RRB ALP CBT-I 2024 Official Paper (Held On: 26 Nov, 2024 Shift 2) (Previous Year Paper)

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

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STAGE I (CBT I)

Q1. Given below is a cause followed by three effects numbered I, II and III. Read the cause carefully and decide which of the three can be a/the possible effect(s).

Cause - A major train accident occurred at Katpadi Junction last night, where seven bogies of G.T. Express derailed and fell across the tracks.

Effect I - Many trains on the Katpadi - Chennai route are running several hours late today.

Effect II - Long queues were seen at the railway ticket booking counters in Bangalore.

Effect III - Railways has decided to run two holiday special trains between Kolkata and Patna from October to December 2023.

(a) Both I and II are possible effects.
(b) Only I is a possible effect.
(c) Both II and III are possible effects.
(d) Only II is a possible effect.

Q2. If each vowel in the word PARKING is changed to the letter following it in the English alphabetical order and each consonant is changed to the letter following it in the English alphabetical order, then which of the following letters will be third from the left in the group of letters thus formed?

(a) L
(b) S
(c) O
(d) J

Q3. An article is sold for Rs. x after offering two successive discounts of 25% and 8% on its marked price of Rs. 500. The value of x is

(a) 285
(b) 280
(c) 300
(d) 345

Q4. Which of the following statements refer/s to the law of conservation of energy?

Statements:

I) Energy can be converted from one form to another form of energy.

II) Energy can neither be created nor destroyed.

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

Q5. If 'A' stands for '÷', 'B' stands for '×', 'C' stands for '+', and 'D' stands for '–', what will come in place of the question mark '?' in the following equation?

61 D 39 C 14 C (62 A 2) B 4 = ?

(a) 110
(b) 145
(c) 160
(d) 180

Q6. 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 bees are insects.

All bees are hives.

Conclusions:

(I) Some hives are insects.

(II) All hives are bees.

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

Q7. Which organelle is found ONLY in plant cells?

(a) Mitochondria
(b) Chloroplast
(c) Lysosome
(d) Nucleus

Q8. A, B, C, D, E and F are sitting around a circular table facing the centre. E sits to the immediate right of D. A is an immediate neighbour of B and D. F sits second to the right of D. What is the position of C with respect to D?

(a) Immediate left
(b) Second to the left
(c) Second to the right
(d) Third to the left

Q9. In the word BLEACH, each consonant is changed to the letter immediately preceding it in the English alphabetical order and each vowel is changed to the letter immediately succeeding it in the English alphabetical order. Which of the following letters is repeated twice in the new group of letters thus formed?

(a) A
(b) K
(c) F
(d) B

Q10. What constant speed should be maintained in order to reach a distance of 600 km in 10 hrs?

(a) 60 km/h
(b) 80 km/h
(c) 50 km/h
(d) 85 km/h

Q11. 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) VZ-TX
(b) GK-ZD

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(c) CG-VZ
(d) WA-PT

Q12. The work done in moving 10 coulomb charges across the potential difference of 5 volts is _____.
(a) 20 joules
(b) 2 joules
(c) 50 joules
(d) 5 joules

Q13. Seven people, A, B, C, D, E, F and G, are sitting in a row, facing north. A sits fifth from the right end. Only two people sit between E and A. C is an immediate neighbour of G and E. B sits to the immediate right of F. How many people sit between D and B?
(a) Two
(b) Three
(c) Four
(d) One

Q14. Which of the following options should come in place of the question mark (?) in the given series based on the English alphabetical order?
BDG, DFI, FHK, HJM, JLO, ?
(a) LNQ
(b) OPR
(c) POR
(d) NLQ

Q15. Town L lies to the west of Town M. Town D lies to the northeast of Town L. Town A lies to the west of Town D. Town R lies to the east of Town D. What is the position of Town R with respect to Town L?
(a) Northwest
(b) Northeast
(c) Southwest
(d) Southeast

Q16. Which of the following statements is/are correct?
Statements:
I) A current carrying conductor acts like a magnet.
II) Moving electrons perpendicular to the magnetic field do not experience any force.
(a) Statement I only
(b) Statement II only
(c) Neither Statement I nor II
(d) Both Statements I and II

Q17. Three years ago, the average age of a family of six members was 19 years. Since then a boy has been born and the average age of the family is the same today as it was three years ago. What is the age of the boy?
(a) 2.5 years
(b) 1.5 years
(c) 2 years
(d) 1 year

Q18. Select the correct pair from the following options.
(a) Object's resistance to change its state of motion - Gravitation
(b) Object's resistance to change its state of motion - Inertia
(c) Object's resistance to change its state of motion - Momentum
(d) Object's resistance to change its state of motion - Acceleration

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Q19. 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 the 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 : 961 :: 34 : Y

(a) X = 39, Y = 529
(b) X = 41, Y = 576
(c) X = 45, Y = 625
(d) X = 47, Y = 729

Q20. Which of the following statements is INCORRECT about Rutherford's model of an atom?

(a) Electrons revolve around the nucleus in circular paths.
(b) There is a positively charged centre in an atom, which is called the nucleus.
(c) Electrons revolve around the nucleus in elliptical paths.
(d) The size of the nucleus is very small as compared to that of the atom.

Q21. If a sum of money doubles itself in 10 years on compound interest, then in how many years will it become 16 times of itself at the same rate of interest?

(a) 20
(b) 10
(c) 40
(d) 30

Q22. Which department's Disaster Management Division organised the conference on 'Experience Sharing and Capacity Building in Disaster Management' in August 2024?

(a) National Institute of Disaster Management (NIDM)
(b) National Disaster Response Force (NDRF)
(c) Department of Telecommunications (DoT)
(d) Ministry of Communications

Q23. CYBS is related to GWFQ in a certain way based on the English alphabetical order. In the same way, KUJO is related to OSNM. To which of the following options is SQRK related, following the same logic?

(a) UOWH
(b) VNWJ
(c) WOVI
(d) UPVH

Q24. Which of the following statements is INCORRECT regarding metals?

(a) Metals are good conductors of heat.
(b) Metals have to be drawn into thin wires.
(c) Lead and mercury are comparatively good conductors of heat.
(d) Surface of metals in their pure state is shiny.

Q25. In 2023, 'Garba' was declared as an intangible cultural heritage by UNESCO. Which of the following states is Garba from?

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

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Q26. In which of the following are CFCs NOT used?

(a) Fire extinguishers
(b) Grinders
(c) Aerosol sprays
(d) Refrigerators

Q27. Two angles are complementary. The larger angle is 6° less than five times the measure of the smaller angle. What is the measure of the larger angle?

(a) 63°
(b) 87°
(c) 74°
(d) 66°

Q28. IIT Bombay and _____ have partnered to develop India's first Quantum Diamond Microchip Imager.

(a) Mahindra and Mahindra
(b) TCS
(c) Google
(d) L&T

Q29. 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 oceans are rivers.

Some rivers are ponds.

Conclusions:

(I) All ponds are oceans.

(II) Some oceans are ponds.

(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

Q30. In 2024, which company entered into a Memorandum of Understanding (MoU) with iCreate to promote AI startups in India?

(a) Infosys
(b) Meta
(c) Google
(d) Microsoft

Q31. The Sangameshwara Temple had been submerged in the backwaters of the Srisailam project due to heavy rainfall in the monsoon of 2024. This temple lies on the banks of which river?

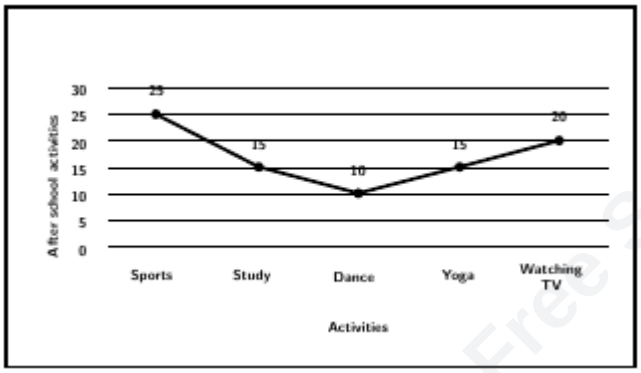
(a) Narmada
(b) Yamuna
(c) Krishna
(d) Ganga

Q32. Study the given graph and answer the question that follows.

The graph shows the number of students involved in different after-school activities.

What is the average number of students participating in Sports and Yoga?

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

Q33. The particles size of a solution is:

(a) smaller than 1 nm in diameter
(b) smaller than 28 nm in diameter
(c) smaller than 100 nm in diameter
(d) smaller than 52 nm in diameter

Q34. The relation between focal length ‘f’, object distance ‘u’ and image distance ‘v’ in the case of reflection of light by a spherical mirror is given by _____.

(a) 1/f = (uv)/(u+v)
(b) 1/f = (1/u) + (1/v)
(c) 1/f = (1/u) - (1/v)
(d) 1/f = (1/v) - (1/u)

Q35. Amita is 2 years older than her friend Amrita. Amita's father is twice as old as Amita, and Amrita is twice as old as her sister. The ages of Amita's father and Amrita's sister differ by 43 years. The sum of the ages (in years) of Amita and Amrita is:

(a) 54
(b) 50
(c) 64
(d) 68

Q36. Simplify the following expression:

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

(a) $3b^2+3ab-5bc-ac$
(b) $2b^2+3ab-4bc+c$
(c) $3ab+b^2+c^2-3ab-5bc-ac$
(d) $3b^2+c^2+3ab-5bc-ac$

Q37. Based on the English alphabetical order, three of the following four letter-clusters are alike in a certain way and thus form a group. Which letter-cluster 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) GMJ
(b) BHF
(c) KQN
(d) RXU

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Q38. Select the number from among the given options that can replace the question mark (?) in the following series.

184, 242, 275, 333, 366, 424, ?

(a) 464
(b) 457
(c) 426
(d) 478

Q39. 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 father of B',

A ÷ B means 'A is the sister of B'.

Based on the above, how is Q related to T if 'P + Q – R × S ÷ T'?

(a) Father's brother
(b) Brother
(c) Mother's mother
(d) Mother's brother

Q40. In our body, brain and spinal cord together constitute the:

(a) endocrine system
(b) central nervous system
(c) peripheral nervous system
(d) autonomic nervous system

Q41. The average of the first 30 natural numbers is:

(a) 15
(b) 16
(c) 15.5
(d) 16.5

Q42. Which of the following organisations is responsible for the development of the Long-Range Glide Bomb (LRGB), GAURAV, tested in August 2024?

(a) Indian Space Research Organisation (ISRO)
(b) Hindustan Aeronautics Limited (HAL)
(c) Defence Research and Development Organisation (DRDO)
(d) Indian Navy

Q43. A trader lost 20% by selling a watch for Rs. 1,024. What percentage will he gain by selling it for Rs. 1,472?

(a) 15%
(b) 10%
(c) 20%
(d) 12%

Q44. The book authored by Vijay Lokapally on Virat Kohli in the year 2023 is _____.

(a) The Cover Shot: The Virat Kohli Story (Revised and Updated World Cup Edition)
(b) The Straight Drive: The Virat Kohli Story (Revised and Updated World Cup Edition)
(c) Driven: The Virat Kohli Story (Revised and Updated World Cup Edition)
(d) The Cover Drive: The Virat Kohli Story (Revised and Updated World Cup Edition)

Q45. The angle of elevation of the top of a small tree from a point on the ground 300 m away from the foot of the tree was 30°. When the tree grew taller, its angle of elevation became 60° from the same point. By how much did the tree grow?

