b^3 = (a - b)(a^2 + ab + b^2)$.

Square of a Binomial

$(a + b)^2 = a^2 + b^2 + 2ab$ and $(a - b)^2 = a^2 + b^2 - 2ab$.

Q37. Answer: (a) Hockey

The correct answer is Hockey

Key Points

• The Indian men's team won a bronze medal in Hockey at the Tokyo 2021 Olympics.

• This victory marked India's first Olympic medal in hockey since the 1980 Moscow Olympics, where they won gold.

• The Indian men's hockey team defeated Germany 5-4 in a thrilling match to secure the bronze medal.

• It was a historic moment as it ended India's 41-year wait for an Olympic medal in hockey.

• Players like Manpreet Singh, PR Sreejesh, and Harmanpreet Singh played crucial roles in this achievement.

Additional Information

• The 2021 Tokyo Olympics were held from July 23 to August 8, 2021, after being postponed from 2020 due to the COVID-19 pandemic.

• India sent a contingent of over 120 athletes to compete in various sports at the Tokyo Olympics.

• India's overall performance at the Tokyo 2021 Olympics was one of the best in its history, with a total of seven medals (1 gold, 2 silver, and 4 bronze).

• The Indian women's hockey team also performed admirably, finishing in fourth place after losing to Great Britain in the bronze medal match.

• Neeraj Chopra won India's first-ever gold medal in athletics, in the men's javelin throw event.

Q38. Answer: (b) Som

The correct answer is Som

Key Points

• Som is an integral deity in Hinduism, often associated with the moon and vegetation.

• Som is also known as the healer of diseases and bestower of wealth.

• In Hindu mythology, Som is considered the "Lord of Trees" and is revered for his healing properties and association with plant life.

• The god Som is also linked with the sacred Soma plant, which was used in ancient rituals and believed to have divine properties.

Additional Information

• Yama is the god of death in Hindu mythology.

• Usha is the goddess of dawn.

• Varuni is the goddess associated with water and wine.

Q39. Answer: (c) -2

Shortcut Trick

For a quadratic equation to have equal roots, the discriminant (D) must be zero.

Applying $D = b2 - 4ac = 0$ for $(2 - p)x2 + 2px - (p + 1) = 0$.

$(2p)2 - 4(2 - p)(-(p + 1)) = 0$

$4p2 + 4(2 - p)(p + 1) = 0 \Rightarrow p2 + (2p + 2 - p2 - p) = 0$

$p + 2 = 0 \Rightarrow p = -2$

Therefore The correct answer is −2.

Alternate Method

Given:

Quadratic Equation: $(2 - p)x^2 + 2px - (p + 1) = 0$

Coefficients: $a = (2 - p)$, $b = 2p$, $c = -(p + 1)$

Formula Used:

For equal roots: Discriminant $(D) = b^2 - 4ac = 0$

Calculations:

$\Rightarrow (2p)^2 - 4 \times (2 - p) \times [-(p + 1)] = 0$

$\Rightarrow 4p^2 + 4 \times (2 - p)(p + 1) = 0$

Dividing the entire equation by 4:

$\Rightarrow p^2 + (2 - p)(p + 1) = 0$

$\Rightarrow p^2 + (2p + 2 - p^2 - p) = 0$

$\Rightarrow p^2 - p^2 + p + 2 = 0$

$\Rightarrow p + 2 = 0$

$\Rightarrow p = -2$

Therefore The correct answer is -2.

Additional Information

Nature of Roots

The nature depends on $D = b^2 - 4ac$. If $D > 0$, roots are real and distinct. If $D = 0$, roots are real and equal. If $D < 0$, roots are imaginary.

Sum and Product of Roots

For $ax^2 + bx + c = 0$, Sum $= -b/a$ and Product $= c/a$.

Condition for Quadratic

The coefficient of x^2 must be non-zero ($a \neq 0$). In this case, $2 - p \neq 0 \Rightarrow p \neq 2$.

Q40. Answer: (a) Kitchen waste

The correct answer is Kitchen waste

Key Points

• Kitchen waste is organic and biodegradable, making it suitable for composting.

• Composting is the process of recycling organic matter, such as kitchen waste, into a valuable fertilizer that can enrich soil and plants.

• Items such as vegetable peels, fruit scraps, coffee grounds, and eggshells are common kitchen wastes that can be composted.

• Composting helps in reducing the amount of waste sent to landfills and decreases greenhouse gas emissions.

• It also improves soil structure, enhances nutrient content, and increases the soil's ability to retain water.

Additional Information

• Medical waste includes items like used needles, bandages, and surgical instruments, which are hazardous and cannot be composted.

• E-waste refers to discarded electronic appliances like computers, TVs, and phones, which contain harmful chemicals and are not suitable for composting.

• Industrial waste consists of materials produced by factories and industries, often containing chemicals and toxins, making them unsuitable for composting.

• Composting requires a balance of green (nitrogen-rich) and brown (carbon-rich) materials, moisture, and aeration to decompose effectively.

• Using compost in gardening and agriculture can reduce the need for chemical fertilizers and promote sustainable farming practices.

Q41. Answer: (a) 14 m, West

Given: All turns are 90 degree turns only

Sheena steps out from her apartment and walks 9 m towards the south.

She takes a right turn and walks 43 m.

She takes a right turn again and walks 38 m.

Again, she takes a right turn and walks 43 m.

She takes a right turn again and walks 12 m.

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Again, she takes a right turn again and walks 26 m.

She then takes a left turn and walks 17 m.

She takes a left turn again and walks 12 m to reach point A.

So, the distance between point A and Sheena's apartment is: (26 - 12) = 14 m

Thus, point A is 14 m away from Sheena's apartment in the west direction.

Hence, "Option 1" is the correct answer.

Q42. Answer: (d) Subbanna Ayyappan

The correct answer is Subbanna Ayyappan

Key Points

• Subbanna Ayyappan has been awarded the Padma Shri in the year 2022 in the field of Science and Engineering.

• The Padma Shri is the fourth highest civilian award in the Republic of India, awarded to citizens of India to recognize their distinguished contributions in various spheres of activity, including the Arts, Education, Industry, Literature, Science, Sports, Medicine, Social Service, and Public Affairs.

• Subbanna Ayyappan is renowned for his contributions to agricultural science and has been recognized for his significant work in this field.

• The award is announced annually on the occasion of Republic Day and is conferred by the President of India at ceremonial functions held at Rashtrapati Bhavan.

Additional Information

• The Padma Awards were instituted in the year 1954 and are announced every year on Republic Day, except for brief interruptions during the years 1978 and 1979 and 1993 to 1997.

• The awards are given in three categories: Padma Vibhushan (for exceptional and distinguished service), Padma Bhushan (for distinguished service of high order), and Padma Shri (for distinguished service in any field).

• The selection process for the Padma Awards is carried out by the Padma Awards Committee, constituted by the Prime Minister of India every year.

• Recommendations for Padma Awards can be made by the state governments, union territories, central ministries, institutions of excellence, and even individuals.

• Recipients of the Padma Awards are announced on the eve of Republic Day and are conferred the award by the President of India in a ceremonial function held at Rashtrapati Bhavan.

Q43. Answer: (a) 0.91 A

The correct answer is 0.91 A

Key Points

• The current through the bulb can be calculated using the formula: I = P / V, where I is the current, P is the power, and V is the voltage.

• Given the power of the bulb, P = 200 W, and the voltage source, V = 220 V.

• Substituting the values into the formula, we get: I = 200 W / 220 V = 0.91 A.

• Therefore, the correct answer is 0.91 A.

Additional Information

• Ohm’s Law: It states that the current through a conductor between two points is directly proportional to the voltage across the two points.

• In this problem, we used the power formula, which is derived from Ohm’s Law.

