RRB Group D Previous Year Paper (Held on: 13 Sept 2022 Shift 1)

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

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CBT

Q1. Ramadan or Ramazan is the _____ month of Islamic calendar and is observed by Muslims worldwide as a month of fasting.

(a) 7^(th)
(b) 9^(th)
(c) 6^(th)
(d) 8^(th)

Q2. Why do organic carbon compounds have lower melting points than ionic compounds ?

(a) Presence of ionic bonds
(b) Presence of covalent bonds
(c) Strong force of attraction between molecules
(d) Weak force of attraction between molecules

Q3. What is the full name of ADSL, which is a technology that provides high transmission speeds for video and voice to homes over an ordinary copper telephone wire ?

(a) Asynchronized Digital Subscriber Line
(b) Asymmetric Digital Subscriber Line
(c) Algorithm Digital Subscriber Line
(d) Arithmetic Digital Subscriber Line

Q4. Select the option that represents the letters that, when placed from left to right in the same sequence in the blanks below, will complete the letter series.

P Q _ R R R _ S S S T U _ V V V W _ W W

(a) PRVW
(b) QRUW
(c) QSVW
(d) QSUW

Q5. Energy conversion in electromagnet is from _____ to _____.

(a) Magnetic energy, heat energy
(b) Electric energy, magnetic energy
(c) Electrical energy, light
(d) Electric, heat energy

Q6. In a certain code language, 'MERGE' is written as 'NHWNN' and 'HEAVY' is written as 'IHFCH'. How will 'MORSE' be written in that language ?

(a) NLDIE
(b) NRWZN
(c) LDYTB
(d) LPRCH

Q7. Which organic compound does NOT belong to the same homologous series as the other three ?

(a) C4H8
(b) C3H8
(c) C2H6
(d) CH4

Q8. If the ratio of two numbers is 5 : 7, and their HCF is 8, then their LCM is:

(a) 280
(b) 480
(c) 580
(d) 380

Q9. The reddish appearance of the sun at the time of sunrise is due to:

(a) dispersion of light
(b) refraction of light
(c) reflection of light
(d) scattering of light

Q10. A shopkeeper has the following 2 schemes.

(I) Two successive discounts of 15% and 20%

(II) Buy 5, get 4 free

The single discount from each scheme, respectively, is:

(a) 35%, 40%
(b) 30%, 45%
(c) 32%, 44.44%
(d) 33.33%, 45%

Q11. The sum of twice a number and three times of 52 is 342. What is the sum of four times the number and two times 52 ?

(a) 776
(b) 476
(c) 576
(d) 676

Q12. If current is doubled and potential difference is reduced to half, then _____.

(a) resistance will become one-fourth
(b) resistance will be doubled
(c) resistance will be halved
(d) resistance will become four times

Q13. The urban local government which works for the development of any Metropolitan City with a population of more than _____ is known as the Municipal Corporation in India.

(a) 10 lakh
(b) 2 lakh
(c) 5 lakh
(d) 12 lakh

Q14. Which of the following is/are a capital receipt for the government ?

(A) Loans taken by the government from the public

(B) Borrowings from foreign countries and Institutes

(C) Disinvestment of assets

(a) Only A and B
(b) Only A and C
(c) Only A

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(d) All - A, B and C

Q15. What will come in the place of the question mark (?) in the following equation, if '+' and '-' are interchanged and also '×' and '÷' are interchanged ?

24 × 6 ÷ 5 - 3 + 2 = ?

(a) 11
(b) 10
(c) 1
(d) 21

Q16. In a certain code language, 'AVOID' is written as '85395' and 'MULTI' is written as '56679'. How will 'EVENT' be written in that language ?

(a) 45744
(b) 45747
(c) 47544
(d) 45447

Q17. Six persons are sitting around a circular table facing the centre. Madhuram is an immediate neighbour of both Rahim and Amit. Sumit is sitting second to the right of Rahim. David is sitting third to the left of Amit. Prem is an immediate neighbour of both Sumit and Amit. Who is an immediate neighbour of both Madhuram and Prem ?

(a) Rahim
(b) David
(c) Sumit
(d) Amit

Q18. Refer to the following letter, number, symbol series and answer the question.

(Left) B F % 6 J Q 6 H & K M 8 1 5 T Z # @ K L 9 (Right)

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

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

Q19. Which of the following is NOT a variable cost for a firm ?

(a) Commissions
(b) Property taxes
(c) Labour
(d) Packing

Q20. Select the number from among the given options that can replace the question mark (?) in the following series.

3, 16, 5, 13, 9, 8, ?, ?, 23, -8

(a) 13, 2
(b) 11, 3
(c) 15, 1
(d) 12, 3

Q21. Which of the following is divisible by 2, 3, and 5 ?

(a) 2240
(b) 3150
(c) 14175
(d) 54332

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Q22. The mean proportional of 25 and 36 is:

(a) 60
(b) 25
(c) 36
(d) 30

Q23. _____ means cases that can be directly considered by the Supreme Court without going to the lower courts before that.

(a) Appellate Jurisdiction
(b) Advisory Jurisdiction
(c) Writ Jurisdiction
(d) Original Jurisdiction

Q24. The surface area of a sphere is 196 π cm^2. The volume of the sphere is:

(a) 1372π/3 cm^3
(b) 1472π/3 cm^3
(c) 1572π/3 cm^3
(d) 1272π/3 cm^3

Q25. If '+' means '-', '-' means '×', '×' means '÷', and '÷' means '+', what will come in place of the question mark (?) in the following equation ?

12 × 3 - 25 ÷ 25 + 25 = ?

(a) 80
(b) 200
(c) 100
(d) 300

Q26. A substance gains hydrogen during a chemical process called:

(a) decomposition
(b) reduction
(c) Oxidation
(d) Rusting

Q27. What will come in the place of the question mark (?) in the following equation, if '+' and '-' are interchanged and also '×' and '÷' are interchanged ?

20 × 5 ÷ 5 - 5 + 3 = ?

(a) 22
(b) 32
(c) 2
(d) 12

Q28. The LCM and the HCF of two numbers are given as 459 and 3, respectively. If one number is 51, then find the other number.

(a) 27
(b) 21
(c) 37
(d) 33

Q29. One-third of a certain journey is covered at the speed of 25 km/h, one-fourth at 30 km/h and the rest at 50 km/h. The average speed for the whole journey is:

(a) 35 km/h
(b) 331/3 km/h
(c) 301/2 km/h
(d) 331/6 km/h

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Q30. If $x - 1/x = 6$, then the value of $x^3 - 1/(x^3)$ is:

(a) 534
(b) 334
(c) 434
(d) 234

Q31. A boy can complete a piece of work alone in 10 days, but with the help of his friend he can complete it in 6 days. In how much time will his friend be able to complete the same piece of work alone ?

(a) 8 days
(b) 15 days
(c) 4 days
(d) 4 1/2 days

Q32. Each of A, B, C, D and E has an exam on a different day of a week, starting from Monday and ending on Friday of the same week.

C has the exam on Thursday. Only one person has the exam between B and A. B has the exam on the day immediately before D. Who has the exam on Wednesday ?

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

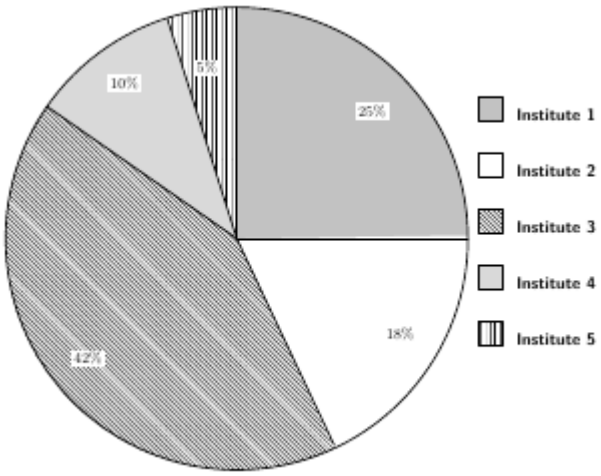
Q33. Find the value of $(\tan^2 60° + \cot^2 30°)/(\tan^2 20° - \sec^2 20°)$ - fracsin 90° + cos 0° cos ec²20° - cot²20°.

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

Q34. At what temperature does gypsum get converted into Plaster of Paris ?

(a) 573 K
(b) 273 K
(c) 373 K
(d) 473 K

Q35. The given pie chart provides details of qualified students for an entrance examination from different institutes. Study the pie chart and answer the question.



If 45 students qualified from Institute 1, how many students qualified from Institute 4 ?

(a) 18
(b) 36
(c) 27
(d) 29

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Q36. Energy conversion in water pump is from _____ to _____.

(a) light, electrical
(b) electrical, heat
(c) electrical, mechanical
(d) mechanical, electrical

Q37. Which of the following elements of group 14 is a metalloid ?

(a) C
(b) Sn
(c) Pb
(d) Ge

Q38. Identify the FALSE statement regarding circulation of blood in fishes.

(a) Blood from the ventricle goes only to the gills.
(b) Blood is sent from the gills to the rest of the body.
(c) Blood from the body enters the auricle.
(d) The two chambered heart provides double circulation.

Q39. 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 cups are bottles.

2. All bottles are pans.

Conclusions:

I. All cups are pans.

II. All bottles are cups.

III. All pans are cups.

IV. Some pans are bottles.

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

Q40. In which of the following quadrilaterals do diagonals NOT intersect at 90 ° ?

(a) Rhombus
(b) Kite
(c) Parallelogram
(d) Square

Q41. Refer to the following letter, symbol series and answer the question.

L J + K - Y % T # U P

If all symbols are dropped from the series, which letter will be at the middle most position in the newly formed series ?

(a) J
(b) K
(c) T
(d) Y

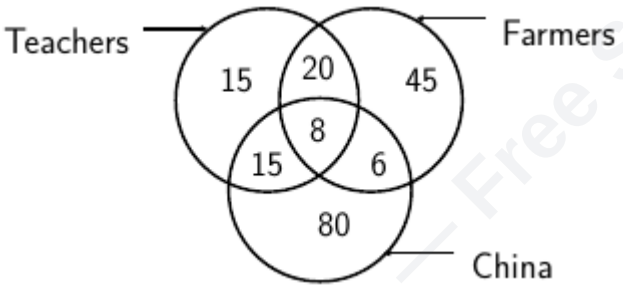
Q42. A statement is given below, followed by four conclusions given in the options. Find out which conclusion is true based on the given statement.

Statement: T ≥ Y > U < I ≤ O = P

(a) P = T
(b) Y > I

(c) U > P
(d) T > U

Q43. Study the given diagram carefully and answer the question. The numbers in different sections indicate the number of persons.



How many such teachers are there who are also farmers but NOT from China ?

(a) 15
(b) 20
(c) 45
(d) 25

Q44. _____ is a translation service and information site developed jointly by the Central Institute of Indian Languages, Sahitya Akademi and National Book Trust in 2002.

(a) Praroop .net
(b) Anuvaad .net
(c) Anukriti .net
(d) Pratilipi .net

Q45. Select the option in which the numbers are related in the same way as are the numbers of the given sets.

(NOTE: Operations should be performed on the whole numbers without breaking down the numbers into its constituent digits.

E.g. 13 - Operations on 13 such as adding /deleting /multiplying etc. to 13 can be performed. Breaking down 13 into 1 and 3 and then performing mathematical operations on 1 and 3 is not allowed)

(2, 42, 4)

(7, 57, 5)

(a) (5, 57, 7)
(b) (1, 19, 9)
(c) (3, 83, 8)
(d) (8, 46, 4)

Q46. Study the following number arrangement and answer the question given below. All numbers given below are 2 digit numbers.

78 25 96 36 14 45 76 79 39 34 31 38 29 24 26 16 37 43

What will be the sum of all prime numbers present in the above series ?

(a) 190
(b) 261
(c) 248
(d) 219

Q47. 10 friends of a class appeared for a class test. Each friend got different marks in test. Rama scored more than 4 friends only. Usha scored less than 3 friends only. How many friends scored more than Rama but less than Usha ?

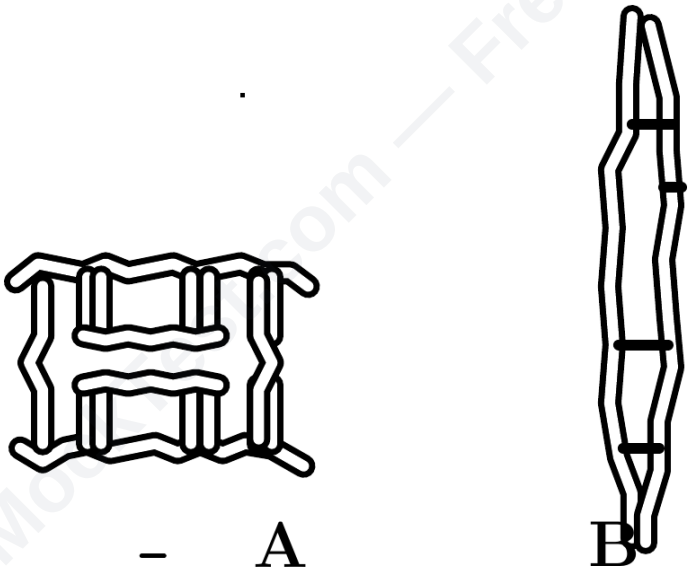
(a) 3
(b) 2
(c) 4
(d) 1

Q48. Which of the following numbers will replace the question mark (?) in the given series ?

23, 27, 35, 47, 63, ?

(a) 80
(b) 81
(c) 82
(d) 83

Q49. Both the diagrams A and B given below are of Sclerenchyma tissue in plants, yet they look different. Why ?



(a) A - Longitudinal section; B - Oblique section
(b) A - Longitudinal section; B - Transverse section
(c) A - Radial section; B - Transverse section
(d) A - Transverse section; B - Longitudinal section

Q50. Given below are two letter-cluster pairs in which the second letter-cluster is related to the first letter-cluster following a certain logic. Select the letter-cluster pair from among the options that follows the same logic.

QTS : WZY

MPG : SVM

(a) HKW : BEQ
(b) HKW : NQC
(c) HKW : BQQ
(d) HKW : NEC

Q51. The refractive indices of two transparent media A and B are 3/2 and 4/3, respectively. The refractive index of medium A with respect to medium B is equal to:

(a) 9/8
(b) 1/2
(c) 8/9
(d) 3/4

Q52. Under which of the following Funds has the scheme 'One Stop Centre (OSC) scheme' been implemented across the country since 1 April 2015 ?

(a) PM National Relief Fund
(b) Durga Vahini Fund
(c) Nirbhaya Fund
(d) Women Empowerment Fund

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Q53. Which of the following displacement reactions is NOT possible ?

(a) Pb(s) + $CuCl_2$(aq) → $PbCl_2$(aq) + Cu(s)
(b) Cu(s) + $PbCl_2$(aq) → $CuCl_2$(aq) + Pb(s)
(c) Fe(s) + $CuSO_4$(aq) → $FeSO_4$(aq) + Cu(s)
(d) Zn(s) + $CuSO_4$(aq) → $ZnSO_4$(aq) + Cu(s)

Q54. What is the purpose of establishing 'protected areas' ?

(a) To develop tourism spots
(b) To preserve natural ecosystems
(c) To prevent human settlements
(d) To protect endangered animals

Q55. Which of the following statements is correct about Petrology ?

