RRB Group D Previous Year Paper (Held on: 12 Sept 2022 Shift 2)

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

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CBT

Q1. Roots of the equation $x^2 + 2x - 6 = 0$ are:

(a) $-2 \pm \sqrt{7}$
(b) $-1 \pm \sqrt{7}$
(c) $-3 \pm \sqrt{7}$
(d) $-1 \pm \sqrt{5}$

Q2. Select the option that is related to the fifth number in the same way as the second number is related to the first number and the fourth number is related to the third number.

9 : 90 :: 5 :30 :: 10 : ?

(a) 125
(b) 110
(c) 105
(d) 100

Q3. The value of 9/10÷ (4/5+1/10) is:

(a) 81/100
(b) 0
(c) 1/10
(d) 1

Q4. The ratio of the ages of A and B is 5 : 9. After 7 years, B's age will be 52 years. Six years ago, A's age was:

(a) 44 years
(b) 35 years
(c) 24 years
(d) 19 years

Q5. The value of 5 + 12 ÷ 4 - 2 × (1 + 3) is:

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

Q6. Six friends A, B, C, I, J and K prepared together for an interview and each one scored differently. C didn't score less than K. J didn't score more than A. I scored less than 3 friends only. C scored more than A. B scored less than J but not the least. Who scored the least?

(a) K
(b) C
(c) A
(d) J

Q7. Who among the following won a Gold Medal at UWW Ranking Series in the 62 kg category held in the month of June 2022?

(a) Kavita Devi
(b) Vinesh Phogat
(c) Babita Kumari
(d) Sakshi Malik

Q8. Which of the following statements is NOT correct for antacids?

(a) Mg(OH)2 is an antacid.
(b) NaHCO3 is an antacid.
(c) Antacids are useful to neutralise excess stomach acid.
(d) Antacids are strong acids.

Q9. Rajani borrowed an amount of Rs. 11,550 at an interest rate of 10% per annum, compounded annually. She repaid the entire amount with interest in two equal instalments, the instalments being paid at the end of the first and the second years from the date of borrowing. What is the value of each instalment, if interest is computed on reducing balance?

(a) Rs. 5,775
(b) Rs. 6,655
(c) Rs. 4,455
(d) Rs. 7,755

Q10. If the speed of light in water and glass are 2.25 x 10^8m/s and 1.86 x 10^8m/s respectively then the refractive index of glass with respect to water is:

(a) 0.83
(b) 1.31
(c) 0.52
(d) 1.21

Q11. This question is based on the following three-letter words:

(Left) ALL NTE PET ARE (Right)

If in each of the words, each letter is changed to the next letter in the English alphabetical order, how many words thus formed will have no vowel?

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

Q12. If '+' means '-', '-' means '×', '×' means '÷' and '÷' means '+', what will come in place of the question mark (?) in the following equation?

18 × 3 - 15 ÷ 10 + 20 = ?

(a) 60
(b) 80
(c) 40
(d) 20

Q13. Which of the following statements is INCORRECT?

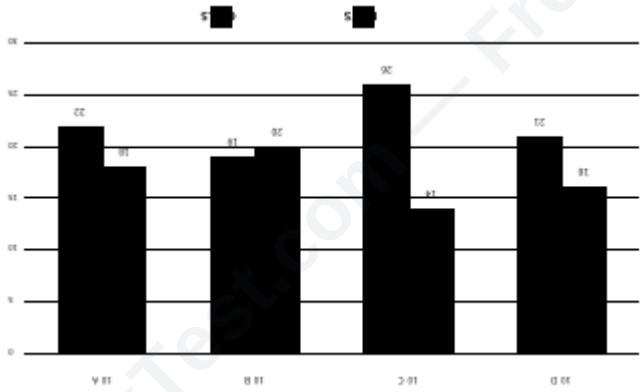
(a) The human excretory system includes a pair of kidneys, a pair of ureters, a urinary bladder and a urethra.
(b) Each kidney has large numbers of the filtration units called neurons packed close together.
(c) Normally, in a healthy adult, the initial filtrate in the kidneys is about 180 L daily
(d) Kidneys are located in the abdomen, one on either side of the backbone

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Q14. In a certain code language, 'DIARY' is written as 'FLFXF' and 'READY' is written as 'THFJF'. How will 'ERROR' be written in that language?

(a) JBDYU
(b) GNJUY
(c) GUWUY
(d) JULDJ

Q15. The given graph provides details of the number of girl students and boy students in four sections of class X of a school. Study the graph and answer the question.



Which section has the maximum percentage of girls of the total students in that section?

(a) 10C
(b) 10D
(c) 10A
(d) 10B

Q16. Which of the following sexually transmitted diseases is caused by a virus?

(a) Warts
(b) Gonorrhoea
(c) Tuberculosis (Chlamydia)
(d) Syphilis

Q17. A tree is 10 m in front of a convex mirror of focal length 2.5 m. Its image is formed:

(a) 1.25 m behind mirror
(b) 2.0 m in front of mirror
(c) 1.25 m in front of mirror
(d) 2.0 m behind mirror

Q18. The number 678954321 is divisible by which of the following?

(a) 6
(b) 2
(c) 11
(d) 3

Q19. On the eve of International Women's Day 2022, the Ministry of Women and Child Development, in collaboration with the Ministry of Education and UNICEF, launched a landmark campaign to reintegrate out-of-school adolescent girls in India. What is the name of this campaign?

(a) Kanya Shiksha Utsav
(b) Kanya Shiksha Pravesh Utsav
(c) Kanya Shiksha
(d) Kanya Shiksha Utthan

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Q20. If '+' means '-', '-' means '×', '×' means '÷', and '÷' means '+', what will come in place of the question mark (?) in the following equation?

18 × 3 - 5 ÷ 6 + 4 = ?

(a) 30
(b) 36
(c) 32
(d) 34

Q21. P, Q, R, S, T and U are six participants of an international Olympiad. Each of them scored different marks on the test. T scored more than Q. S scored more than Q. Q scored more than P and P scored more than R. T scored more than S. R scored more than only one participant. Which participant, among the six, scored the second highest?

(a) S
(b) R
(c) P
(d) T

Q22. How much reservation is given to women in the panchayat and municipality of Bihar?

(a) 10%
(b) 50%
(c) 25%
(d) 33%

Q23. Who disproved the statement, "organic compounds could only be formed within a living system"?

(a) Charles
(b) Rutherford
(c) Wohler
(d) Dalton

Q24. Which of the following oxides corresponds to the oxide of Eka-aluminium?

(a) In2O3
(b) B2O3
(c) Ge2O3
(d) Ga2O3

Q25. Arrange the following in a food chain.

A. Frog; B. Eagle; C. Rice Plant; D. Snake; E. Locust

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

Q26. The greatest number which divides 72 and 122 leaving remainders 3 and 7, respectively, is:

(a) 23
(b) 26
(c) 17
(d) 29

Q27. Which of the following schemes is aimed to ensure comprehensive financial inclusion of all the households in the country by providing universal access to banking facilities with at least one basic banking account to every household, financial literacy, access to credit, insurance and pension facilities?

(a) Varishtha Pension Bima Yojana
(b) Pradhan Mantri Suraksha Bima Yojana
(c) Pradhan Mantri Vaya Vandana Yojana
(d) Pradhan Mantri Jan Dhan Yojana

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Q28. The phenomenon of electromagnetic induction occurs due to:

(a) connecting the system with an electromagnet
(b) change in magnet flux passing through coil
(c) stationary positions of the magnet and coil
(d) placement of galvanometer in the system

Q29. The perimeter of a circle whose diameter is 50 cm is:

(a) 50 π cm
(b) 30 π cm
(c) 20 π cm
(d) 40 π cm

Q30. Which of the following is a wildlife sanctuary?

(a) Pachmarhi
(b) Sundarban
(c) Manas
(d) Nilgiri

Q31. Select the number from among the given options that can replace the question mark (?) in the following series.

44, 42, 38, 36, 32, 30, 26, 24, ?

(a) 18
(b) 20
(c) 23
(d) 22

Q32. Dental Caries result in _____.

(a) Bleeding gums
(b) Broken tooth
(c) Foul-smelling breath
(d) Softened enamel

Q33. Consider the below statements and identify the correct answer.

Statement-I: The compounds formed by the transfer of electrons from a metal to a non-metal are known as electrovalent compounds.

Statement-II: Electrovalent compounds are generally soluble in water and insoluble in solvent such as kerosene, petrol etc.

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

Q34. During dispersion of light through a triangular prism white light will split into _____ bands of colour.

(a) three
(b) five
(c) seven
(d) eight

Q35. Refer to the following letter, number, symbol series and answer the question.

(Left) N 3 % Y 7 & 3 5 G M Q 1 @ 2 C ^ 9 L 2 B (Right)

How many such symbols are there which are immediately preceded by a letter and also immediately followed by a number?

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

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(d) 3

Q36. The First Five-Year Plan in India achieved a growth rate of _____ against a target of 2.1%.

(a) 3.6%
(b) 1.2%
(c) 4.8%
(d) 2.4%

Q37. The diameter of the base of a cylinder is 3 cm and its height is 14 cm. The volume of the cylinder is:

(a) 69 cm^3
(b) 79 cm3
(c) 89 cm3
(d) 99 cm3

Q38. In the wake of the AP microfinance crisis in 2010, RBI had constituted a committee under the chairmanship of _____ to study issues and concerns in the MFI sector.

(a) Shri Mukund M Chitale
(b) Shri Jagdish Capoor
(c) Dr YV Reddy
(d) Shri YH Malegam

Q39. Which of the following statements is correct about oxidation reaction?

(a) Oxidation is gain of oxygen and hydrogen.
(b) Oxidation is loss of oxygen and hydrogen.
(c) Oxidation is gain of oxygen or loss of hydrogen.
(d) Oxidation is loss of oxygen or gain of hydrogen.

Q40. Which shell of the nitrogen atom participates in forming N2 molecule?

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

Q41. As of March 2022, who is the Union Minister of Parliamentary Affairs?

(a) Raj Kumar Singh
(b) Arjun Munda
(c) Piyush Goyal
(d) Pralhad Venkatesh Joshi

Q42. Which of the following is a pair of co-prime numbers?

(a) 52, 24
(b) 363, 77
(c) 455, 49
(d) 81, 16

Q43. This question is based on the following 3-letter words

(left) BOW SAD LOW RAY (right)

How many letters are there in the English alphabetical order between the second letter of the first word from the right and the second letter of the first word from the left?

(a) Fifteen
(b) Thirteen
(c) Twelve
(d) Eight

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Q44. Five friends C, D, E, F and G are seated around a round table facing the centre. Only D is seated between G and E. D is seated 2^(nd) to the right of F, who is not seated at either side of G. Where is C seated?

(a) To the immediate left of F
(b) To the immediate right of F
(c) To the immediate right of E
(d) To the immediate left of G

Q45. In March 2022 _____ became the first woman cricketer in the world to appear in six Worlds Cups.

(a) Jhulan Goswami
(b) Harmanpreet Kaur
(c) Smriti Mandhana
(d) Mithali Raj

Q46. Read the given statements and conclusions carefully. Assuming that the information given in the statements is true, even if it appears to be at variance with commonly known facts, decide which of the given conclusions logically follow(s) from the statements.

Statements:

1. All cloths are green.
2. All green are leaves.
3. Some leaves are originals.

Conclusions:

I. Some originals are green.
II. Some leaves are cloths.
III. No cloth is an original.

(a) Only conclusion II follows.
(b) Only conclusions I and III follow.
(c) Only conclusions I and II follow.
(d) Only conclusion III follows.

Q47. All 20 students of a class are standing in a straight row facing north. Rohan is 8^(th) from the right end, while Nikhil is 10^(th) from the left end. How many students are standing between Rohan and Nikhil?

(a) 6
(b) 3
(c) 2
(d) 5

Q48. Which of the following has NO pair of parallel sides?

(a) Rectangle
(b) Rhombus
(c) Trapezium
(d) Kite

Q49. Select the option that is related to the fifth number in the same way as the fourth number is related to the third number and the second number is related to the first number.

27 : 36 :: 39 : 52 :: 30 : ?

(a) 42
(b) 40
(c) 39
(d) 43

Q50. A certain number of people are sitting around a round table facing the centre. S is sitting 3^(rd) to the right of P, who is 4^(th) to the left of Z. Only M is sitting between A and B. No other people are sitting around the table. How many people are there in total?

(a) 9

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

Q51. The arithmetic mean of the observations 39, 49, 59, 60, 70, 80, 90, 93 and 90 is:
(a) 70
(b) 79
(c) 76
(d) 78

Q52. Venuvan Vihara Buddhist Monastery is in which among the following states of India?
(a) Manipur
(b) Nagaland
(c) Tripura
(d) Meghalaya

Q53. What is the longitudinal valley lying between the lesser Himalayas and the Shivalik's known as?
(a) Duns
(b) Bugyal
(c) Payar
(d) Marg

Q54. Which of the below two signs should be interchanged to make the following equation correct?
75 ÷ 8 × 6 + 24 - 6 = 31
(a) ÷ and -
(b) • and +
(c) × and -
(d) • and ÷

Q55. Amir, Bineet, Chandra, Dinesh, Indresh, Farukh, Gurmeet and Hariom are sitting around a square table facing the centre of the table. Four of them are sitting at the corners, while four are sitting at the middle of the sides. Indresh sits third to the left of Gurmeet. Indresh sits at one of the comers. Bineet sits second to the right of Farukh. Farukh does not sit at any of the corners. Farukh is not an immediate neighbour of Indresh. Hariom is an immediate neighbour of Amir. Hariom does not sit at any of the middle of the sides. Only three people sit between Hariom and Chandra. Who sits third to the left of Dinesh?
(a) Bineet
(b) Hariom
(c) Amir
(d) Indresh

Q56. Which of the following two successive discounts are equivalent to a single discount of 84%?
(a) 40% and 60%
(b) 10% and 90%
(c) 30% and 70%
(d) 20% and 80%

Q57. Given below is a statement followed by two possible conclusions I and II. Read the information carefully and select the correct option.

Statement:

If the sheep from country K are cross bred with sheep of their neighbouring country Q, the quality of wool produced will be much better than that reared from purebred sheep of either country.

Which of the following can be concluded from the given information?

I. Any two breeds of sheep can be successfully bred with each other.

II. The demand of wool reared by purebred sheep of either of these countries might go down once the wool from the crossbred sheep is easily available in the market at comparable prices.

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(a) Only I can be concluded from the given information.
(b) Only II can be concluded from the given information.
(c) Neither I nor II can be concluded from the given information.
(d) Both I and II can be concluded from the given information.

Q58. ICAR-Indian Institute of Horticultural Research's main research station is located in which city of India?

(a) Bengaluru
(b) Shimla
(c) Ranchi
(d) Bhopal

Q59. The number of boys and girls in a class are in the ratio 6 : 5. The number of boys is 9 more than the number of girls. The total class strength (only boys and girls are in the class) is:

(a) 89
(b) 99
(c) 100
(d) 129

Q60. What is the difference between striated and smooth muscle cells?

(a) All striated muscles work by reflex action as compared to smooth muscles.
(b) Striated muscles lack nuclei while smooth muscles are binucleated
(c) Smooth muscles are not connected to the nerves while striated muscles are connected.
(d) Smooth muscles cannot contract at will, while voluntary muscles contract at will

Q61. Which of the following is the largest tiger reserve park of India?

