RRB ALP CBT-I 2024 Official Paper (Held On: 27 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. Which of the following statements is correct about the gravitational force between the earth and the moon?

(a) Gravitational force is repulsive when the moon is far from the earth.
(b) Gravitational force is repulsive and minimum when the moon is far from the earth.
(c) Gravitational force is attractive and maximum when the moon is close to the earth.
(d) Gravitational force is attractive and maximum when the moon is far from the earth.

Q2. In a certain code language,A + B means ‘A is the mother of B’,
A - B means ‘A is the brother of B’,
A × B means ‘A is the wife of B’,
A ÷ B means ‘A is the father of B’,
A # B means ‘A is the daughter of B’.
How is P related to F if ‘F - E # L × Q - P # N’

(a) Brother's daughter
(b) Mother's sister
(c) Brother's son
(d) Father's sister

Q3. Read the given statements and conclusions carefully. You have to take the given statements to be true even if they seem to be at variance from commonly known facts and decide which conclusion(s) logically follow(s) from the given statements.
Statements:
Some kings are servants.
Some servants are fighters.
Conclusions:
(I) Some fighters are kings.
(II) All servants are kings.

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

Q4. If a light ray is travelling from medium of refractive index 'n1' to the medium of refractive index 'n2' such that angle of incidence is 'i' and angle of refraction 'r' (assuming n1/n2 is equal to _____.

(a) (sin i)/(sin r)
(b) sin r - sin i
(c) (sin r)/(sin i)
(d) sin i - sin r

Q5. The equivalent resistance of the combination of resistors, when 1 ohm and 2 ohm are connected in parallel, is _____.

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

Q6. The square of 42 is:

(a) 1504
(b) 1564
(c) 1764
(d) 1664

Q7. Which of the following compounds is used in soda-acid fire extinguishers?

(a) Bleaching powder
(b) Calcium chloride
(c) Sodium bicarbonate
(d) Sodium carbonate

Q8. Average velocity of a body can be given by the arithmetic mean of initial velocity and final velocity for a given period of time when the body is:

(a) moving with uniform acceleration
(b) moving with non-uniform acceleration
(c) moving with uniform speed
(d) moving with uniform velocity

Q9. Seven people, A, B, C, D, E, F and G, are sitting in a row, facing north. E sits third from the left end. Only one person sits to the right of D. G sits second to the left of D. B sits to the immediate right of C. F does not sit to the right of A. How many people sit between F and E?

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

Q10. Select the option that shows all biodegradable substances.

(a) Eggshells, Tea leaves, Potato peelings
(b) Bubble packs, Vegetable peelings, Stale bread
(c) Glass bottle, Milk packets, Egg shells, Banana peel
(d) Medicine bottle, Old shoe, Stale biscuits

Q11. If x : y = 7: 3, then (x - y) : (x + y) = ?

(a) 5 : 2
(b) 5 : 1
(c) 2 : 5
(d) 1 : 5

Q12. In a row of 37 persons, Aneesha is 12^(th) from the left end. What is her position from the right end?

(a) 16
(b) 26
(c) 27
(d) 24

Q13. The Indian Air Force (IAF) contingent returned to India on 10 August 2024 after participating in Exercise _____ in Malaysia.

(a) Garuda
(b) Cope India

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(c) Udara Shakti
(d) Red Flag

Q14. Which off the following is the roadmap to achieve development and child protection priorities aligned with the Sustainable Development Goals (SDGs)?
(a) Mission Surksha
(b) Mission Vardan
(c) Mission Vatsalya
(d) Mission Arpan

Q15. Who among the following won the Gold medal at Paralympics in the Women's 10m air rifle standing SH1 Shooting category?
(a) Amulya Choudhary
(b) Manisha Agarwal
(c) Avani Lekhara
(d) Preeti Pal

Q16. After a decrease of 24%, the price of an article is Rs. 988. The actual cost of the article is:
(a) Rs. 1,400
(b) Rs. 1,100
(c) Rs. 1,300
(d) Rs. 1,200

Q17. The arithmetic mean of the observations 3, 6, 8, 10, 12, 14, 18, 24 and 31 is:
(a) 17
(b) 16
(c) 14
(d) 15

Q18. If $x + 1/x = 4$, then $x^2 + 1/(x^2) = ?$
(a) 12
(b) 18
(c) 14
(d) 16

Q19. The area of the base of a rectangular tank is 6500 cm^2 and the volume of water contained in it is 2.6 cubic meters. The depth of water in the tank is:
(a) 3.5m
(b) 4m
(c) 5m
(d) 6m

Q20. In June 2024, the Indian Army opened the Khalubar War Memorial to tourists, which is located in _____, India.
(a) New Delhi
(b) Ladakh
(c) Bengaluru
(d) Chandigarh

Q21. Which of the following is the longest cell in our body?
(a) Nerve cell
(b) Ovum
(c) Blood cell
(d) Fat cell

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Q22. Select the number from among the given options that can replace the question mark (?) in the following series.

45,95,245,695 ?

(a) 2045
(b) 1995
(c) 2125
(d) 2075

Q23. The smallest four-digit number that is exactly divisible by each of 24, 40 and 56 is:

(a) 1080
(b) 1680
(c) 1170
(d) 1260

Q24. 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 chairs are tables.

Some tables are beds.

Conclusions:

(I) All beds are chairs.

(II) Some tables are chairs.

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

Q25. If 6 men and 8 boys can do a piece of work in 10 days while 26 men and 48 boys can do the same in 2 days, the time taken by 15 men and 20 boys in doing the same type of work will be:

(a) 5 days
(b) 6 days
(c) 4 days
(d) 7 days

Q26. KGFL is related to OJHM in a certain way based on the English alphabetical order. In the same way, ASNP is related to EVPQ. To which of the following options is MBTS related, following the same logic?

(a) QEVT
(b) QEXS
(c) QFVT
(d) QEVW

Q27. If each vowel in the word GROUPS 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 and then arrange the so formed group of letters in English alphabetical order, then which of the following letters will be third from the left in the group of letter thus formed?

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

Q28. Which institute is responsible for the development of the 'Investor Information and Analytics Platform' in 2024?

(a) IIT Delhi
(b) IIT Kanpur
(c) IIT Madras

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(d) IIT Bombay

Q29. Which of the following options should come in place of the question mark (?) in the given series based on the English alphabetical order?

YZX, VWU, STR, PQO, MNL,?

(a) KJI
(b) CBA
(c) IJK
(d) JKI

Q30. If each vowel in the word RELATION is changed to the letter following it in the English alphabetical order and each consonant is changed to the letter preceding it in the English alphabetical order, and then arranged in reverse order of the English alphabetical order, then which of the following letters will be fourth from the right in the group of letters thus formed?

(a) Q
(b) P
(c) K
(d) M

Q31. The ability of a fully differentiated organism to give rise to new individuals from their body parts is known as:

(a) Fragmentation
(b) fission
(c) budding
(d) regeneration

Q32. Which union territory became the first to achieve full functional literacy under the ULLAS-Nav Bharat Saaksharta Karyakram?

(a) Chandigarh
(b) Ladakh
(c) Puducherry
(d) Lakshadweep

Q33. For certain data, the mode is 24.6 and mean is 20.1. What is the median of that data, using empirical formula?

(a) 22.2
(b) 23.5
(c) 24.1
(d) 21.6

Q34. A man sells an article at a profit of 25%. If he had bought it at 20% less and sold it for Rs. 10.50 less, he would have gained 30%. Find the cost price of the article.

(a) Rs. 25
(b) Rs. 125
(c) Rs. 50
(d) Rs. 100

Q35. In the following number-pairs, the second number is obtained by applying certain mathematical operations to the first number. Select the set in which the numbers are related in the same way as are the numbers of the following sets.

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

(6, 37)

(8, 65)

(a) (5, 24)
(b) (7, 49)
(c) (3, 27)

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(d) (9, 82)

Q36. Which of the following options should come in place of the question mark (?) in the given series based on the English alphabetical order?

GHM, IJO, KLQ, MNS, OPU, ?

(a) QSV
(b) QRW
(c) QSW
(d) QRV

Q37. In which of the following phenomena does a solid substance change into a liquid substance?

(a) Fusion
(b) Solidification
(c) Sublimation
(d) Deposition

Q38. Vineet starts from Point Y and drives 10 km towards the North. He then takes a right turn, drives 29 km, turns right and drives 34 km. He then takes a right turn and drives 13 km. He takes a final right turn, drives 24 km and stops at Point Z. How far (shortest distance) and towards which direction should he drive in order to reach Point Y again? (All turns are 90 degrees turns only unless specified)

(a) 24 km towards the south
(b) 19 km towards the east
(c) 16 km towards the west
(d) 14 km towards the north

Q39. A fraction becomes 1/2 if 2 is added to the numerator and 5 is added to the denominator. It also becomes 1/3 if 2 is subtracted from both the numerator and denominator. The positive difference between the denominator and the numerator of the fraction is:

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

Q40. Select the triad which follows the same pattern as that followed by the two triads given below. Both triads follow the same pattern.

LG - MH - OP

HC - ID - KL

(a) OJ - PK - RT
(b) KF - LG - NP
(c) JE - KF - MN
(d)

ID-JE-LN

Q41. L, P, R, V, X, Y, and Z are sitting around a circular table facing the centre. R sits to the immediate right of V. Only three people sit between R and Z when counted from the left of R. Only three people sit between V and P. X sits to the immediate right of Y. How many people sit between L and Y, when counted from the left of Y?

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

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Q42. What is the name of Bhim Singh's book launched on August 11, 2024?

(a) 75 Great Revolutionaries of India
(b) Unsung Warriors of India
(c) Legends of Indian Revolution
(d) Heroes of Indian Freedom

Q43. The cost of 12 pens and 7 pencils is Rs. 233. If the cost of a pen decreases by Rs. 1.50 and the cost of a pencil increases by Rs. 1, then the cost of 2 pens and 3 pencils is Rs. 48. What is the original cost of 2 pens and 3 pencils?

(a) Rs. 46
(b) Rs. 54
(c) Rs. 41
(d) Rs. 48

Q44. The expenditure of Swarna is 125% more than her savings. If her expenditure decreases by 6% and savings increases by 26.5%, then by what percentage does her income increase?

(a) 20.5%
(b) 18.5%
(c) 8%
(d) 4%

Q45. If 'I' stands for '+', 'J' stands for '×', 'K' stands for '÷', and 'L' stands for '-', what will come in place of question mark '?' in the following equation?

(24 J 3) K 6 I (14 J 2) L 19 =?

(a) 19
(b) 21
(c) 34
(d) 15

Q46. A dealer allows a 30% discount on the marked price of an item. What is the marked price of the item if its sale price is Rs. 12,460?

(a) Rs. 17,800
(b) Rs. 16,760
(c) Rs. 16,800
(d) Rs. 17,860

Q47. In this question, a statement is followed by two courses of action, numbered I and II. You must assume everything in the statement to be true and on the basis of the information given in the statement, decide which of the courses of action logically follow(s) for pursuing.

Statement:

The special task force set up by the government has found that toxic waste is being mixed with dry waste by many apartment complexes before collection by the municipality, causing severe danger to the waste processing personnel and the environment.

