RRB Group D Official Paper (Held On: 16 Dec, 2025 Shift 3) (Previous Year Paper)

RRB Group D • 2025 • 100 questions • 90 minutes • Answer key and solutions

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GENERAL SCIENCE

Q1. A battery of 12 V is connected in series with resistors of 1 Ω, 2 Ω, 3 Ω, 4 Ω and 10 Ω, respectively. How much current would flow through the 10 Ω resistor?

(a) 12 A
(b) 1.2 A
(c) 1.0 A
(d) 0.6 A

Q2. Which of the following is an example of a combination reaction?

(a) $CaO + H_2O \rightarrow Ca(OH)_2$
(b) $Zn + H_2SO_4 \rightarrow ZnSO_4 + H_2$
(c) $2KClO_3 \rightarrow 2KCl + 3O_2$
(d) $CuSO_4 + BaCl_2 \rightarrow BaSO_4 + CuCl_2$

Q3. Which of the following plants can have buds in the margins of leaves?

(a) Mango
(b) Bryophyllum
(c) Neem
(d) Peepal

Q4. If the frequency of a sound wave increases but its speed remains constant, then its wavelength will:

(a) Decrease
(b) Become zero
(c) Remain the same
(d) Increase

Q5. The potential energy acquired by a balloon when we press it (changing its shape), or by a spring inside a toy car when wound, is possessed by virtue of the object's _____.

(a) constant speed
(b) mass and volume
(c) acceleration rate
(d) configuration

Q6. The reaction between CaO and H_2O is highly exothermic and produces $Ca(OH)_2$. This is an example of:

(a) Double displacement reaction
(b) Combination reaction
(c) Rearrangement reaction
(d) Displacement reaction

Q7. A biologist cuts a hydra into two unequal parts. One part has a fully formed bud. What is most likely to happen to the bud?

(a) The hydra will not survive
(b) The bud will turn into a spore
(c) The bud will mature into a new hydra
(d) The bud will die instantly

Q8. What is the primary reason ores are enriched prior to the extraction of metals?

(a) To alter the internal crystal structure of the ore for conversion
(b) To improve the final metal's resistance to corrosion and rust
(c) To enhance the melting point of the mineral content for refining
(d) To eliminate earthy impurities such as sand and unwanted rock

Q9. A wooden block has a mass of 6 kg and its size is 40 cm × 30 cm × 20 cm. It is placed on a table resting on its 30 cm × 20 cm side. If g = 10 m/s², what is the pressure it puts on the table?

(a) 100 Pa
(b) 200 Pa
(c) 1000 Pa
(d) 300 Pa

Q10. What makes cartilage more flexible than bone in the human body?

(a) It contains a solid, protein-rich matrix.
(b) It contains a fluid-like matrix.
(c) It joins muscles to bones.
(d) It contains a matrix filled with fat.

Q11. Which of the following rules can be used to determine the direction of magnetic field due to a current carrying circular loop?

(a) Flemming’s Right Hand Rule
(b) Flemming’s Left Hand Rule
(c) Right Hand Thumb Rule
(d) Maxwell’s Left Hand Rule

Q12. The thalamus (receptacle) in flowers performs which of the following functions?

(a) Forms the ovules.
(b) Supports flower parts and can become part of the fruit.
(c) Produces nectar.
(d) Produces pollen grains.

Q13. A car moves with uniform speed along a straight road. Its distance–time graph is:

(a) a curve concave downwards
(b) a straight line parallel to the time-axis
(c) a straight line inclined to the time-axis
(d) a curve concave upwards

Q14. What happens to a stone tied to a string and moving in a circular path when the string is suddenly released?

(a) It returns to its starting point
(b) It stops immediately
(c) It changes direction and moves in a zig-zag path
(d) It continues moving in the direction it was heading at the moment of release

Q15. What is the primary function of the dendrites in a neuron?

(a) To form a synapse
(b) To transmit signals from the axon to the cell body
(c) To create an electrical impulse

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(d) To protect the neuron

Q16. Which particle did JJ Thomson discover?

(a) Neutron
(b) Proton
(c) Electron
(d) Nucleus

Q17. Which of the following is a converging lens?

(a) Cylindrical lens
(b) Convex lens
(c) Concave lens
(d) Planoconcave lens

Q18. When an acid reacts with a base, which of the following is/are always formed, regardless of the specific acid or base used?

(a) Hydrogen gas
(b) Carbon dioxide
(c) Salt and water
(d) Oxygen

Q19. Which of the following statements correctly describes image formation by a convex mirror?

(a) When the object is at infinity, the image is formed at the focus, real and inverted.
(b) When the object is at infinity, the image is formed at the pole and is real and inverted.
(c) When the object is at a finite distance, the image is formed between the pole and focus, virtual and diminished.
(d) When the object is at a finite distance, the image is formed beyond the centre of curvature, real and enlarged.

Q20. Which of the following activities best demonstrates that there is a force of attraction between particles of matter?

(a) Compressing a sponge
(b) Dissolving sugar in water
(c) Breaking a chalk stick
(d) Heating ice to form water

Q21. Read the given statements and select the most appropriate option.

Statements:

A: Coal and petroleum were formed from the degradation of bio-mass.

B: They are exhaustible resources.

(a) Only statement B is correct
(b) Both statements A and B are correct
(c) Neither statement A nor B is correct
(d) Only statement A is correct

Q22. How many grams of sodium carbonate are produced when 112 g of sodium hydroxide reacts with 44 g of carbon dioxide, resulting in 18 g of water?

(a) 132 g
(b) 143 g
(c) 138 g
(d) 141 g

Q23. Each succeeding member of the homologous series of alkane differs from the previous one by a unit that consists of:

(a) two carbon and two hydrogens
(b) one carbon and two hydrogens
(c) one carbon and three hydrogens
(d) two carbon and three hydrogens

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Q24. In which of the following parts of the human body do the epithelial cells have cilia?

(a) Buccal cavity
(b) Food pipe
(c) Respiratory tract
(d) Stomach wall

Q25. Which component(s) of blood is/are mainly responsible for transporting food, carbon dioxide and nitrogenous wastes?