(a) 100 / √3 m
(b) 200√3 m

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(c) 200 / √3 m
(d) 100√3 m

Q46. The angles of a quadrilateral are in the ratio 2 : 5 : 7 : 10. Find the difference between the greatest and the smallest angles of the quadrilateral.
(a) 50°
(b) 120°
(c) 180°
(d) 60°

Q47. The 2024 philately scholarship scheme was launched by the Department of Posts under the _____.
(a) Sarva Shiksha Abhiyan
(b) Pradhan Mantri Kaushal Vikas Yojana
(c) Deen Dayal SPARSH Yojana
(d) Digital India Program

Q48. Seven boxes A, B, C, D, E, F and G are kept one over the other but not necessarily in the same order. G is kept third from the bottom. Only two boxes are kept between C and E. A is kept immediately above D. D is kept at one of the positions above G. Only two boxes are kept between B and E. B is not kept at the top-most position.
How many boxes are kept between D and B?
(a) Four
(b) Two
(c) Three
(d) One

Q49. Who coined the term ‘protoplasm’ for the fluid substance of the cell?
(a) Virchow
(b) Robert Brown
(c) Purkinje
(d) Robert Hooke

Q50. In a certain code language, ‘lost in space’ is coded as ‘vp de ez’ and ‘never get lost’ is coded as ‘gb ez cy’. What is the code for ‘lost’ in the given code language?
(a) gb
(b) dc
(c) vp
(d) ez

Q51. The tax on a commodity is reduced by 10%, but its consumption is increased by 20%. The percentage increase in the tax revenue derived from it is:
(a) 15%
(b) 8%
(c) 20%
(d) 10%

Q52. In the word HYPNOTIC, each letter of the word is changed to the letter immediately succeeding it in the English alphabetical order and then the new group of letters thus formed is rearranged according to the English alphabetical order. Which letter is second to the left in the new rearranged group of letters?
(a) I
(b) O
(c) D
(d) J

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Q53. Why does carbon make a stable compound?

(a) Due to big size carbon forms strong bonds.
(b) Due to small size carbon forms strong bonds.
(c) Due to higher electronegativity carbon forms strong bonds.
(d) Due to higher enthalpy carbon forms strong bonds.

Q54. Which two numbers should be interchanged to make the given equation correct?

46 + 24 - (12 + 19) × 2 + 38 × 6 + 44 ÷ 4 = 262

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

(a) 6 and 2
(b) 2 and 4
(c) 24 and 38
(d) 24 and 44

Q55. Which of the following options should come in place of the question mark (?) in the given series based on the English alphabetical order?

ACDF, GIJL, MOPR, SUVX, YABD, ?

(a) EGFJ
(b) EGHJ
(c) EGIK
(d) EFHJ

Q56. Select the INCORRECT pair regarding Asexual reproduction

(a) Hydra - multiple fission
(b) Yeast - spore formation
(c) Plasmodium - multiple fission
(d) Leishmania - binary fission

Q57. If $(584)^2 = 3,41,056$, then the value of square root of 34.1056 is:

(a) 0.0584
(b) 0.000584
(c) 0.584
(d) 5.84

Q58. Select the set, from the given options, 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.)

(11, 44, 2)

(6, 54, 3)

(a) (12, 72, 3)
(b) (2, 32, 4)
(c) (7, 98, 2)
(d) (10, 50, 5)

Q59. Which of the following statements is/are correct?

Statements:

I) The mass of an object is the same as its weight.

II) The mass of an object is not the same as its weight.

III) Mass is scalar quantity, whereas weight is vector quantity.

(a) Statements I and III
(b) Statement III
(c) Statements I and II

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(d) Statements II and III

Q60. The radius of a cylinder is 5 cm more than its height. If the curved surface area of the cylinder is 792 cm^2, then the volume of the cylinder (in cm^3), is _____. [Use $\pi = 22/7$]

(a) 5306
(b) 5254
(c) 5544
(d) 5712

Q61. Select the correct balanced equation option for the reaction Fe + H2O → Fe3O4 + H2.

(a) 3Fe + 4H2O → Fe3O4 + 2H2
(b) 2Fe + 4H2O → Fe3O4 + 4H2
(c) 3Fe + 4H2O → Fe3O4 + 4H2
(d) 4Fe + 4H2O → Fe3O4 + 4H2

Q62. In a certain code language, 'LOBE' is coded as '2653' and 'BORE' is coded as '6823'. What is the code for 'L' in the given code language?

(a) 3
(b) 5
(c) 2
(d) 8

Q63. The highest common factor of a set of coprime numbers is equal to:

(a) 1
(b) the lowest among them
(c) the highest among them
(d) 2

Q64. From a 2.25-litre mango drink bottle, how many small glasses of 45 ml can be filled?

(a) 45
(b) 50
(c) 55
(d) 40

Q65. Ravi and Kumar are working on an assignment. Ravi takes 6 hours to type 32 pages on a computer, while Kumar takes 5 hours to type 40 pages. How much time will they take, working together on two different computers to type an assignment of 110 pages?

(a) 8 hours
(b) 8 hours 15 minutes
(c) 7 hours 30 minutes
(d) 8 hours 25 minutes

Q66. Which sexually transmitted diseases are caused by a viruses?

(a) Warts and Gonorrhoea
(b) Gonorrhoea and Syphilis
(c) Syphilis and AIDS
(d) Warts and AIDS

Q67. DEF is related to CDE in a certain way. In the same way, MNO is related to LMN. To which of the following options is UVW related, following the same logic?

(a) EFD
(b) FED
(c) TUV
(d) FDE

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Q68. In October 2023, Prime Minister Narendra Modi formally announced India's interest in bidding for the _____ Olympics at the 141^(st) IOC Session.

(a) 2028
(b) 2040
(c) 2036
(d) 2032

Q69. When 10% of the inhabitants of a village died of cholera, a panic set in, during which 25% of the remaining inhabitants left the village. The population then reduced to 4050. Find the number of original inhabitants.

(a) 7000
(b) 5000
(c) 8000
(d) 6000

Q70. Magnification produced by a spherical mirror is equal to _____.

(a) Object distance / Image distance
(b) Height of the image / Height of the object
(c) Height of the image × Height of the object
(d) Object distance × Image distance

Q71. India's rank in the Corruption Perceptions Index (CPI) decline from ___ in 2022 to ___ in 2023.

(a) 85; 93
(b) 93; 85
(c) 40; 39
(d) 85; 40

Q72. The sum of the length, the breadth and the height of a cuboid is 38 cm and the length of its diagonal is 22 cm. Find the total surface area of the cuboid.

(a) 480 cm^2
(b) 432 cm^2
(c) 960 cm^2
(d) 864 cm^2

Q73. What is the effect of heating on the rate of diffusion?

(a) It first increases and then, decreases after some time.
(b) It increases with increase of temperature
(c) It decreases with increase of temperature
(d) There is no effect of temperature on the rate of diffusion.

Q74. If 25 : x :: x : 36, and x > 0, then what is the value of x?

(a) 21
(b) 18
(c) 27
(d) 30

Q75. Which of the following will be formed when dilute hydrochloric acid is added to a beaker having copper oxide?

(a) A solution with blue-green colour is formed due to the formation of copper (III) chloride.
(b) A solution with green colour is formed due to the formation of copper (II) chloride.
(c) A colourless solution is formed due to the formation of copper (II) chloride.
(d) A solution with blue-green colour is formed due to the formation of copper (II) chloride.

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ANSWER KEY

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

SOLUTIONS

Q1. Answer: (b) Only I is a possible effect.

Statements:

Cause - A major train accident occurred at Katpadi Junction last night, where seven bogies of G.T. Express derailed and fell across the tracks.

Effect I - Many trains on the Katpadi - Chennai route are running several hours late today. Implicit - Effect I is a direct consequence of the train accident as it would cause delays on the Katpadi - Chennai route.

Effect II - Long queues were seen at the railway ticket booking counters in Bangalore. Not implicit - Effect II, about running holiday special trains between Kolkata and Patna, is also unrelated to the accident.

Effect III - Railways has decided to run two holiday special trains between Kolkata and Patna from October to December 2023. Not implicit - Effect III, about running holiday special trains between Kolkata and Patna, is also unrelated to the accident.

Thus, only Effect I is a possible effect of the cause mentioned.

Hence, the correct answer is "Option 2".

Q2. Answer: (b) S

The logic followed here is:

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

Thus, letter S will be third from the left in the group of letters thus formed.

Hence, the correct answer is "S".

Q3. Answer: (d) 345

Shortcut Trick

Effective Discount % = d1 + d2 − (d1 × d2 / 100)

Effective Discount = 25 + 8 − (25 × 8 / 100) = 33 − 2 = 31%

Selling Price (x) = (100% − 31%) of Marked Price

x = 69% of 500 = 0.69 × 500 = 345

Therefore The correct answer is Rs. 345.

Alternate Method

Given:

Marked Price (MP) = Rs. 500

First discount (d1) = 25%

Second discount (d2) = 8%

Formula Used:

Selling Price (SP) = MP × (1 − d1/100) × (1 − d2/100)

Calculations:

=> Price after first 25% discount = 500 × (1 − 25/100)

=> Price after first discount = 500 × (75/100) = Rs. 375

=> Price after second 8% discount (x) = 375 × (1 − 8/100)

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=> x = 375 × (92/100)

=> x = 375 × 0.92

=> x = 345

Therefore The correct answer is Rs. 345.

Additional Information

Successive Discount Formula

For two successive discounts of a% and b%, the single equivalent discount is (a + b − ab/100)%.

Marked Price and Selling Price

The Marked Price is the price printed on the label, and Selling Price is the final amount paid after all discounts: SP = MP × (100 − d%)/100.

Net Discount Value

The total discount in rupees is the difference between the Marked Price and the Selling Price: Discount = MP − SP.

Q4. Answer: (a) Both Statements I and II

The correct answer is Both Statements I and II.

Key Points

• The law of conservation of energy states that energy can neither be created nor destroyed.

• Energy can only be converted from one form to another.

• Statement I correctly refers to the conversion of energy from one form to another.

• Statement II correctly states that energy cannot be created or destroyed.

• Both statements together fully describe the law of conservation of energy.

Additional Information

• Thermodynamics

• The law of conservation of energy is a fundamental principle in thermodynamics.

• It is also known as the first law of thermodynamics.

• Energy Forms

• Different forms of energy include kinetic, potential, thermal, chemical, electrical energy, etc.

• These forms of energy can be interconverted as per the law of conservation of energy.

• Closed System

• The law of conservation of energy applies to a closed system where no energy enters or leaves the system.

• In an open system, energy can be exchanged with the surroundings.

Q5. Answer: (c) 160

Given Equation: 61 D 39 C 14 C (62 A 2) B 4 = ?

BODMAS Rule:

Decoding the given information:

Alphabet	A	B	C	D
Meaning	÷	×	•	•

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

=> 61 - 39 + 14 + (62 ÷ 2) × 4 = ?

=> 61 - 39 + 14 + 31 × 4 = ?

=> 61 - 39 + 14 + 124 = ?

=> 199 - 39 = 160.

Hence, the correct option is "Option 3".

Q6. Answer: (b) Only conclusion (I) follows

Statements:

All bees are insects.

All bees are hives.

The least possible Venn diagram is as follows:

Conclusions:

(I) Some hives are insects. - True (because All bees are insects and All bees are hives. it means bees are intersection with hives

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ad insects so Some hives are insects too)

(II) All hives are bees. - False (because All bees are hives given so, All hives are bees. it can be possible but not definite)

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

Q7. Answer: (b) Chloroplast

The correct answer is Chloroplast.

Note: The correct answer as per the official answer key is Mitochondria but in actual the correct answer would be chloroplast as they are only found in plant cells which allows plants to produce their own food using sunlight.

Key Points

• Chloroplasts are found only in plant cells and certain algae, and they are not present in animal cells.

• They are responsible for photosynthesis, a process that converts light energy into chemical energy stored in glucose.

• Chloroplasts contain the pigment chlorophyll, which captures light energy.

• These organelles have their own DNA and replicate independently of the cell.

• Chloroplasts have a double membrane structure with an inner network of thylakoid membranes where the light reactions of photosynthesis occur.

Additional Information

• Mitochondria

• Known as the powerhouses of the cell, they generate most of the cell's ATP through cellular respiration.

• Present in both plant and animal cells.

• Lysosomes

• These are membrane-bound organelles that contain enzymes responsible for breaking down waste materials and cellular debris.

• Lysosomes are generally found in animal cells. They are found in plant cells in some rare conditions.

• They are often referred to as the "digestive system" of the cell because they help in the degradation of macromolecules.

• Endoplasmic Reticulum (ER)

• It is a network of membranes within the cytoplasm of eukaryotic cells, involved in protein and lipid synthesis.