Courses of Action:

(I) Apartment complexes should be heavily penalised in instances where toxic and dry waste is not properly segregated before collection.

(II) Apartment complexes should issue clear guidelines on waste segregation to the apartment residents.

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

Q48. 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.

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Breaking down 13 into 1 and 3 and then performing mathematical operations on 1 and 3 is not allowed.)

(2, 24, 6)

(4, 32, 2)

(a) (3, 48, 4)
(b) (6, 108, 3)
(c) (9, 80, 1)
(d) (5, 70, 3)

Q49. As of 2024, how many members are there in the steering committee of the GlobE Network, in which India has been elected as a member, as announced by the Central Bureau of Investigation (CBI)?

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

Q50. Which two numbers should be interchanged to make the given equation correct?|

(27 + 15) × 2 - (95 ÷ 5) + 25 × 4 - 135 = 62

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

(a) 2 and 4
(b) 25 and 27
(c) 95 and 135
(d) 5 and 15

Q51. Ramesh and Suresh's mud buildings have heights of 8 cm and 15 cm respectively. They are 24 cm apart. How far are the tops of their mud buildings from each other?

(a) 24 cm
(b) 30 cm
(c) 25cm
(d) 31 cm

Q52. Cells of the meristematic tissue are very active, but they lack:

(a) dense cytoplasm
(b) vacuoles
(c) thin cellulose walls
(d) prominent nuclei

Q53. Which of the following products are formed when sodium sulphate reacts with barium chloride?

(a) White precipitate of $BaSO_4$ and 2NaCl (aq)
(b) Yellow precipitate of $BaSO_4$ and 2NaCl (aq)
(c) Brown precipitate of $BaSO_4$ and 2NaCl (aq)
(d) Black precipitate of $BaSO_4$ and 2NaCl (aq)

Q54. Carbon has the unique ability to form bonds with other atoms of carbon. This property is known as _____.

(a) allotropes
(b) homologus
(c) catenation
(d) Cyclisation

Q55. How many sports personalities have received Major Dhyan Chand Khel Ratna Awards in National Sports Awards 2023?

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

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Q56. Which instrument can be used to give the direction of magnetic field lines at any given point?

(a) Solenoid
(b) Generator
(c) Magnetic Compass
(d) Electric motor

Q57. Which of the following is the SI unit of work done?

(a) Erg
(b) Metre
(c) Newton
(d) Joule

Q58. In a certain code language, ‘big small average’ is coded as ‘22 33 55’, ‘small treat party’ is coded as ‘55 44 77’, and ‘party average people’ is coded as ‘77 22 99’. What is the code for ‘people’ in the given code language?

(a) 99
(b) 22
(c) 55
(d) 77

Q59. 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) JH - FI
(b) QO - MP
(c) NL - JL
(d) TR - PS

Q60. In a certain code language, ‘know me better’ is coded as ‘jf bu pd’ and ‘better know something’ is coded as ‘bu jf ls’.

What is the code for ‘something’ in the given code language?

(a) ls
(b) pd
(c) bu
(d) jf

Q61. If each consonant in the word VERIFY is changed to the letter immediately succeeding it in the English alphabetical order and each vowel is changed to the letter immediately preceding it in the English alphabetical order, then how many consonants are present in the new group of letters thus formed?

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

Q62. 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?

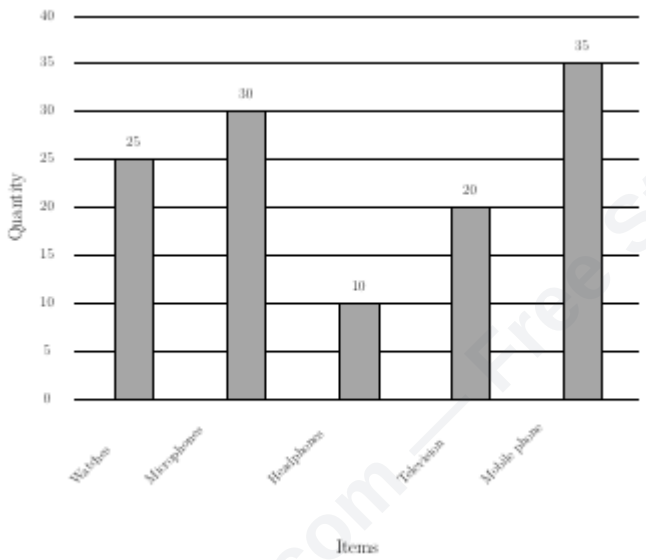
(Note: The odd one out is not based on the number of consonants/vowels or their position in the letter-cluster.)

(a) GJO
(b) CGK
(c) LOT
(d) SVA

Q63. Study the following graph and answer the given question.

The bar graph shows the number of different items sold by a shopkeeper in their respective quantities.

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c

What is the total units of Headphones and Mobile phones sold put together?

(a) 25
(b) 35
(c) 15
(d) 45

Q64. In the case of reflection of light from a concave mirror, when a parallel beam of light is incident on the reflecting surface, reflected light _____.

(a) appears to converge at the centre of curvature
(b) appears to diverge from the principal focus
(c) appears to diverge from the centre of curvature
(d) appears to converge at the principal focus

Q65. At what rate (in percentage) per annum will Rs. 1,300 give Rs. 520 as simple interest in 5 years?

(a) 4%
(b) 5%
(c) 7%
(d) 8%

Q66. What percentage of solar energy is captured by green plants in terrestrial ecosystem?

(a) 10 percent
(b) 5 percent
(c) 100 percent
(d) 1 percent

Q67. A thief running at a speed of 8 km/h is chased by a policeman whose speed is 10 km/h. If the thief is 100 m ahead of the policeman, then the time required for the policeman to catch the thief will be:

(a) 3 minutes
(b) 2 minutes
(c) 6 minutes
(d) 10 minutes

Q68. Which of the following elements is extracted by using electrolytic reduction?

(a) Zn
(b) Fe
(c) Pb
(d) Na

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Q69. The formula unit mass of CaCl2 is:

(a) 115u
(b) 114u
(c) 111u
(d) 110u

Q70. If the surface area of a sphere is 2124 4/7 cm^2, then what is the diameter of that sphere? [Use π = 22/7]

(a) 26cm
(b) 28cm
(c) 13cm
(d) 14cm

Q71. Which of the following hormones stimulates the growth of all organs?

(a) Adrenaline
(b) Glucagon
(c) Insulin
(d) Growth hormone

Q72. The internal bisectors of angle Q and angle R of ΔPQR meet at S. If mangle P = 75º, then mangle QSR is:

(a) 105.5º
(b) 102.5º
(c) 112.5º
(d) 127.5º

Q73. Which award has been conferred to Ms. Prema Dhanraj in the field of Medicine in 2024?

(a) Bharat Ratna
(b) Padma Bhusan
(c) Padma Shri
(d) Padma Vibhusan

Q74. A solution contains 25 g of copper chloride salt in 250 g of water. Calculate the concentration in terms of mass by mass percentage of the solution.

(a) 9.09%
(b) 36.01%
(c) 18.01%
(d) 27.01%

Q75. Which of the following fractions is greater than 2/3 and less than 4/5 ?

(a) 3/4
(b) 1/2
(c) 5/6
(d) 9/11

ANSWER KEY

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

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71 d	72 d	73 c	74 a	75 a

SOLUTIONS

Q1. Answer: (c) Gravitational force is attractive and maximum when the moon is close to the earth.

The correct answer is Gravitational force is attractive and maximum when the moon is close to the earth..

Key Points

• The gravitational force between two objects is always attractive in nature.

• The force of gravity is directly proportional to the product of the masses of the two objects involved.

• It is inversely proportional to the square of the distance between the centers of the two objects.

• As the distance between the moon and the earth decreases, the gravitational force between them increases.

• When the moon is closest to the earth, the gravitational force is at its maximum value.

Additional Information

• Inverse Square Law

• The gravitational force follows the inverse square law, meaning it decreases with the square of the distance between the two objects.

• Newton's Law of Universal Gravitation

• This law states that every point mass attracts every other point mass by a force acting along the line intersecting both points.

• Tidal Forces

• The gravitational attraction between the earth and moon causes tidal forces, which are responsible for the ocean tides on earth.

Q2. Answer: (d) Father's sister

Decoding symbols:

A is				
Symbol	•	×	÷	#
Meaning	Brother	Wife	Father	Daughter
to B				

Given: F - E # L × Q - P # N

F - E → F is the brother of E.

E # L → E is the daughter of L.

L × Q → L is the wife of Q.

Q - P → Q is the brother of P.

P # N → P is the daughter of N.

Thus, P is F's paternal aunt or father's sister.

Hence, the correct answer is "Option 4".

Q3. Answer: (a) Neither conclusion (I) nor (II) follows

The least possible Venn diagram for the given statements is as shown below :

Conclusions:

(I) Some fighters are kings → Does not follow (As some kings are servants and some servants are fighters. So it is possible but not definite.)

(II) All servants are kings → Does not follow (As some kings are servants. So it is possible but not definite.)

Therefore Here, Neither conclusion (I) nor (II) follows.

Hence, the correct answer is "Option 1".

Q4. Answer: (c) (sin r)/(sin i)

Given:

Light ray traveling from a medium of refractive index 'n1' to 'n2'. Angle of incidence is 'i' and angle of refraction is 'r'.

Concept Used:

Snell's Law: It relates the angles of incidence and refraction to the indices of refraction of the two media.

Formula Used:

n1 sin(i) = n2 sin(r)

Calculation:

From Snell's Law:

=> n1 sin(i) = n2sin(r)

=> (n1/n2) = (sin(r)/sin(i))

Hence, the correct answer is option 3.

Q5. Answer: (a) 2/3 ohm

Given:

Resistors: 1 ohm and 2 ohm connected in parallel.

Concept Used:

For resistors in parallel, the equivalent resistance (R_(eq)) is given by:

1/R_(eq) = 1/R1 + 1/R2

Calculation:

We have,

=> R1 = 1 ohm, R2 = 2 ohm

=> 1/R_(eq) = 1/1 + 1/2

=> 1/R_(eq) = 1 + 1/2

=> 1/R_(eq) = (2 + 1)/2

=> 1/R_(eq) = 3/2

=> R_(eq) = 2/3 ohm

Therefore The equivalent resistance is 2/3 ohm.

Q6. Answer: (c) 1764

Shortcut Trick

To find the square of 42 (near 50), use the Base 25 method.

Difference from 50 = 50 − 42 = 8

First part of answer = 25 − 8 = 17

Second part of answer = 8^2 = 64

Combine parts: 1764

Therefore The correct answer is 1764.

Alternate Method

Given:

The number to be squared is 42.

Formula Used:

We can use the algebraic identity: $(a - b)^2 = a^2 - 2ab + b^2$

Calculations:

=> $42^2 = (50 - 8)^2$

=> $42^2 = 50^2 - (2 \times 50 \times 8) + 8^2$

=> $42^2 = 2500 - 800 + 64$

=> $42^2 = 1700 + 64$

=> $42^2 = 1764$

The calculated value 1764 corresponds to option (3).

