RRB Group D Previous Year Paper (Held on: 26 Aug 2022 Shift 3)

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

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CBT

Q1. Consider the below statements and identify the correct answer.

Statement-I: Salts of strong acid and a strong base are neutral with pH value of 7.

Statement-II: Salts of a strong acid and weak base are acidic with pH value less than 7.

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

Q2. Which compounds are required to manufacture baking soda?

(a) Sodium hydroxide and water
(b) Water and sodium carbonate
(c) Water and bleaching powder
(d) Common salt, carbon dioxide and ammonia

Q3. If, for x>0, the mean of 22.5, 56, 42.5, 2x+1, x-2, 3x, 36 is 30, then the value of x is _____.

(a) 9
(b) 6
(c) 7
(d) 4

Q4. Consider the below statements and identify the correct answer.

Statement I: Atomic radius increases in moving from left to right along a period.

Statement II: Nuclear charge increases in moving from left to right along a period.

(a) Only Statement I is correct.
(b) Only Statement II is correct.
(c) Both statements are correct. Statement I is correct explanation of Statement II.
(d) Both statements are correct. Statement II is correct explanation of Statement I.

Q5. Which of the following diseases is NOT sexually transmitted?

(a) Syphilis
(b) Hepatitis B
(c) AIDS
(d) Tuberculosis

Q6. Which of the following reactions will be considered as a double displacement reaction?

(a) $Zn + FeCl_3 \rightarrow ZnCl_2 + Fe$
(b) $H_2CO_3 \rightarrow CO_2 + H_2O$
(c) $HCl + KOH \rightarrow KCl + H_2O$
(d) $MgO + H_2O \rightarrow Mg(OH)_2$

Q7. Two resistors, A of 6 Ω and B of 12 Ω, are connected in parallel to a battery of 3 V. The total energy supplied by the battery to the circuit in 1 second is:

(a) 2.25 J
(b) 1.5 J
(c) 4.5 J
(d) 0.75 J

Q8. Which of the following is the non-metallic form of mineral?

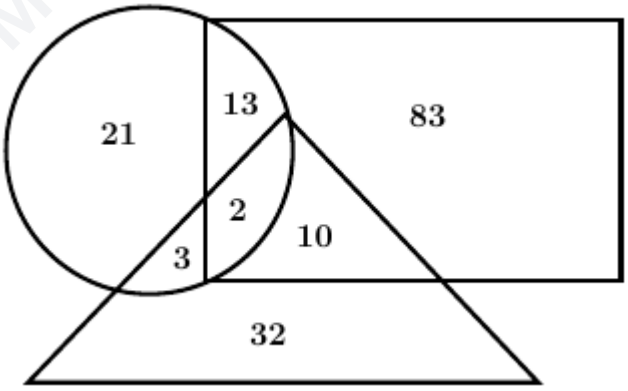
(a) Silver
(b) Lead
(c) Bauxite
(d) Mica

Q9. Which of the following terms will replace the question mark (?) in the given series to make it logically complete?

TDK-4, XHO-9, BLS-16, FPW-25,?

(a) JTA-36
(b) JTB-36
(c) JTA-64
(d) JUA-36

Q10. In the following diagram, the circle represents girls, the triangle represents science students, and the rectangle represents PG students. The numbers in different sections indicate the number of persons. How many PG students are girls who are Not science students?



(a) 12
(b) 22
(c) 19
(d) 13

Q11. Long chain compounds formed by Silicon are _____.

(a) Less polarizable
(b) Very reactive
(c) Very stable
(d) More Ionic

Q12. A, B, C, D, E and F live on six different floors of the same building. The lowermost floor in the building is numbered 1, the floor above it is numbered 2, and so on till the topmost floor is numbered 6. E lives on the floor immediately below F's floor. D lives on the 2^(nd)floor. C lives on the floor immediately below A's floor. F does not live on the 5^(th) floor. On which floor does B live?

(a) 3^(rd)
(b) 1^(st)
(c) 5^(th)
(d) 6^(th)

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Q13. What approximate value should come in place of the question mark (?) in the following equation?

99.01 ÷ 10.93 + 6.987 × 16.01 = ?

(a) 133
(b) 145
(c) 121
(d) 129

Q14. Which of the following groups of three elements each constitutes Dobereiner's triads?

(a) Ca, Ba, F
(b) Li, Mg, Al
(c) Cl, H, Si
(d) Cl, Br, I

Q15. Bhuvan's salary was first decreased by 16% and subsequently increased by 25%. Find the net percentage change in his salary.

(a) 10% decrease
(b) 5% decrease
(c) 5% increase
(d) 10% increase

Q16. Who was the first Deputy Chairman of the Planning Commission of India?

(a) Vallabhbhai Jhaverbhai Patel
(b) Gulzarilal Nanda
(c) KC Neogy
(d) Jawaharlal Nehru

Q17. Which of the following institutions launched the microfinance movement in India on a pilot basis in 1992?

(a) IIFCL
(b) NABARD
(c) SIDBI
(d) IFCI

Q18. Which of the following numbers will replace the question mark (?) in the given series?

7, 18, 34, 72, 142?

(a) 298
(b) 282
(c) 228
(d) 288

Q19. An object is placed in front of a concave mirror of focal length 12 cm, at a distance of 8 cm. Its image is formed at a distance of:

(a) 24 cm
(b) 4.8 cm
(c) 8 cm
(d) 12 cm

Q20. A and B together can complete a work in 12 days. A alone can complete it in 20 days. If B does the work only for the first half of the day daily, then in how many days will A and B together complete the work?

(a) 15 days
(b) 22/3 days
(c) 43/2 days
(d) 40/3 days

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Q21. The potential difference across a copper wire is 2.0 V when a current of 0.4 A flows through it. The resistance of the wire is:

(a) 5.0 Ω
(b) 0.5 Ω
(c) 0.2 Ω
(d) 2.5 Ω

Q22. What will come in the place of the question mark (?) in the following equation if '+' and '-' are interchanged and also '×' and '÷' are interchanged?

10 + 152 × 19 - 2 ÷ 3 =?

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

Q23. A's Salary is 20% less than B's salary. By how much per cent is B's salary more than A's?

(a) 17%
(b) 20%
(c) 25%
(d) 15%

Q24. On 14 February 2022, ISRO (Indian space Research Organisation) launched which of the following satellites?

(a) EOS-04
(b) EOS-03
(c) EOS-01
(d) CMS-01

Q25. In the conservation of forests, stakeholders play a very important role. Which of the following are NOT the stakeholders in the forest?

(a) Wildlife and nature enthusiasts
(b) The people who live in and around the forest and depend on forest produce
(c) Forest Department of the Government
(d) People living in urban areas

Q26. It is found that during dispersion of white light by a glass prism, the more a colour component is bent, the more is the refractive index of the glass for that colour component. If μ_y, μ_V and μ_G are refractive indices for yellow, violet and green lights, respectively, then which of the following relations between them is correct?

(a) μ_Y > μ_V > μ_G
(b) μ_G>μ_Y > μ_V
(c) μ_Y = μ_V = μ_G
(d) μ_V > μ_G > μ_Y

Q27. Which of the following cities is famous for the iconic 'Kumbh Mela'?

(a) Ahmedabad
(b) Surat
(c) Prayagraj
(d) Lucknow

Q28. Some features of villi of the small intestine in humans are given below:

(i) They are finger-like with very thin walls
(ii) Provide a large surface area
(iii) Have small pores for food to pass
(iv) Richly supplied by blood capillaries

Which option/options shows/show the features that enable the villi to absorb food?

(a) Only (i) and (iii)

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(b) (i), (ii) and (iv)
(c) Only (i)
(d) Only (ii) and (iii)

Q29. In the given letter-cluster pairs, the first letter-cluster is related to the second letter-cluster following a certain logic. Study the given pairs carefully, and form the given options, select the pair that follows the same logic.

MGB : NTY

THK : GSP

(a) LCP : OXJ
(b) QDF : JWU
(c) MER : NVH
(d) CHX : XIC

Q30. Find the remainder, when 171 × 172 × 173 is divided by 17.

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

Q31. Which of the following is true?

a) Every trapezium is a parallelogram.

b) Every parallelogram is a square.

c) Every rectangle is a square.

d) Every square is a rhombus.

(a) only c
(b) only a
(c) only d
(d) both a and b

Q32. Which institution governs the area that is in transition from rural to urban?

(a) Gram Panchayat
(b) Gram Sabha
(c) Panchayat Samitis
(d) City Councils

Q33. Raghu invests Rs 5,00,000 in the name of his daughter, who is 16 years old, in a scheme that pays 5% compound interest per annum, compounded annually. What will be the total amount due to the daughter when she turns 18 years old?

(a) Rs 5,52,150
(b) Rs 5,51,520
(c) Rs 5,15,250
(d) Rs 5,51,250

Q34. Express 0.13241241... in the form p/q, where p and q are integers and q ≠ 0.

(a) 3807/24975
(b) 3287/21780
(c) 3337/24160
(d) 3307/24975

Q35. Consider the following statements about magnetic field due to a current-carrying straight conductor:

(a) The direction of the south pole of a compass needle at a point gives the direction of the magnetic field at that point.

(b) The direction of the magnetic field lines gets reversed if the direction of the current in the conductor is reversed.

Which of the above statements is/are correct?

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

Q36. How many such pairs of letters are there in the word HINDUSTAN (in both forward and backward directions) which have as many letters between them in the word as there are in the English alphabetical order?
(a) 2
(b) 3
(c) 4
(d) 1

Q37. Who presented a draft bill in the parliament - The National Anti-Doping Bill, 2021 - to regulate anti-doping activities in sports?
(a) Sandeep Singh
(b) Kiran Rijiju
(c) Anurag Thakur
(d) Rajyavardhan Singh Rathore

Q38. Among six students, K, L, M, N, O and P, each scores different marks in an examination. M scores more marks than only three other students. K scores more marks than N. P scores less marks than M. O scores more marks than L. P scores more marks than K. L scores more marks than M. Who scores the highest marks among all six students?
(a) K
(b) O
(c) P
(d) N

Q39. A lens having power 8 D is kept in contact with another lens having power -4 D. The lens combination will act as a:
(a) Concave lens having focal length 25 cm
(b) Concave lens having focal length 50 cm
(c) Convex lens having focal length 25 cm
(d) Convex lens having focal length 50 cm

Q40. If each of the digits in the number 63547981 is arranged in ascending order from left to right, then the position of how many digits will remain unchanged as compared to that in the original number?
(a) Four
(b) One
(c) Three
(d) Two

Q41. Where was the first session of Indian National Congress held?
(a) Patna
(b) Madras
(c) Lucknow
(d) Bombay

Q42. What is the process called when a substance's spontaneous movement from a high concentration to a low concentration takes place?
(a) Gaseous exchange
(b) Diffusion
(c) Osmosis
(d) Circulation

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Q43. Find the measure of each exterior angle of a regular octagon.

(a) 120^0
(b) 60^0
(c) 45^0
(d) 135^0

Q44. A and B can complete a piece of work in 10 days and 12 days, respectively. If they work on alternate days beginning with A, then in how many days will the work be completed?

(a) 101/2
(b) 101/4
(c) 10
(d) 105/6

Q45. Two resistors, A of 10 Ω and B of 30 Ω, are connected in series to a battery of 6 V. The total heat dissipated in the resistors in 1 second is:

(a) 0.45 J
(b) 0.90 J
(c) 4.8 J
(d) 2.4 J

Q46. If a and b are the roots of the equation $x^2 - 5x - 14 = 0$, then the value of $a^3b^2 + a^2b^3$ is:

(a) 980
(b) 790
(c) 670
(d) 840

Q47. In this question, a group of numbers/symbols is coded using letters as per the table given below and the conditions which follow. The correct combination of codes following the conditions is your answer.

Number /symbol	22	56	33	#	46	&	64	@	%	37	57
Code	L	K	J	H	G	F	D	S	A	P	B

Conditions:

(i) If the first element is a symbol and the last element is a number, then replace these two (first and last) elements with %.

(ii) If the second element is a number and the second last is a symbol, the codes of the first and last elements are to be interchanged.

(iii) If the question has an equal quantity of even and odd numbers, then replace the even numbers with * and odd numbers with <

Question: # 2264 % 33 & 37 @

(a) H A33F37S
(b) #LDAJFP@
(c) HA<F<S
(d) HLDAJFPS

Q48. Mendel worked with a number of contrasting visible characters of garden peas. Some of them were:

a) Round and Wrinkled seeds

b) tall and short plants

c) white and violet flowers

Which of these are the recessive traits in the pea plant?

(a) Violet, short and round
(b) Wrinkled, short and white
(c) Wrinkled, short and violet
(d) Round, short and white

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Q49. If the breadth and height of a closed cuboid are, respectively, 25% and 50% of its length of 12 cm, then find the total surface area of this cuboid.

(a) 126 cm²
(b) 522 cm²
(c) 252 cm²
(d) 63 cm²

Q50. What is the name of a river in central India with a total length of about 724 km, which originates from Betul, Madhya Pradesh, and joins the Arabian Sea?

(a) Tapi River
(b) Kaveri River
(c) Krishna River
(d) Godavari River

Q51. How many such pairs of letters are there in the word TOMORROW (in both forward and backward directions) which have as many letters between them in the word as there are in the English alphabetical order?

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

Q52. Select the option that is related to the fifth number in the same way as the second number is related to the first number and the fourth number is related to the third number.

6 : 33 :: 11 :58 :: 18 : ?

(a) 93
(b) 105
(c) 98
(d) 150

Q53. Among six persons, K, L, M, N, O and P, each one has a different age, P is older than only three other persons, N is older than L. O is younger than L. M is older than K. P is younger than K. Who is the second youngest among all six persons?

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

Q54. A dishonest dealer professes to sell his goods at cost price but uses a false weight and thus gains 20%. For a kilogram he uses a weight of how many grams?