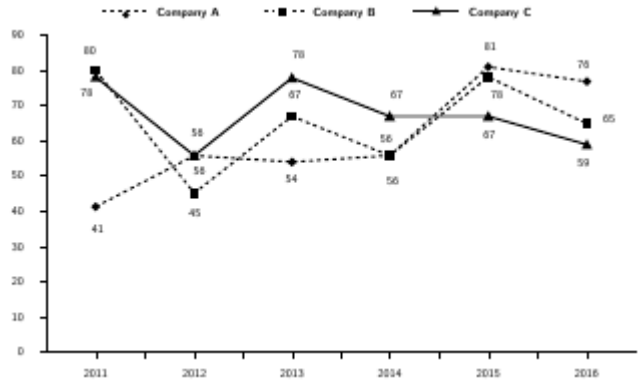
(a) Katarniaghat Wildlife Sanctuary, Uttar Pradesh
(b) Gir Forest, Gujarat
(c) Nagarjunsagar-Srisailam Tiger Reserve, Telangana & Andhra Pradesh
(d) Mayurbhanj Reserve, Odisha

Q62. If x + y = 18, Product of x and y is 77, then which of the following pairs of numbers can be the values of x and y, respectively?

(a) 12 and 6
(b) 11 and 7
(c) 9 and 9
(d) 8 and 10

Q63. Study the given graph and answer the question that follows.

The graph presents total sales (in Rs. crore) of three companies over six years.



For which of the given pairs of years are the total sales of all three companies together equal?

(a) 2013 and 2016
(b) 2011 and 2013
(c) 2015 and 2012
(d) 2011 and 2015

Q64. Which of the following letter-clusters will replace the question mark (?) in the given series to make it logically complete?

GED 14, LJI 17, QON 20, VTS 23, ?

(a) BYX 26
(b) FXY 28
(c) DVS 30
(d) AYX 26

Q65. Which of the following numbers will replace the question mark (?) in the given series?

25, 30, 55, 180, 805, ?

(a) 3930
(b) 3935
(c) 3960
(d) 3400

Q66. The average of the prime numbers between 11 and 30 is:

(a) 20.2
(b) 19.6
(c) 19.5
(d) 20.3

Q67. Consider the following statements about the force acting on a current-carrying straight conductor placed in a magnetic field:

(a) The direction of the force remains the same even when the direction of magnetic field is reversed.

(b) The direction of the force can be determined using Fleming's left-hand rule.

Which of the above statements is/are correct?

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

Q68. How can the general public living near the Ganga River participate in the Namami Gange Programme?

(a) By adding mosquito-larvae-eating fish in the river
(b) By boiling water to kill coliform bacteria before drinking it
(c) By not cutting trees growing on the river banks
(d) By stopping open defecation on river banks

Q69. Which of the following has less opposition to the flow of current?

(a) good insulator
(b) high resistance
(c) A good conductor
(d) A bad conductor

Q70. In which of the following states is India's first medical city 'Indrayani Medicity' scheduled to he set up in March 2022?

(a) Telangana
(b) Maharashtra
(c) Gujarat
(d) Karnataka

Q71. One pipe can fill a tank three times as fast as another pipe. Together the two pipes can fill the tank in 32 minutes. The slower pipe alone will be able to fill the tank in _____ minutes.

(a) 64
(b) 128
(c) 96

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(d) 144

Q72. In March 2022, the EPFO has proposed to change the interest rate on provident fund deposits from 8.5% in 2020-21 to _____ for 2021-22.

(a) 8.1%
(b) 9.2%
(c) 8.3%
(d) 9.4%

Q73. In a certain code language, 'SHOUT' is written as 'VLTAA' and 'TOTAL' is written as 'WSYGS'. How will 'WHITE' be written in that language?

(a) DFJPD
(b) ZLNZL
(c) DPRHB
(d) ZJRKL

Q74. Utkala Dibasa, is celebrated on 1 April in the Indian State of:

(a) Odisha
(b) Chhattisgarh
(c) Jharkhand
(d) Bihar

Q75. Read the given statements and conclusions carefully. Assuming that the information given in the statements is true, even if it appears to be at variance with commonly known facts, decide which of the given conclusions logically follow(s) from the statements.

Statements:

1. Some sandwiches are pizzas.

2. All burgers are pizzas.

3. Some burgers are pastas.

Conclusions:

I-Some sandwiches are burgers.

II-Some pastas are pizzas.

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

Q76. Which statement is correct for the elements of second period?

(a) They do not have the same number of valence electrons, but they contain the same number of shells.
(b) They have the same number of valence electrons, but they do not contain the same number of shells.
(c) They do not have the same number of valence electrons and they do not contain the same number of shells.
(d) They have the same number of valence electrons and they also contain the same number of shells.

Q77. Who among the following was the one of the founders of the revolutionary organisation 'Naujawan Bharat Sabha' which was founded in the year 1926?

(a) Bhagat Singh
(b) Subhash Chandra Bose
(c) Chandrashekar Azad
(d) Lala Hardayal

Q78. TB 12 is related to QY 20 in a certain way. In the same way, ML 16 is related to JI 24. To which of the following is RD 20 related following the same logic?

(a) BO 26
(b) OA 28
(c) OA 26

(d) AO 28

Q79. In quadrilateral PQRS, the bisectors of angle R and angle S meet at the point T (inside the quadrilateral) and angle STR = 87.5°. If the ratio of angle P to angle Q is 2 : 3, then what is the difference between the measures of angle Q and angle P?

(a) 45°
(b) 40°
(c) 35°
(d) 25°

Q80. The fourth proportional of 17, 32, and 51 is:

(a) 32
(b) 96
(c) 72
(d) 64

Q81. According to Constitution of India, which article is not related to Fundamental Rights from following?

(a) Article 18
(b) Article 30
(c) Article 40
(d) Article 25

Q82. Maulana Azad National Urdu University (MANUU) is a Central University established by an Act of Parliament in _____.

(a) 1991
(b) 2000
(c) 2002
(d) 1998

Q83. Which of the following is involved in emulsification of fats?

(a) Liver
(b) Stomach
(c) Pancreas
(d) Spleen

Q84. Read the given statements and conclusions carefully. Assuming that the information given in the statements is true, even if it appears to be at variance with commonly known facts, decide which of the given conclusions logically follow(s) from the statements.

Statements:

1. No rose is a hibiscus.

2. Some hibiscuses are lotuses.

Conclusions:

I. No rose is a lotus.

II. Some lotuses are not roses.

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

Q85. The average of 41 numbers is 62. The average of the first 18 numbers is 65.5 and the average of the last 24 numbers is 61.5. If the 18^(th) number from the beginning is excluded, then what is the average of the remaining numbers?

(a) 60.725
(b) 61.325
(c) 60.5

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(d) 61.625

Q86. A copper wire AB is made of three parts, AC, CD and DB of resistances in the ratio of 2 : 3 : 4. The wire is connected to a battery. If V1, V2 and V3 are the potential drops across AC, CD and DB, respectively, then which of the following is correct?

(a) V1 : V2 : V3 = 3 : 4 : 2
(b) V1 : V2 : V3 = 1 : 1 : 1
(c) V1 : V2 : V3 = 1 : 2 : 3
(d) V1 : V2 : V3 = 2 : 3 : 4

Q87. Two trains M and N cross a pole in 30 seconds and 1 minute 45 seconds, respectively. The length of train M is half the length of train N. The respective ratio of the speed of train M to that of train N is:

(a) 5 : 4
(b) 2 : 3
(c) 7 : 4
(d) 9 : 4

Q88. A man buys a car for Rs. 2,50,000 and spends Rs. 30,000 on its repairs. If he sells the car for Rs. 3,50,000, then his profit percentage is:

(a) 33.33%
(b) 28%
(c) 25%
(d) 32%

Q89. What is the nature of BaSO4 formed by a reaction of SO4 SO^(2-)4 and Ba^(2+)?

(a) Water insoluble
(b) Black crystals
(c) Red powder
(d) Water soluble

Q90. The sum of five consecutive numbers is 240. The sum of the first and last numbers is:

(a) 126
(b) 106
(c) 116
(d) 96

Q91. Preeti walks 30 m towards the east from point P. She takes a left turn and walks 18 m. She takes a left turn again and walks 65 m. Again, she takes a left turn and walks 86 m. She takes a left turn again and walks 65 m. Again, she takes a left turn and walks 18 m. She takes one final left turn and walks 30 m to reach point Q. How far and in which direction is point Q from point P? (All turns are 90 degree turns only)

(a) 50 m, North
(b) 50 m, South
(c) 68 m, North
(d) 68 m, South

Q92. Which of the following points always lie(s) on the principal axis of a spherical mirror?

(i) Centre of curvature
(ii) Point of incidence
(iii) Pole

(a) Only (ii)
(b) Both (i) and (ii)
(c) Both (i) and (iii)
(d) Only (i)

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Q93. The two numbers whose mean proportional is 14 and third proportional is 4802 are:

(a) 8 and 24
(b) 2 and 98
(c) 7 and 28
(d) 4 and 49

Q94. Avadhesh starts from Point A and drives 10 km towards the east. He then takes a left turn, drives 10 km, turns left and drives 10 km. Then he takes a final left turn, drives 3 km and stops at Point M. How far and towards which direction should he drive in order to reach Point A from Point M? (All turns are 90 degree turns only)

(a) 7 km towards the north
(b) 13 km towards the east
(c) 7 km towards the south
(d) 7 km towards the east

Q95. A certain number of people are sitting in a row facing north. C sits second to the right of B. Only four people sit between C and A. X sits second to the left of A. Only one person sits between A and Y. Z sits to the immediate right of Y. If no other person is sitting in the row, what is the total number of persons seated?

(a) 12
(b) 10
(c) 11
(d) 8

Q96. What is the number of new jobs that is proposed to be created under the productivity linked incentive scheme in 14 sectors for achieving the vision of Atmanirbhar Bharat?

(a) 55 lakh
(b) 60 lakh
(c) 50 lakh
(d) 65 lakh

Q97. The correct formula for electric power is:

(a) P = V. I. T
(b) P = V. T
(c) P = V. I
(d) P = V/I

Q98. The position of how many letters will remain unchanged if each of the letters in the word POSITIVE is arranged in alphabetical order?

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

Q99. Who among the following was conferred the Ramanujan Prize for Young Mathematicians 2021?

(a) Ritabrata Munshi
(b) Huang Hilep Pham
(c) Neena Gupta
(d) Carolina Araujo

Q100. The hypotenuse of a right-angled triangle is 2 more than twice of one of the sides, while the third side is 13 more than half of the hypotenuse. The length of the median to the hypotenuse is:

(a) 15
(b) 17
(c) 20
(d) 18

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ANSWER KEY

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

SOLUTIONS

Q1. Answer: (b) -1 ± √7

Shortcut Trick

For a quadratic equation in the form $x^2 + bx + c = 0$ (where a = 1), the roots can be directly found using the formula: $-(b/2) \pm \sqrt{((b/2)^2 - c)}$.

In this equation, b = 2 and c = −6.

Substituting the values: $-(2/2) \pm \sqrt{((2/2)^2 - (-6))}$

=> $-1 \pm \sqrt{(1 + 6)} = -1 \pm \sqrt{7}$.

Therefore The correct answer is $-1 \pm \sqrt{7}$.

Alternate Method

Given: The quadratic equation is $x^2 + 2x - 6 = 0$.

Formula Used: The standard quadratic formula to find the roots of $ax^2 + bx + c = 0$ is: $x = [-b \pm \sqrt{(b^2 - 4ac)}] / 2a$.

=> Here, the coefficients are: a = 1, b = 2, and c = −6.

=> Calculate the Discriminant (D): $D = b^2 - 4ac = (2)^2 - 4 \times 1 \times (-6)$.

=> $D = 4 + 24 = 28$.

=> Now, substitute D into the formula: $x = (-2 \pm \sqrt{28}) / (2 \times 1)$.

=> Since $\sqrt{28} = \sqrt{(4 \times 7)} = 2\sqrt{7}$, the expression becomes: $x = (-2 \pm 2\sqrt{7}) / 2$.

=> Dividing both terms by 2, we get: $x = -1 \pm \sqrt{7}$.

Therefore The correct answer is $-1 \pm \sqrt{7}$.

Additional Information

Nature of Roots

The nature depends on the Discriminant ($D = b^2 - 4ac$): 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 the equation $ax^2 + bx + c = 0$, the Sum of roots $(\alpha + \beta) = -b/a$ and the Product of roots $(\alpha\beta) = c/a$.

Completing the Square

Roots can also be found by transforming the equation into a perfect square: $(x + b/2a)^2 = (b^2 - 4ac) / 4a^2$.

Q2. Answer: (b) 110

The logic followed here is:

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

Now,

For 9 : 90

→ 9 × (9 + 1)

=> 9 × 10 = 90.

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For, 5 :30
→ 5 × (5 + 1)
=> 5 × 6 = 30.
Similarly, for 10 : ?
→ 10 × (10 + 1)
=> 10 × 11 = 110.
Hence, the correct answer is "110".

Q3. Answer: (d) 1

calculation
9/10÷ (4/5+1/10)
=> 9/10 ÷ 9/10
=>9/10 × 10/9 = 1
The answer is 1.

Q4. Answer: (d) 19 years

Shortcut Trick
B's present age = 52 − 7 = 45 years.
Ratio A : B = 5 : 9 => 9 units = 45 years.
So, 1 unit = 5 years => A's present age = 5 × 5 = 25 years.
A's age 6 years ago = 25 − 6 = 19 years.
Therefore The correct answer is 19 years.
Alternate Method
Given: Ratio of ages of A and B = 5 : 9. Let their present ages be 5x and 9x.
Calculations:
=> B's age after 7 years = 9x + 7
=> 9x + 7 = 52
=> 9x = 52 − 7 = 45
=> x = 45 ÷ 9 = 5
=> A's present age = 5x = 5 × 5 = 25 years
=> A's age 6 years ago = 25 − 6 = 19 years
Therefore The correct answer is 19 years.
Additional Information
Ratio of Ages
If the ratio of ages of two people is a : b, their ages can be assumed as ax and bx where x is a common constant.
Age After/Before 'n' Years
If present age is P, age after n years = P + n, and age n years ago = P − n.
Age Difference Constant
The difference between the ages of two persons remains constant regardless of the number of years passed or preceding.

Q5. Answer: (c) 0

Given:
5 + 12 ÷ 4 - 2 × (1 + 3)
Concept used:
Calculation:
5 + 12 ÷ 4 - 2 × (1 + 3)
=> 5 + 3 - 2 × 4
=> 8 - 8 = 0
The answer is 0.

Q6. Answer: (a) K

Given: Six friends A, B, C, I, J and K.
1) I scored less than 3 friends only.

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> > I > > __

2) C scored more than A

3) J didn't score more than A.

C > A > J

3) B scored less than J but not the least.

C > A > J > B

4) C didn't score less than K.

C > K

So, the final arrangement will be:

C > A > J > I > B > K

Here, K scored the least marks.

Hence, the correct answer is "Option 1".

Q7. Answer: (d) Sakshi Malik

The correct answer is Sakshi Malik.

Key Points

• Sakshi Malik won her first international gold medal in almost five years at the Bolat Turlykhanov Cup wrestling tournament- a UWW Ranking Series event - at Almaty in Kazakhstan on 3 June 2022.

• India's Mansi Ahlawat and Divya Kakran also finished at the top of the podium in their respective weight categories.

• The last time Sakshi Malik won a gold was at the 2017 Commonwealth Championship.

Additional Information

• The 30-member Indian contingent participated at the 35th Edition of Asian Wrestling Championships 2022 held in Ulaanbaatar, Mongolia.

• Indian wrestlers secured a total of 17 medals, that includes (1-Gold, 5-Silver, and 11-Bronze medals).

• Gold Medalist: Ravi Kumar Dahiyais the only Gold medalist representing India.

• Ministry of Railways has approved to set up a state-of-art wrestling academy in Indian Railways, at Kishanganj, Delhi.

• The wrestling academy will be the biggest in India and equipped with advanced training facilities to promote the sports of wrestling in the country.

Q8. Answer: (d) Antacids are strong acids.

The correct answer is Antacids are strong acids.

Key Points Antacids

• It is a substance used to neutralize excess Hydrochloric acid produced in the stomach.

• The action of antacid is a neutralization reaction- Acid + Base → Salt + Water

• Antacids are a class of medicines that neutralize the acid in the stomach.