Therefore The correct answer is 1764.

Additional Information

Square of Numbers Ending in 5

Multiply the first digit by its successor and append 25 at the end. For example, 45^2 = (4 × 5) and 25 = 2025.

Base 50 Rule

For any number (50 ± x), the square is calculated as (25 ± x) in the hundreds place and x^2 in the units place.

Difference of Squares

The identity $a^2 - b^2 = (a - b)(a + b)$ is helpful for quick mental calculations of product of numbers.

Q7. Answer: (c) Sodium bicarbonate

The correct answer is Sodium bicarbonate.

Key Points

• Sodium bicarbonate (NaHCO3) is used in soda-acid fire extinguishers.

• It reacts with sulfuric acid (H2SO4) to produce carbon dioxide (CO2), which helps to extinguish the fire.

• The chemical reaction involved is: NaHCO3 + H2SO4 → Na2SO4 + CO2 + H2O.

• The generated CO2 gas forms a blanket over the fire, cutting off the oxygen supply and thereby extinguishing it.

• Sodium bicarbonate is preferred because it is non-flammable and non-toxic.

Additional Information

• Bleaching powder

• Also known as calcium hypochlorite, it is used for disinfecting drinking water and in the textile industry for bleaching.

• It is not used in fire extinguishers.

• Calcium chloride

• It is used for de-icing roads and in the food industry as a firming agent.

• It is not used in fire extinguishers.

• Sodium carbonate

• Commonly known as washing soda, it is used in glass manufacturing and as a water softener.

• It is not used in fire extinguishers.

Q8. Answer: (a) moving with uniform acceleration

The Correct answer is moving with uniform acceleration.

Key Points

• Average velocity is calculated as the arithmetic mean of the initial velocity and final velocity when the body is moving under uniform acceleration.

• This is because under uniform acceleration, the change in velocity is linear and equally distributed over time.

• The formula for average velocity in this case is: (Initial velocity + Final velocity) / 2.

• Uniform acceleration implies that the rate of change of velocity is constant during the given period of time.

• This relationship holds true for motion in a straight line, such as a body falling under the influence of gravity (ignoring air resistance).

• For example, in cases like the motion of a car accelerating uniformly or free-fall motion, this method of calculating average velocity can be applied.

• If the acceleration is not uniform, this formula does not apply, and the average velocity must be calculated by integrating the velocity function over time.

Additional Information

• Moving with non-uniform acceleration

• Non-uniform acceleration refers to a situation where the rate of change of velocity is not constant.

• In this case, the velocity changes irregularly over time, and the average velocity cannot be determined using the simple arithmetic mean formula.

• Instead, the average velocity must be calculated by integrating the velocity function over the time interval.

• Moving with uniform speed

• Uniform speed implies that the body covers equal distances in equal intervals of time.

• In this case, the average velocity is the same as the constant speed, and there is no variation in velocity to consider.

• Moving with uniform velocity

• Uniform velocity means that both the speed and direction of motion remain constant throughout the period of time.

• Since there is no change in velocity, the initial velocity equals the final velocity, and the average velocity will be the same as the constant velocity.

Q9. Answer: (b) One

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

1) E sits third from the left end.

2) Only one person sits to the right of D.

3) G sits second to the left of D.

4) B sits to the immediate right of C.

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5) F does not sit to the right of A.

Thus, according to the final arrangement, one person sit between F and E.

Hence, "Option 2" is the correct answer.

Q10. Answer: (a) Eggshells, Tea leaves, Potato peelings

The correct answer is option 1.

Key Points

• Biodegradable substances are those that can be broken down by natural processes involving microorganisms.

• Option 1 includes eggshells, tea leaves, and potato peelings, all of which are organic materials and can decompose naturally.

• Bubble packs (option 2) and glass bottles (option 3) are non-biodegradable as they do not decompose naturally.

• Medicine bottles and old shoes (option 4) are also non-biodegradable because they are made of synthetic materials that resist natural decomposition.

• Option 1 correctly identifies substances that are biodegradable and can return nutrients to the ecosystem through natural processes.

Additional Information

• Non-biodegradable Substances

• These are materials that cannot be broken down by natural processes. Examples include plastics, metals, and glass.

• Non-biodegradable substances can accumulate in the environment and cause pollution.

• Importance of Biodegradable Materials

• Using biodegradable materials helps reduce waste and environmental pollution.

• They contribute to sustainable practices by returning nutrients to the soil through decomposition.

• Composting

• Composting is a process that involves the decomposition of organic waste to produce compost, a nutrient-rich soil amendment.

• It is an effective way to manage biodegradable waste and improve soil health.

Q11. Answer: (c) 2 : 5

Shortcut Trick

Directly substitute the ratio values x = 7 and y = 3 into the required expression.

(x − y) : (x + y) = (7 − 3) : (7 + 3)

(x − y) : (x + y) = 4 : 10

Simplify the ratio by dividing both sides by 2: 4/2 : 10/2 = 2 : 5.

Therefore The correct answer is 2 : 5.

Alternate Method

Given: The ratio of x to y is x : y = 7 : 3.

Formula Used: Ratio is represented as a fraction x/y. For any ratio a : b, it can be written as a/b.

Let x = 7k and y = 3k, where k is a non-zero constant.

=> (x − y) = 7k − 3k = 4k

=> (x + y) = 7k + 3k = 10k

=> Required Ratio = (x − y) / (x + y)

=> Required Ratio = 4k / 10k

=> Required Ratio = 4 / 10 = 2 / 5

Therefore The correct answer is 2 : 5.

Additional Information

Componendo and Dividendo Rule

If a/b = c/d, then (a + b) / (a − b) = (c + d) / (c − d). This rule is useful for solving complex ratio and proportion problems quickly.

Properties of Ratios

A ratio remains unchanged if both its terms are multiplied or divided by the same non-zero number (e.g., a : b = ma : mb).

Comparison of Ratios

To compare two ratios, convert them into fractions and make their denominators equal. The fraction with the larger numerator represents the larger ratio.

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Q12. Answer: (b) 26

Given:

Aneesha's position from the left end = 12th

Total number of persons = 37

Aneesha's position from the right end = Total number of persons - Aneesha's position from the left end + 1

(37 - 12) + 1 = 25 + 1 = 26

Hence, Aneesha's position from the right end is "26".

Q13. Answer: (c) Udara Shakti

The correct answer is Udara Shakti

Key Points

• A contingent of the Indian Air Force (IAF) left for Malaysia on 12 August 2022 to participate in a bilateral exercise named 'Udarashakti'.

• This is the first bilateral exercise being conducted between Indian Air Force and Royal Malaysian Air Force (RMAF).

• IAF is participating in the exercise with Su-30 MKI and C-17 aircraft while the RMAF will be flying Su 30 MKM aircraft.

• The exercise was held from August 5–9, 2024 in Kuantan, Malaysia.

• The exercise's main goal is to improve military cooperation, mutual understanding, and operational expertise sharing.

• The IAF contingent was led by Group Captain Ajay Rathi.

• The IAF contingent participated with seven Su-30MKI aircraft.

Additional Information:

• Malaysia is a country in Southeast Asia.

• It's known for its beaches, rainforests and mix of Malay, Chinese, Indian and European cultural influences.

• Malaysia:

• Prime Minster: Ismail Sabri Yaakob

• Capital: Kuala Lumpur (Executive capital), Putrajaya (Administrative capital)

• Currency: Malaysian ringgit

Q14. Answer: (c) Mission Vatsalya

The correct answer is Mission Vatsalya

Key Points

• The Mission Vatsalya Monitoring System is a roadmap to achieve child protection and development priorities that align with the Sustainable Development Goals (SDGs).

• The Mission Vatsalya roadmap aims to protect children at the community and family level.

• It helps families and communities identify risks and vulnerabilities that affect children.

• It also helps create and promote preventive measures to protect children from abuse, risk, and vulnerability.

Additional Information

• Sustainable Development Goals (SDG)15 seeks to ‘Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss.

• The United Nations General Assembly adopted the "2030 Agenda for Sustainable Development" in 2015, with global goals.

• The 193 members of GA adopted the framework "Transforming our world: the 2030 Agenda for Sustainable Development" with 17 goals & 169 targets.

Q15. Answer: (c) Avani Lekhara

The correct answer is Avani Lekhara

Key Points

• Avani Lekhara won the gold medal in the Women's 10m air rifle standing SH1 event at the 2024 Paris Paralympics.

• Avani Lekhara is an Indian para shooter who won her second consecutive gold medal in the women's 10m air rifle event.

• She scored 249.7 points, breaking her own previous record of 249.6 set in 2021.

• Lekhara is wheelchair bound after a vehicle accident left her paralyzed below the waist when she was 11 years old.

Additional Information

Name	Field	Achievements	Notable Work/Recognition
Amulya Choudhary	Civil Services	UPSC Civil Services Examination topper, 2021	Ranked 1st in UPSC CSE 2021

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Manisha Agarwal	Indian Administrative Service	IAS officer, Rajasthan cadre	Notable contributions in rural development
Preeti Pal	Science & Technology	Indian biotechnologist and scientist, Padma Shri awardee	Pioneering work in plant molecular biology

Q16. Answer: (c) Rs. 1,300

Shortcut Trick

Let the Actual Cost of the article be 100%.

After a Decrease of 24%, the remaining value = 100% − 24% = 76%.

Given: 76% = Rs. 988

Unitary method: 1% = 988 ÷ 76 = 13

Actual Cost (100%) = 13 × 100 = Rs. 1,300.

Therefore The correct answer is Rs. 1,300.

Alternate Method

Given:

Final Price after reduction = Rs. 988

Percentage Decrease = 24%

Formula Used:

Original Price = Reduced Price ÷ (1 − Decrease %)

Calculations:

=> Let the Actual Cost be x.

=> x × (100 − 24) ÷ 100 = 988

=> x × 76 ÷ 100 = 988

=> x = (988 × 100) ÷ 76

=> x = 13 × 100

=> x = Rs. 1,300

Therefore, the actual cost of the article is Rs. 1,300, which corresponds to Option (3).

Therefore The correct answer is Rs. 1,300.

Additional Information

Percentage Decrease Formula

To find the new value after a decrease, use New Value = Original Value × (100 − Decrease%) ÷ 100.

Finding the Original Value

If the reduced value is given, the Original Value = (Reduced Value × 100) ÷ (100 − Decrease%).

Successive Percentage Changes

For two successive changes of a% and b%, the net effective change is (a + b + (a × b) ÷ 100)%.

Q17. Answer: (c) 14

Shortcut Trick

Use the Assumed Mean method by picking a central value like 15.

Calculate deviations from 15: −12, −9, −7, −5, −3, −1, +3, +9, +16.

Sum of deviations = (−12 − 9 − 7 − 5 − 3 − 1) + (3 + 9 + 16) = −37 + 28 = −9.

Correction in average = −9 ÷ 9 = −1.

Actual Arithmetic Mean = 15 + (−1) = 14.

Therefore The correct answer is 14.

Alternate Method

Given: The observations are 3, 6, 8, 10, 12, 14, 18, 24, and 31.