• The ER is divided into two types: rough ER (with ribosomes) and smooth ER (without ribosomes).

• Rough ER is involved in protein synthesis and folding, while smooth ER is associated with lipid synthesis and detoxification processes.

Q8. Answer: (d) Third to the left

Given: A, B, C, D, E and F are sitting around a circular table facing the centre.

E sits to the immediate right of D.

F sits second to the right of D.

A is an immediate neighbour of B and D.

Then final arrangement:

So, the position of C with respect to D is "Third to the left".

Hence, the correct answer is "Third to the left".

Q9. Answer: (d) B

The logic followed here is:

In the word BLEACH, each consonant is changed to the letter immediately preceding it in the English alphabetical order and each vowel is changed to the letter immediately succeeding it in the English alphabetical order.

Thus, letter B is repeated twice in the new group of letters thus formed.

Hence, the correct answer is "B".

Q10. Answer: (a) 60 km/h

Shortcut Trick

To find the constant speed, use the relation: Speed = Distance ÷ Time.

Speed = 600 ÷ 10 = 60 km/h.

Therefore The correct answer is 60 km/h.

Alternate Method

Given:

Total Distance = 600 km

Total Time = 10 hr

Formula Used:

Speed (S) = Distance (D) ÷ Time (T)

=> Speed = 600 ÷ 10

=> Speed = 60 km/h

Therefore The correct answer is 60 km/h.

Additional Information

Average Speed

It is defined as the total distance traveled divided by the total time taken. Average Speed = Total Distance ÷ Total Time.

Unit Conversion

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

Relative Speed

When two objects move in the same direction, relative speed is S1 − S2. In the opposite direction, it is S1 + S2.

Q11. Answer: (a) VZ-TX

The logic followed here is:

1) VZ-TX

2) GK-ZD

3) CG-VZ

4) WA-PT

Hence, the correct answer is "VZ-TX".

Q12. Answer: (c) 50 joules

The correct answer is 50 joules.

Key Points

• The work done (W) in moving a charge (Q) across a potential difference (V) is given by the formula W = Q × V.

• In this question, the charge (Q) is given as 10 coulombs.

• The potential difference (V) is given as 5 volts.

• Substituting the given values into the formula: W = 10 coulombs × 5 volts.

• Therefore, the work done is W = 50 joules.

Additional Information

• Potential Difference

• It is the difference in electric potential between two points in a circuit.

• It is measured in volts (V).

• Charge

• It is a fundamental property of matter that causes it to experience a force when placed in an electromagnetic field.

• It is measured in coulombs (C).

• Work Done

• In the context of electricity, it refers to the energy transferred by an electric charge moving through a potential difference.

• It is measured in joules (J).

Q13. Answer: (c) Four

Given: Seven people, A, B, C, D, E, F and G, are sitting in a row, facing north.

A sits fifth from the right end.

Only two people sit between E and A.

C is an immediate neighbour of G and E.

B sits to the immediate right of F.

Thus final arrangement:

So, Four people sit between D and B.

Hence, the correct answer is "Four".

Q14. Answer: (a) LNQ

The logic followed here is:

Hence, the correct answer is "LNQ".

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Q15. Answer: (b) Northeast

Given:

Town L lies to the west of Town M.

Town D lies to the northeast of Town L.

Town A lies to the west of Town D.

Town R lies to the east of Town D.

So, Northeast is the position of Town R with respect to Town L.

Hence, the correct answer is "Northeast".

Q16. Answer: (a) Statement I only

The correct answer is Statement I only.

Key Points

• A current-carrying conductor generates a magnetic field around it, behaving like a magnet (Statement I is correct).

• Moving electrons perpendicular to the magnetic field experience a force called the Lorentz force (Statement II is incorrect).

• The direction of the magnetic field around a current-carrying conductor can be determined using the right-hand thumb rule.

• The magnitude of the magnetic field produced by a current-carrying conductor is directly proportional to the current and inversely proportional to the distance from the conductor.

• Electromagnets are practical applications of the principle that a current-carrying conductor acts like a magnet.

Additional Information

• Magnetic Force on a Moving Charge

• The magnetic force on a moving charge is given by the equation F = q(v × B), where q is the charge, v is the velocity, and B is the magnetic field.

• The direction of the force is perpendicular to both the velocity of the charge and the magnetic field.

• Electromagnetic Induction

• Electromagnetic induction is the process by which a changing magnetic field induces an electric current in a conductor.

• This phenomenon is the principle behind the operation of transformers, electric generators, and inductors.

Q17. Answer: (d) 1 year

Shortcut Trick

If the average age remains the same after n years and adding one new member:

Age of new member = Average − (Initial Members × Years Passed)

Age of the boy = 19 − (6 × 3)

=> Age = 19 − 18 = 1 year.

Therefore The correct answer is 1 year.

Alternate Method

Given:

Number of family members = 6

Average age 3 years ago = 19 years

Current average age (including boy) = 19 years

Calculations:

=> Total age of 6 members 3 years ago = 6 × 19 = 114 years

=> Total age of these 6 members today = 114 + (6 × 3) = 114 + 18 = 132 years

=> Total family members today = 6 + 1 (boy) = 7 members

=> Total age of 7 members today = 7 × 19 = 133 years

=> Age of the boy = Total age of 7 members − Total age of 6 members

=> Age of the boy = 133 − 132 = 1 year

Therefore The correct answer is 1 year.

Additional Information

Average Age Concept

The average of a group is the sum of all values divided by the total count (Average = Sum ÷ Count).

Age Shift Rule

If every person in a group grows older by 'n' years, the average age of the group also increases by exactly 'n' years.

New Member Addition

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Value of new member = (New Average × New Count) − (Old Average × Old Count).

Q18. Answer: (b) Object's resistance to change its state of motion - Inertia

The correct answer is Object's resistance to change its state of motion - Inertia.

Key Points

• Inertia is the property of an object that resists changes to its state of motion.

• An object at rest will stay at rest, and an object in motion will stay in motion with the same speed and direction unless acted upon by an unbalanced force.

• Inertia is directly related to the mass of an object; the greater the mass, the greater the inertia.

• It is a fundamental concept in Newton's First Law of Motion, which is also known as the Law of Inertia.

• Inertia explains why passengers in a moving vehicle feel a jolt when the vehicle suddenly stops or starts.

Additional Information

• Gravitation

• Gravitation is the force by which objects with mass attract one another.

• It is responsible for the falling of objects towards the Earth and the orbits of planets around the sun.

• Momentum

• Momentum is the product of an object's mass and its velocity.

• It is a vector quantity, meaning it has both magnitude and direction.

• Acceleration

• Acceleration is the rate of change of velocity of an object with respect to time.

• It is a vector quantity and can result from changes in speed, direction, or both.

Q19. Answer: (b) X = 41, Y = 576

The logic followed here is: √2nd number + 10 = 1st number

X : 961 → √961 + 10 = 31 + 10 = 41

Similarly,

34 : Y → √Y + 10 = 34 → √Y = 34 - 10 = 24 → Y = 24^2 = 576

Hence, the correct answer is "X = 41, Y = 576".

Q20. Answer: (c) Electrons revolve around the nucleus in elliptical paths.

The incorrect answer is Electrons revolve around the nucleus in elliptical paths..

Key Points

• Rutherford’s model of an atom proposed that electrons revolve around the nucleus in circular paths called orbits.

• The nucleus is a small, dense, positively charged center within the atom.

• The size of the nucleus is very small compared to the size of the atom.

• Rutherford's model could not explain the stability of the atom as it did not account for energy loss by electrons.

• The model was based on the gold foil experiment, which showed that most of the atom is empty space.

Additional Information

• Bohr’s Model of the Atom

• Proposed that electrons move in fixed orbits with quantized energy levels.

• Explained the stability of atoms and the emission spectra of hydrogen.

• Gold Foil Experiment

• Conducted by Ernest Rutherford in 1909.

• Involved the deflection of alpha particles by a thin gold foil, leading to the discovery of the nucleus.

• Limitations of Rutherford’s Model

• Could not explain the stability of electron orbits.

• Did not account for atomic spectra.

Q21. Answer: (c) 40

Shortcut Trick

In Compound Interest, if a sum becomes n times in T years, it becomes n^k times in T × k years.

Given: Sum becomes 2 times in 10 years (n = 2, T = 10).

Target: Sum becomes 16 times.

=> 16 = 2^4 (So, k = 4).

=> Required time = T × k = 10 × 4 = 40 years.

Therefore The correct answer is 40 years.

Alternate Method

Given:

Initial Sum = P

Time (n1) = 10 years

Amount (A1) = 2P

Target Amount (A2) = 16P

Formula Used:

$A = P(1 + r/100)^n$

Calculations:

=> 2P = P(1 + r/100)^(10)

=> 2 = (1 + r/100)^(10) ... (Equation 1)

For the sum to become 16 times (16P) in T years:

=> 16P = P(1 + r/100)^T

=> 16 = (1 + r/100)^T

=> 2^4 = (1 + r/100)^T

Substitute the value of 2 from Equation 1:

=> ((1 + r/100)^(10))^4 = (1 + r/100)^T

=> (1 + r/100)^(40) = (1 + r/100)^T

Comparing powers on both sides:

=> T = 40 years.

Therefore The correct answer is 40 years.

Additional Information

Compound Interest Formula

The amount A is calculated as A = P(1 + r/n)^(nt), where n is the number of times interest is compounded per unit t.

Rule of 72

A quick way to estimate doubling time is by dividing 72 by the annual interest rate (t ≈ 72/r).

SI vs CI for First Year

For the first year (or first compounding period), the Simple Interest and Compound Interest on the same principal and rate are always equal.

Successive Growth

Compound interest follows a Geometric Progression (GP) where the common ratio is (1 + r/100).

Q22. Answer: (c) Department of Telecommunications (DoT)

The correct answer is Department of Telecommunications (DoT)

Key Points

• The Department of Telecommunications (DoT) organized the conference on "Experience Sharing and Capacity Building in Disaster Management" in August 2024.

• The conference was held in collaboration with the National Telecommunications Institute for Policy Research, Innovation, and Training (NTIPRIT) and LSA, Delhi.

• The conference's goal was to improve disaster preparedness and resilience in India

• The National Institute of Disaster Management (NIDM) is the capacity building arm at the national level.

• State Administrative Training Institutes and other training institutes also perform capacity building functions.

Additional Information

• National Institute of Disaster Management (NIDM):

• It is a Premier Institute for Training and Capacity Development programs for managing Natural disasters in India, on a national as well as on a regional basis.

• The National Centre of Disaster Management (NCDM), constituted under an Act of Parliament in 1995 was renamed to give the present name of the National Institute of Disaster Management (NIDM) by the Disaster Management Act 2005, passed by the President of India on 9 January 2006.

• The main objective of the National Institute of Disaster Management (NIDM) is To work as a Consulting Agency for the

Government of India by providing Assistance in policy formulation and to facilitate in Reducing the Impact of Natural Disasters through its Technological innovations.

• The organization is Presided by the Union Home Minister of India.

• Ministry of Communications

• Ministry of Communications is a Central ministry under the Government of India responsible for telecommunications and postal service.

• It was carved out of Ministry of Communications and Information Technology on 19 July 2016.

• It consists of two departments viz. Department of Telecommunications and the Department of Posts.

• National Disaster Response Force (NDRF)

• The National Disaster Response Force (NDRF), constituted under Section 46 of the Disaster Management Act, 2005.

• The National Disaster Response Force is administered by the Union Home Minister. Which is the apex decision-making body before, during, and after a disaster.

• It is managed by the Central Government of India to control the expenses for emergency response, relief, and rehabilitation due to any threatening disaster situation or disaster in the country.

• This fund helps the State Disaster Response Force, in case of a disaster of severe nature, provided adequate funds are not available in SDRF.

• The Centre contributes 75% of the SDRF allocation for general category States and Union Territories and 90% for some special hilly states of India.

• This fund is financed through the levy of a cess on certain items, chargeable to excise and customs duty, and approved annually through the Finance Bill.

Q23. Answer: (c) WOVI

The logic followed here is:

CYBS is related to GWFQ

KUJO is related to OSNM

Similarly, SQRK will be related,

Hence, the correct answer is "WOVI".