• Understanding these basic electrical principles is crucial for solving similar problems in physics and electrical engineering.

Q44. Answer: (c) -4

Shortcut Trick

For a quadratic equation of the form ax2 + bx + c = 0, the sum of the roots is always −b/a.

In the given equation 7x2 + 28x + 1 = 0, we have a = 7 and b = 28.

Sum of roots = −28 ÷ 7 = −4.

Therefore The correct answer is -4.

Alternate Method

Given:

Quadratic Equation: 7x2 + 28x + 1 = 0

Formula Used:

For a standard quadratic equation ax2 + bx + c = 0, the sum of the roots (α + β) is −b/a and the product of the roots (αβ) is c/a.

Calculations:

=> Comparing $7x^2 + 28x + 1 = 0$ with $ax^2 + bx + c = 0$:

=> $a = 7, b = 28, c = 1$

=> Sum of the roots = $-b \div a$

=> Sum of the roots = $-28 \div 7$

=> Sum of the roots = -4

Therefore The correct answer is -4.

Additional Information

Product of Roots

The product of the roots of a quadratic equation is calculated as c/a. For this equation, it would be 1/7.

Nature of Roots

The nature is determined by the Discriminant ($D = b^2 - 4ac$). If $D > 0$, the roots are real and unequal.

Quadratic Formula

Individual roots can be found using the formula $x = [-b \pm \sqrt{(b^2 - 4ac)}] \div 2a$.

Formation of Equation

If roots are known, the equation is $x^2 - (\text{Sum of Roots})x + (\text{Product of Roots}) = 0$.

Q45. Answer: (a) Friday

Given: 9 May 2016 was Monday.

Now,

May to September = 4 Months (May, June, July, August).

Days in each month:

May = 22 days (since we start from 9th May)

June = 30 days

July = 31 days

August = 31 days

September = 2 days

Total days = 22 + 30 + 31 + 31 + 2 = 116 days.

116 days → 116/7 = 16 weeks and 4 odd days.

Then, 2 September 2016 will be Monday + 4 = Friday.

Hence, the correct answer is "Option 1".

Q46. Answer: (c) Second and Fourth

Given: Five boxes G, T, Y, R and U are placed one over the other.

1) Exactly two boxes are placed between T and Y, but T is neither at the bottom nor at the top.

As position of rest of the boxes i.e. G, R, and U is not known yet therefore they can be positioned in any order.

Sr. no	Top	
	Case 1	Case 2
1	G / R / U	Y
2	T	G / R / U
3	G / R / U	G / R / U
4	G / R / U	T
5	Y	G / R / U
	Bottom	

Thus, according to the final arrangement, the probable positions that 'T' can take from the bottom are second and fourth.

Hence, "Option 3" is the correct answer.

Q47. Answer: (d) 5 litres

Shortcut Trick

Initial Ratio of Milk : Water = 3 : 2 (Total 5 units = 10 litres => 1 unit = 2 litres)

To make Milk constant (since only water is added), multiply Initial Ratio by 2 and Final Ratio (2 : 3) by 3.

New Initial Ratio = 6 : 4 (Total 10 units) | New Final Ratio = 6 : 9

Increase in Water = 9 − 4 = 5 units.

Since 10 units = 10 litres, then 5 units = 5 litres.

Therefore The correct answer is 5 litres.

Alternate Method

Given: Total volume = 10 litres, Initial Ratio (M:W) = 3 : 2, Final Ratio (M:W) = 2 : 3.

Calculations:

=> Initial Quantity of Milk = (3 / 5) × 10 = 6 litres

=> Initial Quantity of Water = (2 / 5) × 10 = 4 litres

=> Let the Water added be x litres.

=> New Milk : New Water = 6 : (4 + x) = 2 : 3

=> 6 / (4 + x) = 2 / 3

=> 18 = 2 × (4 + x)

=> 18 = 8 + 2x

=> 2x = 10

=> x = 5

Therefore The correct answer is 5 litres.

Additional Information

Ratio Constant Property

When one component is added to a mixture, the quantity of the other component remains unchanged. Use this to equate parts in shortcut methods.

Compound Ratio

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

Rule of Alligation

Used to find the proportion in which two or more ingredients at a given price/ratio are mixed to produce a mixture of a specified price/ratio.

Q48. Answer: (a) 24/55

Given:

The fraction equivalent to 0.4363636..... is:

Formula used:

Let x = 0.4363636...

Calculation:

Let x = 0.4363636...

=> 100x = 43.6363636...

Subtracting the first equation from the second:

=> 100x - x = 43.6363636... - 0.4363636...

=> 99x = 43.2

=> x = 43.2 / 99

=> x = 432 / 990

=> x = 24 / 55

Therefore The correct answer is option (1).

Q49. Answer: (d) Na_2SO_4 (aq) + $BaCl_2$ (aq) → $BaSO_4$ (s) + 2NaCl (aq)

The correct answer is Na_2SO_4 (aq) + $BaCl_2$ (aq) → $BaSO_4$ (s) + 2NaCl (aq)

Key Points

• Option 4 represents a double-displacement reaction.

• In a double-displacement reaction, two compounds exchange ions to form two new compounds.

• The reaction Na_2SO_4 (aq) + $BaCl_2$ (aq) → $BaSO_4$ (s) + 2NaCl (aq) involves the exchange of ions between Na_2SO_4 and $BaCl_2$.

• This results in the formation of $BaSO_4$, a solid precipitate, and NaCl, which remains in the aqueous phase.

• Such reactions are also known as metathesis reactions and are characterized by the formation of a precipitate, gas, or a weak electrolyte.

Additional Information

• Single-displacement reactions involve one element being displaced from a compound by another element.

• Examples of single-displacement reactions include options 1, 2, and 3, where a metal displaces another metal from its compound.

• In contrast, double-displacement reactions require the exchange of ions between two reacting compounds, as seen in option 4.

• Double-displacement reactions are common in precipitation reactions, neutralization reactions, and gas formation reactions.

Q50. Answer: (c) 34%

Shortcut Trick

Use the Successive Percentage formula: Net Change = a + b + (a × b)/100

Here, radius (r) increases by 10% (a = +10) and height (h) decreases by 40% (b = −40).

Net Change = 10 − 40 + (10 × (−40))/100 = −30 − 4 = −34%.

The negative sign indicates a decrease of 34%.

Therefore The correct answer is 34%.

Alternate Method

Given: Increase in radius = 10%, Decrease in height = 40%.

Formula Used: Curved Surface Area (CSA) of cylinder = 2πrh

=> Let original radius = r and original height = h.

=> New radius (r') = 1.1r | New height (h') = 0.6h.

=> Initial CSA = 2πrh.

=> New CSA = 2π × (1.1r) × (0.6h) = 2πrh × 0.66.

=> Percentage decrease = [(Initial CSA − New CSA) ÷ Initial CSA] × 100.

=> Percentage decrease = [1 − 0.66] × 100 = 0.34 × 100 = 34%.

Therefore The correct answer is 34%.

Additional Information

Total Surface Area of Cylinder

It includes the curved area and the area of two circular bases: TSA = 2πr(h + r).

Volume of Cylinder

The space occupied by the cylinder: V = πr²h. If radius changes, the effect on volume is squared.

Successive Percentage for 3D

For volume changes involving three variables, apply the successive formula twice: result of (a, b) with c.

Q51. Answer: (a) M L G P A C

Given:

Number/Symbol	**$**	**6**	**8**	**<**	**?**	**/**	**2**	**5**	**!**	**@**	**7**	**3**	**^**
Code	G	L	F	M	E	N	D	P	C	R	T	B	V

Conditions:

1. If the first element is a symbol and the last a number, then the first and last elements are to be coded as C and ¥, respectively.