Formula: Arithmetic Mean = (Sum of all observations) ÷ (Number of observations)

=> Total Sum = 3 + 6 + 8 + 10 + 12 + 14 + 18 + 24 + 31

=> Total Sum = 126

=> Number of observations (n) = 9

=> Arithmetic Mean = 126 ÷ 9

=> Arithmetic Mean = 14

Therefore The correct answer is 14.

Additional Information

Arithmetic Mean Definition

The arithmetic mean is the most common measure of central tendency, calculated by dividing the sum of values by their count.

Effect of Operations on Mean

If each observation is multiplied or divided by a constant non-zero value 'k', the resulting mean is also multiplied or divided by 'k'.

Deviation Property

The sum of the squares of deviations of a set of observations is minimum when taken about the arithmetic mean.

Q18. Answer: (c) 14

Shortcut Trick

For any expression of the form $x + 1/x = k$, the value of $x^2 + 1/x^2$ is always $k^2 - 2$.

Given: $k = 4$.

Required value = $4^2 - 2$.

=> $16 - 2 = 14$.

Therefore The correct answer is 14.

Alternate Method

Given:

$x + 1/x = 4$

Formula Used:

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

Calculations:

Squaring both sides of the given equation $x + 1/x = 4$:

=> $(x + 1/x)^2 = (4)^2$

=> $x^2 + (1/x)^2 + 2 \times x \times (1/x) = 16$

=> $x^2 + 1/x^2 + 2 = 16$

=> $x^2 + 1/x^2 = 16 - 2$

=> $x^2 + 1/x^2 = 14$

Therefore, the calculated value is 14, which corresponds to Option (3).

Therefore The correct answer is 14.

Additional Information

Negative Sign Identity

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

Cubic Identity

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

Fourth Power Identity

If $x + 1/x = k$, then $x^4 + 1/x^4 = (k^2 - 2)^2 - 2$.

Q19. Answer: (b) 4m

Shortcut Trick

Depth of water = Volume ÷ Base Area

Convert Base Area to m^2: 6500 cm^2 = 6500 ÷ 10,000 = 0.65 m^2

Depth = 2.6 ÷ 0.65 = 4 m

Therefore The correct answer is 4m.

Alternate Method

Given:

Area of the base of the tank = 6500 cm^2

Volume of water in the tank = 2.6 m^3

Formula Used:

Volume of a Rectangular Tank (Cuboid) = Area of Base × Depth (Height)

Calculations:

=> First, ensure all units are consistent. Convert Base Area from cm^2 to m^2.

=> 1 m^2 = 10,000 cm^2

=> Base Area = 6500 ÷ 10,000 m^2 = 0.65 m^2

=> Volume = 2.6 m^3

=> Volume = Base Area × Depth

=> 2.6 = 0.65 × Depth

=> Depth = 2.6 ÷ 0.65

=> Depth = 260 ÷ 65 = 4 m

Therefore The correct answer is 4m.

Additional Information

Volume of a Cuboid

The total space occupied by a cuboid is calculated as Volume = Length × Breadth × Height.

Area-Volume Relation

Since Length × Breadth represents the Area of the Base, the formula simplifies to Volume = Base Area × Height (or Depth).

Metric Unit Conversion

1 m = 100 cm | 1 m^2 = 10,000 cm^2 | 1 m^3 = 1,000,000 cm^3 = 1,000 liters.

Q20. Answer: (b) Ladakh

The correct answer is Ladakh

Key Points

• The Khalubar War Memorial is located in Ladakh, India.

• The Indian Army opened the memorial to tourists in June 2024.

• The Khalubar War Memorial is a tribute to the soldiers who fought in the 1999 Kargil War between India and Pakistan.

• The memorial was opened as part of the "Forever in Operations" Division's pre-Kargil Vijay Diwas celebrations.

• The Kargil War Memorial is also known as the Dras War Memorial. It is located in the town of Dras, near Kargil city in the Kargil district of Ladakh.

• The Kargil War Memorial is a poignant tribute to the soldiers who lost their lives in the war.

• It is set against the backdrop of Tololing Peak and the Dras Valley.

Additional Information

• The Indian Army is the land-based branch and largest component of the Indian Armed Forces.

• The President of India is the Supreme Commander of the Indian Army,

• and its professional head is the Chief of Army Staff (COAS).

• The Indian Army was established on 1 April 1895 alongside the long established presidency armies of the East India Company, which too were absorbed into it in 1903.

Q21. Answer: (a) Nerve cell

The correct answer is Nerve cell.

Key Points

• Nerve cells, also known as neurons, are the longest cells in the human body.

• Neurons are specialized for the transmission of electrical impulses throughout the body.

• Each neuron consists of a cell body, dendrites, and an axon, with the axon being the long, thread-like part that transmits impulses away from the cell body.

• Neurons play a crucial role in the nervous system by enabling communication between different parts of the body.

Additional Information

• Ovum

• The ovum, or egg cell, is one of the largest cells in the human body, but not the longest.

• It is a reproductive cell that, when fertilized by a sperm cell, can develop into a new organism.

• Blood Cells

• Blood cells include red blood cells (RBCs), white blood cells (WBCs), and platelets.

• RBCs are responsible for oxygen transport, WBCs for immune response, and platelets for blood clotting.

• Fat Cells

• Fat cells, or adipocytes, are specialized for the storage of fat and are important for energy regulation.

• They play a role in cushioning and insulating the body.

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Q22. Answer: (a) 2045

The logic followed here is:

Hence, "Option 1" is the correct answer.

Q23. Answer: (b) 1680

Shortcut Trick

Find the LCM of the given numbers: 24, 40, and 56.

LCM(24, 40, 56) = 8 × 3 × 5 × 7 = 840.

Identify the smallest four-digit multiple of 840.

840 × 1 = 840 (3-digit)

840 × 2 = 1680 (Smallest 4-digit)

Therefore The correct answer is 1680.

Alternate Method

Given: Numbers 24, 40, and 56.

Formula Used: Required number = Smallest multiple of LCM(24, 40, 56) ≥ 1000.

=> Prime factorization of 24 = $2^3 \times 3$

=> Prime factorization of 40 = $2^3 \times 5$

=> Prime factorization of 56 = $2^3 \times 7$

=> LCM = $2^3 \times 3 \times 5 \times 7 = 8 \times 105 = 840$

=> Smallest 4-digit number = 1000

=> Dividing 1000 by 840: 1000 ÷ 840 = 1 with remainder 160

=> Next multiple = 840 × (1 + 1) = 840 × 2 = 1680

Therefore The correct answer is 1680.

Additional Information

Least Common Multiple (LCM)

The LCM is the smallest positive integer that is perfectly divisible by each number in a set.

HCF and LCM Relation

For any two numbers a and b, HCF(a, b) × LCM(a, b) = a × b.

Divisibility Property

If a number N is divisible by x, y, and z, then N must be a multiple of LCM(x, y, z).

Q24. Answer: (b) Only conclusion (II) follows

The least possible Venn diagram for the given statements is as shown below :

Conclusions:

(I) All beds are chairs → Does not follow (As all chairs are tables and some tables are beds. So it is possible but not definite.)

(II) Some tables are chairs → Follow (As all chairs are tables. As whole chairs comes in tables, therefore it is possible.)

Therefore Here, Only conclusion (II) follows.

Hence, the correct answer is "Option 2".

Q25. Answer: (c) 4 days

Shortcut Trick

Notice the proportional relationship between the given and asked workforce.

Asked workforce: (15 men + 20 boys) = 2.5 × (6 men + 8 boys).

Since the workforce efficiency becomes 2.5 times, the time taken will be divided by 2.5.

Time taken = 10 ÷ 2.5 = 4 days.

Therefore The correct answer is 4 days.

Alternate Method

Given:

6 men and 8 boys complete the work in 10 days.

26 men and 48 boys complete the work in 2 days.

Method Used:

Total Work = LCM of Days. Efficiency = Total Work ÷ Days.

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Person	Days	Total Work	Efficiency
6M + 8B	10	10	1
26M + 48B	2	5	

=> Let efficiency of a man be M and a boy be B.

=> 6M + 8B = 1... (i)

=> 26M + 48B = 5... (ii)

=> Multiplying equation (i) by 6, we get: 36M + 48B = 6... (iii)

=> Subtracting (ii) from (iii): 10M = 1 => M = 0.1

=> Substituting M = 0.1 in (i): 6(0.1) + 8B = 1 => 0.6 + 8B = 1 => 8B = 0.4 => B = 0.05

=> Efficiency of 15 men and 20 boys = 15M + 20B = 15(0.1) + 20(0.05) = 1.5 + 1.0 = 2.5

=> Time taken = Total Work ÷ Efficiency = 10 ÷ 2.5 = 4 days.

Therefore The correct answer is 4 days.

Additional Information

MDH Rule (Work Equivalence)

M1 × D1 × H1 ÷ W1 = M2 × D2 × H2 ÷ W2, where M is number of workers, D is days, H is hours, and W is work done.

Efficiency and Time Relation

Time taken to complete a piece of work is inversely proportional to the total efficiency or the number of workers. More workers mean less time required.

Multiple Group Work Problems

When men and boys are given together, an alternate method is to establish a ratio of their efficiencies (e.g., 1 Man = 2 Boys) using the MDH equation to convert the entire workforce into a single unit type.

Q26. Answer: (a) QEVT

The logic followed here is:

KGFL is related to OJHM

And,

ASNP is related to EVPQ

Similarly,

MBTS is related to

Hence, "Option 1" is the correct answer.

Q27. Answer: (d) Q

The logic followed here is:

→ Each vowel in the word GROUPS is changed to the letter following it in the English alphabetical order.

→ Each consonant is changed to the letter following it in the English alphabetical order.

→ Then arrange the new group of letters in English alphabetical order.

Given Series	G	R	O	U	P	S
Transformation	+1	+1	+1	+1	+1	+1
Arranged Alphabetically	H	S	P	V	Q	T

New series formed → H P Q S T V

Thus, 'Q' is the third letter from the left end.

Hence, the correct answer is "Option 4".

Q28. Answer: (c) IIT Madras

The correct answer is IIT Madras

Key Points

• The Indian Institute of Technology (IIT) Madras developed the Investor Information and Analytics Platform (IIAP) in 2024.

• The platform was launched by Union Minister Rajeev Chandrasekhar in February 2024.

• The IIAP was developed by researchers at the Centre for Research on Start-ups and Risk Financing (CREST) at IIT Madras.

• The platform is intended to help entrepreneurs, startup founders, and young people who want to build their own services,

devices, and platforms.

• The IIAP is intended to strengthen India's startup ecosystem.

Additional Information

IIT	Established
IIT Delhi	1961
IIT Kanpur	1959
IIT Bombay	1958

Q29. Answer: (d) JKI

The logic followed here is:

Hence, "Option 4" is the correct answer.

Q30. Answer: (c) K

The logic followed here is:

→ Each vowel in the word changed to the letter following it in the English alphabetical order.

→ Each consonant is changed to the letter preceding it in the English alphabetical order.

→ Then arranged new word in reverse order of the English alphabetical order.

