RRB ALP CBT-I 2024 Official Paper (Held On: 26 Nov, 2024 Shift 1) (Previous Year Paper)

RRB Group D • 2024 • 75 questions • 60 minutes • Answer key and solutions

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STAGE I (CBT I)

Q1. Based on the English alphabetical order, three of the following four letter-cluster pairs are alike in a certain way and thus form a group. Which pair does not belong to that group?

(Note: The odd one out is not based on the number of consonants/vowels or their position in the letter-cluster.)

(a) VS-PU
(b) YV-SW
(c) RO-LQ
(d) TQ-NS

Q2. Which is the internal energy reserve in plants?

(a) Glycogen
(b) Starch
(c) Glucose
(d) Sucrose

Q3. If the mode of the following data is 7, then find the value of k.2, 4, 6, 7, 5, 6, 10, 6, 7, 2k + 1, 9, 7, 13

(a) 3
(b) 6
(c) 2
(d) 4

Q4. Out of his total income, Sanjay spends 20% on house rent and 70% of the rest on household expenses. If he saves Rs. 1,800, then his total income is:

(a) Rs. 10,000
(b) Rs. 7,500
(c) Rs. 8,000
(d) Rs. 9,000

Q5. In which month was the Guru Kelucharan Mohapatra Awards 2024 organised by the Srjan-Guru Kelucharan Mohapatra Odissi Nrityabasa?

(a) October
(b) September
(c) August
(d) July

Q6. Which of the following options should come in place of the question mark (?) in the given series based on the English alphabetical order?

CFI, LOR, UXA, DGJ,?

(a) MOQ
(b) LOR
(c) LNP

(d) MPS

Q7. For preparation of which of the following compounds is the chlor-alkali process used?

(a) NaOH + Cl2
(b) NaHCO3
(c) Na2CO3
(d) NaCl

Q8. The work done by a constant force of 5 Newton acting on a body is 5 joules. The displacement of the body in the direction of the applied force is _____.

(a) 100 m
(b) 10 m
(c) 1 m
(d) 1000 m

Q9. The LCM of 24, 42, and 56 is:

(a) 186
(b) 168
(c) 618
(d) 816

Q10. Which of the following options should come in place of the question mark (?) in the given series based on the English alphabetical order?

HLA, BFU, VZO, PTI?

(a) JMB
(b) JNC
(c) JMC
(d) JNB

Q11. In a certain code language, 'PLOW' is coded as '7164' and 'WOLF' is coded as '1564'. What is the code for 'F' in the given code language?

(a) 6
(b) 1
(c) 5
(d) 7

Q12. Magnification produced by a convex mirror for a given object of height 5 cm is 0.2. Here, the height of the image is _____.

(a) 10 cm
(b) 1.5 cm
(c) 0.4 cm
(d) 1 cm

Q13. Find the total surface area of a cylinder whose radius of base is 7 cm and height is 12 cm.

(a) 308 π cm^2
(b) 266 π cm^2
(c) 208 π cm^2
(d) 280 π cm^2

Q14. In the word OPTICAL, each vowel is changed to the letter immediately succeeding it in the English alphabetical order and each consonant is changed to the letter immediately preceding it in the English alphabetical order. Which of the following letters is repeated twice in the new group of letters thus formed?

(a) B
(b) P
(c) O
(d) K

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Q15. Evaluate the given expression. 13 - 12 ÷ 4 × 2

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

Q16. The equivalent resistance of the two resistors of resistance R ohm each connected in series is _____

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

Q17. Which of the following statements is/are correct?

Statements:

I) Electromagnet is a device used to convert magnetic field into electrical energy.

II) Electromagnet is a device used to convert mechanical energy into magnetic energy.

(a) Statement II only
(b) Neither Statement I nor II
(c) Both Statements I and II
(d) Statement I only

Q18. Evaluate 297*303

(a) 89991
(b) 89091
(c) 90991
(d) 79991

Q19. Seven people, B, C, D, E, F, G and K are sitting in a straight line, facing north. Only two people sit to the left of B. Only three people sit between B and K. F sits second to the right of B. Only two people sit between F and C. G sits at some place to the right of E but at some place to the left of D. How many people sit to the right of G?

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

Q20. Jaggu can make one wooden chair in 3 days and Rabbu can make the same chair in 4 days. If they work together, in how many days will they make 14 chairs of the same kind?

(a) 18 days
(b) 16 days
(c) 24 days
(d) 20 days

Q21. Based on the English alphabetical order, three of the following four letter-cluster pairs are alike in a certain way and thus form a group. Which pair does not belong to that group?

(Note: The odd one out is not based on the number of consonants/vowels or their position in the letter cluster.)

(a) ZI-UD
(b) BK-VE
(c) TC-NW
(d) EN-YH

Q22. If a regular polygon has 20 diagonals, then the number of sides of this polygon is:

(a) 5
(b) 6
(c) 8
(d) 10

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Q23. Which of the following options does NOT represent a property of suspensions?

(a) The particles of a suspension scatter a beam of light passing through it.
(b) A suspension is a heterogeneous mixture.
(c) The particles of a suspension cannot be seen by the naked eyes.
(d) A suspension is unstable in nature.

Q24. If + means –, – means ×, × means ÷, ÷ means +, then what will come in place of the question mark (?) in the following equation?

22 – 5 ÷ 3 + 12 × 3 = ?

(a) 111
(b) 109
(c) 112
(d) 110

Q25. Shailesh Nayak has been conferred Padma Shri award in 2024 in which field?

(a) Science and Engineering
(b) Medicine
(c) Sports
(d) Literature & Education

Q26. In a certain code language, 'climb the mountains' is coded as 'js bg md' and 'climb the tree' is coded as 'bg cx js'. What is the code for 'tree' in the given code language?

(a) bg
(b) cx
(c) js
(d) md

Q27. In which of the following types of reaction is there an exchange of ions between the reactants?

(a) Decomposition
(b) Addition reaction
(c) Double displacement reaction
(d) Disproportion reaction

Q28. Other than the nervous system, which other system helps in control and coordination in our body?

(a) Excretory system
(b) Endocrine system
(c) Respiratory system
(d) Digestive system

Q29. A car can cover 275 km in 5 hours. If its speed is reduced by 5 km/hr, then how much time will the car take to cover a distance of 250 km?

(a) 4 hr 30 min
(b) 6 hr
(c) 5 hr 30 min
(d) 5 hr

Q30. A diver rowing at the speed of 3 km/h in still water takes double the time going 50 km upstream compared to going 50 km downstream. The speed of the diver against the stream is

(a) 4/3 km/h
(b) 1 km/h
(c) 7/3 km/h
(d) 2 km/h

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Q31. The successful automotive trials of the Zorawar light tank on 13 September 2024 were an important milestone for India's defence sector. Which organisation is responsible for developing this light tank?

(a) Defence Research and Development Organisation (DRDO)
(b) Hindustan Aeronautics Limited (HAL)
(c) Indian Army
(d) Bharat Electronics Limited (BEL)

Q32. The draft of the 'Telecommunications (Administration of Digital Bharat Nidhi) Rules, 2024' was published for public consultation on which date?

(a) 1 August 2024
(b) 30 June 2024
(c) 5 September 2024
(d) 4 July 2024

Q33. Read the given statements and conclusions carefully. You have to take the given statements to be true even if they seem to be at variance from commonly known facts and decide which conclusion(s) logically follow(s) from the given statements.

Statements:

All ropes are chains.

All chains are strings.

Conclusions:

(I) All strings are ropes.

(II) All ropes are strings.

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

Q34. ACE is related to BDF in a certain way. In the same way, GIK is related to HJL. To which of the following options is MOQ related, to following the same logic?

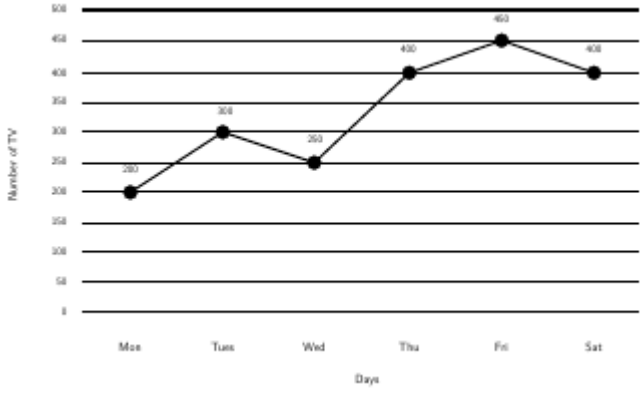
(a) OPQ
(b) NPR
(c) NPS
(d) NOP

Q35. Which of the following does NOT increase the rate of evaporation?

(a) Decrease in temperature
(b) Increase in surface area
(c) Increase in wind speed
(d) Decrease in humidity

Q36. Study the given graph and answer the question that follows.

The graph shows the daily production of TV sets in a factory for 6 days of a week.



How many units of TV sets were produced on Monday and Tuesday together?

(a) 400
(b) 700
(c) 500
(d) 600

Q37. _____ has been honoured as an International Anti-Corruption Champion by the US government for the year 2023.

(a) Nikhil Dey
(b) Medha Patkar
(c) Anna Hazare
(d) Aruna Roy

Q38. Which of the following options represents two successive discounts that are equivalent to a single discount of 84%?

(a) 30% and 70%
(b) 20% and 80%
(c) 10% and 90%
(d) 40% and 60%

Q39. As of March 2024, what does Morgan Stanley's research forecast for India's GDP growth rate in FY25?

(a) 6.80%
(b) 2.40%
(c) 0.90%
(d) 12.50%

Q40. The sum of a two-digit number and the number obtained by reversing the digits is 99. If the digits of the number differ by 5, then the two-digit number can be:

(a) 27
(b) 83
(c) 16
(d) 18

Q41. In a row of 48 students facing North, Tinu is 15th from the left end. If Dinesh is 9th to the right of Tinu, what is Dinesh's position from the right end of the line?

(a) 25th
(b) 23rd
(c) 22nd
(d) 24th

Q42. In the following number-pairs, the second number is obtained by applying certain mathematical operations to the first number. Which numbers should replace X and Y so that the pattern followed by the two numbers on the left side of :: is same as that on the right side of ::?

(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.)

X : 112 :: 15 : Y

(a) X = 14, Y = 166
(b) X = 12, Y = 184
(c) X = 10, Y = 148
(d) X = 16, Y = 192

Q43. A solid metallic sphere of radius 12 cm is melted and recast in the form of small spheres of radius 2 cm. How many small spheres are formed?

(a) 96
(b) 216
(c) 48

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(d) 864

Q44. Indian women team won the Chess Olympiad 2024 title by defeating which of the following teams?

(a) Azerbaizan
(b) Spain
(c) France
(d) Taiwan

Q45. Select the number from among the given options that can replace the question mark (?) in the following series.
549, 525, 477, 405, 309, ?

(a) 145
(b) 167
(c) 189
(d) 139

Q46. Khelo India Para games (2023) were held in _____.

(a) Dispur
(b) Ahmedabad
(c) Patna
(d) New Delhi

Q47. In a certain code language,
A + B means ‘A is the mother of B’,
A – B means ‘A is the brother of B’,
A × B means ‘A is the wife of B’,
A ÷ B means ‘A is the father of B’
And A # B means ‘A is the daughter of B’.
How is K related to Q if ‘P × Q ÷ T + Z – S # K’?