2. If the first element is an odd number and the last an even number, the codes for these two are to be interchanged.

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

Let's code '5 $ = 2 ^ 8':

Now: - The first element is 5 (odd number) and the last element is 8 (even number), so their codes should be interchanged according to condition

So, '5 $ = 2 ^ 8' will be coded as 'M L G P A C'

Hence, the correct answer is "Option 1".

Q52. Answer: (a) Both the statements are true.

The correct answer is Both the statements are true

Key Points

• Statement - I: The chemical formula for washing soda is Na2CO3. Washing soda, also known as sodium carbonate, is indeed represented by this chemical formula.

• Statement - II: Washing soda is used for removing permanent hardness of water. This is true because washing soda reacts with the calcium and magnesium ions in hard water to form insoluble precipitates, thereby softening the water.

• Therefore, both statements are correct.

Additional Information

• Washing Soda: It is commonly used in households for laundry purposes and can also be used in various industrial processes.

• Permanent Hardness of Water: It is caused by the presence of dissolved calcium and magnesium salts. Washing soda helps in precipitating these salts out of the water.

Q53. Answer: (b) Mg, Zn, Sn, Pb, Fe, Na

The correct answer is Mg, Zn, Sn, Pb, Fe, Na

Key Points

• Option 2 includes the metals Mg, Zn, Sn, Pb, Fe, Na, which are all more reactive than hydrogen.

• According to the reactivity series of metals, these metals are positioned above hydrogen, indicating higher reactivity.

• Metals like Hg, Ag, and Au, which are not included in Option 2, are less reactive than hydrogen.

Additional Information

• The reactivity series is a list of metals arranged in order of their reactivity from highest to lowest.

• Metals at the top of the series, such as Na (sodium) and Mg (magnesium), react more vigorously with water and acids compared to those lower in the series.

• Hydrogen is included in the reactivity series for comparison, even though it is a non-metal.

• Metals above hydrogen in the series can displace hydrogen from acids, whereas metals below hydrogen cannot.

Q54. Answer: (c) Ca

The correct answer is Ca

Key Points

• Newlands' Law of Octaves was one of the earliest attempts to classify the elements in a systematic way.

• This law stated that every eighth element had properties similar to the first element, much like the octaves in music.

• However, this periodicity was observed only up to Calcium (Ca).

• Beyond calcium, the elements did not follow the pattern predicted by Newlands' Octaves.

• Newlands' work was a precursor to the more comprehensive periodic table developed by Dmitri Mendeleev.

Additional Information

• John Newlands, an English chemist, proposed the Law of Octaves in 1864.

• His classification was based on the atomic weights of the elements known at that time.

• Despite its limitations, Newlands' work was important because it showed a periodic pattern among the elements, which was a significant step towards the development of the modern periodic table.

• Newlands' Octaves were initially met with skepticism by the scientific community but later gained recognition for their contribution to the field of chemistry.

Q55. Answer: (c) 15x + 3y - 12z

Shortcut Trick

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

Subtract this sum from the final expression: 12x − z − (−3x − 3y + 11z).

Change signs and simplify: 12x + 3x + 3y − z − 11z = 15x + 3y − 12z.

Therefore The correct answer is 15x + 3y − 12z.

Alternate Method

Given:

Expression 1: 2x − 3y + 7z

Expression 2: 4z − 5x

Target Expression: 12x − z

Calculations:

=> Step 1: Find the sum of (2x − 3y + 7z) and (4z − 5x)

=> Sum = (2x − 5x) + (−3y) + (7z + 4z)

=> Sum = −3x − 3y + 11z

=> Step 2: Subtract the sum from (12x − z)

=> Result = (12x − z) − (−3x − 3y + 11z)

=> Result = 12x − z + 3x + 3y − 11z

=> Result = (12x + 3x) + 3y + (−z − 11z)

=> Result = 15x + 3y − 12z

Therefore The correct answer is 15x + 3y − 12z.

Additional Information

Like Terms

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

Subtraction Rule

When subtracting an expression, reverse the sign of every term inside the parentheses: −(a − b + c) = −a + b − c.

BODMAS in Algebra

Always resolve the operations within the brackets first before performing the final subtraction from the target value.

Q56. Answer: (d) Tehsil Level Panchayat

The correct answer is Tehsil Level Panchayat

Key Points

• The 3-tier Panchayati Raj system in India consists of the following levels: Village Level Panchayat, Block Level Panchayat, and District Level Panchayat.

• The Village Level Panchayat is the grassroots level of the Panchayati Raj system.

• The Block Level Panchayat, also known as the Panchayat Samiti, functions at the intermediate level.

• The District Level Panchayat, also known as the Zila Parishad, operates at the district level.

• Tehsil Level Panchayat is not part of the 3-tier Panchayati Raj system.

Additional Information

• The Panchayati Raj system was introduced in India to decentralize governance and empower local self-government.

• The system was recommended by the Balwant Rai Mehta Committee in 1957 and was implemented through the 73rd Constitutional Amendment Act in 1992.

• The 73rd Amendment Act added Part IX to the Constitution titled "The Panchayats" and also added the Eleventh Schedule which contains 29 functional items for Panchayats.

• The objective of the Panchayati Raj system is to create a decentralized structure of governance where local bodies have the power and resources to plan and implement programs for economic development and social justice.

• Each level of the Panchayati Raj system is elected directly by the people, ensuring democratic participation at the grassroots level.

Q57. Answer: (c) 1.0 cm

The correct answer is 1.0 cm

Key Points

• A concave lens always forms a virtual, erect, and diminished image of an object placed in front of it.

• Given: Object height (h_o) = 2.5 cm, Object distance (u) = -24 cm, Focal length (f) = -16 cm.

• Using the lens formula: $1/f = 1/v - 1/u$

• Substitute the values: $1/(-16) = 1/v - 1/(-24)$

• Solving for v: v = -9.6 cm (image distance)

• Magnification (m) is given by: $m = h_i / h_o = v / u$

• Using the values: m = -9.6 / -24 = 0.4

• Image height (h_i) = m × h_o = 0.4 × 2.5 cm = 1.0 cm

Additional Information

• A concave lens is also known as a diverging lens because it spreads out light rays that are initially parallel.

• Concave lenses are used in various optical devices like glasses for correcting myopia (nearsightedness), cameras, and telescopes.

• The image formed by a concave lens is always smaller than the object, irrespective of the object's position.

Q58. Answer: (a) $\tan^2\theta + \cot^2\theta = 1$

Shortcut Trick

Standard Trigonometric Pythagorean Identities are fixed: $\sin^2\theta + \cos^2\theta = 1$, $\sec^2\theta - \tan^2\theta = 1$, and $\text{cosec}^2\theta - \cot^2\theta = 1$.

Option (1) states $\tan^2\theta + \cot^2\theta = 1$, which is mathematically impossible as tan and cot are reciprocals, and their sum of squares is always ≥ 2 for real θ.

Checking options (2), (3), and (4) shows they perfectly match the fundamental identities.

Therefore The correct answer is $\tan^2\theta + \cot^2\theta = 1$.

Alternate Method

Given: Trigonometric expressions involving squares of θ.

Formula Used: $p^2 + b^2 = h^2$ (Pythagoras Theorem)

=> Identity 1: $(p/h)^2 + (b/h)^2 = (p^2 + b^2)/h^2 = h^2/h^2 = 1 \rightarrow \sin^2\theta + \cos^2\theta = 1$ (True)

=> Identity 2: $(h/b)^2 - (p/b)^2 = (h^2 - p^2)/b^2 = b^2/b^2 = 1 \rightarrow \sec^2\theta - \tan^2\theta = 1$ (True)

=> Identity 3: $(h/p)^2 - (b/p)^2 = (h^2 - b^2)/p^2 = p^2/p^2 = 1 \rightarrow \text{cosec}^2\theta - \cot^2\theta = 1$ (True)

=> Testing (1): $\tan^2\theta + \cot^2\theta = (p/b)^2 + (b/p)^2$. This value varies with θ and is not constant 1.