Given Series	R	E	L	A	T	I	O	N
Consonant -1, Vowel +1	-1	+1	-1	+1	-1	+1	+1	-1
New series formed	Q	F	K	B	S	J	P	M
Reversed order	S	Q	P	M	K	J	F	B

New series formed → S Q P M K J F B

Thus, 'K' is the fourth letter from the right end.

Hence, the correct answer is "Option 3".

Q31. Answer: (d) regeneration

The correct answer is regeneration.

Key Points

• Regeneration is the ability of a fully differentiated organism to give rise to new individuals from their body parts.

• This process is common in certain species such as starfish, planarians, and some amphibians.

• In regeneration, cells undergo dedifferentiation to form a mass of cells, which then proliferate and differentiate to form new tissues and organs.

• Regeneration can occur at the level of tissues, organs, or even entire organisms depending on the species and the extent of damage.

• This biological process is crucial for healing and recovery from injuries in organisms capable of regeneration.

Additional Information

• Fragmentation

• It is a form of asexual reproduction where an organism is split into fragments, and each fragment grows into a new, complete organism.

• This method is common in algae, fungi, and some invertebrates.

• Fission

• It is a type of asexual reproduction where a single organism divides into two or more separate organisms.

• Bacteria and protists commonly reproduce through binary fission.

• Budding

• In budding, a new organism develops from an outgrowth or bud due to cell division at one particular site.

• Hydra and yeast are examples of organisms that reproduce through budding.

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Q32. Answer: (b) Ladakh

The correct answer is Ladakh

Key Points

• Ladakh has become the first administrative unit to achieve full functional literacy under the ULLAS-Nav Bharat Saaksharta Karyakram (New India Literacy Program).

• The Union Territory has surpassed 97% literacy, marking a major success for the centrally sponsored scheme.

• ULLAS is a centrally sponsored scheme that aims to improve the literacy and numeracy skills of adults aged 15 and above.

• The scheme is also known as the New India Literacy Programme (NILP).

Additional Information

• The scheme is based on volunteerism, where volunteers teach non-literate people through the ULLAS Mobile App.

• The scheme's goal is to help adults who didn't receive a proper education to contribute to the country's growth.

• The scheme's components include foundational literacy, numeracy, critical life skills, basic education, vocational skills, and continuing education.

Q33. Answer: (d) 21.6

Shortcut Trick

Apply the Empirical Formula: 3 × Median = Mode + 2 × Mean

3 × Median = 24.6 + 2 × 20.1

3 × Median = 24.6 + 40.2 = 64.8

Median = 64.8 ÷ 3 = 21.6

Therefore The correct answer is 21.6.

Alternate Method

Given:

Mode of the data = 24.6

Mean of the data = 20.1

Formula Used:

The relationship between Mean, Median, and Mode is given by: Mode = 3(Median) − 2(Mean)

Calculations:

=> Mode = 3 × Median − 2 × Mean

=> 24.6 = 3 × Median − 2 × 20.1

=> 24.6 = 3 × Median − 40.2

=> 3 × Median = 24.6 + 40.2

=> 3 × Median = 64.8

=> Median = 64.8 ÷ 3

=> Median = 21.6

Therefore The correct answer is 21.6.

Additional Information

Empirical Relationship

For a moderately skewed distribution, the relationship is approximately Mode = 3 Median − 2 Mean.

Symmetric Distribution

In a perfectly symmetrical distribution (like a normal curve), the Mean, Median, and Mode are all equal (Mean = Median = Mode).

Skewness Types

If Mean > Median > Mode, it is positively skewed. If Mode > Median > Mean, it is negatively skewed.

Median from Mean and Mode

The formula can be rearranged to find Median: Median = (Mode + 2 × Mean) ÷ 3.

Q34. Answer: (c) Rs. 50

Shortcut Trick

Let original Cost Price (CP) = 100 units → Original Selling Price (SP) = 125 units.

New CP = 80 units (20% less) → New Profit = 30% of 80 = 24 units.

New SP = 80 + 24 = 104 units.

Difference in SP = 125 − 104 = 21 units.

Given 21 units = Rs. 10.50 => 1 unit = 10.50 ÷ 21 = Rs. 0.5.

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Original Cost Price = 100 units × 0.5 = Rs. 50.

Therefore The correct answer is Rs. 50.

Alternate Method

Given:

Initial Profit = 25%

New CP = 20% less than original CP

New SP = Rs. 10.50 less than original SP

Final Gain = 30%

Formula Used:

SP = CP × (100 + Profit%) ÷ 100

Calculations:

Let the original Cost Price be x.

=> Original Selling Price = 1.25x

=> New Cost Price = x − 20% of x = 0.80x

=> New Selling Price = 1.25x − 10.50

=> According to the condition: 1.25x − 10.50 = 130% of 0.80x

=> 1.25x − 10.50 = 1.30 × 0.80x

=> 1.25x − 10.50 = 1.04x

=> 1.25x − 1.04x = 10.50

=> 0.21x = 10.50

=> x = 10.50 ÷ 0.21 = 50

Therefore The correct answer is Rs. 50.

Additional Information

Profit and Loss Percentage

Profit % is always calculated on the Cost Price unless specified otherwise. Formula: Profit % = (Profit ÷ CP) × 100.

Relationship between SP and CP

If there is a profit of P%, then SP = CP × (100 + P) ÷ 100. If there is a loss of L%, then SP = CP × (100 − L) ÷ 100.

Percentage Change Method

When multiple percentage changes are applied to a base value, the final value can be found using multiplying factors (e.g., 20% decrease is 0.8 and 30% increase is 1.3).

Q35. Answer: (d) (9, 82)

The logic followed here is :

Logic : (1^(st)number)² + 1 = 2^(nd) number.

(6, 37)

→ 6² + 1

→ 36 + 1

→ 37 = Equal to 2^(nd) number.

(8, 65)

→ 82 + 1

→ 64 + 1

→ 65 = Equal to 2nd number.

Now check for each given option,

Option 1) (5, 24)

→ 52 + 1

→ 25 + 1

→ 26 = Not Equal to 2nd number.

Option 2) (7, 49)

→ 72 + 1

→ 49 + 1

→ 50 = Not Equal to 2nd number.

Option 3) (3, 27)

→ 32 + 1

→ 9 + 1

→ 10 = Not Equal to 2nd number.

Option 4) (9, 82)

→ 92 + 1

→ 81 + 1

→ 82 = Equal to 2nd number.

Thus, Option 4 follows the logic.

Hence, the correct answer is "Option 4".

Q36. Answer: (b) QRW

The logic followed here is:

Hence, "Option 2" is the correct answer.

Q37. Answer: (a) Fusion

The correct answer is Fusion.

Key Points

• Fusion is the process where a solid substance changes into a liquid substance.

• This process occurs when the temperature of the solid reaches its melting point.

• During fusion, the solid absorbs heat energy, which breaks the intermolecular bonds holding its molecules in place.

• The absorbed heat energy increases the kinetic energy of the molecules, causing them to move more freely and transition into the liquid state.

• Examples of fusion include the melting of ice into water and the melting of metals when heated.

Additional Information

• Solidification

• This is the process where a liquid changes into a solid, also known as freezing.

• It occurs when the temperature of a liquid is lowered below its freezing point.

• Sublimation

• Sublimation is the process where a solid changes directly into a gas without passing through the liquid state.

• An example of sublimation is dry ice (solid carbon dioxide) changing directly into carbon dioxide gas.

• Deposition

• Deposition is the process where a gas changes directly into a solid without becoming a liquid first.

• An example of deposition is the formation of frost on cold surfaces.

Q38. Answer: (c) 16 km towards the west

Given:

Vineet starts from Point Y and drives 10 km towards the North.

He then takes a right turn, drives 29 km, turns right and drives 34 km.

He then takes a right turn and drives 13 km.

He takes a final right turn, drives 24 km and stops at Point Z.

Thus, Vineet should drive (29 km - 13 km) 16 km in the west direction to reach Point Y again.

Hence, "Option 3" is the correct answer.

Q39. Answer: (d) 2

Shortcut Trick

Let the numerator be x and the denominator be y.

From the first condition: $2(x + 2) = y + 5 \Rightarrow 2x - y = 1$.

From the second condition: $3(x - 2) = y - 2 \Rightarrow 3x - y = 4$.

Subtracting equations: $(3x - y) - (2x - y) = 4 - 1 \Rightarrow x = 3$.

Substituting $x = 3$ in the first equation: $2(3) - y = 1 \Rightarrow y = 5$.

Therefore The correct answer is 2.

Alternate Method

Given:

Condition 1: (x + 2) / (y + 5) = 1/2

Condition 2: (x − 2) / (y − 2) = 1/3

Calculations:

=> From Condition 1: 2 × (x + 2) = 1 × (y + 5)

=> 2x + 4 = y + 5 => 2x − y = 1 --- (Eq. 1)

=> From Condition 2: 3 × (x − 2) = 1 × (y − 2)

=> 3x − 6 = y − 2 => 3x − y = 4 --- (Eq. 2)

=> Subtracting (Eq. 1) from (Eq. 2):

=> (3x − y) − (2x − y) = 4 − 1

=> x = 3

=> Putting x = 3 in (Eq. 1): 2(3) − y = 1 => 6 − y = 1 => y = 5

=> Positive difference = y − x = 5 − 3 = 2

Therefore The correct answer is 2.

Additional Information

Types of Fractions

A proper fraction has a numerator less than the denominator (e.g., 3/5), while an improper fraction has a numerator greater than or equal to the denominator (e.g., 5/3).

Linear Equations in Two Variables

To solve for two variables, we need at least two independent equations. Common methods include substitution, elimination, or cross-multiplication.

Equivalent Fractions

Fractions that represent the same value even though they look different are called equivalent fractions (e.g., 1/2 = 2/4 = 3/6).

Q40. Answer: (c) JE - KF - MN

The logic followed here is:

LG - MH - OP

And,

HC - ID - KL

So, checking each option one by one:

Option 1) OJ - PK - RT

Option 2) KF - LG - NP

Option 3) JE - KF - MN

Option 4) ID - JE - LN

Thus, out of all the options, 'JE - KF - MN ' follows the same logic as given.

Hence, "Option 3" is the correct answer.

Q41. Answer: (c) Two

Given: L, P, R, V, X, Y, and Z are sitting around a circular table facing the centre. R sits to the immediate right of V. Only three people sit between R and Z when counted from the left of R.

1) R sits to the immediate right of V.

2) Only three people sit between R and Z when counted from the left of R.

3) Only three people sit between V and P.

4) X sits to the immediate right of Y.

After positioning X and Y only one position is left which will be occupied by the only person left i.e. L.

Thus, according to the final arrangement, two people sit between L and Y, when counted from the left of Y.

Hence, "Option 3" is the correct answer.

Q42. Answer: (a) 75 Great Revolutionaries of India

The correct answer is 75 Great Revolutionaries of India

Key Points

• On August 11, 2024, Rajya Sabha MP Bhim Singh launched his book titled '75 Great Revolutionaries of India'.

• The launch event was attended by Rajya Sabha Deputy Chairman Harivansh Narayan Singh, who praised the work for highlighting lesser-known freedom fighters.