Q24. Answer: (c) Lead and mercury are comparatively good conductors of heat.

The correct answer is option 3.

Key Points

• Metals are generally good conductors of heat due to the free movement of electrons within their structure.

• Metals can be drawn into thin wires, a property known as ductility.

• Lead and mercury are comparatively poor conductors of heat when compared to other metals like copper and aluminum.

• Lead and mercury are poor conductors of heat because they have relatively few free electrons available for conducting thermal energy, and their atomic structures (heavy atomic mass for lead and liquid state for mercury at room temperature) do not facilitate efficient energy transfer through lattice vibrations or electron movements.

• Metals, in their pure state, typically exhibit a shiny, lustrous surface.

• Conductivity of heat in metals is crucial for their use in various industrial applications such as cookware and heat exchangers.

Additional Information

• Properties of Metals

• Metals are malleable, meaning they can be hammered or rolled into thin sheets.

• Most metals have high melting and boiling points.

• Alloys

• Alloys are mixtures of two or more elements, with at least one being a metal, to enhance properties such as strength and resistance to corrosion.

• Common examples include steel (iron and carbon) and bronze (copper and tin).

• Non-metals

• Non-metals are elements that lack the properties of metals and are generally poor conductors of heat and electricity.

• Examples include sulfur, phosphorus, and carbon (in the form of graphite).

Q25. Answer: (d) Gujarat

The correct answer is Gujarat

Key Points

• The Garba dance is from Gujarat, India.
• Garba is a traditional, ritualistic, and devotional dance that is celebrated during the Navratri festival.
• On December 6, 2023, UNESCO added Garba to its Representative List of Intangible Cultural Heritage of Humanity.
• Garba is a unifying force that promotes social and gender inclusivity.
• It is performed around a pot with an oil lamp or an image of the mother goddess Amba.
• Dancers move in a counter-clockwise circle, singing and clapping their hands.

Additional InformationUNESCO's Headquarters are located in Paris, France.
• United Nations Educational, Scientific and Cultural Organization (UNESCO) is a specialized agency of the United Nations (UN).
• It seeks to build peace through international cooperation in Education, the Sciences, and Culture.
• It has 193 Members and 11 Associate Members (As of April 2020).
• Three UNESCO member states are not UN members: Cook Islands, Niue, and Palestine.
• UNESCO was founded on 16 November 1945.
• The first session of the General Conference of UNESCO was held in Paris in November-December of 1946.

Q26. Answer: (b) Grinders

The correct answer is Grinders.

Note: As per the official answer key, the correct answer is Fire extinguishers but in actual the correct answer would be Grinders. Traditionally, fire extinguishers have utilized halogens (CFCs), which today are well-known ozone-depleting agents. Grinders are tools used for grinding, cutting, and shaping materials, usually in industrial settings.

CFCs are not used in grinders

Source: https://www.sciencedirect.com/topics/earth-and-planetary-sciences/fire-extinguisher#:~:text=Traditionally%2C%20fire%20extinguishers%20have%20utilized,systems%20and%20contaminate%20water%20supplies.

Key PointsFire Extinguishers:
• Certain types of fire extinguishers, especially older models, used halons, which are chemically related to CFCs and also have ozone-depleting properties.

Grinders:
• Grinders are tools used for grinding, cutting, and shaping materials, usually in industrial settings.
• CFCs are not used in grinders because there is no need for refrigerants or propellants in these types of tools.

Aerosol Sprays:
• CFCs were commonly used as propellants in aerosol sprays such as deodorants, hair sprays, and sprays for various household products.
• Due to their harmful impact on the ozone layer, alternative propellants have been developed and are now used instead.

Refrigerators:
• CFCs were widely used as refrigerants in refrigeration systems, including refrigerators, freezers, and air conditioners.
• Due to the regulations concerning ozone depletion, CFCs have been replaced with more environmentally friendly refrigerants, but they historically were used in these applications.

Additional Information
• Ozone Layer Depletion
• CFCs release chlorine atoms upon exposure to ultraviolet (UV) radiation, which then break down ozone molecules in the stratosphere.
• This process leads to the thinning of the ozone layer, which protects the Earth from harmful UV radiation.
• Montreal Protocol
• An international treaty signed in 1987 aimed at phasing out the production and use of substances that deplete the ozone layer, including CFCs.
• The protocol has been successful in reducing the emissions of ozone-depleting substances.
• Alternative Compounds
• Hydrofluorocarbons (HFCs) and other environmentally friendly refrigerants have been developed as alternatives to CFCs.
• HFCs do not deplete the ozone layer but are potent greenhouse gases, necessitating further advancements in sustainable alternatives.

Q27. Answer: (c) 74°

Shortcut Trick

Total sum of complementary angles = 90°.

Let the smaller angle be 1 unit.

Then the larger angle = 5 units − 6°.

Sum: 1 unit + 5 units − 6° = 90° => 6 units = 96°.

=> 1 unit = 16° (smaller angle).

Larger angle = 90° − 16° = 74°.

Therefore The correct answer is 74°.

Alternate Method

Given:

=> The two angles are complementary (sum = 90°).

=> The larger angle is 6° less than 5 times the smaller angle.

Formula Used:

=> Sum of complementary angles: α + β = 90°

Calculations:

=> Let the measure of the smaller angle be x.

=> According to the question, the larger angle = 5x − 6.

=> x + (5x − 6) = 90

=> 6x − 6 = 90

=> 6x = 90 + 6

=> 6x = 96

=> x = 96 ÷ 6 = 16°

=> Larger angle = 5(16) − 6 = 80 − 6 = 74°.

Therefore The correct answer is 74°.

Additional Information

Supplementary Angles

Two angles are said to be supplementary if the sum of their measures is exactly 180°.

Linear Pair of Angles

A pair of adjacent angles formed by intersecting lines, where the sum of the angles is always 180°.

Adjacent Angles

Angles that share a common vertex and a common side but do not overlap.

Q28. Answer: (b) TCS

The correct answer is TCS

Key Points

• The Indian Institute of Technology, Bombay (IIT-Bombay) and Tata Consultancy Services (TCS) are partnering to develop India's first Quantum Diamond Microchip Imager

• The Quantum Diamond Microchip Imager is an advanced sensing tool that will test the quality of semiconductor chips without damaging them.

• The partnership aims to transform sectors like electronics and healthcare and to propel India forward with new technologies.

• TCS is a global leader in IT services, consulting, and business solutions.

• They have been partnering with some of the world's largest businesses for over 56 years

Additional Information

• Mahindra and Mahindra

• Mahindra & Mahindra is an Indian automobile manufacturing company headquartered in Mumbai, Maharashtra.

• It was established in 1945 as Mahindra & Mohammed and later renamed Mahindra & Mahindra.

• Part of the Mahindra Group, M&M is one of the largest vehicle manufacturers by production in India; the Mahindra Tractors subsidiary is the largest manufacturer of tractors in the world by volume.

• L&T

• Larsen & Toubro Limited, abbreviated as L&T, is an Indian multinational conglomerate, with interests in industrial technology, heavy industry, engineering, construction, manufacturing, power, information technology, military and financial services.

• It is headquartered in Mumbai, Maharashtra.

• L&T was founded in 1938 in Bombay by Danish engineers Henning Holck-Larsen and Søren Kristian Toubro

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Q29. Answer: (c) Neither conclusion (I) nor (II) follows

Statements:

All oceans are rivers.

Some rivers are ponds.

The least possible Venn diagram is as follows:

Conclusions:

(I) All ponds are oceans - False (because there is no direct relation between ponds and oceans so it can be possible but not definite)

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

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

Q30. Answer: (d) Microsoft

The correct answer is Microsoft

Key Points

• In 2024, Microsoft signed a Memorandum of Understanding (MoU) with the International Centre for Entrepreneurship and Technology (iCreate) to promote AI startups in India.

• This collaboration, facilitated by the Ministry of Electronics & IT (MeitY), aims to support AI startups across both urban and rural areas of the country.

• The initiative includes the iMPEL-AI (iCreate-Microsoft Programme for Emerging Leaders in Artificial Intelligence) program, which plans to screen 1,100 AI innovators nationwide, focusing on sectors such as healthcare, financial inclusion, sustainability, education, agriculture, and smart cities.

• The top 25 startups will receive go-to-market support from Microsoft's global network.

• Additionally, the partnership intends to provide AI skilling opportunities to 11,000 innovators, startups, and young Indians through Microsoft's Learning Management System, offering globally recognized certifications upon completion.

Additional Information

• Infosys

• Infosys Limited is an Indian multinational technology company that offers business consulting, information technology, and outsourcing services.

• Founded in 1981, the company is headquartered in Bengaluru.

• On 24 August 2021, Infosys became the fourth Indian company to achieve a market capitalization of US$100 billion.

• As of 2024, Infosys is the second-largest Indian Big Tech company by revenue and market capitalization.

Q31. Answer: (c) Krishna

The correct answer is Krishna

Key Points

• The Sangameshwara Temple is located in the Srisailam region on the banks of the Krishna River.

• It is one of the ancient temples in India, known for its religious and architectural significance.

• The temple is part of the Srisailam shrine complex, which is a prominent pilgrimage site, especially for those following Hinduism.

• During the monsoon of 2024, heavy rainfall caused water levels to rise significantly, leading to the submersion of the temple in the backwaters of the Srisailam Project.

• The temple, built in the Chola and Vijayanagara architectural style, has been a site of cultural and religious importance, and the flooding raised concerns about the loss of such heritage.

Additional Information

• Narmada

• The Narmada river originates from the Narmada Kund located in Amarkantak, Anuppur district in Madhya Pradesh.

• Amarkantak is located on the Maikal mountain.

• The Narmada river forms the unmarked boundary between North and South India.

• The major tributaries of the Narmada are Barna, Tawa, Kanar, Kolar, Man, Hatni, Uri, Shakkar, etc.

• It flows westwards (1, 312 km) before falling into the Gulf of Khambhat.

• The Narmada river is the longest river in Madhya Pradesh and it's called "The Lifeline of Madhya Pradesh".

• The waterfalls created by the Narmada River include Kapil Dhara and Dudh Dhara Falls (Anuppur), Dhuandhar Falls (Bhedaghat, Jabalpur), Sahasradhara Falls (Maheshwar, Khargone), Dardhi Falls, Manadhata Falls, etc.

• Yamuna

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• Yamuna is India's longest river that does not flow into the sea.
• Yamuna is a tributary of Ganga river.
• The Yamuna is approximately 1376 km.
• It originates from Yamunotri Glacier in Uttrakhand.
• Tributaries of Yamuna river- Chambal, Betwa, Sindh, Banas, Hindon, Ken, etc.
• Yamuna river merges with the Ganga river at Triveni Sangam in Praygraj in Uttar Pradesh.
• It is called Triveni because it is believed that the mythic Saraswati river along with Ganga and Yamuna also merges here.
• Ganga
• Ganga originates from in the Himalaya Mountains at Gomukh, the terminus of the Gangotri glacier, and falls in the mouth of the Bay of Bengal.
• It is a transboundary river of India which flows through India and Bangladesh.
• To achieve the objectives of the Ganga Action Plan, Ganga was declared the National River in 2008.
• Since then, it has been a part of the National Symbols of India.
• Ganga is also revered as the holiest river of India and signifies purity and spirituality.
• In Indian traditions and culture, the river Ganga is personified as Goddess Ganga.
• Ganga is also mentioned in one of the four Vedas- Rigveda.
• It is the third-largest river on Earth by discharge

Q32. Answer: (b) 20

Given:

The number of students involved in different after-school activities is given in the graph.

Formula Used:

Average = (Sum of values) / (Number of values)

Calculations:

Number of students in Sports = 25

Number of students in Yoga = 15

Average = (25 + 15) / 2 = 40 / 2 = 20

Therefore The correct answer is option (2).

Q33. Answer: (a) smaller than 1 nm in diameter

The correct answer is smaller than 1 nm in diameter.

Key Points

• The particles in a true solution are molecular in size, typically less than 1 nanometer (nm) in diameter.
• Such small particles are not visible to the naked eye and do not scatter light, making the solution appear clear and homogeneous.
• Due to their small size, these particles do not settle down when left undisturbed.
• True solutions are stable and the solute cannot be separated from the solvent by filtration.
• Examples of true solutions include salt dissolved in water or sugar dissolved in water.