Therefore The correct answer is $\tan^2\theta + \cot^2\theta = 1$.

Additional Information

Reciprocal Identities

The product of reciprocal ratios is always 1: $\sin\theta \times \text{cosec}\theta = 1$, $\cos\theta \times \sec\theta = 1$, and $\tan\theta \times \cot\theta = 1$.

AM-GM Inequality in Trig

For $\tan^2\theta$ and $\cot^2\theta$, the sum $\tan^2\theta + \cot^2\theta \geq 2\sqrt{(\tan^2\theta \times \cot^2\theta)}$, which means the minimum value is 2, never 1.

Complementary Angles

Functions change to their "co" ratios: $\sin(90° - \theta) = \cos\theta$, $\tan(90° - \theta) = \cot\theta$, and $\sec(90° - \theta) = \text{cosec}\theta$.

Q59. Answer: (b) M > L > K

The correct answer is M > L > K

Key Points

• The order of K, L, and M cells in terms of the total number of electrons is M > L > K.

• In an atom, the K shell can hold up to 2 electrons, the L shell can hold up to 8 electrons, and the M shell can hold up to 18 electrons.

• The capacity of electron shells follows the $2n^2$ rule, where n is the shell level (K=1, L=2, M=3, etc.).

• Therefore, the M shell, being the third shell, can accommodate more electrons than the L and K shells.

• This arrangement is crucial for understanding the electron configuration in atoms and their chemical behavior.

Q60. Answer: (d) Krishna

The correct answer is Krishna.

Key Points

• Krishna:

• It originates at Mahabaleswar in Maharashtra, passes through Sangli and meets the sea in the Bay of Bengal at Hamasaladeevi in Andhra Pradesh.

• After the Ganges and the Godavari, the Krishna River is the third-longest and fourth-largest river in India.

• Its length is 1,400 kilometers (870 mi). Approximately 258,948 square kilometers (99,980 sq mi) or 8% of India's total land area is made up of the Krishna River basin.

• The river provides a significant amount of water for power generation, irrigation, and drinking.

Additional Information

• Godavari:

• It is a river that flows through the states of Maharashtra, Telangana, Andhra Pradesh, Chhattisgarh, and Odisha in India.

• It is also known as Dakshin Ganga.

• It flows into Bay of Bengal.

• Narmada:

• It is a river that flows through the states of Madhya Pradesh, Maharashtra, and Gujarat in India.

• It flows into Arabian sea.

• Tapi:

• It is a central Indian river.

• It originates in the Eastern Satpura Range of southern Madhya Pradesh state.

• It flows in a westward direction, draining some important historic places like Madhya Pradesh's Nimar region, East Vidarbha region, and Maharashtra's Khandesh in the northwest corner of the Deccan Plateau and South Gujarat before draining into the Gulf of Cambay of the Arabian Sea.

• The River Basin of Tapi River lies mostly in the eastern and northern districts of Maharashtra state.

Q61. Answer: (d) 660 cm²

Shortcut Trick

For a cylinder with radius r = 7 cm, the circumference is 44 cm and base area is 154 cm².

Curved Surface Area (CSA) = Circumference × h = 44 × 8 = 352 cm².

Total Surface Area (TSA) = CSA + 2 × Base Area = 352 + 2 × 154 = 352 + 308 = 660 cm².

Therefore The correct answer is 660 cm².

Alternate Method

Given:

Radius (r) = 7 cm

Height (h) = 8 cm

π = 22/7

Formula Used:

Total Surface Area of Cylinder = 2πr(r + h)

Calculations:

=> TSA = 2 × (22/7) × 7 × (7 + 8)

=> TSA = 2 × 22 × 15

=> TSA = 44 × 15

=> TSA = 660 cm²

Therefore The correct answer is 660 cm².

Additional Information

Curved Surface Area (CSA)

The area of the side surface only, excluding the top and bottom circles. Formula: 2πrh

Volume of Cylinder

The total space occupied by the cylinder. Formula: πr²h

Hollow Cylinder TSA

For a cylinder with inner radius r and outer radius R, TSA = 2π(R + r)(h + R − r)

Q62. Answer: (d) 6,24,000

Shortcut Trick

Net percentage increase = a + b + (a × b)/100

Net increase = 20 + 30 + (20 × 30)/100 = 50 + 6 = 56%

Population after 2 years = 4,00,000 × 156/100 = 4,000 × 156 = 6,24,000

Therefore The correct answer is 6,24,000.

Alternate Method

Given: Initial population = 4,00,000 | Year 1 increase = 20% | Year 2 increase = 30%

=> Population after 1st year = 4,00,000 × (1 + 20/100)

=> Population after 1st year = 4,00,000 × 1.2 = 4,80,000

=> Population after 2nd year = 4,80,000 × (1 + 30/100)

=> Population after 2nd year = 4,80,000 × 1.3 = 6,24,000

Therefore The correct answer is 6,24,000.

Additional Information

Successive Percentage Change

When a value changes by x% and then by y% successively, the net change is given by [x + y + (xy/100)]%.

Population Depreciation

If the population decreases, use a negative sign for the percentage: Net Change = −x − y + (xy/100)%.

Fractional Method

20% = 1/5 (multiplier 6/5) and 30% = 3/10 (multiplier 13/10). Final = Initial × 6/5 × 13/10.

Q63. Answer: (a) Prime Minister

The correct answer is Prime Minister

Key Points

• The Prime Minister of India is the head of several important bodies including the Nuclear Command Authority, NITI Aayog,

Appointments Committee of the Cabinet, Department of Atomic Energy, Department of Space, and Ministry of Personnel, Public Grievances and Pensions.

• The Nuclear Command Authority is responsible for the command, control, and operational decisions regarding India's nuclear weapons program.

• The NITI Aayog serves as the policy think tank of the Government of India and provides both directional and policy inputs.

• The Appointments Committee of the Cabinet is responsible for appointments to several top posts under the Government of India.

• The Department of Atomic Energy and Department of Space are crucial for India's advancements in nuclear and space technologies, respectively.

• The Ministry of Personnel, Public Grievances and Pensions deals with personnel matters, especially those related to recruitment, training, career development, staff welfare, and post-retirement dispensation.

Additional Information

• The Prime Minister is appointed by the President of India and is usually the leader of the party that has a majority in the Lok Sabha.

• The Prime Minister plays a critical role in the governance and administration of the country, acting as the chief advisor to the President of India and the head of the Council of Ministers.

• As the head of the government, the Prime Minister is responsible for implementing laws and policies passed by the Parliament and for the overall administration of the executive branch.

Q64. Answer: (c) X57

The logic followed here is:

Hence, "Option 3" is the correct answer.

Q65. Answer: (c) They fly to lay eggs.

The correct answer is They fly to lay eggs.

Key Points

• Bird migration is primarily undertaken for breeding purposes.

• Many bird species migrate to find the best conditions and habitats for laying eggs and raising their young.

• Migrating to different regions allows birds to access abundant food resources and favorable climates that are essential for the growth and survival of their offspring.

• This behavior ensures that the young have a higher chance of survival due to the availability of optimal conditions.

Additional Information

• Bird migration is a complex phenomenon that involves long-distance travel, often covering thousands of kilometers.

• Different species of birds have specific migratory patterns and routes that they follow each year.

• Besides breeding, some birds also migrate to escape harsh weather conditions and to find better feeding grounds during different seasons.

• Advancements in technology, such as satellite tracking, have provided deeper insights into the migratory patterns and behaviors of various bird species.

Q66. Answer: (d) x = -5

Shortcut Trick

Simplify the quadratic equation by dividing by 3: $x^2 + 4x - 5 = 0$.