(a) It has been derived from a Latin word which means brick.
(b) It is the branch of science concerned with the origin, structure and composition of petroleum.
(c) It is the branch of science concerned with the origin, structure and composition of rocks.
(d) It is the sedimentary rock formed out of deposits of glaciers.

Q56. The given table provides details of the marks obtained by a student in different subjects in two term exams. Study the table and answer the question.

	Term Exam 1	Term Exam 2
Mathematics	80	85
Science	84	89
Social Science	78	82
Hindi	85	88
English	92	91

What is the average of the maximum marks obtained in Mathematics and the minimum marks obtained in Hindi ?

(a) 88
(b) 76
(c) 80
(d) 85

Q57. Which of the following represents the equation $(x + 2)^3 = x(x^2 - 1)$ in standard form ?

(a) $4x^2 + 10x + 7 = 0$
(b) $6x^2 + 13x + 8 = 0$
(c) $6x^2 + 11x + 6 = 0$
(d) $x^2 + 12x + 8 = 0$

Q58. Amongst six friends A, B, C, D, E an F, each has a different height. F is taller than only two other friends. A is shorter than only one friend. D is shorter than F but taller than C. E is shorter than B. Who is the third tallest among all the friends ?

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

Q59. The value of 597 × 603 is:

(a) 659991
(b) 459991
(c) 559991
(d) 359991

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Q60. The mean proportional between 8 + 4√2 and 6 - 3√2 is:

(a) √6
(b) 3√6
(c) 2√6
(d) 4√6

Q61. Consider the magnitudes and directions of the induced potential difference in the following situations:

(a) A magnet moving with a speed of 1 m/s with its north pole towards a stationary coil.

(b) The same magnet moving with a speed of 1 m/s with its south pole towards the same stationary coil.

The induced potential differences are of ____ magnitude(s) and have ____ sign(s) in the above two cases

(a) the same, the same
(b) the same, opposite
(c) different, opposite
(d) different, the same

Q62. Javelin thrower Neeraj Chopra became the ____ Indian to win a medal at World Athletics Championships in July 2022.

(a) fourth
(b) third
(c) second
(d) first

Q63. 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 beds are cots.

2. All sofas are beds.

Conclusions:

I. All sofas are cots.

II. Some beds are sofas.

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

Q64. P, Q, R, S, T, U and V are sitting on a wall in a straight row, and all of them are facing north. R is on the immediate right of S. Q is at one of the extreme end and has T as his immediate neighbour. V is the immediate neighbour of T and U. S is sitting third from the extreme right end. Which of the following pairs is sitting at each of the extreme end ?

(a) QR
(b) QS
(c) QU
(d) PQ

Q65. Which of the following is NOT an example of variable costs ?

(a) Rent
(b) Distribution
(c) Packaging
(d) Raw Material

Q66. The sum of the present ages of A and B is 80 years. If the ratio of their ages after 8 years will be 17 : 15, then the present age of B is:

(a) 35 years
(b) 55 years

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(c) 45 years
(d) 37 years

Q67. Which of the following should be managed to ensure sustainability ?
(a) Industries
(b) Crop varieties
(c) Natural resources
(d) Byproducts of Mining

Q68. Shevroy Hills are a part of the _____.
(a) Deccan Plateau
(b) Chotanagpur Plateau
(c) Eastern Ghats
(d) Western Ghats

Q69. A statement is given followed by two assumptions numbered I and II. You have to assume everything in the statement to be true and decide which of the assumptions is/are implicit in the statement.
Statement:
"In order to retain employees, we must reward them with monthly benefits", company chairman tells the manager.
Assumptions:
I. Monthly benefits will keep the employees happy.
II. The employees will be punctual.
(a) Neither assumption I nor II is implicit
(b) Only assumption I is implicit
(c) Both assumptions I and II are implicit
(d) Only assumption II is implicit

Q70. How much annual instalment will discharge a debt of Rs. 9,600 in 5 years at 10% simple interest per annum ?
(a) Rs. 1,500
(b) Rs. 1,450
(c) Rs. 1,600
(d) Rs. 1,550

Q71. If the volume of a cube is 512 cm^3, then the measure of the main diagonal of the cube will be:
(a) $8\sqrt{3}$ cm
(b) $17\sqrt{3}$ cm
(c) $14\sqrt{3}$ cm
(d) $7\sqrt{3}$ cm

Q72. If each interior angle of a regular polygon is 144°, then the number of its sides is:
(a) 14
(b) 8
(c) 12
(d) 10

Q73. A man covers equal distances at the speeds of 5 km/h, 8 km/h and 6 km/h. His average speed for the entire journey is:
(a) 76/59 km/h
(b) 56/59 km/h
(c) 86/59 km/h
(d) 66/59 km/h

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Q74. Which statement about effective nuclear charge is NOT correct ?

(a) It decreases down a group.
(b) It acts on the valence shell electrons.
(c) It increases across a period from left to right.
(d) It depends only upon the nuclear charge.

Q75. 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.

12 : 18 :: 28 : 42 :: 10 : ?

(a) 16
(b) 15
(c) 24
(d) 18

Q76. Which of the following organelles is/are known as the 'suicide bags' of a cell ?

(a) Lysosomes
(b) Ribosomes
(c) Endoplasmic reticulum
(d) Golgi apparatus

Q77. One morning Yogesh started from his home to visit his sister in another city. He first drove for 20 km towards the north and then turned towards the east and further drove for 10 km. After this he turned towards the north and drove for 30 km. Finally he turned towards the east and drove for 20 km to reach his sister 's home. In which direction is his home from his sister's home ?

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

Q78. The light from a point source is rendered parallel by a concave mirror. What is the position of the light source ?

(a) At centre of curvature
(b) At Focus
(c) At infinity
(d) Between focus and centre of curvature

Q79. What does the Right to Constitutional Remedies mean ?

(a) If any citizen feels the fundamental rights have been violated by the State, then they can move the court.
(b) All linguistic and religious minorities can set up their own education institutions.
(c) Any person has the right to move freely and live anywhere in India.
(d) Each and every person is equal before the law, which means everyone will receive the same protection as per the laws of the country.

Q80. How many scientists got the Shanti Swarup Bhatnagar Award 2021 for Science & Technology ?

(a) 11
(b) 9
(c) 13
(d) 7

Q81. Hollong (Dipterocarpus macrocarpus) is the tallest tree in the state of ___ and also its State Tree.

(a) Nagaland
(b) Sikkim
(c) Assam
(d) Manipur

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Q82. Refer to the following letter and number series and answer the question.

(Left) G C T 7 D 4 6 K 2 R Y 3 5 E S A 4 T Y 7 8 G T (Right)

How many such letters are there in the series which are immediately preceded by a letter and also immediately followed by a number ?

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

Q83. Which of the following sportspersons was awarded the Padma Bhushan in January 2022 ?

(a) Pramod Bhagat
(b) Neeraj Chopra
(c) Devendra Jhajharia
(d) Sumit Antil

Q84. As of July 2022 which of the following organisations runs 'School to School' programme that builds a relationship of empathy and dignity between urban and rural children ?

(a) CARE
(b) Oxfam India
(c) Goonj
(d) HelpAge India

Q85. A concave mirror has a ___ towards the centre of sphere with polish ___ the centre of curvature.

(a) depression, opposite to
(b) bulge, opposite
(c) bulge, towards
(d) depression, towards

Q86. What is the value of 222.22 + 22.22 + 12 + 0.22 + 0.02 ?

(a) 256 .68
(b) 255.68
(c) 256.08
(d) 256.86

Q87. Each of Prem, Amit, Ram, Sudheer, Tejas, Uma and Vivek has an exam on a different day of a week, starting from Monday and ending on Sunday of the same week. Prem has the exam on Thursday. Only one person has the exam between Prem and Uma. Ram has the exam on the day immediately before Uma but not on a Monday. Only two people have exams between Ram and Tejas. Vivek's exam is on one of the days before Sudheer and on one of the days after Amit. Who among the following has the exam on Monday ?

(a) Tejas
(b) Sudheer
(c) Prem
(d) Amit

Q88. If the speed of a vehicle decreases by 10 km/h, it takes 2 hours more than what it usually takes to cover a distance of 1800 km. The time it usually takes is:

(a) 17 hours
(b) 18 hours
(c) 19 hours
(d) 10 hours

Q89. In which year was India's first complete census operation undertaken ?

(a) 1879
(b) 1877
(c) 1881

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(d) 1875

Q90. During the preparation of NaOH by chlor-alkali process, which of the following ions migrates toward the cathode ?

(a) Na^+
(b) Cl^-
(c) OH^-
(d) CO3^(2-)

Q91. If the cost price of an article is Rs. 3,200 and its selling price is Rs. 4,700, then the profit percentage is:

(a) 567/8%
(b) 467/8%
(c) 568/9%
(d) 468/9%

Q92. Parul started walking towards the north. After walking for 300 metres she turned right and walked for 400 metres. Then she turned right and walked for 500 metres. She then turned left and walked for 200 metres. Again, she turned left and walked for 200 metres. Finally she turned left and walked for 200 metres. In which direction and how far is Parul from her starting position ? (All turns are 90 degree turns only)

(a) 200 metres west
(b) 200 metres east
(c) 400 metres east
(d) 400 metres west

Q93. Vishu is one of the very famous festivals of which of the following states of India ?

(a) Kerala
(b) Odisha
(c) West Bengal
(d) Gujarat

Q94. An electrical device that works on the principle of Joule's Law of Heating is:

(a) Speaker
(b) Electromagnet
(c) Immersion rod
(d) Electrical bell

Q95. Which of the following is the best definition of 'biodegradable' ?

(a) Capable of depolymerization into carbon dioxide and water by the action of enzymes
(b) A suitable and sufficient nutrient source for growth to saprophytic organisms
(c) Easily digested into smaller molecules by action of bacteria or bacterial enzymes
(d) Capable of being broken down into harmless products by the action of microbes

Q96. The mode of the observations 2, 6, 3, 9, 5, 6, 7, 8, 4, 6, 10, 6 and 11 is:

(a) 11
(b) 10
(c) 7
(d) 6

Q97. Which of the following transports food, carbon dioxide and nitrogenous wastes in dissolved form ?

(a) Plasma
(b) WBC
(c) RBC
(d) Platelets

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Q98. In December 2021, Supreme Court stated that the Law Commission can consider the issue for appointment of Dowry Prohibition Officer, equivalent to Right to Information Officer. Who were the justices to give this order ?

(a) Justice Indira Banerjee and Hemant Gupta
(b) Justice Uday Umesh Lali and AM Khanwilkar
(c) Justice DY Chandrachud and AS Bopanna
(d) Justice L Nageswara Rao and Sanjay Kishan Kaul

Q99. You are shocked to see how waste is littered in your society and no one is bothered. As a result, kids of the society fall sick very often. As a science student, how would you react to the situation ?

(a) Explain the importance of waste management to all residents, start segregation of waste and start composting
(b) Follow their footsteps
(c) Shout at the staff for not taking care
(d) Turn a blind eye to the situation

Q100. The value of 6 × 7 - {9 ÷ 3 + [3 × (5 - 2)]} is:

(a) 24
(b) 30
(c) 45
(d) 11

ANSWER KEY

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

SOLUTIONS

Q1. Answer: (b) 9^(th)

The correct answer is 9th.

Key Points

• Ramadan or Ramazan is the ninth month of Islamic calendar and is observed by Muslims worldwide as a month of fasting.
• Ramadan is considered as the holiest month in the Islamic calendar.
• During Ramadan, Muslims fast from dawn until sunset, abstaining from food, drink, and other physical needs.
• It is believed that fasting during Ramadan is a way to purify the soul and gain a deeper understanding of Allah's blessings.
• The end of Ramadan is marked by Eid al-Fitr, a major festival in the Islamic calendar.

Additional Information

• The Muslim calendar and Islamic calendar are other terms used to refer to the Hijri calendar in English.
• It is a lunar calendar with 12 lunar months and 354 or 355 days in a year.
• It is employed to ascertain the appropriate dates for Islamic holidays and customs, including the annual fasting period and the time of the big pilgrimage.

Q2. Answer: (d) Weak force of attraction between molecules

The correct answer is Option 4.

Key Points

• Since the attractive forces between molecules are weak, it doesn't take much energy to disrupt them and thus organic molecules have low melting and boiling points. Ionic compounds, in general, do not burn in oxygen.

• An organic compound is any of a large class of chemical compounds in which one or more atoms of carbon are covalently linked to atoms of other elements, most commonly hydrogen, oxygen, or nitrogen.

• Life is based on carbon; organic chemistry studies compounds in which carbon is a central element.

• The properties of carbon make it the backbone of the organic molecules which form living matter.

• Carbon is such a versatile element because it can form four covalent bonds.

• Carbon skeletons can vary in length, branching, and ring structure.

• The functional groups of organic molecules are the parts involved in chemical reactions.

• Organic molecules important for life include relatively small monomers as well as large polymers.

Additional Information

• Ionic Bond:

• The ionic bond is the electrostatic force of attraction that holds two oppositely charged ions together.

• The complete transfer of one or more electrons from one atom to the other forms a chemical link between two atoms, causing the atoms to acquire their closest inert gas configuration.

• Examples - KCl, AlCl3, NaCl

Q3. Answer: (b) Asymmetric Digital Subscriber Line

The correct answer is Asymmetric Digital Subscriber Line.

Key Points

• Asymmetric Digital Subscriber Line is the correct full name of ADSL technology.

• Asymmetric refers to the fact that ADSL provides higher download speeds than upload speeds.

• ADSL technology provides high transmission speeds for video and voice to homes over an ordinary copper telephone wire.

• ADSL uses different frequencies for upstream and downstream data transmission.

Additional Information

• Asynchronized refers to a communication mode where data is transmitted without a clock signal, but ADSL uses a clock signal for synchronization.

• Algorithm refers to a set of rules or instructions for solving a problem, but ADSL is a specific technology for data transmission over copper telephone lines.

• Arithmetic refers to mathematical operations like addition, subtraction, multiplication, and division, but ADSL technology does not involve arithmetic operations.

Q4. Answer: (d) QSUW

The logic followed here is:

1. PRVW → P - Q P - R R R - R S S S - T - U V - V V V - W W W W

2. QRUW → P - Q Q - R R R - R S S S - T - U U - V V V - W W W W

3. QSVW → P - Q Q - R R R - S S S S - T - U V - V V V - W W W W

4. QSUW → P - Q Q - R R R - S S S S - T - U U - V V V - W W W W

Letters are increased as per the English dictionary starting from P to W with increase in number of repetition.

Hence, 'QSUW' is the correct answer.

Q5. Answer: (b) Electric energy, magnetic energy

The correct answer is Option 2.

Key Points

• The energy change that takes place in an electromagnet is electrical energy to magnetic energy.

• An electromagnet is a device consisting of a core of magnetic material surrounded by a coil, through which an electric current is passed to magnetize the core.

• An electromagnet is used wherever controllable magnets are required.

• Electromagnetism is directly proportional to the number of turns of the coil, the current flow through the coil, and the material of the coil.

• As the flow of current and number of turns increases, the strength of the electromagnet increases.

• Using a soft core increase the strength of the electromagnet because when the core is made up of a soft or hard magnetic material. Soft iron will magnetize more readily than steel.

• Electromagnets are controllable.

• Electromagnets have adjustable power levels.

• They are used in MRI and Generators.