(a) 785.5 gm
(b) 750.5 gm
(c) 833.33 gm
(d) 708.06 gm

Q55. A 3-digit number is such that the unit digit, tens digit and hundreds digit are in the ratio 1: 2: 3. The sum of this number and its reversed number is 1332. Find the reversed number

(a) 414
(b) 246
(c) 123
(d) 369

Q56. All of the statements given below regarding inhalation in humans are correct except one. Which one is NOT correct?

a) Ribs move inward and diaphragm is raised.
b) Ribs are lifted up and diaphragm becomes flat.
c) Chest cavity becomes larger.

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d) Air is sucked into the lungs.

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

Q57. Find the surface area of a sphere with a diameter 1/2 cm.

(a) π/4 cm²
(b) π/2 cm²
(c) π²cm²
(d) 2π² cm²

Q58. The following table shows the population of six different cities, A, B, C, D, E and F, the ratio of males to females among them and the ratio of adults to children in the total population. Study the table and answer the question.

City	Population	Male : Female	Adult : Children
A	410400	13 : 11	5 : 3
B	369900	5 : 4	7 : 2
C	442800	5 : 7	7 : 5
D	465500	17 : 18	4 : 3
E	499500	5 : 4	5 : 4
F	424500	8 : 7	17 : 13

What is the difference between the total number of adults and the total number children in city A?

(a) 1, 04, 600
(b) 1, 02, 600
(c) 1, 02, 000
(d) 1, 12, 600

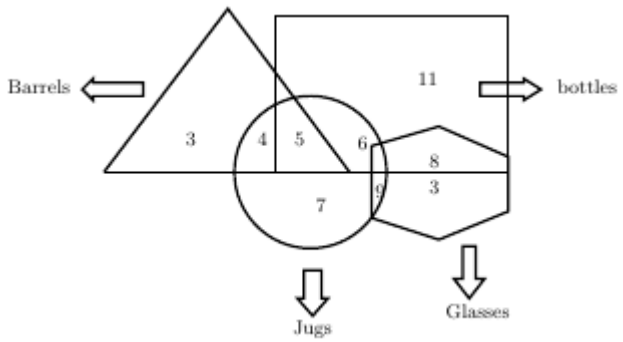
Q59. If x = 2 + √ 5 and y = 2 - √5, then the value of x² + y² is:

(a) 18
(b) 16
(c) 20
(d) 22

Q60. Books that contain the records of Christ's life are known as _____.

(a) Gospels
(b) Torahs
(c) Sermons
(d) Psalms

Q61. Study the given diagram carefully and answer the question. The numbers in different sections indicate the number of articles.



How many such barrels are there that are only jugs?

(a) 5
(b) 1
(c) 4
(d) 6

Q62. Select the option that is related to the fifth number in the same way as the second number is related to the first number and the fourth number is related to the third number.

18 : 63 :: 44 : 154 :: 54 : ?

(a) 146
(b) 138
(c) 189
(d) 179

Q63. Where in the human body does pyruvate undergo aerobic breakdown?

(a) Nucleus
(b) Mitochondria
(c) Cytoplasm
(d) Muscles

Q64. For a given data, if mean and mode are 42 and 60, respectively, then find the median of the data using empirical relation.

(a) 50
(b) 44
(c) 46
(d) 48

Q65. The first step to practice waste management is segregation. Select the INCORRECT option with regard to segregation of waste into different categories.

(a) It helps to identify materials that can be sold to earn revenue
(b) It prevents items suitable for recycling from being thrown away
(c) It increases the amount of waste going into landfills
(d) Segregation helps to reduce the money spent on disposal of waste

Q66. Eight students, 1 to 8, are sitting around a circular table facing the centre. 1 is the immediate neighbour of both 8 and 2. 3 is sitting second to the right of 1. 1 is sitting second to the right of 7. 5 is the immediate neighbour of 6 and 4. How many students were sitting between 5 and 1?

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

Q67. According to Article 24 of the Constitution of India which deals with the Right against Exploitation, what is the minimum age fixed by the government to work in a factory or mine?

(a) 14 years
(b) 16 years
(c) 18 years
(d) 21 years

Q68. Refer to the following letter, number and symbol series and answer the question.

(Left) G B D F H & 8 * T % 7 D 4 @ 6 K & 2 R P Q T @ Y # 3 5 E * S (Right)

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

(a) One
(b) Four

(c) Three
(d) Two

Q69. 'Families increase savings to offset the increased government dissaving.'
Who among the following has given the above mentioned theory?
(a) BR Ambedkar
(b) Takeshi Amemiya
(c) Walter Adams
(d) David Ricardo

Q70. India's first wholly owned women's industrial park opened in March 2022 in Hyderabad. This park has been promoted by which organization in collaboration with the Government of Telangana?
(a) Confederation of Women Entrepreneurs
(b) Self Employed Women's Association
(c) FICCI Ladies Organisation
(d) Sabala Organisation

Q71. The sum of the distinct prime factors of 9^6 × 12^4 × 7^7 is:
(a) 13
(b) 12
(c) 11
(d) 14

Q72. If x3 - 3x + 6 = 0, then it is:
(a) a quadratic equation
(b) a linear equation
(c) a quadratic expression
(d) not a quadratic equation

Q73. Which of the following types of coal is known to have the highest carbon content in it?
(a) Bituminous
(b) Lignite
(c) Sub-bituminous
(d) Anthracite

Q74. The sum of the ages of five children born at the intervals of three years each is 60 years. What is the age of the youngest child?
(a) 4 years
(b) 7 years
(c) 5 years
(d) 6 years

Q75. A retailer would have made a profit of 18% if he sold an article at its marked price. If he allowed a discount of 10% on the marked price, what would his actual profit on that article have been?
(a) 4.6%
(b) 7.1%
(c) 6.2%
(d) 5.5%

Q76. Hisar is to the north of Bhiwani, Bhiwani is to the west of New Delhi, Rohtak is to the south of Panipat and to the east of New Delhi. What is the position of Hisar with respect to Panipat?
(a) North
(b) South
(c) East
(d) West

Q77. Ramya got married 10 years ago. Now her age is 11/5 times of marriage. Her daughter's age is one-tenth of her present age. Find her daughter's present age.

(a) 12 years
(b) 20 years
(c) 6 years
(d) 8 years

Q78. Consider the following statements about magnetic field due to a current-carrying solenoid:

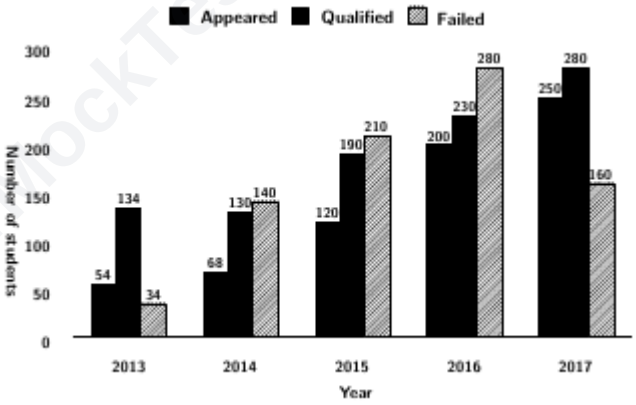
(a) The magnetic field is uniform inside the solenoid.

(b) One end of the solenoid behaves like the north pole and the other like the south pole of a bar magnet.

Which of the above statements is/are correct?

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

Q79. The following bar graph gives the information on the number of students who appeared, qualified and failed in a bank PO exam (in hundreds) in different years. Study the graph and answer the question.



By what percentage is the average number of students who failed in the given five years more than the number of students who failed in 2017?

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

Q80. Nirmal and Sushma are standing in a queue of people facing north. Nirmal is at the 20th position from the extreme left end, and Sushma is at the 10th position from the extreme right end. The positions of Nirmal and Sushma are interchanged due to some criteria based on age. If the new position of Nirmal is 30th from the extreme left end, then what is the new position of Sushma from the extreme right end?

(a) 25th
(b) 30th
(c) 18th
(d) 20th

Q81. A concave mirror converges light rays from the sun at 10 cm from the mirror. If an object is placed 20 cm from the mirror, the image is formed:

(a) 20 cm in front of the mirror
(b) 20 cm behind the mirror
(c) 10 cm in front of the mirror
(d) 10 cm behind the mirror

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Q82. Silver chloride turns into silver and chlorine gas in the presence of ultraviolet radiation. This is an example of:

(a) photolytic decomposition reaction
(b) double displacement reaction
(c) thermal decomposition reaction
(d) redox reaction

Q83. The value of $2 - (\sin^2 a)/(1 - \cos a) + (1 - \cos a)/(\sin a) - (\sin a)/(1 + \cos a)$ is

(a) $1 - \sin\alpha$
(b) $1 + \sin\alpha$
(c) $1 + \cos\alpha$
(d) $1 - \cos\alpha$

Q84. Nine people, 1 to 9, are sitting in a straight row, facing the north. 8 is sitting in the middle of the row and his immediate left and right neighbours are 5 and 1, respectively. 9 is sitting at one of the extreme ends and his immediate right neighbour is 2. Only five people are there between 2 and 3. 3 is sitting between 7 and 6. 1 and 7 are immediate neighbours. How many people are there between 4 and 6?

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

Q85. Which of the following numbers will replace the question mark (?) in the given series?

3, 9, 25, 53, 157, ?

(a) 371
(b) 317
(c) 307
(d) 300

Q86. Formation of methyl chloride from methane and chlorine gas is which type of reaction?

(a) Oxidation reaction
(b) Addition reaction
(c) Substitution reaction
(d) Combustion reaction

Q87. At what time between 2 o' clock and 3 o' clock will the hands of a clock be together?

(a) 1010/11 past 2
(b) 1112/11 past 2
(c) 65/11 past 2
(d) 35/11 past 2

Q88. In September 2021, which state government launched the Nirbhaya Ek Pahal scheme under phase 3 of Mission shakti?

(a) Rajasthan
(b) Goa
(c) Uttar Pradesh
(d) Chhatisgarh

Q89. The Secretary General of the Rajya Saba is appointed by who among the following?

(a) Attorney General
(b) Prime Minister
(c) Chairman of Rajya Sabha
(d) President

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Q90. As a part of policy to promote 'Sports for Unity' National Games Gujarat 2022 is proposed to have a total of how many sports?

(a) 28
(b) 36
(c) 30
(d) 32

Q91. Given below are three statements and three conclusions. Take the statements to be true even if they are at variance with commonly known facts, and decide whether the conclusion/s follow/s the given statements.

Statements:

I. All pen drives are hard drives.

II. Some hard drives are chips.

III. All chips are keyboards.

Conclusions:

I. Some keyboards are pen drives.

II. Some chips are pen drives.

III. Some keyboards are hard drives.

(a) Conclusions I and III follow
(b) Only conclusion I follows
(c) All the conclusions follow
(d) Only conclusion III follows

Q92. Which of the following statements about Classical Language is INCORRECT?

(a) The classical language and literature being distinct from modern for a language to be classical.
(b) At least two million people must speak the language for it to be considered classical.
(c) High antiquity of a language's early texts over a period of 1500-2000 years for it to be considered classical.
(d) The literary tradition be original and not borrowed from another speech community for a language to be classical.

Q93. If Average Production is decreasing, then what will be the effect on Marginal Production?

(a) It will have a positive slope
(b) It will be more than Average Production
(c) It will be less than Average Production
(d) It will be same as Average Production

Q94. In this question, a group of numbers/symbols is coded using letters as per the table given below and the conditions which follow. The correct combination of codes following the conditions is your answer.

Number/ Symbol	**4**	**prop. to**	**5**	**9**	**÷**	**±**	**8**	**$**	**!**	**3**	**@**	**6**	**7**	**2**
Code	C	G	K	Q	W	R	T	V	X	D	A	E	H	G

Conditions:

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

(ii) If the first element is an EVEN number and the last, an ODD number, the first and last elements are to be coded as !

(iii) If both the third and the fourth elements are prime numbers, the fourth element is to be coded as the code for the third element and vice-versa.

Question: 8 $ 5 2 @

(a) TVKGA
(b) TVGKA
(c) AVKGT
(d) AVGKT

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Q95. Simplify $6^2 + 3^2 + 2^4$.

(a) 61
(b) 52
(c) 45
(d) 63

Q96. Q started from a point and walked towards the south for 42 m and reached point A. Q then turned right from point A and walked 2 m, he then turned right again and walked 30 m. Q turned left now and walked 10 m, he then turned left again and walked 30 m. How far is Q from point A?

(All turns are 90 degree turn only)

(a) 52 m
(b) 12 m
(c) 42 m
(d) 30 m

Q97. In a college, the Art room, the Library, the Gym, the Labs, the storerooms, the staffrooms and the Classrooms are there on seven different floors of the same building. The lowermost floor in the building is numbered 1, the floor above it is numbered 2, and so on till the topmost floor is numbered 7. No other floors are there below the Library, and the Library is immediately below the Gym. Only two floors are there between the Gym and the Classrooms. Both the Labs and the Staffrooms are on even numbered floors. Only three floors are there between the storerooms and the Art room. The Storerooms are immediately below the Labs. Which of the following is/are there on floor number 4?

(a) Storerooms
(b) Staffrooms
(c) Art room
(d) Labs

Q98. Solve: $3(5x^2 - 7) - 5(3x^2 + 2x - 7) = -16$

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

Q99. A statement is given followed by two arguments I and II. Read the statement and the arguments carefully and select the appropriate answer from the given options.

Statement:

Students have complained that questions outside the prescribed syllabus were asked in the X standard board exams this year.

Arguments:

I. The pass percentage in the X standard board exams has declined by 8 percent this year.

II. This number of students scoring over 60 percent in the X standard board exams has shown an increase of 15 percent this year.

(a) Both arguments I and II weaken the statement
(b) Argument II weakens, while argument I strengthens the statement
(c) Both arguments I and II strenthen the statement
(d) Argument I weakens, while argument II strengthens the statement

Q100. From which of the following countries has the Freedom of Trade feature been taken by the Indian Constitution?