(a) Plasma
(b) White blood cells
(c) Platelets
(d) Red blood corpuscles

MATHEMATICS

Q26. The ages of three siblings are x, 25, and 2x + 8 years, arranged in ascending order. The total ages of the youngest and the eldest is double the age of the third sibling. What is the age (in years) of the eldest?

(a) 39
(b) 30
(c) 33
(d) 36

Q27. Two trains, 136 metres and 144 metres in length are running in opposite directions. The first runs at the rate of 65 km/hr and the second at the rate of 79 km/hr. How long will they take to cross each other?3629

(a) 7 seconds
(b) 12 seconds
(c) 16 seconds
(d) 6 seconds

Q28. Pipe P can fill 3/8 part of a tank in 30 hours and pipe Q can fill 3/5 part of the same tank in 48 hours. Both P and Q were kept open for 4 hours, then both were closed. Pipe R alone was then opened and it emptied the water in the tank in 6 hours. Pipes P, Q and R together can fill the empty tank in:

(a) 112 hours
(b) 120 hours
(c) 104 hours
(d) 115 hours

Q29. If the third proportional of 9 and 51 be x, then what is the value of x ?

(a) 287
(b) 291
(c) 288
(d) 289

Q30. A and B working together can complete a piece of work in 2 days. B alone can complete the same work in 4 days. How long (in days) will A alone take to complete double the work?2523

(a) 11
(b) 4
(c) 9
(d) 8

Q31. A dealer makes a profit of 50% even after giving a 25% discount on the advertised price of a bike. If he makes a profit of Rs. 1,290 on the sale of the bike, what is the advertised price (in Rs.)?

(a) 5,160
(b) 5,236
(c) 5,298

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(d) 5,220

Q32. If 60% of 30% of 1/3 of a number is 204, find the number.

(a) 4390
(b) 7050
(c) 5250
(d) 3400

Q33. A rectangle has a perimeter of 64 cm. If its length is 8 cm more than its width, find the width of the rectangle.

(a) 12 cm
(b) 14 cm
(c) 16 cm
(d) 10 cm

Q34. The sides of a triangle are 35 cm, 21 cm and 28 cm. What is the length of its altitude corresponding to the side with length of 21 cm?

(a) 39 cm
(b) 64 cm
(c) 28 cm
(d) 29 cm

Q35. The area of a right-angled triangle is three-fourths of the area of a rhombus, whose one diagonal is 48 cm long. The sides containing the right angle of the triangle are 36 cm and 64 cm. Find the perimeter of the rhombus.

(a) 140 cm
(b) 160 cm
(c) 152 cm
(d) 184 cm

Q36. Manu purchased a microwave for Rs. 12,000 and sold it to Anuj at a loss of 12.5%. Anuj sold it to Rani at a profit of 20% and Rani sold it to Priya at a profit of 62/3%. Find the price at which Priya purchased it.

(a) Rs. 12,600
(b) Rs. 13,340
(c) Rs. 13,440
(d) Rs. 13,100

Q37. If the LCM of two numbers is 192 and their HCF is 32. If the first number is 64, find the second number.3197

(a) 95
(b) 96
(c) 94
(d) 93

Q38. The average of 13 numbers is 7. If each number is multiplied by 2, then what will the new average be?

(a) 7
(b) 2
(c) 13
(d) 14

Q39. The income of Raman is Rs. 83,000. He saves 16% of his income. If his income increases by 22% and expenditure increases by 25%, then his savings will:

(a) decrease by Rs. 828
(b) increase by Rs. 830
(c) increase by Rs. 827
(d) decrease by Rs. 833

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Q40. Simplify: (8.4 × 8.4 - 2.8 × 2.8)/(5.6 × 11.2)

(a) 0.5
(b) 5.6
(c) 1
(d) 4.2

Q41. If the radius of the base of a right circular cylinder is decreased by 17% and its height is increased by 138%, then what is the percentage increase (rounded off to the closest integer) in its volume?

(a) 61%
(b) 64%
(c) 55%
(d) 75%

Q42. 1/20 is what percentage of 2/70?

(a) 190%
(b) 350%
(c) 185%
(d) 175%

Q43. Two banks, A and B, offered loans at 3.5% and 7.5% per annum, respectively. Ajay borrowed an amount of Rs. 2,40,000 from each bank. Find the positive difference (in Rs.) between the amounts of simple interest paid to the two banks by Ajay after 4 years.

(a) 37,900
(b) 39,400
(c) 38,400
(d) 39,900

Q44. What is the mode of the following data?

5, 7, 6, 5, 9, 8, 6, 7, 11, 10, 5, 7, 6, 8, 6, 9, 10, 6

(a) 5
(b) 9
(c) 6
(d) 7

Q45. Simplify $(x^2 - 15x + 50)/(x - 10)$.

(a) x + 10
(b) x + 5
(c) x − 5
(d) x − 10

Q46. Zakir travels from City A to City B. If Zakir drives his car at 3/8 th of his normal speed, then he reaches City B 10 minutes late. Find the time (in minutes) that Zakir would have taken to travel from City A to City B if he drove at his normal speed.

(a) 10
(b) 14
(c) 5
(d) 6

Q47. Simplify $(3\text{^}6 \div 3^2)^2 \times (3^3 \div 3\text{^}4)$.

(a) 3^7
(b) 34
(c) 310
(d) 32

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Q48. If an item marked at Rs. 3,392 is sold for Rs. 1,696, then what is the discount percentage?

(a) 49%
(b) 52%
(c) 50%
(d) 51%

Q49. Rs. 1,071 is to be divided among three persons M, N and T. If the shares of M and N are in the ratio 3 : 9 and that of N and T are in the ratio 6 : 9, what is the share (in Rs.) of N?

(a) 376
(b) 380
(c) 379
(d) 378

Q50. A boy standing 12 m away from a flagpole observes the top of the pole at an angle of elevation of 60°. Find the height of the flagpole.

Note: Consider the height of the boy as 0 m.

(Use $\sqrt{3} \approx 2$)

(a) 20 m
(b) 18 m
(c) 22 m
(d) 24 m

GENERAL INTELLIGENCE & REASONING

Q51. Town D is to the south of Town E. Town F is to the east of Town D. Town G is to the north of Town F. Town H is to the west of Town G. Town E is to the north-east of Town H. What is the position of Town G with respect to Town E?