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• This book aims to inspire a developed India by recognizing historical sacrifices.

• 75 Great Revolutionaries of India" is that the book was released as part of the celebrations for "Azadi Ka Amrit Mahotsav", commemorating 75 years of India's independence.

• It emphasizes the contributions of unsung heroes who played crucial roles in India's freedom struggle

Additional Information

Book Title	Author	Genre/Subject	Publication Date	Brief Description
The Lucky Ones	Zara Chowdhury	Memoir	October 2024	A debut memoir exploring multigenerational violence against Muslim communities.
The Many Lives of Syeda X	Neha Dixit	Fiction/Urban Migrants' Struggles	August 2024	Focuses on the resilience of a Muslim woman in urban Delhi.
Marginlands	Arati Kumar-Rao	Environmental Crisis/Travel Narrative	February 2025	Explores India's vanishing landscapes and environmental challenges.
The New India	Rahul Bhatia	Political Analysis/Hindu Nationalism	December 2024	Examines the rise of Hindu nationalism and its impact on Indian democracy.
A New Idea of India	Harsh Madhusudan & Rajeev Mantri	Politics/Individual Rights	2020	Focuses on secularism, capitalism, and individualism in India.
Fire Bird	Perumal Murugan	Fiction/Caste Relations and Rural Life	2023	Explores themes of rural life, caste, and migration.

Q43. Answer: (d) Rs. 48

Shortcut Trick

Let the original cost of 1 pen be x and 1 pencil be y.

New cost of 2 pens and 3 pencils = 2(x − 1.50) + 3(y + 1)

New cost = 2x − 3 + 3y + 3 = 2x + 3y

Notice that the new cost (2x + 3y) exactly equals the original cost of 2 pens and 3 pencils.

Given the new cost is Rs. 48, the original cost must also be Rs. 48.

Therefore The correct answer is Rs. 48.

Alternate Method

Given:

Cost of 12 pens and 7 pencils = Rs. 233

Cost of 2 pens and 3 pencils = Rs. 48 (when pen price drops by Rs. 1.50 and pencil price rises by Rs. 1)

Calculation:

Let the original cost of a pen be x and a pencil be y.

=> 12x + 7y = 233 ... (1)

According to the second condition:

=> 2(x − 1.50) + 3(y + 1) = 48

=> 2x − 3 + 3y + 3 = 48

=> 2x + 3y = 48

=> 2x = 48 − 3y

=> x = 24 − 1.5y ... (2)

Substitute equation (2) into equation (1):

=> 12(24 − 1.5y) + 7y = 233

=> 288 − 18y + 7y = 233

=> 288 − 11y = 233

=> 11y = 288 − 233

=> 11y = 55

=> y = 5

Substitute y = 5 in equation (2):

=> x = 24 − 1.5 × 5

=> x = 24 − 7.5 = 16.5

The original cost of 2 pens and 3 pencils:

=> 2x + 3y = 2 × 16.5 + 3 × 5

=> 33 + 15 = 48

Therefore The correct answer is Rs. 48.

Additional Information

Extraneous Information Trick

Competitive exams often include additional complex data to consume time. Identifying direct mathematical relationships can lead to instant solutions without full calculation.

System of Linear Equations

A pair of linear equations in two variables typically has one unique solution if the lines intersect, represented by a consistent and independent system.

Substitution Method

A technique for solving simultaneous equations by expressing one variable in terms of the other and substituting it into the second equation.

Q44. Answer: (d) 4%

Shortcut Trick

Ratio of Expenditure to Savings = (100 + 125) : 100 = 225 : 100 = 9 : 4

Total Income in ratio parts = 9 + 4 = 13 parts

Using the weighted average method for percentage change:

Net % Change in Income = [(9 × −6) + (4 × 26.5)] ÷ 13

Net % Change = (−54 + 106) ÷ 13 = 52 ÷ 13 = 4%

Therefore The correct answer is 4%.

Alternate Method

Expenditure (225)

Decreases by 6%

Savings (100)

Increases by 26.5%

Income (325) = +4%

Given:

Expenditure is 125% more than Savings.

Expenditure decreases by 6% and Savings increases by 26.5%.

Formula Used:

Income = Expenditure + Savings

Percentage Change = (Final Value − Initial Value) ÷ Initial Value × 100

Calculations:

=> Let initial Savings = 100

=> Initial Expenditure = 100 + (125% of 100) = 225

=> Initial Income = 225 + 100 = 325

=> New Expenditure = 225 − (6% of 225) = 225 − 13.5 = 211.5

=> New Savings = 100 + (26.5% of 100) = 126.5

=> New Income = 211.5 + 126.5 = 338

=> Increase in Income = 338 − 325 = 13

=> Percentage Increase in Income = (13 ÷ 325) × 100 = 4%

Therefore The correct answer is 4%.

Additional Information

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Income, Expenditure, and Savings

The fundamental relationship is Income = Expenditure + Savings. Any percentage change in total income is essentially the weighted average of the percentage changes in expenditure and savings.

Weighted Average Formula

Net Percentage Change = (E × %Change in E + S × %Change in S) ÷ (E + S), where E and S refer to the initial expenditure and savings respectively.

Percentage Increase / Decrease

Percentage Change = (New Value − Old Value) ÷ Old Value × 100. A positive calculation indicates an overall increase, while a negative calculation indicates a decrease.

Q45. Answer: (b) 21

Given Equation: (24 J 3) K 6 I (14 J 2) L 19 = ?

BODMAS Rule:

Decoding the given information:

Alphabet	I	J	K	L
Meaning	•	×	÷	–

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

=> (24 × 3) ÷ 6 + (14 × 2) - 19

= 72 ÷ 6 + 28 - 19

= 12 + 28 - 19

= 40 - 19

= 21

Hence, the correct option is "Option 2".

Q46. Answer: (a) Rs. 17,800

Shortcut Trick

Use the ratio method: 30% discount → 3/10 (where 10 is Marked Price and 3 is Discount).

Selling Price (SP) = 10 − 3 = 7 units.

Given 7 units = Rs. 12,460.

1 unit = 12,460 ÷ 7 = Rs. 1,780.

Marked Price (MP) = 10 units = 1,780 × 10 = Rs. 17,800.

Therefore The correct answer is Rs. 17,800.

Alternate Method

Given:

Discount Percentage = 30%

Sale Price (SP) = Rs. 12,460

Formula Used:

Marked Price (MP) = [Sale Price ÷ (100 − Discount%)] × 100

Calculations:

=> Let the Marked Price be x.

=> SP = x × (100 − 30)/100

=> 12,460 = x × 70/100

=> 12,460 = 0.70 × x

=> x = 12,460 ÷ 0.70

=> x = 124,600 ÷ 7

=> x = 17,800

Therefore The correct answer is Rs. 17,800.

Additional Information

Marked Price (MP)

It is the price printed on the label of an article, also known as the List Price. Discounts are always calculated on this value.

Successive Discount

When two or more discounts are applied one after another, the single equivalent discount is given by: [d1 + d2 − (d1 × d2)/100]%.

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Profit/Loss on Marked Price

To find Cost Price (CP) when Profit % and Discount % are given: CP/MP = (100 − Discount%) / (100 + Profit%).

Q47. Answer: (c) Both I and II follow

Statement: The special task force set up by the government has found that toxic waste is being mixed with dry waste by many apartment complexes before collection by the municipality, causing severe danger to the waste processing personnel and the environment.

Course of Action I: Penalizing apartment complexes for improper segregation creates accountability and deters them from continuing this practice. This directly addresses the issue.

Course of Action II: Issuing clear guidelines on waste segregation to residents helps in creating awareness and ensures that waste is segregated correctly. This is a proactive and logical step.

So, Both I and II follow.

Hence, the correct answer is "Option 3".

Q48. Answer: (b) (6, 108, 3)

The logic follows here:

(1st number)² × 3rd number = 2nd number.

Given: (2, 24, 6)

=> (2)2 × 6 = 4 × 6 = 24 = 2nd number.

And, (4, 32, 2)

=> (4)2 × 2 = 16 × 2 = 32 = 2nd number.

Similarly, Option (2): (6, 108, 3)

=> (6)2 × 3 = 36 × 3 = 108 = 2nd number.

Hence, the correct answer is "Option (2)"

Q49. Answer: (b) 15

The correct answer is 15

Key Points

• The GlobE Network (Global Operational Network of Anti-Corruption Law Enforcement Authorities) was established under the United Nations Office on Drugs and Crime (UNODC).

• It aims to strengthen international cooperation in combating corruption.

• The steering committee, comprising 15 members, plays a crucial role in guiding the network's initiatives and strategies.

• India, represented by the Central Bureau of Investigation (CBI), was elected as a member of the steering committee, showcasing its leadership in global anti-corruption efforts.

• The election to the steering committee was part of the GlobE Network's annual plenary meeting in Beijing, held in September 2024.

• India’s inclusion reflects its growing influence in international law enforcement and anti-corruption initiatives.

Additional Information

• The CBI was established in 1963 by a resolution made by the Ministry of Home Affairs.

• It was established on the recommendation of the Santhanam Committee on the prevention of corruption (1962 -64)

• CBI attributes its powers to the Delhi Special Police Establishment Act of 1946.

• CBI is the major investigating agency of the Central Government and it performs an integral role in the prevention of corruption.

• The Director of CBI is responsible for the administration of the organisation.

• CBI now works under the Ministry of Personnel, Pension & Public Grievances, Government of India, and coordinates the investigation on behalf of the Interpol Member countries.

Q50. Answer: (c) 95 and 135

Given: (27 + 15) × 2 - (95 ÷ 5) + 25 × 4 - 135 = 62

Logic: Interchange should be done of entire number and not individual digits of a given number.

Given Equation: (27 + 15) × 2 - (95 ÷ 5) + 25 × 4 - 135 = 62

Let's check options one by one.

Option 1) 2 and 4

=> (27 + 15) × 4 - (95 ÷ 5) + 25 × 2 - 135 = 62

=> 42 × 4 - 19 + 50 - 135 = 62

=> 168 - 19 + 50 - 135 = 62

=> 218 - 19 - 135 = 64 ≠ 62

Option 2) 25 and 27

=> (25 + 15) × 2 - (95 ÷ 5) + 27 × 4 - 135 = 62

=> 40 × 2 - 19 + 148 - 135 = 62

=> 80 - 154 + 148 = 62

=> 228 - 154 = 74 ≠ 62

Option 3) 95 and 135

=> (27 + 15) × 2 - (135 ÷ 5) + 25 × 4 - 95 = 62

=> 42 × 2 - 27 + 100 - 95 = 62

=> 84 - 27 + 100 - 95 = 62

=> 184 - 27 - 95 = 62

Option 4) 5 and 15

=> (27 + 5) × 2 - (95 ÷ 15) + 25 × 4 - 135 = 62

=> 32 × 2 - 6.33 + 100 - 135 = 62

=> 64 - 141.33 + 100 = 62

=> 164 - 141.33 = 22.67

Hence, the correct answer is "Option 3".

Q51. Answer: (c) 25cm

Shortcut Trick

Identify the height difference between the two buildings: 15 cm − 8 cm = 7 cm.