(a) USSR
(b) Germany
(c) Ireland
(d) Australia

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ANSWER KEY

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

SOLUTIONS

Q1. Answer: (b) Both the statements are true.

The correct answer is 'Both the statements are true'.

Key Points

• The neutralization process between an acid and a base produces the compound known as salt.

• Strong acid and strong base react to generate salts, which are naturally neutral since the bonds within the salt solution are stable. They often hydrate without hydrolyzing and have a pH value of 7.

• Strong base and weak acid react to generate salts that are basic in nature and have a pH higher than 7.

• Strong acid and weak base react to generate salts that are acidic in nature and have a pH lower than 7.

• Depending on the types of acids and bases involved, salts created by neutralizing weak acids and weak bases might be acidic, basic, or neutral.

Additional Information

• The pH is calculated as the negative logarithm of the concentration of H+ ions. So, the significance of pH as the power of hydrogen is validated.

• The pH scale has a 0–14 range. Materials can be identified as an acid or a base using litmus paper. To identify the type of chemical being tested, compare the colour of the paper to the pH scale values.

• Neutral solutions are those whose pH value on the pH scale is equal to 7.

Q2. Answer: (d) Common salt, carbon dioxide and ammonia

The correct answer is Common salt, carbon dioxide and ammonia

Key Points

• The Solvay process is an industrial method for producing sodium carbonate (soda ash), from which baking soda can subsequently be obtained by a simple conversion process.

• The key raw materials for the Solvay process are:

• Sodium chloride (NaCl): Common salt, which serves as the source of sodium ions.

• Ammonia (NH3): Ammonia is used to react with carbon dioxide and water to form ammonium bicarbonate.

• Carbon dioxide (CO2): Introduced into the reaction, carbon dioxide reacts with the ammonium bicarbonate to precipitate out sodium bicarbonate.

Q3. Answer: (a) 9

Shortcut Trick

Total number of observations = 7

Total Sum = Mean × 7 = 30 × 7 = 210

Sum of numeric values = 22.5 + 56 + 42.5 + 1 − 2 + 36 = 156

Sum of variable terms = 2x + x + 3x = 6x

6x = 210 − 156 = 54 => x = 9

Therefore The correct answer is 9.

Alternate Method

Given: Observations are 22.5, 56, 42.5, 2x+1, x−2, 3x, 36. Mean = 30.

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

=> Sum of observations = 22.5 + 56 + 42.5 + (2x + 1) + (x − 2) + 3x + 36

=> Sum = (22.5 + 56 + 42.5 + 1 − 2 + 36) + (2x + x + 3x)

=> Sum = 156 + 6x

=> 30 = (156 + 6x) ÷ 7

=> 30 × 7 = 156 + 6x

=> 210 = 156 + 6x

=> 6x = 210 − 156

=> 6x = 54

=> x = 54 ÷ 6

=> x = 9

Therefore The correct answer is 9.

Additional Information

Sum of Deviations

The sum of deviations of all observations from their arithmetic mean is always zero, i.e., $\Sigma(x_i - x) = 0$.

Change of Origin and Scale

If a constant k is added to or subtracted from every observation, the new mean becomes Old Mean ± k. If every observation is multiplied by k, the new mean becomes Old Mean × k.

Combined Mean

If two groups have n1 and n2 observations with means x1 and x2 respectively, the combined mean is (n1x1 + n2x2) ÷ (n1 + n2).

Q4. Answer: (b) Only Statement II is correct.

The correct answer is 'Only Statement II is correct'.

Key Points

• The arrangement of chemical elements in rows and columns is called a periodic table.

• The atomic radius decreases as we move from left to right in a period as a result of an increase in effective nuclear charge.

• Atomic radius increases along the group as we move from top to bottom because the principal quantum number increases, increasing the number of shells and the shielding effect in the process.

• Ionic radii decrease along the periodic table from left to right and increase down the group from top to bottom.

Q5. Answer: (d) Tuberculosis

The correct answer is 'Tuberculosis'.

Key Points

• The contagious diseases spread through sexual contact are known as sexually transmitted diseases or STDs.

• Some of the commonly found STDs are AIDS, gonorrhea, syphilis, genital herpes and warts, chlamydiosis, and hepatitis-B.

• STDs can be caused by disease causing bacterias, viruses, or parasites.

• Tuberculosis is a bacterial infection affecting the lungs and is transmitted to others through air.

Q6. Answer: (c) HCl + KOH → KCl + H2O

The correct answer is HCl + KOH → KCl + H2O.

Key Points

• When two reactants exchange ions to create two new compounds, the reaction is referred to as a double displacement reaction.

• Typically, a precipitate is the end product of double displacement processes.

• The reactants may form covalent or ionic chemical bonds with one another.

• The general form of double displacement reaction is: AB + CD → AD + CB.

Q7. Answer: (a) 2.25 J

Given:

• Resistance of resistor is 6 Ω.

• Resistance of resistor is 12 Ω.

• Resistors A and B are connected in parallel to a battery to a battery of 3V.

Formula Used:

• Equivalent Resistance (for parallel), 1/(R_(eq)) = 1/R1 + 1/R2

• Current, I= V/R

• Energy, E=VIt

Calculations:

Equivalent Resistance,

1/(R_(eq)) = 1/A + 1/B; => 1/(R_(eq)) = 1/6 + 1/12; => 1/(R_(eq)) =0.25; => R_(eq)=4 Ω

Current,

I= V/R; => I= 3/4; => I=0.75A

The total energy supplied by the battery to the circuit in 1 second can be given as,

E=VIt; => E=3× 0.75 × 1; => E=2.25J

Therefore, the total energy supplied by the battery to the circuit in 1 second is 2.25J.

Q8. Answer: (d) Mica

The correct answer is "Mica".

Key Points

The inorganic materials that are found naturally as minerals. They can be found in a variety of settings. Crystalline structures and specific chemical compositions are characteristics of minerals.

• Metallic minerals are those that contain metals in their natural state.

• Examples of metallic minerals include bauxite, gold, silver, copper, and iron.

• Minerals without any metal content are referred to as non-metallic minerals.

• When non-metallic minerals are liquefied, nothing new can be made from them, making them a unique class of chemical elements.

• Minerals like limestone, mica and gypsum, coal, and petroleum are examples of non-metallic minerals.

• Inorganic, non-metallic silicate makes up the majority of mica's chemical makeup.

Q9. Answer: (a) JTA-36

The pattern followed here is:

Thus, the correct answer is 'JTA-36'.

Q10. Answer: (d) 13

Given:

The circle represents girls, the triangle represents science students, and the rectangle represents PG students. The numbers in different sections indicate the number of persons.

Here, PG students are girls who are Not science students are '13'.

Hence, the correct answer is Option (4).

Q11. Answer: (b) Very reactive

The correct answer is Very reactive.

Key Points

• Non-metallic chemical element silicon (Si) is a member of the carbon family.

• The octahedral crystalline structure of pure silicon is a hard, dark grey solid with a metallic lustre.

• Since pure silicon is too reactive to be found in nature, it is instead mixed with other elements or oxygen to form silica, which is present in almost all rocks, sand, clays, and soils.

• the long chain compounds formed by silicon are very reactive.

Additional Information

• Reactivity is the ease with which one substance reacts chemically with another.

• The arrangement of metals in descending order of their reactivities is referred to as the "metal reactivity series", sometimes known as the "activity series".

• The susceptibility of an anion to become polarised by a cation is known as polarizability. When the degree of polarization is very low, an ionic bond is created, and when it is very high, a covalent bond is created.

Q12. Answer: (b) 1^(st)

Given:

A, B, C, D, E and F live on six different floors of the same building. The lowermost floor in the building is numbered 1, the floor

above it is numbered 2, and so on till the topmost floor is numbered 6.

1. E lives on the floor immediately below F's floor. D lives on the 2nd floor.

2. C lives on the floor immediately below A's floor.

Case 3 is eliminated, case 2 and case 1 are considered.

3. F does not live on the 5th floor.

Case 1 is eliminated and case 2 will be considered.

4. On which floor does B live:

Thus, B lives on the '1st Floor'.

Q13. Answer: (c) 121

Given:

99.01 ÷ 10.93 + 6.987 × 16.01 = ?

Concept used:

This question will be solved by BODMAS rule.

Calculation:

99.01 ÷ 10.93 + 6.987 × 16.01

Division will be solved first:

=99.01/10.93+6.987×16.01; =9901/1093+6.987×16.01; =9.058+6.987×16.01

Now multiplication will be solved:

=9.058+111.861; =120.919

This is approximately equal to 121.

Thus the correct answer is 'Option 3'.

Q14. Answer: (d) Cl, Br, I

The correct answer is Cl, Br, I.

Key Points

• Johann Wolfgang Dobereiner, a German scientist, discovered Dobereiner's triads, which are collections of elements with related properties.

• He noticed that triads—groups of three elements—could develop in which all the components had comparable physical and chemical characteristics.

• According to Dobereiner's law of triads, the atomic masses of the first and third elements in a triad will approximately equal the atomic masses of the second element in that triad.

• Halogens, chlrone (Cl), bromine (Br), and iodine (I) together form a triad and is an example of Dobereiner's triads.

Q15. Answer: (c) 5% increase

Shortcut Trick

Using the effective percentage change formula: a + b + (a × b)/100

Here, a = −16% (decrease) and b = +25% (increase).

Net Change = −16 + 25 + (−16 × 25)/100

Net Change = 9 − 400/100 = 9 − 4 = 5%

Therefore The correct answer is 5% increase.

Alternate Method

Given: Initial decrease = 16%, Subsequent increase = 25%.

Formula: Net Change % = [Final Value − Initial Value] / Initial Value × 100

=> Let Initial Salary be 100 units.

=> Salary after 16% decrease = 100 − 16 = 84 units.

=> Salary after 25% increase = 84 + (25% of 84)

=> 25% of 84 = 84 ÷ 4 = 21.

=> Final Salary = 84 + 21 = 105 units.

=> Net change = 105 − 100 = 5%.

Therefore The correct answer is 5% increase.

Additional Information

Successive Percentage Change

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When a value is changed by x% and then by y%, the net change is given by (x + y + xy/100)%. Use positive for increase and negative for decrease.

Ratio Method

Convert percentages to fractions. Final Ratio = (Initial Ratio) × (Multiplier 1) × (Multiplier 2). For 16% decrease, multiplier is 21/25; for 25% increase, multiplier is 5/4.

Base Change Rule

If salary increases by x%, to return to the original salary, it must decrease by [x/(100+x)] × 100%.

Q16. Answer: (b) Gulzarilal Nanda

The correct answer is Gulzarilal Nanda.

Key Points

• The Planning Commission is a department of the Indian government, formed on March 15, 1950, to oversee the economic and social growth of the nation, primarily through the creation of five-year plans.

• The head of the serving government, the Prime Minister of India, also happen to be the chairman of the Planning Commission.

• The first Prime Minister of India, Jawaharlal Nehru was the Chairman of Planning Commission.

• Former Indian Prime Minister Gulzarilal Nanda served as the first deputy chairman of the planning commission from 17 February 1953 until 21 September 1963.

• Planning commission is currently abolished. Today, the Planning Commission is known as NITI Aayog.

• The Planning Commission of India's deputy chairperson is chosen by the central cabinet because the prime minister serves as the body's ex-officio chair.

• Mr Montek Singh Ahluwalia is the former and current deputy chairperson of the Planning Commission.

Additional Information

• Vallabhbhai Jhaverbhai Patel:

• Vallabhbhai Jhaverbhai Patel, also known as Sardar Patel, was an Indian lawyer, statesman, and powerful political figure.

• From 1947 until 1950, he held the positions of India's first Deputy Prime Minister and Home Minister.

• He was a lawyer and a prominent member of the Indian National Congress who led the country's independence movement and oversaw its fusion into a single, sovereign state.

• KC Neogy:

• Kshitish Chandra Neogy, popularly known as KC Neogy, was a politician from West Bengal, India.

• He served as the chairman of India's first finance commission and was a member of the country's first independent cabinet as well as the Indian Constituent Assembly.

• Neogy, an Indian National Congress member, was chosen to represent Bengal in the Central Legislative Assembly in 1920, 1923, 1926, and 1930.

• He was re-elected to the body in subsequent elections.

• Jawaharlal Nehru:

• Jawaharlal Nehru was a prominent figure in India around the middle of the 20th century.

• He was an anti-colonial patriot, secular humanism, social democrat, statesman, and author.

• He was appointed India's first Prime Minister in 1947, taking power for 16 years.

• Nehru greatly influenced India's development into a modern nation in the 1950s by promoting parliamentary democracy, secularism, science, and technology.

Q17. Answer: (b) NABARD

The correct answer is "NABARD".

Key Points

• The beginning of the micro finance movement in India could be traced to the selfhelp group (SHG) - bank linkage programme (SBLP) started as a pilot project in 1992 by National Bank for Agricultural and Rural Development (NABARD).

• This programme not only proved to be very successful, but has also emerged as the most popular model of micro finance in India. \

• Other approaches like micro finance institutions (MFIs) also emerged subsequently in the country.

Q18. Answer: (d) 288

The logic followed here is:

Hence, '228' is the correct answer.

Q19. Answer: (a) 24 cm

Given:

• An object is placed in front of a concave mirror

• Focal length, f = -12 cm(since it is a concave mirror so f is negative)

• Object distance, u = -8 cm.

Formula Used:

Mirror Formula, 1/f = 1/v+ 1/u

Calculations:

Using the mirror formula, we get

1/f = 1/v+ 1/u; => (-1)/12 = 1/v+ (-1)/8; => 1/v = (-1)/12 +1/8; => 1/v =1/24 ; => v = 24 cm

Therefore, the image of the concave mirror is formed at a distance (v) of 24 cm.

Q20. Answer: (a) 15 days

Shortcut Trick

Total Work (LCM of 12, 20) = 60 units.