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

Q52. Seven people, A, B, C, D, E, F and G, are sitting in a row, facing north. Only five people sit to the right of A. Only five people sit to the left of B. F is the immediate neighbour of G and E. C sits second to the left of E. How many people sit to the left of G?

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

Q53. In a certain code language, 'XANJ' is coded as '98' and 'VLQG' is coded as '116'. What is the code for 'ZRHU' in that language?

(a) 141
(b) 146
(c) 130
(d) 139

Q54. Parvesh ranked 12^(th) from the top and 38^(th) from the bottom in his class. How many students are there in the class?

(a) 39
(b) 59
(c) 49
(d) 50

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Q55. Anita starts from Point A and drives 6 km towards the south. She then takes a left turn, drives 8 km, turns left and drives 10 km. She then takes a right turn and drives 2 km. She then takes a right turn and drives 4 km. She takes a final right turn, drives 4 km and stops at Point D. How far(shortest distance) and in which direction is Point D with respect from Point A?

(All turns are 90° turns only unless specified.)

(a) 8 km towards east
(b) 8 km towards south
(c) 12 km towards west
(d) 6 km towards east

Q56. 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 is the letter-cluster pair that 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) MR - LQ
(b) EJ - DI
(c) PU - OT
(d) QV - PV

Q57. Refer to the given series and answer the question that follows (all numbers are single digit numbers only). Counting to be done from left to right only.

(Left) 4 7 5 1 3 2 9 1 6 9 7 4 6 2 8 1 3 8 8 8 4 7 3 7 7 9 1 (Right)

How many such odd numbers are there, each of which is immediately preceded by an odd number and also immediately followed by an even number?

(a) 5
(b) 4
(c) 3
(d) 6

Q58. Which of the following letter-number clusters will replace the question mark (?) in the given series to make it logically complete?

HO22 JQ31 LS40 NU49 ?

(a) PX58
(b) PX59
(c) PW59
(d) PW58

Q59. What should come in place of the question mark (?) in the given series?

717 707 710 700 703 ?

(a) 691
(b) 695
(c) 693
(d) 697

Q60. In a certain code language,

‘A ? B’ means ‘A is the daughter of B’

‘A = B’ means ‘A is the son 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 C related to L if 'C ? D √E = F @ L'?

(a) Mother's sister
(b) Daughter
(c) Sister
(d) Sister's daughter

Q61. What should come in place of the question mark (?) in the given series based on the English alphabetical order?

DKQ GNT JQW MTZ ?

(a) SWY
(b) PWC
(c) RYC
(d) QXD

Q62. A, B, C, D, E, F and G are sitting around a circular table, facing the centre. B sits third to the left of D. A sits second to the left of G. D is the immediate neighbour of both C and A. E is not an immediate neighbour of B. How many people sit between E and F when counted from the right of E?

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

Q63. Jhanvi ranked 14^(th) from the top and 6^(th) from the bottom in her class. How many students are there in the class?

(a) 17
(b) 23
(c) 21
(d) 19

Q64. If '+' means '−', '−' means '×', '×' means '÷' and '÷' means '+', then what will come in place of the question mark (?) in the following equation?

52 − 14 ÷ 169 + 456 × 12 = ?

(a) 859
(b) 815
(c) 899
(d) 836

Q65. L, M, N, O, P and Q are sitting around a circular table facing the centre. M sits second to the left of P. N sits second to the right of Q. O is on the immediate left of M. Who is sitting on the immediate right of L?

(a) N
(b) Q
(c) P
(d) O

Q66. 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.)

(15, 75, 5)

(12, 36, 3)

(a) (11, 88, 6)
(b) (18, 48, 9)
(c) (14, 28, 2)
(d) (17, 49, 3)

Q67. Refer to the given series and answer the question that follows (all numbers are single digit numbers only). Counting to be done from left to right only.

(Left) 1 5 4 6 4 5 4 8 1 9 8 3 4 (Right)

How many such even digits are there, each of which is immediately preceded by an even digit and also immediately followed by an odd digit?

(a) Four

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

Q68. Refer to the following series and answer the question (all numbers are single-digit numbers only). Counting to be done from left to right only.

(Left) 9 2 1 4 2 2 8 3 7 6 7 5 2 4 8 9 7 1 2 3 8 9 2 2 6 2 8 (Right)

How many such odd numbers are there, each of which is immediately preceded by an odd number and also immediately followed by an even number?

(a) 3
(b) 6
(c) 5
(d) 4

Q69. TM 13 is related to WR 16 in a certain way. In the same way, MF 18 is related to PK 21. To which of the given options is QJ 26 related, following the same logic?

(a) UM 28
(b) UP 29
(c) TO 29
(d) TM 28

Q70. What should come in place of the question mark (?) in the given series?

328 330 320 324 314 320 ?

(a) 306
(b) 310
(c) 308
(d) 312

Q71. If 2 is added to each odd digit and 1 is subtracted from each even digit in the number 3427165, which of the following digits will be third from the left in the new number thus formed?

(a) 1
(b) 5
(c) 9
(d) 7

Q72. 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 is the letter-cluster that 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) HIK
(b) XYA
(c) FHI
(d) KLN

Q73. Read the given statements and conclusions carefully. Assuming that the information given in the statements is true, even if it appears to be at variance with commonly known facts, decide which of the given conclusions logically follow(s) from the statements.

Statements:

All rugs are mats.

All mats are blankets.

All blankets are quilts.

Conclusions:

(I): All rugs are quilts.

(II): Some quilts are mats.