Additional Information

• Colloids
• Colloidal particles range from 1 nm to 1000 nm in diameter.
• They scatter light (Tyndall effect) and appear cloudy or opaque.
• Examples include milk, smoke, and fog.
• Suspensions
• Suspension particles are larger than 1000 nm in diameter.
• They are visible to the naked eye and tend to settle out over time.
• Examples include sand in water or flour in water.
• Emulsions
• Emulsions are mixtures of two immiscible liquids where one liquid is dispersed in the other.
• Common examples include oil in water or water in oil emulsions like mayonnaise.
• Emulsifying agents are often needed to stabilize emulsions.

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Q34. Answer: (b) 1/f = (1/u) + (1/v)

The correct answer is 1/f = (1/u) + (1/v).

Key Points

• The formula 1/f = (1/u) + (1/v) is known as the mirror equation or the mirror formula.

• This equation applies to both concave and convex mirrors, with the appropriate sign conventions.

• In the equation, f represents the focal length of the mirror, u is the object distance from the mirror, and v is the image distance from the mirror.

• The mirror equation is derived from the geometry of the mirror and the laws of reflection.

• This relationship helps in determining the position and nature (real or virtual) of the image formed by spherical mirrors.

Additional Information

• Sign Conventions for Spherical Mirrors

• Distances are measured from the pole of the mirror.

• Distances measured in the direction of the incident light are positive, and those measured against the direction of the incident light are negative.

• Heights measured upward and perpendicular to the principal axis are positive, while those measured downward are negative.

• Concave Mirrors

• These mirrors can produce real and inverted images or virtual and erect images depending on the position of the object.

• They are used in applications like shaving mirrors, reflecting telescopes, and headlights of vehicles.

• Convex Mirrors

• Convex mirrors always produce virtual, erect, and diminished images.

• They are commonly used as rearview mirrors in vehicles because they provide a wider field of view.

Q35. Answer: (a) 54

Shortcut Trick

Let Amrita's sister's age be x years.

Amrita = 2x, Amita = 2x + 2, Father = 2(2x + 2) = 4x + 4.

Given: Father − Sister = 43 => (4x + 4) − x = 43 => 3x = 39 => x = 13.

Sum of Amita and Amrita = (2x + 2) + 2x = 4x + 2 = 4(13) + 2 = 54 years.

Therefore The correct answer is 54 years.

Alternate Method

Given:

Amita = Amrita + 2

Father = 2 × Amita

Amrita = 2 × Sister

Father − Sister = 43 years

Calculations:

Let Amrita's age be M years.

=> Amita's age (A) = M + 2

=> Father's age (F) = 2(M + 2) = 2M + 4

=> Sister's age (S) = M ÷ 2

=> F − S = 43

=> (2M + 4) − (M ÷ 2) = 43

=> 2M − 0.5M = 43 − 4

=> 1.5M = 39

=> M = 39 ÷ 1.5 = 26 years

=> Amita's age (A) = 26 + 2 = 28 years

=> Sum = A + M = 28 + 26 = 54 years

Therefore The correct answer is 54 years.

Additional Information

Constant Age Difference

The difference between the ages of two persons always remains constant regardless of the number of years passed or preceding.

Linear Equation Formulation

In age problems, it is always efficient to assume the age of the youngest person or the reference person as 'x' to simplify calculations.

Ratio in Ages

If the ratio of ages is given for different time periods, use the concept of ratio balancing by making the age difference units equal across the time gaps.

Q36. Answer: (d) $3b^2+c^2+3ab-5bc-ac$

Shortcut Trick

Apply the substitution method by assuming values for the variables: Let a = 1, b = 1, and c = 1.

Expression: $(1 + 2 - 1)(1 - 1) + (1 - 1) \times 2 \times 1 + 1^2 = 2 \times 0 + 0 + 1 = 1$.

Check the options for value 1: $3(1)^2 + 1^2 + 3(1)(1) - 5(1)(1) - (1)(1) = 3 + 1 + 3 - 5 - 1 = 1$.

Therefore The correct answer is $3b^2+c^2+3ab-5bc-ac$.

Alternate Method

Given: $(a + 2b - c)(b - c) + (a - c)2b + b^2$

Formula Used: Distributive Property of multiplication over addition/subtraction: $x(y + z) = xy + xz$.

=> Expand the first term $(a + 2b - c)(b - c)$:

=> $a(b - c) + 2b(b - c) - c(b - c) = ab - ac + 2b^2 - 2bc - bc + c^2$

=> $2b^2 + c^2 + ab - 3bc - ac$

=> Expand the second term $(a - c)2b$:

=> $2ab - 2bc$

=> Now, combine all parts of the expression:

=> $(2b^2 + c^2 + ab - 3bc - ac) + (2ab - 2bc) + b^2$

=> Group the like terms together: $(2b^2 + b^2) + c^2 + (ab + 2ab) + (-3bc - 2bc) - ac$

=> $3b^2 + c^2 + 3ab - 5bc - ac$

Therefore The correct answer is $3b^2+c^2+3ab-5bc-ac$.

Additional Information

Algebraic Expansion

Multiplying two polynomials involves multiplying each term of the first polynomial by every term of the second and then simplifying the result.

Like Terms

Terms that have the same variables raised to the same powers are called like terms; they can be added or subtracted from each other.

BODMAS Rule

Always perform operations inside brackets first, followed by multiplication, and finally addition/subtraction to avoid errors during simplification.

Q37. Answer: (b) BHF

The logic followed here is:

1) GMJ

2) BHF

3) KQN

4) RXU

Hence, the correct answer is "BHF".

Q38. Answer: (b) 457

The logic followed here is:

Hence, the correct answer is "457".

Q39. Answer: (a) Father's brother

Family Chart:

Decoding the Symbols:

Symbol	•	•	×	÷
Meaning	Mother	Brother	Father	Sister

Given: P + Q – R × S ÷ T

It means: P is the mother of Q, Q is the brother of R, R is the father of S and S is the sister of T.

So, Q is the Father's brother of T.

Hence, the correct answer is "Father's brother".

Q40. Answer: (b) central nervous system

The correct answer is central nervous system.

Key Points

• The central nervous system (CNS) is comprised of the brain and spinal cord.
• The CNS is responsible for processing and transmitting information throughout the body.
• The brain controls most of the functions of the body including thought, memory, emotion, and sensory processing.
• The spinal cord acts as a conduit for signals between the brain and the rest of the body.
• The CNS is protected by the skull and vertebral column, as well as by cerebrospinal fluid.

Additional Information

• Endocrine System
• This system is responsible for hormone production and regulation.
• It includes glands such as the pituitary, thyroid, and adrenal glands.
• Peripheral Nervous System (PNS)
• This system consists of all the nerves that lie outside the central nervous system.
• It connects the CNS to the limbs and organs, essentially serving as a communication relay.
• Autonomic Nervous System (ANS)
• This is a part of the peripheral nervous system that controls involuntary bodily functions.
• The ANS regulates functions such as heart rate, digestion, respiratory rate, and pupillary response.

Q41. Answer: (c) 15.5

Shortcut Trick

The average of the first n natural numbers is always given by the formula: (n + 1) ÷ 2.

Here, the number of terms n = 30.

Average = (30 + 1) ÷ 2

Average = 31 ÷ 2 = 15.5.

Therefore The correct answer is 15.5.

Alternate Method

Given: First 30 natural numbers: 1, 2, 3, ..., 30.

Formula Used: Sum of first n natural numbers = [n × (n + 1)] ÷ 2 and Average = Sum ÷ n.

=> Total numbers (n) = 30

=> Sum = [30 × (30 + 1)] ÷ 2

=> Sum = 15 × 31 = 465

=> Average = 465 ÷ 30

=> Average = 15.5

Therefore The correct answer is 15.5.

Additional Information

Sum of First n Natural Numbers

The total sum is calculated as S = [n(n + 1)] ÷ 2.

Average of Consecutive Numbers

For any Arithmetic Progression, Average = (First term + Last term) ÷ 2.

Sum of Squares and Cubes

Sum of squares = [n(n + 1)(2n + 1)] ÷ 6 | Sum of cubes = [[n(n + 1)] ÷ 2]².

Average of First n Even/Odd Numbers

Average of first n even numbers = n + 1 | Average of first n odd numbers = n.

Q42. Answer: (c) Defence Research and Development Organisation (DRDO)

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

Key Points

• The Defence Research and Development Organisation (DRDO) is responsible for developing the Long-Range Glide Bomb (LRGB), GAURAV.

• The DRDO successfully tested the Gaurav LRGB for the first time on August 13, 2024.

• The Gaurav is a 1,000 kg glide bomb that can be launched from the air and hit targets from a long distance.

• The Gaurav uses a combination of GPS and INS data to steer towards its target.

• The Gaurav was developed by the Research Centre Imarat (RCI) in Hyderabad.

• The Gaurav was tested from a Su-30 MK-I fighter jet of the Indian Air Force (IAF) off the coast of Odisha.

• The Gaurav is part of a family of precision guided munitions with a range of 50–150 km.

• The Gaurav was developed as an alternative to the Spice 2000.

Additional InformationDefence Research and Development Organisation (DRDO):

• DRDO was formed in 1958 from the amalgamation of the then already functioning Technical Development Establishment (TDEs) of the Indian Army and the Directorate of Technical Development & Production (DTDP) with the Defence Science Organisation (DSO).

• DRDO is the R&D wing of Ministry of Defence, Govt of India, with a vision to empower India with cutting-edge defence technologies.

• The vision is empowering the nation with state-of-the-art indigenous Defence technologies and systems.

• DRDO is a network of more than 50 laboratories which are deeply engaged in developing defence technologies covering various disciplines, like aeronautics, armaments, electronics, combat vehicles, engineering systems, instrumentation, missiles, advanced computing and simulation, special materials, naval systems, life sciences, training, information systems and agriculture.

• DRDO's pursuit of self-reliance and successful indigenous development and production of strategic systems and platforms such as Agni and Prithvi series of missiles; light combat aircraft, Tejas; multi-barrel rocket launcher, Pinaka; air defence system, Akash; a wide range of radars and electronic warfare systems; etc., have given quantum jump to India's military might, generating effective deterrence and providing crucial leverage.

Q43. Answer: (a) 15%

Shortcut Trick

Selling at a 20% loss means the Selling Price is 80% of the Cost Price.

Applying the Unitary Method: Rs. 1,024 → 80%

Therefore, Rs. 1,472 → (80 ÷ 1024) × 1472 = 115%

Since the new percentage is 115%, the gain is 115% − 100% = 15%.

Therefore The correct answer is 15%.

Alternate Method

Given:

Initial Selling Price (SP1) = Rs. 1,024

Initial Loss Percentage = 20%

New Selling Price (SP2) = Rs. 1,472

Formula Used:

Cost Price (CP) = [SP × 100] / [100 − Loss%]

Gain Percentage = [(SP − CP) / CP] × 100

Calculations:

=> CP = (1024 × 100) / (100 − 20)

=> CP = (1024 × 100) / 80

=> CP = 12.8 × 100 = Rs. 1,280

=> New Profit = SP2 − CP = 1472 − 1280 = Rs. 192

=> Gain Percentage = (192 / 1280) × 100

=> Gain Percentage = 15%

Therefore The correct answer is 15%.

Additional Information

Profit and Loss Base

Profit or Loss percentage is always calculated on the Cost Price (CP) unless specifically mentioned otherwise in the question.

Selling Price Formula

The direct relationship is SP = CP × (100 ± Percentage Change) / 100, where ± represents Profit (+) or Loss (−).

Marked Price and Discount

Discount is always calculated on the Marked Price (MP). SP = MP − Discount.

Q44. Answer: (c) Driven: The Virat Kohli Story (Revised and Updated World Cup Edition)

The correct answer is Driven: The Virat Kohli Story (Revised and Updated World Cup Edition)

Key Points

• The book authored by Vijay Lokapally in 2023 on Virat Kohli is titled:

• "Driven: The Virat Kohli Story (Revised and Updated World Cup Edition)."