• Electromagnetic strength is directly proportional to the number of turns and the current flowing through it.

Additional Information

• Electric Energy -

• The commercial unit of electric energy is Kilowatt-hour.

• One kilowatt-hour is defined as the energy consumed by the power consumption of 1kW during 1 hour.

• One kilowatt-hour is equal to 3600 kilojoules.

• The SI unit of electrical energy is Joule.

• Magnetic Energy -

• Magnetic field: If a current is passed through a wire a magnetic field is produced around it.

• lenz's Law: According to this law, the direction of induced emf or current in a circuit is such as to oppose the cause that produces it.

• This law gives the direction of induced emf/induced current.

• This law is based upon the law of conservation of energy.

Q6. Answer: (b) NRWZN

The logic followed here is:

• • Similarly,

• Hence, 'NRWZN' is the correct answer.

Q7. Answer: (a) C4H8

The correct answer is Option 1.

Key Points

• All C3H8, C2H6, CH4 saturated carbon compounds with the general formula: CnH2n+2 whereas C4H8 is an alkene with general formula CnH2n.

• Homologous series is defined as a series of compounds in which the same functional group substitutes for hydrogen in a carbon chain.

• This series will be differing with a successive member of CH2.

• Some examples are methane (CH4), ethane (C2H6), propane (C3H8) as they differ by CH2 and they have the same functional group called alkanes (General formula CnH2n+2).

Additional Information

• Homologous series -

• Homologous series is a series of compounds with similar chemical properties and some functional groups differing from the successive member by CH2.

• Carbon chains of varying lengths have been observed in organic compounds having the same general formula.

• Such organic compounds that vary from one another by a repeating unit and have the same general formula form a series of compounds.

• Alkanes with the general formula CnH2n+2, alkenes with the general formula CnH2n, and alkynes with the general formula CnH2n-2 form the most basic homologous series in organic chemistry.

• The same thing can be observed in the case of alkenes in which the first member is ethene and the successive members are C3H6, C4H8, and C5H10.

• They differ from each other by a –CH2 unit. The Alkene formula is written as CnH2n.

Q8. Answer: (a) 280

Shortcut Trick

For two numbers in ratio a : b with HCF = H:

LCM = a × b × H

Given: a = 5, b = 7, H = 8

=> LCM = 5 × 7 × 8 = 35 × 8 = 280

Therefore The correct answer is 280.

Alternate Method

Given:

Ratio of numbers = 5 : 7

HCF (Highest Common Factor) = 8

Calculations:

Let the two numbers be 5x and 7x, where x is the HCF.

=> x = 8

=> First Number = 5 × 8 = 40

=> Second Number = 7 × 8 = 56

We know the property: Product of two numbers = HCF × LCM

=> 40 × 56 = 8 × LCM

=> LCM = (40 × 56) ÷ 8

=> LCM = 5 × 56 = 280

Therefore The correct answer is 280.

Additional Information

Fundamental Property

For any two positive integers a and b: a × b = HCF(a, b) × LCM(a, b).

Ratio and HCF relationship

If two numbers are in the ratio p : q (where p and q are co-prime), their LCM is always p × q × HCF.

Co-prime Numbers

If two numbers are co-prime, their HCF is 1 and their LCM is simply their product.

Q9. Answer: (d) scattering of light

The correct answer is Option 4.

Key Points

• When light passes from one medium to any other medium say air, a glass of water then a part of the light is absorbed by particles of the medium preceded by its subsequent radiation in a particular direction. This phenomenon is termed a scattering of light.

• Rayleigh's law of scattering:-

• According to Rayleigh's law of scattering, the intensity of light of wavelength λ present in the scattered light is inversely proportional to the fourth power of λ, provided the size of the scattering particles is much smaller than λ. Mathematically,

• I prop. to 1/(λ^4)

• Thus the scattered intensity is maximum for a shorter wavelength.

Additional Information

• The molecules of air and other fine particles in the atmosphere have a size smaller than the wavelength of visible light.

• These are more effective in scattering light of shorter wavelengths at the blue end than the light of longer wavelengths at the red end.

• The red light has a wavelength of about 1.8 times greater than blue light.

• Thus, when sunlight passes through the atmosphere, the fine particles in the air scatter the blue colour (shorter wavelengths) more strongly than red.

• The scattered blue light enters our eyes.

• The red colour of the sun at sunrise is due to the scattering of light.

• Dispersion of Light - It means the splitting of white light when it passes through a glass prism into its constituent spectrum of colors (i.e. Violet, Indigo, Blue, Green, Yellow, Orange, and Red).

• Refraction: When a ray of light passes from one medium to another it suffers a change in direction at the boundary of two media is called refraction.

The change in direction is because the speed of light travels at different speeds in different mediums. The Refractive Index of a medium defines that it is denser or rarer.

Examples of refraction of light:

• Twinkling of stars in a clear sky.

• Pool of water appears to be less deep than it actually is.

• Rainbow formation in the sky.

Reflection

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• The property of light to fall on a surface and then reflect back the same medium is known as reflection.
• As a result, the medium of light does not change during reflection.
• Reflection is the change in direction of light when it strikes a surface.
• In the case of reflection, the light returns to the medium from which it originated.

Q10. Answer: (c) 32%, 44.44%

Shortcut Trick
Scheme (I): Successive discount = a + b − (a × b) ÷ 100 = 15 + 20 − (15 × 20) ÷ 100 = 35 − 3 = 32%.
Scheme (II): Discount% = [Free Items ÷ Total Items] × 100 = [4 ÷ (5 + 4)] × 100 = 4 ÷ 9 × 100 = 44.44%.
Therefore The correct answer is 32%, 44.44%.
Alternate Method
Given → Scheme I: 15% and 20% successive; Scheme II: Buy 5 Get 4 Free.
Formulas: Successive = a + b − ab/100 | Scheme II Discount% = [Free ÷ (Buy + Free)] × 100.
=> For Scheme I: Successive Discount = 15 + 20 − (15 × 20)/100 = 35 − 3 = 32%.
=> For Scheme II: MP of 9 items = 9 units; Free items = 4 units.
=> Discount % = (4 ÷ 9) × 100 = 44.44%.
Therefore The correct answer is 32%, 44.44%.
Additional Information
Successive Discounts
When two or more discounts are applied one after another, the net discount is less than the sum of individual percentages.
Buy X Get Y Free
In this offer, the customer pays for X items but receives X + Y items. The discount is calculated on the total (X+Y) items provided.

Q11. Answer: (b) 476

Shortcut Trick
Value of 2 × number = 342 − (3 × 52) = 342 − 156 = 186.
Required sum = (4 × number) + (2 × 52).
Since 4 × number = 2 × (2 × number) = 2 × 186 = 372.
Required sum = 372 + 104 = 476.
Therefore The correct answer is 476.
Alternate Method
Given:
Sum of twice a number and three times of 52 = 342
Formula Used:
Linear Equation: ax + b = c
Calculations:
Let the number be x.
=> 2x + 3 × 52 = 342
=> 2x + 156 = 342
=> 2x = 342 − 156
=> 2x = 186
=> x = 186 ÷ 2 = 93
Now, we need to find the sum of four times the number and two times 52:
=> 4x + 2 × 52
=> 4 × 93 + 104
=> 372 + 104 = 476
Therefore The correct answer is 476.
Additional Information
Linear Equation in One Variable
An equation which can be written in the form ax + b = 0, where a and b are constants and x is the variable.
Transposition Rule
When a term is moved from one side of the equation to the other, its sign changes (+ becomes −, and × becomes ÷).

BODMAS Rule

Always follow the order: Brackets, Orders, Division, Multiplication, Addition, and Subtraction for multi-step calculations.

Q12. Answer: (a) resistance will become one-fourth

The correct answer is Option 1.

Key Points

• According to ohm's law Current (I) = Potential difference (V) / Resistance(R)

• If the potential difference is maintained constant and the resistance is changed - Current (I) is inversely proportinal to the reisistance (R) => I prop. to 1/R

• So If current is doubled and potential difference is reduced to half, then resistance will become one-fourth.

Additional Information

• Resistance:

• It is defined as the hurdles in the path of flow of current.

• The SI unit of resistance is the ohm.

• It is denoted by the symbol Ω.

• It depends on the material of the conductor and the dimensions of the conductor.

• In other words, we can say it is the ratio of voltage to the current.

• R= (rho×length)/area

• Note: rho=Resistivity

Q13. Answer: (a) 10 lakh

The correct answer is 10 lakh.

Key Points

• Municipal Corporations are the governing bodies responsible for the development and administration of urban areas in India.

• The population of a Metropolitan City with more than 10 lakh inhabitants is managed by a Municipal Corporation.

• The Municipal Corporation is responsible for providing basic amenities such as water supply, sanitation, and maintenance of roads and infrastructure.

• The Municipal Corporation also collects taxes and fees from the citizens to fund its activities and projects.

Additional Information

• 2 lakh and 5 lakh are a relatively small population, and such cities are usually managed by a Municipal Council or a Nagar Panchayat.

• 12 lakh is a large population, and such cities are usually managed by a Metropolitan Development Authority or a Metropolitan Planning Committee.

• Panchayat Raj institutions are the local government authorities in rural areas.

• Village panchayats are the local governing bodies at the village level.

• They are referred to as panchayat samitis at the block level.

• They are referred to as zilla parishads at the district level.

Q14. Answer: (d) All - A, B and C

The correct answer is All - A, B and C.

Key Points

• Capital receipts refer to the inflow of funds that create liabilities or reduce assets for the government.

• Loans taken by the government from the public, borrowings from foreign countries and institutes, and disinvestment of assets are all examples of capital receipts.

• Loans taken by the government from the public are a form of borrowing and create a liability for the government.

• Borrowings from foreign countries and institutes also create a liability for the government and are usually accompanied by conditions and terms of repayment.

• Disinvestment of assets refers to the sale of government-owned assets like shares, land, or buildings, and generates revenue for the government.

Additional Information

• Capital receipts are earnings from non-routine or infrequently occurring activity.

• An organization's primary or consistent source of income is not capital receipts.

• Additionally, due to their capital nature, these receipts are displayed on a company's balance sheet rather than in the income statement or profit and loss account.

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• The recording of these receipts follows the accrual method.

• Additionally, unlike revenue receipts, capital receipts cannot be used for the distribution of profit due to their non-recurring nature.

Q15. Answer: (d) 21

Symbols	•	×
Meaning	•	÷

Given equation: 24 × 6 ÷ 5 - 3 + 2 = ?

After replacing the symbols by their meaning, we get:

24 ÷ 6 × 5 + 3 - 2 = ?

=> 4 × 5 + 3 - 2 = ?

=> 23 - 2 = ?

=> 21 = ?

Hence, '21' is the correct answer.

Q16. Answer: (d) 45447

The logic followed here is:

• • Similarly,

• Hence, '45447' is the correct answer.

Q17. Answer: (d) Amit

Six persons are sitting around a circular table facing the centre.

1. Madhuram is an immediate neighbour of both Rahim and Amit.
2. Sumit is sitting second to the right of Rahim.
3. David is sitting third to the left of Amit.
4. Prem is an immediate neighbour of both Sumit and Amit.

The above condition cannot be satisfies in Case I, so it is eliminated.

Clearly, Amit is an immediate neighbour of both Madhuram and Prem.

Hence, ‘Amit’ is the correct answer.

Q18. Answer: (c) 3

Pattern: Letter Letter Number

(Left) B F % 6 J Q 6 H & K M 8 1 5 T Z # @ K L 9 (Right)

Clearly, three such letters are there which are immediately preceded by a letter and also immediately followed by a number.

Hence, ‘3’ is the correct answer.

Q19. Answer: (b) Property taxes

The correct answer is Property taxes.

Key Points

• Variable costs are expenses that vary with the level of production or sales.

• They increase as production or sales increase and decrease as production or sales decrease.

• In contrast, fixed costs are expenses that do not vary with production or sales levels.

• Commissions and labor costs are both examples of variable costs.

• Commissions are paid based on the level of sales, so they increase when sales increase and decrease when sales decrease.

• Labor costs similarly increase as production increases and decrease as production decreases.

• Packing costs could be either a variable or fixed cost depending on how they are structured.

• If the cost of packing materials and labor varies with the level of production, then it is a variable cost.

• If it is a fixed cost that does not vary with production levels, then it is a fixed cost.

• Property taxes, on the other hand, are typically a fixed cost.

• They are based on the assessed value of the property and do not vary with production or sales levels.

Additional Information

• Commissions are payments made to salespeople or other employees based on their level of sales or performance.

• They are a form of incentive compensation that is designed to motivate employees to work harder and sell more.

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• Property taxes are taxes that are levied on real estate property.
• They are typically assessed by local governments and are based on the value of the property.
• They are used to fund a variety of local services, such as schools, police, and fire departments.
• Labor costs are the wages and benefits paid to employees.
• They are a major expense for many companies and can vary widely depending on the type of work being done and the location of the company.
• Packing costs are the expenses associated with packaging and shipping products.
• They can include the cost of materials, labor, and shipping fees.

Q20. Answer: (c) 15, 1

The logic followed here is:
Hence, '15, 1' is the correct answer.

Q21. Answer: (b) 3150

Shortcut Trick
To be divisible by 2, 3, and 5, a number must be divisible by their LCM.
LCM(2, 3, 5) = 2 × 3 × 5 = 30.
Check Divisibility Rules: Unit digit must be 0 (for 2 and 5) and sum of digits must be divisible by 3.
Only 3150 ends in 0 and 3+1+5+0 = 9 (divisible by 3).
Therefore The correct answer is 3150.
Alternate Method
Given: Divisors are 2, 3, and 5.
Divisibility Rule for 2: Last digit must be even (0, 2, 4, 6, 8).
Divisibility Rule for 5: Last digit must be 0 or 5.
=> Combining 2 and 5, the last digit must be 0.
=> Options (3) 14175 and (4) 54332 are eliminated.
Divisibility Rule for 3: Sum of digits must be divisible by 3.
=> For 2240: 2 + 2 + 4 + 0 = 8 (Not divisible by 3).
=> For 3150: 3 + 1 + 5 + 0 = 9 (Divisible by 3).
Therefore The correct answer is 3150.
Additional Information
Divisibility by 6
A number is divisible by 6 if it is divisible by both 2 and 3.
Divisibility by 10
A number is divisible by 10 if its last digit is 0.
LCM Property
If a number is divisible by several coprime numbers, it is also divisible by their product.

Q22. Answer: (d) 30

Shortcut Trick
Mean Proportional of two numbers a and b is √(a × b).
=> Mean Proportional = √(25 × 36)
=> Mean Proportional = 5 × 6 = 30
Therefore The correct answer is 30.
Alternate Method
Given: First number (a) = 25, Second number (b) = 36
Formula Used: If x is the mean proportional between a and b, then a : x = x : b
=> $x^2 = a \times b$
=> $x^2 = 25 \times 36$
=> x = √(900)
=> x = 30
Therefore The correct answer is 30.
Additional Information

Third Proportional

For two numbers a and b, the third proportional c is such that a : b = b : c, calculated as $c = b^2 \div a$.

Fourth Proportional

For three numbers a, b, and c, the fourth proportional d is such that a : b = c : d, calculated as $d = (b \times c) \div a$.

Compound Ratio

The compound ratio of (a : b) and (c : d) is $(a \times c) : (b \times d)$.