Efficiency of (A + B) = 60 ÷ 12 = 5; Efficiency of A = 60 ÷ 20 = 3.

Efficiency of B = 5 − 3 = 2.

If B works half-day, his efficiency = 2 × 1/2 = 1.

New combined efficiency = 3 + 1 = 4 units/day.

Time taken = 60 ÷ 4 = 15 days.

Therefore The correct answer is 15 days.

Alternate Method

Person	Days	Total Work	Efficiency
A + B	12	60	5
A	20	3	

=> Efficiency of B = Efficiency of (A + B) − Efficiency of A

=> Efficiency of B = 5 − 3 = 2 units/day

=> Given: B works only for half a day daily.

=> Effective Efficiency of B = 2 ÷ 2 = 1 unit/day

=> New combined efficiency of (A + B) = 3 (A's full) + 1 (B's half) = 4 units/day

=> Total Days = Total Work ÷ Combined Efficiency

=> Total Days = 60 ÷ 4 = 15 days

Therefore The correct answer is 15 days.

Additional Information

Work and Efficiency Relationship

Efficiency is inversely proportional to the time taken to complete a work. Total Work = Efficiency × Time.

Partial Work Rule

When a person works for a fraction of a day, their effective efficiency for that day is multiplied by that same fraction (e.g., half day = 1/2 efficiency).

Pipes & Cisterns Connection

Similar logic applies to pipes where efficiency represents the rate of flow per unit time.

Q21. Answer: (a) 5.0 Ω

The correct answer is 5.0 Ω.

Key Points

• The obstruction to current flow in an electrical circuit is measured by resistance.

• The Greek letter omega (Ω) represents the unit of measurement for resistance, known as ohms.

• Georg Simon Ohm, a German physicist who investigated the connection between voltage, current, and resistance, is the subject of the name "Ohm."

• The formula for resistance is given as, R = V/I, where R is the resistance in ohms, V is the potential difference in volts and I is the current in amperes.

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• When the potential difference and current are found to be 2.0 V and 0.4 A respectively, then the resistance of the wire is given as,

R = V/I; => R = 2/0.4; => R = 5 Ω

Additional Information

• A given object's resistance is mostly determined by its material and shape.

• The resistance for a particular material is inversely proportional to the cross-sectional area. Moreover, resistance is inversely proportional to material length.

• Electrical resistance, which is measured with an ohmmeter, is expressed in ohms. The resistance to be measured can be connected to the instrument in parallel or in series using the simplest ohmmeters.

Q22. Answer: (d) 8

BODMAS Table:

Decoding the information,

If '+' and '-' are interchanged and also '×'and '÷'

Sign	•	×
Meaning	•	÷

Given equation: 10 + 152 × 19 - 2 ÷ 3

After interchanging '+' and '-' and '×'and '÷' and using the BODMAS rule:

→ 10 - 152 ÷ 19 + 2 × 3

→ 10 - 8 + 2 × 3

→ 10 - 8 + 6

→ 16 - 8 = 8.

Thus, the correct answer is '8'.

Q23. Answer: (c) 25%

Shortcut Trick

Apply the percentage change formula: Percentage more = [r ÷ (100 − r)] × 100

Given r = 20%

Required percentage = [20 ÷ (100 − 20)] × 100

=> [20 ÷ 80] × 100 = 1/4 × 100 = 25%

Therefore The correct answer is 25%.

Alternate Method

Given: A's salary is 20% less than B's salary.

Let B's salary = 100

=> A's salary = 100 − 20% of 100 = 80

=> Difference in salary = 100 − 80 = 20

=> Required Percentage = (Difference ÷ A's Salary) × 100

=> (20 ÷ 80) × 100

=> 1/4 × 100 = 25%

Therefore The correct answer is 25%.

Additional Information

Percentage Increase/Decrease Rule

If A is r% more than B, then B is [r ÷ (100 + r)] × 100% less than A.

Successive Percentage Change

The net change for two successive changes of x% and y% is given by [x + y + (xy/100)]%.

Fraction Equivalents

20% = 1/5. If value decreases by 1/5, it must increase by 1/(5-1) = 1/4 (which is 25%) to return to original.

Q24. Answer: (a) EOS-04

The correct answer is "EOS-04".

Key Points

• India's Polar Satellite Launch Vehicle PSLV-C52 injected Earth Observation Satellite EOS-04, into an intended sun synchronous

polar orbit of 529 km altitude at 06:17 hours IST on February 14, 2022 from Satish Dhawan Space Centre, SHAR, Sriharikota

• PSLV C52 has been designed to orbit the 1,710 kg EOS-04 satellite in a 529 km sun-synchronous polar orbit. Two more small satellites will be installed in the PSLV-C52 mission. EOS-04 is a radar imaging satellite that will send high-quality all-weather images of agriculture, vegetation, soil moisture, and more.

Q25. Answer: (d) People living in urban areas

The correct answer is People living in urban areas.

Key Points

• A stakeholder is a person with an interest in a particular business.

• Everyone uses forest resources in one form or the other.

• The stakeholders of forest resources include:

• People who live around the forest areas and depend upon the forest resources for sustenance,

• The Government Forest Department, which owns the forest land.

• The industrialists who use forest products for various industrial purposes.

• The enthusiasts for the conservation of wildlife and nature

Additional Information

• The people staying in nearby areas use firewood, thatch, and small timber from the forests.

• Bamboo is used in making huts, and baskets for collecting fruits and food materials.

• Forests are also the sites for hunting and fishing.

• The industries consider the forest as a source of raw materials for the factories.

• Industrialists are not concerned about sustainability.

• Before independence, the stakeholders were free to use forest resources. But after the British took over, access to forest resources was restricted to the forest dwellers. After independence, the government overtook forest departments, but the interest of the people staying in forests was still ignored. A few cultivation practices disturbed the whole biodiversity of the area.

Q26. Answer: (d) μ_V > μ_G > μ_Y

The correct answer is μV > μG > μY.

Key Points

• Dispersion is the splitting of white light into its constituent colours when passed through a glass prism.

• Dispersion is the process by which white light divides into the colors that make up its spectrum, which are violet, indigo, blue, green, yellow, orange, and red (in order).

• The change in refractive index with wavelength is also measured by the dispersion.

• During dispersion of white light by a glass prism, the more a colour component is bent, the more is the refractive index of the glass for that colour component.

• Violet has the shortest wavelength and bent the most and its refractive index is more while red has the longest wavelength and bend the least and its refractive index is least.

Q27. Answer: (c) Prayagraj

The correct answer is "Prayagraj".

Key Points

• In Hinduism, Kumbh Mela is a major pilgrimage and festival. It is celebrated at four river-bank pilgrimage sites in a period of approximately 12 years: the Prayagraj (confluence of the Ganges-Yamuna Sarasvati rivers), Haridwar (Ganges), Nashik (Godavari), and Ujjain (Shipra).

• The festival is characterised by a ceremonial dip in the waters, but it is also a celebration of community exchange with various fairs, schooling, saintly religious discourses, monks or poor people's mass feedings, and entertainment displays.

• As part of his efforts to launch major Hindu gatherings for philosophical discussions and debates along with Hindu monasteries in the Indian subcontinent, the festival is historically attributed to the Hindu philosopher and Saint Adi Shankara of the 8th century.

• There is, however, no historical literary evidence before the 19th century of these mass pilgrimages called "Kumbha Mela".

• It has been inscribed on the UNESCO Official List of Humanity's Intangible Cultural Heritage.

Q28. Answer: (b) (i), (ii) and (iv)

The correct answer is (i), (ii), and (iv).

Key Points

• Villi present in the small intestines of humans are finger-like projections having very thin walls with a rich supply of blood vessels.

• Villi provide a larger surface area in the inner lining of the small intestine and helps in larger absorption of nutrients with the

increase in surface area.

• Villi is richly supplied with blood capillaries that helps in the absorption of digested food and carrying it to the blood stream.

Q29. Answer: (b) QDF : JWU

The logic followed here is:

For, MGB : NTY

For, THK : GSP

Similarly, for QDF : JWU

Hence, the correct answer is 'Option 2'.

Q30. Answer: (a) 6

Shortcut Trick

Find individual remainders for each number when divided by 17.

Remainder of 171 ÷ 17 is 1.

Remainder of 172 ÷ 17 is 2.

Remainder of 173 ÷ 17 is 3.

Final Remainder = 1 × 2 × 3 = 6.

Therefore The correct answer is 6.

Alternate Method

Given: Expression = 171 × 172 × 173, Divisor = 17.

Formula Used: Rem(A × B × C / K) = [Rem(A/K) × Rem(B/K) × Rem(C/K)] / K

Calculations:

=> 171 = (17 × 10) + 1

=> 172 = (17 × 10) + 2

=> 173 = (17 × 10) + 3

=> Required Remainder = (1 × 2 × 3) ÷ 17

=> Required Remainder = 6 ÷ 17

=> Since 6 is less than 17, the remainder is 6.

Therefore The correct answer is 6.

Additional Information

Remainder Theorem

If a number is expressed as a product, the total remainder is the product of individual remainders divided by the divisor.

Negative Remainder Concept

Sometimes using a negative remainder (e.g., 16 ÷ 17 has a remainder of −1) simplifies calculations in large powers.

Property of Multiples

Any number in the form (n × k + r) when divided by k will always yield a remainder of r.

Q31. Answer: (c) only d

Shortcut Trick

Use the Quadrilateral Hierarchy: Square is the most specific shape.

A Square possesses all properties of a Rhombus (all sides equal) and a Rectangle (all angles 90°).

Therefore, Every Square is a Rhombus is a true statement.

Other statements are false because a Trapezium only needs one pair of parallel sides, and a Rectangle or Parallelogram does not require all sides to be equal.

Therefore The correct answer is only d.

Alternate Method

Given Statements:

a) Trapezium → Parallelogram: False. A trapezium requires only one pair of parallel sides, while a parallelogram requires two.

b) Parallelogram → Square: False. A parallelogram does not necessarily have equal sides or 90° angles.

c) Rectangle → Square: False. A rectangle only requires 90° angles; its sides may not be equal.

d) Square → Rhombus: True. A square has four equal sides, which is the defining property of a rhombus.

Calculations:

=> A Rhombus is defined as a quadrilateral with all four sides equal.

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=> A Square is defined as a quadrilateral with all four sides equal and all interior angles equal to 90°.

=> Since every Square must have four equal sides, it automatically satisfies the definition of a Rhombus.

=> Therefore, the statement Every square is a rhombus is mathematically true.

Therefore The correct answer is only d.

Additional Information

Quadrilateral Hierarchy

The hierarchy flows from general to specific: Quadrilateral → Trapezium → Parallelogram → Rhombus/Rectangle → Square.

Properties of a Square

A Square is both a Rectangle (all angles 90°) and a Rhombus (all sides equal).

Trapezium Definition

A Trapezium is a quadrilateral with at least one pair of parallel sides. Every Parallelogram is a Trapezium, but not vice versa.

Q32. Answer: (d) City Councils

The correct answer is City councils.

Key Points

• States are required by Article 243Q to create the three types of municipalities listed below in each state.

• Nagar Panchayats (city councils) are for transitional areas, or areas that are changing from being rural to urban.

• Municipal council for a smaller urban area.

• Municipal corporation for a larger urban area.

Q33. Answer: (d) Rs 5,51,250

Shortcut Trick

Effective rate for 2 years at 5% compound interest = 5 + 5 + (5 × 5)/100 = 10.25%.

Total amount percentage = 100% + 10.25% = 110.25%.

Amount = 110.25% of Rs 5,00,000.

Amount = 1.1025 × 5,00,000 = 5,51,250.

Therefore The correct answer is Rs 5,51,250.

Alternate Method

Given: Principal (P) = Rs 5,00,000, Rate (R) = 5%, Current age = 16 years, Maturity age = 18 years.

Formula Used: Amount (A) = $P(1 + R/100)^n$, where n = time period.

=> Time (n) = 18 − 16 = 2 years

=> $A = 5,00,000 \times (1 + 5/100)^2$

=> $A = 5,00,000 \times (105/100) \times (105/100)$

=> $A = 5,00,000 \times (21/20) \times (21/20)$

=> $A = 5,00,000 \times (441/400)$

=> $A = 1,250 \times 441$

=> A = 5,51,250

Therefore The correct answer is Rs 5,51,250.

Additional Information

Effective Interest Rate for 2 Years

The net percentage change for compound interest over 2 years is calculated using the formula R_(eff) = x + y + (xy/100).

Difference between CI and SI for 2 Years

The difference between Compound Interest and Simple Interest for 2 years is given by $D = P \times (R/100)^2$.

Compounding Annually vs Half-Yearly

If interest is compounded half-yearly, the rate is halved (R/2) and the time period is doubled (2n) in the standard formula.

Q34. Answer: (d) 3307/24975

Shortcut Trick

For a mixed recurring decimal, the numerator is the total number minus the non-recurring part.

The denominator consists of as many 9s as there are recurring digits, followed by as many 0s as there are non-recurring digits after the decimal.

Fraction = (13241 − 13) ÷ 99900

Fraction = 13228 ÷ 99900 = 3307 ÷ 24975

Therefore The correct answer is 3307/24975.

Alternate Method

Given: x = 0.13241241241...

Formula Used: Conversion of Mixed Recurring Decimals to Vulgar Fractions.

=> Let x = 0.13241241...

=> Multiply by 100: 100x = 13.241241... (Equation 1)

=> Multiply Equation 1 by 1000: 100000x = 13241.241241... (Equation 2)

=> Subtract Equation 1 from Equation 2:

=> 100000x − 100x = 13241.241... − 13.241...

=> 99900x = 13228

=> x = 13228 ÷ 99900

=> Dividing numerator and denominator by 4:

=> x = 3307 ÷ 24975

Therefore The correct answer is 3307/24975.

Additional Information

Pure Recurring Decimal

A decimal in which all digits after the decimal point repeat, e.g., 0.333... = 3/9 = 1/3.