• This revised edition of the book highlights Virat Kohli's remarkable journey in cricket and includes:

• It Focuses on Kohli's performances in the World Cup and other recent milestones.

• It Features updated visuals of key moments in Kohli's career.

• It Provides insights into his achievements in the cricketing world.

• The book originally explores Kohli's life, his growth as a cricketer, and the passion and determination that made him one of India's greatest sports icons.

Additional Information

• Virat Kohli is an Indian cricketer and the former captain of the Indian national team.

• A right-handed top-order batsman, Kohli is regarded as one of the best contemporary batsmen in the world.

• He plays for Royal Challengers Bangalore in the Indian Premier League (IPL) and has been the team's captain since 2013.

• Kohli was appointed the vice-captain of the ODI team in 2012 and handed over the Test captaincy following Mahendra Singh Dhoni's Test retirement in 2014.

• In early 2017, he became the limited-overs captain as well after Dhoni stepped down from the position. In ODIs, Kohli has the second-highest number of centuries and the highest number of centuries in run-chases in the world.

• He holds the world record for being the fastest batsman to 8,000, 9,000, 10,000, and 11,000 runs in ODI cricket, reaching the milestones in 175, 194, 205, and 222 innings respectively.

Q45. Answer: (b) 200√3 m

Shortcut Trick

Growth in height = Distance × (tan θ2 − tan θ1)

Here, Distance = 300 m, θ1 = 30°, and θ2 = 60°

Growth = 300 × (tan 60° − tan 30°) = 300 × (√3 − 1/√3)

Growth = 300 × (2/√3) = 600/√3 = 200√3 m

Therefore The correct answer is 200√3 m.

Alternate Method

Given:

Distance from foot (AB) = 300 m

Initial angle of elevation (θ1) = 30°

Final angle of elevation (θ2) = 60°

Formula used:

tan θ = Height / Base

In triangle ABP_(initial):

=> tan 30° = h1 / 300

=> 1 / √3 = h1 / 300

=> h1 = 300 / √3 = 100√3 m

In triangle ABP_(final):

=> tan 60° = h2 / 300

=> √3 = h2 / 300

=> h2 = 300√3 m

Growth of the tree = h2 − h1

=> Growth = 300√3 − 100√3

=> Growth = 200√3 m

Therefore The correct answer is 200√3 m.

Additional Information

Angle of Elevation

It is the angle between the horizontal line of sight and the line joining the observer's eye to the object above the horizontal level.

Trigonometric Ratios

For a constant distance, height is directly proportional to the tangent of the angle: h = d × tan θ.

Standard Tangent Values

tan 30° = 1/√3 ≈ 0.577, tan 45° = 1, and tan 60° = √3 ≈ 1.732.

Height Difference Property

If the base is d and the angle changes from θ1 to θ2, the vertical change is Δh = d(tan θ2 − tan θ1).

Q46. Answer: (b) 120°

Shortcut Trick

Sum of ratio parts = 2 + 5 + 7 + 10 = 24 units.

Total internal angles of a quadrilateral = 360°.

=> 24 units = 360° => 1 unit = 15°.

Difference between greatest (10) and smallest (2) parts = 10 − 2 = 8 units.

=> Difference = 8 × 15° = 120°.

Therefore The correct answer is 120°.

Alternate Method

Given: Ratio of angles = 2 : 5 : 7 : 10.

Formula Used: Sum of all interior angles of a quadrilateral is always 360°.

=> Let the four angles be 2x, 5x, 7x, and 10x respectively.

=> 2x + 5x + 7x + 10x = 360°

=> 24x = 360°

=> x = 360° ÷ 24

=> x = 15°

=> Smallest angle = 2x = 2 × 15° = 30°

=> Greatest angle = 10x = 10 × 15° = 150°

=> Difference = 150° − 30° = 120°

Therefore The correct answer is 120°.

Additional Information

Angle Sum Property of Polygons

The sum of internal angles of any polygon with n sides is given by (n − 2) × 180°.

Cyclic Quadrilateral

In a cyclic quadrilateral, the sum of opposite angles is always 180°.

Exterior Angle Sum

The sum of all exterior angles of any convex quadrilateral (or any polygon) is always 360°.

Q47. Answer: (c) Deen Dayal SPARSH Yojana

The correct answer is Deen Dayal SPARSH Yojana

Key Points

• The 2024 philately scholarship scheme was launched by the Department of Posts under the Deen Dayal SPARSH Yojana.

• Deen Dayal SPARSH Yojana:

• This scholarship scheme is for students in classes 6–9 who have good academic records and pursue philately as a hobby.

• The scheme aims to generate interest in philately among students.

• The scholarship amount is Rs. 6,000 per year for each student.

• SC/ST students receive a 5% relaxation.

Additional Information

• Sarva Shiksha Abhiyan

• Sarva Shiksha Abhiyan (SSA) is an Indian government program that provides free and compulsory education to children ages 6 to 14.

• It is also known as the Universalisation of Elementary Education (UEE).

• SSA covers the entire country and reaches 200 million children in 1.1 million habitations

• SSA was launched in 2001-2002 in partnership with state and local governments

• Pradhan Mantri Kaushal Vikas Yojana

YourMockTest.com — Free Study Material

• The Pradhan Mantri Kaushal Vikas Yojana (PMKVY) is a skill development scheme by the Government of India that helps Indian youth gain industry-relevant skills

• The goal is to help Indian youth secure better livelihoods by providing industry-relevant skill training

• The government pays for training and assessment fees, lodging, and boarding

• The scheme offers short-term training at PMKVY Training Centres (TCs)

• Digital India Programme

• Digital India is a campaign launched by the Government of India to make its services available to citizens electronically via improved online infrastructure and by increasing Internet connectivity.

• The initiative includes plans to connect rural areas with high-speed internet networks.

• It consists of three core components: the development of secure and stable digital infrastructure, delivering government services digitally, and universal digital literacy.

Q48. Answer: (c) Three

Given: Seven boxes A, B, C, D, E, F and G are kept one over the other but not necessarily in the same order.

1) G is kept third from the bottom.

2) Only two boxes are kept between B and E.

3) B is not kept at the top-most position.

4) Only two boxes are kept between C and E.

S.No.	Boxes
7	C
6	
5	
4	E
3	G
2	
1	B

5) A is kept immediately above D.

6) D is kept at one of the positions above G.

S.No.	Boxes
7	C
6	A
5	D
4	E
3	G
2	
1	B

Thus, final arrangement:

S.No.	Boxes
7	C
6	A
5	D
4	E
3	G
2	F

1	B

So, Three boxes are kept between D and B.

Hence, the correct answer is "Three".

Q49. Answer: (c) Purkinje

The correct answer is Purkinje.

Key Points

• The term ‘protoplasm’ was coined by the Czech physiologist Jan Evangelista Purkinje.

• Purkinje introduced the term in 1839 while studying the embryonic development of chickens.

• Protoplasm refers to the living content of a cell that is surrounded by a plasma membrane.

• It is composed mainly of water, proteins, lipids, carbohydrates, and inorganic salts.

• The concept of protoplasm has evolved, and it is now generally referred to as the cytoplasm and nucleoplasm within eukaryotic cells.

Additional Information

• Virchow

• Rudolf Virchow was a German pathologist known for his advancement of the cell theory.

• He introduced the concept that all cells arise from pre-existing cells, encapsulated in the Latin phrase "Omnis cellula e cellula".

• Robert Brown

• Robert Brown was a Scottish botanist who discovered the cell nucleus in 1831.

• His contributions to botany include the detailed study of plant pollination mechanisms and the random movement of particles in fluid, known as Brownian motion.

• Robert Hooke

• Robert Hooke was an English scientist who is credited with the discovery of the cell.

• In 1665, he published "Micrographia", where he detailed his observations of cork cells using a microscope.

Q50. Answer: (d) ez

According to the given information:

Thus the code for 'lost' = ez

Hence, the correct answer is "ez".

Q51. Answer: (b) 8%

Shortcut Trick

Use the Successive Percentage Change formula: Net Change = x + y + (xy ÷ 100)

Here, x = −10% (tax reduction) and y = +20% (consumption increase).

Net change in Tax Revenue = −10 + 20 + [(−10 × 20) ÷ 100]

=> Net change = 10 − 2 = 8%

Since the result is positive, it indicates an increase.

Therefore The correct answer is 8%.

Alternate Method

Given: Reduction in tax = 10% | Increase in consumption = 20%

Formula Used: Total Revenue = Tax Rate × Consumption

=> Let the initial tax rate be Rs. 100 and initial consumption be 100 units.

=> Initial Revenue = 100 × 100 = Rs. 10,000

=> New Tax Rate = 100 − 10% of 100 = Rs. 90

=> New Consumption = 100 + 20% of 100 = 120 units

=> New Revenue = 90 × 120 = Rs. 10,800

=> Increase in Revenue = 10,800 − 10,000 = Rs. 800

=> Percentage Increase = (800 ÷ 10,000) × 100 = 8%

Therefore The correct answer is 8%.

Additional Information

Revenue-Consumption Relation

Revenue is the product of price (or tax) and quantity (consumption). If the price changes by a% and quantity by b%, the net

change is a + b + (ab/100)%.

Successive Percentage for Geometry

This formula also applies to areas of rectangles where length and breadth change. Area = Length × Breadth.

Constant Revenue Case

If revenue is kept constant, the relationship between tax and consumption is inversely proportional: New Consumption = Original × [100 ÷ (100 − Tax Reduction %)].

Q52. Answer: (a) I

The logic followed here is:

Given word: HYPNOTIC,

Each letter of the word is changed to the letter immediately succeeding it in the English alphabetical order.

Thus letter I is second to the left in the new rearranged group of letters.

Hence, the correct answer is "I".

Q53. Answer: (b) Due to small size carbon forms strong bonds.

The correct answer is Due to small size carbon forms strong bonds.

Key Points

• Carbon's small size allows it to form strong covalent bonds with other atoms.

• The bond energy of carbon-carbon bonds is relatively high, leading to stable compounds.

• Carbon can form up to four covalent bonds, allowing for a variety of stable structures.

• Carbon's ability to form double and triple bonds adds to the versatility and stability of its compounds.

• Carbon's tetrahedral bonding geometry contributes to the stability of organic molecules.

Additional Information

• Electronegativity of Carbon

• Carbon has a moderate electronegativity, which allows it to form stable bonds with both electronegative and electropositive elements.

• Allotropes of Carbon

• Carbon exists in various forms such as graphite, diamond, and fullerenes, each with unique properties.

• Organic Chemistry

• Organic chemistry is the study of carbon-containing compounds and their properties, structures, and reactions.

Q54. Answer: (d) 24 and 44

Given equation: 46 + 24 - (12 + 19) × 2 + 38 × 6 + 44 ÷ 4 = 262

Option 1) 6 and 2

Two numbers need to be interchanged then:

=> 46 + 24 - (12 + 19) × 6 + 38 × 2 + 44 ÷ 4 = 262

=> 46 + 24 - 31 × 6 + 38 × 2 + 11 = 262

=> 46 + 24 - 186 + 76 + 11 = 262

=> 157 - 186 = 262

=> -29 ≠ 262

Option 2) 2 and 4

Two numbers need to be interchanged then:

=> 46 + 24 - (12 + 19) × 4 + 38 × 6 + 44 ÷ 2 = 262

=> 46 + 24 - 31 × 4 + 38 × 6 + 22 = 262

=> 46 + 24 - 124 + 228 + 22 = 262

=> 320 - 124 = 262

=> 196 ≠ 262

Option 3) 24 and 38

Two numbers need to be interchanged then:

=> 46 + 38 - (12 + 19) × 2 + 24 × 6 + 44 ÷ 4 = 262

=> 46 + 38 - 31 × 2 + 24 × 6 + 11 = 262

=> 46 + 38 - 62 + 144 + 11 = 262

=> 239 - 62 = 262

=> 177 ≠ 262

Option 4) 24 and 44

Two numbers need to be interchanged then:

=> 46 + 44 - (12 + 19) × 2 + 38 × 6 + 24 ÷ 4 = 262

=> 46 + 44 - 31 × 2 + 38 × 6 + 6 = 262

=> 46 + 44 - 62 + 228 + 6 = 262

=> 324 - 62 = 262

=> 262 = 262

Hence, the correct answer is "24 and 44".