The horizontal distance between them is 24 cm.

Recognize the Pythagorean triplet (7, 24, 25).

The distance between the tops is the hypotenuse, which corresponds to the third value in the triplet.

Therefore The correct answer is 25 cm.

Alternate Method

Given:

Height of Ramesh's building (h1) = 8 cm

Height of Suresh's building (h2) = 15 cm

Horizontal distance (d) = 24 cm

Formula Used:

In a right-angled triangle, Hypotenuse² = Base² + Perpendicular²

Calculations:

The difference in height forms the perpendicular of the triangle:

=> Perpendicular = 15 cm − 8 cm = 7 cm

The horizontal distance forms the base of the triangle:

=> Base = 24 cm

Let the distance between the tops be x:

=> $x^2 = 24^2 + 7^2$

=> $x^2 = 576 + 49$

=> $x^2 = 625$

=> $x = \sqrt{625}$

=> x = 25 cm

Therefore The correct answer is 25 cm.

Additional Information

Pythagoras Theorem

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

Common Pythagorean Triplets

Sets of three positive integers that satisfy the theorem include (3, 4, 5), (5, 12, 13), (8, 15, 17), (7, 24, 25), and (20, 21, 29).

Distance in 2D Plane

The straight-line distance between two points (x1, y1) and (x2, y2) is calculated using $\sqrt{((x2-x1)^2 + (y2-y1)^2)}$.

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Q52. Answer: (b) vacuoles

The correct answer is vacuoles.

Key Points

• Meristematic tissue cells are highly active and are involved in continuous cell division.

• These cells possess a dense cytoplasm which supports their high metabolic activity.

• The cells have thin cellulose walls that provide flexibility and support for cell division.

• Meristematic cells contain prominent nuclei which are essential for regulating cell division and growth.

• These cells generally lack vacuoles or have very small vacuoles because vacuoles are more prominent in mature cells and are involved in storage and maintenance of cell turgor.

Additional Information

• Parenchyma Cells

• These are the most common type of plant cells and are found in various parts of the plant.

• They have thin cell walls and large central vacuoles.

• Parenchyma cells are involved in storage, photosynthesis, and tissue repair.

• Collenchyma Cells

• These cells provide structural support to growing parts of the plant.

• They have thicker cell walls compared to parenchyma cells and are typically found in stems and leaves.

• Sclerenchyma Cells

• These cells are known for their thick, lignified cell walls which provide mechanical support.

• Sclerenchyma cells are found in non-growing regions of the plant such as the bark and mature stems.

Q53. Answer: (a) White precipitate of BaSO4 and 2NaCl (aq)

The correct answer is White precipitate of BaSO4 and 2NaCl (aq).

Key Points

• When sodium sulphate reacts with barium chloride, the reaction produces barium sulphate (BaSO4) and sodium chloride (NaCl).

• Barium sulphate is a white precipitate that forms as a result of this reaction.

• The balanced chemical equation for this reaction is Na2SO4 + BaCl2 → BaSO4 + 2NaCl.

• This reaction is a typical example of a double displacement reaction.

• In a double displacement reaction, the ions of the reactants exchange places to form new compounds.

Additional Information

• Solubility Rules

• Barium sulphate is insoluble in water, which is why it forms a precipitate.

• Sodium chloride is soluble in water and remains in the aqueous solution.

• Applications of Barium Sulphate

• Barium sulphate is used in medical imaging as a radiocontrast agent for X-ray imaging and other diagnostic procedures.

• It is also used in the production of paints, coatings, and plastics.

• Double Displacement Reactions

• These reactions are also known as metathesis reactions.

• They typically occur in aqueous solutions where the ions can move freely and react with each other.

Q54. Answer: (c) catenation

The correct answer is catenation.

Key Points

• Catenation is the unique ability of carbon to form bonds with other carbon atoms.

• This property allows carbon to form long chains, branched molecules, and complex structures such as rings.

• Catenation is a significant reason for the vast number of organic compounds.

• Carbon-carbon bonds are strong and stable, facilitating the formation of a wide variety of molecular structures.

• The ability of carbon to catenate is due to its tetravalent nature, allowing it to form up to four covalent bonds with other atoms, including other carbon atoms.

Additional Information

• Allotropes

• These are different forms of the same element, where the atoms are bonded together in different ways. For example, carbon has several allotropes, including diamond, graphite, and graphene.

• Homologous Series

• A homologous series is a group of organic compounds with a similar general formula, varying by a CH2 unit. They have similar chemical properties and show a gradation in physical properties.

• Cyclisation

• This refers to the process of forming a ring structure from a chain of atoms. Cyclisation is common in organic chemistry for forming cyclic compounds.

Q55. Answer: (d) 2

The correct answer is 2

Key Points

• Two sportspersons received the Major Dhyan Chand Khel Ratna Award in 2023:

• Chirag Chandrashekhar Shetty:

• Chirag Shetty is an Indian badminton player.

• With his doubles partner Satwiksairaj Rankireddy, he is an Asian Games, Commonwealth Games, and Asian Championships gold medalist.

• They are the only Indian doubles pair to become No. 1 in World Ranking, win the World Tour S1000, and the first Indians to win a gold medal at the Asian Games in badminton.

• Rankireddy Satwik Sai Raj

• He is an Asian Games, Commonwealth Games, and Asian Championships gold medalist

• He achieved a new Guinness World Record for the fastest hit in badminton by a male player, with his smash reaching a speed of 565 km/h

Additional Information Major Dhyan Chand Khel Ratna Award

• It is named after the hockey wizard Major Dhyan Chand (1905–79), a Indian legendary field hockey player.

• The “Major Dhyan Chand Khel Ratna Award” (erstwhile Rajiv Gandhi Khel Ratan Award) is the highest sporting honour in India.

• It was instituted in 1991–1992, the award is conferred annually by the Ministry of Youth Affairs and Sports, Government of India

• It was renamed in August 2021 to honor the legendary hockey player Major Dhyan Chand.

Q56. Answer: (c) Magnetic Compass

The correct answer is Magnetic Compass.

Key Points

• A magnetic compass is a device that shows the direction of the magnetic field at a point.

• It consists of a small, lightweight magnet called a needle, which is free to rotate.

• The needle aligns itself with the Earth's magnetic field, pointing towards the magnetic north.

• It is commonly used in navigation to determine direction.

• Magnetic compasses are also used in physics to study magnetic fields and their directions.

Additional Information

• Solenoid

• A solenoid is a long coil of wire that generates a magnetic field when an electric current passes through it.

• It is used in various applications such as electromagnets, inductors, and valves.

• Generator

• A generator is a device that converts mechanical energy into electrical energy using electromagnetic induction.

• It is commonly used in power plants to produce electricity.

• Electric Motor

• An electric motor is a device that converts electrical energy into mechanical energy.

• It is used in various appliances and machines, such as fans, refrigerators, and electric vehicles.

Q57. Answer: (d) Joule

The correct answer is Joule.

Key Points

• The SI unit of work done is the Joule (J).

• A Joule is defined as the amount of work done when a force of one newton displaces an object by one meter in the direction of the force.

• It is a derived unit in the International System of Units (SI).

• The unit is named after the English physicist James Prescott Joule.

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• Work done can also be represented in other units such as ergs, but Joule is the standard SI unit.

Additional Information

• Erg

• It is a unit of work or energy in the CGS (centimeter-gram-second) system.

• 1 Joule is equal to 10^7 ergs.

• Newton

• It is the SI unit of force.

• 1 Newton is the force required to accelerate a mass of one kilogram by one meter per second squared.

• Metre

• It is the SI unit of length.

• One meter is the distance light travels in a vacuum in 1/299,792,458 seconds.

Q58. Answer: (a) 99

The logic followed here is:

The code for Big is "33",

The code for Treat is "44",

The code for People is "99".

Hence, the correct answer is "Option 1".

Q59. Answer: (c) NL - JL

The logic followed here is:

Logic: - 4 and + 1 respectively in the positional value of letters.

Option 1) JH - FI

Option 2) QO - MP

Option 3) NL - JL

Option 4) TR - PS

Hence, the correct answer is "Option 3".

Q60. Answer: (a) Is

The logic followed here is:

The code for Something is "Is".

Hence, the correct answer is "Option 1".

Q61. Answer: (b) Six

The pattern followed here is:

→ Each consonant is changed to the letter immediately succeeding it in the English alphabetical order.

→ Each vowel is changed to the letter immediately preceding it in the English alphabetical order.

Given word	V	E	R	I	F	Y
Consonant +1, Vowels - 1	+1	-1	+1	-1	+1	+1
New word	W	D	S	H	G	Z

After applying all conditions, we get the 'Six' consonant in the new word formed.

Hence, the correct answer is "Option 2".

Q62. Answer: (b) CGK

Logic followed here is:

Logic: +3 and +5 respectively in the positional value of letters.

Option 1) GJO

Option 2) CGK

Option 3) LOT

Option 4) SVA

Hence, the correct answer is "Option 2".

Q63. Answer: (d) 45

Given:

Number of Headphones sold = 10

Number of Mobile phones sold = 35

Formula used:

Total units = Number of Headphones + Number of Mobile phones

Calculation:

Total units = 10 + 35

Total units = 45

Therefore The total units of Headphones and Mobile phones sold together is 45.

Q64. Answer: (d) appears to converge at the principal focus

The correct answer is appears to converge at the principal focus.

Key Points

• When a parallel beam of light is incident on a concave mirror, it reflects and converges at a single point called the principal focus.

• The principal focus of a concave mirror is the point where parallel rays of light meet after reflection.

• The distance between the mirror's surface and the principal focus is known as the focal length.

• The center of curvature is the center of the sphere from which the concave mirror segment is taken.

• The principal axis is the line that passes through the center of curvature and the midpoint of the mirror.

Additional Information

• Convex Mirror

• A convex mirror diverges parallel beams of light, making them appear to originate from a point behind the mirror called the virtual focus.

• Convex mirrors are used in vehicles as rear-view mirrors due to their wider field of view.

• Reflection Laws

• The angle of incidence is equal to the angle of reflection.

• The incident ray, the reflected ray, and the normal to the surface all lie in the same plane.

• Uses of Concave Mirrors

• Concave mirrors are used in telescopes to gather and focus light.

• They are also used in headlights of vehicles to focus light beams into parallel rays.

Q65. Answer: (d) 8%

Shortcut Trick

Interest for 1 year = Total Interest ÷ Time = 520 ÷ 5 = Rs. 104.

Rate % = (Interest for 1 year ÷ Principal) × 100

Rate % = (104 ÷ 1300) × 100 = 8%.

Therefore The correct answer is 8%.

Alternate Method

Given:

Principal (P) = Rs. 1,300

Simple Interest (SI) = Rs. 520

Time (T) = 5 years

Formula Used:

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

Calculations:

=> 520 = (1300 × R × 5) ÷ 100

=> 520 = 13 × R × 5

=> 520 = 65 × R

=> R = 520 ÷ 65

=> R = 8%

Therefore The correct answer is 8%.