(a) Both conclusions (I) and (II) follow

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(b) Only conclusion (I) follows
(c) Only conclusion (II) follows
(d) Neither conclusion (I) nor (II) follows

Q74. PXTR is related to UCYW in a certain way based on the English alphabetical order. In the same way, KANS is related to PFSX. To which of the given options is LFKO related, following the same logic?
(a) OINR
(b) QKPT
(c) NHMQ
(d) PJOS

Q75. What should come in place of the question mark (?) in the given series?
14,22,38,62,94 ?
(a) 136
(b) 133
(c) 134
(d) 135

Q76. If 1 is added to each odd digit and 2 is subtracted from each even digit in the number 1874356, then what will be the sum of the digits that are second from the left and second from the right?
(a) 14
(b) 10
(c) 8
(d) 12

Q77. Read the given statements and conclusions carefully. Assuming that the information given in the statements is true, even if it appears to be at variance with commonly known facts, decide which of the given conclusions logically follow(s) from the statements.
Statements: Some pens are copies. All copies are erasers.
Conclusion (I) : Some pens are erasers.
Conclusion (II) : All erasers are copies.
(a) Neither conclusion (I) nor (II) follows
(b) Both conclusions (I) and (II) follow
(c) Only conclusion (II) follows
(d) Only conclusion (I) follows

Q78. In a certain code language, ‘hen hat house’ is coded as ‘zu ef lh’ and ‘lime hen rat’ is coded as ‘lh wf cm’. How is ‘hen’ coded in that language?
(a) lh
(b) zu
(c) ef
(d) wf

Q79. XO 16 is related to ZS 10 in a certain way. In the same way, IF 9 is related to KJ 3. To which of the given options is OP 19 related, following the same logic?
(a) NJ 18
(b) QT 13
(c) GT 14
(d) JU 16

Q80. Refer to the number series given below and answer the question that follows. Counting to be done from left to right only.
(NOTE: All numbers are single-digit numbers only.)
(Left) 6 5 7 9 7 7 1 3 4 5 2 3 1 9 6 8 1 5 1 4 6 5 3 5 3 2 7 (Right)
How many such odd numbers are there each of which is immediately preceded by an odd number and also

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immediately followed by an even number?

(a) 5
(b) 4
(c) 3
(d) 6

GENERAL AWARENESS AND CURRENT AFFAIRS

Q81. Which of the following is the oldest bird sanctuary in India?

(a) Vedanthangal Lake Bird Wildlife Sanctuary
(b) Mayani Bird Sanctuary
(c) Vellode Birds Wildlife Sanctuary
(d) Chilika Lake Bird Sanctuary

Q82. What is the height of the Chenab Rail Bridge above the riverbed?

(a) 359 m
(b) 859 m
(c) 478 m
(d) 300 m

Q83. Who became the fastest cricketer to score 2000 T20I runs in 2025?

(a) Babar Azam
(b) Jos Buttler
(c) Virat Kohli
(d) Sai Sudharsan

Q84. Who were the judges of the special bench that ordered an immediate ban on manual scavenging and sewer cleaning in metropolitan cities in early 2025?

(a) Justice DY Chandrachud and Justice Hima Kohli
(b) Justice UU Lalit and Justice Sanjay Kishan Kaul
(c) Justice Sudhanshu Dhulia and Justice Aravind Kumar
(d) Justice Ranjan Gogoi and Justice NV Ramana

Q85. In June 2025, the Ministry of Coal achieved a historic milestone with the allocation of its _____.

(a) 100th coal mine
(b) 300th coal mine
(c) 400th coal mine
(d) 200th coal mine

Q86. In which year did Smriti Mandhana become the fastest Indian woman to reach 4,000 ODI runs?

(a) 2023
(b) 2022
(c) 2024
(d) 2025

Q87. Which of the following municipal corporations has issued India's first certified green municipal bond in April 2025?

(a) Indore Nagar Nigam
(b) Lucknow Nagar Nigam
(c) Varanasi Nagar Nigam
(d) Ghaziabad Nagar Nigam

Q88. Satellite Technology Day 2025 honoured which of the following anniversaries of Aryabhata, the first indigenously built Indian satellite?

(a) 75th
(b) 40th

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(c) 25th
(d) 50th

Q89. What honourarium did the P C Chandra Puraskaar include?
(a) Rs. 5 lakh
(b) Rs. 15 lakh
(c) Rs. 20 lakh
(d) Rs. 10 lakh

Q90. In which of the following places was the regional workshop on 'Sangathan, Swasthya, Samriddhi: Women Collective's Action on Food, Nutrition, Health and Water, Sanitation and Hygiene,' held from 22^(nd) to 23^(rd) July 2025?
(a) Lucknow, Uttar Pradesh
(b) Bhopal, Madhya Pradesh
(c) Ranchi, Jharkhand
(d) Patna, Bihar

Q91. Which of the following was the focus of the National Workshop held at Gujarat University, organised by the Ministry of Minority Affairs in July 2025?
(a) Hinduism
(b) Sikhism
(c) Jainism
(d) Buddhism

Q92. Which Indian cricketer was inducted into the ICC Hall of Fame in June 2025?
(a) MS Dhoni
(b) Sachin Tendulkar
(c) Sourav Ganguly
(d) Virat Kohli

Q93. Who won the 2025 French Open men's singles title?
(a) Novak Djokovic
(b) Jannik Sinner
(c) Carlos Alcaraz
(d) Rafael Nadal

Q94. Which award did Armando Colaco receive in January 2025?
(a) Khel Ratna Award
(b) Dronacharya Award
(c) Arjuna Award
(d) MAKA Trophy

Q95. What is the enhanced credit limit under the Modified Interest Subvention Scheme (MISS) for Kisan Credit Card (KCC) loans as per the Union Budget, 2025–26?
(a) Rs. 2 lakh
(b) Rs. 3 lakh
(c) Rs. 5 lakh
(d) Rs. 4 lakh

Q96. The National Vaccination Day in India is observed on 16 March every year to commemorate the first administration of which vaccine in India?
(a) Dengue
(b) HIV
(c) Polio
(d) Malaria

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Q97. Indian exports to US faced a 50% US tariff starting 27 August 2025, for buying discounted oil from _____.

(a) Iraq
(b) Russia
(c) Iran
(d) Saudi Arabia

Q98. Which of the following cities hosted the first Climate Week in May 2025?

(a) Mexico City
(b) Rio de Janeiro
(c) Washington
(d) Panama City

Q99. Where was the United Nations Troop Contributing Countries' (UNTCC) Chiefs' Conclave held in October 2025?

(a) New Delhi
(b) Bengaluru
(c) Chennai
(d) Mumbai

Q100. In June 2025, the World Bank approved a Rs. 3,700 crore loan for lake rejuvenation in which of the following cities of India to aid flood resilience?

(a) Chennai
(b) New Delhi
(c) Hyderabad
(d) Bengaluru

ANSWER KEY

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

SOLUTIONS

Q1. Answer: (d) 0.6 A

The correct answer is 0.6 A.

Key Points

• In a series circuit, the total or equivalent resistance is calculated by simply adding the individual resistances of all resistors connected in the circuit.