• Some amount of HCl is needed for digestion but excess amount formed due to indigestion creates problems.

• The antacid can only give temporary relief to the symptoms.

• They contain ingredients such as aluminum, calcium, magnesium, or sodium bicarbonate which act as bases (alkalis) to counteract stomach acid and make its pH more neutral.

• We consume antacids when we get Acidity that is when we have a Gastric response to overeating and such as more HCl starts forming in the stomach.

• Antacids are used which are mild bases that react to Acids in the stomach to form Harmless salts and thus stopping the HCl from damaging all the inner linings.

• It will balance the pH of the stomach otherwise excess amounts of HCl produced will burn the stomach wall.

• Mg(OH)2 and NaHCO3 is an antacid.

• Therefore Antacids are not strong acid.

Q9. Answer: (b) Rs. 6,655

Shortcut Trick

Rate 10% → 1/10 (Principal 10 : Amount 11)

For two instalments, the equivalent principal ratio is (10/11) + $(10/11)^2$

Principal = Instalment × [(10/11) + (100/121)] => 11550 = Instalment × (210/121)

Instalment = (11550 × 121) ÷ 210 = 55 × 121 = 6655

Therefore The correct answer is Rs. 6,655.

Alternate Method

Given:

Borrowed Amount (Principal) = Rs. 11,550

Rate of interest = 10% per annum

Number of instalments (n) = 2

Formula Used:

$P = x \div (1 + r/100) + x \div (1 + r/100)^2$

Where x is the value of each equal instalment.

Calculations:

$\Rightarrow 11550 = x \div (1 + 10/100) + x \div (1 + 10/100)^2$

$\Rightarrow 11550 = x \div (1.1) + x \div (1.21)$

$\Rightarrow 11550 = (1.1x + x) \div 1.21$

$\Rightarrow 11550 = 2.1x \div 1.21$

$\Rightarrow x = (11550 \times 1.21) \div 2.1$

$\Rightarrow x = 5500 \times 1.21$

$\Rightarrow x = 6655$

Therefore The correct answer is Rs. 6,655.

Additional Information

Compound Interest Instalment Formula

For n years, Principal $P = x \times [1/(1+r)^1 + 1/(1+r)^2 + ... + 1/(1+r)^n]$, where r is the rate in decimals and x is the instalment.

Reducing Balance Method

In this method, interest is calculated on the outstanding principal amount at the end of each period, after subtracting the previous repayment.

Effective Interest Rate

The actual annual interest rate when compounding occurs more than once a year: $R_{(eff)} = (1 + r/n)^n - 1$.

Q10. Answer: (d) 1.21

The correct answer is 1.21.

Key Points

• Refractive index is defined as the ratio of the speed of light in vacuum to the speed of light in a medium.

• Therefore, the refractive index of glass with respect to water can be calculated as the ratio of the speed of light in water to the speed of light in glass.

• Refractive index = speed of light in vacuum / speed of light in medium.

• Refractive index of glass with respect to water = Speed of light in water / Speed of light in glass = 2.25 x 108 / 1.86 x 108 = 1.21

Additional Information

• The refractive index of a medium is a measure of how much the speed of light is reduced when it passes through that medium, compared to the speed of light in a vacuum.

• In mathematical formulae and descriptive texts, the letter n or n' is most frequently used to represent the refractive index variable.

• The amount of light path bending, or refractive index, that occurs when light enters a substance is determined by this number.

Q11. Answer: (a) Two

Given: (Left) ALL NTE PET ARE (Right)

Each letter is changed to the next letter in the English alphabetical order then,

Word	ALL	NTE	PET	ARE
After changed to next letter	BMM	OUF	QFU	BSF

After changed to the next letter in the English alphabetical order,

there are "Two" words having no vowels.

Hence, the correct answer is "Option 1".

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Q12. Answer: (b) 80

BODMAS Rule:

According to the question:

Symbols	•	•	×	÷
Meaning	•	×	÷	•

Now,

Given equation: 18 × 3 - 15 ÷ 10 + 20 = ?

After replacing the symbols:

=> 18 ÷ 3 × 15 + 10 - 20 = ?

=> 6 × 15 + 10 - 20 = ?

=> 90 + 10 - 20 = ?

=> 100 - 20 = 80.

Hence, the correct answer is "80".

Q13. Answer: (b) Each kidney has large numbers of the filtration units called neurons packed close together.

The correct answer is Each kidney has large numbers of the filtration units called neurons packed close together.

Key Points Human Excretory system:

• The system of the organ which is used to remove the waste product out from the body is called the human excretory system.

• The human excretory system includes a pair of kidneys, a pair of ureters, a urinary bladder and a urethra.

• The major waste product generated in the human body is urea, along with which some other toxins are also generated.

• Normally, in a healthy adult, the initial filtrate in the kidneys is about 180 L daily

• Kidneys are located in the abdomen, one on either side of the backbone

• Urea is eliminated by kidneys by the process of urination and solid wastes are removed from the body by the intestines.

• In kidneys, the Nephron is the functional unit, each kidney has as many as 1 million nephrons in each human kidney.

• The basic functions of the nephron are to carry out secretion as well as the process of excretion and also called as filtration unit of the human excretory system.

• Each nephron is made up of a Malpighian body.

• Nephrons are of two types which are Cortical Nephrons and Juxtamedullary Nephrons.

• Each kidney has large numbers of the filtration units called Nephrons and not neurons.

Additional InformationExcretory system organs:

1. Kidneys:It is a bean shaped organ. Its function is to clean blood and eliminate the waste from the blood in form of urine

• It is present in the abdomen, just below the diaphragm, and is protected by ribs.

• Each kidney weighs 120g to 170 g and 10-12 cm long and 5-7 cm wide and is the size of a fist.

• Kidneys are made up of subunits called Nephron

2.Ureters: Each kidney is connected to the rinal pelvis by a thin muscular tube, this tube is called as Ureter.

• Its function is to propel urine from the kidney to the urinary Bladder from time to time.

3.Bladders: It's the organ that controls the passage of urine, it is a muscular sac-like structure.

• The average capacity of the bladder is 400-600 ml.

• It holds urine until its capacity expels, or till it gets full.

4.Urethra: The Urethra is a tube made up of fibro muscular tissue that arises from the lower opening of the bladder, and open to the external uretral orifice.

• It helps to expel urine through the body, in the male it is also the tube that consist of the sperms.

Q14. Answer: (c) GUWUY

The logic followed here is:

'DIARY' is written as 'FLFXF'.

'READY' is written as 'THFJF'.

Similarly, for 'ERROR'

So, 'ERROR' will be written as 'GUWUY'

Hence, the correct answer is "Option 3".

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Q15. Answer: (a) 10C

Calculation

The maximum percentage of girls of the total students is in 10C which is 26.

The answer is 10C.

Q16. Answer: (a) Warts

The correct answer is Warts.

Key Points

• Warts

• Small bumps called warts frequently appear on the skin of the hands and the feet.

• Warts can seem different and might grow singly or in groups.

• It is a sexually transmitted diseases

• Some have a higher propensity to affect certain body parts.

• Though warts are not malignant, they can resemble several types of cancer.

• The human papillomavirus infection is what causes warts (HPV).

• The virus makes the top layer of the skin that generates an excessive quantity of keratin, a tough protein (epidermis).

• The additional keratin gives the wart its rough, hard texture.

Additional Information

Disease	Caused By
Gonorrhoea	Bacterium Neisseria gonorrhoeae
Tuberculosis (Chlamydia)	Mycobacterium tuberculosis
Syphilis	Bacterium Treponema pallidum

Q17. Answer: (d) 2.0 m behind mirror

The correct answer is 2.0 m behind mirror.

Key Points

• A convex mirror always forms a virtual, diminished, and erect image of the object placed in front of it.

• The focal length of a convex mirror is always positive, which means that the mirror is diverging in nature.

• Using the mirror formula, 1/f = 1/v + 1/u, where f is the focal length, u is the object distance, and v is the image distance, we can find the image distance for the given problem.

• Here, the object distance is -10 m and the focal length is 2.5 m.

• By substituting these values in the formula, we get v = 2.0 m, which means that the image is formed 2.0 m behind the mirror.

Additional Information

• A convex mirror is also known as a diverging mirror as it diverges the light rays.

• The image formed by a convex mirror is always virtual, diminished, and upright.

• The principal focus of a convex mirror is a point on the principal axis where the light rays appear to diverge from after reflecting from the mirror.

• The focal length of a convex mirror is always negative, and it is equal to half of the radius of curvature of the mirror.

Q18. Answer: (d) 3

Shortcut Trick

Check the Sum of Digits for divisibility by 3.

Sum = 6 + 7 + 8 + 9 + 5 + 4 + 3 + 2 + 1 = 45.

Since 45 is divisible by 3 (45 ÷ 3 = 15), the whole number is divisible by 3.

The number ends in 1 (odd), so it is not divisible by 2 or 6.

Therefore The correct answer is 3.

Alternate Method

Given: Number = 678954321

Divisibility Rules Check:

=> Divisibility by 2: A number must end in an even digit (0, 2, 4, 6, 8). Here, last digit is 1. Not divisible.

=> Divisibility by 3: Sum of digits = 6+7+8+9+5+4+3+2+1 = 45. 45 ÷ 3 = 15. Divisible.

=> Divisibility by 6: A number must be divisible by both 2 and 3. Since it is not divisible by 2, it is not divisible by 6.

=> Divisibility by 11: (Sum of odd-placed digits) − (Sum of even-placed digits)

=> (1+3+5+8+6) − (2+4+9+7) = 23 − 22 = 1. Since 1 is not 0 or a multiple of 11, it is not divisible.

Therefore The correct answer is 3.

Additional Information

Divisibility by 9

A number is divisible by 9 if the sum of its digits is divisible by 9 (e.g., 45 is divisible by 9).

Divisibility by 4

A number is divisible by 4 if its last two digits form a number divisible by 4 (e.g., 321 is not, but 324 is).

Divisibility by 5

A number is divisible by 5 if its last digit is either 0 or 5.

Q19. Answer: (b) Kanya Shiksha Pravesh Utsav

The correct answer is Kanya Shiksha Pravesh Utsav.

Key Points

• The Ministry of Women and Child Development, in partnership with Ministry of Education and UNICEF, launched a campaign 'Kanya Shiksha Pravesh Utsav', on 7 March 2022.

• It has been launched to bring back out-of-school adolescent girls in India to the formal education and/or skilling system.

• Over 400 districts will be funded under Beti Bachao Beti Padhao scheme for awareness generation.

Additional Information

• Some of the Important Women Impowerment Schemes launched by Central Government:

1. Women Empowerment Schemes
2. Beti Bachao Beti Padhao Scheme
3. One Stop Centre Scheme
4. Women Helpline Scheme
5. UJJAWALA: A Comprehensive Scheme for Prevention of trafficking and Rescue, Rehabilitation and Re-integration of Victims of Trafficking and Commercial Sexual Exploitation
6. Working Women Hostel
7. Ministry approves new projects under Ujjawala Scheme and continues existing projects
8. SWADHAR Greh (A Scheme for Women in Difficult Circumstances)
9. NARI SHAKTI PURASKAR
10. Awardees of Stree Shakti Puruskar, 2014 & Awardees of Nari Shakti Puruskar
11. Awardees of Rajya Mahila Samman & Zila Mahila Samman
12. Mahila Shakti Kendras (MSK)
13. NIRBHAYA
14. Mahila police Volunteers

Q20. Answer: (c) 32

BODMAS Rule:

According to the question:

Symbols	•	•	×	÷
Meaning	•	×	÷	•

Now,

Given equation: 18 × 3 - 5 ÷ 6 + 4 = ?

After replacing the symbols:

=> 18 ÷ 3 × 5 + 6 - 4 = ?

=> 6 × 5 + 6 - 4 = ?

=> 30 + 6 - 4 = ?

=> 36 - 4 = 32.

Hence, the correct answer is "32".

Q21. Answer: (a) S

Given: P, Q, R, S, T and U are six participants.

1) R scored more than only one participant.

> > > R > __

2) Q scored more than P and P scored more than R.

3) T scored more than Q.

T > Q > P > R

4) S scored more than Q.

5) T scored more than S.

T > S > Q

So, the final arrangement will be:

T > S > Q > P > R > U

So, 'S' is scored the second highest marks.

Hence, the correct answer is "Option 1".

Q22. Answer: (b) 50%

The correct answer is 50%.

Key Points

• Bihar was the first state to reserve 50% of seats for women in Panchayat Raj Institutions (PRIs) in 2006.

• As per provisions contained in Article 243 D of the Constitution, 1/3rd of the Seats of Panchayati Raj Institutions and 1/3rd offices of the Chairperson at all levels of Panchayati Raj Institutions covered by Part IX of the Constitution are reserved for women.

• 20 States namely Andhra Pradesh, Assam, Bihar, Chhattisgarh, Gujarat, Himachal Pradesh, Jharkhand, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Odisha, Punjab, Rajasthan, Sikkim, Tamil Nadu, Telangana, Tripura, Uttarakhand, and West Bengal have made provisions of 50% reservation for women in Panchayati Raj Institutions in their respective State Panchayati Raj Acts.

• A statement giving the position about the Elected Women Representatives in all States and UTs as per the State of Panchayat Report 2007-08 commissioned by the Ministry of Panchayati Raj is given in Annexure.

Additional Information

• Panchayati System:

• Article 40 of the Indian Constitution mandated that "the state shall take steps to organise village panchayats and invest them with such powers and authority as may be necessary to enable them to function as units of self-government".

• The Panchayati Raj system is a three-tiered administration for rural development in India.

• The development of local self-governments in districts, zones, and villages is the goal of the Panchayati Raj.

• The village panchayat has been the primary political body in rural India for many years.

• Panchayats were typically elected councils having both administrative and judicial functions in ancient India.

• A number of committees were created by the Indian government to investigate the implementation of self-governance at the rural level and to make recommendations for how to proceed.

• Municipality means Urban local self-governance body.

• Ministry of Urban Development, Ministry of Defence & Ministry of Home affairs deals with municipal governance.

• It derives Constitutional validity from the 74th Constitutional Amendment Act 1992 which added Part-IXA and Schedule 12th in our Indian Constitution.

Q23. Answer: (c) Wohler

The correct answer is Wohler.

Key Points

• Friedrich Wohler is best known for the synthesis of urea, an organic compound, from ammonium cyanate, an inorganic salt.

• Wohler was a German chemist.

• He disproved the statement, "organic compounds could only be formed within a living system"

• He was the first to isolate the elements yttrium, beryllium, and titanium.

• Wöhler was also known for being a co-discoverer of beryllium, silicon and silicon nitride, as well as the synthesis of calcium carbide.

• He was awarded The Copley Medal in 1872.

• Copley Medal is awarded by the Royal Society, for "outstanding achievements in research in any branch of science."

• Urea, also known as carbamide, is an organic compound with chemical formula CO(NH2)2. This amide has two –NH2 groups

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joined by a carbonyl (C=O) functional group.

Q24. Answer: (d) Ga2O3

The correct answer is

Key Points Eka-aluminum:

• This is the name given by Mendeleev to the undiscovered element.
• This element presently exists by the name of Gallium.
• Gallium belongs to group 13 of the periodic table.
• Its atomic number is 31.
• It's a soft, silvery metal at standard temperature and pressure.
• Ga2O3 corresponds to the oxide of Eka-aluminium.

Additional Information

Oxides:

• These are chemical compounds with one or more oxygen atoms combined with another element.
• Oxides are binary compounds of oxygen with another element, e.g., CO2, SO2, CaO, CO, ZnO, BaO2, H2O, etc.
• Acidic Oxide: An oxide that combines with water to give an acid is termed an acidic oxide.
• Basic Oxide: The oxide that gives a base in water is known as a basic oxide.
• Amphoteric solution: It's a solution that can chemically react as either acid or base.
• Neutral Oxide: It is also possible for an oxide to be neither acidic nor basic, but is a neutral oxide.