(a) Husband's mother
(b) Wife's brother
(c) Wife's father
(d) Daughter's husband

Q48. Rohit starts from Point A and drives 25 km towards the East. He then takes a right turn, drives 17 km, turns right and drives 14 km. He then takes a right turn and drives 11 km. He takes a final left turn, drives 11 km and stops at Point P. How far (shortest distance) and towards which direction should he drive to reach Point A again? (All turns are 90 degrees turns only unless specified.)

(a) 6 km towards the South
(b) 8 km towards the North
(c) 4 km towards the North
(d) 6 km towards the North

Q49. Which phenomenon causes bending of the ray of light when it moves in the earth's atmosphere?

(a) Atmospheric refraction
(b) Atmospheric scattering
(c) Atmospheric reflection
(d) Atmospheric dispersion

Q50. In what duration will a sum of money double itself at 10% per annum rate of simple interest?

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

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Q51. What percentage of the numbers from 1 to 70, both included, have 1 or 7 in the unit's digit?

(a) 21
(b) 14
(c) 20
(d) 1

Q52. Who among the following participated in the United Nations 'World Climate Action Summit (COP28)' in Dubai?

(a) Ram Nath Kovind
(b) Narendra Modi
(c) Jagdeep Dhankhar
(d) Droupadi Murmu

Q53. Which of the following lacks membrane?

(a) Plant cell
(b) Fungi cell
(c) Viruses
(d) Animal cell

Q54. If a : b = 3 : 2 and b : c = 3 : 2, then a : b : c = ?

(a) 9 : 6 : 4
(b) 9 : 4 : 6
(c) 6 : 3 : 4
(d) 6 : 4 : 3

Q55. A, B, E, F, L, M and P are sitting around a circular table, facing the centre. F sits second to the left of E. A sits third to the right of B. M sits third to the left of L. A sits to the immediate right of M. P is not an immediate neighbour of M. Who sits second to the left of F?

(a) A
(b) M
(c) B
(d) P

Q56. Select the triad which follows the same pattern as that followed by the two triads given below. Both triads follow the same pattern.

JG-NK-RT

EB-IF-MO

(a) GD-KI-OQ
(b) IF-MJ-QR
(c) HE-LI-PR
(d) FC-JG-NO

Q57. Which Indian singer was awarded the Padma Bhushan award, one of India's highest civilian awards, for the first time in 2024?

(a) Asha Bhosle
(b) Usha Uthup
(c) Alka Yagnik
(d) Lata Mangeshkar

Q58. If each vowel in the word HISTORY is changed to the letter preceding it in the English alphabetical order and each consonant is changed to the letter following it in the English alphabetical order, then how many vowels will be there in the group of letters thus formed?

(a) 1
(b) 0
(c) 3
(d) 2

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Q59. Which part of the neuron is responsible for acquiring information?

(a) Dendritic tip
(b) Axon
(c) Cell body
(d) Synapse

Q60. The simplified value of 0.002 × 0.5 is:

(a) 0.1
(b) 0.01
(c) 0.0001
(d) 0.001

Q61. A tree breaks and falls to the ground such that its upper part is still partially attached to its stem. At what height did it break, if the original height of the tree was 24 m and it makes an angle of 30° with the ground?

(a) 9 m
(b) 10 m
(c) 12 m
(d) 8 m

Q62. The arithmetic mean of the observations 39, 49, 59, 60, 70, 80, 90, 93 and 90 is:

(a) 79
(b) 78
(c) 70
(d) 76

Q63. When an empty bottle is closed air tight and pushed inside water it bounces back when it is released. This is because _____.

(a) water does not exert force on an empty bottle
(b) gravitational force on a bottle is equal to the buoyant force of the water
(c) upthrust of water on a bottle is greater than the gravitational force acting on the bottle
(d) gravitational force acting on the bottle is greater than the upthrust of water

Q64. Which two numbers should be interchanged to make the given equation correct?

186 – 82 + (129 ÷ 3) – 6 × 8 + (31 – 19) × 2 = 85

(Note: Interchange should be done of entire number and not individual digits of a given number.)

(a) 186 and 129
(b) 8 and 19
(c) 2 and 6
(d) 82 and 31

Q65. In the following number-pairs, the second number is obtained by applying certain mathematical operations to the first number. Which numbers should replace X and Y so that the pattern followed by the two numbers on the left side of :: is same as that on the right side of ::?

(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.)

X : 68.4 :: 22 : Y

(a) X = 22, Y = 74.8
(b) X = 14, Y = 68.8
(c) X = 18, Y = 83.6
(d) X = 16, Y = 70.4

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Q66. In this question, a statement is followed by two courses of action, numbered I and II. You must assume everything in the statement to be true and on the basis of the information given in the statement, decide which of the courses of action logically follow(s) for pursuing.

Statement:

Due to water pipeline work planned in Grant Road for the next 3 days, the road will be closed for traffic till further notice.

Courses of Action:

(I) Traffic police should increase the number of personnel present at Grant Road to physically coordinate traffic diversion effectively.

(II) Traffic police should issue a notification in major newspapers regarding traffic diversions and alternate routes that can be taken by the general public till the Grant Road closure continues.

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

Q67. What is the valency of carbon?

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

Q68. According to the law of constant proportion, what will be the correct ratio of obtained oxygen and hydrogen (O : H) after decomposition of 18 g water?

(a) 4:14
(b) 16:2
(c) 2:16
(d) 14:4

Q69. Which of the following non-metals is a liquid?

(a) Chlorine
(b) Bromine
(c) Fluorine
(d) Sulphur

Q70. Read the given statements and conclusions carefully. You have to take the given statements to be true even if they seem to be at variance from commonly known facts and decide which conclusion(s) logically follow(s) from the given statements.

Statements:

Some beds are tables.

No tables are chairs.

Conclusions:

(I) All tables are beds.

(II) Some chairs are beds.

(a) Only conclusion (II) follows
(b) Both conclusions (I) and (II) follow
(c) Neither conclusion (I) nor (II) follows
(d) Only conclusion (I) follows 2

Q71. Which of the following organisms does NOT show asexual reproduction by means of fission?

(a) Plasmodium
(b) Earthworm
(c) Amoeba
(d) Leishmania

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Q72. A sells a bicycle to B at a profit of 20% and B sells it to C at a profit of 25%. If C pays Rs. 1,500, then what did A pay for it?

(a) Rs. 1,125
(b) Rs. 1,000
(c) Rs. 1,100
(d) Rs. 825

Q73. Which of the following physical quantities represents the rate of change of velocity?

(a) Speed
(b) Velocity
(c) Acceleration
(d) Distance

Q74. If each vowel in the word MARKETING is changed to the letter following it in the English alphabetical order and each consonant is changed to the letter preceding it in the English alphabetical order, then which of the following letters will be fourth from the left in the group of letters thus formed?

(a) S
(b) Q
(c) F
(d) J

Q75. Which of the following organisms is/are NOT unicellular?

(a) Amoeba
(b) Plants
(c) Paramoecium
(d) Chlamydomonas

ANSWER KEY

1	b	2	b	3	a	4	b	5	b	6	d	7	a	8	c	9	b	10	b
11	c	12	d	13	b	14	a	15	c	16	c	17	b	18	a	19	b	20	c
21	a	22	c	23	c	24	b	25	a	26	b	27	c	28	b	29	d	30	d
31	a	32	d	33	a	34	b	35	a	36	c	37	a	38	b	39	a	40	a
41	a	42	b	43	b	44	a	45	c	46	d	47	d	48	d	49	a	50	a
51	c	52	b	53	c	54	a	55	d	56	c	57	b	58	d	59	a	60	d
61	d	62	c	63	c	64	a	65	c	66	c	67	a	68	b	69	b	70	c
71	b	72	b	73	c	74	d	75	b										

SOLUTIONS

Q1. Answer: (b) YV-SW

The logic followed here is:
1) VS-PU
2) YV-SW
3) RO-LQ
4) TQ-NS
Hence, the correct answer is "YV-SW".

Q2. Answer: (b) Starch

The correct answer is Starch.
Key Points
• Starch is a polysaccharide that serves as a form of energy storage in plants.

• It is composed of numerous glucose units joined together by glycosidic bonds.
• Plants synthesize starch during photosynthesis and store it generally in plastids.
• Starch can be broken down into glucose molecules when the plant needs energy for growth and other metabolic activities.
• It is a complex carbohydrate that is insoluble in water, making it a good storage form of energy.

Additional Information

• Glycogen
• It is a polysaccharide of glucose that serves as a form of energy storage in animals and fungi.
• Glycogen is stored primarily in the liver and muscle cells.
• Glucose
• It is a simple sugar and a primary source of energy for cells.
• Glucose is involved in cellular respiration to produce ATP.
• Sucrose
• It is a disaccharide composed of glucose and fructose.
• Sucrose is commonly found in plants and is used for energy transport.

Q3. Answer: (a) 3

Shortcut Trick

Mode is the value that occurs most frequently in a data set.

Count existing frequencies: 6 appears 3 times and 7 appears 3 times.

Since the mode is given as 7, the value 7 must occur more times than 6.

This is only possible if the unknown term (2k + 1) is equal to 7.

$2k + 1 = 7 \rightarrow 2k = 6 \rightarrow k = 3$.

Therefore The correct answer is 3.

Alternate Method

Given: Data set = 2, 4, 6, 7, 5, 6, 10, 6, 7, 2k + 1, 9, 7, 13. Given Mode = 7.

Frequency distribution of the known terms:

=> Number 2: 1 time
=> Number 4: 1 time
=> Number 5: 1 time
=> Number 6: 3 times
=> Number 7: 3 times
=> Number 9: 1 time
=> Number 10: 1 time
=> Number 13: 1 time

For the mode to be exactly 7, the frequency of 7 must be the highest in the set.

=> Current max frequency is 3 (for both 6 and 7).

=> To make 7 the unique mode, its frequency must become 4.

=> Therefore $2k + 1 = 7$

=> $2k = 7 - 1$

=> $2k = 6$

=> $k = 6 \div 2$

=> $k = 3$

Therefore The correct answer is 3.

Additional Information

Definition of Mode

The mode is the value that appears most often in a set of data values. A data set can have one mode (unimodal), two modes (bimodal), or multiple modes (multimodal).

Empirical Relationship

For a moderately skewed distribution, the relationship between mean, median, and mode is: Mode = (3 × Median) − (2 × Mean).

No Mode Condition

If all values in a data set appear with the same frequency, the data set is said to have no mode.

Q4. Answer: (b) Rs. 7,500

Shortcut Trick

Let the total income be 100%.

Remaining after 20% rent = 80%.

Savings = 30% of 80% (since 70% is spent) = 24%.

Given 24% = Rs. 1,800 => 1% = Rs. 75.

Total Income = 100 × 75 = Rs. 7,500.

Therefore The correct answer is Rs. 7,500.

Alternate Method

Given:

Expenditure on house rent = 20%

Expenditure on household expenses = 70% of the remaining income

Final savings = Rs. 1,800

Formula Used:

Final Savings = Total Income × (100 − r1)% × (100 − r2)%

Calculations:

=> Let Total Income = x

=> x × (100 − 20)/100 × (100 − 70)/100 = 1,800

=> x × (80/100) × (30/100) = 1,800

=> x × (4/5) × (3/10) = 1,800

=> x × (12/50) = 1,800

=> x = (1,800 × 50) ÷ 12

=> x = 150 × 50

=> x = 7,500

Therefore The correct answer is Rs. 7,500.

