RRB Group D Previous Year Paper (Held on: 18 Aug 2022 Shift 1)

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

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

Statement - I: If a substance loses oxygen during a reaction, it is said to be reduced.

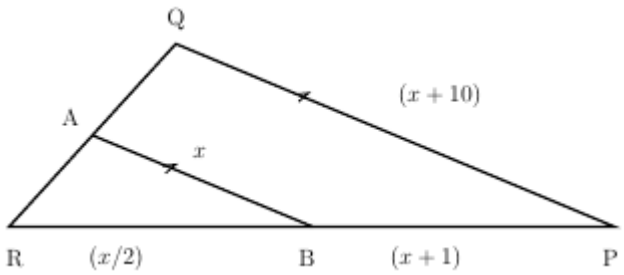
Statement - II: If a substance gains hydrogen during a reaction, it is said to be reduced.

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

Q2. In March 2022, which state has become the first to start 'Air Health Service' in rural areas?

(a) Tamil Nadu
(b) Bihar
(c) Gujarat
(d) Odisha

Q3. In the given figure, AB || QP. AB = x, PQ = x + 10. RB = x/2, BP = x + 1. Find PQ



(a) 13 units
(b) 14 units
(c) 18 units
(d) 12 units

Q4. The table below shows the differences between the structure and function of plants and animals.

Sr. no.	Plants	Animals
a.	Do not move	Move in search of food, mate and shelter
b.	Most tissues are dead	Most tissues are living
c.	Need less energy	Need more energy
d.	Growth is limited to certain regions	Growth is limited to certain regions

Which option shows the INCORRECT statement?

(a) b

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

Q5. Select the option that is related to the fifth number in the same way as the second number is related to thé first number and the fourth number is related to the third number.

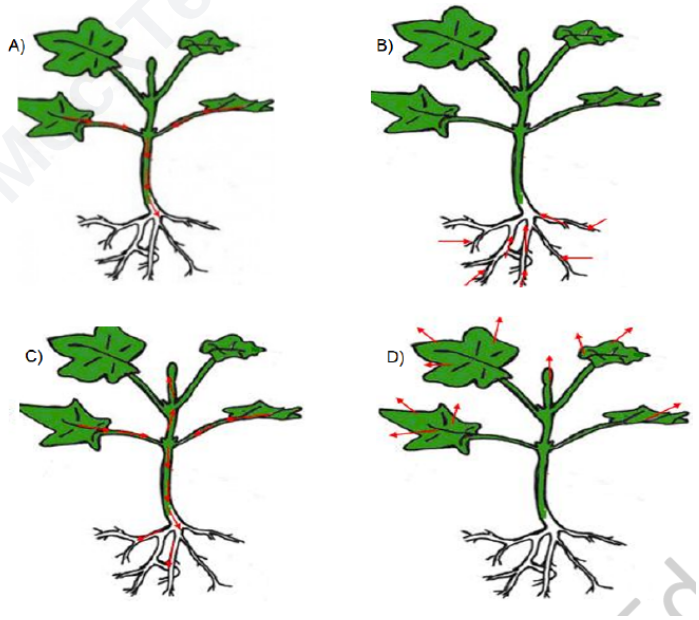
11 : 130 :: 7 : 58 :: 15 : ?

(a) 216
(b) 234
(c) 248
(d) 224

Q6. Who among the following is considered as the founder of Islam?

(a) Prophet Abraham
(b) Prophet Noah
(c) Prophet Yusuf
(d) Prophet Muhammad

Q7. Which figure is the correct representation of the movement of food in phloem?



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

Q8. What was the achievement of Dobereiner's triads?

(a) First attempt to study the size of atoms.
(b) First attempt to relate the properties of elements with atomic mass.
(c) First attempt to study the colour of elements.
(d) First attempt to study the atomicity of molecules.

Q9. Eight friends Kriti, Durga, Manasi, Surya, Tahira, Vritti, Ahana and Yoshita are sitting around an square table in such a way that four friends are sitting on the corners of the table while the other four are sitting at the exact centre of sides of the table. All are facing the centre of the table. Surya is sitting at the third place to right of Durga. Only Tahira is between Kriti and Durga. Manasi is second to left of Durga. Only Vritti is sitting between Surya and Yoshita. Yoshita is second to left of Ahana. Vritti is second to left of Manasi. Who is sitting third to left of Tahira?

(a) Surya
(b) Ahana
(c) Yoshita

(d) Manasi

Q10. Which of the following properties do covalent compounds generally NOT exhibit?

(a) They form by sharing of electrons.
(b) They do not form ions generally.
(c) They are not soluble in an organic solvent.
(d) They are bad conductors of electricity and heat.

Q11. Under which five-year plan was Bharat Nirman started by the Government of India to upgrade rural infrastructure?

(a) Ninth Five Year Plan
(b) Tenth Five Year Plan
(c) Eighth Five Year Plan
(d) Sixth Five Year Plan

Q12. In a clearance sale, a sari whose marked price was Rs. 10,490, is now sold for Rs. 9,441. What is the discount per cent on the sari?

(a) 18%
(b) 10%
(c) 12%
(d) 15%

Q13. A wire of a given material has length 'l' and resistance 'R'. Another wire of the same material having three times the length and twice the area of cross section will have a resistance equal to:

(a) 3 R
(b) 1/2 R
(c) 2/3 R
(d) 3/2 R

Q14. 2.666... + 2.77... in fraction form is:

(a) 49/9
(b) 47/9
(c) 29/9
(d) 31/9

Q15. Among six persons. P, Q, R, S, T and U, each one has a different weight. The weight of Q is more than only two other persons. The weight of P is more than U's weight. The weight of S is more than Q's weight. The weight of R is less than the weight of T. The weight of Q is more than the weight of T. U has the second highest weight among all the six persons. Who has the third highest weight among all six persons?

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

Q16. Identify the correct chemical reaction involved in bleaching powder preparation

(a) $NaCl + H_2O + CO_2 + NH_3 \rightarrow NH_4Cl + NaHCO_3$
(b) $2\ NaCl\ (aq) + 2\ H_2O\ (l) \rightarrow 2\ NaOH\ (aq) + Cl_2\ (g) + H_2\ (g)$
(c) $Ca(OH)_2 + Cl_2 \rightarrow CaOCl_2 + H_2O$
(d) $NaHCO_3 + H^+ \rightarrow CO_2 + H_2O$ + Sodium salt of acid

Q17. The simple interest on Rs. 1,280 at 5% p.a. for 3 years is:

(a) Rs. 480
(b) Rs. 192
(c) Rs. 195
(d) Rs. 180

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Q18. Which of the following elements is the most reactive?

(a) Pb
(b) Mg
(c) Al
(d) Ca

Q19. How and when is oxygen produced as a waste product in plants?

(a) By respiration during the night
(b) By respiration during the day
(c) By photosynthesis during the day
(d) By photosynthesis during the night

Q20. A, B, C, D, E and F were six friends playing games around a circular table. They were standing facing the centre of the table. E was standing to the immediate left of A. C was second to the left of F. There were exactly two people between D and A. B was at the immediate right of A. Which friend was at the immediate right of F?

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

Q21. An item costs Rs. 2,000 less than Rs. 5,000. The dealer offers a discount of 10% and the retailer further offers a discount of 5% on its CP. The final SP for the customer is:

(a) Rs. 2,878
(b) Rs. 1,987
(c) Rs. 2,565
(d) Rs. 3,454

Q22. Six girls decided to record a video of their talks, one on each separate day of the same week. Sunday will be a rest day. P said Friday will suit her. U will start the process and record on Monday. S will record immediately before T. Q will record on a day exactly between the days of U and S. T selected Thursday. Which day is left for R to record the video?

(a) Thursday
(b) Saturday
(c) Monday
(d) Wednesday

Q23. 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 grasses are shrubs.

II. All roots are fruits.

III. All fruits are flowers.

Conclusions:

I. All grasses are flowers.

II. All roots are flowers.

III. Some flowers are fruits.

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

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Q24. Which of the following statements are correct?

(a) For a lens the first principal focus is the position of the object whose image is at infinity

(b) For a lens the first principal focus is the position of the object whose image is formed at twice the focal length.

(c) For a lens the second principal focus is the position of the real image whose object is at infinity

(d) For a lens the second principal focus is the position of the object whose image is formed at twice the focal length

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

Q25. If a and b are the roots of x2 + x - 2 = 0, then the quadratic equation in x whose roots are 1/a + 1/b and ab is:

(a) 2x2 + 3x - 2 = 0
(b) 2x2 - 5x + 2 = 0
(c) 2x2 + 5x - 2 = 0
(d) 2x2 - 3x + 2 = 0

Q26. Select the option that represents the letters that, when placed from left to right in the same sequence in the blanks below, will complete the letter series.

B _ M _ Q _ V M W _ B V M W _ B V _ _ T

(a) V W V R R M W
(b) V W V R S M R
(c) V W B V S W M
(d) V W B R S M W

Q27. A statement is given, followed by four conclusions given in the options. Find out which conclusion is true based on the given statement.

Statement: H = W > F ≥ S ≥ T > Y

(a) Y < S
(b) T ≥ F
(c) H < F
(d) W < T

Q28. 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	5	6	8	3	%	#	7
Codes	U	S	C	K	D	T	A

Conditions:

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

(ii) If the second element is a symbol and the fifth element is an even number, the codes for these two (the second and the fifth elements) are to be interchanged.

(iii) If the third element is a number and the fourth element is a symbol, both these elements (the third and the fourth elements) are to be coded as W.

Question: 5 # % 6 7 # 3 8

(a) C A D S T T K U
(b) C T D S A T K U
(c) C T W W A T K U
(d) U T D S A T K C

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Q29. Match the following:

	A		B
i.	red cabbage leaves	a.	olfactory indicator
ii.	methyl orange	b.	acid base indictor
iii.	Onion, clove	c.	natural acid base indictor

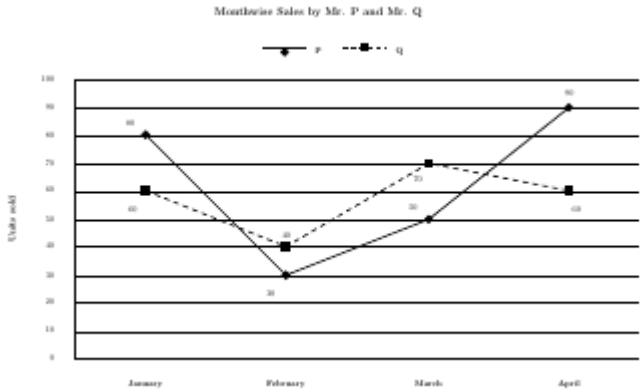
(a) i - c, ii - a, iii - b
(b) i - c, ii - b, iii - a
(c) i - a, ii - b, iii - c
(d) i - a, ii - c, iii - b

Q30. Which of the following is worshipped by people during the festival of Pongal?
(a) God Shiva
(b) The Sun
(c) Maa Durga
(d) The Moon

Q31. If two parallel lines are intersected by a transversal, then which of the options below is not necessarily correct?
(a) A pair of corresponding angles have the same measure.
(b) A pair of interior angles on the same side of the transversal have the same measure.
(c) A pair of vertically opposite angles have the same measure.
(d) A pair of alternate interior angles have the same measure.

Q32. If '+' means '÷', '-' means '+', '×' means '-' and '÷' means '×', then what will be the value of the following expression?
[{(23 × 15) - (1 ÷ 4)} + (2 - 2)] ÷ 2
(a) 8
(b) 4
(c) 6
(d) 10

Q33. The graph and the table below show the units sold by two salesmen, Mr. P and Mr. Q, in 4 months from January to April. Study the graph and the table and answer the question



What is the respective ratio of the total units sold by Mr. P and Mr. Q during the 4 months?
(a) 25 : 27
(b) 24 : 23
(c) 23 : 21
(d) 25 : 23

Q34. Which of the following uses spores to reproduce?
(a) Yeast
(b) Ferns
(c) Amoeba

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(d) Mango

Q35. Which of the following ministries introduced The Weapons of Mass Destruction and their Delivery Systems (Prohibition of Unlawful Activities) Amendment Bill, 2022, in the Lok Sabha on 5 April 2022?

(a) Ministry of Law and Justice
(b) Ministry of Home Affairs
(c) Ministry of External Affairs
(d) Ministry of Defence

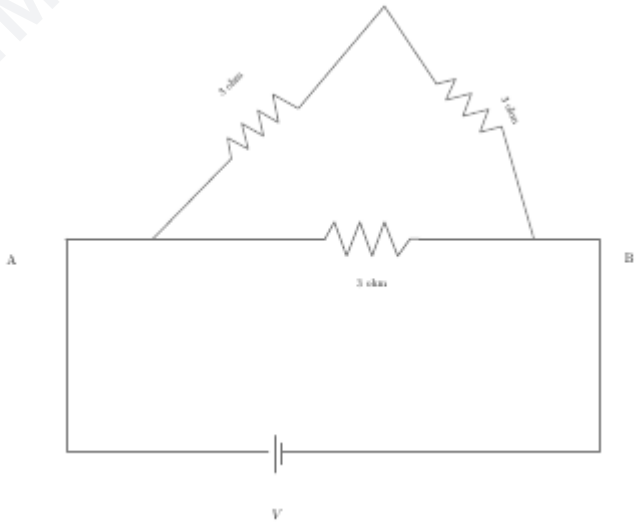
Q36. The position of how many letters will remain unchanged if each of the letters in the word ‘DIRECT’ is arranged in alphabetical order?

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

Q37. A can count 100 eggs in 4 minutes while B can count the same number of eggs in 5 minutes. How much time will be required if they work together to count 450 eggs?

(a) 5 min
(b) 15 min
(c) 20 min
(d) 10 min

Q38. The equivalent resistance between points A and B shown in the figure below:



(a) 9 Ω
(b) 2 Ω
(c) 4.5 Ω
(d) 6 Ω

Q39. In a certain code language, 'GLEPK’ is written as 'DIBMH' and 'QRYHN' is written as 'NOVEK'. How will 'POTER’ be written, in that language?

(a) LMPOB
(b) MLPOB
(c) MLQBO
(d) LMQOB

Q40. This question is based on the five, three-digit numbers given below:

(Left) 158 438 182 325 230 (Right)

If 5 is added to the first digit of every number, in how many numbers will the first digit be exactly divisible by the second digit?

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

Q41. Which of the following numbers will replace the question mark (?) in the given series?

0, 2, 6, 12, 20, ?

(a) 35
(b) 34
(c) 28
(d) 30

Q42. Which of the following is NOT a possible isomer of hexane?

(a) 2-methyl pentane
(b) 3-methyl pentane
(c) 2-ethyl pentane
(d) 2,2 dimethyl butane

Q43. Three statements are followed by four conclusions numbered I, II, III and IV. You have to consider these statements to be true, even if they seem at variance from commonly known facts. Decide which of the given conclusions logically follow/s from the given statements.

Statements:

1. All couriers are shipments.

2. All shipments are transports.

3. No haul is transport.

Conclusions:

I. No transport is shipment.

II. All couriers are transports.

III. Some transports are shipments.

IV. No courier is haul.

(a) Only conclusions II and IV follow.
(b) Only conclusions I and IV follow.
(c) All conclusions follow.
(d) Only conclusions II, III and IV follow.

Q44. P, Q, R, S, T, U and V live 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. U lives on the top floor. Only two persons live between T and Q. Q is on floor number 3. V lives on the floor immediately above P's floor. S lives on the floor immediately above R's floor. Q lives on the floor immediately below R's floor. Who lives on floor number 6?