Find two numbers that multiply to −5 and add to 4, which are 5 and −1.

The roots are these numbers with their signs reversed: −5 and 1.

The question asks for the negative root, which is −5.

Therefore The correct answer is x = −5.

Alternate Method

Given: $3x^2 + 12x - 15 = 0$

Formula Used: Splitting the middle term (Factorization)

$\Rightarrow 3x^2 + 12x - 15 = 0$

$\Rightarrow 3(x^2 + 4x - 5) = 0$

$\Rightarrow x^2 + 5x - x - 5 = 0$

$\Rightarrow x(x + 5) - 1(x + 5) = 0$

$\Rightarrow (x + 5)(x - 1) = 0$

$\Rightarrow x + 5 = 0$ or $x - 1 = 0$

=> x = −5 or x = 1

The negative root of the equation is x = −5.

Therefore The correct answer is x = −5.

Additional Information

Nature of Roots

For any quadratic equation $ax^2 + bx + c = 0$, the discriminant $D = b^2 − 4ac$ determines if roots are real, equal, or imaginary.

Sum and Product of Roots

The sum of roots is equal to −b/a and the product of roots is equal to c/a.

Quadratic Formula

The roots can always be calculated using the formula $x = [−b ± √(b^2 − 4ac)] / 2a$.

Q67. Answer: (b) carbon dioxide

The correct answer is carbon dioxide

Key Points

• Without photosynthesis, carbon dioxide removal is the main exchange activity at night.

• Plants typically take in carbon dioxide and release oxygen during the day through the process of photosynthesis.

• At night, in the absence of sunlight, photosynthesis ceases, and the primary gas exchange activity involves the removal of carbon dioxide.

• This process is crucial for maintaining the plant's metabolic balance and overall health.

• Understanding this nocturnal exchange activity helps in comprehending the broader aspects of plant physiology and their interaction with the environment.

Additional Information

• Photosynthesis is the process by which green plants use sunlight to synthesize foods with the help of chlorophyll.

• During photosynthesis, plants absorb carbon dioxide from the atmosphere and release oxygen as a by-product.

• At night, plants switch to respiration, taking in oxygen and releasing carbon dioxide.

• This shift from photosynthesis to respiration highlights the dynamic nature of plant metabolic processes.

• Understanding these processes is essential for fields like agriculture, horticulture, and environmental science.

Q68. Answer: (d) 9

Given:

[(234^5 - 243^8 + 1/72)^(-8)]^0 + 8

Formula used:

Any number raised to the power of 0 is 1.

Calculation:

[(234^5 - 243^8 + 1/72)^(-8)]^0 + 8

=> [(234^5 - 243^8 + 1/72)^(-8)]^0 = 1

=> 1 + 8 = 9

Therefore The correct answer is option (4).

Q69. Answer: (d) GDP at constant price

The correct answer is GDP at constant price

Key Points

• GDP at constant price is used to measure the Real National Income.

• It refers to the value of goods and services produced in an economy, adjusted for changes in price level or inflation.

• This adjustment allows for the comparison of economic output from one year to another without the distortion caused by inflation.

• Constant prices are typically based on the prices of a base year, providing a more accurate reflection of an economy's true growth.

Additional Information

• Gross Domestic Product (GDP) is a monetary measure of the market value of all final goods and services produced in a specific time period.

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

• Real GDP is a key indicator of the economic health of a country and is used by policymakers to craft economic policies and by analysts to assess economic performance.

• Comparing Real GDP across different periods helps in understanding whether an economy is growing or shrinking in real terms.
• Real GDP is also used to compare the standard of living between different countries by adjusting for price level differences.

Q70. Answer: (d) 170 mm × 130 mm

The correct answer is 170 mm × 130 mm

Key Points

• The measurement of an ostrich egg is 170 mm × 130 mm.
• Ostrich eggs are the largest of all eggs, though they are the smallest eggs relative to the size of the adult bird.
• They have a thick shell that is about 2 mm thick, making them quite robust compared to other bird eggs.
• Despite their size, the incubation period for ostrich eggs is approximately 42 days.
• These eggs are often used in various culinary dishes and can be equivalent to about 24 chicken eggs in volume.

Additional Information

• The ostrich is the largest living bird species, and it is native to Africa.
• Ostriches can run at speeds up to 70 km/h (43 mph), making them the fastest birds on land.
• They have long legs and a large, powerful body, which helps them cover great distances in search of food.
• Ostriches are omnivores, feeding on a variety of plant matter, seeds, and insects.
• Their eggs are often used in art and decoration due to their large size and sturdy shell.

Q71. Answer: (b) G

Given: A, B, C, D, E, F, G and H are sitting around a square table facing the centre of the table. Some of them are sitting at the corners, while some are sitting at the exact centre of the sides.

1) E is sitting at one of the corners and to the immediate left of F and immediate right of A.

2) H, G and C are exactly sitting opposite to E, A and F, respectively.

3) D is sitting to the immediate right of C.

After positioning D only one position is left which will be occupied by the only person left i.e. B.

Thus, according to the final arrangement G is sitting to the immediate right of B.

Hence, "Option 2" is the correct answer.

Q72. Answer: (d) Civil Disobedience Movement

The correct answer is Civil Disobedience Movement

Key Points

• The Salt Satyagraha, also known as the Civil Disobedience Movement, was a significant phase of the Indian independence movement.
• It was led by Mahatma Gandhi in March 1930 to protest against the British monopoly on salt production and sales.
• The movement began with the historic Dandi March, where Gandhi and his followers marched from Sabarmati Ashram to the coastal village of Dandi in Gujarat to make salt from seawater.
• This act of defiance against British laws sparked widespread participation across India and became a symbol of resistance against colonial rule.
• The Civil Disobedience Movement aimed to achieve Purna Swaraj (complete self-rule) and involved the refusal to obey certain laws, demands, and commands of the British government.

Additional Information

• The Non-Cooperation Movement (1920-1922) was another major movement led by Gandhi, urging Indians to withdraw from British institutions.
• The Quit India Movement (1942) was a mass protest demanding an end to British rule in India.
• The Indian Self Rule Movement refers to the broader struggle for independence, encompassing various movements and efforts to achieve self-governance.
• The Salt Satyagraha was a pivotal event that galvanized Indian society and gained international attention, highlighting the injustices of British colonial rule.

Q73. Answer: (c) 1964

The correct answer is 1964

Key Points

• Bharat Heavy Electricals Limited (BHEL) was incorporated in the year 1964.
• BHEL is an Indian public sector engineering and manufacturing enterprise based in New Delhi, India.
• It is owned and founded by the Government of India, and is one of India's largest power generation equipment manufacturers.

• The company is also engaged in the design, engineering, manufacture, construction, testing, commissioning, and servicing of a wide range of products and services for the core sectors of the economy, including power, transmission, industry, transportation (railways), renewable energy, oil & gas, and defense.

Additional Information

• BHEL was established with the aim of making India self-reliant in the field of power generation and heavy electrical equipment manufacturing.

• The company has a widespread network of manufacturing facilities and service centers across India.

• BHEL has made significant contributions to the development of India's infrastructure and has played a key role in the country's industrialization.

• Over the years, BHEL has diversified its product portfolio and expanded its presence in international markets.

• The company is known for its commitment to quality, innovation, and sustainability in its operations.

Q74. Answer: (d) 127.5°

Shortcut Trick

For any triangle, the angle formed by the internal angle bisectors of two angles at the incenter is given by the standard formula:

angle BDC = 90° + angle A ÷ 2

Given that angle A = 75°:

angle BDC = 90° + 75° ÷ 2 = 90° + 37.5° = 127.5°

Therefore The correct answer is 127.5°.

Alternate Method

Given:

=> In ΔABC, the internal bisectors of angle B and angle C meet at D.