• The formula for equivalent resistance (R) in series is R = R1 + R2 + R3 + R4 + R5. Given the values, R = 1 Ohm + 2 Ohm + 3 Ohm + 4 Ohm + 10 Ohm, which equals 20 Ohm.

• According to Ohm's Law, the relationship between voltage (V), current (I), and resistance (R) is given by the formula V = I × R, which can be rearranged to find current as I = V / R.

• Substituting the given potential difference of 12 V and the calculated total resistance of 20 Ohm into the formula: I = 12 / 20, which results in 0.6 A.

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• A fundamental characteristic of a series connection is that the current remains the same through every component in the circuit. Therefore, the current flowing through the 10 Ohm resistor is the same as the total current of the circuit, which is 0.6 A.

Additional Information

• Ohm's Law:

• Discovered by the German physicist Georg Simon Ohm in 1827, this law states that the current through a conductor between two points is directly proportional to the voltage across the two points, provided physical conditions like temperature remain constant.

• The SI unit of resistance is the Ohm (Ω), named in his honor.

• Series vs. Parallel Circuits:

• In a series circuit, there is only one path for the electrons to flow. If one component fails, the entire circuit is broken. The voltage is distributed across the resistors.

• In a parallel circuit, the voltage remains the same across each branch, but the total current is the sum of the currents through each branch. The total resistance in parallel is always less than the smallest individual resistance.

• Measurement Tools:

• An Ammeter is used to measure electric current in a circuit and is always connected in series because it has very low resistance.

• A Voltmeter is used to measure the potential difference and is always connected in parallel across the points where the voltage is to be measured due to its high resistance.

Important Points

• Current Consistency: It is a common misconception that resistors with higher resistance "consume" more current in a series circuit. In reality, the 1 Ohm resistor and the 10 Ohm resistor in this setup both experience exactly 0.6 A of current.

• Voltage Drop: While the current is the same, the voltage drop across each resistor varies. Using $V = I \times R$, the voltage drop across the 10 Ohm resistor would be 0.6 A × 10 Ohm = 6 V, which is exactly half of the total 12 V battery supply.

• Power Dissipation: The power dissipated by the 10 Ohm resistor can be calculated using $P = I^2R$. In this case, $P = (0.6)^2 \times 10 = 0.36 \times 10 = 3.6$ Watts.

Q2. Answer: (a) CaO + H2O → Ca(OH)2

The correct answer is CaO + H2O → Ca(OH)2.

Key Points

• A Combination Reaction is a type of chemical reaction where two or more reactants (elements or compounds) combine to form a single product. The general representation is A + B → AB.

• CaO + H2O → Ca(OH)2: In this reaction, Calcium Oxide (also known as Quick Lime) reacts vigorously with Water to produce Calcium Hydroxide (known as Slaked Lime). Since two reactants combine to form one single product, it is a classic example of a Combination Reaction. Hence, statement 1 is correct.

• Zn + H2SO4 → ZnSO4 + H2: This reaction involves Zinc displacing Hydrogen from Sulphuric Acid. This is an example of a Single Displacement Reaction, not a combination reaction. Hence, statement 2 is incorrect.

• 2KClO3 → 2KCl + 3O2: In this case, a single reactant, Potassium Chlorate, breaks down into two simpler products, Potassium Chloride and Oxygen, usually upon heating. This is a Decomposition Reaction. Hence, statement 3 is incorrect.

• CuSO4 + BaCl2 → BaSO4 + CuCl2: This reaction involves the exchange of ions between Copper(II) Sulphate and Barium Chloride to form Barium Sulphate and Copper(II) Chloride. It is categorized as a Double Displacement Reaction or a Precipitation Reaction. Hence, statement 4 is incorrect.

• Hence, the correct answer is CaO + H2O → Ca(OH)2.

Additional Information

• Exothermic Nature of Combination Reactions: Many combination reactions, such as the reaction of Quick Lime with Water, release a significant amount of heat. Such reactions are called Exothermic Reactions. This specific reaction is used in whitewashing walls, where the Slaked Lime reacts slowly with Carbon Dioxide in the air to form a thin layer of Calcium Carbonate.

• Decomposition Reactions: These are the opposite of combination reactions. A single substance splits into two or more substances. This process usually requires energy in the form of heat (Thermal Decomposition), light (Photolysis), or electricity (Electrolysis). For example, the electrolysis of Water (H2O) yields Hydrogen and Oxygen gases.

• Displacement Reactions: A more reactive element displaces a less reactive element from its compound. The Reactivity Series is used to determine which metal can displace another. For instance, Iron (Fe) can displace Copper (Cu) from a Copper Sulphate (CuSO4) solution because Iron is more reactive.

• Double Displacement Reactions: These occur when two ionic compounds in solution react by exchanging their cations and anions. Often, one of the products formed is an insoluble solid called a precipitate, as seen with Barium Sulphate (BaSO4) in the reaction between Barium Chloride and sodium sulphate.

Important Points

• Chemical Equations: A chemical equation must always be balanced to satisfy the Law of Conservation of Mass, which states

that mass can neither be created nor destroyed in a chemical reaction.

• Oxidation and Reduction (Redox): Most chemical reactions also involve the transfer of electrons. Oxidation is the gain of Oxygen or loss of Hydrogen/Electrons, while Reduction is the loss of Oxygen or gain of Hydrogen/Electrons.

• Physical States: In chemical equations, symbols like (s) for solid, (l) for liquid, (g) for gas, and (aq) for aqueous (dissolved in water) are used to provide more information about the reaction conditions.

Q3. Answer: (b) Bryophyllum

The correct answer is Bryophyllum.

Key Points

• Bryophyllum is a genus of plant species that belongs to the Crassulaceae family. It is widely recognized for its unique method of asexual reproduction.

• The leaves of Bryophyllum are broad and have notches along their margins. These notches contain specialized tissue that develops into adventitious buds.

• These buds are also known as epiphyllous buds. When a leaf matures or falls onto moist soil, these buds develop into small plantlets with their own roots and stems.

• Once the plantlets are sufficiently developed, they detach from the parent leaf and grow into independent new plants. Hence, the correct answer is Bryophyllum.