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

Q45. The position of how many letters will remain unchanged if each of the letters in the word 'LAMENT' is arranged in alphabetical order?

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

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Q46. Janhvi starts walking from her home and goes 45 m towards the west. She then turns right and walks 32 m. Then, she turns right and walks 88 m. After that, she turns right and walks 50 m. Finally, she turns right again and walks 43 m. How far and in which direction is she now from her home? (All turns are 90 degree turns only)

(a) 18 m, South
(b) 16 m, South
(c) 45 m, North
(d) 18 m, North

Q47. Three statements are followed by three conclusions numbered I, II and III. You have to consider these statements to be true, even if they seem to be at variance with commonly known facts, and decide which of the given conclusions logically follow/s from the given statements.

Statements:

All donkeys are zebras.

Some bulls are cats.

Some donkeys are apes.

Conclusions:

(I) Some zebras are bulls.

(II) Some zebras are apes.

(III) Some donkeys are cats.

(a) None of the conclusions follow
(b) Only conclusion III follows
(c) Only conclusion II follows
(d) Only conclusion I follows

Q48. One of the roots of the equation x2 - 12x + k = 0 is x = 3. The other root is _____.

(a) x = -9
(b) x = -4
(c) x = 9
(d) x = 4

Q49. How many languages are there in the 8th schedule of the Indian Constitution as on June 2022?

(a) 19
(b) 25
(c) 15
(d) 22

Q50. If 9 : 12 : 12 : x, and 28 : 42 : 42 : y, then the value of 2x + y is:

(a) 69
(b) 79
(c) 95
(d) 84

Q51. A boy focusses a sharp image of a distant object on a screen using a lens. The distance between the lens and screen is approximately equal to:

(a) f/3
(b) 2f
(c) f
(d) f/2

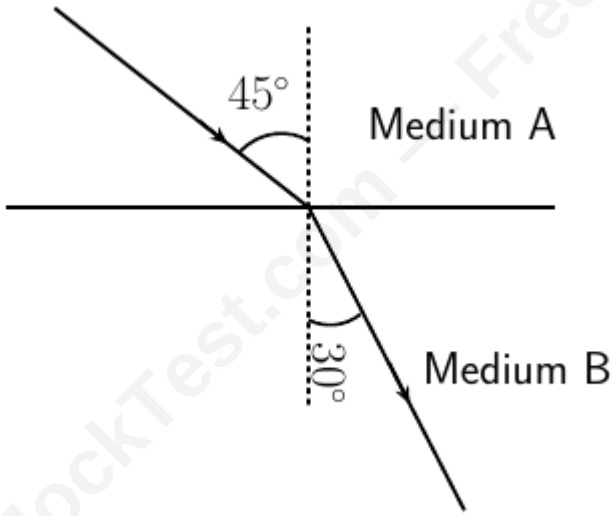
Q52. In January 2022, Paytm Money launched India's first intelligent messenger called _____.

(a) Pops
(b) Pay Money
(c) PayU
(d) Cops

Q53. The HCF of any set of 10 co-prime numbers is always

(a) 10
(b) 1
(c) 0
(d) 2

Q54. The path of a ray of light incident on an interface separating two media is shown in the figure below. The refractive index of medium A with respect to medium B is equal to:



(a) 1/2√2
(b) 2√2
(c) √2
(d) 1/√2

Q55. Which of the following should be done to conserve coal and petroleum?

(a) Avoid substituting CFL bulbs for standard incandescent bulbs.
(b) Solar cookers should be avoided at all costs.
(c) Avoid using public transportation or joining a carpool.
(d) Do not overuse air conditioning or heating systems.

Q56. The area (in square units) of the quadrilateral ABCD, formed by the vertices A (0, -2), B (2, 1), C (0, 4), and D (-2, 1) is:

(a) 12
(b) 14
(c) 15
(d) 13

Q57. A television costs Rs. 35,000 less than a printer. If the cost of the printer is twice the cost of the television, then the cost of the television is:

(a) Rs. 15,700
(b) Rs. 17,500
(c) Rs. 35,000
(d) Rs. 53,000

Q58. My father is presently 25 years older than me. The sum of our ages 5 years ago was 39 years. Find my present age.

(a) 20 years
(b) 13 years
(c) 12 years
(d) 15 years

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Q59. If x and y are the two digits of the number 115 xy such that this number is divisible by 90, then the value of x + y is:

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

Q60. An AC generator works on the principle of:

(a) electromagnetism
(b) heating effect of electric current
(c) electromagnetic induction
(d) force on a current carrying conductor

Q61. Some reasons highlighting the importance of delivering sex education in schools are mentioned below. Choose the incorrect option.

(a) Helps to keep teenagers away from sexual abuse
(b) Discouraging various myths and misconceptions
(c) Knowing about their body changes, teenagers start making fun of each other
(d) Knowledge about changes taking place during puberty

Q62. If three numbers are in the ratio 5 : 6 : 8 and the sum of their squares is 1250, then the product of those numbers is:

(a) 2400
(b) 2400√10
(c) 1200
(d) 1200√10

Q63. Two boxes have chocolates in the ratio 7 : 5. If the difference in the number of chocolates is 28, find the number of chocolates in the box with larger numbers.

(a) 84
(b) 91
(c) 77
(d) 98

Q64. The value of 53 × 54 × 52 = ?

(a) 56
(b) 59
(c) 55
(d) 57

Q65. Pankaj Advani bagged his 41st title by defeating whom, to lift his 8th title at the Asian 100 UP Billiards Championship 2022?

(a) Sourav Kothari
(b) Manan Chandra
(c) Aditya Mehta
(d) Dhruv Sitwala

Q66. According to the 'World Economic Outlook-April 2022' report, raised India's GDP growth estimate to 9% for 2022-23 and for 2023-24 it forecast the economy to grow by 7.1%. Who released this report?

(a) Reserve Bank of India
(b) Ministry of Finance of India
(c) International Monetary Fund (IMF)
(d) World Bank

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Q67. Which Amendment of the Constitution of India envisages the Gram Sabha as the foundation of the Panchayat Raj System to perform functions and powers entrusted to it by the State Legislatures?

(a) 71st
(b) 63rd
(c) 73rd
(d) 54th

Q68. A truck travels at a speed of 60 km/h from city P to city Q and returns to city P by the same route at a speed of 100 km/h. What is the average speed of the truck for the given journey?

(a) 85 km/h
(b) 80 km/h
(c) 75 km/h
(d) 70 km/h

Q69. India launched a commemorative logo to mark her 30th anniversary of diplomatic ties with which of these countries?

(a) Spain
(b) America
(c) Israel
(d) Canada

Q70. A motor car starts with a speed of 60 km/h and increases its speed after every two hours by 15 km/h. In how much time will it cover a distance of 360 km?

(a) 9 hours
(b) 5 hours
(c) 7 hours
(d) 2 hours

Q71. Which two numbers should be interchanged to make the given equation correct?

$7 \times 8 + 9 - 6 \div 3 = 59$

(a) 8 and 9
(b) 6 and 9
(c) 3 and 6
(d) 7 and 3

Q72. The value of $\sqrt{(1 - \cos\theta)/(1 + \cos\theta)}$ is:

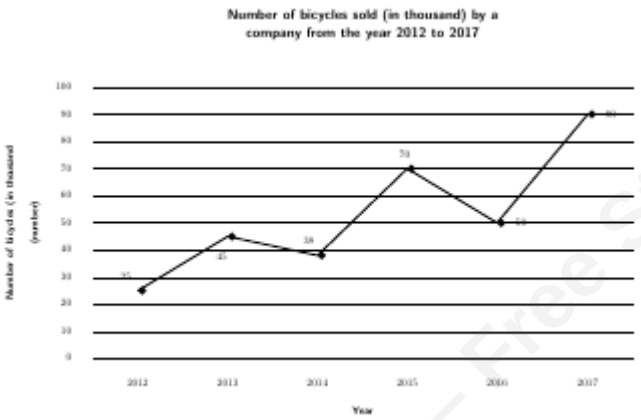
(a) $\text{cosec}\ \theta + \cot\theta$
(b) $\text{cosec}\ \theta - \cot\theta$
(c) $\sec\theta - \cot\theta$
(d) $\sec\theta + \cot\theta$

Q73. In how many states was the first round of Mission Indradhanush (IMI) 4.0 organised by the Union Ministry of Health and Family Welfare in February 2022, with an aim to increase full immunisation coverage?

(a) 16
(b) 14
(c) 11
(d) 8

Q74. Study the following line graph carefully and answer the given question.

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The number of bicycles sold in 2013 is approximately what percent of the number of bicycles sold in 2017?

(a) 50%
(b) 10%
(c) 45%
(d) 100%

Q75. The value of 0.0486 ÷ 0.002 =

(a) 13.8
(b) 24.3
(c) 21.5
(d) 18.7

Q76. Anita is standing facing the north direction. Then, she turns 135° anticlockwise. After that, she turns 90° clockwise. In which direction is she facing now?

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

Q77. A statement is given followed by two assumptions numbered I and II. You have to assume everything in the statement to be true and decide which of the given assumptions is/are implicit in the statement.

Statement:

Essay writing is an art. It requires an understanding of the subject as well as a command over the language to be able to write a good essay.

Assumptions:

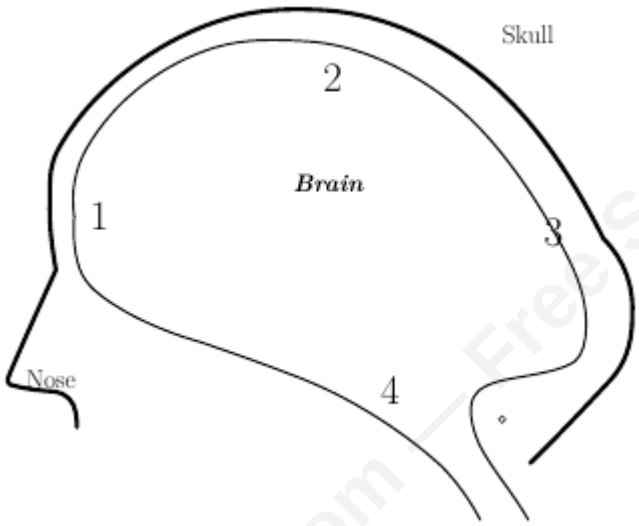
I. Essays cannot be written without complete mastery over the subject.

II. Anyone with a good command over the language can write a good essay.

(a) Neither assumption I nor II is implicit
(b) Only assumption II is implicit
(c) Both assumptions I and II are implicit
(d) Only assumption I is implicit

Q78. Which of the following numbers indicates the spinal cord's location in the human brain?

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

Q79. Which of the following is NOT included in the financial budget of India?
(a) Credit control
(b) Revenue deficit
(c) Primary deficit
(d) Fiscal deficit

Q80. Select the option that is related to the fifth letter-cluster in the same way as the second letter-cluster is related to the first letter-cluster and the fourth letter-cluster is related to the third letter-cluster.
BEING : YVRMT : : PRIDE : KIRWV : : CLEAN: ?
(a) GOVZP
(b) XPVRM
(c) XOVZM
(d) XOWZM

Q81. Identify the long jumper of India who won a silver medal at the U-20 World Athletics Championships in the year 2021.
(a) Mercy Kuttan
(b) Shaili Singh
(c) Nayana James
(d) Seema Punia

Q82. Consider the below statements and identify the correct answer.
Statement I: Dobereiner gave the law of triads.
Statement II: Dobereiner tried to arrange the elements with different properties into groups, having three elements each.
(a) Both statements are correct. Statement II is correct explanation of Statement I.
(b) Only Statement I is Correct.
(c) Both Statements are correct. Statement I is correct explanation of Statement II.
(d) Only Statement II is correct.

Q83. Which of the following is NOT a biotic component of the ecosystem?
(a) Frog
(b) Flower
(c) Insect
(d) Soil

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Q84. According to the Economic Survey 2021-22, what is the rank of India (Globally) in average annual net gain in forest area?

(a) 4^(th)
(b) 1^(st)
(c) 3^(rd)
(d) 2^(nd)

Q85. Which social reformer founded the 'Brahmo Samaj' in 1828 and became famous for his pioneering role in advocating education and opposing practices like Sati, child marriage and social division?

(a) Swami Vivekananda
(b) Ishwarchandra Vidyasagar
(c) Swami Dayanand Saraswati
(d) Raja Ram Mohan Roy

Q86. Which of the following falls under Article 51A of the Indian Constitution?

(a) Promotion of International peace and security
(b) Cultural and Education Rights
(c) Fundamental rights
(d) Fundamental Duties

Q87. A group of class IX students conducted a survey for the number of family members in a household on 40 households in a locality, which resulted in the given frequency table. What is the mode of the data?

Family size	Number of families
2 - 4	10
4 - 6	8
6 - 8	12
8 - 10	6
10 - 12	4

(a) 6.9
(b) 6.8
(c) 6.6
(d) 6.7

Q88. How many times are the hour and the minute hands of a clock at a right angle in a period of two days?

(a) 88
(b) 77
(c) 48
(d) 92

Q89. 1 horsepower equals:

(a) 746 J
(b) 746 kW
(c) 74.6 J/s
(d) 746 W

Q90. Which of the following statements is/are correct?

(i) Magnetic field strength is strongest at the centre of a bar magnet.
(ii) No two magnetic field lines can intersect.
(iii) Magnetic field lines always form closed continuous curves.

(a) Only (ii)
(b) Both (i) and (ii)

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

Q91. Which of the following numbers will replace the question mark (?) in the given series?

5, 13, 23, 49, ?, 193

(a) 95
(b) 120
(c) 105
(d) 82

Q92. The original Constitution of 1950 envisaged a Supreme Court with a Chief Justice and _____ puisne Judges - leaving it to Parliament to increase this number.

(a) 7
(b) 14
(c) 11
(d) 17

Q93. If the difference between two numbers is 52 and they are in the ratio 7 : 3, then find the greater of the two numbers.

(a) 84
(b) 70
(c) 65
(d) 91

Q94. 30 people are standing in a queue facing north. Manoj is standing at the 11th position from the front. Shahin is standing at the 7th position from the back. Neeraj is standing exactly in front of Shahin. How many people are standing between Neeraj and Manoj?

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

Q95. If '+' means '-', '-' means '÷', '÷' means '×' and '×' means '+', what will come in place of the question mark (?) in the following equation?

12 ÷ 6 + 28 - 7 × 14 = ?

(a) 80
(b) 72
(c) 82
(d) 78

Q96. Which of the following places is a harnessing site for geothermal energy in India?

(a) Bokaro
(b) Kolkata
(c) Tarapur
(d) Manikaran

Q97. An object is placed at the principal focus of a concave lens. Which of the following options represents the characteristics of the image formed?

(a) Real and enlarged
(b) Virtual and enlarged
(c) Real and diminished
(d) Virtual and highly diminished

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Q98. In India, Mangrove Forests are majorly found in which of the following states?

(a) Nagaland
(b) Telangana
(c) Maharashtra
(d) West Bengal

Q99. Select the set in which the numbers are related in the same way as are the numbers of the following sets.

(NOTE: Operations should be performed on the whole numbers, without breaking down the numbers into its constituent digits. E.g. 13 - Operations on 13 such as adding / subtracting / multiplying etc. to 13 can be performed. Breaking down 13 into 1 and 3 and then performing mathematical operations on 1 and 3 is not allowed)

(1, 8, 3)

(2, 21, 5)

(a) (2, 26, 3)
(b) (5, 112, 11)
(c) (7, 128, 10)
(d) (4, 33, 7)

Q100. Find the area of a triangle whose sides are 12 m, 14 m and 16 m.