Mixed Recurring Decimal

A decimal in which some digits do not repeat and some do, e.g., 0.1222... = (12 − 1)/90 = 11/90.

Rational Number Property

Every terminating or recurring decimal can be expressed in the form p/q and is thus a rational number.

Q35. Answer: (a) Only (b)

The correct answer is Only (b).

Key Points

The characteristics of the magnetic field produced by a straight conductor carrying current are:

• Magnetic field lines in the shape of concentric circles are created when electric current flows through a straight conductor.

• The strength of the magnetic field at any point is inversely proportional to the distance of the point from the straight conductor and directly proportional to the current magnitude.

• The direction of the magnetic field lines gets reversed if the direction of the current in the conductor is reversed.

Q36. Answer: (b) 3

The positions of letters according to the English alphabet series:

The word can be represented as follows,

Clearly, we can see that 3 such pairs are there HI, ST and AH.

Hence, the correct answer is Option (2).

Q37. Answer: (c) Anurag Thakur

The correct answer is "Anurag Thakur".

Key Points

• The passing of the bill, which was introduced by Union Sports Minister Anurag Thakur in December 2021, in help of establishment of the National Board of Anti Doping in sports, with competent and independent personnel.

• Anti-doping Bill seeks to give NADA powers of 'investigation, levying sanctions for Anti-Doping Rule Violations, the disciplinary procedures to be adopted and the powers of inspection, sample collection and sharing and free flow of information.

• It is intended to provide a "statutory framework for the operation of the National Anti-Doping Agency (NADA), the National Dope Testing Laboratory (NDTL) and other dope testing laboratories and for creation of a National Board for Anti-Doping in Sports to strengthen anti-doping activities in sport.

Q38. Answer: (b) O

Given: Six students, K, L, M, N, O and P.

1. M scores more marks than only three other students.

2) L scores more marks than M.

3) O scores more marks than L.

O > L > M > _ >_ >___

4. K scores more marks than N.

5. P scores more marks than K.

P > K > N

6. P scores less marks than M.

O > L > M > P > K > N

Here, the highest mark scored among all six students is 'O'.

Hence, the correct answer is Option (2).

Q39. Answer: (c) Convex lens having focal length 25 cm

Given:

• The power of first lens is 8 D.

• The power of second lens is -4 D.

Formula Used:

• Net Power, P_(net)=P1+P2

• Focal length, f=1/P

Calculations:

Net Power,

P_(net)=8+(-4); => P_(net)=+4D

Since, the net power is positive, the lens combination will act as converging or convex lens.

Focal length,

f=1/P; => f=1/4; => f = 0.25 m; => f=25cm

Therefore, the lens combination will act as a convex lens having focal length 25 cm.

Q40. Answer: (d) Two

Given: 63547981

The digits is arranged in ascending order from left to right:

Here, 'Two' numbers 3 and 9 will remain unchanged.

Thus, the correct answer is 'Two'.

Q41. Answer: (d) Bombay

The correct answer is "Bombay".

Key Points

• Originally from India, the Indian National Congress is a political party.

• The party was established in 1885, making it the first modern nationalist movement to appear throughout Asia and Africa under the rule of the British Empire. Congress took the lead in the drive for Indian independence at the end of the 19th century.

• Bombay hosted the Congress's inaugural meeting (Mumbai).

Additional Information

• The anti-colonial nationalist movements in the British Empire were greatly influenced by Congress, which also helped India win its independence from Britain.

• A well-known Bengali lawyer named Womesh Chandra Banerjee presided over the meeting. The meeting hosted 72 attendees from across the country.

• This gathering took place in December 1885, the same month that Calcutta hosted the All-India National Conference.

Q42. Answer: (b) Diffusion

The correct answer is Diffusion.

Key Points

• Diffusion is the process of spontaneous movement of a substance from a high concentration to a low concentration area.

• There are two types of diffusion, simple diffusion and facilitated diffusion.

• Simple diffusion is the process by which a substance flows through a semipermeable membrane or in a solution without the aid of transport proteins.

• Facilitated diffusion occurs when molecules passively move from a location of higher concentration to a region of lower concentration through the cell membrane using a carrier molecule.

• Some of the factors affecting diffusion are temperature, particle size, region or area of interaction, and the steepness of concentration gradient.

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Additional Information

• Gaseous exchange refers to the exchange or interchange of gases during respiration or other processses.

• Osmosis is the transfer of solvent molecules via a semipermeable membrane from an area of lower concentration to a region of higher concentration.

• Blood circulates continuously throughout the body as a result of the heart's pumping function and this process is known as circulation.

Q43. Answer: (c) 45^0

Shortcut Trick

For any regular polygon with n sides, the sum of all exterior angles is always 360°.

A regular octagon has n = 8 equal sides.

Measure of each exterior angle = 360° ÷ n = 360° ÷ 8 = 45°.

Therefore The correct answer is 45^0.

Alternate Method

Given: The polygon is a regular octagon.

Formula Used:

Measure of each exterior angle of a regular polygon = 360° ÷ n

Where n is the number of sides of the polygon.

Calculations:

=> For a regular octagon, number of sides (n) = 8

=> Measure of each exterior angle = 360° ÷ 8

=> Measure of each exterior angle = 45°

Therefore The correct answer is 45^0.

Additional Information

Interior Angle of a Regular Octagon

Each interior angle of a regular polygon is given by 180° − (Exterior Angle). For an octagon, it is 180° − 45° = 135°.

Sum of Interior Angles

The sum of interior angles of any polygon with n sides is (n − 2) × 180°. For an octagon, it is (8 − 2) × 180° = 1080°.

Regular Polygon Properties

In a regular polygon, all sides are equal in length and all interior (as well as exterior) angles are equal in measure.

Q44. Answer: (d) 105/6

Shortcut Trick

Total Work (LCM of 10, 12) = 60 units.

Efficiency: A = 6, B = 5. Combined (2 days) = 11 units.

In 10 days (5 pairs): 11 × 5 = 55 units. Remaining = 60 − 55 = 5 units.

On 11th day, A works: Time taken = 5/6 days.

Total Time = 10 + 5/6 = 10(5)/(6) days.

Therefore The correct answer is 10(5)/(6) days.

Alternate Method

Given: Time taken by A = 10 days, Time taken by B = 12 days.

Formula Used: Total Work = Time × Efficiency.

Person	Days	Total Work	Efficiency
A	10	60	6
B	12	5	

=> Work done in 1st day (A) = 6 units

=> Work done in 2nd day (B) = 5 units

=> Work done in 1 cycle (2 days) = 6 + 5 = 11 units

=> Work done in 5 cycles (10 days) = 11 × 5 = 55 units

=> Remaining work = 60 − 55 = 5 units

=> On 11th day, it is A's turn. Time taken by A = 5/6 days

=> Total time = 10 + 5/6 = 10(5)/(6) days

Therefore The correct answer is 10(5)/(6) days.

Additional Information

Alternate Day Concept

In alternate day work, identify the starting person and the work completed in one full cycle (sum of efficiencies of all participants).

Time and Work Relation

Efficiency is inversely proportional to the time taken to complete the work. Efficiency = Total Work ÷ Time.

Remaining Work Calculation

If the remaining work is less than the efficiency of the person whose turn it is, time taken = Remaining Work ÷ Efficiency.

Q45. Answer: (b) 0.90 J

Given:

• The resistance of A is 10 Ω.

• The resistance of B is 30 Ω.

• A and B are connected in series to a battery of 6V.

Formula Used:

• Equivalent Resistance (for series), $R_{eq}=R1+R2$

• Current, $I= V/R$

• Heat Dissipated, $H=I^2Rt$

Calculations:

Equivalent resistance,

R=A+B; => R = 10 +30; => R =40 Ω

Current,

I=V/R; => I = 6/40; => I = 0.15 A

Total heat dissipated in the resistors in 1 second,

$H=I^2Rt$; => $H=0.15^2 \times 40 \times 1$; => H = 0.9 J

Therefore, the total heat dissipated in the resistors in 1 second is 0.90 J.

Q46. Answer: (a) 980

Shortcut Trick

From the quadratic equation x2 − 5x − 14 = 0, identify sum and product of roots.

Sum (a + b) = 5 and Product (ab) = −14.

The expression a3b2 + a2b3 simplifies to a2b2(a + b) = (ab)2(a + b).

Substitute the values: (−14)2 × 5 = 196 × 5 = 980.

Therefore The correct answer is 980.

Alternate Method

Given quadratic equation: x2 − 5x − 14 = 0

Comparing with standard form Ax2 + Bx + C = 0, we get A = 1, B = −5, C = −14.

Using the relations between roots and coefficients:

=> Sum of roots (a + b) = −B/A = −(−5)/1 = 5

=> Product of roots (ab) = C/A = −14/1 = −14

Now, we need to evaluate the expression: a3b2 + a2b3

=> Factor out the common term a2b2:

=> a3b2 + a2b3 = a2b2(a + b)

=> (ab)2 × (a + b)

=> (−14)2 × 5

=> 196 × 5 = 980

Therefore The correct answer is 980.

Additional Information

Vieta's Formulas for Quadratic Equations

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

Nature of Roots

The nature of roots is determined by the Discriminant (D) = b2 − 4ac. If D > 0, roots are real and distinct; if D = 0, roots are real and equal; if D < 0, roots are complex/imaginary.

Formation of Quadratic Equation

If roots a and b are known, the equation is given by x2 − (a + b)x + (ab) = 0.

Q47. Answer: (c) HA<F<S

Given:

Number/ symbol	22	56	33	#	46	&	64	@	%	37	57
Code	L	K	J	H	G	F	D	S	A	P	B

Conditions:

Condition	Result
1. If the first element is a symbol and the last element is a number	then replace these two (first and last) elements with %
2. If the second element is a number and the second last is a symbol	the codes of the first and last elements are to be interchanged
3.If the question has an equal quantity of even and odd numbers	then replace the even numbers with * and odd numbers with <

Given question: # 2264 % 33 & 37 @

Condition 1 → does not follows (the first element is a symbol, but the last element is not a number)

Condition 2 → does not follow (the second element is a number and the second last is not a symbol)

Condition 3 → follow (the question has an equal quantity of even and odd numbers)

So, # 2264 % 33 & 37 @ will be coded as HA<F<S.

Hence, the correct answer is Option (3).

Q48. Answer: (b) Wrinkled, short and white

The correct answer is'Wrinkled, short and white'.

Key Points

• Mendel experiments of inheritance:

• Pea plant was used by Mendel for this experiment.

• It was chosen because this plant has many contrasting characters like a dwarf and tall or wrinkled or round seeds.

• Gregor Mendel, through his experiments on pea plants, discovered the fundamental laws of inheritance.

• His breeding experiments in pea plants revealed that hereditary characteristics are determined by discrete factors (genes) that are transmitted to the next generation.

• He deduced three laws from his experiments and these laws are applicable when parents are pure breeding.

• The three laws of inheritance proposed by Mendel include:

• Law of Dominance

• Law of Segregation

• Law of Independent Assortment

• Mendel coined terms 'dominant' and 'recessive' in terms of the characters studied by him.

• A dominant trait is one that expresses itself in the presence of other contrasting trait and dominates it. eg: tallness.

• A recessive trait is one that is not expressed when present along with the contrasting trait in the hybrid. eg: dwarfness.

• Wrinkled, short and white these are the recessive traits in the pea plant.

Q49. Answer: (c) 252 cm²

Shortcut Trick

Length (L) = 12 cm

Breadth (B) = 25% of 12 = 3 cm

Height (H) = 50% of 12 = 6 cm

Total Surface Area = 2 × (LB + BH + LH) = 2 × (36 + 18 + 72) = 2 × 126 = 252 cm²

Therefore The correct answer is 252 cm².

Alternate Method

Given:

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Length (L) = 12 cm

Breadth (B) = 25% of L = (1/4) × 12 = 3 cm

Height (H) = 50% of L = (1/2) × 12 = 6 cm

Formula Used:

Total Surface Area (TSA) of a cuboid = 2(lb + bh + hl)

Calculations:

=> TSA = 2 × (12 × 3 + 3 × 6 + 6 × 12)

=> TSA = 2 × (36 + 18 + 72)

=> TSA = 2 × 126

=> TSA = 252 cm²

Therefore The correct answer is 252 cm².

Additional Information

Volume of Cuboid

The capacity of a cuboid is calculated as Volume = Length × Breadth × Height (V = L × B × H).

Lateral Surface Area

The area of the four side walls of a cuboid is LSA = 2 × Height × (Length + Breadth).

Diagonal of Cuboid

The longest rod that can be placed in a cuboid is given by √(L² + B² + H²).

Q50. Answer: (a) Tapi River

The correct answer is "Tapi River".

Key Points

• The Tapi River is a river in central India.

• It is one of the major rivers in peninsular India with a length of roughly 724 km and a flow direction from east to west.

• The Tapi River rises to a height of roughly 752 metres near Multai in the Betul district of Madhya Pradesh and flows for a distance of about 724 kilometres before emptying into the Arabian Sea through the Gulf of Cambay.

Additional Information

• There are just three rivers in peninsular India that flow from east to west, the other two being the Narmada River and the Mahi River.

• The second-largest interstate river basin that empties into the west is the Tapi.

• It includes a major portion of the state of Maharashtra as well as portions of Gujarat and Madhya Pradesh.

Q51. Answer: (b) 1

English alphabet and their positional value:

Given Word: TOMORROW

Pairs in both forward and backward directions:

Here, 1 such pairs are there i.e. 'OR'.

Hence, the correct answer is Option (2).

Q52. Answer: (a) 93

The logic followed here is:

Logic: (1st number × 5) + 3 = 2nd number.

1) 6 : 33

2) 11 : 58

Similarly, for 18 : ?

Hence, the correct answer is '93'.