Additional Information

Successive Percentage Rule

When expenditures are made on the remaining amount, the overall reduction is calculated as 1 − (1−r1)(1−r2)...(1−r_n).

Base Value Concept

Always identify the base for each percentage; in this problem, the second percentage (70%) is applied to the remainder (80%), not the total income.

Income Formula

Total Income = Total Expenditure + Total Savings.

Q5. Answer: (b) September

The correct answer is September.

Key Points

The Guru Kelucharan Mohapatra Awards 2024 were presented to four eminent personalities:

• Kumkum Lal: Renowned Odissi dancer.

• Guru Lakshmikanta Palit: Eminent figure in the field of music.

• Guru Dhaneswar Swain: Renowned percussionist.

• Uttam Mohanty: Veteran actor, recognized for his contributions to Odia cinema.

The awards were presented at the 30th Guru Kelucharan Mohapatra Award Festival, held from September 5-11, 2024, in Bhubaneswar, Odisha.

Additional Information

• Kelucharan Mohapatra is a renowned Indian classical dancer and choreographer who is primarily associated with the dance form of Odissi.

• He is considered as one of the pioneers who revived and popularized Odissi dance in the 20th century.

• Kelucharan Mohapatra was born in 1926 in the state of Odisha and started his dance training at a young age under the guidance of his guru, Pankaj Charan Das.

• He has received several awards and honors for his contribution to the field of dance, including the Padma Vibhushan, the second-highest civilian award in India.

• Kathak, Chhau, and Manipuri are also prominent Indian classical dance forms, but they are not directly associated with

Kelucharan Mohapatra.

Q6. Answer: (d) MPS

The logic followed here is:

Hence, the correct answer is "MPS".

Q7. Answer: (a) NaOH + Cl2

The correct answer is NaOH + Cl2.

Key Points

• The chlor-alkali process is used for the industrial production of sodium hydroxide (NaOH) and chlorine gas (Cl2).
• In this process, electrolysis of brine (a concentrated solution of NaCl) occurs.
• Sodium hydroxide is produced at the cathode, while chlorine gas is produced at the anode.
• The process also produces hydrogen gas as a by-product at the cathode.
• The chlor-alkali process is a major industrial process and is essential for producing various chemical products.

Additional Information

• NaHCO3 (Sodium Bicarbonate)
• Commonly known as baking soda, it is used in baking, cleaning, and as an antacid.
• It is produced through the Solvay process.
• Na2CO3 (Sodium Carbonate)
• Also known as soda ash, it is used in glass manufacturing, as a water softener, and in detergents.
• It can be produced by the Solvay process or mining of trona ore.
• NaCl (Sodium Chloride)
• Commonly known as table salt, it is essential for human consumption and various industrial applications.
• It is obtained by mining or evaporation of seawater.

Q8. Answer: (c) 1 m

The correct answer is 1 m.

Key Points

• The work done by a force is calculated using the formula: Work = Force × Displacement.
• Given the work done is 5 joules and the force applied is 5 Newtons.
• Rearranging the formula to find displacement: Displacement = Work / Force.
• Substituting the given values: Displacement = 5 J / 5 N = 1 m.
• Hence, the displacement in the direction of the applied force is 1 meter.

Additional Information

• Work-Energy Theorem
• This theorem states that the work done by the net force on an object is equal to the change in its kinetic energy.
• Mathematically, it is expressed as Work = ΔK.E.
• Units of Work
• The SI unit of work is the joule (J).
• 1 joule is defined as the work done when a force of 1 Newton displaces an object by 1 meter in the direction of the force.
• Types of Forces
• Forces can be categorized into various types such as gravitational force, normal force, frictional force, and applied force.
• In this context, the force mentioned is an applied force of 5 Newtons acting on the body.

Q9. Answer: (b) 168

Shortcut Trick

Pick the largest number 56 and check its multiples for divisibility by 24 and 42.

Multiples of 56 are: 56, 112, 168, ...

Check 168: 168 ÷ 24 = 7 (Divisible) and 168 ÷ 42 = 4 (Divisible).

Since 168 is the first multiple of 56 divisible by both, it is the LCM.

Therefore The correct answer is 168.

Alternate Method

Given: Numbers 24, 42, and 56.

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Method: Use the Common Division Method to find the Least Common Multiple (LCM).

=> Prime factors obtained: 2, 2, 2, 3, 7

=> LCM = 2 × 2 × 2 × 3 × 7

=> LCM = 8 × 21

=> LCM = 168

Therefore The correct answer is 168.

Additional Information

LCM (Least Common Multiple)

The smallest positive integer that is perfectly divisible by each of the given numbers.

Relation between LCM and HCF

For two numbers a and b, the product of the numbers is equal to the product of their HCF and LCM: a × b = HCF(a, b) × LCM(a, b).

Prime Factorization Method

LCM is the product of the highest powers of all prime factors present in any of the given numbers.

Q10. Answer: (b) JNC

The logic followed here is:

Hence, the correct answer is "JNC".

Q11. Answer: (c) 5

According to the given information:

Thus the code for 'F' = 5

Hence, the correct answer is "5".

Q12. Answer: (d) 1 cm

The correct answer is 1 cm.

Key Points

• Magnification (m) produced by a mirror is given by the ratio of the height of the image (h_i) to the height of the object (h_o).

• Mathematically, magnification (m) = h_i / h_o.

• Given magnification (m) = 0.2 and height of the object (h_o) = 5 cm.

• Substituting the values into the magnification formula: 0.2 = h_i / 5 cm.

• Solving for h_i, we get h_i = 0.2 * 5 cm = 1 cm.

Additional Information

• Concave Mirror

• Produces real and inverted images when the object is placed beyond the focal point.

• Produces virtual and magnified images when the object is placed between the focal point and the mirror.

• Plane Mirror

• Always produces a virtual, erect, and laterally inverted image.

• The size of the image is equal to the size of the object.

Q13. Answer: (b) 266 π cm²

Shortcut Trick

Total Surface Area (TSA) of a cylinder = 2πr(r + h)

Given: r = 7 cm and h = 12 cm

TSA = 2 × π × 7 × (7 + 12) = 14 × 19 × π

Calculation: 14 × 19 = 266

Therefore The correct answer is 266 π cm².

Alternate Method

Given:

Radius (r) of the base = 7 cm

Height (h) of the cylinder = 12 cm

Formula Used:

Total Surface Area (TSA) = Curved Surface Area + 2 × Base Area

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TSA = $2\pi rh + 2\pi r^2 = 2\pi r(r + h)$

Calculations:

=> TSA = $2 \times \pi \times 7 \times (7 + 12)$

=> TSA = $14 \times \pi \times (19)$

=> TSA = $(14 \times 19)\ \pi$

=> TSA = $266\ \pi\ cm^2$

The calculation shows that the total surface area is $266\ \pi\ cm^2$, which corresponds to Option (2).

Therefore The correct answer is $266\ \pi\ cm^2$.

Additional Information

Curved Surface Area (CSA)

The area of the side surface of the cylinder excluding the top and bottom bases is given by $2\pi rh$.

Volume of Cylinder

The total space occupied by the cylinder is calculated using the formula Volume = $\pi r^2 h$.

Base Area

The area of each circular base is πr^2. A cylinder has two such identical bases.

Lateral Surface Area

For a cylinder, the lateral surface area is the same as the curved surface area (CSA).

Q14. Answer: (a) B

The logic follows here is :-

In the word OPTICAL:

• Each vowel (O, I, A) is changed to the letter immediately succeeding it in the English alphabetical order

• Each consonant (P, T, C, L) is changed to the letter immediately preceding it in the English alphabetical order:

Word	O	P	T	I	C	A	L
Vowel + 1 & Consonant - 1	P	O	S	J	B	B	K

After applying the transformations: POSJBBK

In the new sequence, the letter 'B' is repeated twice.

Thus, the correct answer is "Option 1".

Q15. Answer: (c) 7

Given:

Evaluate the given expression: 13 - 12 ÷ 4 × 2

Formula Used:

Order of operations (PEMDAS/BODMAS): Parentheses/Brackets, Exponents/Orders, Multiplication and Division (from left to right), Addition and Subtraction (from left to right).

Calculation:

First, perform the division:

12 ÷ 4 = 3

Next, perform the multiplication:

3 × 2 = 6

Finally, perform the subtraction:

13 - 6 = 7

The correct answer is option 3.

Q16. Answer: (c) 2R ohm

The correct answer is 2R ohm.

Key Points

• When resistors are connected in series, their resistances add up.

• The total or equivalent resistance (R_(eq)) in a series circuit is given by the formula R_(eq) = R1 + R2 + ... + R_n.

• For two resistors of resistance R ohm each connected in series, the equivalent resistance is R + R.

• Thus, the equivalent resistance is 2R ohm.

• This is why the correct answer is option 3, which states 2R ohm.

Additional Information

• Resistors in Parallel

• When resistors are connected in parallel, the total resistance decreases.

• The formula for the equivalent resistance in a parallel circuit is 1/R_(eq) = 1/R1 + 1/R2 + ... + 1/R_n.

• Ohm's Law

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

• The formula is V = IR, where V is the voltage, I is the current, and R is the resistance.

• Combining Series and Parallel Circuits

• In complex circuits, series and parallel connections can be combined.

• The approach involves simplifying the circuit step by step, first solving series and parallel parts separately.

Q17. Answer: (b) Neither Statement I nor II

The correct answer is option 2.

Key Points

• Electromagnets are devices that produce a magnetic field when an electric current passes through them.

• They do not convert magnetic fields into electrical energy.

• Electromagnets do not convert mechanical energy into magnetic energy; they convert electrical energy into magnetic energy.

• Statement I is incorrect because the function of an electromagnet is to create a magnetic field using electrical energy.

• Statement II is also incorrect because electromagnets do not deal with mechanical energy directly.

Additional Information

• Generators

• They convert mechanical energy into electrical energy.

• They operate based on electromagnetic induction principles.

• Transformers

• They change the voltage levels of alternating current (AC).

• They work based on the principle of mutual induction between two or more windings.

• Motors

• They convert electrical energy into mechanical energy.

• They operate using magnetic fields and current-carrying conductors.

Q18. Answer: (a) 89991

Given:

Evaluate 297 × 303

Formula Used:

Multiplication of two numbers

Calculation:

297 × 303

=> 297 × (300 + 3)

=> (297 × 300) + (297 × 3)

=> 89100 + 891

=> 89991

The correct answer is option 1

Q19. Answer: (b) Three

Given: Seven people, B, C, D, E, F, G and K are sitting in a straight line, facing north.

1. Only two people sit to the left of B.

2. Only three people sit between B and K.

3. F sits second to the right of B.

4. Only two people sit between F and C.

5. G sits at some place to the right of E but at some place to the left of D.

So, three people sit to the right of G.

Hence, the correct answer is "Three".

Q20. Answer: (c) 24 days

Shortcut Trick

Rate of Jaggu = 1/3 chairs/day and Rate of Rabbu = 1/4 chairs/day.

Combined rate = (1/3 + 1/4) = 7/12 chairs/day.

Number of days for 14 chairs = Total chairs ÷ Combined rate.

Required days = 14 ÷ (7/12) = 14 × (12/7) = 2 × 12 = 24 days.

Therefore The correct answer is 24 days.

Alternate Method

Given:

Time taken by Jaggu for 1 chair = 3 days.

Time taken by Rabbu for 1 chair = 4 days.