(a) $2\sqrt{15}$ m²
(b) $21\sqrt{15}$ m2
(c) $7\sqrt{15}$ m2
(d) $\sqrt{15}$ m2

ANSWER KEY

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

SOLUTIONS

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

The correct answer is 4 Only.

Key Points

• Reduction is a chemical reaction that involves the loss of oxygen or the gain of hydrogen by a substance.

• In the context of redox (reduction-oxidation) reactions:

• Statement I: If a substance loses oxygen during a reaction, it is said to be reduced. This is correct because the loss of oxygen is one of the criteria for reduction.

• Statement II: If a substance gains hydrogen during a reaction, it is said to be reduced. This is also correct because the gain of hydrogen is another criterion for reduction.

• Thus, both statements are true and accurately describe the process of reduction in a chemical reaction.

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Q2. Answer: (d) Odisha

The correct answer is Odisha

Key Points

• Odisha became the first state in India to launch 'Air Health Service' in rural areas in March 2022.

• The initiative aims to provide advanced healthcare services in remote and rural areas using air transportation.

• This service will help in reducing the time taken to reach medical facilities and provide timely treatment to patients in need.

• The 'Air Health Service' initiative is expected to significantly improve the healthcare infrastructure and accessibility in the rural regions of Odisha.

Additional Information

• Odisha has been at the forefront of implementing various innovative healthcare programs to improve the health and well-being of its citizens.

• The state government has also been focusing on building robust healthcare infrastructure and ensuring that medical services reach the most remote areas.

• Other states are expected to follow Odisha's example and implement similar services to enhance healthcare delivery in rural regions.

Q3. Answer: (b) 14 units

Shortcut Trick

Since AB || QP, by the Basic Proportionality Theorem, the triangles ΔRAB and ΔRQP are similar.

Therefore, the ratio of their corresponding sides is equal:

AB ÷ QP = RB ÷ RP

=> x ÷ (x + 10) = (x/2) ÷ (x/2 + x + 1)

=> 1 ÷ (x + 10) = 1 ÷ (3x + 2) => 3x + 2 = x + 10 => 2x = 8 => x = 4

=> PQ = x + 10 = 4 + 10 = 14 units

Therefore The correct answer is 14 units.

Alternate Method

Given:

AB || QP

AB = x

PQ = x + 10

RB = x/2

BP = x + 1

Formula Used:

In similar triangles, the ratio of corresponding sides is equal. Since AB || QP, we have ΔRAB ~ ΔRQP, which gives:

AB ÷ QP = RB ÷ RP

Calculations:

=> RP = RB + BP

=> RP = (x/2) + (x + 1)

=> RP = (3x + 2)/2

Using the similarity ratio:

=> AB ÷ QP = RB ÷ RP

=> x ÷ (x + 10) = (x/2) ÷ ((3x + 2)/2)

=> x ÷ (x + 10) = x ÷ (3x + 2)

Since x cannot be 0, we divide both sides by x:

=> 1 ÷ (x + 10) = 1 ÷ (3x + 2)

=> 3x + 2 = x + 10

=> 2x = 8

=> x = 4

Substitute the value of x to find the length of PQ:

=> PQ = x + 10

=> PQ = 4 + 10 = 14 units

Verification of other options:

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If PQ = 13 units (Option 1): x + 10 = 13 => x = 3. Then AB = 3, RB = 1.5, BP = 4, RP = 5.5. The ratio AB/QP = 3/13 ≈ 0.23, while RB/RP = 1.5/5.5 ≈ 0.27. Since the ratios are not equal, this option is incorrect.

If PQ = 18 units (Option 3): x + 10 = 18 => x = 8. Then AB = 8, RB = 4, BP = 9, RP = 13. The ratio AB/QP = 8/18 = 4/9 ≈ 0.44, while RB/RP = 4/13 ≈ 0.31. Since the ratios are not equal, this option is incorrect.

If PQ = 12 units (Option 4): x + 10 = 12 => x = 2. Then AB = 2, RB = 1, BP = 3, RP = 4. The ratio AB/QP = 2/12 = 1/6 ≈ 0.17, while RB/RP = 1/4 = 0.25. Since the ratios are not equal, this option is incorrect.

Therefore The correct answer is 14 units.

Additional Information

Basic Proportionality Theorem (Thales Theorem)

If a line is drawn parallel to one side of a triangle intersecting the other two sides, then it divides the two sides in the same ratio.

Similarity of Triangles

Two triangles are similar if their corresponding angles are equal and their corresponding sides are in the same ratio (proportional).

Q4. Answer: (b) d

The correct answer is Option 2.

Key Points

• Statement a: Plants do not move, whereas animals move in search of food, mate, and shelter. This statement is correct.

• Statement b: Most tissues are dead in plants, whereas most tissues are living in animals. This statement is correct.

• Statement c: Plants need less energy, whereas animals need more energy. This statement is correct.

• Statement d: Growth is limited to certain regions in both plants and animals. This statement is incorrect. Growth is limited to certain regions in plants but not in animals.

Additional Information

• Plants:

• Plants are generally stationary and do not move from place to place.

• Most of the plant tissues are dead at maturity, which provides structural support.

• Plants require less energy as they produce their own food through photosynthesis.

• Growth in plants is typically restricted to meristematic regions (e.g., root and shoot tips).

• Animals:

• Animals are mobile and move in search of food, mate, and shelter.

• Most of the animal tissues are living, which supports various functions like movement, digestion, and reproduction.

• Animals require more energy as they have to perform various activities and obtain food from external sources.

• Growth in animals is not limited to certain regions and occurs throughout the body.

Q5. Answer: (b) 234

The logic followed here is:

Logic: (1st number)²+ 9 = 2nd number.

Now,

For, 11 : 130

=> $11^2 + 9 = 121 + 9 = 130$.

For, 7 : 58

=> $7^2 + 9 = 49 + 9 = 58$.

Similarly, for 15 : ?

=> $15^2 + 9 = 225 + 9 = 234$.

Hence, the correct answer is "Option 2".

Q6. Answer: (d) Prophet Muhammad

The correct answer is Prophet Muhammad

Key Points

• Prophet Muhammad is considered the founder of Islam.

• He is believed to be the last prophet sent by God to guide humanity.

• Prophet Muhammad's teachings are compiled in the holy book of Islam, the Quran.

• He was born in Mecca in 570 CE and began receiving revelations from God at the age of 40.

• His teachings emphasized monotheism, social justice, and moral conduct.

Additional Information

• Islam is one of the world's major religions, with over a billion followers globally.

• The word "Islam" means "submission to the will of God."

• Muslims follow the Five Pillars of Islam, which are the basic acts of worship and the foundation of a Muslim's faith and practice.

• The life and teachings of Prophet Muhammad have had a profound impact on the world and continue to influence the lives of many people today.

• His migration from Mecca to Medina in 622 CE, known as the Hijra, marks the beginning of the Islamic calendar.

Q7. Answer: (c) C

The correct answer is option 3

Key Points

• The movement of food in phloem is represented by figure C.

• Phloem is responsible for the translocation of nutrients, particularly sugar, from the leaves to other parts of the plant.

• This process is known as source to sink movement, where the source is the part of the plant where the food is produced (usually the leaves), and the sink is where the food is consumed or stored (such as roots, fruits, and seeds).

• The correct diagram would illustrate the flow from the source (leaves) to the sink (roots, fruits, etc.) via the phloem vessels.

Additional Information

• Phloem is one of the two types of vascular tissue in plants, the other being xylem.

• While xylem transports water and minerals from roots to other parts of the plant, phloem distributes the products of photosynthesis.

• The movement in phloem is bidirectional, meaning it can move substances up or down the plant as needed.

• This process is energy-dependent and involves active transport mechanisms.

• Phloem tissues consist of sieve tube elements, companion cells, phloem fibers, and phloem parenchyma.

Q8. Answer: (b) First attempt to relate the properties of elements with atomic mass.

The correct answer is First attempt to relate the properties of elements with atomic mass.

Key Points

• Dobereiner's triads were an early attempt to classify elements based on their properties and atomic masses.

• He grouped elements in sets of three (triads) where the atomic mass of the middle element was approximately the average of the other two.

• This classification showed a relationship between the atomic masses and the properties of elements, paving the way for future periodic table developments.

• Examples of Dobereiner's triads include lithium, sodium, and potassium; calcium, strontium, and barium.

Additional Information

• Johann Wolfgang Döbereiner was a German chemist who made significant contributions to the development of the periodic classification of elements.

• His work on triads in the early 19th century was among the first systematic attempts to identify patterns in the properties of elements.

• Döbereiner's observations contributed to the later development of the periodic law by Dmitri Mendeleev.

• The concept of triads eventually evolved into the modern periodic table, where elements are arranged based on increasing atomic number and recurring chemical properties.

• Despite the limitations of his triads, Döbereiner's work highlighted the importance of atomic mass in the study of chemical elements.

Q9. Answer: (d) Manasi

Given: Eight friends Kriti, Durga, Manasi, Surya, Tahira, Vritti, Ahana, and Yoshita are sitting around a square table and all are facing the centre of the table.

1. Surya is sitting at the third place to right of Durga.

2. Manasi is second to left of Durga.

3. Vritti is second to left of Manasi.

4. Only Tahira is between Kriti and Durga.

5. Only Vritti is sitting between Surya and Yoshita.

6. Yoshita is second to left of Ahana.

So, 'Manasi' is sitting third to the left of Tahira.

Hence, the correct answer is "Option 4".

Q10. Answer: (c) They are not soluble in an organic solvent.

The correct answer is They are not soluble in an organic solvent.

Key Points

• Covalent compounds are formed by the sharing of electrons between atoms.

• They generally do not form ions.

• Covalent compounds are usually soluble in organic solvents but not in water.

• They are typically bad conductors of electricity and heat due to the absence of free ions or electrons.

Additional Information

• Covalent compounds often have low melting and boiling points compared to ionic compounds.

• They can exist in all three physical states: solid, liquid, and gas, at room temperature.

• The bond formed in covalent compounds is directional, which affects their physical properties.

• Examples of covalent compounds include methane (CH_4), water (H_2O), and carbon dioxide (CO_2).

Q11. Answer: (b) Tenth Five Year Plan

The correct answer is Tenth Five Year Plan

Key Points

• Bharat Nirman was launched during the Tenth Five Year Plan period (2002-2007).

• The initiative aimed at improving rural infrastructure, including areas such as irrigation, roads, housing, water supply, electrification, and telecommunication connectivity.

• The program sought to provide basic amenities and bridge the gap between rural and urban areas.

• It was a time-bound business plan for action in rural infrastructure for a period of four years (2005-2009).

Additional Information

• The Tenth Five Year Plan aimed at achieving a GDP growth rate of 8% per annum.

• It emphasized the importance of social development and poverty reduction.

• The plan also focused on increasing employment opportunities and improving the quality of education and healthcare services.

• Other major initiatives during the Tenth Plan included the National Rural Employment Guarantee Act (NREGA), now known as MGNREGA, aimed at providing employment to rural households.

Q12. Answer: (b) 10%

Shortcut Trick

The Marked Price (MP) is Rs. 10,490 and the Selling Price (SP) is Rs. 9,441.

Discount = MP − SP = 10,490 − 9,441 = Rs. 1,049.

Discount % = (Discount ÷ MP) × 100.

Discount % = (1,049 ÷ 10,490) × 100 = 1/10 × 100 = 10%.

Therefore The correct answer is 10%.

Alternate Method

Given: Marked Price (MP) = Rs. 10,490, Selling Price (SP) = Rs. 9,441.

Formulas: Discount = MP − SP | Discount % = (Discount ÷ MP) × 100

=> Discount = Rs. 10,490 − Rs. 9,441 = Rs. 1,049

=> Discount % = (1,049 ÷ 10,490) × 100

=> Discount % = 0.1 × 100 = 10%

Therefore The correct answer is 10%.

Additional Information

Marked Price & Discount

The price listed on the label is the Marked Price. Discount is always calculated on the MP unless stated otherwise. SP = MP − Discount.

Selling Price Formula

To find SP when discount % is given: SP = MP × (100 − Discount%) ÷ 100.

Q13. Answer: (d) 3/2 R

The correct answer is (3)/(2) R

Key Points

• Given a wire of length 'l' and resistance 'R', we need to find the resistance of another wire of the same material with three times the length and twice the cross-sectional area.

• Resistance (R) is directly proportional to the length (l) of the wire and inversely proportional to its cross-sectional area (A), given by the formula: R = ρ(l/A), where ρ is the resistivity of the material.

• For the second wire, the length becomes 3l and the cross-sectional area becomes 2A.

• Substituting these values into the resistance formula, we get the new resistance R' as: R' = ρ(3l/2A).

• This simplifies to: R' = (3/2) * (ρ(l/A)).

• Since ρ(l/A) is the original resistance R, we get: R' = (3/2) * R.

• Thus, the resistance of the second wire is (3)/(2) R.

Additional Information

• This problem uses the fundamental concept of resistance in electrical circuits, which is crucial for understanding the behavior of electrical components.

• Understanding how resistance changes with length and cross-sectional area is important for designing electrical systems and components.

• This principle is widely applied in electrical engineering and physics to solve practical problems related to electrical resistance and conductivity.

Q14. Answer: (a) 49/9

Given:

2.666 ... + 2.77 ...

Calculation:

Let x = 2.666666... ----(1)

Multiply by 10 on both sides,

=> 10x = 26.666... ----(2)

Subtracting equation 2 from 1, we get,

=> 9x = 24

=> x=24/9

Now

Let y = 2.7777..... ------ (3)

Multiply by 10 on both sides,

=> 10y = 27.7.... -------(4)

Subtracting equation 4 from 3, we get,

=> 9x = 25

=> y=25/9

=> x+y=24/9+25/9

=> x+y=49/9

Hence, the required answer is ' 49/9 '.

Q15. Answer: (a) S

Given: Six persons P, Q, R, S, T, and U each have a different weight.

1) The weight of Q is more than only two other persons.

=> Q > _ > _

2) The weight of P is more than U's weight.

P > U

3) The weight of S is more than Q's weight.

S > Q

4) The weight of R is less than the weight of T.

T > R

5) The weight of Q is more than the weight of T.

Q > T

6) U has the second-highest weight among all the six persons.

_ > U > _ > Q > _ > _

So, combine all the given information:

P > U > S > Q > T > R

Therefore, the person with the third highest weight is S.

Hence, the correct answer is "Option 1: S".

Q16. Answer: (c) Ca(OH)2 + Cl2 → CaOCl2 + H2O

The correct answer is Ca(OH)2 + Cl2 → CaOCl2 + H2O

Key Points

• Ca(OH)2 + Cl2 → CaOCl2 + H2O is the correct chemical reaction for the preparation of bleaching powder.

• Bleaching powder, also known as calcium hypochlorite, is widely used for disinfecting drinking water and in the textile industry for bleaching fabrics.

• This reaction involves the chlorination of calcium hydroxide, resulting in the formation of bleaching powder and water.

• The chemical formula for bleaching powder is Ca(OCl)2.

Additional Information

• Chlorine is a powerful oxidizing agent and is used in various industrial and household applications.

• Calcium hydroxide, also known as slaked lime, is used in the preparation of bleaching powder due to its alkaline nature.

• Bleaching powder should be stored in a dry and cool place to prevent it from decomposing and losing its effectiveness.