Q53. Answer: (a) L

According to given information, we have the possible arrangements as follows:

1. P is older than only three other persons

• _<_<_< P <_<___

2. N is older than L.

• L < N

3. O is younger than L.

• O < L

4. Collectively (2) and (3) can be written as:

• O < L < N

5. M is older than K.

• K < M

6. P is younger than K.

• P < K

7. Collectively (5) and (6) can be written as:

• P < K < M

8. Final arrangement will be:

• O < L < N < P < K < M

• L is second youngest among all 6 persons.

Thus the correct answer is 'Option 1'.

Q54. Answer: (c) 833.33 gm

Shortcut Trick

The Gain % of 20% can be written in fraction form as 1/5.

This means for every 5 parts of weight given, 1 part is profit.

The ratio of False Weight to True Weight = 5 : (5 + 1) = 5 : 6.

Given that True Weight (6 units) = 1000 gm.

Therefore, False Weight (5 units) = (1000 ÷ 6) × 5 = 833.33 gm.

Therefore The correct answer is 833.33 gm.

Alternate Method

Given:

Gain % = 20%

True Weight = 1 kg = 1000 gm

Let the False Weight used by the dealer be 'x' gm.

Formula Used:

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

Calculations:

=> 20 = [(1000 − x) ÷ x] × 100

=> 20 ÷ 100 = (1000 − x) ÷ x

=> 1 ÷ 5 = (1000 − x) ÷ x

=> x = 5 × (1000 − x)

=> x = 5000 − 5x

=> 6x = 5000

=> x = 5000 ÷ 6 = 833.33 gm

Therefore The correct answer is 833.33 gm.

Additional Information

Dishonest Dealer Concept

When a dealer sells at Cost Price but uses less weight, the Gain % is calculated as [Error ÷ (True Weight − Error)] × 100.

Profit with Markup and False Weight

If a dealer marks up his goods by x% and uses a false weight of y% less, then Net Profit % = [(100 + x) ÷ (100 − y) × 100] − 100.

Profit with Discount and False Weight

If a dealer offers a discount of d% and uses a false weight, the profit is based on the ratio of the Selling Price of the claimed weight to the Cost Price of the actual weight given.

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Q55. Answer: (d) 369

Shortcut Trick

Ratio of digits (hundreds : tens : units) = 3 : 2 : 1.

Possible number is 321 or 642 or 963.

Check 321: 321 + 123 = 444 (Incorrect).

Check 642: 642 + 246 = 888 (Incorrect).

Check 963: 963 + 369 = 1332 (Correct).

Therefore The correct answer is 369.

Alternate Method

Given:

Ratio of Unit digit : Tens digit : Hundreds digit = 1 : 2 : 3.

Sum of number and its reversed number = 1332.

Calculations:

=> Let unit digit = x, tens digit = 2x, hundreds digit = 3x.

=> Original Number = 100(3x) + 10(2x) + x = 300x + 20x + x = 321x.

=> Reversed Number = 100(x) + 10(2x) + 3x = 100x + 20x + 3x = 123x.

=> Sum = 321x + 123x = 444x.

=> 444x = 1332

=> x = 1332 ÷ 444 = 3.

=> Reversed Number = 123 × 3 = 369.

Therefore The correct answer is 369.

Additional Information

Place Value and Face Value

A number abc is represented as 100a + 10b + c, where a, b, c are the face values and 100, 10, 1 are place values.

Reversing Digits

The difference between a 3-digit number and its reverse is always a multiple of 99: (100a + 10b + c) − (100c + 10b + a) = 99(a − c).

Ratio Proportionality

When digits are in a ratio, they must be integers from 0 to 9. This limits the possible values for the multiplier x.

Q56. Answer: (c) a

The correct answer is a.

Key Points

• Inspiration is the process of taking in atmospheric air.

• It is a dynamic process.

• Inspiration occurs when the air pressure drops and the thoracic cavity's volume rises.

• Thoracic cavity capacity increases as external intercostal muscles contract.

• The magnitude of the thoracic activity is further increased by diaphragmatic contraction. At the same time, the lungs expand.

• The internal air pressure of the lungs reduces as they expand.

• As the pressure equalises, the lungs are suddenly filled with atmospheric air.

• At the time of breathing in inhalation process, the air moves from the outside atmosphere into the lungs, the pressure in the lungs is required to be lower than atmospheric pressure.

• During inhalation, the ribs move outwards and the diaphragm lowers or contracts to enhance the volume of the thoracic cavity.

Additional Information

• During inhalation, when the chest expands air enters the lungs.

• This is because during inspiration the diaphragm contracts and moves downwards.

• This leads to an increase in the chest cavity, with the help of the intercostal muscles present between the ribs.

• The chest cavity expands, creating a small vacuum that draws air into the lungs and fills the enlarged alveoli.

• This space is taken up by the lungs when we inhale.

Q57. Answer: (a) π/4 cm²

Shortcut Trick

Diameter (d) = 1/2 cm => Radius (r) = 1/4 cm.

Surface Area of sphere = $4\pi r^2$.
Surface Area = $4 \times \pi \times (1/4)^2 = 4 \times \pi \times (1/16) = \pi/4$ cm².
Therefore The correct answer is $\pi/4$ cm².
Alternate Method
Given:
Diameter (d) = 1/2 cm
Formula Used:
Radius (r) = Diameter / 2
Surface Area (A) = $4\pi r^2$
Calculations:
=> Radius (r) = (1/2) ÷ 2 = 1/4 cm
=> Surface Area = $4 \times \pi \times (1/4)^2$
=> Surface Area = $4 \times \pi \times (1/16)$
=> Surface Area = $\pi/4$ cm²
Therefore The correct answer is $\pi/4$ cm².
Additional Information
Volume of a Sphere
The amount of space occupied by a sphere is given by Volume (V) = $(4/3)\pi r^3$.
Surface Area of Hemisphere
The Curved Surface Area (CSA) is $2\pi r^2$ and the Total Surface Area (TSA) is $3\pi r^2$.
Relationship with Diameter
Surface area can also be expressed in terms of diameter (d) as Area = πd^2.

Q58. Answer: (b) 1, 02, 600

Given:
The ratio of adults to children in city A = 5 : 3
Total population of City A = 410400
Formula:
Difference = total population x (difference between ratio / sum of ratio)
Calculation:
Difference between the total number of adults and the total number of children in City A = 410400 × (5-3)/8
= 410400 x 1/4
= 102,600
Hence, the correct answer is '1, 02, 600'.

Q59. Answer: (a) 18

Shortcut Trick
Identify the sum (S) and product (P) of the given values x and y.
S = x + y = (2 + √5) + (2 − √5) = 4
P = xy = (2 + √5)(2 − √5) = $2^2 - (\sqrt{5})^2 = 4 - 5 = -1$
Apply the algebraic identity: $x^2 + y^2 = S^2 - 2P = 4^2 - 2(-1) = 16 + 2 = 18$.
Therefore The correct answer is 18.
Alternate Method
Given:
x = 2 + √5
y = 2 − √5
Formula used:
$x^2 + y^2 = (x + y)^2 - 2xy$
Alternatively, calculate x^2 and y^2 individually using $(a \pm b)^2 = a^2 + b^2 \pm 2ab$.
Calculations:
=> $x^2 = (2 + \sqrt{5})^2 = 2^2 + (\sqrt{5})^2 + 2(2)(\sqrt{5})$
=> $x^2 = 4 + 5 + 4\sqrt{5} = 9 + 4\sqrt{5}$

=> $y^2 = (2 - \sqrt{5})^2 = 2^2 + (\sqrt{5})^2 - 2(2)(\sqrt{5})$

=> $y^2 = 4 + 5 - 4\sqrt{5} = 9 - 4\sqrt{5}$

=> $x^2 + y^2 = (9 + 4\sqrt{5}) + (9 - 4\sqrt{5})$

=> $x^2 + y^2 = 9 + 9 + 4\sqrt{5} - 4\sqrt{5} = 18$

Therefore The correct answer is 18.

Additional Information

Algebraic Identity for Squares

The fundamental identities are $(a + b)^2 = a^2 + 2ab + b^2$ and $(a - b)^2 = a^2 - 2ab + b^2$.

Sum and Product relationship

For any two numbers, $x^2 + y^2 = (x + y)^2 - 2xy$ and $x^2 + y^2 = (x - y)^2 + 2xy$.

Conjugate Surds

Expressions like $(a + \sqrt{b})$ and $(a - \sqrt{b})$ are conjugates; their product is always a rational number: $a^2 - b$.

Q60. Answer: (a) Gospels

The correct answer is "Gospels".

Key Points

• The first of the four New Testament Gospels, which detail the life and death of Jesus Christ, is the Gospel of Matthew.

• Along with the Gospels of Mark and Luke, it is one of the so-called Synoptic Gospels (i.e., those presenting a common view).

• The poem describes St. Matthew the Evangelist, one of the Twelve Apostles and a tax collector, as the author (10:3).

Additional Information

• It is obvious that the Gospel According to Mark, which came before it.

• It had an impact on the Gospel According to Matthew, which was written in Greek, most likely after 70 CE.

• Regarding the plausibility of an earlier Aramaic translation, there has been significant discussion. Several literary cues point to books.

Q61. Answer: (c) 4

The shadded area represents the Barrels that are only jugs:

Here, Only 4 barrels that are only jugs.

Hence, the correct answer is 'Option 3'.

Q62. Answer: (c) 189

The logic folloowed here is:

1) 18 : 63

2) 44 : 154

3) 54 : ?

Thus, the correct option is '189'.

Q63. Answer: (b) Mitochondria

The correct answer is Mitochondria.

Key Points

• The majority of archaea, eukaryotes, and bacteria break down glucose using a process known as glycolysis.

• It is in charge of generating compounds that serve as precursors for the metabolic processes carried out inside cells as well as energy and reduced electron carriers.

• Pyruvate can go through either aerobic or anaerobic respiration after glycolysis to go through additional breakdown and release more energy.

• The breakdown of pyruvate using O2 takes place in the mitochondria matrix.

• When glucose gets converted to pyruvate by glycolysis, only a small fraction of the total free energy potentially available from the glucose is released.

• In mitochondria, when the metabolism of sugars is completed: the pyruvate is imported into the mitochondria and oxidized by O2 to CO2 and H2O.

• When oxygen is present, pyruvate enters the Krebs cycle in the mitochondria where it is broken down anaerobically.

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• This allows 15 times more ATP to be made as compared to that produced by glycolysis alone.

Q64. Answer: (d) 48

Shortcut Trick

The Empirical Relation is: Median = (Mode + 2 × Mean) ÷ 3

Substitute values: Median = (60 + 2 × 42) ÷ 3

Median = (60 + 84) ÷ 3 = 144 ÷ 3

Median = 48

Therefore The correct answer is 48.

Alternate Method

Given:

Mean of the data = 42

Mode of the data = 60

Formula Used:

Empirical Relationship: Mode = 3 × Median − 2 × Mean

Calculations:

=> 60 = 3 × Median − 2 × 42

=> 60 = 3 × Median − 84

=> 3 × Median = 60 + 84

=> 3 × Median = 144

=> Median = 144 ÷ 3

=> Median = 48

Therefore The correct answer is 48.

Additional Information

Empirical Relationship

For a moderately skewed distribution, the distance between the Mean and the Mode is approximately three times the distance between the Mean and the Median.

Symmetric Distribution

In a perfectly symmetrical distribution (like the Normal Distribution), the Mean, Median, and Mode are all equal: Mean = Median = Mode.

Negatively Skewed Data

When the distribution is negatively skewed (skewed to the left), the values generally follow the order: Mean < Median < Mode.

Positively Skewed Data

When the distribution is positively skewed (skewed to the right), the values generally follow the order: Mode < Median < Mean.

Q65. Answer: (c) It increases the amount of waste going into landfills

The correct answer is It increases the amount of waste going into landfills.

Key Points

• Landfills are places designated for the disposal of trash, garbage, and other types of solid waste.

• Historically, they have been the most often used technique of removing solid waste, which is either buried or allowed to accumulate in heaps.

• Due in major part to the increasing amount of waste generated by our homes, businesses, markets, and hospitals, landfills are a common occurrence around the world.

Additional Information

• Some of the landfills included in integrated waste management are well-managed and built.

• But the majority of towns neglect their landfills, causing land degradation and an unchecked buildup of various kinds of solid waste.

• Here are the causes, effects, and remedies of landfills.

Q66. Answer: (d) Three

Given: Eight students, 1 to 8, are sitting around a circular table facing the center.

1. 1 is the immediate neighbour of both 8 and 2.

2. 3 is sitting second to the right of 1

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3. 1 is sitting second to the right of 7.

4. 5 is the immediate neighbour of 6 and 4.

• Two cases are possible here.

• In both the cases 3 students are there between 5 and 1.

Hence, the correct answer is Option (4).

Q67. Answer: (a) 14 years

The correct answer is "14 years".

Key Points

• No kid under the age of fourteen may be employed to work in a factory, mine, or in any other hazardous occupation, according to Article 24.

• Children under the age of 14 are never allowed to work in any dangerous jobs, factories, or mines, per this article.

• Children may, however, be employed in non-hazardous jobs.

Additional Information

• Article 23(1): Traffic in human beings and the beggar and other similar forms of forced labour are prohibited and any contravention of this provision shall be an offence punishable in accordance with the law.

• Article 23(2): Nothing in this article shall prevent the State from imposing compulsory service for public purposes, and in imposing such service the State shall not make any discrimination on grounds only of religion, race, caste or class or any of them.

Q68. Answer: (b) Four

Given:

(Left) G B D F H & 8 * T % 7 D 4 @ 6 K & 2 R P Q T @ Y # 3 5 E * S (Right)

Logic:

Symbols immediately preceded by a letter and also immediately followed by a number is:

There are 4 such symbols in the series which are immediately preceded by a letter and also immediately followed by a number.

Hence, the correct answer is 'Option 2'.

Q69. Answer: (d) David Ricardo

The correct answer is "David Ricardo".