Q25. Answer: (a) C - E - A - D - B

The arrangement for the given food chain will be:

C. Rice Plant - It produces food using solar energy.
E. Locust - Locust are primary consumers, They eat plants.
A. Frog - Frogs are secondary consumers, They eat Locust.
D. Snake - Snakes are tertiary consumers, They eat frogs.
B. Eagle - Eagles are Quaternary consumers, They eat snakes.

So, the correct food chain is: 'C - E - A - D - B'.

Hence, the correct answer is "Option 1".

Q26. Answer: (a) 23

Shortcut Trick

Subtract the remainders from the numbers: (72 − 3) = 69 and (122 − 7) = 115.

Find the HCF of 69 and 115.

69 = 23 × 3 and 115 = 23 × 5.

Common factor is 23.

Therefore The correct answer is 23.

Alternate Method

Given: Numbers are 72 and 122; Remainders are 3 and 7.

Formula Used: Required Number = HCF(Number1 − Remainder1, Number2 − Remainder2)

=> First number = 72 − 3 = 69

=> Second number = 122 − 7 = 115

=> Factors of 69 = 1, 3, 23, 69

=> Factors of 115 = 1, 5, 23, 115

=> Highest Common Factor (HCF) = 23

Therefore The correct answer is 23.

Additional Information

HCF Definition

The Highest Common Factor (HCF) is the largest positive integer that divides each of the integers without a remainder.

HCF and LCM Relation

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

Euclid Division Lemma

It states that for any two positive integers a and b, there exist unique integers q and r such that a = bq + r, where 0 ≤ r < b.

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Q27. Answer: (d) Pradhan Mantri Jan Dhan Yojana

The correct answer is Pradhan Mantri Jan Dhan Yojana.

Key Point

• Pradhan Mantri Jan Dhan Yojana was launched on 28th August 2014.

• Pradhan Mantri Jan-Dhan Yojana (PMJDY) under the National Mission for Financial Inclusion was launched initially for a period of 4 years.

• It envisages universal access to banking facilities with at least one basic banking account for every household.

• Financial literacy, access to credit, insurance, and pension.

• PMJDY has provided a platform for the three social security schemes viz. Pradhan Mantri Jeevan Jyoti Bima Yojana (PMJJBY), Pradhan Mantri Suraksha Bima Yojana (PMSBY), Atal Pension Yojana (APY), and Pradhan Mantri Mudra Yojana (PMMY).

• The Government has decided to extend the comprehensive PMJDY program beyond 28.8.2018 with the change in focus on opening accounts from every household to every adult.

Q28. Answer: (b) change in magnet flux passing through coil

The correct answer is change in magnet flux passing through coil.

Key Points

• Electromagnetic Induction

• Electromagnetic Induction was discovered by Michael Faraday in 1831.

• And James Clerk Maxwell mathematically described it as Faraday's law of induction.

• Electromagnetic induction is defined as the process of production of emf or current by changing the magnetic flux with time.

• Formula, emf, $e=-N d\varphi/dt$ where φ = magnetic flux, N = number of turns in a coil.

• Magnetic flux is defined as the number of magnetic field lines passing through a given closed surface.

• The formula of magnetic flux, $\varphi = BA\cos\theta$, where B = magnetic field, A = closed surface, θ = angle between the magnetic field and the closed surface area vector.

Additional Information

• When a magnetic field linked to a coil changes with time, then the magnetic flux also changes.

• Due to the change in magnetic flux, the emf induced in the coil.

• When we attach a resistor of resistance in the circuit, then the current flow in the circuit, and that current is called induced current.

• The phenomenon of electromagnetic induction implies the production of induced current in a coil when a magnetic field changes with time.

Q29. Answer: (a) 50 π cm

Shortcut Trick

Perimeter (Circumference) of a circle = π × Diameter.

Given Diameter = 50 cm.

Perimeter = π × 50 = 50π cm.

Therefore The correct answer is 50π cm.

Alternate Method

Given:

Diameter (d) of the circle = 50 cm

Formula Used:

Perimeter (C) = 2 × π × Radius (r) OR Perimeter (C) = π × Diameter (d)

Calculations:

=> Radius (r) = Diameter ÷ 2 = 50 ÷ 2 = 25 cm

=> Perimeter = 2 × π × 25

=> Perimeter = 50π cm

Therefore The correct answer is 50π cm.

Additional Information

Area of a Circle

The total space occupied by the circle, calculated as Area = πr^2 or $\pi d^2/4$.

Semi-circle Perimeter

The perimeter of a semi-circle includes the curved arc and the diameter: P = πr + 2r.

Relation between Radius and Diameter

The diameter is always twice the length of the radius (d = 2r).

Q30. Answer: (c) Manas

The correct answer is Manas.

Key Points

• Manas Wildlife Sanctuary:

• It is a national park, a Project Tiger reserve, an elephant reserve and a biosphere reserve in Assam.

• It is home to rare and endangered endemic wildlife such as the Assam roofed turtle, hispid hare, golden langur and pygmy hog.

• The Manas National Park was declared a sanctuary in 1928.

• It was included in the list of UNESCO World Heritage Sites in 1985.

Additional Information

• Pachmarhi is a hill station in the Hoshangabad district of Madhya Pradesh.

• Pachmarhi, widely known as the Queen of Satpura, is situated at an altitude of 1100 meters in the valley of the Satpura range in the Hoshangabad district.

• The name Panchmarhi is believed to be derived from the Hindi words Panch ("five") and Marhi ("caves").

• These caves were built by the five Pandava brothers of the Mahabharata period during their thirteen years of exile.

• Sundarban National Park is located in West Bengal.

• The park is listed on the UNESCO world heritage site.

• Sundarban National Park is famous for Royal Bengal Tigers.

• It is a large coastal mangrove forest.

• Sundarban delta is the largest delta in the world.

• Nilgiri Hills are situated in Tamil Nadu.

• Doddabetta is the highest peak of the Nilgiri hills.

• Nilgiri hills are a part of the Western Ghats.

• The hills are located at the tri-junction of the states Karnataka, Kerela, and Tamil Nadu.

• These mountains are named after the Neelakurunji flowers (purplish-blue flowers) found in the Shola forests of Nilgiri hills.

• Nilgiri Hills are known as the Blue Mountains.

Q31. Answer: (b) 20

The logic followed here is:

So, '20' will replace the question mark in the given series.

Hence, the correct answer is "Option 2".

Q32. Answer: (d) Softened enamel

The correct answer is Softened enamel.

Key Points

• Dental caries is a common chronic infection caused by cariogenic bacteria that cling to teeth, mainly Streptococcus Mutans.

• These bacteria break down sugars into acid over time.

• Dental caries can result in the softening of the enamel, which is the hard, outer layer of the tooth.

• This happens due to the acid produced by the bacteria that breaks down the minerals in the enamel.

Additional Information

• Bleeding gums: This is a common symptom of gum disease, which is caused by the buildup of plaque and tartar on the teeth. It can also be a sign of other health conditions such as leukemia or vitamin deficiencies.

• Broken tooth: A broken tooth can occur due to trauma or decay. It can cause pain and sensitivity, and may require dental treatment such as a filling, crown, or extraction.

• Foul-smelling breath: This can be a symptom of poor oral hygiene, gum disease, or other health conditions such as diabetes or liver disease.

Q33. Answer: (a) Both the statements are true.

The correct answer is Both the statements are true.

Key Points

• Electrovalent compounds are also known as ionic compounds.

• These compounds are formed between a metal and a non-metal through the transfer of electrons.

• The metal loses electrons to form a positively charged ion (cation) while the non-metal gains electrons to form a negatively charged ion (anion).
• The resulting ions attract each other through electrostatic forces to form a stable compound.
• They are soluble in water due to the polar nature of water molecules.
• They are insoluble in non-polar solvents such as kerosene and petrol.

Additional InformationIonic Bond:

• Ionic or electrovalent bonds are created when atoms exchange electrons to establish a bond between them.
• It can only occur between non-metals and metals.
• It cannot develop between two non-metals.
• It is formed between atoms when electronegativity varies greatly.
• It is the strongest of all the bonds.

Q34. Answer: (c) seven

The correct answer is seven.

Key Points

• The differing angles of refraction for different wavelengths of light cause white light to be refracted and split into various colors when it passes through a triangular prism.
• The number of colors that are visible depends on the angle at which the light enters and exits the prism, as well as the thickness and material of the prism. Typically, white light is split into seven colors when passing through a triangular prism.
• The colors that are visible to the human eye are red, orange, yellow, green, blue, indigo, and violet. These colors are commonly remembered using the acronym VIBGYOR.
• The phenomenon of splitting light into its constituent colors is called dispersion.

Additional Information

• In the field of optics, a prism is a transparent substance, such as glass, that has been precisely cut with plane faces and angles.
• It is used to reflect and analyze light.
• A standard triangular prism can divide white light into its component colors, or what is known as a spectrum.
• The bending of light as it moves from one transparent substance into another is known as refraction.
• The bending caused by refraction allows us to create rainbows, prisms, magnifying glasses, and lenses.
• Our eyes are dependent on this light bending as well.

Q35. Answer: (a) 1

Given: (Left) N 3 % Y 7 & 3 5 G M Q 1 @ 2 C ^ 9 L 2 B (Right)

Now,

Symbols immediately preceded by a letter and also immediately followed by a number,

So, needed pattern is: Letter - Symbol - Number

Here,

Only 'one' pair having the Symbols immediately preceded by a letter and also immediately followed by a number.

Hence, the correct answer is "Option 1".

Q36. Answer: (a) 3.6%

The correct answer is 3.6%.

Key Points

• First Five Year Plan:
• The first Indian prime minister, Jawaharlal Nehru, presented the First Five-Year Plan to the Parliament of India.
• The First Five-year Plan was launched in 1951 which mainly focused on the development of the primary sector.
• The First Five-Year Plan was based on the Harrod–Domar model with few modifications.
• The target growth rate was 2.1% annual gross domestic product (GDP) growth; the achieved growth rate was 3.6% the net domestic product went up by 15.
• Many irrigation projects were initiated during this period, including the Bhakra, Hirakud, Mettur Dam, and Damodar Valley dams.
• At the end of the plan period in 1956, five Indian Institutes of Technology (IITs) were started and The University Grants Commission (UGC) was set up.
• Contracts were signed to start five steel plants, which existed in the middle of the Second Five-Year Plan.
• The plan was quasi-successful for the government.

Additional Information

• Basic information about planning commission and 5-year plans:
• Planning commission founded: 1950.
• Planning Commission head: Prime Minister
• First five-year plan launched: in 1951
• A total number of 5-year plans: 12.
• Last five-year plan: 2012 to 2017 (Under PM Manmohan Singh).
• Planning Commission dissolved: 2014 (By PM Narendra Modi).

Q37. Answer: (d) 99 cm3

Shortcut Trick
Check for divisibility by 11 (since π = 22/7 involves a factor of 11).
Only option (4) 99 is divisible by 11.
Therefore The correct answer is 99 cm^3.
Alternate Method
Given:
Diameter (d) = 3 cm
Radius (r) = d/2 = 3/2 = 1.5 cm
Height (h) = 14 cm
Formula Used: Volume of Cylinder (V) = $\pi r^2 h$
Calculations:
=> V = (22/7) × (3/2) × (3/2) × 14
=> V = (22/7) × (9/4) × 14
=> V = 22 × (9/4) × 2
=> V = 11 × 9
=> V = 99 cm^3
Therefore The correct answer is 99 cm^3.
Additional Information
Curved Surface Area (CSA)
The lateral area of a cylinder is given by the formula $2\pi rh$.
Total Surface Area (TSA)
The sum of the curved surface and the two circular bases is $2\pi r(h + r)$.
Hollow Cylinder Volume
The volume of a pipe or hollow cylinder is $\pi(R^2 - r^2)h$, where R is outer and r is inner radius.

Q38. Answer: (d) Shri YH Malegam

The correct answer is Shri YH Malegam.
Key Points
• RBI formed a sub-committee to study the issues and concerns in the microfinance sector under YH Malegam.
• In the wake of the AP microfinance crisis in 2010, RBI constituted a committee under the chairmanship of Shri Y H Malegam to study issues and concerns in the MFI sector.
• The regulatory approach toward microfinance has been largely based on the recommendations of the Malegam Committee.
• The key recommendations of the Malegam Committee were as follows:
• Creation of a separate category of NBFC operating in the microfinance sector to be designated as NBFC-MFI.
• Criteria for defining 'microfinance loans' classified as 'qualifying assets.
• Prudential norms on capital adequacy and provisioning requirements
• Prescriptions related to the pricing of credit in terms of a margin cap and interest rate ceiling on individual loans.
• Transparency in interest charges as well as other terms and conditions of the loan Measures to address multiple lending, over-borrowing and coercive methods of recovery Establishment of a proper system of grievance redressal

Q39. Answer: (c) Oxidation is gain of oxygen or loss of hydrogen.

The correct answer is Oxidation is gain of oxygen or loss of hydrogen.
Key PointsOxidation:
• It is a process where a substance loses electrons and becomes more positively charged.

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• It is often accompanied by the gain of oxygen or loss of hydrogen.
• For example, when iron rusts, it undergoes oxidation by reacting with oxygen in the air.

Additional InformationReduction:

• It is a process where a substance gains electrons and becomes more negatively charged.
• It is often accompanied by the loss of oxygen or gain of hydrogen.
• It is used in manufacturing of cement.
• For example, when silver ions gain electrons to form silver metal, they undergo reduction.

Neutralisation:

• It is a reaction that occurs between an acid and a base to form a salt and water.
• The acid and base cancel out each other's properties, resulting in a neutral pH.
• In wastewater treatment, this technique is employed to lessen the harm that the effluents cause.
• It is employed in the process of making antacid pills.
• A strong acid and strong base neutralized has a pH of seven.

Q40. Answer: (c) L

The correct answer is L.

Key Points

• Nitrogen atom has electronic configuration 1s2 2s2 2p3.
• The formation of the N2 molecule involves the sharing of electrons between two nitrogen atoms.
• In the formation of the N2 molecule, the two nitrogen atoms share three pairs of electrons to form a triple bond.
• The triple bond in the N2 molecule is formed by the overlap of the three 2p orbitals of each nitrogen atom.
• The number of electrons in nitrogen is 7.
• The L shell of the nitrogen atom participates in forming the N2 molecule.

Additional InformationApplications of Nitrogen:

• It keeps food from spoiling because it creates an atmosphere that isn't reactive.
• It is used to certain aircraft fuel systems to lessen the risk of fire.
• It is utilized in the manufacturing of explosives, nylon, nitric acid, fertilizers, and colors.
• It is widely employed in the pharmaceutical sector to transfer reaction mixtures from one tank to another.

Q41. Answer: (d) Pralhad Venkatesh Joshi

The correct answer is Pralhad Venkatesh Joshi.

Key Points

• Pralhad Venkatesh Joshi:
• He took charge as the Union Minister of Parliamentary Affairs in July 2021.
• He is presently the Union Minister of Parliamentary Affairs.
• He is a Member of Parliament from the Dharwad constituency in Karnataka.
• He has previously held the position of Minister of Coal, Mines, and Parliamentary Affairs.
• As the Union Minister of Parliamentary Affairs, Joshi is responsible for managing the government's legislative agenda, coordinating with political parties, and ensuring smooth functioning of Parliament.

Additional Information

• Raj Kumar Singh is the current Union Minister of Power and New and Renewable Energy.
• Arjun Munda is the current Union Minister of Tribal Affairs and Minister of Agriculture and Farmers' Welfare.
• Piyush Goyal is the current Union Minister of Commerce and Industry and Consumer Affairs, Food and Public Distribution, and Textiles.

Q42. Answer: (d) 81, 16

Shortcut Trick

Co-prime numbers are pairs of numbers that have only 1 as their common factor (HCF = 1).