• It is important to handle bleaching powder with care, as it can be irritating to the skin and eyes and is harmful if inhaled.

Q17. Answer: (b) Rs. 192

Shortcut Trick

Calculate the Effective Interest Rate by multiplying Rate and Time.

Effective Rate = 5% × 3 = 15%

Simple Interest = 15% of Rs. 1,280

=> 0.15 × 1280 = Rs. 192

Therefore The correct answer is Rs. 192.

Alternate Method

Given:

Principal (P) = Rs. 1,280

Rate (R) = 5% per annum

Time (T) = 3 years

Formula Used:

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

Calculations:

=> SI = (1280 × 5 × 3) ÷ 100

=> SI = (1280 × 15) ÷ 100

=> SI = 19200 ÷ 100

=> SI = Rs. 192

Therefore The correct answer is Rs. 192.

Additional Information

Total Amount Formula

The total amount (A) after T years is the sum of the Principal and the Simple Interest: A = P + SI.

Interest Rate Finding

To find the annual rate when SI, P, and T are known: R = (SI × 100) ÷ (P × T).

Constant Interest Property

In Simple Interest, the interest earned remains the same every year because it is always calculated on the original Principal.

Q18. Answer: (d) Ca

The correct answer is Ca

Key Points

• Calcium (Ca) is the most reactive element among the options provided.

• Reactivity of elements is determined by their ability to lose or gain electrons easily, which is influenced by their position in the periodic table.

• Calcium is an alkaline earth metal, which are known for their high reactivity, especially with water and oxygen.

• Calcium reacts more vigorously with water compared to other elements listed, forming calcium hydroxide and hydrogen gas.

Additional Information

• Lead (Pb) is a post-transition metal with low reactivity.

• Magnesium (Mg) is also reactive, but not as much as calcium.

• Aluminum (Al) forms a protective oxide layer that reduces its reactivity.

• Reactivity generally increases as you move down a group in the periodic table, which is why calcium is more reactive than magnesium.

• Calcium is widely used in various applications due to its reactive properties, including in the production of cement, steel, and as a reducing agent in chemical reactions.

Q19. Answer: (c) By photosynthesis during the day

The correct answer is By photosynthesis during the day

Key Points

• Oxygen is produced as a waste product during the process of photosynthesis.

• Photosynthesis occurs in the chloroplasts of plant cells, where light energy is converted into chemical energy.

• During the day, sunlight provides the energy required for photosynthesis.

• In this process, plants take in carbon dioxide (CO_2) and water (H_2O) and convert them into glucose ($C_6H_{12}O_6$) and oxygen (O_2).

• The oxygen produced is released into the atmosphere as a byproduct.

Additional Information

• Photosynthesis can be summarized by the equation: $6CO_2 + 6H_2O + \text{light energy} \rightarrow C_6H_{12}O_6 + 6O_2$.

• Photosynthesis primarily occurs in the leaves of plants, which contain the most chlorophyll.

• While oxygen is a waste product for the plant, it is essential for the survival of most other living organisms on Earth.

• At night, plants switch to respiration, a process in which they consume oxygen and produce carbon dioxide.

Q20. Answer: (c) E

Given: A, B, C, D, E, and F were six friends playing games around a circular table. They were standing facing the center of the table.

1. E was standing to the immediate left of A.

2. B was at the immediate right of A.

3. There were exactly two people between D and A.

4. C was second to the left of F.

So, 'E' is standing immediately right of F.

Hence, the correct answer is "Option 3".

Q21. Answer: (c) Rs. 2,565

Shortcut Trick

Cost Price (CP) of item = 5,000 − 2,000 = Rs. 3,000.

Successive discounts of 10% and 5% are applied.

Effective Multiplier = (90 ÷ 100) × (95 ÷ 100) = 0.9 × 0.95 = 0.855.

Final Selling Price (SP) = 3,000 × 0.855 = Rs. 2,565.

Therefore The correct answer is Rs. 2,565.

Alternate Method

Given: Initial Price = Rs. 5,000 − Rs. 2,000 = Rs. 3,000; Discount 1 = 10%; Discount 2 = 5%.

Formulas: SP = CP × (100 − D1)% × (100 − D2)% | Successive Discount = a + b − (ab ÷ 100).

=> Cost Price (CP) = 5,000 − 2,000 = Rs. 3,000.

=> Price after Dealer Discount (10%) = 3,000 − (10% of 3,000) = 3,000 − 300 = Rs. 2,700.

=> Price after Retailer Discount (5%) = 2,700 − (5% of 2,700) = 2,700 − 135 = Rs. 2,565.

=> Final Selling Price (SP) = Rs. 2,565.

Therefore The correct answer is Rs. 2,565.

Additional Information

Successive Discounts

When two discounts a% and b% are given, the total equivalent discount is (a + b − ab ÷ 100)%.

Selling Price Calculation

The selling price after multiple discounts is calculated as: SP = MP × (1 − d1/100) × (1 − d2/100).

Q22. Answer: (b) Saturday

Given information,

Six girls decided to record a video of their talks, one on each separate day of the same week.

Sunday will be a rest day.

1) P said Friday will suit her.

2) U will start the process and record on Monday.

3) S will record immediately before T.

4) Q will record on a day exactly between the days of U and S.

4) T selected Thursday.

Days	Persons
Monday	U
Tuesday	Q
Wednesday	S
Thursday	T
Friday	P
Saturday	

So,, the day left for R is Saturday.

The final arrangement is as follows:

Days	Persons
Monday	U
Tuesday	Q
Wednesday	S
Thursday	T
Friday	P
Saturday	R

Hence, the correct answer is "Option 2: Saturday".

Q23. Answer: (a) Conclusions II and III follow

Given Statements:

I. All grasses are shrubs.

II. All roots are fruits.

III. All fruits are flowers.

Conclusions:

I. All grasses are flowers - False (No direct relationship given between grasses and flowers).

II. All roots are flowers - True (Because all roots are fruits and all fruits are flowers So, all roots are also flowers).

III. Some flowers are fruits - True (Because all fruits are flowers So, some flowers are also fruits).

Hence, the correct answer is "Option 1".

Q24. Answer: (a) Both (a) and (c)

The correct answer is 1.

Key PointsPrincipal Focus of a Lens:

• The first principal focus of a lens is the point on the principal axis where light rays parallel to the principal axis converge (in case of a convex lens) or appear to diverge from (in case of a concave lens) after passing through the lens. Hence, for a lens, the first principal focus is the position of the object whose image is at infinity. Thus, statement (a) is correct.

• The second principal focus of a lens is the point on the principal axis where light rays that are converging towards (for a convex

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lens) or diverging from (for a concave lens) appear to come from or converge to after passing through the lens. Hence, for a lens, the second principal focus is the position of the real image whose object is at infinity. Thus, statement (c) is correct.

• Statement (b) is incorrect because the first principal focus is not related to the image being formed at twice the focal length. It is related to the image being at infinity.

• Statement (d) is also incorrect because the second principal focus is not related to the image being formed at twice the focal length.

Therefore, the correct answer is 1) Both (a) and (c).

Q25. Answer: (a) 2x2 + 3x - 2 = 0

Shortcut Trick

For the given quadratic equation, sum (a + b) = −1 and product (ab) = −2.

The new roots are (a + b)/ab = −1/−2 = 1/2 and ab = −2.

New sum of roots = 1/2 − 2 = −3/2 and product of roots = 1/2 × (−2) = −1.

Required equation: x2 − (sum)x + product = 0 => x2 + (3/2)x − 1 = 0.

Therefore The correct answer is 2x2 + 3x − 2 = 0.

Alternate Method

Given: a and b are the roots of the equation x2 + x − 2 = 0.

Formula Used: For Ax2 + Bx + C = 0, Sum = −B/A and Product = C/A. The quadratic equation is x2 − (Sum)x + Product = 0.

=> Sum of original roots (a + b) = −1 / 1 = −1

=> Product of original roots (ab) = −2 / 1 = −2

=> New roots are α = (1/a + 1/b) and β = ab

=> α = (a + b) / ab = −1 / −2 = 1/2

=> β = −2

=> Sum of new roots (α + β) = 1/2 + (−2) = −3/2

=> Product of new roots (α × β) = (1/2) × (−2) = −1

=> The required quadratic equation is x2 − (−3/2)x + (−1) = 0

=> x2 + (3/2)x − 1 = 0

=> 2x2 + 3x − 2 = 0

Therefore The correct answer is 2x2 + 3x − 2 = 0.

Additional Information

Nature of Roots

The nature of roots depends on 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 imaginary.

Relation between Roots and Coefficients

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

Symmetric Functions of Roots

Expressions like 1/a + 1/b, a2 + b2, and a/b + b/a can always be expressed in terms of (a+b) and (ab) to find their values without calculating the individual roots.

Q26. Answer: (d) V W B R S M W

The logic followed here is:

Given Sequence: B _ M _ Q _ V M W _ B V M W _ B V _ _ T

Now, putting the letters in the blank spaces given in the option one by one:

Option 1) V, W, V, R, R, M, W → B V M W Q / V V M W R / B V M W R / B V M W T

Option 2) V, W, V, R, S, M, R → B V M W Q / V V M W R / B V M W S / B V M R T

Option 3) V, W, B, V, S, W, M → B V M W Q / B V M W V / B V M W S / B V W M T

Option 4) V, W, B, R, S, M, W → B V M W Q / B V M W R / B V M W S / B V M W T

• Q + 1 = R, R + 1 = S, S + 1 = T

Here, 'Option 4' followed a pattern.

Hence, the correct answer is "Option 4".

Q27. Answer: (a) Y < S

Given Statement: H = W > F ≥ S ≥ T > Y

Now,

Conclusions:

Option 1: Y < S → True (S ≥ T > Y, it gives Y < S)

Option 2: T ≥ F → False (F ≥ S ≥ T, it gives F > T, so T < F)

Option 3: H < F → False (H = W > F, it gives H > F)

Option 4: W < T → False (W > F ≥ S ≥ T, it gives W > T)

Hence, the correct answer is "Option 1".

Q28. Answer: (b) C T D S A T K U

Given:

Number/Symbol	5	6	8	3	%	#	7
Code	U	S	C	K	D	T	A

Conditions	Coded As
(i) If the first element is an odd number and the last element is an even number.	The codes for these two (the first and the last elements) are to be interchanged.
(ii) If the second element is a symbol and the fifth element is an even number.	The codes for these two (the second and the fifth elements) are to be interchanged.
(iii) If the third element is a number and the fourth element is a symbol.	Both these elements (the third and the fourth elements) are to be coded as W.

Now, the group of numbers and symbols is: '5 # % 6 7 # 3 8'

Following the conditions:

Condition (i) is applied: The first element (5) is odd, and the last element (8) is even. So, the codes for these two elements are interchanged.

After applying Condition (i):

Number/Symbol	8	#	%	6	7	#	3	5
Code	C	T	D	S	A	T	K	U

Hence, the correct answer is "Option 2".

Q29. Answer: (b) i - c, ii - b, iii - a

The correct answer is i - c, ii - b, iii - a.

Key Points

• Red cabbage leaves contain a pigment called anthocyanin, which changes color in response to changes in pH. This makes it a natural acid base indicator. Hence, i matches with c.

• Methyl orange is a synthetic indicator commonly used in titrations because it changes color at a pH range of 3.1 to 4.4. It is an acid base indicator. Hence, ii matches with b.

• Onion and clove are used as olfactory indicators in chemistry to detect the presence of acids or bases by their smell. Hence, iii matches with a.

Additional Information

• Natural Acid Base Indicator:

• Natural indicators are substances found in nature that change color when they come in contact with an acid or a base. Examples include red cabbage juice, turmeric, and litmus.

• Red cabbage leaves contain anthocyanin, which can indicate pH changes by changing colors.

• Acid Base Indicator:

• Acid-base indicators are substances that change color in response to changes in pH, which makes them useful for determining the acidity or basicity of a solution.

• Methyl orange is an example of a synthetic acid-base indicator that changes color at different pH levels.

• Olfactory Indicator:

• Olfactory indicators are substances that change their smell in the presence of an acid or a base. They are used to detect the presence of acids and bases through the sense of smell.

• Onion and clove are examples of olfactory indicators.

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Q30. Answer: (b) The Sun

The correct answer is The Sun

Key Points

• The Sun is worshipped by people during the festival of Pongal.

• Pongal is a popular harvest festival celebrated in Tamil Nadu, India.

• The festival marks the end of the winter solstice and the start of the sun's six-month-long journey northwards (Uttarayana).

• It is a four-day festival that includes Bhogi Pongal, Surya Pongal, Mattu Pongal, and Kaanum Pongal.

• Surya Pongal, the second day of the festival, is dedicated to the Sun God (Surya) and is the most important day of the festival.

• During Surya Pongal, people prepare a special dish called 'Pongal' and offer it to the Sun God as a token of gratitude for a bountiful harvest.

Additional Information

• Pongal is celebrated in the month of Thai (January-February) according to the Tamil calendar.

• The word "Pongal" means "to boil" and refers to the traditional dish prepared from the new harvest of rice boiled in milk with jaggery.

• The festival is similar to other harvest festivals celebrated in different parts of India, such as Makar Sankranti in North India, Lohri in Punjab, and Bihu in Assam.

• It is a time of joy, family reunions, and thanksgiving for the agricultural abundance.

• Pongal is also celebrated with traditional music, dance, and cultural performances.

Q31. Answer: (b) A pair of interior angles on the same side of the transversal have the same measure.

Shortcut Trick

Parallel lines properties: Corresponding angles are equal, Alternate interior angles are equal, and Vertically opposite angles are always equal.

Consecutive interior angles (on the same side) are supplementary (sum = 180°), not necessarily equal.

They are equal only if the transversal is perpendicular to the parallel lines (90° + 90° = 180°).

Therefore The correct answer is A pair of interior angles on the same side of the transversal have the same measure.

Alternate Method

Given: Two parallel lines l and m, and a transversal t.

Formula Used: Parallel line theorems (Corresponding, Alternate, and Co-interior angles).

=> Option A: Corresponding angles (e.g., angle 1 and angle 5) are always equal when lines are parallel.

=> Option C: Vertically opposite angles (e.g., angle 1 and angle 3) are always equal regardless of parallelism.

=> Option D: Alternate interior angles (e.g., angle 4 and angle 6) are always equal when lines are parallel.

=> Option B: Interior angles on the same side (Co-interior angles, e.g., angle 3 and angle 6) are supplementary.

=> angle 3 + angle 6 = 180°. They are equal only if angle 3 = angle 6 = 90°.

=> Therefore, they are not necessarily equal in all cases.

Therefore The correct answer is A pair of interior angles on the same side of the transversal have the same measure.

Additional Information

Supplementary Angles

Two angles are supplementary if their sum is exactly 180°. Co-interior angles formed by parallel lines are always supplementary.

Alternate Exterior Angles

When two parallel lines are cut by a transversal, the pairs of alternate exterior angles (e.g., angle 1 and angle 7) are equal in measure.

Linear Pair Postulate

If a ray stands on a line, then the sum of two adjacent angles so formed is 180° (e.g., angle 1 + angle 2 = 180°).