Q23. Answer: (d) Original Jurisdiction

The correct answer is Original Jurisdiction.

Key Points

• Original Jurisdiction refers to the power of a court to hear a case for the first time, instead of on appeal or by review of another court's decision.

• In the United States, the Supreme Court has original jurisdiction in a limited number of cases, such as disputes between states or cases involving ambassadors or other public ministers.

Additional Information

• Appellate Jurisdiction refers to the power of a court to review and revise the decisions of a lower court.

• The Supreme Court has appellate jurisdiction over most cases, and it is the highest court of appeal in the United States.

• Advisory Jurisdiction refers to the power of a court to provide legal advice or opinions, rather than to decide specific cases.

• The Supreme Court does not have advisory jurisdiction in the United States.

• Writ Jurisdiction refers to the power of a court to issue writs, or orders, to government officials or agencies.

• The Supreme Court has writ jurisdiction, and it can issue writs such as habeas corpus, mandamus, and certiorari.

Q24. Answer: (a) $1372\pi/3$ cm³

Shortcut Trick

Surface Area = $4\pi r^2 = 196\pi \Rightarrow r^2 = 49 \Rightarrow r = 7$ cm.

Volume = $(4/3)\pi r^3 = (4/3) \times \pi \times 7^3$.

Volume = $(4 \times 343 \times \pi) \div 3 = 1372\pi/3$ cm³.

Therefore The correct answer is $1372\pi/3$ cm³.

Alternate Method

Given:

Surface Area of sphere = 196π cm²

Formula Used:

Surface Area = $4\pi r^2$

Volume = $(4/3)\pi r^3$

Calculations:

$\Rightarrow 4 \times \pi \times r^2 = 196 \times \pi$

$\Rightarrow 4r^2 = 196$

$\Rightarrow r^2 = 196 \div 4$

$\Rightarrow r^2 = 49$

$\Rightarrow r = \sqrt{49} = 7$ cm

$\Rightarrow$ Volume = $(4/3) \times \pi \times (7)^3$

$\Rightarrow$ Volume = $(4/3) \times \pi \times 343$

$\Rightarrow$ Volume = $(1372\pi)/3$ cm³

Therefore The correct answer is $1372\pi/3$ cm³.

Additional Information

Properties of Sphere

A sphere has only one surface, so its Total Surface Area and Curved Surface Area are the same: $4\pi r^2$.

Hemisphere Formulas

For a hemisphere of radius r: Volume = $(2/3)\pi r^3$, CSA = $2\pi r^2$, and TSA = $3\pi r^2$.

Ratio of Volume and Surface Area

The ratio of the Volume to the Surface Area of a sphere is always r/3.

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Q25. Answer: (c) 100

Symbols	•	•	×	÷
Meaning	•	×	÷	•

Given equation: 12 × 3 - 25 ÷ 25 + 25 = ?

After replacing the symbols by their meaning, we get:

12 ÷ 3 × 25 + 25 - 25 = ?

=> 4 × 25 + 25 - 25 = ?

=> 100 + 25 - 25 = ?

=> 125 - 25 = ?

=> 100 = ?

Hence, '100' is the correct answer.

Q26. Answer: (b) reduction

The correct answer is Option 2.

Key Points Oxidation is the loss of hydrogen. Reduction is the gain of hydrogen.

• Reduction Reaction is always accompanied by an oxidation reaction where the reactant loses one or more electron.

• Reduction-oxidation reactions are often called redox equations.

• A reduction reaction is only one half of a redox reaction. The other half is the oxidation reaction.

Additional Information

• Oxidation Reaction refers to a reaction in which either the addition of Oxygen takes place or the removal of Hydrogen takes place.

• Rusting is an example of an oxidation reaction.

• The iron reacts with water and oxygen to form hydrated iron oxide, which we see as rust.

iron + water + oxygen → hydrated iron oxide

• Decomposition is the process of breakdown of the complex organic matter into a simpler inorganic matter like carbon dioxide, water, and nutrients. The fungi, bacteria, and flagellates initiate the process of decomposition and are known as decomposers.

Q27. Answer: (a) 22

Symbols	•	×
Meaning	•	÷

Given equation: 20 × 5 ÷ 5 - 5 + 3 = ?

After interchanging the symbols, we get:

20 ÷ 5 × 5 + 5 - 3 = ?

=> 4 × 5 + 5 - 3 = ?

=> 20 + 5 - 3 = ?

=> 25 - 3 = ?

=> 22 = ?

Hence, '22' is the correct answer.

Q28. Answer: (a) 27

Shortcut Trick

Product of LCM and HCF = Product of the two numbers.

Other number = (LCM × HCF) ÷ Given number

=> (459 × 3) ÷ 51 = 9 × 3 = 27.

Therefore The correct answer is 27.

Alternate Method

Given:

LCM = 459

HCF = 3

First Number (A) = 51

Formula Used:

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A × B = LCM × HCF

Calculations:

=> 51 × Second Number (B) = 459 × 3

=> Second Number (B) = (459 × 3) ÷ 51

=> Second Number (B) = 1377 ÷ 51

=> Second Number (B) = 27

Therefore The correct answer is 27.

Additional Information

HCF Properties

The HCF (Highest Common Factor) is always a factor of the LCM (Least Common Multiple).

Co-prime Numbers

For two co-prime numbers, the HCF is always 1 and their LCM is the product of the numbers.

Ratio and HCF

If two numbers are in the ratio x : y and their HCF is H, then the numbers are Hx and Hy, and their LCM = H × x × y.

Q29. Answer: (b) 331/3 km/h

Shortcut Trick

Assume total distance is LCM of denominators (3, 4) × 100 = 1200 km.

Distances: D1 = 400 km, D2 = 300 km, D3 = 500 km.

Times: T1 = 400/25 = 16 h, T2 = 300/30 = 10 h, T3 = 500/50 = 10 h.

Average Speed = Total Distance ÷ Total Time = 1200 ÷ 36 = 100/3 = 33(1/3) km/h.

Therefore The correct answer is 33(1/3) km/h.

Alternate Method

Given: Speeds are 25 km/h, 30 km/h, and 50 km/h for 1/3, 1/4, and remaining journey.

Formula Used: Average Speed = Total Distance / Total Time

=> Let total distance be D.

=> Remaining distance = D − (D/3 + D/4) = D − 7D/12 = 5D/12.

=> Total Time = (D/3)/25 + (D/4)/30 + (5D/12)/50

=> Total Time = D/75 + D/120 + D/120 = D/75 + 2D/120 = D/75 + D/60

=> Total Time = (4D + 5D)/300 = 9D/300 = 3D/100.

=> Average Speed = D ÷ (3D/100) = 100/3 = 33(1/3) km/h.

Therefore The correct answer is 33(1/3) km/h.

Additional Information

Average Speed (Equal Distances)

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

Average Speed (General Case)

It is always the weighted harmonic mean of the speeds: Total Distance ÷ ∑(d_i/s_i).

Relative Speed

When moving in the same direction, speed = S1 − S2. When moving in opposite directions, speed = S1 + S2.

Q30. Answer: (d) 234

Shortcut Trick

For any expression of the form $x - 1/x = k$, the value of $x^3 - 1/x^3$ is given by the formula $k^3 + 3k$.

Given: k = 6

Value = $6^3 + 3(6)$

Value = 216 + 18 = 234

Therefore The correct answer is 234.

Alternate Method

Given: $x - 1/x = 6$

Formula Used: $(a - b)^3 = a^3 - b^3 - 3ab(a - b)$

Applying the cubic identity by cubing both sides of the given equation:

=> $(x - 1/x)^3 = 6^3$

=> $x^3 - (1/x)^3 - 3 \times x \times (1/x) \times (x - 1/x) = 216$

=> $x^3 - 1/x^3 - 3(1)(6) = 216$

=> $x^3 - 1/x^3 - 18 = 216$

=> $x^3 - 1/x^3 = 216 + 18$

=> $x^3 - 1/x^3 = 234$

Therefore The correct answer is 234.

Additional Information

Standard Algebraic Identity for Sum

If $x + 1/x = k$, then the value of $x^3 + 1/x^3 = k^3 - 3k$.

Relationship with Squares

If $x - 1/x = k$, then the square value $x^2 + 1/x^2 = k^2 + 2$.

Conversion Formula

The relation between sum and difference is $(x + 1/x)^2 = (x - 1/x)^2 + 4$.

Q31. Answer: (b) 15 days

Shortcut Trick

Use the direct formula for two people working together: Time = (a × b) ÷ (a − b)

Where a = time taken by boy (10 days) and b = time taken together (6 days).

=> Friend's time = (10 × 6) ÷ (10 − 6)

=> Friend's time = 60 ÷ 4 = 15 days.

Therefore The correct answer is 15 days.

Alternate Method

Given:

Time taken by Boy alone = 10 days

Time taken by Boy + Friend together = 6 days

Formula: Efficiency = Total Work ÷ Time

Person	Days	Total Work	Efficiency
Boy	10 days	30 units (LCM)	3 units/day
Boy + Friend	6 days	5 units/day	

Calculations:

=> Friend's efficiency = (Boy + Friend) efficiency − Boy efficiency

=> Friend's efficiency = 5 − 3 = 2 units/day

=> Time taken by Friend alone = Total Work ÷ Friend's efficiency

=> Time = 30 ÷ 2 = 15 days

Therefore The correct answer is 15 days.

Additional Information

Total Work Assumption

Total work is always assumed as the LCM of individual days taken by the workers to simplify efficiency calculations.

Combined Efficiency Rule

If person A takes x days and B takes y days, their combined efficiency is (1/x + 1/y), and time taken together is (xy) ÷ (x + y).

Work & Wages Relation

Wages are always distributed in the ratio of work done or the ratio of efficiencies when people work for the same duration.

Q32. Answer: (b) A

Each of A, B, C, D and E has an exam on a different day of a week, starting from Monday and ending on Friday of the same week.

1. C has the exam on Thursday.
2. Only one person has the exam between B and A.
3. B has the exam on the day immediately before D.

WEEK	PERSON
MONDAY	B

TUESDAY	D
WEDNESDAY	A
THURSDAY	C
FRIDAY	E

Hence, ‘A’ is the correct answer.

Q33. Answer: (a) -8

Shortcut Trick

Put standard trigonometric values and basic identities directly into the expression.

Use: $\tan^2\theta - \sec^2\theta = -1$ and $\operatorname{cosec}^2\theta - \cot^2\theta = 1$

Expression = $[(\sqrt{3})^2 + (\sqrt{3})^2] / (-1) - [1 + 1] / 1$

$= (3 + 3) / (-1) - (2) / 1$

$= -6 - 2 = -8$

Therefore The correct answer is -8.

Alternate Method

Given:

$(\tan^2 60° + \cot^2 30°) / (\tan^2 20° - \sec^2 20°) - (\sin 90° + \cos 0°) / (\operatorname{cosec}^2 20° - \cot^2 20°)$

Formula and Values Used:

=> $\sec^2\theta - \tan^2\theta = 1$ => $\tan^2\theta - \sec^2\theta = -1$

=> $\operatorname{cosec}^2\theta - \cot^2\theta = 1$

=> $\tan 60° = \sqrt{3}$, $\cot 30° = \sqrt{3}$

=> $\sin 90° = 1$, $\cos 0° = 1$

Calculations:

=> First part numerator: $\tan^2 60° + \cot^2 30° = (\sqrt{3})^2 + (\sqrt{3})^2 = 3 + 3 = 6$

=> First part denominator: $\tan^2 20° - \sec^2 20° = -1$

=> Second part numerator: $\sin 90° + \cos 0° = 1 + 1 = 2$

=> Second part denominator: $\operatorname{cosec}^2 20° - \cot^2 20° = 1$

=> Expression Value = $(6 / -1) - (2 / 1)$

=> Value = $-6 - 2 = -8$

Therefore The correct answer is -8.

Additional Information

Pythagorean Identities

$\sin^2\theta + \cos^2\theta = 1$ | $1 + \tan^2\theta = \sec^2\theta$ | $1 + \cot^2\theta = \operatorname{cosec}^2\theta$

Key Trigonometric Values

$\sin 90° = 1$, $\cos 0° = 1$, $\tan 45° = 1$, $\tan 60° = \sqrt{3}$, $\cot 30° = \sqrt{3}$.

Complementary Angles

$\sin(90° - \theta) = \cos\theta$ | $\tan(90° - \theta) = \cot\theta$ | $\sec(90° - \theta) = \operatorname{cosec}\theta$

Q34. Answer: (c) 373 K

The correct answer is Option 3.

Key Points

• Calcium Sulphate Dihydrate ($CaSO_4.2H_2O$) is commonly known as “Gypsum”.

• When Gypsum is heated, it gets converted into Calcium Sulphate Hemihydrate ($CaSO_4.1/2H_2O$) or “Plaster of Paris (POP)”.

• This is prepared by heating the gypsum which contains calcium sulfate dihydrate ($CaSO_4.2H_2O$) to a temperature of about 150 deg C.

• When added water to the plaster of Paris (PoP), it will re-form into gypsum.

Additional Information Some common chemical compounds with their common names are:-

Chemical Compounds	Common Names	Chemical Formulas
Sodium Bicarbonate	Baking Soda	$NaHCO_3$
Calcium ChlorohypoChlorite	Bleaching Powder	$Ca(ClO)_2$

Sodium Hydroxide	Caustic Soda	NaOH
Sodium Carbonate	Washing Soda	Na2CO3.10 H2O
Carbon Dioxide	Dry Ice	CO2
Copper Sulphate	Blue Vitriol	CuSO4
Ferrous Sulphate	Green Vitriol	FeSO4
Sulphuric Acid	Oil of vitriol	H2SO4
Calcium Oxide	Quick Lime	CaO
Calcium Sulphate Hemihydrate	Plaster of Paris	(CaSO4.1/2H2O)
Calcium Sulphate Dihydrate	Gypsum	CaSO4.2H2O
Calcium Hydroxide	Slaked Lime	Ca(OH)2
Chile Saltpeter	Sodium nitrate	NaNO3
Saltpeter	Potassium nitrate	KNO3
Muriatic acid	Hydrochloric acid	HCl

Q35. Answer: (a) 18

Calculation

45 students qualified from Institute

25% → 45

The students qualified from Institute 4 = 10%

10% → 45/25 × 10 = 18

The answer is 18.

Q36. Answer: (c) electrical, mechanical

The correct answer is Option 3.

Key Points Energy conversion in water pump is from electrical to mechanical.

• An electric motor uses electromagnetic induction to convert electrical energy into mechanical energy.

• Electric energy is converted into mechanical energy by a direct current (DC) motor, and mechanical energy is converted into electrical energy by an alternating current (AC) generator.

• The electric motor is used as an important component in electric fans, refrigerators, mixers, washing machines, computers, MP3 players, etc.

Additional Information

• Dynamo - A dynamo is an electrical generator that uses a commutator to generate direct current.

• Inverter - An inverter converts direct current (DC) electricity from sources such as batteries or fuel cells to alternating current (AC).The electricity can be at any voltage required; in an instance, it can power AC equipment designed for mains operation or be rectified to produce DC at any voltage required.

• Potentiometer - A potentiometer is a device that we use to measure the electromagnetic force of the cell. Potentiometers operate on the Wheatstone bridge principle, which means no current flows through the meter.

Q37. Answer: (d) Ge

The correct answer is Option 4.