• This process allows the plant to multiply rapidly without the immediate need for seeds or pollination, ensuring survival in various environmental conditions.

Additional Information

• Vegetative Propagation:

• It is a form of asexual reproduction in plants where new individuals arise from vegetative parts like roots, stems, or leaves rather than from seeds.

• In natural vegetative propagation, plants use structures like runners (strawberry), tubers (potato), bulbs (onion), and leaf buds (Bryophyllum).

• Mango (Mangifera indica):

• Mango is a dicotyledonous plant that primarily reproduces sexually through seeds.

• In agriculture, it is often propagated through artificial vegetative methods like grafting to maintain specific fruit qualities, but it does not produce buds on its leaf margins. Hence, this option is incorrect.

• Neem (Azadirachta indica):

• Neem belongs to the Meliaceae family and is native to the Indian subcontinent.

• It reproduces mainly through seeds (neem beans) and occasionally through root suckers. Its leaves are used for medicinal purposes but do not have reproductive buds. Hence, this option is incorrect.

• Peepal (Ficus religiosa):

• The Peepal tree, or Sacred Fig, is known for its cordate-shaped leaves with a long distal tip.

• It reproduces via seeds, which are often dispersed by birds. While it is a hardy tree that can grow in crevices of walls, it does not utilize its leaf margins for budding. Hence, this option is incorrect.

Important Points

• Begonia is another common example of a plant that can produce buds on its leaves for the purpose of vegetative propagation.

• The adventitious buds in Bryophyllum are formed due to the presence of meristematic tissue at the edges of the leaf.

• Vegetative propagation is advantageous because the offspring are genetically identical to the parent, and it allows for faster growth compared to plants grown from seeds.

• The Bryophyllum plant is often colloquially called the "Air Plant" or "Miracle Leaf" due to its ability to sprout from detached leaves.

Q4. Answer: (a) Decrease

The correct answer is Decrease.

Key Points

• The fundamental relationship between the speed of a sound wave, its frequency, and its wavelength is expressed by the wave equation: $v = f \times \lambda$, where v is the wave speed, f is the frequency, and λ (lambda) is the wavelength.

• When the speed of a sound wave remains constant, the wavelength becomes inversely proportional to its frequency. This mathematical relationship implies that if one value increases, the other must decrease to maintain the constant product (speed).

• If the frequency of the sound wave increases, it means more wave cycles are passing through a point per second. To keep the speed unchanged in the same medium, the physical distance between those cycles (the wavelength) must decrease. Hence, the statement that wavelength decreases is correct.

• The speed of sound is primarily determined by the properties of the medium (such as density and elasticity) and environmental factors like temperature. Unless these medium properties change, the speed remains a constant value for all frequencies.

Additional Information

• Frequency (f):

• It represents the number of oscillations or cycles per unit of time.

• The SI unit of frequency is Hertz (Hz), named after the physicist Heinrich Hertz. 1 Hz is equivalent to 1 cycle per second.

• In acoustics, frequency is closely related to the perception of pitch; higher frequencies are perceived as higher-pitched sounds.

• Wavelength (λ):

• It is the distance between two consecutive identical points on a wave, such as from crest to crest or compression to compression.

• The SI unit of wavelength is the meter (m).

• Since sound is a longitudinal wave, the wavelength is the distance between the centers of two consecutive compressions or rarefactions.

• Speed of Sound (v):

• Sound travels at different speeds depending on the state of matter. It travels fastest in solids (e.g., 5960 m/s in steel), slower in liquids (e.g., 1482 m/s in water), and slowest in gases.

• In dry air at a temperature of 20 degrees Celsius, the speed of sound is approximately 343 meters per second.

Important Points

• Human Auditory Range: The typical range of hearing for a healthy young human is 20 Hz to 20,000 Hz. Sounds with frequencies below 20 Hz are known as infrasonic, while those above 20,000 Hz are ultrasonic.

• Effect of Temperature: For a gas like air, the speed of sound increases with temperature. For every 1 degree Celsius rise in temperature, the speed of sound in air increases by approximately 0.6 meters per second.

• Independent Variables: It is important to note that while frequency and wavelength are dependent on each other when speed is constant, the speed itself does not depend on the frequency or wavelength of the sound wave in a non-dispersive medium.

• Period (T): The time taken for one complete cycle is called the time period, which is the reciprocal of frequency (T = 1/f). The SI unit for the period is the second.

Q5. Answer: (d) configuration

The correct answer is configuration.

Key Points

• Potential Energy is defined as the energy possessed by an object by virtue of its position relative to others, stresses within itself, its electric charge, or its configuration.

• When we press a balloon, we apply an external force that changes its shape. This change in physical arrangement or configuration stores energy within the balloon's material. Hence, the mention of changing shape relates directly to configuration.

• A spring inside a toy car, when wound, undergoes a change in its coiling structure. The work done in winding the spring is stored as Elastic Potential Energy due to the altered configuration of the metal coils.

• The term configuration in physics refers to the relative positions of the constituent particles of a system or the geometrical shape of an object.

• This energy remains stored as long as the object is held in that specific state and is released when the object is allowed to return to its original form, often converting into Kinetic Energy.

Additional Information

• Types of Potential Energy:

• Gravitational Potential Energy: This is energy stored in an object due to its vertical position or height. The numerical value is calculated using the formula P.E. = mgh, where m is mass, g is acceleration due to gravity (approx 9.8 m/s^2), and h is height.

• Elastic Potential Energy: Stored in materials that can be stretched or compressed, such as rubber bands, trampolines, or springs.

• Chemical Potential Energy: Stored in the chemical bonds of substances, like in batteries, food, or fuel.

• Kinetic Energy:

• This is the energy of motion. An object moving at a constant speed possesses kinetic energy defined by the mass and the square of its velocity (K.E. = 1/2 mv^2).

• Unlike potential energy, kinetic energy cannot be stored; it is actively used during motion.

• Mechanical Energy:

• The sum of potential and kinetic energy in a system is called Mechanical Energy. According to the Law of Conservation of Energy, the total mechanical energy in an isolated system remains constant.

Important Points

• Configuration vs. Position: While position usually refers to the location of an object in a gravitational field, configuration refers to the internal arrangement or deformation of the object itself.

• Unit of Energy: The S.I. unit of energy is the Joule (J), named after the English physicist James Prescott Joule. One Joule is equal to the work done by a force of one Newton acting through a distance of one meter.