Q32. Answer: (c) 6

Given Equation: [{(23 × 15) - (1 ÷ 4)} + (2 - 2)] ÷ 2

Decoding the given information:

Symbols	•	•	×	÷
Meaning	÷	•	•	×

Now replacing the signs from left to right using the given decoding information, we get:

New Equation: [{(23 - 15) + (1 × 4)} ÷ (2 + 2)] × 2

Calculation:

= [{8 + 4} ÷ 4] × 2

= [12 ÷ 4] × 2

= 3 × 2

= 6

Hence, the correct answer is *'Option 3'.*

Q33. Answer: (d) 25 : 23

Calculation:

=> Total units sold by Mr. P = 80 + 30 + 50 + 90

=> Total units sold by Mr. P = 250

=> Total units sold by Mr. Q = 60 + 40 + 70 + 60

=> Total units sold by Mr. Q = 230

=> Ratio of units sold by Mr. P to Mr. Q = Total units sold by Mr. P / Total units sold by Mr. Q

=> Ratio = 250 / 230

=> Ratio = 25 / 23

Therefore The respective ratio of the total units sold by Mr. P and Mr. Q during the 4 months is 25 : 23.

Q34. Answer: (b) Ferns

The correct answer is Ferns

Key Points

• Ferns reproduce via spores, which are typically found on the underside of their fronds.

• Spores are a common reproductive method for non-flowering plants such as ferns, mosses, and fungi.

• Unlike seeds, spores are usually single-celled and do not contain stored food resources.

• Spores can be dispersed by wind, water, or animals, allowing the plant to spread to new locations.

Additional Information

• Yeast reproduces primarily through budding, a form of asexual reproduction.

• Amoeba reproduces by binary fission, another form of asexual reproduction.

• Mango trees reproduce through seeds and vegetative propagation, not spores.

• Spores are a key feature of the life cycle of many plants and fungi, enabling them to survive in various environments and conditions.

Q35. Answer: (c) Ministry of External Affairs

The correct answer is Ministry of External Affairs

Key Points

• The Weapons of Mass Destruction and their Delivery Systems (Prohibition of Unlawful Activities) Amendment Bill, 2022, was introduced in the Lok Sabha on 5 April 2022.

• The bill was introduced by the Ministry of External Affairs.

Additional Information

• The bill aims to amend the existing Weapons of Mass Destruction and their Delivery Systems (Prohibition of Unlawful Activities) Act, 2005.

• The amendment seeks to prohibit the financing of activities related to weapons of mass destruction and their delivery systems.

• This move aligns with India's international obligations under various treaties and conventions.

• The amendment enhances the regulatory framework to prevent the proliferation of weapons of mass destruction.

Q36. Answer: (a) One

Given word: DIRECT

Now, arranged in alphabetical order:

Word	**D**	**I**	**R**	**E**	**C**	**T**
Alphabetical order	C	D	E	I	R	T

Here, 'T' will remain unchanged if each of the letters in the word DIRECT is arranged in alphabetical order.

Hence, the correct answer is "Option 1".

Q37. Answer: (d) 10 min

Shortcut Trick

Efficiency of A = 100 ÷ 4 = 25 eggs/min

Efficiency of B = 100 ÷ 5 = 20 eggs/min

Combined Efficiency = 25 + 20 = 45 eggs/min

Total Time = 450 ÷ 45 = 10 minutes

Therefore The correct answer is 10 min.

Alternate Method

Given:

Time taken by A to count 100 eggs = 4 minutes

Time taken by B to count 100 eggs = 5 minutes

Total eggs to be counted = 450 eggs

Formula Used:

Efficiency = Total Work ÷ Time

Time Taken = Total Work ÷ Combined Efficiency

Person	Time (min)	Work (eggs)	Efficiency (eggs/min)
A	4	100	100 ÷ 4 = 25
B	5	100 ÷ 5 = 20	

Calculations:

=> Total combined efficiency of A and B = 25 + 20 = 45 eggs per minute

=> Total eggs to count = 450 eggs

=> Time required = 450 ÷ 45

=> Time = 10 minutes

Therefore The correct answer is 10 min.

Additional Information

Unitary Method for Efficiency

Work done by a person in one unit of time (1 minute/1 hour/1 day) is called efficiency. If total work remains constant, efficiency is inversely proportional to time taken.

Time & Work Relation

When multiple people work together, their individual efficiencies are added to get the total efficiency of the group. Total Time = Total Work ÷ (Sum of individual efficiencies).

Q38. Answer: (b) 2 Ω

The correct answer is 2 Ω

Key Points

• The equivalent resistance between points A and B is 2 Ω.

• To find the equivalent resistance, resistors in series and parallel combinations need to be identified and simplified step-by-step.

• R_(series)= R1+ R2 = 3 + 3 = 6 Ω

• 1/R_(parallel)= 1/R1 + 1/R2 = 1/3 + 1/6 = 3/6 = 1/2

• Rparallel = 2 Ω

• In the given circuit, the combination of resistors simplifies to an equivalent resistance of 2 Ω between points A and B.

Additional Information

• Resistors in series add up directly:

• Rseries=R1+R2+…+Rn

• Resistors in parallel combine as:

• 1Rparallel=1R1+1R2+…+1Rn1Rparallel=1R1+1R2+…+1Rn 1/Rparallel = 1/R1 + 1/R2 + ...+1/Rn

• Understanding the configuration of resistors in a circuit is crucial for calculating equivalent resistance accurately.

• The given problem is a common type of question in electrical circuit analysis, often found in exams and practical applications.

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Q39. Answer: (c) MLQBO

The logic followed here is:

'GLEPK' is written as 'DIBMH'

'QRYHN' is written as 'NOVEK'

Similarly, for 'POTER'

So, 'POTER' is written as 'MLQBO'.

Hence, the correct answer is "Option 3".

Q40. Answer: (a) 2

The Given Series: 158, 438, 182, 325, 230

Now, If 5 is added to the first digit of every number:

Series becomes: 658, 938, 682, 825, 730.

There are 2 Numbers in which the first digit is exactly divisible by the second digit: 938, 825.

As 9 is completely divisible by 3.

And, 8 is completely divisible by 2.

Hence, the correct answer is 'Option 1'.

Q41. Answer: (d) 30

The logic followed here is:

So, '30' will come next in the given series.

Hence, the correct answer is "Option 4".

Q42. Answer: (c) 2-ethyl pentane

The correct answer is option 3

Key Points

• Option 3: 2-ethyl pentane is not a possible isomer of hexane.

• Hexane (C6H14) has several isomers, including different structural forms such as straight-chain and branched-chain alkanes.

• Possible isomers of hexane include n-hexane, 2-methyl pentane, 3-methyl pentane, 2,2-dimethyl butane, and 2,3-dimethyl butane.

• 2-ethyl pentane is not a valid isomer because it would imply a seven-carbon chain, which does not match the molecular formula of hexane.

Additional Information

• Isomers are compounds with the same molecular formula but different structural formulas.

• Structural isomers differ in the connectivity of their atoms, while stereoisomers differ in the spatial arrangement of atoms.

• Hexane's structural isomers include different arrangements of the carbon atoms, leading to variations in the branching of the carbon chain.

Q43. Answer: (d) Only conclusions II, III and IV follow.

Given Statements:

1. All couriers are shipments.

2. All shipments are transports.

3. No haul is transport.

The least possible Venn diagram for the given statement is:

Conclusions:

I. No transport is shipment → False (Because it is given that all shipments are transports which means some part of transport is definitely shipment.)

II. All couriers are transports → True (Because it is given that all couriers are shipments and all shipments are transports which gives all couriers are transports)

III. Some transports are shipments → True (Because it is given that all shipments are transports which means some part of transport is definitely shipment.)

IV. No courier is haul → True (Because there is no relation given between courier and haul, so it can be possible but not definitely true)

So, conclusion II, III, and IV follows.

Hence, the correct answer is "Option 4".

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Q44. Answer: (c) T

Given: P, Q, R, S, T, U, and V live on seven different floors of the same building.

1. U lives on the top floor.

2. Q is on floor number 3.

Floor	Person
7	U
6	
5	
4	
3	Q
2	
1	

3. Q lives on the floor immediately below R's floor.

4. S lives on the floor immediately above R's floor.

Floor	Person
7	U
6	
5	S
4	R
3	Q
2	
1	

5. Only two persons live between T and Q.

6. V lives on the floor immediately above P's floor.

Floor	Person
7	U
6	T
5	S
4	R
3	Q
2	V
1	P

So, 'T' lives on the sixth floor.

Hence, the correct answer is "Option 3".

Q45. Answer: (d) Two

Given word: LAMENT

Now, arranged in alphabetical order:

Word	L	A	M	E	N	T
Alphabetical order	A	E	L	M	N	T

Here, 'N' and 'T' will remain unchanged if each of the letters in the word LAMENT is arranged in alphabetical order.

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Hence, the correct answer is "Option 4".

Q46. Answer: (a) 18 m, South

Given:

Janhvi starts walking from her home and goes 45 m towards the west.

She then turns right and walks 32 m.

Then, she turns right and walks 88 m.

After that, she turns right and walks 50 m.

Finally, she turns right again and walks 43 m.

So, at the end, she is 18 m and in South direction from home.

Hence, the correct answer is "Option 1".

Q47. Answer: (c) Only conclusion II follows

Given Statements:

All donkeys are zebras.

Some bulls are cats.

Some donkeys are apes.

The least possible Venn diagram for the given statement is:

Conclusions:

(I) Some zebras are bulls → False (Because there is no relation given between zebras and bulls, so it can be possible but not definitely true)

(II) Some zebras are apes → True (Because it is given that some donkeys are apes and all donkeys are zebras, the part which is common in donkeys and apes is also zebra.)

(III) Some donkeys are cats → False (Because there is no relation given between donkeys and cats, so it can be possible but not definitely true)

So, only conclusion II follows.

Hence, the correct answer is "Option 3".

Q48. Answer: (c) x = 9

Shortcut Trick

For a quadratic equation $ax^2 + bx + c = 0$, the sum of roots is given by $-b/a$.

In the equation $x^2 - 12x + k = 0$, the sum of roots = $-(-12)/1 = 12$.

Given one root is 3, the other root = Total Sum − Given Root.

Other root = 12 − 3 = 9.

Therefore The correct answer is x = 9.

Alternate Method

Given:

Quadratic equation: $x^2 - 12x + k = 0$

One root (x) = 3

Formula Used:

If x = r is a root of a quadratic equation, it must satisfy the equation.

Calculations:

Substitute x = 3 in the equation:

=> $(3)^2 - 12(3) + k = 0$

=> $9 - 36 + k = 0$

=> $-27 + k = 0$

=> $k = 27$

Now, substitute k = 27 back into the original equation:

=> $x^2 - 12x + 27 = 0$

Factorize the quadratic equation by splitting the middle term:

=> $x^2 - 9x - 3x + 27 = 0$

=> $x(x - 9) - 3(x - 9) = 0$

=> $(x - 3)(x - 9) = 0$

=> x = 3 or x = 9

Since one root is 3, the other root is 9.

Therefore The correct answer is x = 9.

Additional Information

Sum and Product of Roots

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

Nature of Roots

The nature depends on the Discriminant (D = b2 − 4ac). If D > 0, roots are real and distinct; if D = 0, roots are real and equal.

Forming an Equation

If roots α and β are known, the quadratic equation is x2 − (α + β)x + (αβ) = 0.

Q49. Answer: (d) 22

The correct answer is 22 languages

Key Points

• As of June 2022, there are 22 languages listed in the Eighth Schedule of the Indian Constitution.

• The Eighth Schedule to the Indian Constitution lists the official languages recognized by the Indian government.

• The original constitution included 14 languages in the Eighth Schedule, but several amendments have increased this number to 22.

• The languages included are Assamese, Bengali, Gujarati, Hindi, Kannada, Kashmiri, Konkani, Malayalam, Manipuri, Marathi, Nepali, Odia, Punjabi, Sanskrit, Sindhi, Tamil, Telugu, Urdu, Bodo, Santhali, Maithili, and Dogri.

• Recognition in the Eighth Schedule means that these languages can be used for official purposes such as parliamentary proceedings, judiciary, and communications between the central government and states.

Additional Information

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

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

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

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

• The Eighth Schedule of the Constitution has been amended several times to include more languages as per the evolving linguistic diversity of the nation.

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

• The inclusion of languages in the Eighth Schedule is significant for the cultural and linguistic recognition of the diverse population of India.

Q50. Answer: (c) 95

Shortcut Trick

For continued proportion a : b : b : c, the formula is $b^2 = ac$.

For first series: $x = 12^2 \div 9 = 144 \div 9 = 16$.

For second series: $y = 42^2 \div 28 = (42 \times 42) \div 28 = 63$.

Required value: $2x + y = 2(16) + 63 = 32 + 63 = 95$.

Therefore The correct answer is 95.

Alternate Method

Given: 9 : 12 :: 12 : x and 28 : 42 :: 42 : y

Formula Used: Product of Extremes = Product of Means (ad = bc)

=> 9 × x = 12 × 12

=> x = 144 ÷ 9 = 16

=> 28 × y = 42 × 42

=> y = (42 × 42) ÷ 28 = 1764 ÷ 28 = 63

=> 2x + y = 2(16) + 63

=> 2x + y = 32 + 63 = 95

Therefore The correct answer is 95.

Additional Information

Fourth Proportional

If a, b, c, d are in proportion, then a/b = c/d, where d is the fourth proportional (d = bc/a).

Third Proportional

In a continued proportion a : b :: b : c, the term c is called the third proportional ($c = b^2/a$).

Mean Proportional

The mean proportional between a and b is $\sqrt{(a \times b)}$.

Q51. Answer: (c) f

The correct answer is f

Key Points

• When a boy focuses a sharp image of a distant object using a lens, the distance between the lens and the screen is approximately equal to the focal length (f) of the lens.

• This is because, for distant objects, the light rays coming into the lens are parallel, and they converge at the focal point of the lens.

• The focal length is the distance between the center of the lens and the point where the parallel rays converge to form a sharp image.

Additional Information

• The focal length (f) of a lens is a crucial parameter in determining its optical power.

• Lens makers use the focal length to design lenses for various applications, including cameras, eyeglasses, microscopes, and telescopes.

• In practical scenarios, the focal length can be determined using lens formulas or experimental setups.

Q52. Answer: (a) Pops

The correct answer is Pops

Key Points

• Pops is the name of India's first intelligent messenger launched by Paytm Money in January 2022.

• This innovative feature aims to provide users with personalized updates, insights, and important information related to their investments.

• The messenger is designed to enhance the user experience by offering timely and relevant notifications directly within the Paytm Money app.

• With Pops, Paytm Money continues to leverage technology to simplify and improve the investment process for its users.

Additional Information

• Paytm Money is a subsidiary of One97 Communications, which owns the brand Paytm.

• It provides a comprehensive suite of investment and wealth management services, including mutual funds, stocks, and digital gold.

• Paytm Money aims to democratize wealth management services and make investing more accessible to the general public.

• Since its inception, Paytm Money has continually introduced new features and services to cater to the evolving needs of its users.

• The launch of Pops is part of Paytm Money's ongoing efforts to integrate advanced technology into its platform to provide a seamless and efficient user experience.

Q53. Answer: (b) 1

Shortcut Trick

By definition, co-prime numbers do not share any common factor other than 1.

Therefore, the highest common factor (HCF) of any set of co-prime numbers, regardless of the number of elements in the set, is always 1.

Therefore The correct answer is 1.

Alternate Method

Given: A set of 10 co-prime numbers.

Formula/Property Used: Two or more numbers are said to be co-prime if their Highest Common Factor (HCF) is 1.

=> Let the set of 10 co-prime numbers be {a1, a2, a3, ..., a10}.

=> Since they are co-prime to each other, there is no common prime factor among all of them.