Check the divisibility of the given pairs:

(1) 52, 24 → Both are even (divisible by 2).

(2) 363, 77 → Both are divisible by 11.

(3) 455, 49 → Both are divisible by 7.

(4) 81, 16 → 81 = 3^4 and 16 = 2^4. No common factor except 1.

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Therefore The correct answer is 81, 16.

Alternate Method

Given: Pairs of numbers to identify co-prime property.

Formula Used: Two numbers a and b are co-prime if HCF(a, b) = 1.

=> Case 1: HCF(52, 24) => 52 = 4 × 13, 24 = 4 × 6. HCF = 4.

=> Case 2: HCF(363, 77) => 363 = 11 × 33, 77 = 11 × 7. HCF = 11.

=> Case 3: HCF(455, 49) => 455 = 7 × 65, 49 = 7 × 7. HCF = 7.

=> Case 4: HCF(81, 16) => 81 = 3^4, 16 = 2^4. Only common factor is 1. HCF = 1.

Therefore The correct answer is 81, 16.

Additional Information

Properties of Co-prime Numbers

Any two prime numbers are always co-prime to each other. Two consecutive natural numbers (n, n+1) are always co-prime.

LCM of Co-prime Numbers

The Least Common Multiple (LCM) of two co-prime numbers is always equal to their product (LCM = a × b).

Twin Primes

A pair of prime numbers with a difference of 2 is called twin primes (e.g., 3 and 5, 11 and 13). All twin primes are co-prime.

Q43. Answer: (b) Thirteen

Given words: (left) BOW SAD LOW RAY (right)

Now,

the second letter of the first word from the right is: A (RAY)

and, the second letter of the first word from the left is: O (BOW)

Here, the number of letters between A to O is 13.

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O

Hence, the correct answer is "Option 2".

Q44. Answer: (a) To the immediate left of F

Given: Five friends C, D, E, F and G.

1) D is seated 2nd to the right of F.

2) Only D is seated between G and E.

3) F, who is not seated at either side of G.

And, C will sit on the remaining place.

So, C is seated to the immediate left of F.

Hence, the correct answer is "Option 1".

Q45. Answer: (d) Mithali Raj

The Correct answer is Mithali Raj. Mithali Raj has become the first woman, and only the third cricketer ever, to appear at six ICC Women's Cricket World Cups.

Key Points

• Mithali Raj became the first Indian woman cricketer to score 10000 international runs.

• Mithali Raj, playing her 212th ODI for India, achieved the landmark during the third match of the bilateral series against South Africa.

• She scored 663 runs in 10 test matches whereas in 89 T20s she scored 2,364 runs at an average of 37.52.

• She is also the first player to score 7 consecutive 50s in One Day International Cricket.

• Mithali Raj, in 2019, became the first woman to complete 20 years in International cricket.

• She is the only female cricketer to surpass the 7,000-run mark in Women's One Day International matches.

• On 8 June 2022, Mithali announced her retirement from all formats of international cricket.

• She is also the recipient of several National and International awards, including the Arjuna Award in 2003 and Padma Shri in 2015.

Additional Information

• Harmanpreet Kaur was named India's captain for the T20 World Cup in the Caribbean.

• In the opening match of the tournament against New Zealand, Harmanpreet became the first woman for India to score a century in T20Is as she slammed 103 off just 51 balls.

• Harmanpreet Kaur is an Indian Cricketer.

• She plays as an All-rounder for the Indian Women's Cricket team and was awarded the Prestigious Arjuna award for cricket in the year 2017 by the Ministry of youth affairs and sports.

• She is born on the 8th of March 1989 in Moga, Punjab.

• Smriti Mandhana

• Smriti Shriniwas Mandhana is an Indian cricketer who plays for the Indian women's national team.

• In June 2018, the Board of Control for Cricket in India (BCCI) named her the Best Women's International Cricketer.

• In December 2018, the International Cricket Council (ICC) awarded her with the Rachael Heyhoe-Flint Award for the best female cricketer of the year.

• On 30 December 2021, she became a nominee for the ICC Women's T20 Player of the Year.

• Jhulan Goswami

• Jhulan Nishit Goswami is an Indian former cricketer. She played for Indian women's cricket team from 2002 to 2022.

• She is one of the fastest bowler of all times and considered one of the greatest bowlers to ever play the sport.

Q46. Answer: (a) Only conclusion II follows.

Statements:

1. All cloths are green.

2. All green are leaves.

3. Some leaves are originals.

The least possible Venn diagram for the given statement is:

Conclusions:

I. Some originals are green - False (No definite relation given between originals and green, so it can be possible only).

II. Some leaves are cloths - True (As All cloths are green, All green are leaves, it implies that some part of leaves will definitely cloths).

III. No cloth is an original - False (No definite relation given between cloth and original, so it can be possible only).

So, Only conclusion II follows.

Hence, the correct answer is "Option 1".

Q47. Answer: (c) 2

Given: 20 students of a class are standing in a straight row facing north.

Rohan from the right end = 8th,

Nikhil from the left end = 10th,

So, person between Rohan and Nikhil = 20 - (8 + 10)

= 20 - 18 = 2.

So, there are '2' students are standing between Rohan and Nikhil.

Hence, the correct answer is "Option 3".

Q48. Answer: (d) Kite

Shortcut Trick

In geometry, Parallel Sides are determined by the definition of the quadrilateral.

Rectangle and Rhombus (Parallelograms) → 2 pairs of parallel sides.

Trapezium → Exactly 1 pair of parallel sides.

Kite → 0 pairs of parallel sides (only adjacent sides are equal).

Therefore The correct answer is Kite.

Alternate Method

Given: A set of quadrilaterals: Rectangle, Rhombus, Trapezium, and Kite.

Formula/Property Used: Definition of Parallelism in polygons.

Step-by-step verification:

=> Rectangle: By definition, it is a parallelogram where opposite sides are equal and parallel. Number of parallel pairs = 2.

=> Rhombus: It is a parallelogram with all sides equal. Opposite sides are parallel. Number of parallel pairs = 2.

=> Trapezium: It is a quadrilateral with at least one pair of parallel sides. Number of parallel pairs = 1.

=> Kite: It is a quadrilateral with two pairs of equal adjacent sides. It does not have any parallel sides.

Therefore The correct answer is Kite.

Additional Information

Properties of a Kite

A kite has two pairs of equal-length sides that are adjacent to each other, and its diagonals intersect at a 90° angle.

Parallelogram Family

Rectangles, Rhombuses, and Squares are all types of parallelograms, meaning they all possess 2 pairs of parallel sides.

Trapezium Characteristics

A trapezium is defined by having exactly (or at least) one pair of opposite sides that are parallel, known as the bases.

Q49. Answer: (b) 40

The logic followed here is:

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

Now,

For, 27 : 36

→ 27 + (27 ÷ 3)

=> 27 + 9 = 36.

For, 39 : 52

→ 39 + (39 ÷ 3)

=> 39 + 13 = 52.

Similarly, for 30 : ?

→ 30 + (30 ÷ 3)

=> 30 + 10 = 40.

Hence, the correct answer is "Option 2".

Q50. Answer: (b) 8

Given: A certain number of people are sitting around a round table facing the centre.

1) S is sitting 3rd to the right of P, who is 4th to the left of Z.

2) Only M is sitting between A and B.

3) No other people are sitting around the table.

So, there are '8' people in the row.

Hence, the correct answer is "Option 2".

Q51. Answer: (a) 70

Shortcut Trick

Assume an Average near the middle value, let Assumed Mean = 70.

Find Deviations from 70: −31, −21, −11, −10, 0, +10, +20, +23, +20.

Sum of Deviations = (−31 − 21 − 11 − 10) + (10 + 20 + 23 + 20) = −73 + 73 = 0.

Since the Net Deviation is 0, the Actual Mean = Assumed Mean + (0 ÷ 9) = 70.

Therefore The correct answer is 70.

Alternate Method

Given:

Observations (x) = 39, 49, 59, 60, 70, 80, 90, 93, 90

Number of observations (n) = 9

Formula Used:

Arithmetic Mean = (Sum of all observations) ÷ (Total number of observations)

Calculations:

=> Sum = 39 + 49 + 59 + 60 + 70 + 80 + 90 + 93 + 90

=> Sum = 630

=> Arithmetic Mean = 630 ÷ 9

=> Arithmetic Mean = 70

Therefore The correct answer is 70.

Additional Information

Sum of Deviations

The algebraic sum of the deviations of a set of observations from their Arithmetic Mean is always zero: $\Sigma(x_i - \text{Mean}) = 0$.

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Effect of Operations

If a constant 'k' is added to or subtracted from every observation, the Mean also increases or decreases by 'k'. If every observation is multiplied by 'k', the Mean is also multiplied by 'k'.

Sensitivity to Outliers

The Arithmetic Mean is highly sensitive to extreme values (outliers), which can pull the mean away from the center of the majority of data points.

Q52. Answer: (c) Tripura

The correct answer is Tripura.

Key Points

• Venuvan Vihara Buddhist Monastery is in Tripura state of India.

• Buddhist Temples in Tripura support the fact that Buddhism is quite prevalent in the state. Archaeological evidences have suggested that Buddhists have inhabited the region since ancient times.

• Several Buddhist rulers ruled over the state and left permanent influences on the culture of the state. It is believed that Buddhists have inhabited the region since ancient times after the archaeological evidences.

• Agartala is the capital city of the state Tripura (one of the seven northeastern states of India). Blessed with natural beauty, it is a slice of paradise on earth. This place lies in the northeast region of India situated on the banks of river Haora which is close to the Bangladesh border.

Additional Information

• Ujjayanta Palace, Agartala: The Ujjayanta Palace is also known as Ujjoyonto Prashad, situated on the banks of a lake. This palace was built by Maharaja Radhakishore Manikya in the Indo-Saracenic architectural style during 1899 to 1901. The name of this palace was given after the Nobel Laureate, Rabindranath Tagore. This palace consists of several Hindu temples dedicated to Lakshmi Narayan, Uma-Maheshwari, Kali and Jagannath.

• Kunjaban Palace, Agartala: Kunjaban Palace is a great monument built by King Birendra Kishore Manikya in 1917. In present time, it is used as the dwelling of the Governor of the State of Tripura. This Palace displays the rich artistic taste of the ruler. Before, this palace was named as ‘Pushbanta Palace’. There are well laid gardens and lawns inside the palace.

• Malancha Niwas, Agartala: It is a major attraction in Agartala. The bungalow is adjacent to the Kunjaban Palace. This is originally a Kutcha house where Rabindranath Tagore, who was the great Indian poet and writer stayed here influenced by the natural beauty during his visit to Agartala in 1919. This magnificent house wins away the heart of the tourists.

• Fourteen Goddess Temple. Agartala: Fourteen Goddess Temple is also known as the Chaturdasha Temple. This temple was built by King Krishna Manikya Debbarma of Tripura in 1761. It was built in honour of fourteen deities, together called the Chaturdasha Devata. It is one of the most interesting temple that attracts a lot of tourist from all over India.

Q53. Answer: (a) Duns

The correct answer is Duns.

Key Points

• The Himachal and Uttarakhand Himalayas: This part lies approximately between the Ravi in the west and the Kali (a tributary of Ghaghara) in the east. It is drained by two major river systems of India, i.e. the Indus and the Ganga.

• All three ranges of the Himalayas are prominent in this section and these are : the Great Himalayan range, the Lesser Himalayas (which is locally known as Dhaoladhar in Himachal Pradesh and Nagtibha in Uttarakhand) and the Shiwalik range from the North to the South.

• The two distinguishing features of this region from the point of view of physiography are the 'Shiwalik' and 'Dun formations'. Duns are longitudinal valleys. Some important duns located in this region are the Chandigarh-Kalka dun, Nalagarh dun, Dehra Dun, Harike dun and the Kota dun, etc. Dehra Dun is the largest of all the duns with an approximate length of 35-45 km and a width of 22-25 km.

Additional Information

• Bugyals are essentially grassland growths on mountain bodies in the form of a meadow in higher levels.

• It grows between 3300 metres and 4000 metres of the Himalayas in the Uttarakhand region.

• They are also called 'nature's own gardens.'

• The favourable topography for the growth of Bugyals is flat or sloped.

Q54. Answer: (a) ÷ and -

Given equation: 75 ÷ 8 × 6 + 24 - 6 = 31.

BODMAS Table:

Let's check each option one by one.

Option 1) ÷ and -

Given: 75 ÷ 8 × 6 + 24 - 6 = 31.

After interchanging the signs we get;
=> 75 - 8 × 6 + 24 ÷ 6 = 31
=> 75 - 8 × 6 + 4 = 31
=> 75 - 48 + 4 = 31
=> 79 - 48 = 31
=> 31 = 31
=> LHS = RHS
Option 2) - and +
Given: 75 ÷ 8 × 6 + 24 - 6 = 31
After interchanging the signs we get;
=> 75 ÷ 8 × 6 - 24 + 6 = 31
=> 9.375 × 6 - 24 + 6 = 31
=> 56.25 - 24 + 6 = 31
=> 62.25 - 24 = 31
=> 38.25 ≠ 31
=> LHS ≠ RHS
Option 3) × and -
Given: 75 ÷ 8 × 6 + 24 - 6 = 31
After interchanging the signs we get;
=> 75 ÷ 8 - 6 + 24 × 6 = 31
=> 9.375 - 6 + 24 × 6 = 31
=> 9.375 - 6 + 144 = 31
=> 153.375 - 6 = 31
=> 147.375 ≠ 31
=> LHS ≠ RHS
Option 4) + and ÷
Given: 75 ÷ 8 × 6 + 24 - 6 = 31
After interchanging the signs we get;
=> 75 + 8 × 6 ÷ 24 - 6 = 31
=> 75 + 8 × 0.25 - 6 = 31
=> 75 + 2 - 6 = 31
=> 77 - 6 = 31
=> 71 ≠ 31
=> LHS ≠ RHS
Hence, the correct answer is "Option 1".

Q55. Answer: (c) Amir

Given: Amir, Bineet, Chandra, Dinesh, Indresh, Farukh, Gurmeet and Hariom.
Four of them are sitting at the corners, while four are sitting at the middle of the sides.
1) Indresh sits third to the left of Gurmeet.
2) Indresh sits at one of the comers.
3) Farukh is not an immediate neighbour of Indresh.
4) Farukh does not sit at any of the corners.
5) Bineet sits second to the right of Farukh.
6) Hariom is an immediate neighbour of Amir.
7) Hariom does not sit at any of the middle of the sides (It means Hariom will sit on the immediate left of Gurmeet).
8) Only three people sit between Hariom and Chandra.
And, Dinesh will sit on the remaining place.
So, 'Amir' sits third to the left of Dinesh.
Hence, the correct answer is "Option 3".

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Q56. Answer: (d) 20% and 80%

Shortcut Trick

Net Discount = a + b − (a × b) ÷ 100

Check option (4): 20 + 80 − (20 × 80) ÷ 100

Net Discount = 100 − 1600 ÷ 100 = 100 − 16 = 84%

This matches the required single discount of 84%.

Therefore The correct answer is 20% and 80%.

Alternate Method

Given: Single equivalent discount = 84%.

Formulas: Equivalent Discount = 100 − [100 × (100 − d1)% × (100 − d2)%]

=> Let Marked Price (MP) be 100.

=> After 20% discount: 100 − (20% of 100) = 80.

=> After 80% discount: 80 − (80% of 80) = 80 − 64 = 16.

=> Total Discount = MP − SP = 100 − 16 = 84.

=> Discount% = (84 ÷ 100) × 100 = 84%.

Therefore The correct answer is 20% and 80%.

Additional Information

Successive Discounts

A successive discount is a discount applied on the reduced price after a previous discount has been deducted. It is not a simple sum of percentages.

Effective Discount Formula

For three discounts a, b, and c, the effective discount is calculated by applying the formula twice or using the ratio method.

Q57. Answer: (b) Only II can be concluded from the given information.