Key Points

Carbon is a chemical element with the symbol C and atomic number 6. It is nonmetallic and tetravalent-making four electrons available to form covalent chemical bonds. It belongs to group 14 of the periodic table. Three isotopes occur naturally and are stable.

• Silicon is a chemical element with the symbol Si and atomic number 14. It is a hard and brittle crystalline solid with a blue-grey metallic cluster, and it is a tetravalent metalloid and semiconductor. It is relatively unreactive.

• Germanium is a chemical element with the symbol Ge and atomic number 32. It is a lustrous, hard-brittle, greyish-white metalloid in the carbon group, chemically similar to its group neighbor's silicon and tin. Pure germanium is a semiconductor with an appearance similar to elemental silicon.

Additional InformationModern Periodic Table has 18 Groups and 7 Periods.

• It has 118 Elements.

• Each of the tables has a vertical row is called group. Elements in groups have similar chemical and physical properties because they have the same number of outer electrons.

• Each of the tables has horizontal rows is called periods. During a period, a gradual change in chemical properties occurs from one element to another.

• The elements are arranged in the modern periodic table on the basis of Mosely law, which states that the physical and chemical properties of elements are the periodic function of their atomic number.

• The Structure of it is like a bird Grid.

• The Modern Periodic table is used to organize all the known elements.

• Advantages of Modern Periodic Table:-

• It is easier to remember the properties of an element if its position in the periodic table is known.

• It made the study of Chemistry Systematic and Easy.

Modern Periodic Table:-

Q38. Answer: (d) The two chambered heart provides double circulation.

The correct answer is Option 4.

Key Points

• Two chambered heart

• The heart of some animals, like fish, only has two chambers. There is only one ventricle and one auricle in their heart.

• The sinus venosus, which leads to the atrium, and the bulbus arteriosus, which follows the ventricle, are on their flanks.

• The sinus venosus is where the deoxygenated blood enters the atrium. It enters the ventricle from here.

• When the blood is pumped out of the ventricle, the pressure is much higher than that at the gills, which are the next place the blood goes.

• Because of their thin walls, the gills run the risk of being damaged by high blood pressure. As a result, the blood pressure that comes out of the ventricle is adjusted by the bulbus arteriosus.

• The blood's pressure must still be sufficient to circulate the fluid throughout the body, even though the decreased pressure may prevent damage to the lungs.

• As a result, a fish's blood circulation relies on a delicate balance between low pressure for the gills and sufficient circulation. Fishes do not have double circulation, unlike humans.

Additional Information

• Three chambered heart

• With the exception of crocodiles, the hearts of all reptiles have three chambers, with two auricles and one ventricle. Compared to fish, this type is more advanced, but not as advanced as mammals.

• However, the ventricle is divided into two sub chambers by an incomplete partition. The right ventricle, also known as the Calum pulmonale, and the left ventricle, also known as the Calum venosum, are the two sub chambers.

• A third sub chamber, the cavum arteriosum, is located toward the top of the ventricle. A valve connects it to the left ventricle.

• Blood that has lost oxygen makes its way into the right atrium and into the right sub chamber of the ventricle. However, it also leaks into and fills the left ventricle as a result of incomplete separation.

• After that, the blood ascends the ventricle and enters the lungs for oxygenation. This descends once more and clogs the third chamber, the cavum arteriosum, temporarily.

• After that, the blood flows into the left ventricle, where it reaches the rest of the body.

Q39. Answer: (c) Only conclusions I and IV follow.

The least possible Venn diagram is:

Conclusions:

I. All cups are pans. → Follows (As, All cups are bottles and All bottles are pans, So the conclusion definitely follows.)

II. All bottles are cups. → Does not follow (As, All cups are bottles → Some bottles are cups)

III. All pans are cups. → Does not follow (As, All cups are bottles and All bottles are pans → Some pans are cups)

IV. Some pans are bottles. → Follows (As, All bottles are pans, So the conclusion definitely follows.)

Hence, only conclusions I and IV follow.

Q40. Answer: (c) Parallelogram

Concept used

Rombus: The diagonal of a rhombus is a line segment that joins any two non-adjacent vertices of a rhombus.

A rhombus has two diagonals that bisect each other at right angles, thus, they form 4 right-angled congruent triangles.

Kite: The two diagonals of a kite bisect each other at 90 degrees. The main diagonal of a kite bisects the other diagonal.

Square: A diagonal divides a square into two isosceles right-angled triangles.

Calculation

The diagonals of Parallelogram do not intersect at 90 °

Q41. Answer: (d) Y

L J + K - Y % T # U P

If all symbols are dropped from the series, then the newly formed series will be:

L J K Y T U P

Clearly, Y is at the middle most position in the newly formed series.

Hence, 'Y' is the correct answer.

Q42. Answer: (d) T > U

1. P = T → False (As, T ≥ Y > U < I ≤ O = P → The relation between P and T cannot be determined)
2. Y > I → False (As, T ≥ Y > U < I ≤ O = P → The relation between Y and I cannot be determined)
3. U > P → False (As, T ≥ Y > U < I ≤ O = P → U < P)
4. T > U → True (As, T ≥ Y > U < I ≤ O = P → T > U)

Hence, 'T > U' is the correct answer.

Q43. Answer: (b) 20

Teachers who are also farmers but NOT from China is shown below:

Hence, '20' is the correct answer.

Q44. Answer: (c) Anukriti .net

The correct answer is Anukriti .net.

Key Points

• Anukriti.net is a website that provides information on Sanskrit language and literature.

• Anukriti.net is a translation service and information site developed jointly by the Central Institute of Indian Languages, Sahitya Akademi and National Book Trust in 2002.

• It was developed by the Rashtriya Sanskrit Sansthan, an autonomous organization under the Ministry of Human Resource Development.

• It offers resources for learning and studying Sanskrit language and literature.

Additional Information

• Praroop.net is a website that provides information on Indian languages and scripts.

• It was developed by the Centre for Development of Advanced Computing (C-DAC) in Pune.

• It offers tools and resources for learning and using various Indian languages.

• Anuvaad.net is a website that offers machine translation services for Indian languages.

• It was launched by the Ministry of Electronics and Information Technology (MeitY) in 2019.

• It uses artificial intelligence and machine learning algorithms to provide accurate translations.

• Pratilipi.net is a website that offers a platform for Indian language writers and readers.

• It was founded in 2014 and has a collection of over 400,000 books and stories in various Indian languages.

• It allows users to read, write, and share stories in their preferred Indian language.

Q45. Answer: (c) (3, 83, 8)

The logic followed here is:

• • Similarly,

• Hence, '(3, 83, 8)' is the correct answer.

Q46. Answer: (d) 219

Shortcut Trick

Identify prime numbers from the given list of 2-digit numbers.

Prime numbers identified: 79, 31, 29, 37, 43.

Sum → 79 + 31 + 29 + 37 + 43 = 219.

Therefore The correct answer is 219.

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Alternate Method

Given series: 78, 25, 96, 36, 14, 45, 76, 79, 39, 34, 31, 38, 29, 24, 26, 16, 37, 43

Check each number for primality (divisibility only by 1 and itself):

=> 78 (Even), 25 (5×5), 96 (Even), 36 (Even), 14 (Even), 45 (5×9), 76 (Even) → Composite

=> 79 (Prime)

=> 39 (3×13), 34 (Even) → Composite

=> 31 (Prime)

=> 38 (Even) → Composite

=> 29 (Prime)

=> 24 (Even), 26 (Even), 16 (Even) → Composite

=> 37 (Prime)

=> 43 (Prime)

Calculations:

=> Sum = 79 + 31 + 29 + 37 + 43

=> Sum = 110 + 29 + 37 + 43

=> Sum = 139 + 80

=> Sum = 219

Therefore The correct answer is 219.

Additional Information

Prime Numbers

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

Composite Numbers

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

Co-prime Numbers

A pair of numbers whose HCF is 1. Example: (8, 15).

Q47. Answer: (d) 1

10 friends of a class appeared for a class test. Each friend got different marks in test.

1. Rama scored more than 4 friends only.

2. Usha scored less than 3 friends only.

10	
9	
8	
7	USHA
6	
5	RAMA
4	
3	
2	
1	

Clearly, only 1 friend scored more than Rama but less than Usha.

Hence, ‘1’ is the correct answer.

Q48. Answer: (d) 83

The logic followed here is:

Hence, '83' is the correct answer.

Q49. Answer: (d) A - Transverse section; B - Longitudinal section

The correct answer is A - Transverse section; B - Longitudinal section

Key Points

• The difference in appearance of the two diagrams is due to the orientation of the tissue in each section.

• In a longitudinal section, the tissue is cut along its length and appears elongated, while in a transverse section, the tissue is cut perpendicular to its length and appears circular.

• Sclerenchyma tissue is a type of plant tissue that provides mechanical support to the plant.

• It is composed of cells with thick, lignified cell walls.

Additional Information

• Sclerenchyma tissue is divided into two types: fibers and sclereids.

• Fibers are elongated cells that provide tensile strength to the plant, while sclereids are shorter cells that provide compressive strength.

• Lignin is a complex organic polymer that is deposited in the cell walls of sclerenchyma cells.

• It makes the cells rigid and waterproof, and gives them their characteristic woody texture.

• Longitudinal sections are often used to study the internal structure of plant organs such as stems and roots, while transverse sections are useful for studying the arrangement of tissues in leaves and flowers.

Q50. Answer: (b) HKW : NQC

The logic followed here is:

• Similarly,

• Hence, 'HKW : NQC' is the correct answer.

Q51. Answer: (a) 9/8

The correct answer is 9/8.

Key Points

• Refractive index is the measure of the bending of light as it passes through a medium.

• The refractive index of medium A with respect to medium B can be calculated by dividing the refractive index of medium A by the refractive index of medium B.

• Therefore, the refractive index of medium A with respect to medium B is 3/2 divided by 4/3 = 9/8.

Additional Information

• How much light is bent, or refracted, as it enters a material is determined by its refractive index.

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

• The velocity of light of a certain wavelength in empty space, c, divided by its velocity in a substance, v, yields the refractive index, which is also equal to n = c/v.

Q52. Answer: (c) Nirbhaya Fund

The correct answer is Nirbhaya Fund.

Key Points

• The One Stop Centre (OSC) scheme was launched by the Ministry of Women and Child Development in 2015 to provide support and assistance to women affected by violence.

• Facilitating access to a wide range of assistance for women affected by abuse is the scheme's main goal.

• The Nirbhaya Fund was set up in 2013 in the aftermath of the Delhi gang-rape case to support initiatives aimed at enhancing the safety and security of women in India.

Additional Information

• The PM National Relief Fund is a fund set up to provide assistance to people affected by natural calamities and other emergencies.

• Durga Vahini Fund is a fund set up by the Vishwa Hindu Parishad to support initiatives aimed at promoting Hindu culture and values.

• Women Empowerment Fund is a general term and could refer to any fund set up to support initiatives aimed at empowering women.

Q53. Answer: (b) Cu(s) + PbCl2(aq) → CuCl2(aq) + Pb(s)

The correct answer is Cu(s) + PbCl2(aq) → CuCl2(aq) + Pb(s).

Key Points

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• A displacement reaction occurs when a more reactive element displaces a less reactive element from its compound.

• Cu(s) + PbCl2(aq) → CuCl2(aq) + Pb(s) is not possible because copper is less reactive than lead, so it cannot displace lead from its compound.

• In Pb(s) + CuCl2(aq) → PbCl2(aq) + Cu(s), lead is more reactive than copper, so it displaces copper from its compound.

• In Fe(s) + CuSO4(aq) → FeSO4(aq) + Cu(s), iron is more reactive than copper, so it displaces copper from its compound.

• In Zn(s) + CuSO4(aq) → ZnSO4(aq) + Cu(s), zinc is more reactive than copper, so it displaces copper from its compound.

Additional Information

• Copper is a moderately reactive metal that is commonly used in electrical wiring, plumbing, and construction materials.

• It is also an essential nutrient for plants and animals.

• Lead is a highly toxic metal that can cause serious health problems, including brain damage, kidney damage, and developmental delays.

• It is commonly found in old paint, plumbing, and soil.

• Iron is the most significant metal, but it rusts easily, making it a mysterious material.

• The majority is utilized in the production of steel, in manufacturing, and in civil engineering (reinforced concrete, girders, etc.).

• Rubber, medications, and metal goods are among the things that employ zinc.

• Roughly 75% of the zinc that is used is used as metal, primarily in the form of rolled zinc, zinc-based die casting alloy, alloying metal for making bronze and brass, and a coating to prevent iron and steel from corroding.

Q54. Answer: (b) To preserve natural ecosystems

The correct answer is To preserve natural ecosystems.

Key Points

• Protected areas are established to conserve and protect natural ecosystems, including flora, fauna, and their habitats.

• These areas are also established to maintain biodiversity and ecological processes that are essential for the survival of various species.

• Protected areas also serve as a buffer zone against human activities such as deforestation, mining, and agriculture that can negatively impact the environment.

• They also provide opportunities for scientific research and education, which can help in understanding the complex ecological systems and developing conservation strategies.

Additional Information

• The Wildlife Protection Act of 1972 established India's four kinds of protected areas.

• Areas covered by national parks and wildlife sanctuaries make up tiger reserves.

• In India, there are 53 tiger reserves.

• India's protected areas accounted for 173,629.52 square kilometers as of January 2023, or around 5.28% of the nation's total land area.

Q55. Answer: (c) It is the branch of science concerned with the origin, structure and composition of rocks.

The correct answer is It is the branch of science concerned with the origin, structure and composition of rocks.

Key Points

• Petrology is the branch of science concerned with the origin, structure and composition of rocks.

• Petrology is derived from the Greek word "petra" which means rock and "logos" which means study or discourse.

• It is a sub-discipline of geology that focuses on the study of rocks, including their formation, mineralogy, and texture.

• Petrologists use various techniques such as microscopy, X-ray diffraction, and chemical analysis to study rocks and understand their properties.

• The study of petrology is important in understanding the geologic history of the Earth, as rocks provide clues about past geological events and processes.

Additional Information

• The branch of science concerned with the origin, structure and composition of petroleum is called Petroleum Geology.

• The sedimentary rock formed out of deposits of glaciers is called Glacial Till or Glacial Sediment.

• Any naturally occurring solid mass or combination of minerals or mineraloid materials is referred to as rock in geology.

• Igneous rocks, sedimentary rocks, and metamorphic rocks are the three main categories into which rocks are typically divided.

• Lava cooling on the surface or beneath the ocean creates igneous rocks.

• Magma cooling in the Earth's crust also produces igneous rocks.

• The weathering, movement, and deposition of pre-existing rocks result in the diagenesis and lithification of sediments, which in turn form sedimentary rocks.

• When pre-existing rocks are exposed to extreme temperatures and pressures that cause them to change without significantly melting, new rocks known as metamorphic rocks are created.

Q56. Answer: (d) 85

Calculation

The sum of the maximum marks obtained in Mathematics and the minimum marks obtained in Hindi = 85 + 85

Average = (85 + 85)/2 = 85

The answer is 85.

Q57. Answer: (b) $6x^2 + 13x + 8 = 0$

Shortcut Trick

Expand the cubic term on the Left-Hand Side (LHS): $(x + 2)^3 = x^3 + 6x^2 + 12x + 8$.

Expand the Right-Hand Side (RHS): $x(x^2 - 1) = x^3 - x$.