=> Thus, the only common divisor for all the 10 numbers is 1.

=> HCF(a1, a2, a3, ..., a10) = 1.

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Therefore The correct answer is 1.

Additional Information

Co-prime Numbers

Two or more numbers are co-prime if they share no common positive factors other than 1. They do not need to be prime numbers themselves (e.g., 8 and 9 are co-prime).

HCF of Prime Numbers

The HCF of any set of distinct prime numbers is always 1, as prime numbers only have 1 and themselves as factors.

LCM of Co-prime Numbers

The Least Common Multiple (LCM) of any set of co-prime numbers is always equal to the product of those numbers.

Q54. Answer: (d) 1/√2

The correct answer is Option 4

Key Points

• Option 4 is the correct answer for the given question.

• The refractive index of medium A with respect to medium B is equal to 1/√2

• This is determined based on the path of the light ray incident on the interface separating the two media as shown in the figure.

• The refractive index is a measure of how much the speed of light is reduced inside a medium compared to the vacuum.

To determine the refractive index of medium A with respect to medium B, you can use Snell's law, which states: $n_A \sin(\theta_A) = n_B \sin(\theta_B)$

Where:

n_A is the refractive index of medium A,

n_B is the refractive index of medium B,

θ_A is the angle of incidence in medium A,

θ_B is the angle of refraction in medium B.

The refractive index of medium A with respect to medium B can be calculated using the formula:

Refractive Index $(n_{(A/B)}) = n_A/n_B = (\sin(\theta_B°))/(\sin(\theta_A°)) ; = (\sin(30°))/(\sin(45°)) ; = 1/2 \times \sqrt{2}/1 = 1/\sqrt{2}$

Q55. Answer: (d) Do not overuse air conditioning or heating systems.

The correct answer is Do not overuse air conditioning or heating systems.

Key Points

• Do not overuse air conditioning or heating systems as these appliances consume a significant amount of energy, which is often generated from coal and petroleum resources.

• Using energy-efficient appliances and adopting energy-saving practices can help reduce the consumption of these fossil fuels.

• Promoting the use of public transportation or joining a carpool can significantly decrease the reliance on petroleum products.

• Utilizing renewable energy sources like solar cookers can reduce the dependency on coal and petroleum.

Additional Information

• Coal and petroleum are non-renewable resources, meaning they cannot be replenished on a human time scale once depleted.

• The burning of these fossil fuels releases greenhouse gases, contributing to climate change and environmental pollution.

• Adopting energy conservation techniques and promoting renewable energy sources are crucial steps toward sustainable development.

• Energy conservation not only helps in preserving these resources but also reduces energy costs and environmental impact.

Q56. Answer: (a) 12

Shortcut Trick

The vertices A(0, −2) and C(0, 4) lie on the y-axis, forming a vertical diagonal AC of length 4 − (−2) = 6 units.

The vertices B(2, 1) and D(−2, 1) lie on the horizontal line y = 1, forming a horizontal diagonal BD of length 2 − (−2) = 4 units.

Since the diagonals are perpendicular to each other, the area of the quadrilateral ABCD is given by:

Area = (1/2) × d1 × d2 = (1/2) × 6 × 4 = 12 square units.

Therefore The correct answer is 12 square units.

Alternate Method

Given:

Vertices of the quadrilateral ABCD are A(0, −2), B(2, 1), C(0, 4), and D(−2, 1).

Formula Used:

The area of a polygon with vertices (x1, y1), (x2, y2), (x3, y3), and (x4, y4) can be calculated using the Shoelace Formula:

Area = (1/2) × |(x1y2 + x2y3 + x3y4 + x4y1) − (y1x2 + y2x3 + y3x4 + y4x1)|

Calculations:

Let the coordinates be:

(x1, y1) = (0, −2)

(x2, y2) = (2, 1)

(x3, y3) = (0, 4)

(x4, y4) = (−2, 1)

=> Sum1 = x1y2 + x2y3 + x3y4 + x4y1

=> Sum1 = (0 × 1) + (2 × 4) + (0 × 1) + (−2 × −2)

=> Sum1 = 0 + 8 + 0 + 4 = 12

=> Sum2 = y1x2 + y2x3 + y3x4 + y4x1

=> Sum2 = (−2 × 2) + (1 × 0) + (4 × −2) + (1 × 0)

=> Sum2 = −4 + 0 − 8 + 0 = −12

=> Area = (1/2) × |Sum1 − Sum2|

=> Area = (1/2) × |12 − (−12)|

=> Area = (1/2) × |12 + 12|

=> Area = (1/2) × 24 = 12 square units.

Since the calculated area is exactly 12 square units, Option (1) is correct. The other options (14, 15, and 13 square units) are incorrect because they do not match the geometric area computed from the given coordinates.

Therefore The correct answer is 12 square units.

Additional Information

Area of a Rhombus / Kite

When the diagonals of a quadrilateral are perpendicular, the area is always half the product of the lengths of the diagonals: Area = (1/2) × d1 × d2.

Shoelace Formula (Gauss's Area Formula)

A mathematical algorithm to determine the area of a simple polygon whose vertices are described by ordered pairs in the coordinate plane.

Distance Formula

The distance between any two points (x1, y1) and (x2, y2) is given by d = √((x2 − x1)² + (y2 − y1)²).

Q57. Answer: (c) Rs. 35,000

Shortcut Trick

Ratio of cost of Printer to Television = 2 : 1

Difference in ratio parts = 2 − 1 = 1 unit

Given difference in price = Rs. 35,000

Therefore 1 unit = Rs. 35,000

Cost of Television (1 unit) = Rs. 35,000

Therefore The correct answer is Rs. 35,000.

Alternate Method

Given:

Difference between cost of printer and television = Rs. 35,000

Cost of printer = 2 × Cost of television

Let the cost of the television be x.

Then, the cost of the printer = 2x

According to the question, the television costs Rs. 35,000 less than the printer:

=> 2x − x = 35,000

=> x = 35,000

Thus, the cost of the television is Rs. 35,000, which corresponds to Option (3).

Therefore The correct answer is Rs. 35,000.

Additional Information

Ratio and Proportions

When one value is a multiple of another, representing them as ratio units (e.g., 2:1) simplifies the calculation of differences.

Unitary Method

If 1 unit represents a certain value, any number of units can be found by direct multiplication: Value = Number of units × Value of 1 unit.

Linear Equations

For problems involving 'more than' or 'less than', setting up a linear equation x = y ± constant is a reliable algebraic approach.

Q58. Answer: (c) 12 years

Shortcut Trick

Sum of ages 5 years ago = 39 years.

Sum of present ages = 39 + (5 × 2) = 49 years.

Age of child = (Sum − Difference) ÷ 2 = (49 − 25) ÷ 2 = 12 years.

Therefore The correct answer is 12 years.

Alternate Method

Given: Difference between father and child = 25 years. Sum 5 years ago = 39 years.

Formula Used: Present Sum = Past Sum + (n × number of people).

Let my present age be x years.

Father's present age = x + 25 years.

=> (x − 5) + (x + 25 − 5) = 39

=> 2x + 15 = 39

=> 2x = 39 − 15

=> 2x = 24

=> x = 12 years.

Therefore The correct answer is 12 years.

Additional Information

Age Difference Property

The difference between the ages of two people always remains constant, regardless of the number of years passed.

Sum of Ages Change

If there are n people, the sum of their ages increases or decreases by n × t years after a time period of t years.

Ratio of Ages

Unlike age difference, the ratio of ages changes over time as years are added to both the numerator and denominator.

Q59. Answer: (d) 2

Shortcut Trick

For a number to be divisible by 90, it must be divisible by both 10 and 9 (since 90 = 9 × 10).

Divisibility by 10 => last digit y = 0.

Divisibility by 9 => sum of digits (1 + 1 + 5 + x + 0) = 7 + x must be a multiple of 9.

The nearest multiple of 9 is 9, so 7 + x = 9 => x = 2.

Therefore, x + y = 2 + 0 = 2.

Therefore The correct answer is 2.

Alternate Method

Given: Number = 115xy, Divisor = 90.

Condition: The number is perfectly divisible by 90.

Step 1: Apply Divisibility Rule of 10

=> For a number to be divisible by 10, the unit digit must be 0.

=> In 115xy, the unit digit is y.

=> y = 0.

Step 2: Apply Divisibility Rule of 9

=> A number is divisible by 9 if the sum of its digits is divisible by 9.

=> Sum of digits of 115x0 = 1 + 1 + 5 + x + 0

=> Sum = 7 + x

=> For (7 + x) to be divisible by 9, where x is a single digit (0-9):

=> 7 + x = 9

=> x = 2.

Step 3: Calculate the required value

=> x + y = 2 + 0

=> x + y = 2

Therefore The correct answer is 2.

Additional Information

Divisibility Rule of 9

A number is divisible by 9 if and only if the sum of its digits is a multiple of 9.

Divisibility Rule of 10

A number is divisible by 10 if its unit digit (the last digit) is exactly 0.

Composite Divisibility

If a number is divisible by two co-prime numbers a and b, it is also divisible by their product (a × b). Here, 9 and 10 are co-prime.

Q60. Answer: (c) electromagnetic induction

The correct answer is electromagnetic induction

Key Points

• An AC generator works on the principle of electromagnetic induction.

• Electromagnetic induction refers to the process of generating electric current by changing the magnetic field enclosed by an electrical circuit.

• This principle was discovered by Michael Faraday in 1831.

• The changing magnetic field induces an electromotive force (EMF) in the conductor, which causes the current to flow.

• AC generators are widely used in power plants to produce electricity.

Additional Information

• Michael Faraday's Law of electromagnetic induction states that the induced EMF in any closed circuit is equal to the rate of change of the magnetic flux through the circuit.

• AC generators convert mechanical energy into electrical energy using this principle.

• They consist of a rotating coil within a stationary magnetic field or a rotating magnetic field within a stationary coil.

• AC generators are also known as alternators.

• The frequency of the generated AC voltage depends on the speed of rotation of the coil or the magnetic field.

Q61. Answer: (c) Knowing about their body changes, teenagers start making fun of each other

The correct answer is Knowing about their body changes, teenagers start making fun of each other.

Key Points

• Sex education is crucial in providing teenagers with accurate information about their bodies and sexuality, which can help them make informed decisions.

• It helps in preventing sexual abuse by educating teenagers about consent and boundaries (Option 1).

• Sex education is essential for dispelling myths and misconceptions related to sexual health and puberty (Option 2).

• It provides knowledge about the changes that occur during puberty, helping teenagers understand and cope with these changes (Option 4).

• However, the idea that knowing about body changes leads teenagers to make fun of each other is a misconception and counterproductive to the goals of sex education (Option 3).

Additional Information

• Comprehensive sex education includes topics such as human development, relationships, decision-making, abstinence, contraception, and disease prevention.

• It aims to equip young people with knowledge, skills, and values to make responsible choices about their sexual and social relationships.

• Studies have shown that comprehensive sex education can lead to reduced rates of teen pregnancy and sexually transmitted infections (STIs).

Q62. Answer: (b) 2400√10

Shortcut Trick

Ratio of numbers = 5 : 6 : 8

Sum of squares of ratio parts = $5^2 + 6^2 + 8^2 = 25 + 36 + 64 = 125$

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Common factor x^2 = Total Sum of Squares ÷ Ratio Sum = 1250 ÷ 125 = 10 => $x = \sqrt{10}$
Product = $(5 \times 6 \times 8) \times x^3 = 240 \times (\sqrt{10})^3 = 240 \times 10\sqrt{10} = 2400\sqrt{10}$
Therefore The correct answer is $2400\sqrt{10}$.
Alternate Method
Given: Ratio = 5 : 6 : 8, Sum of squares = 1250
Formula: Let numbers be ax, bx, cx; then $(ax)^2 + (bx)^2 + (cx)^2 = S$
=> Let the numbers be 5x, 6x, and 8x.
=> $(5x)^2 + (6x)^2 + (8x)^2 = 1250$
=> $25x^2 + 36x^2 + 64x^2 = 1250$
=> $125x^2 = 1250$
=> $x^2 = 10$
=> $x = \sqrt{10}$
=> Product = $5x \times 6x \times 8x = 240x^3$
=> Product = $240 \times (\sqrt{10})^3 = 240 \times 10\sqrt{10} = 2400\sqrt{10}$
Therefore The correct answer is $2400\sqrt{10}$.
Additional Information
Ratio and Proportion Basics
When terms are in ratio a:b:c, they can be represented as ax, bx, and cx where x is a common constant.
Compound Ratio
The product of multiple ratios a:b and c:d is given by the compound ratio (ac):(bd).
Square Root Property
For any positive number n, $(\sqrt{n})^3 = n\sqrt{n}$. This is essential for volumetric or product calculations involving square roots.

Q63. Answer: (d) 98

Shortcut Trick
Ratio of chocolates = 7 : 5
Difference in ratio units = 7 − 5 = 2 units
According to the question, 2 units = 28 chocolates => 1 unit = 14 chocolates
Larger number = 7 units = 7 × 14 = 98 chocolates
Therefore The correct answer is 98 chocolates.
Alternate Method
Given:
Ratio of chocolates in two boxes = 7 : 5
Difference in number of chocolates = 28
Calculations:
=> Let the number of chocolates in the boxes be 7x and 5x respectively.
=> According to the problem, 7x − 5x = 28
=> 2x = 28
=> x = 28 ÷ 2
=> x = 14
=> Number of chocolates in the larger box = 7x = 7 × 14
=> Total chocolates = 98
Therefore The correct answer is 98 chocolates.
Additional Information
Ratio and Proportion
A ratio compares two quantities by division. If a : b is the ratio, the actual values are ax and bx where x is the common multiplier.
Difference and Sum in Ratios
If the ratio is a : b and the sum is S, then 1 unit = S / (a + b). If the difference is D, then 1 unit = D / |a − b|.

Q64. Answer: (b) 59

Calculation:
53 × 54 × 52 = ?

Since, a^m × aⁿ = a^(m+n)

53 × 54 × 52 = 5^(3+4+2)

53 × 54 × 52 = 59

Therefore The correct answer is option 2.

Q65. Answer: (d) Dhruv Sitwala

The correct answer is Dhruv Sitwala

Key Points

• Pankaj Advani secured his 41st title by defeating Dhruv Sitwala in the final match.

• This victory marked his 8th title at the Asian 100 UP Billiards Championship 2022.

• Pankaj Advani is a renowned Indian billiards and snooker player with multiple world titles to his name.

• He has been a dominant force in both national and international billiards and snooker tournaments.

Additional Information

• Pankaj Advani has won numerous titles across different formats, including both the long and short formats of billiards and snooker.

• He has been awarded several prestigious honors in India, including the Padma Bhushan, Padma Shri, and the Rajiv Gandhi Khel Ratna Award.

• Advani's consistent performance has contributed significantly to India's reputation in the global billiards and snooker community.

Q66. Answer: (c) International Monetary Fund (IMF)

The correct answer is International Monetary Fund (IMF)

Key Points

• The 'World Economic Outlook-April 2022' report raised India's GDP growth estimate to 9% for 2022-23 and forecasted the economy to grow by 7.1% for 2023-24.

• This report was released by the International Monetary Fund (IMF).

• The IMF is an international organization that aims to promote global economic growth and financial stability, encourage international trade, and reduce poverty.

• The IMF publishes the World Economic Outlook report biannually, providing analysis and projections of economic developments globally.

Additional Information

• The IMF was established in 1944 during the Bretton Woods Conference and has its headquarters in Washington, D.C.