Additional Information

Total Amount (A)

The total amount returned after the time period is the sum of Principal and Interest: A = P + SI.

Finding Time (T)

If the Rate and Principal are known, Time can be calculated as: T = (SI × 100) ÷ (P × R).

Constant Interest Property

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

Rate-Time Product

The total interest percentage relative to the principal is always the product of Rate and Time (R × T) percent.

Q66. Answer: (d) 1 percent

The correct answer is 1 percent.

Key Points

• Green plants in terrestrial ecosystems capture only about 1 percent of the solar energy that reaches them.

• This energy is utilized for the process of photosynthesis, where it is converted into chemical energy.

• The chemical energy is stored in the form of glucose and other organic molecules.

• The efficiency of solar energy capture by plants is relatively low due to various factors such as reflection, transmission, and absorption of light by non-photosynthetic parts.

• Despite the low percentage, this energy forms the base of the food chain in terrestrial ecosystems, supporting a wide range of life forms.

Additional Information

• Photosynthesis

• It is the process by which green plants, algae, and some bacteria convert light energy into chemical energy.

• Photosynthesis primarily occurs in the chloroplasts of plant cells.

• Energy Transfer in Ecosystems

• Energy captured by plants is transferred to herbivores when they consume plants, and subsequently to carnivores when they consume herbivores.

• Only about 10 percent of the energy is transferred from one trophic level to the next.

• Solar Energy Utilization

• A large portion of solar energy is not used for photosynthesis and is instead reflected or absorbed as heat.

• Plants have evolved various adaptations to maximize their light absorption efficiency.

Q67. Answer: (a) 3 minutes

Shortcut Trick

Relative speed of policeman = 10 − 8 = 2 km/h

Distance gap to close = 100 m = 0.1 km

Time required = Distance ÷ Relative speed = 0.1 ÷ 2 = 1/20 hours

Time in minutes = 1/20 × 60 = 3 minutes

Therefore The correct answer is 3 minutes.

Alternate Method

Given:

Speed of the policeman (S_p) = 10 km/h

Speed of the thief (S_t) = 8 km/h

Initial distance ahead (D) = 100 m = 0.1 km

Formula Used:

Relative Speed = S_p − S_t (Since they move in the same direction)

Time = Distance ÷ Relative Speed

Calculations:

=> Relative Speed = 10 − 8 = 2 km/h

=> Time required to catch the thief = 0.1 km ÷ 2 km/h = 0.05 hours

=> To convert hours into minutes, multiply by 60:

=> Time required = 0.05 × 60 = 3 minutes

Therefore The correct answer is 3 minutes.

Additional Information

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Relative Speed (Same Direction)

When two bodies move in the same direction at speeds S1 and S2 (where S1 > S2), their relative speed is S1 − S2.

Relative Speed (Opposite Direction)

When two bodies move towards each other at speeds S1 and S2, their relative speed is S1 + S2.

Speed Unit Conversion

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

Q68. Answer: (d) Na

The correct answer is Na.

Key Points

• Sodium (Na) is extracted by the process of electrolytic reduction.
• This method involves the electrolysis of molten sodium chloride (NaCl).
• The process is carried out in a Down's cell where sodium ions are reduced to form sodium metal at the cathode.
• Electrolytic reduction is used for metals that are highly reactive and cannot be reduced by chemical methods.
• Other metals like zinc, iron, and lead are typically extracted through reduction by carbon or carbon monoxide.

Additional Information

• Electrolytic Reduction
• It is a process where metals are extracted from their ores using electrical energy.
• This method is primarily used for metals that are highly reactive and cannot be extracted by reduction with carbon.
• Down's Cell
• A Down's cell is an electrolytic cell used to obtain sodium metal by the electrolysis of molten sodium chloride.
• In this process, chlorine gas is also produced at the anode as a by-product.
• Other Extraction Methods
• Metals like zinc and iron are extracted from their ores by reduction using carbon or carbon monoxide.
• Lead is typically extracted by roasting its sulfide ore followed by reduction.

Q69. Answer: (c) 111u

Given:

The question asks for the formula unit mass of $CaCl_2$.

Concept Used:

The formula unit mass of a compound is the sum of the atomic masses of the atoms present in the formula unit.

Atomic Masses:

Calcium (Ca) = 40 u

Chlorine (Cl) = 35.5 u

Calculation:

We have,

$CaCl_2$

=> Formula unit mass = (Atomic mass of Ca) + 2 × (Atomic mass of Cl)

=> Formula unit mass = 40 u + 2 × 35.5 u

=> Formula unit mass = 40 u + 71 u

=> Formula unit mass = 111 u

Therefore The formula unit mass of $CaCl_2$ is 111 u.

Q70. Answer: (a) 26cm

Shortcut Trick

Convert the mixed fraction 2124 4/7 into an improper fraction: 14872/7.

Using the Surface Area formula $4\pi r^2$: $(4 \times 22/7 \times r^2) = 14872/7$.

Simplify: $88 \times r^2 = 14872 \Rightarrow r^2 = 169$.

Since r = 13 cm, the Diameter (2r) = 26 cm.

Therefore The correct answer is 26 cm.

Alternate Method

Given:

Surface Area of the sphere = 2124 4/7 cm^2 = 14872/7 cm^2

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Value of π = 22/7
Formula Used:
Surface Area of a sphere = $4\pi r^2$
Diameter (d) = 2 × Radius (r)
Calculations:
=> $4 \times (22/7) \times r^2 = 14872/7$
=> $(88/7) \times r^2 = 14872/7$
=> $88 \times r^2 = 14872$
=> $r^2 = 14872 \div 88$
=> $r^2 = 169$
=> $r = \sqrt{169} = 13$ cm
=> Diameter (d) = 2 × 13 cm
=> d = 26 cm
Therefore The correct answer is 26 cm.
Additional Information
Volume of a Sphere
The amount of space enclosed by a sphere is given by Volume = $(4/3)\pi r^3$.
Hemisphere Formulas
For a hemisphere: Curved Surface Area = $2\pi r^2$ and Total Surface Area = $3\pi r^2$.
Surface Area to Volume Ratio
For a sphere, the ratio of Surface Area to Volume is 3/r.
Units of Measurement
Always ensure consistency: Area is in square units (cm^2), while Radius and Diameter are in linear units (cm).

Q71. Answer: (d) Growth hormone

The correct answer is Growth hormone.
Key Points
• The growth hormone is produced by the pituitary gland.
• It plays a crucial role in stimulating the growth of all organs and tissues in the body.
• Growth hormone promotes protein synthesis and increases muscle mass.
• It also influences the metabolism of fats and carbohydrates.
• A deficiency in growth hormone can lead to growth failure and other health issues.
Additional Information
• Adrenaline
• Also known as epinephrine, it is produced by the adrenal glands.
• It plays a role in the body's fight-or-flight response by increasing heart rate and blood flow to muscles.
• Glucagon
• A hormone produced by the pancreas.
• It helps increase blood glucose levels by promoting the conversion of glycogen to glucose in the liver.
• Insulin
• Another hormone produced by the pancreas.
• It helps lower blood glucose levels by facilitating the uptake of glucose into cells for energy production.

Q72. Answer: (d) 127.5º

Shortcut Trick
When internal bisectors of two angles of a triangle meet at a point S (Incenter), the angle angle QSR is given by:
angle QSR = 90º + (angle P ÷ 2)
=> angle QSR = 90º + (75º ÷ 2)
=> angle QSR = 90º + 37.5º
=> angle QSR = 127.5º
Therefore The correct answer is 127.5º.
Alternate Method

Given: In ΔPQR, mangle P = 75º. QS and RS are angle bisectors of angle Q and angle R.

Formula: Sum of all internal angles of a triangle is 180º.

=> In ΔPQR: angle P + angle Q + angle R = 180º

=> 75º + angle Q + angle R = 180º

=> angle Q + angle R = 180º − 75º = 105º

Since QS and RS are bisectors:

=> angle SQR + angle SRQ = (angle Q + angle R) ÷ 2

=> angle SQR + angle SRQ = 105º ÷ 2 = 52.5º

In ΔSQR:

=> angle QSR + angle SQR + angle SRQ = 180º

=> angle QSR + 52.5º = 180º

=> angle QSR = 180º − 52.5º = 127.5º

This result confirms that the required angle is 127.5º, matching option (4).

Therefore The correct answer is 127.5º.

Additional Information

Incenter of a Triangle

The Incenter (S) is the point where all three internal angle bisectors of a triangle intersect. It is the center of the incircle.

Ex-center Angle Formula

The angle formed by external bisectors of angle Q and angle R at point T is given by: angle QTR = 90º − (angle P ÷ 2).

Incircle Radius (Inradius)

The inradius (r) can be calculated using the formula r = Area ÷ semi-perimeter (s).

Q73. Answer: (c) Padma Shri

The correct answer is Padma Shri

Key Points

• In 2024, Ms. Prema Dhanraj was conferred the Padma Shri award in the field of Medicine.

• Dr. Prema Dhanraj is the Founder and Director of Agni Raksha, a non-profit organization providing Holistic Rehabilitation for Burn survivors from poor families, especially women and children.

• Agni Raksha also aims to support the socio-economic development of marginalized communities through skill training and income-generating programs.

• Dr. Prema founded Agni Raksha in memory of her parents in 1999 in Bangalore to treat burn patients.

Additional Information

• Bharat Ratna

• The highest civilian award in India, which translates to "Jewel of India". It is given for exceptional service or performance in any field.

• Padma Vibhushan

• The second-highest civilian award in India, which translates to "Lotus Grandeur". It is given for exceptional and distinguished service.

• Padma Bhushan

• The third-highest civilian award in India, which translates to "Lotus Decoration". It is given for distinguished service of a high order.

Q74. Answer: (a) 9.09%

Given:

A solution contains 25 g of copper chloride salt in 250 g of water.

Concept:

Mass by mass percentage concentration is defined as the mass of solute divided by the total mass of solution, multiplied by 100.

Formula Used:

Mass percentage = (Mass of solute / Total mass of solution) × 100

Calculation:

=> Mass of solute (copper chloride) = 25 g

=> Mass of solvent (water) = 250 g

=> Total mass of solution = Mass of solute + Mass of solvent

=> Total mass of solution = 25 g + 250 g = 275 g

=> Mass percentage = (25 g / 275 g) × 100

=> Mass percentage = 0.0909 × 100

=> Mass percentage = 9.09%

Therefore The correct answer is option 1: 0.0909

Q75. Answer: (a) 3/4

Given:

We need to find a fraction greater than 2/3 and less than 4/5.

Calculation:

2/3 ≈ 0.6667 and 4/5 = 0.8

Option 1: 3/4 = 0.75

Option 2: 1/2 = 0.5

Option 3: 5/6 ≈ 0.8333

Option 4: 9/11 ≈ 0.8182

Check each option:

Option 1: 0.75 lies between 0.6667 and 0.8. Correct

Option 2: 0.5 is less than 0.6667. Wrong

Option 3: 0.8333 is greater than 0.8. Wrong

Option 4: 0.8182 is greater than 0.8. Wrong

Therefore The fraction 3/4 (Option 1) is greater than 2/3 and less than 4/5.

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