=> angle A = 75°

By the angle sum property of ΔABC:

=> angle A + angle B + angle C = 180°

=> angle B + angle C = 180° − 75° = 105°

Since BD and CD are the internal angle bisectors of angle B and angle C respectively:

=> angle DBC = angle B ÷ 2

=> angle DCB = angle C ÷ 2

Now, in ΔBDC, by the angle sum property:

=> angle BDC + angle DBC + angle DCB = 180°

=> angle BDC + (angle B ÷ 2) + (angle C ÷ 2) = 180°

=> angle BDC + (angle B + angle C) ÷ 2 = 180°

Substitute the value of (angle B + angle C) = 105°:

=> angle BDC + 105° ÷ 2 = 180°

=> angle BDC + 52.5° = 180°

=> angle BDC = 180° − 52.5°

=> angle BDC = 127.5°

Let us analyze the options:

=> Option (1) 102.5°: Incorrect, as this would require angle A = 25°.

=> Option (2) 105.5°: Incorrect, as this would require angle A = 31°.

=> Option (3) 112.5°: Incorrect, as this would require angle A = 45°.

=> Option (4) 127.5°: Correct, as it perfectly matches the calculated value of 127.5°.

Therefore The correct answer is 127.5°.

Additional Information

Incenter of a Triangle

The point of concurrency of the three internal angle bisectors of a triangle is called the incenter. It is the center of the unique circle (incircle) that touches all three sides of the triangle internally.

External Angle Bisector Theorem

If the external bisectors of angle B and angle C of ΔABC meet at an excenter E, then the angle formed is given by: angle BEC = 90° − angle A ÷ 2.

Angle Bisector Theorem (Sides)

An angle bisector of an angle of a triangle divides the opposite side into two segments that are proportional to the other two sides

of the triangle (i.e., BD ÷ DC = AB ÷ AC).

Q75. Answer: (b) 0.1 Ω

The correct answer is 0.1 Ω

Key Points

• Given:

• The resistance of the first wire (length = L and area = A) is 0.2 Ω.

• For the second wire, the length is 2L and the area of cross-section is 4A.

• Formula: R=ρ l/A, where:

• R is the resistance,

• ρ is the resistivity of the material,

• L is the length of the wire,

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

• Calculation:

• The resistance of this second wire is given by: R'=ρ 2L/4A =ρ L/2A

• Now, compare the two resistances: R' = 1/2 ρ L/A

• Since, R=ρ l/A=0.2Ω

• We can substitute this into the equation for R': R' = 1/2 * 0.2 Ω = 0.1 Ω

• Thus, the resistance of the second wire will be 0.1 Ω.

Q76. Answer: (a) (12, 16, 3)

The logic followed here is:

Logic: (1st number ÷ 3rd number)² = 2nd number.

Now,

For, (12, 9, 4)

=> (12 ÷ 4)² = 3² = 9.

For, (25, 25, 5)

=> (25 ÷ 5)² = 5² = 25.

Similarly, for (12, 16, 3)

=> (12 ÷ 3)² = 4² = 16.

Hence, the correct answer is "Option 1".

Q77. Answer: (a) 105

The logic followed here is:

Hence, "Option 1" is the correct answer.

Q78. Answer: (d) 19 m, South

Given: All turns are 90 degree turns only

Amit steps out of his house and walks 76 m towards the north.

He takes a right turn and walks 23 m.

He takes a right turn again and walks 61 m.

Then he takes a left turn and walks 20 m.

Then he takes a right turn and walks 34 m.

He takes a final right turn and walks 43 m to reach a library.

So, the distance between library and Amit's house is: (61 + 34) - 76 => 19 m

Thus, the library is 19 m away from Amit's house in the south direction.

Hence, "Option 4" is the correct answer.

Q79. Answer: (a) T(1 + P/100)^M - T

Shortcut Trick

The standard formula for Compound Interest (CI) is CI = Principal [(1 + Rate/100)^(Time) − 1].

Given Principal = T, Rate = P, and Time = M.

Substituting the values: CI = T[(1 + P/100)^M − 1] => T(1 + P/100)^M − T.

Therefore The correct answer is T(1 + P/100)^M − T.

Alternate Method

Given:

Sum of money (Principal) = T

Rate of interest (Rate) = P% per annum

Number of years (Time) = M

Formula Used:

Amount (A) = Principal × (1 + Rate/100)^(Time)

Compound Interest (CI) = Amount − Principal

Calculations:

=> Amount (A) = T × (1 + P/100)^M

=> CI = A − T

=> CI = [T(1 + P/100)^M] − T

Therefore The correct answer is T(1 + P/100)^M − T.

Additional Information

Simple Interest (SI)

Simple interest is calculated only on the principal amount: SI = (Principal × Rate × Time) / 100.

Compound Interest Half-Yearly

If interest is compounded semi-annually, the rate becomes P/2 and time becomes 2M: A = T(1 + P/200)^(2M).

Difference between CI and SI (2 years)

For a period of 2 years, the difference is given by: CI − SI = Principal × (Rate/100)².

Q80. Answer: (a) Ø D X G Ø

Given solution in given format:

Given:

Number/symbol	**3**	**#**	**4**	**7**	**@**	**%**		**2**	**!**	**?**	**5**	**8**	**$**	**9**
Code	S	F	T	J	D	G	E	X	V	W	K	U	P	M

Conditions	**Coded As**
First element is a symbol and the last element is a number	Codes for these two (the first and the last elements) are to be interchanged
First element is an odd number and the last element is an even number	First and last elements are to be coded as Ø
Second and Third elements are perfect squares	Third element is to be coded as the code for the second element

Now, the group of numbers and symbols is: 3 @ 2 % 8

Here, Here, Second conditions followed in the given group,

So, First and last elements are to be coded as Ø.

Then, the code for '3 @ 2 % 8' is → 'Ø D X G Ø'.

Hence, the correct answer is "Option 1".

Q81. Answer: (a) Nai Manzil

The correct answer is Nai Manzil

Key Points

• Nai Manzil is the first World Bank supported programme for minority welfare being implemented by the Ministry of Minority Welfare, Government of India.

• The programme aims to provide education and skill training to the minority youth, thereby improving their employability and livelihood opportunities.

• It focuses on bridging the academic and skill development gaps among minority communities.

• The initiative includes components such as providing non-residential training, placement support, and tracking of trainees for a year post-training.

• Nai Manzil targets school dropouts and those in the age group of 17-35 years from minority communities.

Additional Information

• The Ministry of Minority Welfare, Government of India, was established to ensure a more focused approach towards issues relating to the minorities.

• Other schemes under the Ministry include Naya Savera, which provides free coaching for minority students, and Nai Udaan, which offers financial support for minority students clearing prelims of Group A and B examinations conducted by UPSC, SSC, and State Public Service Commissions.

• Padho Pardesh is another scheme that provides interest subsidies on educational loans for overseas studies for students belonging to minority communities.

• The World Bank's involvement in Nai Manzil highlights the international support and collaboration in improving the socio-economic conditions of minority communities in India.

Q82. Answer: (b) Neither conclusion I nor II is true

Given Statement: Z > G ≥ W < Y = V > L < N

Now,

Conclusions:

Option 1: V < G → False (Z > G ≥ W < Y = V It gives V > G)

Option 2: Z < W → False (Z > G ≥ W It gives Z > W)

Hence, the correct answer is "Option 2".

Q83. Answer: (c) calcium sulphate

The correct answer is calcium sulphate

Key Points

• Calcium sulphate is the main product formed when calcium hydroxide reacts with concentrated sulphuric acid.

• The chemical reaction involved is:

$Ca(OH)_2 + H_2SO_4 \rightarrow CaSO_4 + 2H_2O$

• This reaction results in the formation of calcium sulphate ($CaSO_4$) and water (H_2O).