Formula Used:

Total Work = Efficiency × Time

Person	Days (per chair)	Total Work (1 chair)	Efficiency
Jaggu	3	12 (LCM of 3, 4)	4
Rabbu	4	3	

=> Combined efficiency of Jaggu and Rabbu = 4 + 3 = 7 units/day.

=> Units of work required to make 1 chair = 12 units.

=> Total work for 14 chairs = 14 × 12 = 168 units.

=> Days required = Total units ÷ Combined efficiency

=> Days required = 168 ÷ 7 = 24 days.

Therefore The correct answer is 24 days.

Additional Information

Combined Efficiency Rule

When two or more people work together, their individual rates of work (efficiencies) are added to determine the collective rate of progress.

Work and Time Relationship

Efficiency is inversely proportional to time. If A can do a work in x days, his efficiency is 1/x of the work per day.

Total Work Assumption

Assuming Total Work as the LCM of individual days simplifies calculations by avoiding fractions in efficiency values.

Q21. Answer: (a) ZI-UD

The logic followed here is:

1) ZI-UD

2) BK-VE

3) TC-NW

4) EN-YH

Hence, the correct answer is "ZI-UD".

Q22. Answer: (c) 8

Shortcut Trick

The number of diagonals in a polygon with n sides is given by n(n − 3) ÷ 2.

Test the given options to find which value of n results in 20 diagonals:

For n = 8: 8 × (8 − 3) ÷ 2 = 8 × 5 ÷ 2 = 40 ÷ 2 = 20.

This matches the given condition, so the number of sides must be 8.

Therefore The correct answer is 8.

Alternate Method

Given:

Number of diagonals in a regular polygon = 20

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Formula Used:

Number of diagonals = n(n − 3) ÷ 2, where n is the number of sides.

Calculations:

=> n(n − 3) ÷ 2 = 20

=> n(n − 3) = 20 × 2

=> $n^2 - 3n = 40$

=> $n^2 - 3n - 40 = 0$

=> $n^2 - 8n + 5n - 40 = 0$

=> n(n − 8) + 5(n − 8) = 0

=> (n − 8)(n + 5) = 0

=> n = 8 or n = −5

Since the number of sides must be a positive integer, we take n = 8.

Therefore, Option 3 is the correct one.

Therefore The correct answer is 8.

Additional Information

Sum of Interior Angles

The sum of all interior angles of an n-sided polygon is (n − 2) × 180°.

Sum of Exterior Angles

For any convex polygon, the sum of all exterior angles is always 360°.

Individual Angle of a Regular Polygon

Each interior angle = [(n − 2) × 180°] ÷ n and each exterior angle = 360° ÷ n.

Diagonal Formula Derivation

From n vertices, nC2 lines can be drawn. Subtracting n sides gives n(n−1)/2 − n = n(n−3)/2 diagonals.

Q23. Answer: (c) The particles of a suspension cannot be seen by the naked eyes.

The correct answer is option 3.

Key Points

• A suspension is a heterogeneous mixture, meaning its components are not uniformly distributed.

• The particles in a suspension are large enough to be seen with the naked eye.

• Suspensions are unstable; the particles can settle upon standing.

• The particles of a suspension scatter a beam of light passing through it, a phenomenon known as the Tyndall effect.

• The correct answer states that the particles of a suspension cannot be seen by the naked eyes, which is incorrect as they can be seen.

Additional Information

• Colloids

• Colloids are mixtures where the particle size is intermediate between that of a solution and a suspension.

• Particles in a colloid are not visible to the naked eye but can scatter light (Tyndall effect).

• Solutions

• Solutions are homogeneous mixtures where the solute is completely dissolved in the solvent.

• The particles in a solution are at the molecular or ionic level and do not scatter light.

• Emulsions

• Emulsions are a type of colloid where two immiscible liquids are mixed together.

• Common examples include milk and mayonnaise.

Q24. Answer: (b) 109

Given: 22 - 5 ÷ 3 + 12 × 3 = ?

Decoding the given information:

Symbol	•	•	×	÷
Means	•	×	÷	•

Now replacing the sign from left to right using BODMAS Rule, we get:

=> 22 × 5 + 3 - 12 ÷ 3

= 22 × 5 + 1 - 4
=> 22 × 5 - 1
= 110 - 1
= 109
Hence, the correct answer is "Option 2".

Q25. Answer: (a) Science and Engineering

The correct answer is Science and Engineering.

Key Points

• The following are the names of Padma Award 2024 recipients:

Padma Vibhushan	Padma Bhushan	Padma Shri
1. Vyjayantimala Bali	1. M Fathima Beevi	1. Khalil Ahamad
2. Konidela Chiranjeevi	2. Hormusji N Cama	2. Badrappan M
3. M Venkaiah Naidu	3. Mithun Chakraborty	3. Kaluram Bamaniya
4. Bindeshwar Pathak	4. Sitaram Jindal	4. Rezwana Choudhury Bannya
5. Padma Subrahmanyam	5. Young Liu	5. Naseem Bano
	6. Ashwin Balachand Mehta	6. Ramlal Bareth
	7. Satyabrata Mookherjee	7. Gita Roy Barman
	8. Ram Naik	8. Parbati Baruah
	9. Tejas Madhusudan Patel	9. Sarbeswar Basumatary
	10. Olanchery Rajagopal	10. Som Datt Battu
	11. Dattatray Ambadas Mayaloo Alias Rajdutt	11. Takdira Begum
	12. Togdan Rinpoche	12. Sathyanarayana Beleri
	13. Pyarelal Sharma	13. Drona Bhuyan
	14. Chandreshwar Prasad Thakur	14. Ashok Kumar Biswas
	15. Usha Uthup	15. Rohan Machanda Bopanna
	16. Vijaykanth	16. Smriti Rekha Chakma
		17. Narayan Chakraborty
		18. A Velu Ananda Chari
		19. Ram Chet Chaudhary
		20. K Chellammal
		21. Joshna Chinappa
		22. Charlotte Chopin
		23. Raghuveer Choudhary
		24. Joe D Cruz
		25. Ghulam Nabi Dar
		26. Chitta Ranjan Debbarma
		27. Uday Vishwanath Deshpande
		28. Prema Dhanraj
		29. Radha Krishan Dhiman
		30. Manohar Krishana Dole

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		31. Pierre Sylvain Filliozat
		32. Mahabir Singh Guddu
		33. Anupama Hoskere
		34. Yazdi Maneksha Italia
		35. Rajaram Jain
		36. Jankilal
		37. Ratan Kahar
		38. Yashwant Singh Kathoch
		39. Zahir I Kazi
		40. Gaurav Khanna
		41. Surendra Kishore
		42. Dasari Kondappa
		43. Sridhar Makam Krishnamurthy
		44. Yanung Jamoh Lego
		45. Jordan Lepcha
		46. Satendra Singh Lohia
		47. Binod Maharana
		48. Purnima Mahato
		49. Uma Maheshwari D
		50. Dukhu Majhi
		51. Ram Kumar Mallick
		52. Hemchand Manjhi
		53. Chandrashekhar Mahadeorao Meshram
		54. Surendra Mohan Mishra
		55. Ali Mohammed & Shri Ghani Mohammed (Duo)
		56. Kalpana Morparia
		57. Chami Murmu
		58. Sasindran Muthuvel
		59. G Nachiyar
		60. Kiran Nadar
		61. Pakaravur Chithran Namboodiripad (Posthumous)
		62. Narayanan E P
		63. Shailesh Nayak
		64. Harish Nayak
		65. Fred Negrit
		66. Hari Om
		67. Bhagabat Padhan
		68. Sanatan Rudra Pal

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		69. Shankar Baba Pundlikrao Papalkar
		70. Radhe Shyam Pareek
		71. Dayal Mavjibhai Parmar
		72. Binod Kumar Pasayat
		73. Silbi Passah
		74. Shanti Devi Paswan & Shri Shivan Paswan (Duo)
		75. Sanjay Anant Patil
		76. Muni Narayana Prasad
		77. K S Rajanna
		78. Chandrashekar Channapatna Rajannachar
		79. Bhagwatilal Rajpurohit
		80. Romalo Ram
		81. Navjivan Rastogi
		82. Nirmal Rishi
		83. Pran Sabharwal
		84. Gaddam Sammaiah
		85. Sangthankima
		86. Machihan Sasa
		87. Omprakash Sharma
		88. Eklabya Sharma
		89. Ram Chander Sihag
		90. Harbinder Singh
		91. Gurvinder Singh
		92. Godawari Singh
		93. Ravi Prakash Singh
		94. Seshampatti T Sivalingam
		95. Somanna
		96. Kethavath Somlal
		97. Shashi Soni
		98. Urmila Srivastava
		99. Nepal Chandra Sutradhar (Posthumous)
		100. Gopinath Swain
		101. Laxman Bhatt Tailang
		102. Maya Tandon
		103. Aswathi Thirunal Gouri Lakshmi Bayi Thampuratty
		104. Jagdish Labhshanker Trivedi

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		105. Sano Vamuzo
		106. Balakrishnan Sadanam Puthiya Veetil
		107. Kurella Vittalacharya
		108. Kiran Vyas
		109. Jageshwar Yadav
		110. Babu Ram Yadav

Q26. Answer: (b) cx

According to the given information:

Thus 'tree' will be written as 'cx'.

Hence, the correct answer is "cx".

Q27. Answer: (c) Double displacement reaction

The correct answer is Double displacement reaction.

Key Points

• In a double displacement reaction, the ions of two compounds exchange places in an aqueous solution to form two new compounds.

• This type of reaction generally occurs between two ionic compounds.

• The general formula for a double displacement reaction is AB + CD → AD + CB.

• These reactions are often characterized by the formation of a precipitate, a gas, or water.

• Double displacement reactions are also known as metathesis reactions.

Additional Information

• Decomposition Reaction

• In this reaction, a single compound breaks down into two or more simpler substances.

• It can be represented as AB → A + B.

• Addition Reaction

• Involves two or more substances combining to form a single product.

• This type of reaction is common in organic chemistry.

• Disproportionation Reaction

• It is a specific type of redox reaction in which a single substance is simultaneously oxidized and reduced.

• An example is the conversion of hydrogen peroxide into water and oxygen.

Q28. Answer: (b) Endocrine system

The correct answer is Endocrine system.

Key Points

• The endocrine system consists of glands that secrete hormones directly into the bloodstream.

• These hormones regulate various bodily functions such as metabolism, growth, and mood.

• Major glands in the endocrine system include the pituitary, thyroid, adrenal, and pancreas.

• Hormones are chemical messengers that travel to target organs and tissues to exert their effects.

• The endocrine system works in conjunction with the nervous system to maintain homeostasis in the body.

Additional Information

• Excretory system

• Responsible for removing waste products from the body.

• Includes organs such as kidneys, ureters, bladder, and urethra.

• Respiratory system

• Responsible for the exchange of gases (oxygen and carbon dioxide) between the body and the environment.

• Includes organs such as the lungs, trachea, and bronchi.

• Digestive system

• Breaks down food into nutrients that the body can absorb and use for energy.

• Includes organs such as the stomach, intestines, liver, and pancreas.

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Q29. Answer: (d) 5 hr

Shortcut Trick

Initial speed = 275 ÷ 5 = 55 km/hr.

Reduced speed = 55 − 5 = 50 km/hr.

New time = 250 ÷ 50 = 5 hr.

Therefore The correct answer is 5 hr.