• Factors affecting Elastic Potential Energy: It depends on the spring constant (k), which represents the stiffness of the material, and the displacement (x) or the amount of deformation applied.

• Historical Context: The concept of Potential Energy was formally introduced in the 19th century by the Scottish engineer and physicist William Rankine.

Q6. Answer: (b) Combination reaction

p data-end="57" data-start="0">The correct answer is Combination reaction.

Key Points

• The reaction between Calcium Oxide (CaO) and Water (H2O) is a classic example of a Combination reaction. In this process, Quicklime (CaO) reacts vigorously with water to produce Slaked Lime [Ca(OH)2].

• A Combination reaction is defined as a chemical reaction where two or more reactants combine to form a single product. In this specific case, the two reactants (CaO and H2O) merge to form one product [Ca(OH)2]. Hence, the statement regarding it being a combination reaction is correct.

• This reaction is characterized by being highly exothermic. An Exothermic reaction is one in which heat energy is released into the surroundings. During the formation of Slaked Lime, a significant amount of thermal energy is evolved, which can even cause the water to boil.

• The chemical equation for this process is: CaO (s) + H2O (l) → Ca(OH)2 (aq) + Heat. This demonstrates the synthesis of a new substance from simpler ones.

Additional Information

• Types of Chemical Reactions:

• Displacement Reaction: This occurs when a more reactive element displaces a less reactive element from its compound. An example is the reaction between Iron (Fe) and Copper Sulphate (CuSO4), where iron replaces copper.

• Double Displacement Reaction: These are reactions in which there is an exchange of ions between the reactants to form new compounds. Often, one of the products formed is an insoluble precipitate (e.g., the reaction between Barium Chloride and Sodium Sulphate).

• Rearrangement Reaction: This involves the structural reorganization of a molecule to form an isomer. The atoms remain the same, but their connectivity or spatial arrangement changes.

• Practical Applications:

• The Slaked Lime produced is extensively used for whitewashing walls. After application, it reacts slowly with Carbon Dioxide (CO2) in the air to form a thin layer of Calcium Carbonate (CaCO3).

• This Calcium Carbonate layer gives a shiny, white finish to the walls, usually appearing 2 to 3 days after the whitewashing process.

Important Points

• Chemical Nomenclature:

• CaO is chemically known as Calcium Oxide and is commercially referred to as Quicklime or Burnt Lime.

• Ca(OH)2 is chemically known as Calcium Hydroxide and is commonly called Slaked Lime. When dissolved in water, the clear solution is known as Lime Water.

• Thermodynamic Context:

• The highly exothermic nature of the reaction is a critical safety consideration in industrial and laboratory settings, as the intensity of heat released can be dangerous if not controlled.

• In contrast to Exothermic reactions, Endothermic reactions are those that absorb heat from the surroundings to proceed, such as the decomposition of Calcium Carbonate back into CaO and CO2.

Q7. Answer: (c) The bud will mature into a new hydra

The correct answer is The bud will mature into a new hydra.

Key Points

• Hydra is a freshwater organism that primarily reproduces asexually through a process called budding. This occurs during favorable environmental conditions when nutrients are abundant.

• A bud begins as an outgrowth on the parent's body due to repeated cell division at one specific generative site. This bud eventually develops tentacles and a mouth while still attached to the parent.

• When a Hydra is cut into two unequal parts, its extraordinary regenerative power allows the pieces to survive. If one part contains a fully formed bud, that bud will continue its developmental cycle naturally. Hence, the statement that the bud will mature into a new hydra is correct.

• Once the bud reaches maturity, it constricts at the base and detaches from the parent body to become a self-sufficient,

independent organism. Hence, the statement that the bud will die or turn into a spore is incorrect.

• The process ensures that the offspring is a genetic clone of the parent, maintaining the biological traits of the species.

Additional Information

• Regeneration in Hydra: Hydra possess a remarkable ability to regenerate lost or damaged body parts. This was first discovered by Abraham Trembley in 1744. Even if the organism is fragmented, each piece (provided it is of a minimum size) can grow into a complete Hydra.

• Interstitial Cells: The secret behind Hydra's immortality and regeneration lies in its interstitial cells. These are totipotent or multipotent stem cells that constantly proliferate and differentiate into various cell types.

• Taxonomy: Hydra belongs to the phylum Cnidaria and the class Hydrozoa. They are characterized by a radially symmetrical body and a hypostome surrounded by stinging tentacles.

• Sexual Reproduction: While budding is the default mode of reproduction, Hydra can reproduce sexually when conditions become harsh (e.g., in winter). They develop temporary gonads (testes or ovaries) on the outer wall of the body.

Important Points

• Nematocysts: These are specialized stinging organelles within cells called cnidocytes. Hydra use these to paralyze prey such as Daphnia or Cyclops.

• Biological Immortality: Because of the constant turnover of their cells, Hydra do not undergo senescence (aging) in the same way most multicellular organisms do, making them a subject of intense longevity research.

• Gastrovascular Cavity: The bud is initially connected to the parent's digestive tract, allowing it to receive nourishment directly until it is capable of independent feeding.

• Body Structure: The body is diploblastic, consisting of two layers—the ectoderm and endoderm—separated by a gelatinous substance called mesoglea.

Q8. Answer: (d) To eliminate earthy impurities such as sand and unwanted rock

The correct answer is To eliminate earthy impurities such as sand and unwanted rock.

Key Points

• Ores mined from the earth are seldom pure; they are usually contaminated with large amounts of unwanted materials such as soil, sand, clay, and stony matter. These impurities are collectively referred to as gangue.

• The process used to remove these impurities from the ore before the metal is extracted is known as enrichment of ore or concentration of ore. Hence, the primary reason for enrichment is to eliminate earthy impurities like sand and rock, making option 4 correct.

• The extraction of metal from a concentrated ore is chemically and economically more feasible than extracting it directly from the raw mined ore.

• Various techniques for enrichment are selected based on the differences between the physical or chemical properties of the ore and the gangue.

• Common physical methods of enrichment include hydraulic washing (based on gravity), magnetic separation (based on magnetic properties), and froth flotation (specifically for sulfide ores).