• Calcium sulphate is commonly known as gypsum when in its dihydrate form ($CaSO_4 \cdot 2H_2O$).

• This reaction is an example of a double displacement reaction where the cations and anions of two different compounds switch places, forming two new compounds.

Additional Information

• Calcium hydroxide is also known as slaked lime and is a common ingredient in many industrial processes.

• Concentrated sulphuric acid is a highly corrosive strong mineral acid with the molecular formula H_2SO_4.

• Calcium sulphate has various applications, including in the building industry (as plaster of Paris), in the medical field (as a cast material), and as a desiccant.

• Proper safety measures should be taken while handling concentrated sulphuric acid due to its highly corrosive nature.

Q84. Answer: (c) 190/7

Shortcut Trick

Determine total frequency N = 46 and N/2 = 23.

Identify Median Class: The cumulative frequency reaches 18 at 20 and 25 at 30, so the 23^(rd) term lies in 20-30.

Quick calculation: Median = Lower Limit + [(Gap to N/2) ÷ Frequency] × Class Width.

Median = 20 + [(23 − 18) ÷ 7] × 10 = 20 + 50/7 = 190/7.

Therefore The correct answer is 190/7.

Alternate Method

Given: Frequency distribution with 5 classes.

Formula Used: Median = L + [((N/2) − cf) / f] × h

=> Total frequency N = 10 + 8 + 7 + 9 + 12 = 46.

=> N/2 = 46 ÷ 2 = 23.

=> Cumulative frequencies (cf) are 10, 18, 25, 34, 46.

=> The Median Class is 20-30 because its cumulative frequency (25) is the first to exceed 23.

=> L (Lower limit) = 20, cf (prev class) = 18, f (median class) = 7, h (width) = 10.

=> Median = 20 + [(23 − 18) ÷ 7] × 10

=> Median = 20 + (5 ÷ 7) × 10 = 20 + 50/7

=> Median = (140 + 50) ÷ 7 = 190/7.

Therefore The correct answer is 190/7.

Additional Information

Empirical Relationship

For a moderately skewed distribution, the relationship between measures of central tendency is: 3 × Median = Mode + 2 × Mean.

Mean of Grouped Data

The arithmetic mean is calculated as Σ(f_ix_i) ÷ Σf_i, where x_i represents the class marks (mid-points).

Modal Value

Mode = L + [(f1 − f0) ÷ (2f1 − f0 − f2)] × h, where f1 is the frequency of the modal class.

Q85. Answer: (c) 2

Given word: ABDUCT

According to the question each letter of the word is arranged in English alphabetical order:

Word given	A	B	D	U	C	T
Word after arrangement	A	B	C	D	T	U

Thus, according to the final arrangement positions of A and B will remain unchanged.

Hence, "Option 3" is the correct answer.

Q86. Answer: (d) 12, 3, 15

The correct answer is 12 σ-bonds, 3 π-bonds, and 15 total bonds

Key Points

• A benzene molecule has a total of 12 σ-bonds and 3 π-bonds.

• Benzene is an aromatic hydrocarbon with the chemical formula C6H6.

• The structure of benzene consists of a six-carbon ring with alternating double bonds, known as a resonance structure.

• Each carbon atom in benzene forms three σ-bonds: two with adjacent carbon atoms and one with a hydrogen atom.

• The three π-bonds are formed by the overlapping of p-orbitals above and below the plane of the carbon atoms.

• In total, benzene has 15 bonds (12 σ-bonds + 3 π-bonds).

• The resonance stabilization of benzene makes it more stable compared to other unsaturated hydrocarbons.

Additional Information

• The concept of resonance in benzene was first proposed by August Kekulé in 1865.

• Benzene is a fundamental component in organic chemistry and is widely used in the production of various chemicals and polymers.

• Due to its aromatic nature, benzene undergoes substitution reactions rather than addition reactions, preserving its stable ring structure.

• Exposure to benzene is hazardous and can cause serious health effects, including leukemia and other blood disorders.

Q87. Answer: (d) material sciences

The correct answer is material sciences

Key Points

• Professor Narayan Pradhan has been selected for the 31st GD Birla Award for Scientific Research.

• He has made a major contribution in the field of material sciences.

• The GD Birla Award for Scientific Research is one of the prestigious awards in India, recognizing outstanding Indian scientists below the age of 50 for their original research contributions.

• Professor Pradhan's work has significantly advanced the understanding and application of material sciences, which has broad implications for various industries and technologies.

Additional Information

• The GD Birla Award was instituted in 1991 by the K. K. Birla Foundation.

• It carries a cash prize of Rs. 5 lakh, a citation, and a trophy.

• The award aims to encourage and recognize scientists who have made significant contributions to their fields and have the potential to impact the future of science and technology in India.

• Past recipients of the award include several prominent scientists who have gone on to achieve further recognition and accolades in their respective fields.

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Q88. Answer: (b) 2

Given: (left) 248 382 425 127 335 (right)

If 3 is added to the first digit of every number, we get the following numbers:

• 248: 2 + 3 = 5, so the new number is 548

• 382: 3 + 3 = 6, so the new number is 682

• 425: 4 + 3 = 7, so the new number is 725

• 127: 1 + 3 = 4, so the new number is 427

• 335: 3 + 3 = 6, so the new number is 635

Now, we check how many numbers have the first digit exactly divisible by the second digit:

• 548: 5 is not divisible by 4

• 682: 6 is not divisible by 8

• 725: 7 is not divisible by 2

• 427: 4 is divisible by 2

• 635: 6 is divisible by 3

So, there are 2 numbers where the first digit is exactly divisible by the second digit.

The correct answer is Option 2.

Q89. Answer: (b) PV Sindhu

The correct answer is PV Sindhu

Key Points

• PV Sindhu won the Swiss Open 2022.

• She defeated Thailand's Busanan Ongbamrungphan in the final.

• This victory marked her second title of the year 2022.

• PV Sindhu is one of India's most prominent badminton players, having won multiple international titles.

Additional Information

• PV Sindhu became the first Indian woman to win an Olympic silver medal in badminton at the 2016 Rio Olympics.

• She followed it up with a bronze medal at the 2020 Tokyo Olympics.

• She has also won the prestigious BWF World Championships in 2019.

• PV Sindhu has been awarded numerous accolades including the Padma Bhushan, India's third-highest civilian award.

Q90. Answer: (c) CNH : EJN

The logic followed here is:

BLG : DHM

GMQ : IIW

So, checking each option one by one:

Option 1) YPJ : ATP

Option 2) ULF : WGL

Option 3) CNH : EJN

Option 4) QDR : TZX

Thus, out of all the options 'CNH : EJN' follows the same logic as given.

Hence, "Option 3" is the correct answer.

Q91. Answer: (c) 6

The correct answer is 6

Key Points

• The nitrogen molecule (N2) consists of two nitrogen atoms connected by a triple bond.

• Each nitrogen atom has 5 valence electrons, making a total of 10 valence electrons for the N2 molecule.

• In the triple bond, 6 electrons are shared between the two nitrogen atoms.

• This sharing of electrons results in a very strong bond, making N2 a stable molecule.

Additional Information

• The triple bond in N2 consists of one sigma bond and two pi bonds.

• The triple bond contributes to the high bond dissociation energy of N2, which is why nitrogen gas is relatively inert and does not react easily at room temperature.

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• Nitrogen is essential for life and is a major component of amino acids, proteins, and nucleic acids.

• Nitrogen fixation is the process by which nitrogen in the atmosphere is converted into ammonia or related nitrogenous compounds in soil.

Q92. Answer: (a) 126°

Shortcut Trick

In a cyclic quadrilateral, the sum of opposite angles is always 180°.

Ratio of angles = 3 : 7 => Total parts = 3 + 7 = 10 units.

10 units = 180° => 1 unit = 18°.