Alternate Method

Given:

Original Distance = 275 km

Original Time = 5 hr

Speed reduction = 5 km/hr

New Distance = 250 km

Formula Used:

Speed = Distance ÷ Time

Time = Distance ÷ Speed

Calculations:

=> Initial speed of the car = 275 ÷ 5 = 55 km/hr

=> New speed after reduction = 55 − 5 = 50 km/hr

=> New time taken = New Distance ÷ New speed

=> New time = 250 ÷ 50 = 5 hr

Therefore The correct answer is 5 hr.

Additional Information

Unit Conversion

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

Average Speed Formula

If a car covers two equal distances at speeds x and y, the Average Speed = (2 × x × y) ÷ (x + y).

Proportionality Rule

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

Q30. Answer: (d) 2 km/h

Shortcut Trick

Since the distance (50 km) is constant, the speed of the diver is inversely proportional to the time taken.

Time ratio (Upstream : Downstream) = 2 : 1 => Speed ratio (Upstream : Downstream) = 1 : 2

Speed in still water = (Upstream Speed + Downstream Speed) ÷ 2 = (1 + 2) ÷ 2 = 1.5 ratio units.

We are given that still water speed is 3 km/h => 1.5 ratio units = 3 km/h.

=> 1 ratio unit = 2 km/h. Since the upstream speed corresponds to 1 ratio unit, it directly equals 2 km/h.

Therefore The correct answer is 2 km/h.

Alternate Method

Given:

Speed of diver in still water (v) = 3 km/h

Distance traveled upstream and downstream = 50 km

Time taken upstream = 2 × Time taken downstream

Formula Used:

Time = Distance ÷ Speed

Upstream Speed = v − s | Downstream Speed = v + s

Calculations:

Let the speed of the stream be s km/h.

=> Upstream speed (U) = (3 − s) km/h

=> Downstream speed (D) = (3 + s) km/h

According to the given condition in the question:

=> 50 ÷ (3 − s) = 2 × [50 ÷ (3 + s)]

Canceling 50 from both sides:

=> 1 ÷ (3 − s) = 2 ÷ (3 + s)

By cross-multiplying:

=> 3 + s = 2 × (3 − s)

=> 3 + s = 6 − 2s

=> s + 2s = 6 − 3

=> 3s = 3

=> s = 1 km/h

The speed of the diver against the stream (Upstream Speed):

=> U = 3 − s

=> U = 3 − 1 = 2 km/h.

Therefore The correct answer is 2 km/h.

Additional Information

Speed in Still Water

It is the average of the downstream and upstream speeds. Formula: v = (D + U) ÷ 2, where D is downstream speed and U is upstream speed.

Speed of Stream

It is half the difference between the downstream and upstream speeds. Formula: s = (D − U) ÷ 2.

Constant Distance Relation

Whenever the distance traveled is constant, the ratio of speeds is always inversely proportional to the ratio of their respective times taken. (Speed prop. to 1 ÷ Time).

Q31. Answer: (a) Defence Research and Development Organisation (DRDO)

The correct answer is Defence Research and Development Organisation (DRDO).

Key Points

• The indigenous light tank Zorawar was developed jointly by the Defence Research and Development Organisation (DRDO) and Larsen & Toubro (L&T).

• The prototype of Zorawar is ready and will soon undergo extensive trials.

• The tank is currently powered by a Cummins engine, with a project underway to develop a new engine domestically.

• It is designed to operate in extreme weather and high-altitude conditions with minimal logistic support.

• The tank will be subjected to various trials over the next six months, including tests in summer, winter, and high-altitude environments.

• The development of Zorawar was expedited to meet the Indian Army's needs for a lightweight, agile tank that can be deployed at high altitudes.

• The tank is versatile, built in a modular fashion, and capable of future upgrades, enhancing its tactical and operational mobility.

Q32. Answer: (d) 4 July 2024

The correct answer is 4 July 2024.

Key Points

• The new rules aim to enhance the management and implementation of the Digital Bharat Nidhi initiative.

• The Universal Service Obligation Fund has been renamed as Digital Bharat Nidhi to address emerging technological demands.

• Funds from Digital Bharat Nidhi will focus on projects to improve telecom services in underserved and remote regions.

• Projects funded under the initiative must promote telecom services, security, innovation, and sustainable technologies.

Additional Information

• The Digital Bharat Nidhi initiative is part of the Telecommunications Act, 2023, which was passed by Parliament and received the President’s assent in December 2023.

• The rules outline the powers and responsibilities of the administrator overseeing the Digital Bharat Nidhi.

• Criteria for funded projects include enhancing access to telecom services, improving security, and fostering innovation and green technologies.

• The Act and the new rules aim to align with India’s vision of becoming a developed nation by 2047 (Viksit Bharat).

Q33. Answer: (a) Only conclusion (II) follows

Statements:

All ropes are chains.

All chains are strings.

The least possible Venn diagram is as follows:

Conclusions:

(I) All strings are ropes. - False (because All ropes are chains and All chains are strings. So, All strings are ropes it can be possible but not definite)

(II) All ropes are strings. - True (because All ropes are chains and All chains are strings. So, All ropes are strings it is definite)

Hence, the correct answer is "Only conclusions (II) follows".

Q34. Answer: (b) NPR

The logic followed here is:

ACE is related to BDF

GIK is related to HJL

Similarly, MOQ will be related:

Hence, the correct answer is "NPR".

Q35. Answer: (a) Decrease in temperature

The correct answer is Decrease in temperature.

Key Points

• Evaporation is the process by which water changes from a liquid to a gas or vapor.

• An increase in temperature generally increases the rate of evaporation because the molecules move faster and are more likely to escape into the air.

• An increase in surface area allows more molecules to evaporate at once, thus increasing the rate of evaporation.

• An increase in wind speed removes the air saturated with water vapor from the vicinity, allowing more water to evaporate.

• A decrease in humidity means the air can hold more water vapor, thus increasing the rate of evaporation.

Additional Information

• Condensation

• Condensation is the process by which water vapor in the air is changed into liquid water.

• It is the opposite of evaporation and occurs when the air is cooled to its dew point.

• Boiling

• Boiling is the rapid vaporization of a liquid, which occurs when a liquid is heated to its boiling point.

• At this temperature, the vapor pressure of the liquid is equal to the external pressure exerted on the liquid.

• Sublimation

• Sublimation is the transition of a substance directly from the solid to the gas phase without passing through the liquid phase.

• This occurs under specific conditions of pressure and temperature.

Q36. Answer: (c) 500

Given:

Number of TVs produced on Monday = 200

Number of TVs produced on Tuesday = 300

Formula used:

Total production for two days = Production on Monday + Production on Tuesday

Calculation:

Total production = 200 + 300

=> Total production = 500

Therefore The total number of TV sets produced on Monday and Tuesday together is 500.

Q37. Answer: (a) Nikhil Dey

The correct answer is Nikhil Dey.

Key Points

• Nikhil Dey, an Indian social activist, has been named as the International Anti-Corruption Champion by the US State Department.

• He has been acknowledged for his noteworthy support of social movements that oppose corruption in government welfare programs in India by encouraging transparency and accountability, public audits, and participatory democracy.

• Dey's efforts as a co-founder of Mazdoor Kisan Shakti Sangathan (MKSS) contributed to anti-corruption and transparency reforms in India, assisting the state of Rajasthan in establishing public policies that promote accountability and transparency.

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Q38. Answer: (b) 20% and 80%

Shortcut Trick

Use the Successive Discount Formula: Net Discount = x + y − (x × y)/100

For 20% and 80%: Net Discount = 20 + 80 − (20 × 80)/100

=> Net Discount = 100 − (1600/100) = 100 − 16 = 84%

This matches the required single discount of 84%.

Therefore The correct answer is 20% and 80%.

Alternate Method

Given: Net discount = 84%. Let the Marked Price (MP) = 100 units.

Formula Used: Final Selling Price = MP × (100 − d1)/100 × (100 − d2)/100

=> Let Marked Price = Rs. 100

=> Value after 1^(st) discount of 20% = 100 − (20% of 100) = Rs. 80

=> Value after 2^(nd) discount of 80% = 80 − (80% of 80) = 80 − 64 = Rs. 16

=> Total Discount amount = 100 − 16 = Rs. 84

=> Net Discount percentage = (84/100) × 100 = 84%

Therefore The correct answer is 20% and 80%.

Additional Information

Successive Discount Formula

For two discounts d1 and d2, the single equivalent discount is calculated as [d1 + d2 − (d1 × d2)/100]%.

Order of Discounts

The final Selling Price remains the same regardless of the order in which successive discounts are applied (e.g., 20% then 80% is the same as 80% then 20%).

Multiple Successive Discounts

If there are three discounts a, b, and c, the net multiplier for the Selling Price is (1 − a/100) × (1 − b/100) × (1 − c/100).

Q39. Answer: (a) 6.80%

The correct answer is 6.80%.

Key Points

This downward revision primarily stems from the slower-than-expected economic growth observed in the second quarter of FY25. While the services sector continued to demonstrate resilience, the industry sector, particularly manufacturing, experienced a notable slowdown.

• Weakening domestic demand: Slower growth in private consumption and capital expenditure impacted overall economic activity.

• Global headwinds: The challenging global economic environment, including potential risks of a global recession, also weighed on India's growth prospects.

Despite this downward revision, Morgan Stanley maintains a relatively optimistic outlook for the second half of FY25. The investment bank anticipates a rebound driven by several factors:

• Robust festive and wedding season: Increased consumer spending during these periods is expected to boost economic activity.

• Government policy measures: The government's continued focus on infrastructure development and supportive policy initiatives could further stimulate growth.

Q40. Answer: (a) 27

Shortcut Trick

Sum of digits = (Sum of number and its reverse) ÷ 11 = 99 ÷ 11 = 9.

Difference of digits = 5 (given).

Larger digit = (9 + 5) ÷ 2 = 7; Smaller digit = (9 − 5) ÷ 2 = 2.

Possible numbers are 27 or 72.

Comparing with given options, 27 is the required number.

Therefore The correct answer is 27.

Alternate Method

Given: Sum of number and its reverse = 99, Difference of digits = 5.

Formula Used: A two-digit number with digits x and y is 10x + y.

Let the tens digit be x and units digit be y.

=> Original Number = 10x + y

=> Reversed Number = 10y + x
=> (10x + y) + (10y + x) = 99
=> 11x + 11y = 99
=> x + y = 9 ... (Equation 1)
Also, difference of digits |x − y| = 5 ... (Equation 2)
=> Case 1: x − y = 5. Adding Eq 1 and Eq 2: 2x = 14 => x = 7, y = 2. Number = 72.
=> Case 2: y − x = 5. Adding Eq 1 and Eq 2: 2y = 14 => y = 7, x = 2. Number = 27.
=> Among options, 27 is present.
Therefore The correct answer is 27.
Additional Information
Sum of Reversed Numbers
The sum of a 2-digit number and its reverse is always a multiple of 11. Sum = 11 × (sum of digits).
Difference of Reversed Numbers
The difference between a 2-digit number and its reverse is always a multiple of 9. Difference = 9 × (difference of digits).
Digit Sum Constraint
If the sum of digits (S) and difference of digits (D) are known, the digits are (S+D)/2 and (S-D)/2.

Q41. Answer: (a) 25th

In a row of 48 students facing North, Tinu is 15th from the left end. If Dinesh is 9th to the right of Tinu;
So, Dinesh's position from the right end of the line = 48 - (15 + 9) + 1 = 48 - 24 + 1 = 25
Hence, the correct answer is "25th".