Given Statement:

If the sheep from country K are cross bred with sheep of their neighbouring country Q, the quality of wool produced will be much better than that reared from purebred sheep of either country.

Now, Conclusion:

I. Any two breeds of sheep can be successfully bred with each other - Does not concluded (Because in the statement, the particular country given and nothing mention about the any two breeds).

II. The demand of wool reared by purebred sheep of either of these countries might go down once the wool from the crossbred sheep is easily available in the market at comparable prices - Concluded (Because of the comparable prices the demand of wool reared by purebred sheep may be reduced).

Hence, the correct answer is "Option 2".

Q58. Answer: (a) Bengaluru

The correct answer is Bengaluru.

Key Points

• The IIHR has its main research station at Hessaraghatta, Bengaluru with 263 ha of land and Regional experiment station at Bhuvaneshwar in Orissa with two Krishi Vigyan Kendras both located in Karnataka state at Gonikopal in Kodagu and Hirehalli in Tumkur districts. Apart from this, the Project Coordinating Cell of the All India Coordinated Research Project on Fruits is also located at the institute at Bengaluru.

• The Institute has also an Agriculture Technology Information Centre (ATIC), which is a single window agency for dissemination of information and technologies developed by the Institute. All the technological products and popular publications developed by the Institute are sold to the farmers and interested public through the agricultural technology information centre.

• The institute’s main research agenda was to increase the yields of horticultural crop varieties by developing high yielding varieties in fruits, vegetables, ornamentals and medicinal products, aromatic plants and also develop advanced production technologies to increase the productivity of horticultural crops.

• The Institute has also got an Agriculture Technology Information Centre (ATIC), which is a single-window agency for the dissemination of information and technologies developed by the Institute.

• Director - Dr. B.N. Srinivasa Murthy

Additional Information

• Indian Institute of Horticultural Research has developed a new variety of Marigold named Arka Shubha.

• This variety of marigolds has a carotene content of around 2.8% (for all marigolds, its maximum up to 1.4%) which is the highest among all plant sources.

• This new variety of marigolds can be used for the extraction of crude carotene.
• The Arka Shubha variety is of use in the poultry sector as well. Its petals could be used as feed to get quality yolk.

Q59. Answer: (b) 99

Shortcut Trick
Ratio of Boys to Girls = 6 : 5
Difference in ratio units = 6 − 5 = 1 unit
Given difference = 9 boys
Therefore 1 unit = 9 students
Total strength = (6 + 5) = 11 units = 11 × 9 = 99 students
Therefore The correct answer is 99.
Alternate Method
Given:
Ratio of boys to girls = 6 : 5
Difference = 9
Calculations:
=> Let the number of boys be 6x and girls be 5x.
=> According to the question, 6x − 5x = 9
=> x = 9
=> Total strength = 6x + 5x = 11x
=> Total strength = 11 × 9 = 99
Therefore The correct answer is 99.
Additional Information
Ratio and Proportion
A ratio compares two quantities. If a : b is given, the actual values can be represented as ax and bx where x is the common multiplier.
Compound Ratio
The compound ratio of (a : b) and (c : d) is (ac : bd).
Invertendo and Alternendo
If a/b = c/d, then b/a = d/c (Invertendo) and a/c = b/d (Alternendo).

Q60. Answer: (d) Smooth muscles cannot contract at will, while voluntary muscles contract at will

The correct answer is Smooth muscles cannot contract at will, while voluntary muscles contract at will.
Key PointsStriated muscles:
• They are also known as skeletal muscles and are responsible for voluntary movements.
• The can contract at will as they are voluntary muscles.
• These are long-fiber muscles that, when examined under a microscope, are identified by oblique or transverse striations, or alternatively, arranged bands of light and dark.
• Each muscle cell has many sarcomeres, or arrays of overlapping thin and thick filaments, which give each muscle cell its unique look.
Smooth muscles:
• These non-striated muscles exhibit steady, rhythmic contractions that are involuntary in nature.
• They cannot contract will as they are involuntary in nature.
• They comprise spindle-shaped, narrow cells and a centrally located single nucleus.
• The lining of smooth muscles can be found in most internal organs and large sections of the digestive tract.
Additional InformationCardiac Muscles:
• Cardiomyocytes are specialized cells that comprise cardiac muscle.
• Muscle ventricles and atria are formed out of cardiomyocytes.
• They contract regularly to maintain the heart's blood flow.
• Cardiomyocytes depend on actin and myosin for contraction, which makes their structure crucial.

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Q61. Answer: (c) Nagarjunsagar-Srisailam Tiger Reserve, Telangana & Andhra Pradesh

The correct answer is option 3.

Key Points

• The largest tiger reserve in India is the Nagarjunsagar-Srisailam Tiger Reserve. Located in the Nallamala forest, the reserve spreads over five districts, Kurnool District, Prakasam District, Guntur District, Nalgonda District and Mahabub Nagar district.

• The tiger reserve covers an area of 3,728 km2 (1,439 sq mi).

• This reserve's main area is 1,200 km2 (460 sq mi).

• There are several plateaus in the hill ranges, including Amrabad, Srisailam, Peddacheruvu, Sivapuram, and Nekkanti.

• The southwest monsoon, which is active from the second part of June to the end of September, brings rain to Nagarjunasagar.

• Over a course of 130 kilometres (81 miles), the Krishna river carves a basin over 200 meters (660 feet) deep.

Additional Information

• Critical wildlife/tiger habitats (CWH) are designated as parts of National Parks and Sanctuaries that must be preserved inviolate for the purposes of wildlife protection under the Forest Rights Act of 2006.

• It is determined and declared by the Central Government through the Ministry of Environment and Forests following an open consultation procedure by an Expert Committee.

Q62. Answer: (b) 11 and 7

Shortcut Trick

Identify the factors of the product 77.

Possible factor pairs for 77: (1, 77) and (7, 11).

Check the sum for each pair: 1 + 77 = 78 (Incorrect); 7 + 11 = 18 (Correct).

The pair that satisfies both conditions (Sum = 18 and Product = 77) is 11 and 7.

Therefore The correct answer is 11 and 7.

Alternate Method

Given:

Sum (x + y) = 18

Product (xy) = 77

Formula Used:

Algebraic Identity: $(x - y)^2 = (x + y)^2 - 4xy$

Calculations:

=> $(x - y)^2 = (18)^2 - 4 \times (77)$

=> $(x - y)^2 = 324 - 308$

=> $(x - y)^2 = 16$

=> $x - y = \sqrt{16} = 4$

Now we have two equations:

1) x + y = 18

2) x − y = 4

=> Adding (1) and (2): 2x = 22 => x = 11

=> Subtracting (2) from (1): 2y = 14 => y = 7

Therefore The correct answer is 11 and 7.

Additional Information

Quadratic Roots Relation

If the sum (S) and product (P) of two numbers are known, they are the roots of the quadratic equation $t^2 - St + P = 0$.

Algebraic Identity

The identity $(x + y)^2 = x^2 + y^2 + 2xy$ can also be used to find the sum of squares of the numbers if required.

Factorization Rule

To split a middle term in a quadratic expression, find two numbers whose product equals the constant term and sum equals the coefficient of the middle term.

Q63. Answer: (b) 2011 and 2013

Calculation

The total sales of all three companies together in 2011 = 80 + 78 + 41 = 199

The total sales of all three companies together in 2012 = 56 + 56 + 45 = 157

The total sales of all three companies together in 2013 = 78 + 67 + 54 = 199

The total sales of all three companies together in 2014 = 67 + 56 + 56 = 179

The total sales of all three companies together in 2015 = 81 + 78 + 67 = 226

The total sales of all three companies together in 2016 = 76 + 65 + 59 = 200

The answer is 2011 and 2013.

Q64. Answer: (d) AYX 26

The logic followed here is:

So, 'AYX 26' will complete the series.

Hence, the correct answer is "Option 4".

Q65. Answer: (a) 3930

The logic followed here is:

So, '3930' will complete the series.

Hence, the correct answer is "Option 1".

Q66. Answer: (a) 20.2

Shortcut Trick

Identify Prime Numbers strictly between 11 and 30: 13, 17, 19, 23, 29.

Sum of these numbers = 13 + 17 + 19 + 23 + 29 = 101.

Total count of numbers = 5.

Average = 101 ÷ 5 = 20.2.

Therefore The correct answer is 20.2.

Alternate Method

Given: Range for Prime Numbers is between 11 and 30.

Formula Used: Average = (Sum of all observations) ÷ (Total number of observations)

=> Prime numbers between 11 and 30 = {13, 17, 19, 23, 29}

=> Sum = 13 + 17 + 19 + 23 + 29 = 101

=> Count (n) = 5

=> Average = 101 ÷ 5

=> Average = 20.2

Therefore The correct answer is 20.2.

Additional Information

Prime Numbers

A Prime Number is a natural number greater than 1 that has no positive divisors other than 1 and itself. 2 is the only Even Prime Number.

Average of Grouped Data

If a set of observations x1, x2, ..., x_n occurs, the arithmetic mean is given by Σx ÷ n.

Consecutive Primes

Except for (2, 3), all consecutive Prime Numbers have a difference of at least 2 (Twin Primes have a difference of exactly 2).

Q67. Answer: (b) Only (b)

The correct answer is Only (b).

Key Points

• The thumb points in the direction of the force experienced by the conductor, the forefinger points in the direction of the magnetic field, and the middle finger points in the direction of the electric current, according to Fleming's Left Hand Rule.

• This arrangement of the thumb, forefinger, and middle finger of the left hand is perpendicular to each other.

• A current-carrying straight conductor receives a force perpendicular to the direction of the current flow and the field when it is put in an external magnetic field.

Additional InformationFleming’s Right Hand Thumb Rule:

• This rule is frequently applied as a mnemonic to help remember the way the three axes—X, Y, and Z—orient on a three-dimensional plane.

• It says that when we position our right hand's thumb, forefinger, and middle finger perpendicular to one another, then:

• The thumb indicates the direction in which the conductor is moving in relation to the magnetic field.

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• The direction of the magnetic field is shown by the forefinger.

• The middle finger is pointing in the induced current's direction.

Q68. Answer: (d) By stopping open defecation on river banks

The correct answer is option 4.

Key Points

• The Union Cabinet chaired by the Prime Minister, Shri Narendra Modi approved the flagship "Namami Gange" programme which integrates the efforts to clean and protect the Ganga River in a comprehensive manner.

• Marking a major shift in implementation, the Government is focusing on involving people living on the banks of the river to attain sustainable results. Drawing from the lesson learned from the previous implementation, the program also focuses on involving the States and grassroots levels institutions such as Urban Local Bodies and Panchayati Raj Institutions in implementation. The program would be implemented by the National Mission for Clean Ganga (NMCG), and its state counterpart organizations i.e., State Program Management Groups (SPMGs). NMCG will also establish field offices wherever necessary.

Additional Information

• Namami Gange Programme was approved in June 2014.

• It was started in 2014.

• Namami Gange Programme is an Integrated Conservation Mission, approved by the Government of India.

• It was started with a budget outlay of Rs.20,000 Crore to accomplish the twin objectives of effective abatement of pollution, conservation, and rejuvenation of the National River Ganga.

• The River Ganga is important not only for its cultural and spiritual significance but also because it hosts more than 40% of the country’s population.

• 8 states are covered under the project including Uttar Pradesh, West Bengal, and Jharkhand.

• The main pillars of this programme include Biodiversity, Riverfront Development, Sewage Treatment Infrastructure, River Surface Cleaning, Public Awareness, Afforestation, Ganga Gram and Industrial Effluent Monitoring.

Q69. Answer: (c) A good conductor

The correct answer is A good conductor.

Key PointsConduction:

• It is the mechanism via which energy is transferred from one medium particle to another.

• It can occur in solids, liquids, and gases.

• Conductors are materials that allow the flow of electric current through them.

• The resistance of a material is determined by its ability to resist the flow of electric current.

• Good conductors have low resistance, meaning they allow the current to flow easily.

Additional Information

• Insulators are materials that do not allow the flow of electric current. They have very few free electrons and high resistance.

• A bad conductor, also known as a semiconductor, has a moderate resistance that can be controlled by adding impurities or changing temperature. They are used in electronics for their ability to switch between conducting and insulating states.

• High-resistance materials are used as resistors to limit the flow of current in a circuit. They are made of materials like carbon, metal alloys, or ceramics.

Q70. Answer: (b) Maharashtra

The correct answer is "Maharashtra".

Key Points

• Indrayani Medicity will have hospitals, centres for medical research, pharmaceutical manufacturing, wellness and physiotherapy, and will be the first-of-its-kind city in the country to have all the treatments available at one place.

• Maharashtra government, during the budget presentation announced that the contry's first medical city will be set up in Pune.

• The Medicity will have about 24 separate hospital buildings, each housing one department. The Medicity will not only benefit Pune but will also be useful for people from neighbouring districts who come to the city for better treatment.

• There will be medical education and research institutes, and treatment will be provided at affordable rates to citizens.

• The proposed Medicity will have separate departments for trauma critical, heart disease, kidney, brain disease, dentistry, paediatrics, ophthalmology, endocrinology, gastroenterology, urology, haematology, organ transplantation, gynaecology, cardiology and psychiatry and separate super-speciality hospitals will be set up for all departments such as cancer, AYUSH etc.

• The Medicity will be set up by the Pune Metropolitan Region Development Authority (PMRDA). The entire facility is likely to have over 10,000 to 15,000 beds.

Additional Information

• The government of Maharashtra is conducted within a framework of parliamentary government, with a bicameral legislature consisting of the Maharashtra Legislative Assembly and the Maharashtra Legislative Council. The legislative assembly (Vidhan Sabha) is the lower chamber and consists of 288 members.

• Maharashtra is divided into 6 revenue divisions, which are further divided into 36 districts. These 36 districts are further divided into 109 sub-divisions of the districts and 357 talukas.

Q71. Answer: (b) 128

Shortcut Trick

Ratio of efficiencies of pipes (Faster : Slower) = 3 : 1

Combined efficiency = 3 + 1 = 4 units/min

Total capacity of tank = Combined efficiency × Total time = 4 × 32 = 128 units

Time taken by slower pipe = Total capacity ÷ Slower efficiency = 128 ÷ 1 = 128 minutes

Therefore The correct answer is 128 minutes.

Alternate Method

Given:

Efficiency of Pipe A = 3 × Efficiency of Pipe B

Combined time (A + B) = 32 minutes

Pipe	Efficiency (units/min)	Total Capacity (units)	Time (min)
Faster (A)	3	4 × 32 = 128	128 ÷ 3
Slower (B)	1	128 ÷ 1 = 128	

Calculations:

=> Let the efficiency of the slower pipe be x units/min.

=> Efficiency of the faster pipe = 3x units/min.

=> Combined efficiency = x + 3x = 4x units/min.

=> Total work (capacity) = Efficiency × Time = 4x × 32 = 128x units.

=> Time for slower pipe alone = Total work ÷ Slower efficiency = 128x ÷ x

=> Time = 128 minutes.

Therefore The correct answer is 128 minutes.

Additional Information

Efficiency and Time Relationship

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

Pipes and Cisterns formula

Total Capacity = (Efficiency of Pipe A + Efficiency of Pipe B) × Combined time taken by both.

Inlet vs Outlet

Inlet pipes add to the volume (positive efficiency), while outlet/leakage pipes subtract from it (negative efficiency).

Q72. Answer: (a) 8.1%

The correct answer is 8.1%.

Key Points

• The Employees' Provident Fund Organisation (EPFO) has reduced the interest rate on EPF deposits from 8.5 percent in 2020-21 and 2019-20 to 8.1 percent in 2021-22. It's the lowest it has been in over 40 years.

• Interest rate comparison

Schemes/ FDs	Interest rate
EPF	8.10%
PPF	7.10%
HDFC Bank FD	5.45-5.60%
SBI FD (3-5 years)	5.45-5.50%
POTD(5 years)	6.70%

Additional Information

• EPFO is one of the World's largest Social Security Organisations in terms of clientele and the volume of financial transactions undertaken. At present it maintains 24.77 crore accounts (Annual Report 2019-20) pertaining to its members.