Equate LHS = RHS: $x^3 + 6x^2 + 12x + 8 = x^3 - x$.

Subtract x^3 from both sides and combine like terms: $6x^2 + 12x + x + 8 = 0$.

The Standard Form is $6x^2 + 13x + 8 = 0$.

Therefore The correct answer is $6x^2 + 13x + 8 = 0$.

Alternate Method

Given Equation: $(x + 2)^3 = x(x^2 - 1)$

Formula Used: $(a + b)^3 = a^3 + 3a^2b + 3ab^2 + b^3$

=> LHS = $(x)^3 + 3(x)^2(2) + 3(x)(2)^2 + (2)^3$

=> LHS = $x^3 + 6x^2 + 12x + 8$

=> RHS = $x \times x^2 - x \times 1$

=> RHS = $x^3 - x$

Equating both sides:

=> $x^3 + 6x^2 + 12x + 8 = x^3 - x$

=> $x^3 - x^3 + 6x^2 + 12x + x + 8 = 0$

=> $0 + 6x^2 + 13x + 8 = 0$

=> $6x^2 + 13x + 8 = 0$

Therefore The correct answer is $6x^2 + 13x + 8 = 0$.

Additional Information

Standard Form of a Quadratic Equation

A quadratic equation is typically written in the form $ax^2 + bx + c = 0$, where $a \neq 0$.

Algebraic Expansion

The identity $(a + b)^3 = a^3 + 3a^2b + 3ab^2 + b^3$ is essential for expanding cubic binomials.

Degree of Equation

When the highest power (degree) of the variable after simplification is 2, the equation is quadratic. If the cubic terms do not cancel, it remains a cubic equation.

Q58. Answer: (d) E

Amongst six friends A, B, C, D, E an F, each has a different height.

1. F is taller than only two other friends.

> > F > > __

2. A is shorter than only one friend.

A > > F > >

3. D is shorter than F but taller than C.

F > D > C

4. E is shorter than B.

B > E

From 1, 2, 3 and 4, we get:

B > A > E > F > D > C

Clearly, E is the third tallest among all the friends.

Hence, ‘E’ is the correct answer.

Q59. Answer: (d) 359991

Shortcut Trick

The numbers 597 and 603 are equidistant from 600.

Use the algebraic identity $(a - b)(a + b) = a^2 - b^2$.

Here, a = 600 and b = 3.

Result = $600^2 - 3^2 = 360000 - 9 = 359991$.

Therefore The correct answer is 359991.

Alternate Method

Given:

Expression: 597 × 603

Formula Used:

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

Calculations:

=> 597 × 603 = (600 − 3) × (600 + 3)

=> 597 × 603 = $(600)^2 - (3)^2$

=> 597 × 603 = 360000 − 9

=> 597 × 603 = 359991

Therefore The correct answer is 359991.

Additional Information

Difference of Two Squares

The identity $(a + b)(a - b) = a^2 - b^2$ is used to simplify products of numbers close to a multiple of 10 or 100.

Unit Digit Method

Multiplying the last digits: 7 × 3 = 21. The result must end in 1, which helps eliminate wrong options quickly.

Digital Sum Rule

Digital sum of 597 (5+9+7=21→3) × 603 (6+0+3=9). Product DS = 3 × 9 = 27 → 9. The answer must have a digital sum of 9.

Q60. Answer: (c) 2√6

Shortcut Trick

Mean proportional between a and b is √(a × b).

Here, $a = 4(2 + \sqrt{2})$ and $b = 3(2 - \sqrt{2})$.

Product $ab = 12 \times (2 + \sqrt{2})(2 - \sqrt{2}) = 12 \times (4 - 2) = 12 \times 2 = 24$.

Mean proportional = $\sqrt{24} = 2\sqrt{6}$.

Therefore The correct answer is $2\sqrt{6}$.

Alternate Method

Given: First number (a) = $8 + 4\sqrt{2}$, Second number (b) = $6 - 3\sqrt{2}$.

Formula Used: Mean proportional = √(a × b)

=> Let Mean Proportional be x.

=> $x = \sqrt{[(8 + 4\sqrt{2}) \times (6 - 3\sqrt{2})]}$

=> $x = \sqrt{[4(2 + \sqrt{2}) \times 3(2 - \sqrt{2})]}$

=> $x = \sqrt{[12 \times (2^2 - (\sqrt{2})^2)]}$

=> $x = \sqrt{[12 \times (4 - 2)]}$

=> $x = \sqrt{[12 \times 2]} = \sqrt{24}$

=> $x = 2\sqrt{6}$

Therefore The correct answer is $2\sqrt{6}$.

Additional Information

Third Proportional

For two numbers a and b, the third proportional c is such that a : b = b : c, giving $c = b^2/a$.

Fourth Proportional

For three numbers a, b, and c, the fourth proportional d is such that a : b = c : d, giving $d = (b \times c)/a$.

Algebraic Identity

The identity $(x + y)(x - y) = x^2 - y^2$ is used to simplify the product of conjugate surds.

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Q61. Answer: (b) the same, opposite

The correct answer is the same, opposite.

Key Points

• In both cases, the induced potential differences are of the same magnitude.

• In case (a), the induced potential difference has the same sign as that of the magnet's north pole, i.e., it is positive.

• In case (b), the induced potential difference has the opposite sign as that of the magnet's south pole, i.e., it is negative.

• The magnitude of the induced potential difference depends on the rate of change of magnetic flux through the coil, which, in turn, depends on the speed and orientation of the magnet.

• The induced potential difference is given by the formula: V = -N du/dt, where V is the induced potential difference, N is the number of turns in the coil, and du/dt is the rate of change of magnetic flux through the coil.

Additional Information

• Induced potential difference refers to the voltage generated in a conductor when it is subjected to a changing magnetic field.

• An electric potential difference is created in the coil by the pace at which the number of magnetic field lines connected to the loop changes while the magnet and loop are moving relative to one another or by a change in current in a nearby conductor.

• The circuit resistance is inversely proportional to the induced current, and it is proportional to the induced electromotive force.

• Although there is no current when the circuit is open, there may be an induced electromotive force.

Q62. Answer: (c) second

The correct answer is second.

Key Points

• Neeraj Chopra

• Neeraj Chopra on 24 July 2022 won a Silver medal in the men's javelin throw event at World Athletics Championships in Eugene, US.

• Chopra grabbed the 2nd position with his best throw of 88.13 metres.

• Grenadian Anderson Peters won the gold medal with a throw of 90.54 meters.

• With this win, Neeraj Chopra has become the first-ever Indian to win a silver medal at World Athletics Championships.

• He is the second Indian after former long jumper Anju Bobby George, who won a bronze medal in long jump at 2003 in Paris.

Additional Information Sports:

• Indian weightlifter Harshada Garud on 18 July 2022 won a gold medal in the 2022 Asian Youth and Junior Weightlifting Championship.

• The Netherlands clinched their ninth FIH Women’s Hockey World Cup by beating Argentina 3-1 in the final on 17 July 2022.

• Youth World Boxing champions Alfiya Pathan & Gitika won gold medals at the first edition of the Elorda Boxing Cup in Nur-Sultan, Kazakhstan on 4 July 2022.

• Archers Jyothi Surekha Vennam and Abhishek Verma won the gold medal in the compound mixed team event at the Archery World Cup 2022 Stage- 3 in Paris on 25 June 2022.

• Cyclist Ronaldo Singh made history by winning a silver medal in the senior category sprint event at the Asian Track Cycling Championship 2022 (41st edition) held in New Delhi.

• Neeraj Chopra won the gold medal at the Kuortane Games in Finland on 18 June 2022.

• On 14 June 2022, Chopra also broke his own national record with a throw of 89.30m at the Paavo Nurmi Games 2022.

• Indian para-powerlifters Manpreet Kaur and Parmjeet Kumar have won bronze medals in World Para-powerlifting 2022 Asia Oceania Open Championships

Q63. Answer: (b) Both conclusions I and II follow.

The least possible Venn diagram is:

Conclusions:

I. All sofas are cots. → Follows (As, All beds are cots and All sofas are beds)

II. Some beds are sofas. → Follows (As, All sofas are beds)

Hence, both conclusions I and II follow.

Q64. Answer: (d) PQ

P, Q, R, S, T, U and V are sitting on a wall in a straight row, and all of them are facing north.

1. Q is at one of the extreme end and has T as his immediate neighbour.

2. V is the immediate neighbour of T and U.

3. S is sitting third from the extreme right end.

The above condition cannot be satisfied in Case I, so it is eliminated.

4. R is on the immediate right of S.

P, the only person left will occupy the vacant position.

Clearly, PQ is sitting at each of the extreme end.

Hence, 'PQ' is the correct answer.

Q65. Answer: (a) Rent

The correct answer is Rent.

Key Points

• Rent is a fixed cost as it remains constant regardless of the level of production or sales.
• It is a cost that is incurred regularly and does not vary with the quantity produced or sold.
• Examples of other fixed costs include salaries, insurance, and property taxes.
• Fixed costs are important to consider when calculating the breakeven point for a business.

Additional Information

• Distribution costs can be variable or fixed, depending on the method of distribution.
• If a company uses a third-party logistics provider, the cost may be variable based on the volume of goods shipped.
• If a company has its own distribution network, the cost may be fixed as it is a regular expense.
• Other variable costs in distribution may include fuel costs and transportation expenses.
• Packaging costs can be variable or fixed, depending on the type of packaging used.
• If a company uses custom packaging for each product, the cost may be variable based on the quantity produced.
• If a company uses standard packaging for all products, the cost may be fixed as it is a regular expense.
• Other variable costs in packaging may include materials and labor costs.
• Raw material costs are typically considered variable costs as they vary with the quantity produced.
• The cost of raw materials may fluctuate based on supply and demand, weather conditions, and other factors.
• It is important for companies to monitor raw material costs and adjust pricing or production levels accordingly.
• Other variable costs in production may include labor costs and energy costs.

Q66. Answer: (d) 37 years

Shortcut Trick

Total age after 8 years = 80 + (8 × 2) = 96 years.

Sum of ratio parts = 17 + 15 = 32 units.

32 units = 96 years => 1 unit = 3 years.

B's age after 8 years = 15 × 3 = 45 years.

Present age of B = 45 − 8 = 37 years.

Therefore The correct answer is 37 years.

Alternate Method

Given: Sum of present ages of A and B = 80 years.

Ratio of ages after 8 years = 17 : 15.

=> Let ages of A and B after 8 years be 17x and 15x.

=> Present age of A = 17x − 8

=> Present age of B = 15x − 8

=> (17x − 8) + (15x − 8) = 80

=> 32x − 16 = 80

=> 32x = 96

=> x = 3

=> Present age of B = 15(3) − 8 = 45 − 8 = 37 years.

Therefore The correct answer is 37 years.

Additional Information

Age Sum Shift

If the sum of ages of 'n' people is S at present, then after 't' years, the sum will be S + (n × t).

Ratio and Proportion in Ages

When a ratio a : b is given for a future or past time, always adjust the current sum or individual ages to that specific time frame

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before applying the ratio parts.

Constant Difference

The difference between the ages of two individuals remains constant regardless of the number of years passed.

Q67. Answer: (c) Natural resources

The correct answer is Natural resources.

Key Points

• Natural resources are the foundation of sustainability.

• They provide the essential resources for human well-being, including food, water, and energy.

• Proper management of natural resources ensures their availability for future generations.

• This includes sustainable practices such as conservation, restoration, and responsible use.

• Natural resources also play a crucial role in mitigating climate change and promoting biodiversity.

• For example, forests absorb carbon dioxide, while wetlands provide habitat for a variety of wildlife.

Additional Information

• While industries provide employment opportunities and contribute to economic growth, they can have negative impacts on the environment if not managed properly.

• For example, industrial activities can lead to air and water pollution, as well as contribute to greenhouse gas emissions.

• The choice of crop varieties can impact the environment.

• Some crops require more water and pesticides than others, which can lead to negative impacts Mining activities can have negative impacts on the environment, including water pollution, soil erosion, and habitat destruction.

• The by-products of mining, such as tailings and waste rock, can also have negative impacts on the environment if not managed properly.

Q68. Answer: (c) Eastern Ghats

The correct answer is Eastern Ghat.

Key Points Shevroy Hills

• Shevroy Hills and the Javadi Hills are located to the southeast of the Eastern Ghats.

• The Western Ghats and the Eastern Ghats mark the western and the eastern edges of the Deccan Plateau respectively.

• The Western Ghats are higher than the Eastern Ghats.

• The Eastern Ghats stretch from the Mahanadi Valley to the Nilgiris in the south.

• Mahendragiri (1,501 meters) is the highest peak in the Eastern Ghats.

• The Western Ghats cause orographic rain by facing the rain-bearing moist winds to rise along the western slopes of the Ghats.

• The highest peaks include the Anai Mudi (2,695 meters) and the Doda Betta (2,637 meters).

Q69. Answer: (b) Only assumption I is implicit

I. Monthly benefits will keep the employees happy.

Only assumption I is implicit as it is clearly stated in the question that In order to retain employees, we must reward them with monthly benefits.

II. The employees will be punctual.

Assumption II is not implicit as there is no statement regarding the punctuality of employees.

Hence, only assumption I is implicit.

Q70. Answer: (c) Rs. 1,600

Shortcut Trick

Assume the annual installment is 100%.

Total units for 5 years = (100 + 40) + (100 + 30) + (100 + 20) + (100 + 10) + 100 = 600%.

Interest parts = Rate × Sum of years remaining = 10 × (4 + 3 + 2 + 1 + 0) = 100%.

Given 600% = Rs. 9,600 => 1% = 16.

Installment (100%) = 100 × 16 = Rs. 1,600.

Therefore The correct answer is Rs. 1,600.

Alternate Method

Given:

Total debt (A) = Rs. 9,600

Rate of interest (R) = 10% per annum

Time period (n) = 5 years

Formula Used:

A = n × x + [R × x × n(n − 1) / 200]

Where x = annual installment.

Calculations:

=> 9,600 = 5 × x + [10 × x × 5 × 4 / 200]

=> 9,600 = 5x + [200x / 200]

=> 9,600 = 5x + x

=> 9,600 = 6x

=> x = 9,600 / 6

=> x = 1,600

Therefore The correct answer is Rs. 1,600.

Additional Information

Definition of Debt

The debt (or amount due) is the sum of all installments and the simple interest earned by each installment from the time of payment until the end of the total period.

Installment Interest Pattern

For n years, the 1^(st) installment earns interest for (n − 1) years, the 2^(nd) for (n − 2) years, and the final installment earns 0 interest.

SI Installment General Formula

Installment (x) = [100 × A] / [100n + R × n(n − 1)/2], where A is Total Debt, R is Rate, and n is Time.

Q71. Answer: (a) 8√3 cm

Shortcut Trick

Side of cube (a) = ∛(Volume) = ∛(512) = 8 cm.

Main Diagonal of cube = a√3.

Diagonal = 8√3 cm.

Therefore The correct answer is 8√3 cm.

Alternate Method

Given: Volume of cube = 512 cm^3.

Formula Used: Volume = a^3 | Main Diagonal = a√3 (where a is the side).

=> a^3 = 512

=> a = ∛(8 × 8 × 8)

=> Side (a) = 8 cm

=> Main Diagonal = a × √3

=> Diagonal = 8√3 cm

Therefore The correct answer is 8√3 cm.