Q42. Answer: (b) X = 12, Y = 184

The logic followed here is: 1st number × (1st number - 3) + 4 = 2nd number
For Option 2: X = 12, Y = 184
X : 112 → 12 × (12 - 3) + 4 → 12 × 9 + 4 → 112
Similarly,
15 : Y → 15 × (15 - 3) + 4 → 15 × 12 + 4 → 184
Hence, the correct answer is "X = 12, Y = 184".

Q43. Answer: (b) 216

Shortcut Trick
For melting and recasting spheres, the number of small spheres (n) = $(R \div r)^3$.
Given Large Radius (R) = 12 cm and Small Radius (r) = 2 cm.
$n = (12 \div 2)^3 = 6^3$
$n = 6 \times 6 \times 6 = 216$
Therefore The correct answer is 216.
Alternate Method
Given:
Radius of the metallic sphere (R) = 12 cm
Radius of each small sphere (r) = 2 cm
Formula Used:
Volume of a sphere = $(4/3) \times \pi \times (\text{radius})^3$
Calculations:
=> Total volume of material remains constant during recasting.
=> Volume of large sphere = n × Volume of one small sphere
=> $(4/3) \times \pi \times R^3 = n \times (4/3) \times \pi \times r^3$
=> $R^3 = n \times r^3$
=> $12^3 = n \times 2^3$
=> $1728 = n \times 8$
=> $n = 1728 \div 8$
=> $n = 216$
Therefore The correct answer is 216.

Additional Information

Conservation of Volume

When a solid object is melted and recast into new shapes, the total volume of the material remains the same, provided there is no wastage.

Sphere Properties

The Surface Area of a sphere is $4\pi r^2$ and the Volume is $(4/3)\pi r^3$. For a hemisphere, the volume is $(2/3)\pi r^3$.

Ratio of Volumes

If the radii of two spheres are in the ratio a : b, then the ratio of their volumes is $a^3 : b^3$ and the ratio of their surface areas is $a^2 : b^2$.

Q44. Answer: (a) Azerbaizan

The correct answer is Azerbaizan.

Key Points

• The 45th Chess Olympiad was held in Budapest, Hungary.

• India secured gold medals in both the open and women's categories.

• The open team, featuring players like Arjun Erigaisi and Gukesh D, claimed their first-ever gold after a critical win and China dropping points.

• The women's team, led by Harika Dronavalli, dominated Azerbaijan to secure their victory.

• This achievement marked India's first gold in the open section.

• PM Modi praised the teams for their stellar performances on social media.

Q45. Answer: (c) 189

The logic follows here is:

Hence, the correct answer is "189".

Q46. Answer: (d) New Delhi

The correct answer is New Delhi.

Key Points

• The opening ceremony will be held at the KD Jadhav Indoor Hall located at Indira Gandhi Sports Complex.

• Position: Maharashtra secured the fifth position in the Khelo India Para Games 2023.

• Medal Haul: Maharashtra athletes won a total of 35 medals, with the breakdown being:

• Gold medals: 12

• Silver medals: 7

• Bronze medals: 16

• Comparison with other states:

• Haryana emerged champions with a total of 105 medals.

• Uttar Pradesh finished second with 62 medals.

• Tamil Nadu secured the third spot with 42 medals.

Q47. Answer: (d) Daughter's husband

Family Chart:

Decoding the Symbols:

Symbol	•	•	×	÷	#
Meaning	Mother	Brother	Wife	Father	Daughter

Given: P × Q ÷ T + Z – S # K

It means: P is the wife of Q, Q is the father of T, T is the mother of Z, Z is the brother of S and S is the daughter of K.

So, K is the Daughter's husband of Q.

Hence, the correct answer is "Daughter's husband".

Q48. Answer: (d) 6 km towards the North

Given:

Rohit starts from Point A and drives 25 km towards the East.

He then takes a right turn, drives 17 km, turns right and drives 14 km.

He then takes a right turn and drives 11 km.

He takes a final left turn, drives 11 km and stops at Point P.

Shortest distance between A and P = 17 - 11 = 6km

Thus, 6km (shortest distance) and towards which North direction should he drive to reach Point A again.

Hence, the correct answer is "6 km towards the North".

Q49. Answer: (a) Atmospheric refraction

The correct answer is Atmospheric refraction.

Key Points

• Atmospheric refraction is the bending of light rays as they pass through the Earth's atmosphere, which has varying densities.

• This phenomenon occurs because light travels at different speeds in different layers of the atmosphere.

• As light moves from one layer to another, it changes direction due to the change in its speed.

• Atmospheric refraction is responsible for various optical phenomena such as the twinkling of stars and the apparent position of the sun.

• This bending of light also causes the apparent position of celestial objects to shift from their true position.

Additional Information

• Atmospheric scattering

• This occurs when particles and molecules in the atmosphere scatter light in different directions.

• It is responsible for the blue color of the sky during the day and the red/orange hues during sunrise and sunset.

• Atmospheric reflection

• This is the process by which light rays are reflected off the surface of clouds and other atmospheric particles.

• It contributes to phenomena such as the visibility of clouds and the brightness of the sky.

• Atmospheric dispersion

• This refers to the spreading of light into its component colors due to varying refractive indices for different wavelengths.

• It is responsible for the formation of rainbows and the separation of light into a spectrum.

Q50. Answer: (a) 10 years

Shortcut Trick

When a sum of money doubles itself, the Simple Interest earned is exactly 100% of the Principal.

Shortcut formula for doubling: Time (T) = 100 ÷ Rate (R)

Given Rate = 10% per annum.

=> T = 100 ÷ 10 = 10 years.

Therefore The correct answer is 10 years.

Alternate Method

Given:

Rate (R) = 10% per annum

Let the Principal (P) = Rs. 100

Since the sum doubles itself, the Amount (A) = 2 × 100 = Rs. 200

Formula Used:

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

Amount (A) = Principal (P) + Simple Interest (SI)

Calculations:

=> SI = A − P

=> SI = 200 − 100 = Rs. 100

Now, substituting values in the Simple Interest formula:

=> 100 = (100 × 10 × T) ÷ 100

=> 100 = 10 × T

=> T = 100 ÷ 10

=> T = 10 years.

Therefore The correct answer is 10 years.

Additional Information

n-times the Sum (Simple Interest)

If a sum of money becomes n times itself at R% rate of interest, the time T is given by: T = (n − 1) × 100 ÷ R.

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Relationship between Rate and Time

For a fixed amount of Simple Interest, the Rate of interest and Time are inversely proportional (R prop. to 1/T).

Rule of 72 (Compound Interest)

In Compound Interest, the time required to double a sum is approximately T ≈ 72 ÷ R (where R is the annual interest rate).

Q51. Answer: (c) 20

Shortcut Trick

In every block of 10 consecutive numbers (e.g., 1-10, 11-20), there are exactly 2 numbers that have 1 or 7 in the unit's digit.

From 1 to 70, there are exactly 7 such blocks of 10 numbers.

Total favorable numbers = 7 blocks × 2 numbers per block = 14 numbers.

Required percentage = (14 ÷ 70) × 100% = 20%.

Therefore The correct answer is 20%.

Alternate Method

Given: The range of numbers is from 1 to 70 (both included).

Total numbers (n) = 70

Formula Used: Percentage = (Favorable Numbers ÷ Total Numbers) × 100

=> Numbers with 1 in unit's digit: {1, 11, 21, 31, 41, 51, 61} → 7 numbers

=> Numbers with 7 in unit's digit: {7, 17, 27, 37, 47, 57, 67} → 7 numbers

=> Total favorable numbers = 7 + 7 = 14

=> Required Percentage = (14 ÷ 70) × 100

=> Percentage = (1 ÷ 5) × 100

=> Percentage = 20%

Therefore The correct answer is 20%.

Additional Information

Unit Digit Distribution

In any sequence of 10 consecutive integers, each digit from 0 to 9 appears exactly once in the unit's place. This property is useful for quickly counting occurrences in large ranges.

Percentage to Fraction Conversion

To convert a percentage to a fraction, divide by 100. Common conversions include 20% = 1/5, 25% = 1/4, 40% = 2/5, and 50% = 1/2.

Total Elements in a Range

For a range from 'a' to 'b' (both inclusive), the total number of terms is given by the formula: (b − a) + 1.

Q52. Answer: (b) Narendra Modi

The correct answer is Narendra Modi.

Key Points

• Prime Minister Narendra Modi, in collaboration with his Swedish counterpart Ulf Kristersson, launched the India-Sweden Industry Transition Partnership during the COP28 World Climate Action Summit, hosted in Dubai.

• The initiative, introduced under the broader framework of the Leadership Group for Industry Transition (LeadIT) 2.0, marks a significant stride toward a sustainable and green industrial revolution.

• Since its inception in 2019, LeadIT has grown into a collaborative effort involving 18 countries and 20 industry-leading companies.

• The LeadIT initiative, initially centered around pivotal sectors such as iron, steel, cement, and aluminum, focused on industry transition and knowledge sharing. LeadIT has played a pivotal role in accelerating the adoption of low-carbon technologies, aligning with global environmental goals.

• The unveiling of LeadIT 2.0 at COP28 in Dubai signaled a new chapter in the initiative's trajectory, with an intensified commitment to three core areas:

1. Inclusive and Just Industry Transition : Ensuring that industry transitions are not only efficient but also equitable, promoting fairness and inclusivity in the process.

2. Low Carbon Technology Development and Transfer : Placing renewed emphasis on the development and seamless transfer of low-carbon technologies, crucial for achieving sustainable practices across industries.

3. Emerging Economy Technology Transfer: Facilitating the expedited transfer of innovative solutions to emerging economies, assisting in their transition to more sustainable practices.

• The launch of the India-Sweden Industry Transition Partnership within the LeadIT framework aims to specifically address the

challenges faced by heavy-emitting industries.

Q53. Answer: (c) Viruses

The correct answer is Viruses.

Key Points

• Viruses are acellular entities, meaning they do not have a cellular structure and lack cell membranes.

• They are composed of genetic material (either DNA or RNA) surrounded by a protein coat called a capsid.

• Viruses cannot replicate on their own and must infect a host cell to reproduce.

• They do not possess organelles such as mitochondria, endoplasmic reticulum, or ribosomes, which are found in eukaryotic cells.

• Due to their lack of cellular structure, viruses are considered obligate intracellular parasites.

Additional Information

• Plant Cell

• Plant cells have a cell wall, a large central vacuole, and chloroplasts in addition to the cell membrane.

• These cells are eukaryotic and have membrane-bound organelles.

• Fungi Cell

• Fungi cells are also eukaryotic and have a cell wall made of chitin, in addition to a cell membrane and membrane-bound organelles.

• Animal Cell

• Animal cells lack a cell wall and chloroplasts but have a cell membrane and various membrane-bound organelles such as mitochondria and the endoplasmic reticulum.

Q54. Answer: (a) 9 : 6 : 4

Shortcut Trick

Use the zig-zag multiplication method to combine ratios a : b and b : c.

Multiply vertically for a (3×3), diagonally for b (2×3), and vertically for c (2×2).

a : b : c = (3 × 3) : (2 × 3) : (2 × 2)

a : b : c = 9 : 6 : 4

Therefore The correct answer is 9 : 6 : 4.

Alternate Method

Given:

Ratio 1: a : b = 3 : 2

Ratio 2: b : c = 3 : 2

Formula Used:

To combine two ratios with a common term, the value of the common term (b) must be made equal in both sets.

Calculations:

=> The common term is b. Its values are 2 and 3.

=> LCM of 2 and 3 = 6.