• The organization currently has 190 member countries.

• The primary purpose of the IMF is to ensure the stability of the international monetary system—the system of exchange rates and international payments that enables countries to transact with each other.

• IMF provides policy advice, financial assistance, and technical assistance to its member countries.

• It also monitors global economic trends and performance, providing regular assessments in its World Economic Outlook report.

Q67. Answer: (c) 73rd

The correct answer is 73rd

Key Points

• The 73rd Amendment of the Constitution of India envisages the Gram Sabha as the foundation of the Panchayat Raj System.

• This amendment was enacted in 1992 and came into effect on 24th April 1993.

• It added Part IX to the Constitution, titled "The Panchayats", and consists of provisions from Article 243 to Article 243O.

• The amendment aims to provide constitutional status to the Panchayati Raj institutions and ensure more participation of people in the administration of local affairs.

• The Gram Sabha is entrusted with powers and functions by the state legislatures to ensure effective governance at the grassroots level.

Additional Information

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

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

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

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

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• The Seventh Schedule of the Constitution contains three lists which delineate the subjects under the Union, State, and Concurrent lists.

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

• The 73rd Amendment has played a significant role in empowering local governance and decentralizing administration in India.

Q68. Answer: (c) 75 km/h

Shortcut Trick

When the distance traveled is the same for two speeds S1 and S2, the Average Speed is given by the Harmonic Mean formula.

Average Speed = (2 × S1 × S2) ÷ (S1 + S2)

=> Average Speed = (2 × 60 × 100) ÷ (60 + 100) = 12000 ÷ 160 = 75 km/h.

Therefore The correct answer is 75 km/h.

Alternate Method

Given:

Speed from P to Q (S1) = 60 km/h

Speed from Q to P (S2) = 100 km/h

Formula Used:

Average Speed = Total Distance ÷ Total Time

Calculations:

Let the distance between P and Q be the LCM of 60 and 100 = 300 km.

=> Time taken from P to Q (t1) = 300 ÷ 60 = 5 hours

=> Time taken from Q to P (t2) = 300 ÷ 100 = 3 hours

=> Total Distance = 300 + 300 = 600 km

=> Total Time = 5 + 3 = 8 hours

=> Average Speed = 600 ÷ 8 = 75 km/h

Therefore The correct answer is 75 km/h.

Additional Information

Average Speed for Different Distances

If distances d1, d2 are covered with speeds v1, v2, use Average Speed = (d1 + d2) ÷ (d1/v1 + d2/v2).

Relative Speed

For two objects moving in the opposite direction, Relative Speed = S1 + S2. For same direction, Relative Speed = |S1 − S2|.

Speed-Time Relation

When distance is constant, speed is inversely proportional to time (S prop. to 1/T). Ratio of speeds S1:S2 = Ratio of times T2:T1.

Q69. Answer: (c) Israel

The correct answer is Israel

Key Points

• India launched a commemorative logo to mark her 30th anniversary of diplomatic ties with Israel.

• The logo was unveiled in a virtual ceremony attended by the ambassadors of both countries.

• The logo features the Star of David and the Ashoka Chakra, symbolizing the strong friendship and deep-rooted ties between the two nations.

• India and Israel established full diplomatic relations on January 29, 1992, and have since developed a multi-faceted partnership across various sectors including defense, agriculture, and technology.

Additional Information

• India was among the 164 nations that voted in favor of the UN resolution for the partition of Palestine and the creation of Israel in 1947.

• Despite early support, India did not establish full diplomatic relations with Israel until 1992.

• Since the establishment of full diplomatic ties, India and Israel have significantly expanded cooperation in areas such as defense, agriculture, water management, and cybersecurity.

• The two countries have also increased people-to-people contacts through cultural exchanges and tourism.

• India is one of Israel's largest trading partners in Asia, and both countries continue to explore new avenues for collaboration.

Q70. Answer: (b) 5 hours

Shortcut Trick

Distance in first 2 hours = 60 × 2 = 120 km

Distance in next 2 hours (at 75 km/h) = 75 × 2 = 150 km

Total distance covered in 4 hours = 120 + 150 = 270 km

Remaining distance = 360 − 270 = 90 km

Time for remaining distance (at 90 km/h) = 90 ÷ 90 = 1 hour

Total time = 2 + 2 + 1 = 5 hours

Therefore The correct answer is 5 hr.

Alternate Method

Given: Initial Speed = 60 km/h, Increase = 15 km/h every 2 hours, Total Distance = 360 km.

Formula Used: Distance = Speed × Time

=> Distance in first interval (0 to 2 hrs) = 60 km/h × 2 hr = 120 km

=> Speed for second interval (2 to 4 hrs) = 60 + 15 = 75 km/h

=> Distance in second interval = 75 km/h × 2 hr = 150 km

=> Cumulative distance after 4 hours = 120 + 150 = 270 km

=> Remaining distance = 360 − 270 = 90 km

=> Speed for third interval (after 4 hrs) = 75 + 15 = 90 km/h

=> Time to cover remaining distance = 90 km ÷ 90 km/h = 1 hr

=> Total time taken = 2 + 2 + 1 = 5 hours

Therefore The correct answer is 5 hr.

Additional Information

Uniform Speed vs. Variable Speed

In uniform speed, the distance covered per unit time remains constant. In variable speed problems, calculate distance separately for each time interval where the speed is constant.

Average Speed

Average Speed = Total Distance ÷ Total Time. For this journey, Average Speed = 360 ÷ 5 = 72 km/h.

Arithmetic Progression in Speed

When speed increases by a fixed amount (d) over fixed time intervals, the speeds form an Arithmetic Progression (AP): a, a+d, a+2d, ...

Q71. Answer: (b) 6 and 9

Given equation: 7 × 8 + 9 - 6 ÷ 3 = 59

Let's check each option one by one.

Option 1) 8 and 9

Given: 7 × 8 + 9 - 6 ÷ 3 = 59

After interchanging 8 and 9 we get;

=> 7 × 9 + 8 - 6 ÷ 3 = 59

=> 63 + 8 - 2 = 59

=> 71 - 2 = 69

=> 69 ≠ 59

=> LHS ≠ RHS

Option 2) 6 and 9

Given: 7 × 8 + 9 - 6 ÷ 3 = 59

After interchanging 6 and 9 we get;

=> 7 × 8 + 6 - 9 ÷ 3 = 59

=> 56 + 6 - 3 = 59

=> 62 - 3 = 59

=> 59 = 59

=> LHS = RHS

Option 3) 3 and 6

Given: 7 × 8 + 9 - 6 ÷ 3 = 59

After interchanging 3 and 6 we get;

=> 7 × 8 + 9 - 3 ÷ 6 = 59

=> 56 + 9 - 0.5 = 59

=> 65 - 0.5 = 64.5

=> 64.5 ≠ 59

=> LHS ≠ RHS

Option 4) 7 and 3

Given: 7 × 8 + 9 - 6 ÷ 3 = 59

After interchanging 7 and 3 we get;

=> 3 × 8 + 9 - 6 ÷ 7 = 59

=> 24 + 9 - 0.857 ≈ 59

=> 33 - 0.857 ≈ 32.143

=> 32.143 ≠ 59

=> LHS ≠ RHS

Hence, the correct answer is "Option 2".

Q72. Answer: (b) cosec θ - cot θ

Shortcut Trick

Put a standard angle, let θ = 60°.

Expression = √((1 − 1/2) ÷ (1 + 1/2)) = √((1/2) ÷ (3/2)) = √(1/3) = 1/√3.

Check options: cosec 60° − cot 60° = 2/√3 − 1/√3 = 1/√3. (Matches)

Therefore The correct answer is cosec θ − cot θ.

Alternate Method

Given: √((1 − cos θ) ÷ (1 + cos θ))

Formula Used: Rationalization of denominator and Identity: $\sin^2 \theta + \cos^2 \theta = 1$

=> √[((1 − cos θ) × (1 − cos θ)) ÷ ((1 + cos θ) × (1 − cos θ))]

=> √[(1 − cos θ)² ÷ (1 − cos² θ)]

=> √[(1 − cos θ)² ÷ sin² θ]

=> (1 − cos θ) ÷ sin θ

=> (1 ÷ sin θ) − (cos θ ÷ sin θ)

=> cosec θ − cot θ

Therefore The correct answer is cosec θ − cot θ.

Additional Information

Trigonometric Identities

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

Reciprocal Relations

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

Rationalization Rule

When simplifying square roots involving (1 ± cos θ) or (1 ± sin θ), multiply numerator and denominator by the conjugate to create a perfect square.

Q73. Answer: (c) 11

The correct answer is 11

Key Points

• The first round of Mission Indradhanush (IMI) 4.0 was organised by the Union Ministry of Health and Family Welfare in 11 states in February 2022.

• The aim of the initiative was to increase the full immunisation coverage across these states.

• Mission Indradhanush aims to vaccinate all unvaccinated and partially vaccinated children and pregnant women by 2022 against vaccine-preventable diseases.

• The campaign is conducted in rounds, with each round focusing on identified high-risk areas.

• IMI 4.0 is a strategic endeavor to ensure that the benefits of vaccination reach every child and pregnant woman in the country.

Additional Information

• Mission Indradhanush was first launched in December 2014 to achieve full immunisation coverage for all children and pregnant women at a rapid pace.

• The mission focuses on districts and urban areas with low immunisation coverage to ensure that no child is left out.

• It includes vaccines for diseases such as diphtheria, whooping cough, tetanus, polio, tuberculosis, measles, and hepatitis B,

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among others.

• Special attention is given to marginalized and under-served populations, including those living in remote and inaccessible areas.

• The initiative has been praised for its contribution to reducing child mortality and improving maternal health in India.

Q74. Answer: (a) 50%

Calculation:

=> B2013 = 45 (Assumed from graph)

=> B2017 = 90 (Assumed from graph)

=> Percentage = (B2013 / B2017) × 100

=> Percentage = (45 / 90) × 100

=> Percentage = 50%

Q75. Answer: (b) 24.3

Given:

The value of 0.0486 ÷ 0.002

Concept:

To divide two decimal numbers, adjust the decimal places to convert the divisor into a whole number and then perform the division.

Formula Used:

Division of decimals: Move the decimal point of both numbers to the right until the divisor is a whole number.

Calculation:

We have,

=> 0.0486 ÷ 0.002

Move the decimal point three places to the right for both numbers:

=> 48.6 ÷ 2

Now, perform the division:

=> 48.6 ÷ 2 = 24.3

Therefore The correct answer is option 2.

Q76. Answer: (c) North-west

Given:

Anita is standing facing the north direction.

Then, she turns 135° anticlockwise.

After that, she turns 90° clockwise.

So, Anita is facing 'North west' direction.

Hence, the correct answer is "Option 3".

Q77. Answer: (a) Neither assumption I nor II is implicit

Statement:

"Essay writing is an art. It requires an understanding of the subject as well as a command over the language to be able to write a good essay."

Analysis:

Assumption I: The statement mentions that essay writing requires an understanding of the subject. However, it does not state that complete mastery is necessary. It implies that some level of understanding is required but does not suggest that mastery is mandatory. Therefore, Assumption I is not implicit.

Assumption II: The statement indicates that both an understanding of the subject and a command over the language are needed to write a good essay. Thus, having only a good command over the language is not sufficient on its own. Therefore, Assumption II is not implicit.

Neither Assumption I nor Assumption II is implicit in the statement.

Hence, the correct answer is "Option (1)".

Q78. Answer: (a) Number 4

The correct answer is Number 4

Key Points

• Number 4 indicates the spinal cord's location in the human brain.

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• The spinal cord is an essential part of the central nervous system that extends from the brainstem and continues down the vertebral column.
• It plays a crucial role in transmitting nerve signals between the brain and the rest of the body.
• Understanding the location and function of the spinal cord is vital for studying human anatomy and neurobiology.

Additional Information

• The spinal cord starts at the medulla oblongata in the brainstem and extends down to the lumbar region of the vertebral column.
• It is protected by the vertebral bones and is surrounded by cerebrospinal fluid, which cushions it against impacts.
• The spinal cord is responsible for reflex actions and transmitting sensory and motor information to and from the brain.
• Damage to the spinal cord can result in loss of sensation and motor function below the level of injury.
• Medical imaging techniques like MRI and CT scans are often used to diagnose spinal cord injuries and diseases.

Q79. Answer: (a) Credit control

The correct answer is Credit Control.

Key Points

• Credit control is NOT included in the financial budget of India.
• The financial budget primarily includes revenue deficit, primary deficit, and fiscal deficit.
• Revenue deficit occurs when the net income generated (revenue receipts) is less than the projected net income.
• Primary deficit is the fiscal deficit of the current year minus the interest payments on previous borrowings.
• Fiscal deficit is the difference between the government's total expenditure and its total receipts (excluding borrowing).

Additional Information

• Credit control refers to the measures taken by the central bank to control the amount of credit in the economy.
• The financial budget is presented annually by the Finance Minister and outlines the government's revenue and expenditure for the upcoming fiscal year.
• The budget aims to allocate resources efficiently, manage public finances, and achieve economic stability and growth.
• India's financial budget includes various components such as tax revenue, non-tax revenue, capital receipts, and expenditure on different sectors.
• Understanding the components of the financial budget is crucial for analyzing the government's fiscal policy and economic strategy.

Q80. Answer: (c) XOVZM

Given: BEING : YVRMT : : PRIDE : KIRWV : : CLEAN: ?

The logic followed here is:

→ BEING : YVRMT

→ PRIDE : KIRWV

→ CLEAN: ?

Hence, the correct answer is "Option 3".

Q81. Answer: (b) Shaili Singh

The correct answer is Shaili Singh

Key Points

• Shaili Singh is an Indian athlete specializing in the long jump.
• She won a silver medal at the U-20 World Athletics Championships in 2021.
• Shaili Singh is considered one of India's most promising young athletes in track and field.
• Her achievement at the U-20 World Athletics Championships has brought her significant recognition in the sports community.

Additional Information

• Mercy Kuttan is a former Indian long jumper who later switched to sprinting and is the first Indian woman to qualify for the Olympics in long jump.
• Nayana James is another Indian long jumper who has represented India in various international competitions.
• Seema Punia is an Indian discus thrower and has won medals in several Commonwealth and Asian Games.

Q82. Answer: (b) Only Statement I is Correct.

The correct answer is Only Statement I is Correct..

Key Points

• Statement I: Dobereiner gave the law of triads.

• Statement II: Dobereiner tried to arrange the elements with different properties into groups, having three elements each.

• Explanation:

• Johann Wolfgang Döbereiner was a German chemist who is best known for his work that led to the development of the periodic classification of elements.

• The Law of Triads, proposed by Döbereiner in 1817, states that the atomic weight of the middle element of a triad is approximately the arithmetic mean of the atomic weights of the other two elements.

• Statement I is correct because it accurately describes Döbereiner's contribution to chemistry.

• However, Statement II is incorrect because it suggests that Döbereiner tried to arrange elements with different properties into groups. In reality, Döbereiner grouped elements with similar properties into triads.

• Therefore, only Statement I is correct, making Option 2 the correct answer.

Q83. Answer: (d) Soil

The correct answer is Soil

Key Points

• Soil is an abiotic component of the ecosystem.

• Biotic components refer to the living parts of an ecosystem, such as frogs, flowers, and insects.

• Abiotic components are the non-living parts of an ecosystem that influence living organisms, including soil, water, and air.

• Soil provides essential nutrients and a medium for plant growth, but it itself is not a living entity.