• The Employees' Provident Fund came into existence with the promulgation of the Employees' Provident Funds Ordinance on the 15th November, 1951. It was replaced by the Employees' Provident Funds Act, 1952.

• The Employees' Provident Funds Bill was introduced in the Parliament as Bill Number 15 of the year 1952 as a Bill to provide for the institution of provident funds for employees in factories and other establishments.

• The Act is now referred as the Employees' Provident Funds & Miscellaneous Provisions Act, 1952 which extends to the whole of India. The Act and Schemes framed there under are administered by a tri-partite Board known as the Central Board of Trustees, Employees' Provident Fund,consisting of representatives of Government (Both Central and State), Employers, and Employees.

• According to the circular, for the last quarter of FY 2021-22, the Public Provident Fund (PPF) will continue to earn 7.10 percent. The Senior Citizens Savings Scheme (SCSS) will continue to earn 7.40 percent, and post office time deposits will fetch 5.5-6.7 percent. Sukanya Samriddhi Yojana pays 7.6 percent annually. The interest rates is applicable for the period January 1, 2021, to March 31, 2022.

• The current Finance Minister of India is Nirmala Sitharaman.

Q73. Answer: (b) ZLNZL

The logic followed here is:

'SHOUT' is written as 'VLTAA'.

'TOTAL' is written as 'WSYGS'

Similarly, for 'WHITE'

So, 'WHITE' will be written as 'ZLNZL'.

Hence, the correct answer is "Option 2".

Q74. Answer: (a) Odisha

The correct answer is Odisha.

Key Points

• The state of Odisha was formed on 1 April 1936. This day is celebrated as Utkala Dibasa in Odisha.

• On this day, people pray for the good health of the state and its people.

• The struggle for independence for the Odias intensified with the formation of the Utkal Sammilani, a cultural and social organization. This organization was formed to fight for the formation of Odisha as an independent state.

• Earlier, Odisha was a part of the Bihar and Orissa province, and after significant revolutionary efforts, which lasted three decades, it was announced as an independent state.

Additional Information

• Madhusudan Das -

• He became the first Odia to complete a BA, an MA, and then a BL degree.

• In 1881, he started his law practice in his home state.

• Not only was he a lawyer, but Madhu Babu (as he was called by the people) was also a prolific journalist, social worker, and legislator.

• He became the first person of Odia descent to enter the Bengal provincial legislative council and also the Central Legislative Assembly.

• He strove for the unification of all Odia-speaking regions and through his efforts, the state of Odisha was formed on 1 April 1936. This day is celebrated as Utkala Dibasa in Odisha. Thus he is called the maker of modern Odisha.

• He was the Vice President of the Utkal Sabha in 1889.

• He also protested against the unjust salt tax laws of the British government in 1888 long before Mahatma Gandhi took up the Dandi March.

• His birth anniversary is marked as ‘Lawyers’ Day’ in Odisha. i.e., 28 April.

Q75. Answer: (b) Only conclusion II follows.

Statements:

1. Some sandwiches are pizzas.

2. All burgers are pizzas.

3. Some burgers are pastas.

The least possible Venn diagram for the given statement is:

Conclusions:

I. Some sandwiches are burgers - False (No definite relation given between sandwiches and burgers, so it can be possible only).

II. Some pastas are pizzas - True (those part of pasta that is burger is also pizza).

So, Only conclusion II follows.

Hence, the correct answer is "Option 2".

Q76. Answer: (a) They do not have the same number of valence electrons, but they contain the same number of shells.

The correct answer is They do not have the same number of valence electrons, but they contain the same number of shells.

Key Points

• The elements of the second period are Lithium (Li), Beryllium (Be), Boron (B), Carbon (C), Nitrogen (N), Oxygen (O), Fluorine (F), and Neon (Ne).

• All these elements have the same number of shells, which is two.

• The number of valence electrons in the elements of the second period increases from 1 (Lithium) to 8 (Neon), except for Beryllium, which has only 2 valence electrons.

Additional Information

• Periods are the horizontal rows in the periodic table that represent the number of electron shells in an element's atom.

• The number of electron shells in a row is the same for every element.

• Every subsequent element in a period is less metallic than the one before it and has one extra proton.

Q77. Answer: (a) Bhagat Singh

The correct answer is "Bhagat Singh".

Key Points

• The Naujawan Bharat Sabha was founded by Bhagat Singh in 1926. It was a left-wing organization which sought independence by gathering together worker and peasant youths. It was part of the Hindustan Republican Association.

• The motto of the Naujawan Bharat Sabha service, suffering, sacrifice, exemplifies the selfless life of Bhagwati Charan Vohra.

• Bhagat Singh was a little more than 21 years when he threw a bomb in the assembly in protest against the government.

• He became a member of the Hindustan Republican Association founded by Sachindranath Sanyal in 1924 at Kanpur.

• He started a militant youth organization called the Naujawan Bharat Sabha in 1925.

• He was associated with the Hindustan Socialist Republican Association in 1928.

• He was associated with the Lahore Conspiracy case and Central Assembly Bombing Case(1929).

• Bhagat Singh was arrested and charged in the Saunders murder case, along with Rajguru, Sukhdev, and was hanged on 23rd March 1931.

• 23rd March is observed as ‘Martyrs’ Day’ or ‘Shaheed Diwas’ or ‘Sarvodaya Day’ in honour of Bhagat Singh, Rajguru, and Sukhdev.

Additional Information

• Subhas Chandra Bose (also called Netaji) - is known for his role in India's independence movement. A participant of the noncooperation movement and a leader of the Indian National Congress, he was part of the more militant wing and known for his advocacy of socialist policies.

• Chandra Shekhar Azad - After Bhagat Singh was jailed, the revolutionaries planned to rescue him from jail. Unfortunately, while testing a bomb for this purpose, Vohra died in an accidental explosion on the banks of the River Ravi in Lahore. This occurred on 28th May 1930 and Vohra became a martyr at the age of just 25.

• Hindustan Republican Association (HRA) was established in the year 1924. The founding members of the organization were Ram Prasad Bismil, Sachindra Nath Sanyal, Dr Jadugopal Mukherjee.

• Later it became the Hindustan Socialist Republican Association in 1928. Chandra Sekhar Azad was an Indian revolutionary leader who organised the Hindustan Socialist Republican Association (HSRA) in 1924.

• He died on 27 February 1931 at Azad Park in Allahabad while fighting with the police.

• Lala Hardayal - Establishment of 'Gadar Party' by Lala Hardayal - 1913.

• It is also known as the Pacific Coast Hindustan Association with Sohan Singh Bhakna as its president

• The Ghadar Party was an international political movement consisting of expatriate Indians to overthrow British rule in India.

• The official founding has been dated to a meeting on 15 July 1913 in Astoria, Oregon, the United States of America.

Q78. Answer: (b) OA 28

The logic followed here is:

For, TB 12 is related to QY 20.

For, ML 16 is related to JI 24.

Similarly, for 'RD 20'

So, 'RD 20' will related to 'OA 28'.

Hence, the correct answer is "Option 2".

Q79. Answer: (c) 35°

Shortcut Trick

In any quadrilateral, the angle formed by the bisectors of two adjacent angles is equal to half the sum of the other two angles.

angle STR = (angle P + angle Q) ÷ 2

=> angle P + angle Q = 2 × 87.5° = 175°

Given ratio angle P : angle Q = 2 : 3. Total parts = 2 + 3 = 5 parts.

Difference = (3 − 2) ÷ 5 × 175° = 1/5 × 175° = 35°.

Therefore The correct answer is 35 °.

Alternate Method

Given: angle STR = 87.5°, Ratio angle P : angle Q = 2 : 3.

Formula Used: Sum of interior angles of a quadrilateral = 360°; Sum of angles in a triangle = 180°.

In ΔSTR:

=> angle TSR + angle TRS + angle STR = 180°

=> (angle S ÷ 2) + (angle R ÷ 2) + 87.5° = 180°

=> (angle S + angle R) ÷ 2 = 180° − 87.5° = 92.5°

=> angle S + angle R = 92.5° × 2 = 185°

In quadrilateral PQRS:

=> angle P + angle Q + angle R + angle S = 360°

=> angle P + angle Q + 185° = 360°

=> angle P + angle Q = 360° − 185° = 175°

Let angle P = 2x and angle Q = 3x:

=> 2x + 3x = 175°

=> 5x = 175° => x = 35°

=> angle P = 2 × 35° = 70° and angle Q = 3 × 35° = 105°

=> Difference = 105° − 70° = 35°

Therefore The correct answer is 35 °.

Additional Information

Angle Bisector Property in Quadrilaterals

The angle between the bisectors of two adjacent angles of a quadrilateral is equal to half the sum of the remaining two angles.

Sum of Interior Angles

For any n-sided polygon, the sum of interior angles is given by (n − 2) × 180°. For a quadrilateral (n=4), it is 360°.

Opposite Angle Bisectors

The angle between the bisectors of two opposite angles of a quadrilateral is equal to half the difference of the other two angles.

Q80. Answer: (b) 96

Shortcut Trick

Identify the ratio multiplier between the first and third terms: 17 → 51 is a 3-times increase (17 × 3 = 51).

Apply the same multiplier to the second term: 32 × 3 = 96.

Therefore The correct answer is 96.

Alternate Method

Given: First term (a) = 17, Second term (b) = 32, Third term (c) = 51.

Formula: For fourth proportional (x), a : b :: c : x => x = (b × c) ÷ a

=> 17 : 32 = 51 : x

=> 17 × x = 32 × 51

=> x = (32 × 51) ÷ 17

=> x = 32 × 3

=> x = 96

Therefore The correct answer is 96.

Additional Information

Mean Proportional

The mean proportional between two numbers a and b is calculated as √(a × b).

Third Proportional

If a, b, and c are in continued proportion, then a : b = b : c, and the third proportional c = $b^2 \div a$.

Product Rule

In any proportion, the product of extremes (first and fourth terms) is always equal to the product of means (second and third terms).

Q81. Answer: (c) Article 40

The correct answer is Article 40.

Key Points Article 40

• Article 40 of the Constitution enshrines one of the Directive Principles of State Policy.

• It says that the State shall take steps to organize village panchayats and endow them with powers and authority.

• The objective is to enable them to function as units of self-government.

Additional Information Article 18

• Article 18 comes under the Right to equality.

• It tells about the abolition of titles except military and academic.

Article 30

• Article 30 provides for the right of minorities to establish and administer educational institutions.

• All minorities, whether based on religion or language, shall have the right to establish and administer educational institutions of their choice.

• The State shall not, in granting aid to educational institutions, discriminate against any educational institution on the ground that it is under the management of a minority, whether based on religion or language.

• The rights under Article 30 aim to ensure equality with the majority, and not put the minority at an advantageous position. (This essentially means that there is no reverse discrimination in favour of the minorities.)

Article 25

• Article 25 accords the Right to propagate one's own religious belief. But it does not include a right to convert another person to one's own religion. Forcible conversions amount to a violation of one's freedom of conscience.

• Article 25 states that all persons are equally entitled to freedom of conscience and the right to freely profess, practice and propagate religion.

• Article 25 covers not only religious beliefs but also applies to religious practices.

• These rights are available to citizens and foreigners also.

Q82. Answer: (d) 1998

The correct answer is 1998.

Key Points

• Maulana Azad National Urdu University (MANUU) was established by an Act of Parliament in 1998.

• It is a central university located in Hyderabad, Telangana. It was named after Maulana Abul Kalam Azad, who was a freedom fighter, an educationist, and the first Education Minister of independent India.

• The university is known for promoting Urdu language and literature. It has a dedicated Department of Urdu, which offers courses in Urdu language, literature, and culture.

• It has campuses in Hyderabad, Lucknow, and Srinagar. It also has centers in various cities across India.

Additional InformationMaulana Abul Kalam Azad:

• He was the nation's first minister of education from 1948 to 1958.

• He led the Khilafat movement from the front.

• He chose the pen name "Azad," which means "freedom," in order to distance himself from dogmatic religious beliefs.

• He fought for children's right to free education until the age of fourteen.

• He was also a pioneer in the establishment of India's higher education board, the University Grants Commission.

Q83. Answer: (a) Liver

The correct answer is Liver.

Key Points

• Liver

• The liver is the largest gland in the human body.

• It also secretes bile necessary for the digestion of fats (emulsification of fats).

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• The liver is where both glycogenolysis and glycogenesis take place.
• Dark/Reddish Brown, vital organ.
• Described as having a double blood supply.
• Lies on the right side of the abdominal cavity beneath the diaphragm.
• In males, it weighs from 1.4 to 1.6 kilograms, in females from 1.2 to 1.4 kilograms.
• The Liver is extremely resilient and capable of regenerating itself.
• Functions:
• Production of bile that helps in digestion in the small intestine.
• Production of cholesterol and special proteins that helps carry fats in the body.
• Converts excess glucose to glycogen. Glycogen is later stored in the liver.
• Regulates the level of amino acids in the blood.
• Helps in clearing the blood of toxins.
• Regulates blood clotting.
• Helps in clearing bilirubin from the body.

Q84. Answer: (c) Only conclusion II follows.

Given:
Statements:
1. No rose is a hibiscus.
2. Some hibiscuses are lotuses.
The least possible Venn diagram for the given statement is:
Conclusions:
I. No rose is a lotus - False (No definite relation given between rose and lotus, so it can be possible only)
II. Some lotuses are not roses - True (Those part of lotus that is hibiscus will definitely not roses).
So, Only conclusion II follows.
Hence, the correct answer is "Option 3".

Q85. Answer: (a) 60.725

Shortcut Trick
Net deviation for 18 numbers = 18 × (65.5 − 62) = +63
Net deviation for 24 numbers = 24 × (61.5 − 62) = −12
Value of overlapping 18^(th) number = 62 + (63 − 12) = 113
Exclusion effect on 40 numbers = −(113 − 62) ÷ 40 = −51 ÷ 40 = −1.275
New Average = 62 − 1.275 = 60.725
Therefore The correct answer is 60.725.
Alternate Method
Given: Total numbers = 41 | Average = 62 | First 18 average = 65.5 | Last 24 average = 61.5
Formula Used: Sum = Average × Count | Average = Sum ÷ Count
=> Total Sum of 41 numbers = 41 × 62 = 2542
=> Sum of first 18 numbers = 18 × 65.5 = 1179
=> Sum of last 24 numbers = 24 × 61.5 = 1476
=> Sum including overlap = 1179 + 1476 = 2655
=> Value of 18^(th) number = 2655 − 2542 = 113
=> Sum of remaining 40 numbers = 2542 − 113 = 2429
=> New Average = 2429 ÷ 40 = 60.725
Therefore The correct answer is 60.725.
Additional Information
Deviation Method for Averages
Net deviation = Total Sum of (Individual Value − Average). For a balanced set, the net deviation is always zero.
Weighted Average Formula
Average = (n1x1 + n2x2) ÷ (n1 + n2), where n is the number of items and x is the individual average.
Exclusion Rule

When a value x is excluded, New Average = (Old Sum − x) ÷ (n − 1). If x > Old Average, the new average decreases.

Q86. Answer: (d) V1 : V2 : V3 = 2 : 3 : 4

The correct answer is V1 : V2 : V3 = 2 : 3 : 4.

Key Points

• The resistance ratio of the three parts of the copper wire is 2:3:4.

• The potential drop across each part is proportional to its resistance.

• Let the potential drops across AC, CD, and DB be V1, V2, and V3, respectively.

• Therefore, V1:V2:V3 = 2:3:4.

Additional Information

• The amount of obstruction to current passage in an electrical circuit is measured as resistance.

• Ohms, a unit of measurement for resistance, are represented by the Greek letter omega (Ω).

• The total of the individual values of each component in a series is used to calculate resistance in that series.