=> Convert a : b such that b = 6: Multiply (3 : 2) by 3 → 9 : 6.

=> Convert b : c such that b = 6: Multiply (3 : 2) by 2 → 6 : 4.

=> Combining the results: a : b : c = 9 : 6 : 4.

Therefore The correct answer is 9 : 6 : 4.

Additional Information

Compound Ratio

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

Duplicate and Sub-duplicate Ratio

The duplicate ratio of (a : b) is (a^2 : b^2) and the sub-duplicate ratio is (√a : √b).

Inverse Ratio

The inverse ratio of a : b is 1/a : 1/b, which simplifies to b : a.

Proportion

If a : b = c : d, then a, b, c, and d are in proportion, where a × d = b × c (Product of extremes = Product of means).

Q55. Answer: (d) P

Given: A, B, E, F, L, M and P are sitting around a circular table, facing the centre.

1) A sits third to the right of B.

2) A sits to the immediate right of M.

3) M sits third to the left of L.

F sits second to the left of E.

P is not an immediate neighbour of M.

So, P sits second to the left of F.

Hence, the correct answer is "P".

Q56. Answer: (c) HE-LI-PR

The logic followed here is:

JG-NK-RT

EB-IF-MO

Similarly, HE-LI-PR

Hence, "HE-LI-PR" is the correct answer.

Q57. Answer: (b) Usha Uthup

The correct answer is Usha Uthup.

Key Points

• The following are the names of Padma Award 2024 recipients:

Padma Vibhushan	Padma Bhushan	Padma Shri
1. Vyjayantimala Bali	1. M Fathima Beevi	1. Khalil Ahamad
2. Konidela Chiranjeevi	2. Hormusji N Cama	2. Badrappan M
3. M Venkaiah Naidu	3. Mithun Chakraborty	3. Kaluram Bamaniya
4. Bindeshwar Pathak	4. Sitaram Jindal	4. Rezwana Choudhury Bannya
5. Padma Subrahmanyam	5. Young Liu	5. Naseem Bano
	6. Ashwin Balachand Mehta	6. Ramlal Bareth
	7. Satyabrata Mookherjee	7. Gita Roy Barman
	8. Ram Naik	8. Parbati Baruah
	9. Tejas Madhusudan Patel	9. Sarbeswar Basumatary
	10. Olanchery Rajagopal	10. Som Datt Battu
	11. Dattatray Ambadas Mayaloo Alias Rajdutt	11. Takdira Begum
	12. Togdan Rinpoche	12. Sathyanarayana Beleri
	13. Pyarelal Sharma	13. Drona Bhuyan
	14. Chandreshwar Prasad Thakur	14. Ashok Kumar Biswas
	15. Usha Uthup	15. Rohan Machanda Bopanna
	16. Vijaykanth	16. Smriti Rekha Chakma
		17. Narayan Chakraborty
		18. A Velu Ananda Chari
		19. Ram Chet Chaudhary
		20. K Chellammal
		21. Joshna Chinappa
		22. Charlotte Chopin

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		23. Raghuveer Choudhary
		24. Joe D Cruz
		25. Ghulam Nabi Dar
		26. Chitta Ranjan Debbarma
		27. Uday Vishwanath Deshpande
		28. Prema Dhanraj
		29. Radha Krishan Dhiman
		30. Manohar Krishana Dole
		31. Pierre Sylvain Filliozat
		32. Mahabir Singh Guddu
		33. Anupama Hoskere
		34. Yazdi Maneksha Italia
		35. Rajaram Jain
		36. Jankilal
		37. Ratan Kahar
		38. Yashwant Singh Kathoch
		39. Zahir I Kazi
		40. Gaurav Khanna
		41. Surendra Kishore
		42. Dasari Kondappa
		43. Sridhar Makam Krishnamurthy
		44. Yanung Jamoh Lego
		45. Jordan Lepcha
		46. Satendra Singh Lohia
		47. Binod Maharana
		48. Purnima Mahato
		49. Uma Maheshwari D
		50. Dukhu Majhi
		51. Ram Kumar Mallick
		52. Hemchand Manjhi
		53. Chandrashekhar Mahadeorao Meshram
		54. Surendra Mohan Mishra
		55. Ali Mohammed & Shri Ghani Mohammed (Duo)
		56. Kalpana Morparia
		57. Chami Murmu
		58. Sasindran Muthuvel
		59. G Nachiyar
		60. Kiran Nadar

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		61. Pakaravur Chithran Namboodiripad (Posthumous)
		62. Narayanan E P
		63. Shailesh Nayak
		64. Harish Nayak
		65. Fred Negrit
		66. Hari Om
		67. Bhagabat Padhan
		68. Sanatan Rudra Pal
		69. Shankar Baba Pundlikrao Papalkar
		70. Radhe Shyam Pareek
		71. Dayal Mavjibhai Parmar
		72. Binod Kumar Pasayat
		73. Silbi Passah
		74. Shanti Devi Paswan & Shri Shivan Paswan (Duo)
		75. Sanjay Anant Patil
		76. Muni Narayana Prasad
		77. K S Rajanna
		78. Chandrashekar Channapatna Rajannachar
		79. Bhagwatilal Rajpurohit
		80. Romalo Ram
		81. Navjivan Rastogi
		82. Nirmal Rishi
		83. Pran Sabharwal
		84. Gaddam Sammaiah
		85. Sangthankima
		86. Machihan Sasa
		87. Omprakash Sharma
		88. Eklabya Sharma
		89. Ram Chander Sihag
		90. Harbinder Singh
		91. Gurvinder Singh
		92. Godawari Singh
		93. Ravi Prakash Singh
		94. Seshampatti T Sivalingam
		95. Somanna
		96. Kethavath Somlal
		97. Shashi Soni

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		98. Urmila Srivastava
		99. Nepal Chandra Sutradhar (Posthumous)
		100. Gopinath Swain
		101. Laxman Bhatt Tailang
		102. Maya Tandon
		103. Aswathi Thirunal Gouri Lakshmi Bayi Thampuratty
		104. Jagdish Labhshanker Trivedi
		105. Sano Vamuzo
		106. Balakrishnan Sadanam Puthiya Veetil
		107. Kurella Vittalacharya
		108. Kiran Vyas
		109. Jageshwar Yadav
		110. Babu Ram Yadav

Q58. Answer: (d) 2

The logic followed here is:

Each vowel in the word HISTORY is changed to the letter preceding it in the English alphabetical order and each consonant is changed to the letter following it in the English alphabetical order,

Thus, 2 vowels will be there in the group of letters thus formed.

Hence, "2" is the correct answer.

Q59. Answer: (a) Dendritic tip

The correct answer is Dendritic tip.

Key Points

• The dendritic tip is the part of the neuron that is responsible for receiving and acquiring information from other neurons or sensory receptors.

• Dendrites are branched extensions of the neuron that conduct electrical signals toward the cell body.

• The tips of dendrites have specialized structures known as synaptic terminals that facilitate communication with other neurons.

• Dendrites play a crucial role in neural connectivity and the formation of neural networks.

• The structure and branching pattern of dendrites can influence the strength and integration of synaptic inputs.

Additional Information

• Axon

• The axon is a long, slender projection of the neuron that conducts electrical impulses away from the cell body towards other neurons or effectors.

• Axons are typically involved in the transmission of information over long distances within the nervous system.

• Cell Body

• The cell body, or soma, contains the nucleus and other organelles essential for the neuron's functions.

• It is responsible for maintaining the metabolic activities of the neuron.

• Synapse

• The synapse is the junction between two neurons or between a neuron and a target cell, where communication occurs through neurotransmitter release.

• Synaptic transmission is a crucial process for information flow within the nervous system.

Q60. Answer: (d) 0.001

Given:

The value to be simplified is 0.002 × 0.5.

Formula Used:

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Simple multiplication formula: a×ba×ba×b

Calculation:

=> 0.002 × 0.5

=> 2 × 10^(-3) × 5 × 10^(-1)

=> (2 × 5) × 10^(-3-1)

=> 10 × 10^(-4)

=> 10^(1-4)

=> 10^(-3)

=> 0.001

The simplified value of 0.002 × 0.5 is 0.001.

Q61. Answer: (d) 8 m

Shortcut Trick

For a 30° angle, the ratio of Perpendicular (break height) to Hypotenuse (broken part) is 1 : 2.

The original height of the tree is the sum of these two parts: 1 + 2 = 3 units.

Given 3 units = 24 m => 1 unit = 24 ÷ 3 = 8 m.

The tree broke at 1 unit height = 8 m.

Therefore The correct answer is 8 m.

Alternate Method

Given:

Original height of the tree = 24 m

Angle made by the broken part with the ground = 30°

Formula Used:

sin θ = Perpendicular / Hypotenuse

Let the tree break at height h m from the ground.

The length of the broken part (hypotenuse) = 24 − h m.

In the right-angled triangle formed:

=> sin 30° = h / (24 − h)

=> 1/2 = h / (24 − h)

=> 24 − h = 2 × h

=> 3 × h = 24

=> h = 24 ÷ 3

=> h = 8 m

Therefore The correct answer is 8 m.

Additional Information

Trigonometric Ratios

In a right triangle, sin θ = Opp/Hyp, cos θ = Adj/Hyp, and tan θ = Opp/Adj. These ratios help find missing sides or angles.

Special 30-60-90 Triangle

The sides of a 30°-60°-90° triangle are always in the ratio 1 : √3 : 2. The side opposite 30° is half the hypotenuse.

Pythagoras Theorem

In any right-angled triangle, the square of the hypotenuse (c) is equal to the sum of the squares of the other two sides (a, b): $a^2 + b^2 = c^2$.

Q62. Answer: (c) 70

Shortcut Trick

Assume the Mean to be 70 and calculate the deviations from it.

Deviations: (39−70), (49−70), (59−70), (60−70), (70−70), (80−70), (90−70), (93−70), (90−70)

Net Deviation = −31 − 21 − 11 − 10 + 0 + 10 + 20 + 23 + 20 = −73 + 73 = 0

Actual Arithmetic Mean = Assumed Mean + (Net Deviation ÷ Total Observations) = 70 + (0 ÷ 9) = 70

Therefore The correct answer is 70.

Alternate Method

Given Observations: 39, 49, 59, 60, 70, 80, 90, 93, 90

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Total Number of Observations (n): 9

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

Calculations:

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

=> Sum = 630

=> Arithmetic Mean = 630 ÷ 9

=> Arithmetic Mean = 70

Therefore The correct answer is 70.

Additional Information

Sum of Deviations

The algebraic sum of the deviations of all observations from their arithmetic mean is always zero. This property defines the mean as the center of gravity of the data.

Change of Scale and Origin

If each value in a data set is increased/decreased by a constant 'k', the mean increases/decreases by 'k'. If multiplied by 'k', the new mean is also multiplied by 'k'.

Relationship with Outliers

The arithmetic mean is highly sensitive to outliers (extreme values), which can pull the mean significantly toward the higher or lower end of the spectrum.

Q63. Answer: (c) upthrust of water on a bottle is greater than the gravitational force acting on the bottle

The correct answer is upthrust of water on a bottle is greater than the gravitational force acting on the bottle.

Key Points

• When an empty bottle is pushed underwater, it displaces a volume of water equal to its own volume.

• The water exerts an upward buoyant force on the bottle, known as upthrust.

• Since the bottle is empty (filled with air), its density is much lower than the density of water.

• The upthrust exerted by the water is greater than the gravitational force acting on the empty bottle.