Bigger angle = 7 units = 7 × 18° = 126°.

Therefore The correct answer is 126°.

Alternate Method

Given: The ratio of opposite angles of a cyclic quadrilateral is 3 : 7.

Formula Used: Sum of opposite angles of a cyclic quadrilateral = 180°.

Let the two opposite angles be 3x and 7x.

=> 3x + 7x = 180°

=> 10x = 180°

=> x = 180° ÷ 10

=> x = 18°

=> Smaller angle = 3 × 18° = 54°

=> Bigger angle = 7 × 18° = 126°

Therefore The correct answer is 126°.

Additional Information

Cyclic Quadrilateral Property

A quadrilateral is called cyclic if all its four vertices lie on the circumference of a circle. The sum of each pair of opposite angles is 180°.

Exterior Angle Property

The exterior angle of a cyclic quadrilateral is equal to the interior opposite angle.

Ptolemy's Theorem

For a cyclic quadrilateral with sides a, b, c, d and diagonals p, q, the relation is p × q = (a × c) + (b × d).

Q93. Answer: (a) 5

Given: 1, 2, 3, 4, 5 and 6 are six cakes with different weights in a bakery.

1) Only two cakes are heavier than 4.

_ > _ > 4 > _ > _ > _

2) 2 is heavier than 1 but lighter than 6.

3) 6 is lighter than 4.

_ > _ > 4 > 6 > 2 > 1

4) 3 is not the heaviest cake.

After positioning 3 only one position is left which will be occupied by the only cake left i.e. 5.

5 > 3 > 4 > 6 > 2 > 1

Thus, according to the final arrangement, 5 is the heaviest cake.

Hence, "Option 1" is the correct answer.

Q94. Answer: (b) 7.5 cm

The correct answer is 7.5 cm

Key Points

• The principal focus location for the given convex mirror is 7.5 cm.

• According to the New Cartesian Sign Convention, the focal length (f) of a convex mirror is positive.

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

• Given that the radius of curvature (R) is 15 cm, the focal length (f) is calculated as f = 15 cm / 2 = 7.5 cm.

• Therefore, the principal focus is located at x = 7.5 cm on the positive side of the mirror.

Additional Information

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• In the New Cartesian Sign Convention, the focal length of a convex mirror is always positive.
• The principal focus of a convex mirror is a point on the principal axis where the reflected rays appear to diverge from.
• Convex mirrors are commonly used in vehicle side mirrors and security mirrors because they provide a wider field of view.
• The formula for the mirror equation is 1/f = 1/v + 1/u, where f is the focal length, v is the image distance, and u is the object distance.
• Understanding the properties of convex mirrors is essential in optics and various practical applications.

Q95. Answer: (d) Four

Given: Seven boxes, A, B, C, D, E, F and G, are kept one over the other.

1) G is kept fourth from the bottom and immediately below E and immediately above B.

2) D is kept at the bottom-most position.

Sr.no	Boxes
Top	
1	
2	
3	B
4	G
5	E
6	
7	D
Bottom	

3) There are three boxes between C and F.

After positioning C and F only one position is left which will be occupied by the box left i.e. A.

Sr.no	Boxes
Top	
1	A
2	C / F
3	B
4	G
5	E
6	C / F
7	D
Bottom	

Thus, according to the final arrangement either zero or four number of boxes can be kept between A and F.

Therefore, out of all the options, four number of boxes can be kept between A and F.

Hence, "Option 4" is the correct answer.

Q96. Answer: (b) Salivary glands

The correct answer is Salivary glands

Key Points

• Salivary glands are not endocrine glands. They are exocrine glands that produce saliva and secrete it into the mouth through ducts.
• Endocrine glands, such as the pituitary gland, adrenal gland, and thyroid gland, secrete hormones directly into the bloodstream.
• The primary function of endocrine glands is to regulate various bodily functions by releasing hormones.

Additional Information

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• The pituitary gland is often referred to as the "master gland" because it controls several other hormone glands in the body.

• The adrenal gland produces hormones such as adrenaline and cortisol, which help regulate metabolism, immune response, and stress.

• The thyroid gland produces hormones that regulate metabolism, energy generation, and growth.

• Exocrine glands, like the salivary glands, have ducts to carry their secretions to a specific location.

Q97. Answer: (d) (15, 162, 3)

The logic followed here is:

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

Now,

For, (4, 50, 6)

=> (4 + 6) × (4 + 6) ÷ 2 = 10 × 10 ÷ 2 = 50.

For, (2, 18, 4)

=> (2 + 4) × (2 + 4) ÷ 2 = 6 × 6 ÷ 2 = 18.

Similarly, for (15, 162, 3)

=> (15 + 3) × (15 + 3) ÷ 2 = 18 ×18 ÷ 2 = 162.

Hence, the correct answer is "Option 4".

Q98. Answer: (d) 33.33%

Shortcut Trick

Make the quantity of fruits equal in both cases to compare price.

CP of 14 fruits = Rs. 30.

SP of 7 fruits = Rs. 20 => SP of 14 fruits = Rs. 20 × 2 = Rs. 40.

Profit = SP − CP = 40 − 30 = 10.

Profit% = (Profit ÷ CP) × 100 = (10 ÷ 30) × 100 = 100 ÷ 3 = 33.33%.

Therefore The correct answer is 33.33%.

Alternate Method

Given → CP of 14 fruits = Rs. 30 | SP of 7 fruits = Rs. 20.

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

=> Cost Price (CP) of 1 fruit = 30 ÷ 14 = Rs. 15/7.

=> Selling Price (SP) of 1 fruit = 20 ÷ 7 = Rs. 20/7.

=> Profit per fruit = SP − CP = (20/7) − (15/7) = 5/7.

=> Profit Percentage = [(5/7) ÷ (15/7)] × 100 = (5 ÷ 15) × 100 = 33.33%.

Therefore The correct answer is 33.33%.

Additional Information

Unitary Method in Profit and Loss

Calculating the price per single unit allows for direct comparison between purchase and sale costs regardless of bulk quantity differences.

Profit and Loss Percentage

Profit or Loss percentage is always calculated on the Cost Price (CP) unless stated otherwise in the problem.

Q99. Answer: (d) 1

Given number: 243978615

According to the question each digit of the number 243978615 is arranged in order of value from left to right:

Number given	**2**	**4**	**3**	**9**	**7**	**8**	**6**	**1**	**5**
Number after arrangement	1	2	3	4	5	6	7	8	9

Thus, after the arrangement '3' remains unchanged relative to the original number.

Hence, "Option 4" is the correct answer.

Q100. Answer: (a) 5.0 cm

Shortcut Trick

For any spherical mirror (convex or concave), the focal length (f) is always exactly half of the radius of curvature (R).

Given Radius of curvature (R) = 10.0 cm.

Principal focus distance (f) = R ÷ 2 = 10.0 ÷ 2 = 5.0 cm.

Therefore The correct answer is 5.0 cm.

Alternate Method

Given:

Type of mirror: Convex Mirror

Radius of curvature (R) = 10.0 cm

Formula Used:

Relationship between focal length (f) and radius of curvature (R): f = R ÷ 2

Calculations:

=> The principal focus of a spherical mirror lies midway between the pole (P) and the centre of curvature (C).

=> f = R ÷ 2

=> f = 10.0 cm ÷ 2

=> f = 5.0 cm

Therefore The correct answer is 5.0 cm.

Additional Information

Sign Convention for Convex Mirror

In a convex mirror, the focal length and radius of curvature are always taken as positive because they lie behind the mirror.

Principal Focus (F)

It is the point on the principal axis where rays parallel to the axis appear to diverge from after reflection in a convex mirror.

Mirror Formula

The relationship between object distance (u), image distance (v), and focal length (f) is given by 1/f = 1/v + 1/u.

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