Additional Information

Surface Area of Cube

The Total Surface Area (TSA) of a cube is $6a^2$ and the Lateral Surface Area (LSA) is $4a^2$.

Face Diagonal

The diagonal of any single square face of the cube is given by a√2.

In-radius and Circum-radius

The In-radius (r) is a/2 and the Circum-radius (R) of the cube is (a√3)/2.

Q72. Answer: (d) 10

Shortcut Trick

For a regular polygon, the sum of its interior angle and exterior angle is always 180°.

=> Exterior angle = 180° − Interior angle = 180° − 144° = 36°

For any regular polygon, the number of sides (n) = 360° ÷ Exterior angle

=> n = 360° ÷ 36° = 10

Therefore The correct answer is 10.

Alternate Method

Given:
Each interior angle of a regular polygon = 144°
Formula Used:
Each interior angle of a regular polygon having n sides = [(n − 2) × 180°] ÷ n
Calculation:
=> 144° = [(n − 2) × 180°] ÷ n
=> 144n = 180n − 360
=> 360 = 180n − 144n
=> 360 = 36n
=> n = 360 ÷ 36
=> n = 10
Therefore The correct answer is 10.
Additional Information
Sum of Interior Angles of a Polygon
The sum of all interior angles of any polygon having n sides is (n − 2) × 180°.
Sum of Exterior Angles
The sum of all exterior angles of any convex polygon is always 360°.
Exterior Angle of a Regular Polygon
Each exterior angle of a regular polygon is equal to 360° ÷ n.

Q73. Answer: (d) 66/59 km/h

Shortcut Trick
For three equal distances, Average Speed = (3 × s1 × s2 × s3) ÷ (s1s2 + s2s3 + s3s1)
Average Speed = (3 × 5 × 8 × 6) ÷ (5×8 + 8×6 + 6×5) = 720 ÷ (40 + 48 + 30)
Average Speed = 720 ÷ 118 = 360 ÷ 59 = 6(6/59) km/h
Therefore The correct answer is 6(6/59) km/h.
Alternate Method
Given: Speeds s1 = 5 km/h, s2 = 8 km/h, s3 = 6 km/h. Distances are equal.
Formula: Average Speed = Total Distance ÷ Total Time
=> Let the equal distance be LCM(5, 8, 6) = 120 km each.
=> Time t1 = 120 ÷ 5 = 24 hours
=> Time t2 = 120 ÷ 8 = 15 hours
=> Time t3 = 120 ÷ 6 = 20 hours
=> Total Distance = 120 + 120 + 120 = 360 km
=> Total Time = 24 + 15 + 20 = 59 hours
=> Average Speed = 360 ÷ 59 = 6(6/59) km/h
Therefore The correct answer is 6(6/59) km/h.
Additional Information
Average Speed for Two Equal Distances
When a person covers two equal distances at speeds x and y, the average speed is given by (2xy) ÷ (x + y).
Harmonic Mean Property
When distances are equal, average speed is the Harmonic Mean of the individual speeds.
Relative Speed
In the same direction, relative speed is s1 − s2; in the opposite direction, it is s1 + s2.

Q74. Answer: (d) It depends only upon the nuclear charge.

The correct answer is It depends only upon the nuclear charge.
Key Points
• Down the group, the effective nuclear charge experienced by the valence electrons decreases as the outermost electrons move further away from the nucleus.
• These electrons can be easily lost.
• Thus, the metallic property decreases in a period and moves down the group.

• The effective nuclear charge increases in period from left to right as the table unfolds.

Additional Information

• The word "effective" is used because shielding effect The negatively charged electron prevents the higher energy electrons from experiencing the full nuclear charge of the nucleus due to the repulsive effect of the inner layer.

• The effective nuclear charge experienced by an electron is also called the core charge.

• A higher effective nuclear charge causes greater attraction for electrons, pulling the electron cloud closer to the nucleus resulting in a smaller atomic radius.

Q75. Answer: (b) 15

The logic followed here is:

Logic: 1st digit × (3/2) = 2nd digit

12 : 18 → 12 × (3/2) = 18

28 : 42 → 28 × (3/2) = 42

Similarly,

10 : ? → 10 × (3/2) = 15

Hence, '15' is the correct answer.

Q76. Answer: (a) Lysosomes

The correct answer is Lysosomes.

Key Points

• Lysosomes: These are membrane-bound vesicular structures formed by the process of packaging in the Golgi apparatus. These are formed by the fusion of vesicles that have budded off from the trans-Golgi apparatus.

• These are also called "Suicidal bags" because of their phagocytic activity. Lysosome keeps the cell clean by digesting any foreign material as well as worn-out cell organelles.

• If any cell or cell organelle gets damaged, the lysosome digest the damaged cell or cell organelle by the application of hydrolytic enzymes (hydrolases – lipases, proteases, carbohydrates).

Additional Information

Cell organelle	Character
Centriole	• Centrioles are the feature of animal cells. They are absent in plant cells. - Centrioles are the cell component that is visible during the cell division stages. - Centrioles are the microtubule-producing organelles engaged in cell division. - It is situated near the nucleus in the cytoplasm.
Plasma membrane	• Cell membrane historically referred to as the plasmalemma. - A biological membrane that separates and protects the interior of all cells from the external environment. - Discovered by Carl Naegeli and C. Cramer in 1855.
Golgi apparatus	• Golgi complex was discovered by Camillo Golgi in the year 1898. He saw a densely stained reticular structure close to the nucleus. - These were named Golgy bodies after him.

Q77. Answer: (d) South-west

According to given conditions,

Clearly, Yogesh's home is to the South-West of his Sister's home.

Hence, ‘South-west’ is the correct answer.

Q78. Answer: (b) At Focus

The correct answer is At Focus.

Key Points

• If an object is at infinity from a concave mirror, the parallel rays of light, after reflection converges at focus.

• Hence, the image formed is the focus of the mirror.

Important Points

• A concave mirror has a reflective surface that is curved inward and away from the light source.

• Concave mirrors reflect light inward to one focal point.

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• The image formed by the concave lens when an object is placed at infinity is virtual, erect, highly diminished and at focus.

Additional Information

• Concave mirror: It is cut out of a reflective sphere is a spherical mirror. If the reflective surface is on the side curved inwards, it is a concave mirror.

• These mirrors are commonly used as shaving mirrors or by dentists and even in telescopes.

• The reflected image is magnified but the field of view is limited.

• these mirrors are also called as converging mirrors.

Q79. Answer: (a) If any citizen feels the fundamental rights have been violated by the State, then they can move the court.

The correct answer is If any citizen feels the fundamental rights have been violated by the State, then they can move the court.

Key Points

• Article 32 is the Fundamental Rights and confers the right to constitutional remedies.

• It contains provisions of the right to move the Supreme Court and the Supreme Court shall have the power to issue directions or orders or writs for the enforcement of fundamental rights.

• High Courts are also entitled to enforce these provisions under Article 226.

Additional InformationIf rights are like guarantees, they are of no use if there is no one to honour them.

• The fundamental rights in the Constitution are important because they are enforceable.

• We have a right to seek the enforcement of fundamental rights.

• This is called the Right to Constitutional Remedies.

• This itself is a Fundamental Right.

• This right makes other rights effective.

• It is possible that sometimes our rights may be violated by fellow citizens, private bodies or by the government.

• When any of our rights are violated we can seek a remedy through the courts.

• If it is a Fundamental Right we can directly approach the Supreme Court or the High Court of a state.

• That is why Dr Ambedkar called the Right to Constitutional Remedies, ‘the heart'.

Q80. Answer: (a) 11

The correct answer is 11.

Key Points

• The names of 11 scientists, who received the country’s highest science award Shanti Swarup Bhatnagar Prize for science and technology 2021 were announced on 26 September 2021.

• The prize is given to Indian scientists below the age of 45 for outstanding research in seven fields—Biology, Chemistry, Environment Science, Engineering, Mathematics, Medicine, and Physics.

Additional Information

Shanti Swarup Bhatnagar Award

• It is a science award in India.

• It is given annually by the Council of Scientific and Industrial Research (CSIR).

• It is given for notable and outstanding research, applied or fundamental, in biology, chemistry, environmental science, engineering, mathematics, medicine, and Physics.

• The award was named after the founder-director of the Council of Scientific and Industrial Research, Shanti Swarup Bhatnagar.

• It was first awarded in 1958 to Kariamanickam Srinivasa Krishnan for Physical Sciences.

Q81. Answer: (c) Assam

The correct answer is Assam.

Key Points

• Hollong is the State Tree of Assam.

• Hollong is a medium hardwood, timber tree.

• It grows naturally in forests of upper Assam and Arunachal Pradesh. Hollong is a sacred tree for the Moran community of Assam.

Additional Information

State Animals, Birds, Trees and Flowers of India:

State/UT	Animal	Bird	Tree	Flower

Andhra Pradesh	Blackbuck	Rose-ringed Parakeet	Neem	Jasmine
Arunachal Pradesh	Mithun	Great hornbill	Hollong	Lady slipper orchid
Assam	One-horned rhinoceros	White-winged wood duck	Hollong	Foxtail orchids
Bihar	Ox	House sparrow	Peepal	Marigold
Goa	Gaur	Flame throated bulbul	Matti	•
Gujarat	Asiatic lion	Greater flamingo	Mango	Marigold
Haryana	Blackbuck	Black francolin	Peepal	Lotus
Himachal Pradesh	Snow leopard	Western tragopan	Deodar	Rhododendron
Jammu & Kashmir	Hangul	Black-necked crane	Chinar	Lotus
Jharkhand	Elephant	Koel	Sal	Palash
Karnataka	Elephant	Indian roller	Sandal	Lotus
Kerala	Elephant	Great hornbill	Coconut	Golden shower tree
Madhya Pradesh	Swamp deer	Asian paradise flycatcher	Banyan	Parrot tree
Maharashtra	Giant squirrel	Yellow-footed green pigeon	Mango	Jarul
Manipur	Sangai	Mrs. Hume's pheasant	Toon	Shirui lily
Meghalaya	Clouded leopard	Hill myna	White teak	Lady slipper orchid
Mizoram	Serow	Mrs. Hume's pheasant	Ironwood	Red vanda
Nagaland	Mithun	Blyth's tragopan	Alder	Rhododendron
Odisha	Sambar	Indian roller	Banyan	Lotus
Puducherry	Squirrel	Asian koel	Vilva tree	Cannonball
Punjab	Blackbuck	Northern goshawk	Sheesham	•
Rajasthan	Camel	Great Indian Bustard	Khejri	Rohira
Sikkim	Red panda	Blood pheasant	Rhododendron	Noble orchid
Tamil Nadu	Nilgiri tahr	Emerald dove	Palmyra palm	Kandhal
Telangana	Deer	Indian roller	Jammi	Tangedu
Tripura	Phayre's langur	Green imperial pigeon	Agar	Nageshwar
Uttarakhand	Musk deer	Himalayan monal	Burans	Brahm kamal
Uttar Pradesh	Swamp deer	Sarus crane	Ashok	Brahm kamal
West Bengal	Fishing cat	White-breasted kingfisher	Chatian	Shephali

Q82. Answer: (c) Four

Pattern: Letter Letter Number

(Left) G C T 7 D 4 6 K 2 R Y 3 5 E S A 4 T Y 7 8 G T (Right)

Clearly, there are 4 such letters in the series which are immediately preceded by a letter and also immediately followed by a number.

Hence, '4' is the correct answer.

Q83. Answer: (c) Devendra Jhajharia

The correct answer is Devendra Jhajharia.

Key Points

• Devendra Jhajharia has become the first para-athlete to receive the Padma Bhushan, the country's third-highest civilian award.

• He has won many Paralympic medals, including his first gold at the 2004 Paralympics in Athens.
• Avani Lekhara, a para-shooter, was also awarded the Padma Shri award in the Sports category.
• She is the first Indian woman to win two Paralympic medals in the same Games.

Additional Information

• Devendra Jhajharia won a silver medal at the 2020 Tokyo Olympics.
• Along with Jhajharia and Lekhara, President Ram Nath Kovind also conferred Padma Shri award to Vandana Katariya.
• She also made history by becoming the first Indian woman to achieve a hat trick at the 2020 Tokyo Olympic Games.

Q84. Answer: (a) CARE

The correct answer is CARE.

Key Points

• According to the question, the correct answer for the organisation that runs the 'School to School' programme that builds a relationship of empathy and dignity between urban and rural children as of July 2022 is CARE.
• More than 14500 PM SHRI Schools (PM Schools for Rising India) are to be established under the program by bolstering the current ones from among those run by municipal, state, federal, and local government entities.
• The 'School to School' programme is a programme that aims to build a relationship of empathy and dignity between urban and rural children.
• The programme involves children from urban schools visiting rural schools and vice versa.
• The children learn about each other's cultures, lifestyles, and challenges.
• The programme aims to promote understanding, respect, and friendship between the children.

Additional Information

• Oxfam India is an organization that works towards reducing poverty and inequality in India.
• They work on various issues such as gender justice, humanitarian response, and economic justice.
• They have various programmes for education, health, and livelihoods.
• Goonj is an organization that works towards rural development and disaster relief.
• They work on issues such as education, health, sanitation, and women's empowerment.
• They have various programmes such as Clothes for Work, School to School, and Rahat Disaster Relief.
• HelpAge India is an organization that works towards improving the lives of elderly people.
• They work on issues such as health, income security, and social inclusion.
• They have various programmes for health, livelihoods, and advocacy.

Q85. Answer: (a) depression, opposite to

The correct answer is depression, opposite to.

Key Points

• Concave Mirror:
• Mirror which has a depression towards the centre of sphere with polish opposite to the centre of curvature is called Concave mirror.
• This means that the mirror is curved inward, with the outer edges being closer to the viewer than the center.
• A concave mirror is also known as a converging mirror, as it focuses light rays that enter it towards a single point.
• The Centre of Curvature (C) and the Focus (f) are located in front of the mirror i.e. unpolished side.

Additional Information

• Use of Concave Mirror:
• Used in Shaving mirrors
• Used in Ophthalmoscope
• Used in Astronomical telescopes
• Used in Headlights
• Used in Solar furnaces
• Convex Mirror:
• Mirror which has a depression towards the centre of sphere with polish towards to the centre of curvature is called Convex mirror.
• A convex mirror is one with a curved surface that bulges in the direction of the light source. It is not intended to focus light; instead, this bulging surface reflects light outward.
• Use of convex mirror:

• In corridors of buildings, such as shops, schools, hospitals, hotels, and apartment complexes, convex mirrors are frequently utilised.

• They are used in alleyways, driveways, and other locations where there is poor sight to ensure the safety of all bikers and drivers at bends and turns.

• Additionally, some automated teller machines employ them as a convenient security feature that lets users see what's going on behind them.

• They are used in an automobile's passenger side mirror, where a warning placard reading "objects in mirror are closer than they appear" is placed to alert drivers.

Q86. Answer: (a) 256 .68

Calculation

=> 222.22 + 22.22 + 12 + 0.22 + 0.02

=> 222 + 22 + 12 + 0.68

=> 256.68

The answer is 256.68.

Q87. Answer: (d) Amit

Each of Prem, Amit, Ram, Sudheer, Tejas, Uma and Vivek has an exam on a different day of a week, starting from Monday and ending on Sunday of the same week.