• We apply the following calculation to get the total resistance: RT = R1 + R2 + R3.

• The following formula can be used to find the total resistance in a parallel circuit: 1/Rt = 1/R1 + 1/R2 + 1/R3 + ...

Q87. Answer: (c) 7 : 4

Shortcut Trick

Ratio of Lengths (M : N) = 1 : 2

Ratio of Times (M : N) = 30 : 105 = 2 : 7

Since Speed = Distance ÷ Time, Ratio of Speeds = (1/2) : (2/7)

Cross-multiplying: Ratio = (1 × 7) : (2 × 2) = 7 : 4

Therefore The correct answer is 7 : 4.

Alternate Method

Given:

Time taken by Train M to cross a pole (T_M) = 30 sec

Time taken by Train N to cross a pole (T_N) = 1 min 45 sec = 105 sec

Let the Length of Train N be 2L. Then, Length of Train M = L

Formula Used:

Speed = Distance ÷ Time (When crossing a pole, Distance = Length of the train)

Calculations:

=> Speed of Train M (S_M) = L ÷ 30

=> Speed of Train N (S_N) = 2L ÷ 105

=> Ratio S_M : S_N = (L ÷ 30) : (2L ÷ 105)

=> Ratio = (1 ÷ 30) × (105 ÷ 2)

=> Ratio = 105 ÷ 60

=> Dividing both sides by 15, we get 7 : 4

Therefore The correct answer is 7 : 4.

Additional Information

Unit Conversion

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

Crossing Objects

When a train crosses a pole/man, distance = train's length. When it crosses a platform/bridge, distance = train's length + platform's length.

Relative Speed

If two trains move in the same direction, relative speed = S1 − S2. If they move in opposite directions, relative speed = S1 + S2.

Q88. Answer: (c) 25%

Shortcut Trick

Total Cost Price (CP) = Purchase Price + Repair Cost = 2,50,000 + 30,000 = 2,80,000.

Selling Price (SP) = 3,50,000.

Ratio of CP : SP = 2,80,000 : 3,50,000 = 28 : 35 = 4 : 5.

Profit = 5 − 4 = 1 unit.

Profit % = (1 ÷ 4) × 100 = 25%.

Therefore The correct answer is 25%.

Alternate Method

Given: Purchase Price = Rs. 2,50,000, Repairs = Rs. 30,000, SP = Rs. 3,50,000.

Formulas: Total CP = Purchase Price + Overheads | Profit = SP − CP | Profit% = (Profit ÷ CP) × 100

=> Total Cost Price (CP) = 2,50,000 + 30,000 = Rs. 2,80,000

=> Selling Price (SP) = Rs. 3,50,000

=> Profit = 3,50,000 − 2,80,000 = Rs. 70,000

=> Profit Percentage = (70,000 ÷ 2,80,000) × 100

=> Profit Percentage = (1 ÷ 4) × 100 = 25%

Therefore The correct answer is 25%.

Additional Information

Effective Cost Price

When a person buys an old item, any additional overhead expenses like repairs, transport, or installation are added to the initial price to find the effective Cost Price.

Profit and Loss Calculation

Profit or Loss percentage is always calculated on the total Cost Price unless otherwise specified in the problem.

Q89. Answer: (a) Water insoluble

The correct answer is Water insoluble.

Key Points

• $BaSO_4$ is an insoluble compound formed by the reaction of SO_4^{2-} and Ba^{2+} ions.

• The chemical name of $BaSO_4$ is Barium Sulfate.

• It forms white or colorless crystals that are not soluble in water.

• It is commonly used as a filler in plastics, paints, and other materials due to its inertness and high density.

• It is also used in medical imaging as a contrast agent for X-ray and CT scans.

Additional Information

• Properties of Barium Sulphate:

Molecular Mass	**233.38gm/mol**
Density	4.5 g/cm³
Boiling Point	1,600°C
Melting Point	1,580°C

Q90. Answer: (d) 96

Shortcut Trick

Average of 5 consecutive numbers = Middle number.

Average = 240 ÷ 5 = 48.

Since the numbers are consecutive, the sequence is: 46, 47, 48, 49, 50.

Sum of first and last = 46 + 50 = 96.

Therefore The correct answer is 96.

Alternate Method

Given: Sum of 5 consecutive numbers = 240.

Formula: Let numbers be x, x+1, x+2, x+3, x+4.

=> x + (x + 1) + (x + 2) + (x + 3) + (x + 4) = 240

=> 5x + 10 = 240

=> 5x = 230

=> x = 46

=> First number = 46, Last number = 46 + 4 = 50

=> Required Sum = 46 + 50 = 96

Therefore The correct answer is 96.

Additional Information

Consecutive Numbers Property

For any odd number of consecutive terms (n), the Average is always equal to the Middle Term.

Sum of First and Last Terms

In an Arithmetic Progression, the sum of the 1^(st) and n^(th) term is equal to twice the middle term (for odd n). Sum = 2 × Average.

Q91. Answer: (b) 50 m, South

Given:

Preeti walks 30 m towards the east from point P.

Takes a left turn and walks 18 m.

Takes a left turn again and walks 65 m.

Again, takes a left turn and walks 86 m.

Takes a left turn again and walks 65 m.

Again, takes a left turn and walks 18 m.

Takes one final left turn and walks 30 m to reach point Q.

So, Q is '50 m in South' direction from point P.

Hence, the correct answer is "Option 2".

Q92. Answer: (c) Both (i) and (iii)

The correct answer is Both (i) and (iii).

Key Points

• A spherical mirror is a mirror whose reflecting surface is part of a hollow sphere of glass.

• One side of the mirror is well polished and reflecting, and another side of the mirror is opaque (often painted red).

• Spherical mirrors are of two types:

• Convex mirrors, and Concave mirrors.

• The image formed by the spherical mirrors depends on the position of the object.

• The principal focus of a spherical mirror is that It is the point on the principal axis through which rays of light parallel to the principal axis pass after reflection or appear to be arising from this point on the principal axis.

• Generally, there are two types of spherical mirrors namely Convex Mirror and Concave Mirror.

• Convex mirrors are those whose reflecting surface is bent outwards and Concave Mirror are those whose reflecting surface is bent inwards.

The principal focus of Concave Mirror	**A number of rays which drops parallel to the principal axis on a concave mirror converge at a point on the principal axis after getting reflected.**
The principal focus of Convex Mirror	A number of rays which drops parallel to the principal axis after getting reflected, the rays emerge to come from a point on the principal axis.

Additional Information

• Pole

• The pole is often represented by the letter "P".

• It is the center of the spherical mirror's reflecting surface, also known as the vertex of the mirror.

• Center of Curvature:

• The "C" in "center of curvature" stands for the center of the sphere, which includes the spherical mirror.

• Principal Axis:

• Its primary axis is the line that is perpendicular to both the spherical mirror's pole and its center of curvature.

• Focus:

• After being reflected by the spherical mirror, a light beam incident parallel to the primary axis either genuinely converges toward or appears to diverge from a fixed point on the principal axis.

• The letter "F" designates the fixed point, which is known as the "Principal focus."

• Aperture:

• The aperture is the movable lens opening that regulates how much light may enter the camera.

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Q93. Answer: (b) 2 and 98

Shortcut Trick

Check the options using the Mean Proportional formula: √(a × b) = 14.

Calculation: $14^2 = 196$. We need a pair whose product is 196.

Option 1: 8 × 24 = 192 (Incorrect)

Option 2: 2 × 98 = 196 (Correct)

Option 3: 7 × 28 = 196 (Correct, but check Third Proportional: $28^2 / 7 = 112 \neq 4802$)

Therefore The correct answer is 2 and 98.

Alternate Method

Given: Mean Proportional = 14, Third Proportional = 4802

Formula Used: Mean Proportional = √(ab); Third Proportional = b^2 / a

=> √(ab) = 14

=> ab = 196

=> a = 196 / b

=> $b^2 / a = 4802$

=> $b^2 / (196 / b) = 4802$

=> $b^3 = 4802 \times 196$

=> $b^3 = (2401 \times 2) \times (2 \times 98) = 7^4 \times 2 \times 2 \times 2 \times 7^2 = 7^6 \times 2^3$

=> $b = 7^2 \times 2 = 49 \times 2 = 98$

=> a = 196 / 98 = 2

Therefore The correct answer is 2 and 98.

Additional Information

Mean Proportional

The mean proportional between two numbers a and b is √(ab). It is also known as the geometric mean.

Third Proportional

For two numbers a and b, the third proportional c is such that a : b = b : c, which gives $c = b^2 / a$.

Fourth Proportional

For three numbers a, b, and c, the fourth proportional d is such that a : b = c : d, which gives $d = (b \times c) / a$.

Q94. Answer: (c) 7 km towards the south

Given:

Avadhesh starts from Point A and drives 10 km towards the east.

Takes a left turn, drives 10 km,

Turns left and drives 10 km.

Takes a final left turn, drives 3 km and stops at Point M.

Here, he should be drive '7 km towards the South' direction to reach Point A from Point M.

Hence, the correct answer is "Option 3".

Q95. Answer: (c) 11

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

1) C sits second to the right of B.

2) Only four people sit between C and A.

3) X sits second to the left of A.

4) Only one person sits between A and Y.

5) Z sits to the immediate right of Y.

If no other person is sitting in the row,

Then, there is '11' persons seated in the row.

Hence, the correct answer is "Option 3".

Q96. Answer: (b) 60 lakh

The correct answer is 60 lakh.

Key Points

• Highlights of Budget 2022-23.

• India’s economic growth is estimated at 9.2% to be the highest among all large economies.
• 60 lakh new jobs are to be created under the productivity-linked incentive scheme in 14 sectors.
• PLI Schemes have the potential to create an additional production of Rs 30 lakh crore.
• Entering Amrit Kaal, the 25-year-long lead-up to India @100, the budget provides the impetus for growth along with four priorities:
• PM Gati Shakti
• Inclusive Development
• Productivity Enhancement & Investment, Sunrise opportunities, Energy Transition, and Climate Action.
• Financing of investments
• National Highways Network to be expanded by 25000 Km in 2022-23.
• Rs. 2.37 lakh crore direct payment to 1.63 crore farmers for procurement of wheat and paddy.
• Rs. 48,000 crores allocated for completion of 80 lakh houses in 2022-23 under PM Awas Yojana.
• Introduction of Digital Rupee by the Reserve Bank of India starting 2022-23.
• Total expenditure in 2022-23 is estimated at Rs. 39.45 lakh crore.
• Total receipts other than borrowings in 2022-23 are estimated at Rs. 22.84 lakh crore.
• The fiscal deficit in 2022-23 is estimated at 6.4% of GDP.

Additional Information

• The Atmanirbhar Bharat Abhiyaan was launched by the Prime Minister on 12th May 2020.
• The idea is a catch-all for the Modi administration's aspirations for India to participate more actively in the global economy and to improve its efficiency, competitiveness, and resilience.
• The Mission emphasizes the need of supporting local goods.
• Self-reliance implies creating a helping hand for the entire planet rather than advocating any isolationist or exclusive tactics.

Q97. Answer: (c) P = V. I

The correct answer is P = V.I

Key Points

• The electric power is given by P = VI, {Where V is the potential difference, I is the electric current and P is the electric power.}
• The unit of electrical power is the watt.
• 1 W is the power consumed by a device that carries 1 A of current when operated at a potential difference of 1 V.
• Electric power is the rate at which work is done or energy is transformed into an electrical circuit.
• SI unit of power is Watt, joule per second
• Power is a scalar quantity.

Additional Information

• It is the rate at which work is done or energy is transformed in an electrical circuit.
• Simply put, it is a measure of how much energy is used in a span of time. In physics, the rate of transfer of electrical energy by an electrical circuit per unit of time is called electrical power.
• Electrical power is the product of voltage times current.

Q98. Answer: (b) None

Given word: 'POSITIVE '

Now, arranging in alphabetical order:

Letter	P	O	S	I	T	I	V	E
Alphabetical order	E	I	I	O	P	S	T	V

So, after arranged in alphabetical order, there is no such letter will remain unchange.

Hence, the correct answer is "None".

Q99. Answer: (c) Neena Gupta

The correct answer is Neena Gupta.

Key Points

• Ramanujan Prize for Young Mathematicians 2021 has been awarded to Neena Gupta.
• Professor Neena Gupta, a mathematician at the ISI-Kolkata, was awarded the 2021 DST-ICTP-IMU Ramanujan Prize for Young Mathematicians from developing countries for her outstanding work in commutative algebra, and affine algebraic geometry.

• She is the third woman to receive the prestigious Ramanujan Prize.

Additional Information

• Ramanujan Prize is awarded annually to a renowned Mathematician who is less than 45 years of age.

• It is given by the International Centre for Theoretical Physics (ICTP), Trieste.

• It is sponsored by the Department of Science & Technology (DST), Government of India.

Q100. Answer: (b) 17

Shortcut Trick

Let the sides of the right-angled triangle be represented by the standard Pythagorean triplet 16, 30, and 34.

Here, the hypotenuse is 34, which is 2 more than twice of one side (2 × 16 + 2 = 34), and the third side is 30, which is 13 more than half of the hypotenuse (34 ÷ 2 + 13 = 30).

In any right-angled triangle, the length of the median to the hypotenuse is always equal to half of the hypotenuse.

Therefore Length of the median = Hypotenuse ÷ 2 = 34 ÷ 2 = 17.

Therefore The correct answer is 17.

Alternate Method

Given:

Let one of the sides of the right-angled triangle be x.

Hypotenuse (h) = 2x + 2

Third side (y) = (h ÷ 2) + 13

Formula Used:

Pythagoras' Theorem: $Side1^2 + Side2^2 = Hypotenuse^2$

Length of median to the hypotenuse = Hypotenuse ÷ 2

Calculations:

=> y = ((2x + 2) ÷ 2) + 13

=> y = x + 1 + 13 = x + 14

Applying Pythagoras' Theorem:

=> $x^2 + y^2 = h^2$

=> $x^2 + (x + 14)^2 = (2x + 2)^2$

=> $x^2 + x^2 + 28x + 196 = 4x^2 + 8x + 4$

=> $2x^2 + 28x + 196 = 4x^2 + 8x + 4$

=> $2x^2 - 20x - 192 = 0$

=> $x^2 - 10x - 96 = 0$

=> $x^2 - 16x + 6x - 96 = 0$

=> $x(x - 16) + 6(x - 16) = 0$

=> $(x - 16)(x + 6) = 0$

Since length cannot be negative:

=> x = 16

Now, find the hypotenuse (h):

=> h = 2(16) + 2 = 34

The length of the median to the hypotenuse is:

=> Median = h ÷ 2 = 34 ÷ 2 = 17

Explanation of Options:

=> Option (1) - 15: If the median is 15, the hypotenuse would be 30. This does not satisfy the given algebraic relations for integer side lengths.

=> Option (2) - 17: This is the correct length of the median as it corresponds to a hypotenuse of 34, satisfying all conditions.

=> Option (3) - 20: If the median is 20, the hypotenuse would be 40. This does not satisfy the given algebraic relations.

=> Option (4) - 18: If the median is 18, the hypotenuse would be 36. This does not satisfy the given algebraic relations.

Therefore The correct answer is 17.

Additional Information

Median to the Hypotenuse Theorem

In any right-angled triangle, the length of the median drawn to the hypotenuse is exactly half the length of the hypotenuse. This is because the midpoint of the hypotenuse is the circumcenter of the triangle.

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Circumradius of a Right-Angled Triangle

The circumradius (R) of a right-angled triangle is equal to half of its hypotenuse (R = h ÷ 2). The circumcenter lies exactly at the midpoint of the hypotenuse.

Pythagorean Triplets

Integers that satisfy the relation $a^2 + b^2 = c^2$ are called Pythagorean triplets. Common examples include (3, 4, 5), (5, 12, 13), (8, 15, 17), and their multiples like (16, 30, 34).

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