Key Points

• The first step in understanding economic rent is forgetting what you currently think of as rent.

• Economic rent has nothing to do with the more traditional definition of rent, which is a payment in exchange for the use of something for a set period of time.

• Economic rent is what the owner pays for additional services above what is expected.

• International free trade relies heavily on the idea of comparative advantage.

• According to David Ricardo's theory of international trade, which is partly based on Smith's concept of labour specialisation, countries should concentrate on doing whatever they can do more efficiently and then exchange their surplus for items they can't produce efficiently

Additional Information

• Like many of his contemporaries, David Ricardo was not a qualified economist. Although he didn't study economics, he did go to school to become a stock trader.

• He didn't start thinking and writing about economics until after a successful career in the financial markets, when he read Adam Smith's The Wealth of Nations.

• A family of moderate wealth gave birth to Ricardo in 1772; he was the third of seventeen children to be born into the family. Despite disowning David for choosing a non-Jewish spouse, David's father, a rich stockbroker, gave him the connections he needed to pursue a successful career.

• Ricardo built up his own riches and died at the age of 51, leaving three of his own kids.

Q70. Answer: (c) FICCI Ladies Organisation

The correct answer is "FICCI Ladies Organisation".

Key Points

• The industrial park owned by the FICCI Ladies Organization is the first of its kind in the nation.

• On 50 acres of land in Sultanpur, which is close to Patancheru, this park was constructed.

• It cost 250 crore rupees to produce. Already, female business owners are showing a great desire to establish and run their enterprises in this park.

Additional Information

• In his remarks at the park's opening, IT and Industries Minister KT Rama Rao urged business owners to set high goals and begin considering emerging technology.

• Additionally, he suggested that they focus on the manufacture of agricultural, defence, and aerospace products as well as establish international alliances.

• The minister agreed to add an additional 100 acres to the FLO Women's Industrial Park, subject to the park's viability.

Q71. Answer: (b) 12

Shortcut Trick

Express the base of each term as a prime number.

9^6 → (3^2)^6 → Base is 3.

12^4 → $(2^2 \times 3)$^4 → Bases are 2 and 3.

7^7 → Base is 7.

The distinct prime factors are 2, 3, and 7.

Sum = 2 + 3 + 7 = 12.

Therefore The correct answer is 12.

Alternate Method

Given: Expression = 9^6 × 12^4 × 7^7

Step 1: Prime Factorization

=> 9 = 3^2

=> 12 = $2^2 \times 3^1$

=> 7 = 7^1

Step 2: Substitute in the expression

=> (3^2)^6 × $(2^2 \times 3^1)$^4 × (7^1)^7

=> 3^{12} × 2^8 × 3^4 × 7^7

=> 2^8 × 3^(16) × 7^7

Step 3: Identify distinct prime factors

=> The distinct prime factors are the bases of the prime powers: 2, 3, and 7.

Step 4: Calculate the sum

=> Sum = 2 + 3 + 7

=> Sum = 12

Therefore The correct answer is 12.

Additional Information

Total Number of Prime Factors

If N = a^p × b^q × c^r where a, b, c are primes, total prime factors = p + q + r.

Distinct Prime Factors

These are the unique prime numbers that divide a given integer, regardless of their exponents in the factorization.

Number of Divisors

Total divisors of N = (p+1)(q+1)(r+1). This includes 1 and the number itself.

Q72. Answer: (d) not a quadratic equation

Shortcut Trick

Check the degree (highest power) of the variable x in the equation $x^3 - 3x + 6 = 0$.

Highest power = 3 → This is a Cubic Equation.

A Quadratic Equation must have a degree of exactly 2.

Since the degree is 3, it cannot be a quadratic equation.

Therefore The correct answer is not a quadratic equation.

Alternate Method

Given Equation: $x^3 - 3x + 6 = 0$

Definition: A polynomial equation is called a quadratic equation if it can be written in the standard form $ax^2 + bx + c = 0$, where a ≠

0 and the highest power of the variable is 2.

=> In the given equation $x^3 - 3x + 6 = 0$, the variable is x.

=> The exponents of x are 3 and 1.

=> The highest exponent (degree) of the equation is 3.

=> An equation with degree 3 is known as a cubic equation.

=> Therefore, it does not satisfy the condition of being a quadratic equation.

Therefore The correct answer is not a quadratic equation.

Additional Information

Linear Equation

An equation where the highest power of the variable is 1 (e.g., $ax + b = 0$).

Quadratic Equation

An equation where the highest power of the variable is 2 (e.g., $ax^2 + bx + c = 0$).

Cubic Equation

An equation where the highest power of the variable is 3 (e.g., $ax^3 + bx^2 + cx + d = 0$).

Expression vs Equation

An expression does not contain an equality sign (=), whereas an equation always equates two expressions.

Q73. Answer: (d) Anthracite

The correct answer is Anthracite.

Key Points

• The most metamorphosed variety of coal is anthracite, also referred to as hard coal.

• Its calorific values, which are close to 35 megajoules per kilogramme (15,000 British thermal units per pound), are equivalent to those of the bulk of bituminous coal.

• It possesses the most fixed carbon (86 percent or more) and the least volatile matter (14 percent or less on a dry, ash-free basis) of all the different forms of coal.

• The most uncommon type of coal is anthracite coal.

• Less than 2% of the US's total coal reserves are found in it, largely in northeastern Pennsylvania.

• South Africa, Australia, the eastern Ukraine, western Canada, China, and other areas have less anthracite.

Additional Information

• Bituminous:

• Up to 17 percent moisture can be found in bituminous coal.

• Nitrogen makes up between 0.5 and 2 percent of bituminous coal's weight.

• Up to 85% of its weight can be made up of fixed carbon, while up to 12% of it can be made up of ash.

• Lignite:

• Lignite, often known as brown coal is a soft, brown, flammable sedimentary rock that was created when peat was naturally compacted.

• Due to its relatively low heat content, it is regarded as the lowest rank of coal and has a carbon concentration of between 25 and 35 percent.

• It has a very high moisture content when taken out of the ground, which contributes to its low carbon content.

• Sub-bituminous:

• A lower grade of coal with a carbon content of 35–45% is called sub-bituminous coal.

• This form of coal has qualities that fall between between bituminous coal, the second-highest grade of coal, and lignite, the lowest grade.

• Sub-bituminous coal is primarily utilized as a fuel for the production of steam-electric power.

Q74. Answer: (d) 6 years

Shortcut Trick

Let the middle child be the average age.

Average age = Total Sum ÷ Number of children = 60 ÷ 5 = 12 years.

Since the interval is 3 years, the children ages are: (12 − 6), (12 − 3), 12, (12 + 3), (12 + 6).

Age of the youngest child = 12 − 6 = 6 years.

Therefore The correct answer is 6 years.

Alternate Method

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Given: Sum of ages = 60 years, Number of children = 5, Interval = 3 years.
Formula Used: Sum of an Arithmetic Progression (AP) = n/2 × [2a + (n − 1)d]
Let the age of the youngest child be x.
=> Ages are x, (x + 3), (x + 6), (x + 9), and (x + 12).
=> x + (x + 3) + (x + 6) + (x + 9) + (x + 12) = 60
=> 5x + 30 = 60
=> 5x = 60 − 30
=> 5x = 30
=> x = 30 ÷ 5 = 6
Therefore The correct answer is 6 years.
Additional Information
Arithmetic Progression (AP) in Ages
When ages are at equal intervals, they form an AP where the middle term is the Average of the group.
Average of Odd Terms
For an odd number of terms (n), the Average is always the [(n+1)/2]^(th) term in the sequence.

Q75. Answer: (c) 6.2%

Shortcut Trick
Let CP be 100.
MP = 100 + 18 = 118 (since Profit = 18% at MP).
Discount = 10% of 118 = 11.8.
Actual SP = 118 − 11.8 = 106.2.
Profit % = 106.2 − 100 = 6.2%.
Therefore The correct answer is 6.2%.
Alternate Method
Given → Profit at MP = 18%, Discount = 10%.
Formulas: SP = MP × (100 − D%) ÷ 100 | Profit% = (SP − CP) ÷ CP × 100.
=> Assume Cost Price (CP) = 100.
=> Marked Price (MP) = CP × (100 + 18) ÷ 100 = 118.
=> Selling Price (SP) = MP × (100 − 10) ÷ 100 = 118 × 0.9 = 106.2.
=> Actual Profit = SP − CP = 106.2 − 100 = 6.2.
=> Profit % = (6.2 ÷ 100) × 100 = 6.2%.
Therefore The correct answer is 6.2%.
Additional Information
Relationship between CP and MP
The ratio of Marked Price to Cost Price is given by MP ÷ CP = (100 + Profit%) ÷ (100 − Discount%).
Net Percentage Change
The actual profit can be viewed as the successive effect of Markup percentage (m) and Discount percentage (d): Net % = m − d − (m × d) ÷ 100.

Q76. Answer: (d) West

Diagram is drawn as per the given information:
• Hisar is to the north of Bhiwani.
• Bhiwani is to the west of New Delhi.
• Rohtak is to the south of Panipat and to the east of New Delhi.

Therefore, Hisar is located at the west with respect to Panipat.
Hence, the correct answer is 'West'.

Q77. Answer: (c) 6 years

Shortcut Trick
Age ratio (Now : Marriage) = 1(1/5) : 1 = 6 : 5

Difference in ratio parts = 6 − 5 = 1 unit

Actual time difference = 10 years => 1 unit = 10 years

Ramya present age (6 units) = 6 × 10 = 60 years

Daughter age = 1/10 × 60 = 6 years

Therefore The correct answer is 6 years.

Alternate Method

Let Ramya age at the time of marriage be x years.

Given: Present Age = 1(1/5) × x = 6/5 × x

=> 6x/5 − x = 10

=> (6x − 5x)/5 = 10

=> x/5 = 10 => x = 50 years (Age at marriage)

=> Present Age = 50 + 10 = 60 years

=> Daughter age = 1/10 × 60

=> Daughter age = 6 years

Therefore The correct answer is 6 years.

Additional Information

Ratio Method for Age Problems

When a multiplier like 1(1/5) is given, convert it to an improper fraction (6/5) to represent the ratio between two time periods directly.

Constant Difference Property

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

Fractional Age Relations

If person A is 1/n of person B, then A = B/n. Always ensure to identify the reference person (usually the one mentioned with 'of').

Q78. Answer: (a) Both (a) and (b)

The correct answer is Both (a) and (b).

Key Points

• Solenoid: Using a coil twisted into a compact helix, a solenoid is a form of electromagnet that produces a regulated magnetic field.

• Because electric current flows to produce the magnetic field, solenoids are electromagnets.

• They act like a magnet for bars.

• One end of the solenoid functions as the north pole, and the other as the south pole.

• The field inside the solenoid is never zero but is always uniform.

• This field is supplied with

B = 0 N I, where 0 is the permeability of empty space, N is the number of turns per unit length, and I is the current flowing through the solenoid.

Q79. Answer: (a) 3%

Given:

• The number of students appeared for the bank PO exam (in hundreds) in the years 2013, 2014, 2015, 2016, and 2017 are 54, 68, 120, 200, and 250 respectively.

• The number of students qualified for the bank PO exam (in hundreds) in the years 2013, 2014, 2015, 2016, and 2017 are 134, 130, 190, 230, and 280 respectively.

• The number of students failed for the bank PO exam (in hundreds) in the years 2013, 2014, 2015, 2016, and 2017 are 34, 140, 210, 280, and 160 respectively.

Formula Used:

Percentage Increase, %I = (FV - IV)/IV × 100

Calculations:

Total number of students who failed in the given five years = 34 + 140 + 210 + 280 + 160 = 824

Average number of students who failed in the given five years = 824 ÷ 5 = 164.8

Number of students who failed in 2017 = 160

Here, there is an increase when comparing the average number of students who failed in the given five years with the number of students who failed in 2017.

Calculating percentage increase, we get

%I=(164.8-160)/160 × 100 ; => %I =3%

Therefore, the average number of students who failed in the given five years is more than the number of students who failed in 2017 by 3%.

Q80. Answer: (d) 20th

Drawing the figure as per given information as,

• Nirmal and Sushma are standing in a queue of people facing north.

• Nirmal is at the 20th position from the extreme left end, and

• Sushma is at the 10th position from the extreme right end.

• The positions of Nirmal and Sushma are interchanged due to some criteria based on age.

• If the new position of Nirmal is 30th from the extreme left end, then

Here, 20th is the new position of Sushma from the extreme right end.

Hence, 20th is the correct answer.

Q81. Answer: (a) 20 cm in front of the mirror

The correct answer is '20 cm in front of the mirror '.

Key Points

• f = -10 cm [since rays coming from infinity meet at focus using a concave mirror]

• u = -20 cm

• Since candle flame is placed at the centre of curvature [as object distance is 20 cm which is twice of focal length i.e. center of curvature C],

• so the image will be formed at C.

• So screen will be placed 20 cm from the mirror on the same side of the object.

Q82. Answer: (a) photolytic decomposition reaction

The correct answer is "photolytic decomposition reaction".

Key Points

• Decomposition reaction involves a reactant breaking down into one or more products by taking up energy in the form of heat (thermal decomposition), light (photolytic decomposition) or electricity (electrolytic decomposition).

• Silver chloride in the presence of light energy from the sun, decomposes into silver and chlorine gas.

• 2AgCl (s)→2Ag (s) + Cl2 (g)

• Hence, it is a photolytic decomposition reaction.

Q83. Answer: (d) 1 - cosα

Shortcut Trick

Put a specific value for α to simplify the expression quickly.

Let α = 90°, then sin 90° = 1 and cos 90° = 0.

Expression = 2 − (1^2 / (1 − 0)) + ((1 − 0) / 1) − (1 / (1 + 0))

Expression = 2 − 1 + 1 − 1 = 1.

Check options for α = 90°: (1) 1 − 1 = 0; (2) 1 + 1 = 2; (3) 1 + 0 = 1; (4) 1 − 0 = 1. (Conflict between 3 and 4, try α = 60° or simplify parts).