Q55. Answer: (b) EGHJ

The logic followed here is:

Hence, the correct answer is "EGHJ".

Q56. Answer: (a) Hydra - multiple fission

The correct answer is option 1.

Note: Both hydra and yeast reproduce asexually by budding. Thus, both option 1 and 2 are factually incorrect. But, we have marked the correct answer as Option 1 according to the official answer key.

Source: https://ncert.nic.in/textbook/pdf/gesc108.pdf

Key Points

• Hydra reproduces asexually through a process called budding, not multiple fission.

• Yeast primarily reproduces asexually through budding rather than spore formation.

• Plasmodium is known for reproducing through multiple fission within its host cells.

• Leishmania reproduces asexually through a process called binary fission.

• Each organism has specific methods of asexual reproduction, which are key to their biological processes.

Additional Information

• Budding

• This is a form of asexual reproduction where a new organism develops from an outgrowth or bud on the parent organism.

• Hydra and yeast commonly use this method for reproduction.

• Binary Fission

• This is a method of asexual reproduction where a single organism divides into two parts, each of which becomes a new organism.

• Binary fission is common in prokaryotic organisms such as bacteria and protozoa like Leishmania.

• Multiple Fission

• In this type of asexual reproduction, the parent cell divides into multiple daughter cells simultaneously.

• Plasmodium, the malaria-causing parasite, reproduces using multiple fission within the red blood cells of its host.

Q57. Answer: (d) 5.84

Shortcut Trick

Given that $584^2 = 341056$, it follows that $\sqrt{341056} = 584$.

The number 34.1056 has 4 decimal places.

When taking a square root, the number of decimal places is halved (4 ÷ 2 = 2).

Therefore, we shift the decimal in 584 two places to the left to get 5.84.

Therefore The correct answer is 5.84.

Alternate Method

Given:

Square of 584 = 3,41,056

Value to find = √34.1056

Formula Used:

$\sqrt{(x \div y)} = \sqrt{x} \div \sqrt{y}$

Calculations:

=> $\sqrt{34.1056} = \sqrt{(341056 \div 10000)}$

=> $\sqrt{341056} \div \sqrt{10000}$

=> 584 ÷ 100

=> 5.84

Therefore The correct answer is 5.84.

Additional Information

Decimal Rule in Square Roots

If a perfect square has 2n digits after the decimal point, its square root will have exactly n digits after the decimal point.

Square Root of Powers of 10

The square root of 10^{2n} is always 10^n. For example, √10000 = √10^4 = 10^2 = 100.

Verification of Units Digit

A number ending in 6 in its square form must have a square root ending in either 4 or 6 (since 4^2=16 and 6^2=36).

Q58. Answer: (b) (2, 32, 4)

The logic followed here is: 1st number × (3rd number)² = 3nd number

(11, 44, 2) → 11 × 2^2 = 44

(6, 54, 3) → 6 × 3^2 = 54

Lets check the options:

1) (12, 72, 3) → 12 × 3^2 = 108 ≠ 72

2) (2, 32, 4) → 2 × 4^2 = 32

3) (7, 98, 2) → 7 × 22 = 28 ≠ 98

4) (10, 50, 5) → 10 × 52 = 250 ≠ 50

Hence, the correct answer is "(2, 32, 4)".

Q59. Answer: (d) Statements II and III

The correct answer is option 4.

Key Points

• Mass and weight are different physical quantities; mass is a measure of the amount of matter in an object, while weight is the force exerted by gravity on that object.

• Mass is a scalar quantity, which means it has magnitude but no direction.

• Weight is a vector quantity, as it has both magnitude and direction (towards the center of the Earth).

• Statement I is incorrect because mass and weight are not the same.

• Statement II is correct as it states the differentiation between mass and weight.

• Statement III is correct, further differentiating mass and weight in terms of scalar and vector quantities.

Additional Information

• Mass

• It is measured in kilograms (kg) in the International System of Units (SI).

• Mass remains constant regardless of location.

• Weight

• It is measured in newtons (N) in the SI system.

• Weight varies depending on the gravitational pull of the location (e.g., Earth, Moon).

• Gravitational Force

• It is the force of attraction between two masses.

• Gravitational force is responsible for giving objects weight.

Q60. Answer: (c) 5544

Shortcut Trick

Curved Surface Area (CSA) = 2 × π × r × h = 792 => π × r × h = 396

Volume of a cylinder is π × r^2 × h = (π × r × h) × r = 396 × r

Since 2 × (22/7) × r × (r − 5) = 792 => r × (r − 5) = 126

By simple observation, 14 × (14 − 5) = 126, so the radius r = 14 cm

Volume = 396 × 14 = 5544 cm^3

Therefore The correct answer is 5544 cm^3.

Alternate Method

Given:

Radius of cylinder (r) = height (h) + 5

Curved Surface Area (CSA) = 792 cm^2

Formula Used:

Curved Surface Area (CSA) = $2 \times \pi \times r \times h$

Volume of cylinder = $\pi \times r^2 \times h$

Calculation:

=> $2 \times (22/7) \times (h + 5) \times h = 792$

=> $(44/7) \times (h^2 + 5h) = 792$

=> $h^2 + 5h = 792 \times 7 \div 44$

=> $h^2 + 5h = 18 \times 7$

=> $h^2 + 5h - 126 = 0$

=> $h^2 + 14h - 9h - 126 = 0$

=> $h(h + 14) - 9(h + 14) = 0$

=> $(h - 9)(h + 14) = 0$

=> h = 9 cm (since height cannot be negative)

=> Radius (r) = 9 + 5 = 14 cm

=> Volume = $(22/7) \times (14)^2 \times 9$

=> Volume = $(22/7) \times 196 \times 9 = 22 \times 28 \times 9$

=> Volume = $616 \times 9 = 5544$ cm^3

Therefore The correct answer is 5544 cm^3.

Additional Information

Properties of a Cylinder

A cylinder is a 3D solid with two parallel circular bases. Total Surface Area (TSA) = CSA + 2 × Base Area = $2 \times \pi \times r \times (r + h)$.

Volume of Related Shapes

The volume of a cone with the same base radius and height as a cylinder is exactly one-third of the cylinder's volume. Cone Volume = $(1/3) \times \pi \times r^2 \times h$.

Circumference and Area of Base

The base of a cylinder is a circle. Base Area = $\pi \times r^2$ and Base Perimeter (Circumference) = $2 \times \pi \times r$. The CSA can directly be calculated as Base Perimeter × height.

Q61. Answer: (c) 3Fe + 4H2O → Fe3O4 + 4H2

The correct answer is option 3.

Key Points

• The balanced chemical equation for the reaction Fe + H2O → Fe3O4 + H2 is 3Fe + 4H2O → Fe3O4 + 4H2.

• In this equation, 3 atoms of iron (Fe) react with 4 molecules of water (H2O) to produce 1 molecule of iron(II,III) oxide (Fe3O4) and 4 molecules of hydrogen gas (H2).

• The coefficients in the balanced equation ensure that the number of atoms for each element is the same on both sides of the equation.

• This reaction demonstrates the principle of conservation of mass, where the total mass of reactants equals the total mass of the products.

• Balancing chemical equations is essential in chemistry to accurately represent the quantities of substances involved in reactions.

Additional Information

• Stoichiometry

• Stoichiometry is the calculation of reactants and products in chemical reactions.

• It is based on the conservation of mass and the principle that the total number of atoms of each element must be the same on both sides of a chemical equation.

• Redox Reactions

• Redox reactions involve the transfer of electrons between species, leading to changes in oxidation states.

• In the given reaction, iron is oxidized, and water is reduced.

• Iron Oxides

• Iron oxides are compounds composed of iron and oxygen.

• Fe3O4, also known as magnetite, is a common iron oxide with both Fe^{2}^+ and Fe^{3}^+ ions.

Q62. Answer: (b) 5

According to the given information:

Thus the code for 'L' = 5

Hence, the correct answer is "5".

Q63. Answer: (a) 1

Shortcut Trick

Coprime numbers (or relatively prime numbers) are defined as numbers that share no common factors other than 1.

Since the only common factor is 1, the Highest Common Factor (HCF) must be 1.

Example: For the set {8, 9}, the factors of 8 are {1, 2, 4, 8} and the factors of 9 are {1, 3, 9}. The only common factor is 1.

Therefore The correct answer is 1.

Alternate Method

Given: A set of coprime numbers.

Definition: Two or more numbers are coprime if their greatest common divisor is exactly 1.

=> Let the set of numbers be {x, y}.

=> Factors of x = {1, f1, f2, ...}

=> Factors of y = {1, g1, g2, ...}

=> If x and y are coprime, then {1, f1, f2, ...} ∩ {1, g1, g2, ...} = {1}.

=> The Highest Common Factor (HCF) is the largest value in the intersection set.

=> HCF = 1.

Therefore The correct answer is 1.

Additional Information

LCM of Coprime Numbers

The Least Common Multiple (LCM) of a set of coprime numbers is always equal to their product (e.g., LCM of 5 and 7 is 35).

Consecutive Numbers

Any two consecutive natural numbers (like 14 and 15) are always coprime to each other.

HCF and LCM Relationship

For any two numbers a and b, HCF(a, b) × LCM(a, b) = a × b. For coprime numbers, this simplifies to 1 × LCM = a × b.

Prime Numbers

Two different prime numbers are always coprime, but coprime numbers themselves do not necessarily have to be prime (e.g., 8 and 9 are coprime but composite).

Q64. Answer: (b) 50

Shortcut Trick

Convert Total Volume to ml: 2.25 × 1000 = 2250 ml.

Divide the Total Capacity by the Glass Volume.

Number of glasses = 2250 ÷ 45 = 50.

Therefore The correct answer is 50.

Alternate Method

Given:

Total volume of the mango drink bottle = 2.25 litres

Volume of each small glass = 45 ml

Formula Used:

Number of glasses = Total Volume ÷ Volume of each glass

Calculations:

=> 1 litre = 1000 ml

=> Total volume in ml = 2.25 × 1000 ml

=> Total volume = 2250 ml

=> Number of glasses = 2250 ÷ 45

=> Number of glasses = 50

Therefore The correct answer is 50.

Additional Information

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Unit Conversion (Volume)

To convert Litres (L) to Millilitres (ml), multiply by 1000. Conversely, divide by 1000 to convert ml to L.

Division Principle

When dividing a total quantity into smaller equal parts, ensure both quantities are in the same unit before performing the calculation.

Decimal Multiplication

Multiplying a decimal by 1000 shifts the decimal point three places to the right (e.g., 2.25 → 22.5 → 225 → 2250).

Q65. Answer: (b) 8 hours 15 minutes

Shortcut Trick

Ravi's rate = 32 ÷ 6 = 16/3 pages/hr.

Kumar's rate = 40 ÷ 5 = 8 pages/hr.

Combined rate = 16/3 + 8 = 40/3 pages/hr.

Time for 110 pages = 110 ÷ (40/3) = 33/4 = 8.25 hours = 8 hr 15 min.

Therefore The correct answer is 8 hr 15 min.

Alternate Method

Given:

Ravi types 32 pages in 6 hours.

Kumar types 40 pages in 5 hours.

Total assignment size = 110 pages.

Formula Used:

Work = Rate × Time => Rate = Work ÷ Time

Calculations:

=> Typing speed of Ravi = 32/6 = 16/3 pages/hr

=> Typing speed of Kumar = 40/5 = 8 pages/hr

=> Combined speed = (16/3 + 8) pages/hr

=> Combined speed = (16 + 24) ÷ 3 = 40/3 pages/hr

=> Time taken to type 110 pages = 110 ÷ (40/3)

=> Time = (110 × 3) ÷ 40 = 330 ÷ 40 = 33/4 hours

=> Time = 8.25 hours

=> 8.25 hours = 8 hours + (0.25 × 60) minutes

=> Time = 8 hours 15 minutes

Therefore The correct answer is 8 hr 15 min.