Additional Information

• An ecosystem consists of both biotic (living) and abiotic (non-living) components that interact with each other.

• Examples of biotic components include plants, animals, bacteria, and fungi.

• Abiotic components include climate, sunlight, temperature, and soil.

• Understanding the distinction between biotic and abiotic components is essential for studying ecological interactions and environmental science.

Q84. Answer: (c) 3^(rd)

The correct answer is 3rd

Key Points

• India ranks 3rd globally in terms of average annual net gain in forest area according to the Economic Survey 2021-22.

• This ranking reflects India's commitment to increasing its forest cover and emphasizes the country's efforts towards environmental conservation.

• The survey highlights the importance of sustainable forest management and afforestation programs in achieving this rank.

• India's forest policies and initiatives have played a significant role in enhancing forest area, contributing to biodiversity conservation and climate change mitigation.

Additional Information

• The Economic Survey is an annual document released by the Ministry of Finance, Government of India, that reviews the developments in the Indian economy over the past financial year.

• It provides a detailed analysis of various sectors, including agriculture, industry, and services, and offers insights into the country's economic performance and policy initiatives.

• The survey serves as a valuable resource for policymakers, researchers, and stakeholders to understand the economic trends and formulate strategies for sustainable growth.

• India's efforts towards forest conservation are aligned with its commitments under international agreements such as the Paris Agreement and the United Nations Sustainable Development Goals (SDGs).

• Continuous monitoring, community participation, and the use of technology are crucial for maintaining and enhancing forest cover in the country.

Q85. Answer: (d) Raja Ram Mohan Roy

The correct answer is Raja Ram Mohan Roy

Key Points

• Raja Ram Mohan Roy founded the Brahmo Samaj in 1828.

• He is renowned for his efforts in advocating modern education, particularly for women.

• Raja Ram Mohan Roy was a staunch opponent of social evils like Sati, child marriage, and the caste system.

• His reformist zeal earned him the title of the "Father of the Indian Renaissance."

• The Brahmo Samaj played a crucial role in the socio-religious reform movements in India during the 19th century.

Additional Information

• Raja Ram Mohan Roy was born on 22nd May 1772 in Radhanagar, Bengal.
• He was a polyglot, proficient in multiple languages including Sanskrit, Persian, Arabic, English, and Bengali.
• In addition to founding the Brahmo Samaj, he also established the Atmiya Sabha in 1815 to campaign against social injustices.
• His efforts were instrumental in the abolition of Sati, leading to the enactment of the Sati Regulation Act in 1829 by the British government.
• Raja Ram Mohan Roy's contributions extend to journalism, as he published several newspapers to disseminate his reformist ideas.
• He passed away on 27th September 1833 in Bristol, England, where he was on a visit to campaign for Indian rights and autonomy.

Q86. Answer: (d) Fundamental Duties

The correct answer is Fundamental Duties

Key Points

• Article 51A of the Indian Constitution specifically deals with the Fundamental Duties of Indian citizens.
• These duties were added by the 42nd Amendment Act in 1976, based on the recommendations of the Swaran Singh Committee.
• There are currently 11 Fundamental Duties listed under Article 51A.
• These duties encompass a range of responsibilities, including respect for the national symbols, cherishing the noble ideals of the freedom struggle, and upholding the sovereignty and integrity of India.
• Fundamental Duties serve as a constant reminder to citizens that while enjoying their rights, they also have obligations towards the nation.

Additional Information

• The inclusion of Fundamental Duties aims to instill a sense of patriotism and to uphold the spirit of nationalism among citizens.
• While Fundamental Duties are non-justiciable, meaning they are not enforceable by law, they act as moral obligations for every citizen to contribute to the nation's well-being.
• The concept of Fundamental Duties was borrowed from the Constitution of the USSR (now Russia).
• These duties are intended to complement and reinforce the Fundamental Rights provided to citizens in Part III of the Constitution.
• Understanding and performing these duties is essential for the harmonious and progressive development of society.
• The Fundamental Duties are detailed in Part IV-A of the Indian Constitution.

Q87. Answer: (b) 6.8

Shortcut Trick

Identify the Modal Class (highest frequency): Frequency 12 corresponds to class 6 − 8.

Parameters: l = 6, f1 = 12, f0 = 8, f2 = 6, h = 2.

Apply Mode formula: Mode = l + [(f1 − f0) / (2f1 − f0 − f2)] × h

Calculation: Mode = 6 + [(12 − 8) / (24 − 14)] × 2 = 6 + (4 / 10) × 2 = 6.8.

Therefore The correct answer is 6.8.

Alternate Method

Given:

Maximum frequency = 12, so Modal Class = 6 − 8.

Lower limit (l) = 6

Frequency of modal class (f1) = 12

Frequency of preceding class (f0) = 8

Frequency of succeeding class (f2) = 6

Class size (h) = 2

Formula Used:

Mode = l + [(f1 − f0) / (2f1 − f0 − f2)] × h

Calculations:

=> Mode = 6 + [(12 − 8) / (2 × 12 − 8 − 6)] × 2

=> Mode = 6 + [4 / (24 − 14)] × 2

=> Mode = 6 + [4 / 10] × 2

=> Mode = 6 + 0.4 × 2

=> Mode = 6 + 0.8

=> Mode = 6.8

Therefore The correct answer is 6.8.

Additional Information

Empirical Formula

The relationship between the three measures of central tendency is given by: Mode = 3 × Median − 2 × Mean.

Modal Class

In grouped data, the Modal Class is the interval that contains the highest frequency.

Median for Grouped Data

Median = l + [(n/2 − cf) / f] × h, where cf is the cumulative frequency of the class preceding the median class.

Q88. Answer: (a) 88

The hour and minute hands make a right angle 2 times in 1 hour, and 22 times in every 12 hours (because they don't make a right angle exactly at 6 o'clock and 12 o'clock).

So, Here, two days = 48 hours.

Therefore, in 48 hours 22 × 4 = 88 times.

Hence, the correct answer is "Option (1)".

Q89. Answer: (d) 746 W

The correct answer is 746 W

Key Points

• 1 horsepower is equivalent to 746 watts (W).

• Horsepower is a unit of power that was originally defined to compare the output of steam engines with the power of draft horses.

• The unit was later expanded to include the output power of other types of engines and motors.

• 1 horsepower (hp) is equal to 746 watts (W), which is a measure of the rate at which work is done or energy is transferred.

Additional Information

• James Watt is credited with defining the concept of horsepower to quantify the power output of steam engines.

• The term "horsepower" was adopted in the late 18th century during the industrial revolution.

• There are different types of horsepower, such as mechanical horsepower, metric horsepower, and electrical horsepower, but the most commonly used is mechanical horsepower.

• 1 mechanical horsepower is approximately equal to 745.7 watts.

• The use of horsepower as a unit of measurement has been largely replaced by the watt in scientific and engineering contexts.

Q90. Answer: (c) Both (ii) and (iii)

The correct answer is 3 Both (ii) and (iii).

Key Points

• Statement (i): Magnetic field strength is strongest at the poles of a bar magnet, not at the centre. Therefore, this statement is incorrect.

• Statement (ii): No two magnetic field lines can intersect. This is because if they did, it would imply that the magnetic field has two different directions at the point of intersection, which is not possible. Hence, this statement is correct.

• Statement (iii): Magnetic field lines always form closed continuous curves. They emerge from the north pole and merge at the south pole outside the magnet and continue through the magnet from the south pole back to the north pole. Hence, this statement is correct.

Q91. Answer: (a) 95

The logic follows here:

Hence, the correct answer is "95".

Q92. Answer: (a) 7

The correct answer is 7

Key Points

• The original Constitution of 1950 envisaged a Supreme Court with a Chief Justice and 7 puisne Judges.

• It was left to Parliament to increase this number as required.

• The Supreme Court of India is the highest judicial forum and final court of appeal as established by the Constitution.

• It has extensive powers in the form of original, appellate, and advisory jurisdictions.

• The number of judges in the Supreme Court has been increased from time to time to handle the increasing number of cases.

Additional Information

• The Supreme Court of India was inaugurated on January 28, 1950.

• It succeeded the Federal Court of India, which had been established under the Government of India Act 1935.

• The Supreme Court initially sat in the Chamber of Princes in the Parliament House, before moving to its present building.

• The Constitution of India provides for the independence of the judiciary, ensuring that judges are free from any influence from the executive or legislative branches of government.

• The Chief Justice of India is appointed by the President of India and serves until the age of 65.

• The Supreme Court has the power of judicial review to ensure the constitutionality of laws.

• As of now, the sanctioned strength of the Supreme Court is 34 judges, including the Chief Justice of India.

Q93. Answer: (d) 91

Shortcut Trick

Ratio of numbers = 7 : 3

Difference in ratio parts = 7 − 3 = 4 units

Given, 4 units = 52 => 1 unit = 13

Greater number (7 units) = 7 × 13 = 91

Therefore The correct answer is 91.

Alternate Method

Given:

Ratio of numbers = 7 : 3

Difference between numbers = 52

Calculations:

=> Let the numbers be 7x and 3x.

=> According to the question, 7x − 3x = 52

=> 4x = 52

=> x = 52 ÷ 4

=> x = 13

=> Greater number = 7x = 7 × 13

=> Greater number = 91

Therefore The correct answer is 91.

Additional Information

Ratio and Proportion

A ratio compares two quantities by division. If a : b is the ratio, then the numbers can be represented as ax and bx, where x is a common multiplier.

Sum of Numbers

If the sum of two numbers in ratio a : b is S, then the numbers are [a/(a+b)] × S and [b/(a+b)] × S.

Difference Property

If the difference between two numbers in ratio a : b (a > b) is D, then the constant x = D / (a − b).

Q94. Answer: (c) 11

The logic followed here is:

Position of Manoj from the front = 11th

Position of Shahin from the back = 7th

Total number of people in the queue = 30

Position of Shahin from the front = Total number of people - Position from the back + 1

= 30 - 7 + 1

= 24th

Neeraj is standing exactly in front of Shahin, so Neeraj is at 23rd position.

So,

Number of people between Neeraj and Manoj = Position of Neeraj - Position of Manoj - 1

= 23 - 11 - 1

= 11.

Hence, the correct answer is "11".

Q95. Answer: (c) 82

Given Equation: 12 ÷ 6 + 28 - 7 × 14 = ?

Decoding the given information:

Symbols	•	•	÷	×
Meaning	•	÷	×	•

Now replacing the signs from left to right using the given decoding information, we get:

New Equation: 12 × 6 - 28 ÷ 7 + 14 = ?

Calculation:

= 12 × 6 - 28 ÷ 7 + 14

= 12 × 6 - 4 + 14

= 72 - 4 + 14

= 68 + 14

= 82

Hence, the correct answer is *'Option 3'.*

Q96. Answer: (d) Manikaran

The correct answer is 4) Manikaran

Key Points

• Manikaran is a prominent site for harnessing geothermal energy in India.

• Located in the state of Himachal Pradesh, it is known for its hot springs which are utilized for geothermal energy production.

• Geothermal energy is a renewable energy source derived from the natural heat of the earth.

• Manikaran's geothermal resources are used for various applications including heating and electricity generation.

• Other options like Bokaro, Kolkata, and Tarapur are not known for geothermal energy harnessing.

Additional Information

• Bokaro is known for its steel plant and industrial activities.

• Kolkata is a major metropolitan city with historical and cultural significance.

• Tarapur is known for its atomic power station, which is a nuclear energy facility.

• Geothermal energy is considered an eco-friendly and sustainable source of energy, reducing reliance on fossil fuels.

• India is exploring various geothermal sites to expand its renewable energy portfolio.

Q97. Answer: (d) Virtual and highly diminished

The correct answer is Virtual and highly diminished

Key Points

• When an object is placed at the principal focus of a concave lens, the image formed is virtual, highly diminished, and on the same side as the object.

• A concave lens always forms a virtual image, which means the image cannot be projected on a screen.

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

• This characteristic of concave lenses makes them useful in applications like peepholes and certain types of optical instruments.

Additional Information

• Concave lenses are also known as diverging lenses because they spread out light rays that have been refracted through them.

• They are thinner at the center than at the edges, causing parallel incoming light rays to diverge outward.

• Concave lenses are used in a variety of applications, including glasses for nearsightedness (myopia), cameras, and flashlights.

• In contrast, a convex lens converges light rays and can form real or virtual images depending on the position of the object relative to the lens.

Q98. Answer: (d) West Bengal

The correct answer is West Bengal

Key Points

• Mangrove forests in India are primarily found in the state of West Bengal.

• The Sundarbans, located in West Bengal, are the largest mangrove forest in the world and a UNESCO World Heritage site.

• These forests are crucial for protecting coastal regions from erosion, cyclones, and tsunamis.

• Mangroves serve as important breeding grounds for a variety of marine species and support rich biodiversity.

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Additional Information

• Other states in India where mangrove forests are found include Maharashtra, Andhra Pradesh, Tamil Nadu, and Odisha.

• Mangroves play a vital role in carbon sequestration, helping to mitigate climate change.

• Conservation efforts are essential to protect these unique ecosystems from threats such as deforestation, pollution, and climate change.

• The Indian government has implemented various policies and programs aimed at the conservation and sustainable management of mangrove forests.

Q99. Answer: (d) (4, 33, 7)

The logic followed here is:

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

Now,

For, (1, 8, 3)

→ (3)² - (1)² = 9 - 1 = 8 = 2nd number

For, (2, 21, 5)

→ (5)2 - (2)² = 25 - 4 = 21 = 2nd number

Similarly,

Option 1: (2, 26, 3)

→ (3)² - (2)² = 9 - 4 = 5 ≠ 26 (False)

Option 2: (5, 112, 11)

→ (11)² - (5)² = 121 - 25 = 96 ≠ 112 (False)

Option 3: (7, 128, 10)

→ (10)² - (7)² = 100 - 49 = 51 ≠ 128 (False)

Option 4: (4, 33, 7)

→ (7)² - (4)² = 49 - 16 = 33 = 2nd number (True)

Hence, the correct answer is "Option 4".

Q100. Answer: (b) 21√15 m2

Shortcut Trick

For a triangle with sides a = 12, b = 14, and c = 16.

Semi-perimeter (s) = (12 + 14 + 16) ÷ 2 = 21 m.

Area = √[21 × (21−12) × (21−14) × (21−16)] = √[21 × 9 × 7 × 5].

Area = √[7 × 3 × 3² × 7 × 5] = 7 × 3 × √15 = 21√15 m².

Therefore The correct answer is 21√15 m².

Alternate Method

Given: Sides of the triangle are a = 12 m, b = 14 m, and c = 16 m.

Formula Used: Heron's Formula for Area = √[s(s−a)(s−b)(s−c)], where s = (a + b + c) ÷ 2.

=> s = (12 + 14 + 16) ÷ 2

=> s = 42 ÷ 2 = 21 m

=> Area = √[21 × (21 − 12) × (21 − 14) × (21 − 16)]

=> Area = √[21 × 9 × 7 × 5]

=> Area = √[3 × 7 × 3 × 3 × 7 × 5]

=> Area = 3 × 7 × √[3 × 5] = 21√15 m²

Therefore The correct answer is 21√15 m².

Additional Information

Heron's Formula

Used to find the area of a triangle when all three sides are known: Area = √[s(s−a)(s−b)(s−c)].

Equilateral Triangle Area

If all sides are equal (a), the area is given by (√3 ÷ 4) × a².

Right-Angled Triangle Area

Area = 1/2 × Base × Height. Heron's formula will yield the same result for such triangles.

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