• This difference in forces causes the bottle to bounce back to the surface when it is released.

Additional Information

• Buoyant Force

• It is the upward force exerted by a fluid on an object submerged in it.

• The magnitude of the buoyant force is equal to the weight of the fluid displaced by the object.

• Archimedes' Principle

• This principle states that any object submerged in a fluid experiences a buoyant force equal to the weight of the fluid it displaces.

• It explains why objects float or sink in fluids.

• Density

• Density is defined as mass per unit volume of a substance.

• Objects with lower density than the fluid they are in will float, while those with higher density will sink.

Q64. Answer: (a) 186 and 129

Given equation: 186 – 82 + (129 ÷ 3) – 6 × 8 + (31 – 19) × 2 = 85

Option 1) 186 and 129

Two number need to be interchanged then:

=> 129 – 82 + (186 ÷ 3) – 6 × 8 + (31 – 19) × 2 = 85

=> 129 – 82 + 62 – 6 × 8 + 12 × 2 = 85

=> 129 – 82 + 62 – 48 + 24 = 85

=> 215 - 130 = 85

=> 85 = 85

Option 2) 8 and 19

Two numbers need to be interchanged then:

=> 186 – 82 + (129 ÷ 3) – 6 × 19 + (31 – 8) × 2 = 85

=> 186 – 82 + 43 – 6 × 19 + 23 × 2 = 85

=> 186 – 82 + 43 – 114 + 46 = 85

=> 275 - 196 = 85

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=> 76 ≠ 85

Option 3) 2 and 6

Two numbers need to be interchanged then:

=> 186 – 82 + (129 ÷ 3) – 2 × 8 + (31 – 19) × 6 = 85

=> 186 – 82 + 43 – 2 × 8 + 12 × 6 = 85

=> 186 – 82 + 43 –16 + 72 = 85

=> 301 - 98 = 85

=> 203 ≠ 85

Option 4) 82 and 31

Two numbers need to be interchanged then:

=> 186 – 31 + (129 ÷ 3) – 6 × 8 + (82 – 19) × 2 = 85

=> 186 – 31 + 43 – 6 × 8 + 63 × 2 = 85

=> 186 – 31 + 43 – 48 + 126 = 85

=> 355 - 79 = 85

=> 276 ≠ 85

Hence, the correct answer is "186 and 129".

Q65. Answer: (c) X = 18, Y = 83.6

The logic followed here is: 1st number × 3.8 = 2nd number.

X : 68.4 → X × 3.8 = 68.4 → X = 68.4 / 3.8 = 18

Similarly,

22 : Y → 22 × 3.8 = 83.6

Hence, the correct answer is "X = 18, Y = 83.6"

Q66. Answer: (c) Both I and II follow

Given:

Statement:Due to water pipeline work planned in Grant Road for the next 3 days, the road will be closed for traffic till further notice.

Course of Action:

I. Traffic police should increase the number of personnel present at Grant Road to physically coordinate traffic diversion effectively.- True (Because, it will help manage the immediate situation and prevent chaos).

II. Traffic police should issue a notification in major newspapers regarding traffic diversions and alternate routes that can be taken by the general public till the Grant Road closure continues. - True (Because, it will help people plan their journeys in advance provide information about traffic diversions and alternate routes.)

So, Both I and II follow.

Hence, the correct answer is "Option 3".

Q67. Answer: (a) Four

The correct answer is Four.

Key Points

• The valency of carbon is four.

• Carbon has four electrons in its outer shell.

• It needs four more electrons to complete its octet, hence its valency is four.

• Carbon forms four covalent bonds with other atoms to achieve a stable electronic configuration.

• Common carbon compounds include methane (CH4), where carbon forms four single bonds with hydrogen atoms.

Additional Information

• Carbon Compounds

• Carbon can form a wide variety of compounds due to its ability to form stable covalent bonds with other carbon atoms.

• These compounds can be simple molecules like methane or complex structures like proteins and DNA.

• Allotropes of Carbon

• Carbon exists in several allotropes including graphite, diamond, and graphene.

• Each allotrope has distinct physical properties due to differences in the arrangement of carbon atoms.

• Organic Chemistry

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• The study of carbon compounds is known as organic chemistry.
• It encompasses the study of the structure, properties, and reactions of carbon-containing compounds.

Q68. Answer: (b) 16:2

The correct answer is 16:2.

Key Points

• According to the law of constant proportion, a chemical compound always contains exactly the same proportion of elements by mass.
• Water (H2O) is composed of hydrogen and oxygen in a fixed ratio of 2:16 by mass.
• The molar mass of water is 18 g/mol, with oxygen contributing 16 g/mol and hydrogen contributing 2 g/mol.
• Upon decomposition of 18 g of water, 16 g of oxygen and 2 g of hydrogen will be obtained.
• This ratio of the mass of oxygen to hydrogen (O:H) after decomposition is 16:2, confirming the law of constant proportion.

Additional Information

• Law of Multiple Proportions
• This law states that if two elements combine to form more than one compound, the masses of one element that combine with a fixed mass of the other are in ratios of small whole numbers.
• Law of Conservation of Mass
• This law states that mass is neither created nor destroyed in a chemical reaction.
• Law of Definite Composition
• This law states that a chemical compound always contains the same elements in the exact same proportions by mass.

Q69. Answer: (b) Bromine

The correct answer is Bromine.

Key Points

• Bromine is the only non-metal that is in a liquid state at room temperature.
• It is a halogen and is positioned in Group 17 of the periodic table.
• Its chemical symbol is Br and it has an atomic number of 35.
• Bromine has a red-brown color in its liquid form and emits a brownish vapor at room temperature.
• It is highly reactive and can cause burns upon contact with the skin.

Additional Information

• Chlorine
• Chlorine is a non-metal that is a greenish-yellow gas at room temperature.
• It is commonly used for water purification and in the production of various consumer products.
• Fluorine
• Fluorine is the most reactive and electronegative element and exists as a pale yellow gas at room temperature.
• It is used in toothpaste and in the manufacture of Teflon.
• Sulphur
• Sulphur is a solid non-metal at room temperature, with a bright yellow appearance.
• It is used in the production of sulfuric acid, fertilizers, and in vulcanization of rubber.

Q70. Answer: (c) Neither conclusion (I) nor (II) follows

Statements:

Some beds are tables.

No tables are chairs.

The least possible Venn diagram is as follows:

Conclusions:

(I) All tables are beds. - False (because Some beds are tables given so it can be possible but not definite)

(II) Some chairs are beds. - False (because there is no direct relation between chairs and beds so it can be possible but not definite)

Hence, the correct answer is "Neither conclusion (I) nor (II) follows".

Q71. Answer: (b) Earthworm

The correct answer is Earthworm.

Key Points

• Earthworms reproduce sexually and not by asexual means like fission.
• Plasmodium, Amoeba, and Leishmania are known to reproduce asexually through fission.
• Amoeba reproduces by binary fission, where the organism splits into two equal halves.
• Plasmodium reproduces through multiple fission, where one cell divides into many smaller cells.
• Leishmania also reproduces through binary fission.
Additional Information
• Asexual Reproduction
• It is a type of reproduction that does not involve the fusion of gametes.
• Offspring are genetically identical to the parent organism.
• Common methods include binary fission, budding, and spore formation.
• Binary Fission
• This is a form of asexual reproduction common in prokaryotes and some single-celled eukaryotes.
• The parent organism divides into two approximately equal parts.
• Multiple Fission
• In multiple fission, the nucleus divides several times before the cell divides into multiple new cells.
• This is commonly observed in some protozoa like Plasmodium.

Q72. Answer: (b) Rs. 1,000

Shortcut Trick
Use the ratio method for successive profit: 20% = 1/5 (ratio 5:6) and 25% = 1/4 (ratio 4:5).
Overall ratio (Initial CP : Final SP) = (5 × 4) : (6 × 5) = 20 : 30 = 2 : 3.
The value of 3 units represents the amount paid by C = Rs. 1,500.
=> 1 unit = 1,500 ÷ 3 = Rs. 500.
=> Amount paid by A (2 units) = 2 × 500 = Rs. 1,000.
Therefore The correct answer is Rs. 1,000.
Alternate Method
Given:
Profit at which A sells to B = 20%
Profit at which B sells to C = 25%
Price paid by C = Rs. 1,500
Formula Used:
Final Selling Price = Initial Cost Price × (100 + P1)/100 × (100 + P2)/100
Calculations:
Let the amount paid by A (Cost Price) be Rs. x.
=> Price paid by B = x × (120/100) = 1.2x
=> Price paid by C = 1.2x × (125/100) = 1500
=> 1.2x × 1.25 = 1500
=> 1.5x = 1500
=> x = 1500 ÷ 1.5
=> x = 1000
Therefore The correct answer is Rs. 1,000.
Additional Information
Successive Percentage Change
The net percentage change for two successive changes of a% and b% is given by the formula: [a + b + (ab/100)]%.
Effective Profit Multiplier
If multiple profits occur, the final price is found by multiplying the initial price by (1 + P1/100) × (1 + P2/100) × ... × (1 + P_n/100).
Cost Price from Selling Price
Cost Price (CP) = [Selling Price (SP) × 100] ÷ (100 + Profit%).

Q73. Answer: (c) Acceleration

The correct answer is Acceleration.
Key Points

• Acceleration is defined as the rate of change of velocity of an object with respect to time.
• It is a vector quantity, meaning it has both magnitude and direction.
• The SI unit of acceleration is meters per second squared (m/s^2).
• Acceleration can be caused by changing the speed of an object, its direction of motion, or both.
• In mathematical terms, acceleration is the derivative of velocity with respect to time.

Additional Information

• Speed
• Speed is a scalar quantity that refers to how fast an object is moving, regardless of its direction.
• It is calculated as the distance traveled per unit of time.
• Velocity
• Velocity is a vector quantity that describes the speed of an object in a specific direction.
• It is calculated as the displacement per unit of time.
• Distance
• Distance is a scalar quantity that refers to the total path length covered by an object during its motion.
• It does not take the direction of motion into account.

Q74. Answer: (d) J

The logic followed here is:

If each vowel in the word MARKETING is changed to the letter following it in the English alphabetical order and each consonant is changed to the letter preceding it in the English alphabetical order,

Thus, letter J will be fourth from the left in the group of letters thus formed.

Hence, the correct answer is "J".

Q75. Answer: (b) Plants

The correct answer is Plants.

Key Points

• Plants are multicellular organisms, meaning they are composed of multiple cells that work together to perform various functions.
• Each plant cell has a specific role, contributing to the overall structure and function of the plant.
• Unlike unicellular organisms, plants have specialized cells for different tasks such as photosynthesis, nutrient transport, and reproduction.
• Examples of unicellular organisms include Amoeba, Paramoecium, and Chlamydomonas, which are composed of a single cell that performs all the necessary life functions.
• Multicellular organisms like plants have a higher level of organization and complexity compared to unicellular organisms.

Additional Information

• Amoeba
• Amoeba are unicellular organisms that move and ingest food using pseudopodia, which are temporary projections of the cell.
• They are commonly found in freshwater environments and play a role in nutrient cycling.
• Paramoecium
• Paramoecium are unicellular organisms that use cilia for movement and feeding.
• They are often found in aquatic habitats and are known for their slipper-like shape.
• Chlamydomonas
• Chlamydomonas are unicellular green algae that have flagella for movement and are capable of photosynthesis.
• They serve as a model organism in biological research due to their simple structure and ease of cultivation.

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