Additional Information

Work-Rate Relationship

The total work done is calculated as the product of the efficiency (rate) and the time taken: Work = Rate × Time.

Combined Efficiency

When multiple entities work simultaneously, their individual rates are additive: R_(total) = R1 + R2 + ... + R_n.

Time Conversion

To convert a fractional hour into minutes, multiply the decimal portion by 60. For example, 0.25 hours = 0.25 × 60 = 15 minutes.

Q66. Answer: (d) Warts and AIDS

The correct answer is Warts and AIDS.

Note: The correct answer as per the official answer key is Option 3 but in actual the correct answer would be Option 4 as Syphilis is caused by the bacterium Treponema pallidum.

Source: https://www.who.int/news-room/fact-sheets/detail/syphilis

Key Points

• Warts are caused by the Human Papillomavirus (HPV), which is a viral infection.

• AIDS (Acquired Immunodeficiency Syndrome) is caused by the Human Immunodeficiency Virus (HIV).

• Both Warts and AIDS are sexually transmitted infections (STIs) caused by viruses.

• Gonorrhoea is caused by the bacterium Neisseria gonorrhoeae, not a virus.

• Syphilis is caused by the bacterium Treponema pallidum, not a virus.

Additional Information

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• Human Papillomavirus (HPV)
• HPV is one of the most common sexually transmitted infections.
• It can lead to genital warts and is also associated with several types of cancers, including cervical cancer.
• Human Immunodeficiency Virus (HIV)
• HIV attacks the immune system, specifically the CD4 cells (T cells), which are crucial for immune response.
• Without treatment, HIV can progress to AIDS, severely compromising the immune system.
• Preventive Measures
• Consistent use of condoms can reduce the risk of transmission of STIs, including those caused by viruses.
• Vaccines are available for some viral STIs, such as HPV.
• Regular screening and early detection are essential for managing and treating STIs effectively.

Q67. Answer: (c) TUV

The logic followed here is:
DEF is related to CDE
MNO is related to LMN.
Similarly, UVW will be related:
Hence, the correct answer is "TUV".

Q68. Answer: (c) 2036

The correct answer is 2036
Key Points
• During the 141st International Olympic Committee (IOC) Session held in Mumbai, India, in October 2023,
• Prime Minister Narendra Modi announced India’s formal interest in hosting the 2036 Summer Olympics.
• He expressed India's readiness to organize the event and highlighted the nation's growing infrastructure, economic strength, and enthusiasm for sports.
• Ahmedabad, Gujarat, is being considered as the centerpiece for the 2036 Olympics.
• The proposed events would primarily revolve around the Sardar Vallabhbhai Patel Sports Complex in Ahmedabad, which includes the iconic Narendra Modi Stadium—the world's largest cricket stadium.
Additional Information
• The first modern Olympics was held in Athens, Greece in the 1896 Summer Olympics.
• Baron Pierre de Coubertin started the modern Olympics.
• He is known as the father of the modern Olympics.
• The Olympic flag has a white background, with five interlaced rings in the centre: blue, yellow, black, green, and red.
• Each colour corresponds to a particular continent: blue for Europe, yellow for Asia, black for Africa, green for Australia and Oceania, and red for the Americas.
• The Olympic motto “Citius, Altius, Fortius” (“Faster, Higher, Stronger”) was coined by Father Henri Didon.
• Only three modern Olympic Games have been cancelled.
• The games were cancelled due to World War I (1916) and World War II (1940, 1944).
• The youngest Olympian is Greek gymnast Dimitrios Loundras, who competed in the 1896 Athens Olympics at the age of 10.

Q69. Answer: (d) 6000

Shortcut Trick
Use the fractional multiplier method: 10% death means 9/10 remains; 25% leaving means 3/4 remains.
Let the original inhabitants be x.
$x \times (9/10) \times (3/4) = 4050$
$x \times (27/40) = 4050 \Rightarrow x = 150 \times 40 = 6000$
Therefore The correct answer is 6000.
Alternate Method
Given:
Death rate from cholera = 10%
Inhabitants who left during panic = 25% of the remaining
Final population = 4050
Calculations:

=> Let the original population be P.

=> Population after cholera = P − (10% of P) = 0.90P

=> Population after panic = 0.90P − (25% of 0.90P)

=> Population after panic = 0.90P × (1 − 0.25) = 0.90P × 0.75

=> 4050 = P × 0.90 × 0.75

=> 4050 = P × 0.675

=> P = 4050 ÷ 0.675

=> P = 4050000 ÷ 675 = 6000

Therefore The correct answer is 6000.

Additional Information

Successive Percentage Decrease

If a value is decreased by a% and then by b%, the effective remaining value is Initial × (1 − a/100) × (1 − b/100).

Percentage to Fraction Conversion

10% = 1/10 (Remaining = 9/10) and 25% = 1/4 (Remaining = 3/4). Multiplying these fractions helps in solving population change problems faster.

Net Percentage Change Formula

For two successive changes x% and y%, the net change is [x + y + (xy/100)]%. For decreases, use negative values.

Q70. Answer: (b) Height of the image / Height of the object

The correct answer is Height of the image / Height of the object.

Key Points

• Magnification is a measure of how much larger or smaller the image is compared to the object.

• It is defined as the ratio of the height of the image to the height of the object.

• For spherical mirrors, magnification can also be related to the object distance (u) and image distance (v) by the formula: magnification (m) = -v/u.

• A positive magnification indicates that the image is upright, whereas a negative magnification indicates that the image is inverted.

• Understanding magnification helps in determining the nature and size of the image formed by mirrors and lenses.

Additional Information

• Spherical Mirrors

• These are mirrors with surfaces that form part of a sphere.

• They can be concave (converging) or convex (diverging).

• Concave mirrors can form real or virtual images, whereas convex mirrors always form virtual images.

• Image Formation

• The nature of the image (real or virtual, upright or inverted) depends on the position of the object relative to the mirror.

• Understanding the mirror equation and ray diagrams helps in predicting the nature and position of the image.

• Applications of Spherical Mirrors

• Concave mirrors are used in reflecting telescopes, makeup mirrors, and headlights.

• Convex mirrors are used in vehicle rearview mirrors and security mirrors.

Q71. Answer: (a) 85; 93

The correct answer is 85; 93

Key Points

• India's rank in the Corruption Perceptions Index (CPI) declined from 85th in 2022 to 93rd in 2023.

• The CPI, published annually by Transparency International, assesses perceived levels of public sector corruption across 180 countries and territories, with scores ranging from 0 (highly corrupt) to 100 (very clean).

• A lower score and rank indicate higher perceived corruption.

• This decline suggests a growing perception of corruption in India's public sector, highlighting the need for enhanced anti-corruption measures and governance reforms to improve transparency and accountability.

Additional Information

• Top Performers (2023): Denmark, Finland, and New Zealand retained their positions as the least corrupt nations, with scores exceeding 88.

• Bottom Performers (2023): Countries like Somalia, South Sudan, and Syria ranked the lowest, with scores below 15.

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• To improve its standing in the CPI, India must:
• Strengthen institutions like the Central Vigilance Commission (CVC).
• Promote public awareness and transparency in governance.
• Foster collaborations with international organizations to implement best practices for combating corruption.

Q72. Answer: (c) 960 cm²

Shortcut Trick
Use the direct algebraic identity: $(l + b + h)^2 = (l^2 + b^2 + h^2) + 2(lb + bh + hl)$
Here, $(l^2 + b^2 + h^2)$ = Diagonal² and $2(lb + bh + hl)$ = Total Surface Area (TSA).
Shortcut formula: TSA = (Sum of dimensions)² − (Diagonal)²
=> TSA = $38^2 - 22^2 = 1444 - 484 = 960$ cm².
Therefore The correct answer is 960 cm².
Alternate Method
Given:
Sum of length, breadth, and height $(l + b + h) = 38$ cm
Length of the diagonal (d) = 22 cm
Formula Used:
1. Diagonal of a cuboid = $\sqrt{(l^2 + b^2 + h^2)}$
2. Total Surface Area (TSA) = $2(lb + bh + hl)$
3. Algebraic identity: $(l + b + h)^2 = l^2 + b^2 + h^2 + 2(lb + bh + hl)$
Calculations:
=> Diagonal = $\sqrt{(l^2 + b^2 + h^2)} = 22$
=> Squaring both sides: $l^2 + b^2 + h^2 = 22^2 = 484$
=> We know $(l + b + h) = 38$
=> Squaring both sides: $(l + b + h)^2 = 38^2$
=> $l^2 + b^2 + h^2 + 2(lb + bh + hl) = 1444$
=> 484 + TSA = 1444
=> TSA = 1444 − 484
=> TSA = 960 cm²
Therefore The correct answer is 960 cm².
Additional Information
Volume of a Cuboid
The space occupied by a cuboid is given by the product of its three dimensions: Volume = $l \times b \times h$.
Lateral Surface Area (LSA)
The area of the four side walls of the cuboid (excluding top and bottom) is LSA = $2h(l + b)$.
Special Case: Cube
When $l = b = h = a$, the cuboid becomes a cube. Diagonal = $a\sqrt{3}$, TSA = $6a^2$, and Volume = a^3.

Q73. Answer: (b) It increases with increase of temperature

The correct answer is It increases with increase of temperature.
Key Points
• The rate of diffusion is directly proportional to temperature.
• As temperature increases, the kinetic energy of particles also increases.
• Higher kinetic energy results in particles moving faster.
• Faster movement of particles leads to an increased rate of diffusion.
• This principle is observed in both gases and liquids.
Additional Information
• Effect on Solids
• In solids, diffusion happens very slowly due to fixed particle positions.
• However, an increase in temperature still results in a slight increase in diffusion rate.
• Graham's Law
• This law states that the rate of diffusion of a gas is inversely proportional to the square root of its molar mass.

• It explains why lighter gases diffuse faster than heavier gases.
• Real-life Examples
• Perfume spreading in a room faster in a warmer environment.
• Sugar dissolving faster in hot water compared to cold water.

Q74. Answer: (d) 30

Shortcut Trick
When x is the mean proportional between two numbers a and b, the logic is $x^2 = a \times b$.
Given a = 25 and b = 36.
=> $x = \sqrt{(25 \times 36)}$
=> $x = 5 \times 6 = 30$.
Therefore The correct answer is 30.
Alternate Method
Given: 25 : x :: x : 36 and x > 0.
Formula Used: In a proportion a : b :: c : d, the Product of Extremes = Product of Means (ad = bc).
=> $25 \div x = x \div 36$
=> $x \times x = 25 \times 36$
=> $x^2 = 900$
=> $x = \sqrt{900}$
=> x = 30
Therefore The correct answer is 30.
Additional Information
Mean Proportional
If three quantities a, b, and c are in continued proportion such that a:b = b:c, then b is called the mean proportional and $b^2 = ac$.
Third Proportional
In the continued proportion a:b = b:c, the term 'c' is called the third proportional to a and b, calculated as $c = b^2 \div a$.
Fourth Proportional
If four quantities a, b, c, and d are in proportion (a:b = c:d), then d is the fourth proportional, where $d = (b \times c) \div a$.

Q75. Answer: (d) A solution with blue-green colour is formed due to the formation of copper (II) chloride.

The correct answer is A solution with blue-green colour is formed due to the formation of copper (II) chloride..
Key Points
• When dilute hydrochloric acid (HCl) is added to copper oxide (CuO), a chemical reaction takes place.
• The reaction forms copper (II) chloride ($CuCl_2$) and water (H_2O).
• Copper (II) chloride is a blue-green colored compound.
• The balanced chemical equation for the reaction is: $CuO + 2HCl \rightarrow CuCl_2 + H_2O$.
• The blue-green color of the solution is due to the presence of copper (II) ions in the aqueous solution.
Additional Information
• Copper (II) Chloride
• Copper (II) chloride is often used in textile dyeing and printing.
• It can also act as a catalyst in organic reactions.
• Hydrochloric Acid (HCl)
• Hydrochloric acid is a strong acid commonly used in laboratories and industry.
• It is also found in the stomach, where it aids in digestion.
• Copper Oxide (CuO)
• Copper oxide is a black solid that is used in pigments and ceramics.
• It is also used in the production of copper compounds and as a catalyst in chemical reactions.

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