Therefore The correct answer is 1 − cos α.

Alternate Method

Given: 2 − [$\sin^2\alpha$ / (1 − cosα)] + [(1 − cosα) / sinα] − [sinα / (1 + cosα)]

Formula Used: $\sin^2\alpha + \cos^2\alpha = 1$ => $\sin^2\alpha = 1 - \cos^2\alpha = (1 - \cos\alpha)(1 + \cos\alpha)$

Calculations:

=> Term 1: 2 − [(1 − $\cos^2\alpha$) / (1 − cosα)]

=> 2 − [(1 − cosα)(1 + cosα) / (1 − cosα)] = 2 − (1 + cosα) = 1 − cosα

=> Term 2: [(1 − cosα) / sinα] − [sinα / (1 + cosα)]

=> Take LCM: [(1 − cosα)(1 + cosα) − $\sin^2\alpha$] / [sinα(1 + cosα)]

=> [(1 − $\cos^2\alpha$) − $\sin^2\alpha$] / [sinα(1 + cosα)]

=> Since 1 − $\cos^2\alpha = \sin^2\alpha$, the numerator is [$\sin^2\alpha$ − $\sin^2\alpha$] = 0

=> Combined Expression = (1 − cosα) + 0 = 1 − cosα

Therefore The correct answer is 1 − cos α.

Additional Information

Trigonometric Identities

Fundamental identities include $\sin^2\theta + \cos^2\theta = 1$, $1 + \tan^2\theta = \sec^2\theta$, and $1 + \cot^2\theta = \operatorname{cosec}^2\theta$.

Conjugate Multiplication

Multiplying the numerator and denominator by (1 + cosα) is a common technique to rationalize or simplify denominators containing (1 − cosα).

Q84. Answer: (c) Five

Given:

Nine people, 1 to 9, are sitting in a straight row, facing the north.

Solution:

• 8 is sitting in the middle of the row. This means that 8 is at 5th position.

•

• his immediate left and right neighbours are 5 and 1 .Means 1 is at 6th position and 5 is at 4th position.

•

• . 9 is sitting at one of the extreme ends and his immediate right neighbour is 2.

• 9 must be at position 1st or 9th, 2 is right neighbour. There are two cases:

• • Case 2 is not possible so we will consider case 1.

• Only five people are there between 2 and 3.

• This means 3 is at 8th position.

• • 3 is sitting between 7 and 6.. 1 and 7 are immediate neighbours.

• There are two possible cases

• • As 7 and 1 are immediate neighbours, case 2 is not possible.

• The last vacant space will be occupied by 4.

• People between 4 and 6 are.

•

• There are 5 people between 4 and 6

The correct answer is 'Option 3'.

Q85. Answer: (b) 317

The logic followed here is:

Given: 3, 9, 25, 53, 157, ?

Hence, the correct answer is Option (2).

Q86. Answer: (c) Substitution reaction

The correct answer is 'Substitution reaction'.

Key Points

• The reaction in which an atom or a group in a compound is replaced by another atom or a group is called a substitution reaction.

• During the formation of methyl chloride, a hydrogen atom of methane is replaced by a chlorine atom.

• $CH4+Cl2 \rightarrow CH3Cl+HCl$

• Hence, the formation of methyl chloride from the reaction of methane with chlorine is a substitution reaction.

Q87. Answer: (a) 1010/11 past 2

Given:

The hour hand and minute hand of a clock together means the angle between minute hand and hour hand will be 0º.

Lower value of time (H) = 2 and angle (θ) = 0º (As, hands of a clock will be together)

Concept used:

By formula-

Time=H:(H×5±θ÷60)×12/11

Calculation:

=2:(2×5±0÷60)×12/11

=2:(10±0)×12/11

=2:10×12/11

= 2:120/11

2:1010/11

Thus, the correct answer is ' 1010/11 past 2'.

Q88. Answer: (c) Uttar Pradesh

The correct answer is Uttar Pradesh.

Key Points

• In 2020, the Uttar Pradesh government launched Mission "Shakti" to ensure the safety and respect of women and girls.

• The "Nirbhaya: Ek Pahal" campaign, which will be supported by the Nirbhaya Fund, has officially started the third stage of this mission.

• As a result, about 1000 women from each district in the state, or a total of 75,000 women, will get training kits.

• The Chief Minister emphasized that there was a chaotic environment prior to 2017, when families were wary of their daughters and sisters leaving the house.

• He said that anti-Romeo squads were initially established by the state government to address the problem.

• He claimed that thanks to our efforts, they had accomplished several objectives.

• He went on to say that there were hardly any women employed by the UP police prior to 2017, but that number has since increased to 30,000 female constables.

• CM Yogi Adityanath emphasized that women can increase the production of ready-to-wear clothing, and we want UP to become a center for this.

Additional Information

• The state Department of Micro, Small, and Medium Enterprises will oversee this three-day special training programme.

• The entrepreneurship-related federal and state government initiatives will be made known to women.

• Over the next three months, the state government will support the delivery of capital through a number of programmes.

Q89. Answer: (c) Chairman of Rajya Sabha

The correct answer is Chairman of Rajya Sabha.

Key Points

• The secretary general, who is also India's Vice President, is chosen by the Rajya Sabha Chairman.

• According to the hierarchy of roles, the cabinet secretary, the top bureaucrat in the Indian government, has the status of secretary general.

• The vice president of India (IAST: Bhrat Ke Uparrapati) is the representative of the head of state of the Republic of India, i.e., the president of India.

Additional Information

• The vice presidency is the highest constitutional post following the presidency, coming in second in line of precedence and first in line of succession.

• The vice president is a member of the Indian Parliament and acts as the ex officio chairman of the Rajya Sabha.

Q90. Answer: (b) 36

The correct answer is "36".

Key Points

• For the first time ever, the national games are being held in Gujarat. It will take place from September 29 through October 12, 2022.

• The largest National Games ever will take place with about 15,000 athletes, coaches, and officials competing in 36 sports disciplines from throughout the nation.

• The six cities of Ahmedabad, Gandhinagar, Surat, Vadodara, Rajkot, and Bhavnagar will host the athletic activities.

Additional Information

• Gujarat began the path to build a strong sports infrastructure of world standards under the guidance of the then Chief Minister and current Prime Minister Narendra Modi.

• They assisted the state in becoming ready for the games in a remarkably short amount of time.

Q91. Answer: (d) Only conclusion III follows

Given:

Statements:

I. All pen drives are hard drives.

II. Some hard drives are chips.

III. All chips are keyboards.

Concept used:

These statements can be expressed as:

Solution:

Conclusions:

I. Some keyboards are pen drives.: False- No part of keyboards is contained in pen drives.

II. Some chips are pen drives. False:- No part of chips are contained in pen drives.

III. Some keyboards are hard drives. True- Some portion is contained in hard drives.

Thus the correct answer is 'Only conclusion III follows'.

Q92. Answer: (b) At least two million people must speak the language for it to be considered classical.

The incorrect option is "At least two million people must speak the language for it to be considered classical".

Key Points

• High antiquity of its earliest writings and history as preserved throughout a time span of 1500–2000 years,

• a body of classical literature or texts that has been revered as a priceless cultural legacy by successive speakers gives the classical language.

• The literary tradition must be unique and unaltered from that of another speaking group.

Additional Information

• There may be a break between classical language and its later forms or offshoots since classical language and literature are unique from modern.

• India now has six classical languages.

• The Indian government has designated certain languages as classical.

• In accordance with the Ministry of Culture's rules, classical languages are recognised.

Q93. Answer: (c) It will be less than Average Production

The correct answer is "It will be less than Average Production".

Key Points

• The marginal product and average product have a close relationship.

• The marginal product will alter the average product with each extra unit, and vice versa. The marginal product will decrease if the average product falls or drops.

• The marginal product, however, will always be negative or zero and be less than the average product.

• The marginal and average productivity will be impacted by changes in each unit of output.

Additional Information

• When the average product is at its highest value, marginal product equals average product.

• When average product declines, marginal product does not rise.

• When the average product is declining, the marginal product will not surpass.

• The marginal product will fall and the average product will always be less than the marginal product.

Q94. Answer: (d) AVGKT

Given:

Number/ Symbol	**4**	**prop. to**	**5**	**9**	**÷**	**±**	**8**	**$**	**!**	**3**	**@**	**6**	**7**	**2**
Code	C	G	K	Q	W	R	T	V	X	D	A	E	H	G

Rule no	**Conditions**	**Results**
1.	the first element is a number and the last, a symbol,	the codes for these two (the first and the last elements) are to be interchanged.
2.	the first element is an EVEN number and the last, an ODD number,	the first and last elements are to be coded as !
3.	If both the third and the fourth elements are prime numbers,	the fourth element is to be coded as the code for the third element and vice-versa.

Given code - 8 $ 5 2 @

Here the Rule number 1 and 3 is applied in the given code. i.e.

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

2) If both the third and the fourth elements are prime numbers, the fourth element is to be coded as the code for the third element and vice-versa.

Hence, code for '8 $ 5 2 @' is “AVGKT”.

Q95. Answer: (a) 61

Given:

62 + 32 + 24

Formula Used:

a2 = a × a

a4 = a × a × a × a

Calculations:

62 + 32 + 24 = (6 × 6) + (3 × 3) + (2 × 2 × 2 × 2)

=> 36 + 9 + 16

=> 61

Therefore, the correct answer is '61'.

Q96. Answer: (b) 12 m

Drawing figure as per given information as,

• Q started from a point and walked towards the south for 42 m and reached point A.

• Q then turned right from point A and walked 2 m,

• he then turned right again and walked 30 m.

• Q turned left now and walked 10 m,

• he then turned left again and walked 30 m.

Here, 12m far is Q from point A.

Hence, '12 m' is the correct answer.

Q97. Answer: (d) Labs

Given:

the Art room, the Library, the Gym, the Labs, the storerooms, the staffrooms and the Classrooms are there on seven different floors of the same building

Solution:

• No other floors are there below the Library, This means library is at floor 1:

•

• The Library is immediately below the Gym .This means Gym is at floor 6.

•

• Only two floors are there between the Gym and the Classrooms.

• Two possibilities are there either classroom is below or above gym. There is no space below gym so classroom must two floor above Gym. Hence classroom is at 5th floor.

• • Both the Labs and the Staffrooms are on even numbered floors.

• There are two vacent even number floors i.e 4 and 6. There are two possible cases.

•

• Only three floors are there between the storerooms and the Art room.

• There are further two cases possible.

•

• The Storerooms are immediately below the Labs.

• Case 2 follows this condition so the correct arrangement is:

•

Labs is at 4th floor.

Hence, the correct answer is 'Option 4'.

Q98. Answer: (b) 3

Shortcut Trick

Directly expand the given expression and combine like terms mentally.

Observe that $3 \times 5x^2 = 15x^2$ and $-5 \times 3x^2 = -15x^2$ cancel each other out.

Focus on the remaining terms: $-21 - 10x + 35 = -16$

=> $14 - 10x = -16$

=> $-10x = -30$ => $x = 3$

Therefore The correct answer is 3.

Alternate Method

Given:

$3(5x^2 - 7) - 5(3x^2 + 2x - 7) = -16$

Calculations:

=> Expanding the brackets using the distributive property:

=> $(15x^2 - 21) - (15x^2 + 10x - 35) = -16$

=> $15x^2 - 21 - 15x^2 - 10x + 35 = -16$

=> Grouping the like terms together:

=> $(15x^2 - 15x^2) - 10x + (35 - 21) = -16$

=> $0 - 10x + 14 = -16$

=> $-10x = -16 - 14$

=> $-10x = -30$

=> $x = -30 \div -10$

=> $x = 3$

Therefore The correct answer is 3.

Additional Information

Distributive Property

When simplifying expressions, multiply the term outside the bracket by every term inside: $a(b + c) = ab + ac$.

Sign Rules for Multiplication

Remember that multiplying a negative by a positive gives a negative, and multiplying a negative by a negative results in a positive sign.

Linear Equations

If all higher power terms (like x^2) cancel out in a polynomial equation, it reduces to a linear equation of the form $ax + b = 0$, which yields a single unique solution.

Q99. Answer: (b) Argument II weakens, while argument I strengthens the statement

Given:

Statement:

Students have complained that questions outside the prescribed syllabus were asked in the X standard board exams this year.

Conclusion:

Arguments:

I. The pass percentage in the X standard board exams has declined by 8 percent this year. True : As the question were outside the prescribed syllabus, so there is possibility that students will score less marks and pass percentage will decrease, Hence this argument strengthens the statemen.

II. This number of students scoring over 60 percent in the X standard board exams has shown an increase of 15 percent this year. False: As the question were outside the prescribed syllabus, so there is possibility that students will score less marks but here the pass percentage is increasing so this case weakens the statement.

Thus the correct answer is 'Argument II weakens, while argument I strengthens the statement '.

Q100. Answer: (d) Australia

The correct answer is Australia.

Key Points

- The freedom of trade, commerce, and exchange within the nation is discussed in Article 301.
- It provides that the ability to engage in these activities shall be unrestricted, subject to additional requirements under Part XIII.
- The Australian constitution is where India borrowed the idea of free trade for its own constitution.

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• The constitution's Article 19 G grants the right to engage in any employment, trade, or business.

• According to Section 92 of the Australian Constitution, there should be freedom of trade, commerce, and intercourse that can be conducted through internal or ocean transportation.

• The Australian Constitution's Section 92 states that there should be freedom of trade, commerce, and intercourse that can be conducted via internal or ocean transportation.

Additional Information

• The things borrowed by other countries are given as follows:

1. USSR:

• Fundamental duties

• Ideals of justice

2. Germany:

• The Union will have emergency powers

• Fundamental rights will be suspended in an emergency.

3. Ireland:

• Directive Elements of Government Policy

• Nomination of Rajya Sabha members

• Method of President Election

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