1. Prem has the exam on Thursday.

2. Only one person has the exam between Prem and Uma.

WEEK	PERSON	
Case I	Case II	
MONDAY		
TUESDAY		UMA
WEDNESDAY		
THURSDAY	PREM	PREM
FRIDAY		
SATURDAY	UMA	
SUNDAY		

3. Ram has the exam on the day immediately before Uma but not on a Monday.

The above condition cannot be satisfied in Case II, so it is eliminated.

WEEK	PERSON	
Case I	Case II	
MONDAY		RAM
TUESDAY		UMA
WEDNESDAY		
THURSDAY	PREM	PREM
FRIDAY	RAM	
SATURDAY	UMA	
SUNDAY		

4. Only two people have exams between Ram and Tejas.

WEEK	PERSON
MONDAY	
TUESDAY	TEJAS

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WEDNESDAY	
THURSDAY	PREM
FRIDAY	RAM
SATURDAY	UMA
SUNDAY	

5. Vivek's exam is on one of the days before Sudheer and on one of the days after Amit.

WEEK	PERSON
MONDAY	AMIT
TUESDAY	TEJAS
WEDNESDAY	VIVEK
THURSDAY	PREM
FRIDAY	RAM
SATURDAY	UMA
SUNDAY	SUDHEER

Clearly, Amit has exam on Monday.

Hence, ‘Amit’ is the correct answer.

Q88. Answer: (b) 18 hours

Shortcut Trick

Let the usual speed be s km/h and usual time be t hours.

Distance = [s × (s − 10) ÷ 10] × 2 = 1800

=> s(s − 10) = 9000

=> 100 × 90 = 9000. So, s = 100 km/h.

Usual time = 1800 ÷ 100 = 18 hr.

Therefore The correct answer is 18 hr.

Alternate Method

Given: Distance = 1800 km, Speed Reduction = 10 km/h, Extra Time = 2 hours.

Formula Used: Time = Distance ÷ Speed

Let the usual speed be v km/h.

=> [1800 ÷ (v − 10)] − [1800 ÷ v] = 2

=> 1800 [(v − (v − 10)) ÷ (v(v − 10))] = 2

=> 1800 [10 ÷ (v^2 − 10v)] = 2

=> 9000 = v^2 − 10v

=> v^2 − 10v − 9000 = 0

=> v^2 − 100v + 90v − 9000 = 0

=> v(v − 100) + 90(v − 100) = 0

=> (v − 100)(v + 90) = 0

=> v = 100 km/h (Speed cannot be negative)

=> Usual Time = 1800 ÷ 100 = 18 hr

Therefore The correct answer is 18 hr.

Additional Information

Speed-Distance Relation

When distance is constant, Speed is inversely proportional to Time (S1/S2 = T2/T1).

General Distance Formula

Distance = [S1 × S2 ÷ (S1 − S2)] × Difference in time.

Average Speed

Average Speed = Total Distance ÷ Total Time taken.

Q89. Answer: (c) 1881

The correct answer is 1881.

Key Points

• A census is an official systematic survey of the population of a country.

• Census is a process of collecting, compiling, analyzing, evaluating, publishing and disseminating statistical data regarding the population of a country.

• It covers demographic, social and economic data.

• The first complete Census was taken in India in 1872 under British Viceroy Lord Mayo.

• Lord Mayo was the Viceroy of India from 1869 to 1872.

• A systematic and modern population census, in its present form was conducted non- synchronously between 1865 and 1872 in different parts of the country.

• This effort culminating in 1872 has been popularly labeled as the first population census of India.

• However, the first synchronous census in India was held in 1881.

• Since then, censuses have been undertaken uninterruptedly once in every ten years.

Q90. Answer: (a) Na^+

The correct answer is Na+.

Key Points

• Chlor-alkali process is a method used for the production of NaOH, Cl2, and H2 gas.

• In this process, NaCl is electrolyzed in a diaphragm cell with the help of a direct current.

• The diaphragm cell consists of an anode, a cathode, and a diaphragm that separates the anode and cathode compartments.

• At the anode, Cl- ion is oxidized to form Cl2 gas, and at the cathode, H+ ions are reduced to form H2 gas.

• During the electrolysis, Na+ and OH- ions are formed at the cathode compartment due to the migration of Na+ ion towards the anode and OH- ion towards the cathode.

• The OH- ion reacts with the H+ ion to form water, and the Na+ ion reacts with the Cl- ion to form NaCl.

• The NaCl is then separated from the NaOH solution, and the NaOH solution is further purified to obtain solid NaOH.

Additional Information

• Na+ ion does not migrate towards the cathode during the chlor-alkali process. It migrates towards the anode.

• Cl- ion migrates towards the anode during the chlor-alkali process. It is oxidized to form Cl2 gas.

• OH- ion migrates towards the cathode during the preparation of NaOH by chlor-alkali process.

• CO32- ion is not involved in the chlor-alkali process. It is a carbonate ion that is present in some minerals and rocks.

Q91. Answer: (b) 467/8%

Shortcut Trick

Ratio of Cost Price (CP) to Selling Price (SP) = 3200 : 4700 = 32 : 47.

Profit units = 47 − 32 = 15 units.

Profit % = (Profit ÷ CP) × 100 = (15 ÷ 32) × 100.

Profit % = (15 × 25) ÷ 8 = 375 ÷ 8 = 46(7/8)%.

Therefore The correct answer is 46(7/8)%.

Alternate Method

Given: CP = Rs. 3,200, SP = Rs. 4,700.

Formulas: Profit = SP − CP | Profit% = (Profit ÷ CP) × 100.

=> Profit = 4700 − 3200 = Rs. 1,500.

=> Profit % = (1500 ÷ 3200) × 100.

=> Profit % = 1500 ÷ 32 = 375 ÷ 8.

=> Profit % = 46(7/8)%.

Therefore The correct answer is 46(7/8)%.

Additional Information

Profit and Loss Basics

Profit occurs when SP > CP. Loss occurs when CP > SP. Both are always calculated on the Cost Price unless stated otherwise.

Percentage to Fraction

1/8 is equal to 12.5%. Therefore, 3/8 is 37.5% and 7/8 is 87.5% (or 0.875 decimal).

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Q92. Answer: (c) 400 metres east

According to given conditions,

Clearly, Parul is 400 metres east from her starting point.

Hence, '400 metres east' is the correct answer.

Q93. Answer: (a) Kerala

The correct answer is Kerala.

Key Points

• Vishu marks the beginning of the New Year for the people of Kerala.

• The festival is celebrated in the month of Medam of the Malayalam calendar with much pomp and vigour.

• The most important part of the festival is the Vishukani.

• Apart from Kerala, the festival is celebrated in neighbouring regions like Mangalore, Tulunadu, and Udupi.

• Vishu is also called the festival of fireworks and light as the celebration includes the bursting of firecrackers. It is said that Krishna killed the demon Narakasur on the day of Vishu.

Additional Information

• Festivals of Kerala:

• Onam:

• It is a harvest festival celebrated in Kerala

• Vishu:

• The festival marks the first day of Medam which is the ninth month in the solar calendar followed in Kerala.

• Thiruvathira:

• The festival falls on the asterism Thiruvathira in the Malayalam month of Dhanu (December-January) and this is also the longest night in the year.

• This festival is celebrated in commemoration of the death of Kamadeva, the mythological God of love.

Q94. Answer: (c) Immersion rod

The correct answer is Immersion rod.

Key Points

• Joule's Law of Heating states that the amount of heat generated in a conductor is directly proportional to the square of the current passing through it and the resistance of the conductor.

• An electrical device that works on the principle of Joule's Law of Heating is an immersion rod.

• An immersion rod is a device that is used to heat liquids, such as water, by passing an electric current through it.

• The resistance of the rod produces heat, which is transferred to the liquid.

Additional Information

• A speaker is an electrical device that converts electrical signals into sound waves.

• It does not generate heat.

• An electromagnet is a type of magnet that is created by passing an electric current through a coil of wire.

• It is used in a variety of applications, such as in electric motors and generators.

• It does not generate heat on its own.

• An electrical bell is a device that produces sound by an electromagnet.

• It does not generate heat on its own.

Q95. Answer: (d) Capable of being broken down into harmless products by the action of microbes

The correct answer is Capable of being broken down into harmless products by the action of microbes.

Key Points Biodegradable Waste/Products-

• A biodegradable substance is one that are capable of being broken down into harmless products by the action of microbes.

• Microorganisms and other abiotic influences work together to degrade complex compounds into simpler organic matter that gradually suspends and fades into the soil.(degraded by natural factors such as microbes bacteria, fungi, and a few others and abiotic elements such as temperature, UV, oxygen, and so on.)

• The entire process is normal and can be fast or sluggish.

• As a result, the environmental problems and threats posed by biodegradable wastes are minimal.

EXAMPLES -

• Kitchen waste: vegetable peels, tea leaves, leftover food or rotten food, fruit seeds, eggshells, etc are biodegradable and can be used as compost for home gardening

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• Plant products like wood and paper

• Human and animal waste (feel matter)

• Animal bones and remains of dead organic matter: contains carbon and calcium and some phosphates which are degradable, their period of degradation is relatively more due to their rigid structures but they are biodegradable.

Additional Information Non-Biodegradable Waste/Products-

• A non-biodegradable material is one that cannot be broken down by natural organisms or natural agents and therefore serves as a source of contamination.

• Non-biodegradable waste, unlike biodegradable waste, cannot be easily treated.

• They will survive on Earth for thousands of years without deterioration.

• As a result, the threat posed by them is also more severe.

• They are the primary sources of air, water, and soil contamination, as well as diseases such as cancer.

EXAMPLES -

• Coal: obtained from the biodegradation of animal and plant remains so they can not be further degraded

• Glass: No effect of sunlight or microbes or other conditions that can degrade them into simpler forms hence come under this category

• DDT and DDD

• DDD(Dichlorodiphenyldichloroethane) and DDT (Dichlorodiphenyltrichloroethane): These are harmful pesticides that stay in the soil and seep into surrounding water bodies adding to the environmental pollution and the added risk to human and other organisms' lives.

• Polythene: are a widely used commodity in almost every industry and are temperature and heat resistant along with showing resistance against natural microbes

Q96. Answer: (d) 6

Shortcut Trick

Identify the mode by counting the frequency of each number in the observations.

Observations: 2, 6, 3, 9, 5, 6, 7, 8, 4, 6, 10, 6, 11.

Number 6 appears 4 times, while all other numbers appear only once.

The most frequent value is 6.

Therefore The correct answer is 6.

Alternate Method

Given: Observations = {2, 6, 3, 9, 5, 6, 7, 8, 4, 6, 10, 6, 11}

Formula: Mode is the observation with the maximum frequency.

=> Arrange the data in ascending order: 2, 3, 4, 5, 6, 6, 6, 6, 7, 8, 9, 10, 11.

=> Count frequencies: 2 → 1, 3 → 1, 4 → 1, 5 → 1, 6 → 4, 7 → 1, 8 → 1, 9 → 1, 10 → 1, 11 → 1.

=> Since 6 occurs 4 times (highest frequency), the Mode is 6.

Therefore The correct answer is 6.

Additional Information

Measures of Central Tendency

Mean is the average value (Σx ÷ n), Median is the middle value in a sorted list, and Mode is the most repeated value.

Empirical Relationship

For a moderately skewed distribution, the relationship is: Mode = 3 × Median − 2 × Mean.

Types of Mode

A data set can be unimodal (one mode), bimodal (two modes), or multimodal (multiple modes).

Q97. Answer: (a) Plasma

The correct answer is Plasma.

Key Points The function of blood Plasma

• Plasma absorbs and transfers transports food, carbon dioxide, and nitrogenous wastes in dissolved form.

• Plasma also aids in the regulation of body temperature by absorbing and releasing heat as required.

• It is essential for maintaining electrolyte balance.

• It protects the body from infection and other blood problems.

Additional Information Blood Plasma:

• Blood plasma is a yellowish liquid component of blood that suspends blood cells, proteins, and other components of blood.

• It accounts for around 55% of the body's total blood volume.

• It is made up of 92% of water by volume.

• It contains essential soluble proteins like albumins, globulins, and fibrinogen that constitute 6 to 8 %.

• Glucose, clotting factors, electrolytes like Na+, Ca2+, Mg2+, HCO3–, hormones, and carbon dioxide along with oxygen are also present in the blood plasma.

• Chemical buffers, the respiratory system, and the renal system all work together to keep the pH of extracellular fluid, including blood plasma, between 7.32 and 7.42.

• As the pH is greater than 7, blood plasma is said to be alkaline.

So, the correct answer to this question is - Plasma.

Q98. Answer: (c) Justice DY Chandrachud and AS Bopanna

The correct answer is Justice DY Chandrachud and AS Bopanna.

Key Points

• According to the given statement, the Supreme Court has allowed the Law Commission to consider the appointment of a Dowry Prohibition Officer, equivalent to a Right to Information Officer.

• Justice Indira Banerjee and Hemant Gupta were the judges who gave this order.

• Justice Hemant Gupta and Justice Indira Banerjee, two members of the previous Constitution Bench, have retired now.

Additional Information

• Dowry is a practice in India where the groom's family demands money or gifts from the bride's family as a condition of marriage.

• This practice has been illegal in India since 1961, but it still persists in some parts of the country.

• The appointment of a Dowry Prohibition Officer is expected to help in curbing the practice of dowry and enforcing the law against it.

• The Right to Information Act, 2005, gives citizens of India the right to access information held by public authorities.

• The appointment of a Dowry Prohibition Officer equivalent to a Right to Information Officer means that the Dowry Prohibition Officer will have similar powers to obtain information and take action against those who violate the law.

• The Law Commission is a statutory body in India that advises the government on legal reform.

• The Supreme Court's decision to allow the Law Commission to consider the appointment of a Dowry Prohibition Officer shows the court's commitment to addressing the issue of dowry in India.

Q99. Answer: (a) Explain the importance of waste management to all residents, start segregation of waste and start composting

The correct answer is Explain the importance of waste management to all residents, start segregation of waste and start composting.

Key Points

• As a science student, it is important to understand the impact of waste on the environment and human health.

• Here are some ways to react to the situation:

• Educate the residents:

• Explain the importance of waste management and its impact on the environment and human health.

• Encourage them to start segregation of waste and composting.

• Lead by example:

• Start segregating waste and composting in your own house and encourage others to do the same.

• This will help to reduce the amount of waste generated and promote a cleaner environment.

• Collaborate with local authorities:

• Reach out to local authorities and NGOs working on waste management to understand the existing waste management system in the area and suggest ways to improve it.

• Organize awareness campaigns:

• Organize awareness campaigns in the society to educate people about the importance of waste management.

• Use posters, videos, and other creative ways to spread the message.

Additional Information

• Waste management refers to the process of collecting, transporting, processing, recycling, and disposing of waste materials.

• It is important to manage waste properly to reduce the impact on the environment and human health.

• Effective waste management involves reducing the amount of waste generated, reusing and recycling materials, and disposing of waste in a safe and sustainable manner.

Q100. Answer: (b) 30

Concept used:

Follow the BODMAS rule as given in the below table:

Calculation:

=> 6 × 7 - {9 ÷ 3 + [3 × (5 - 2)]}

=> 6 × 7 - {9 ÷ 3 + [3 × 3]}

=> 6 × 7 - {9 ÷ 3 + [9]}

=> 6 × 7 - {3 + 9}

=> 42 - 12

=> 30

TheThw answer is 30.

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