Additional Information

• Hydraulic Washing: This is a type of gravity separation. It is based on the difference in the specific gravities of the ore and the gangue particles. It is frequently used for heavy oxide ores like hematite (iron ore) and tin stone.

• Froth Flotation Process: This method is predominantly used for the enrichment of sulfide ores (e.g., Copper pyrites, Galena). It relies on the principle that ore particles are wetted by oils (like pine oil) while gangue particles are wetted by water.

• Magnetic Separation: This method is applied when either the ore or the impurities possess magnetic properties. For example, Magnetite (an iron ore) can be separated from non-magnetic gangue using a magnetic roller.

• Leaching: This is a chemical method of enrichment. The ore is treated with a suitable reagent (like Sodium Hydroxide for Bauxite) that dissolves the ore but leaves the impurities insoluble.

• Analysis of Other Options:

• Option 1: Altering internal crystal structure occurs during processes like calcination or roasting (thermal treatment), not enrichment. Hence, statement 1 is incorrect.

• Option 2: Improving resistance to corrosion and rust is achieved after extraction through alloying, galvanizing, or painting. Hence, statement 2 is incorrect.

• Option 3: In metallurgy, fluxes are often added to lower the melting point of impurities, not to enhance the melting point of the mineral content. Hence, statement 3 is incorrect.

Important Points

• The entire scientific and technological process used for the isolation of the metal from its ores is known as metallurgy.

• Roasting: This is the process of heating sulfide ores strongly in the presence of excess air to convert them into oxides.

• Calcination: This involves heating carbonate ores or hydrated oxides in the absence or limited supply of air to remove moisture

and volatile impurities, converting them into oxides.

• Reduction: Once the ore is enriched and converted to an oxide, it is reduced to the metallic state using reducing agents like carbon (coke), carbon monoxide, or through electrolysis for highly reactive metals like Aluminum and Sodium.

Q9. Answer: (c) 1000 Pa

The correct answer is 1000 Pa.

Key Points

• The pressure exerted by an object is defined as the thrust (force) acting per unit area of the surface. The formula is given by Pressure = Force / Area.

• First, we calculate the Force, which in this case is the weight of the wooden block. Weight is calculated using the formula W = m × g, where m is the mass and g is the acceleration due to gravity.

• Given: Mass (m) = 6 kg and g = 10 m/s^2. Therefore, Force (F) = 6 kg × 10 m/s^2 = 60 N.

• Next, we determine the Area of the surface in contact with the table. The block rests on its 30 cm × 20 cm side. We must convert these dimensions into meters (SI units) to find the area in square meters (m^2).

• Length = 30 cm = 0.3 m and Width = 20 cm = 0.2 m. The Area (A) = 0.3 m × 0.2 m = 0.06 m^2.

• Finally, we calculate the pressure: Pressure (P) = 60 N / 0.06 m^2. By shifting the decimal points, this becomes 6000 / 6 = 1000 Pa. Hence, the correct answer is 1000 Pa.

Additional Information

• Concept of Pressure:

• Pressure is a scalar quantity. It depends on the magnitude of the thrust and the surface area over which it is applied.

• The SI unit of pressure is the Pascal (Pa), which is equivalent to one Newton per square meter (N/m^2).

• If the same force is applied over a smaller area, the resulting pressure increases. Conversely, if the area increases, the pressure decreases.

• Applications of Pressure:

• Cutting Tools: Tools like knives and needles have sharp edges (very small area) to exert high pressure with minimal force, making it easier to cut or pierce materials.

• Foundation of Buildings: Large buildings have wide foundations to increase the surface area, thereby reducing the pressure exerted on the ground to prevent sinking.

• Heavy Vehicles: Trucks and tanks have wide tires or continuous tracks to distribute their massive weight over a larger area, reducing the pressure on the road or soft ground.

Important Points

• Thrust: The force acting perpendicularly on a surface is called thrust. In this numerical problem, the weight of the block acts as the thrust on the table.

• Variable Pressure based on Orientation:

• The same 6 kg block would exert different pressures if placed on different sides.

• On the 40 cm × 30 cm side (Area = 0.12 m^2), the pressure would be 60 / 0.12 = 500 Pa.

• On the 40 cm × 20 cm side (Area = 0.08 m^2), the pressure would be 60 / 0.08 = 750 Pa.

• This demonstrates that pressure is inversely proportional to the contact area for a constant force.

• Atmospheric Pressure: For context, the standard atmospheric pressure at sea level is approximately 101,325 Pa (or 101.3 kPa), which is significantly higher than the pressure exerted by this small wooden block.

Q10. Answer: (a) It contains a solid, protein-rich matrix.

The correct answer is It contains a solid, protein-rich matrix..

Key Points

• Cartilage is a specialized type of connective tissue that provides structural support while remaining significantly more flexible than bone.

• Unlike the hard and rigid matrix of bones, the matrix of cartilage is composed of proteins and sugars, which is solid yet flexible, allowing it to be compressed and bent without breaking. Hence, the correct answer is option 1.

• It consists of widely spaced cells called chondrocytes, which are embedded in the extensive extracellular matrix.

• Cartilage is found in various parts of the human body, including the joints between bones, the rib cage, the ear, the nose, the bronchial tubes, and the intervertebral discs.

• Its primary function is to smoothen bone surfaces at joints and provide a flexible framework for structures like the trachea and larynx.

Additional Information

• Bone Tissue:

• Bones have a hard, non-flexible matrix rich in calcium and phosphorus compounds.

• The cells of the bone, called osteocytes, are embedded in this hard matrix, providing the body with its primary structural framework.

• Tendons and Ligaments:

• Tendons are fibrous connective tissues that join muscles to bones. They have great strength but limited flexibility. Hence, statement 3 is incorrect as it describes tendons.

• Ligaments connect bone to bone and are very elastic with considerable strength.

• Adipose Tissue:

• This tissue is specialized for fat storage and is found below the skin and between internal organs.

• It acts as an insulator and a protective cushion for the body. Hence, statement 4 is incorrect as it describes adipose tissue.

Important Points

• Avascular Nature: One of the most important features of cartilage is that it is avascular, meaning it does not contain blood vessels. Nutrients must diffuse through the matrix to reach the cells, which is why cartilage heals more slowly than bone.

• Types of Cartilage:

• Hyaline Cartilage: The most common type, found on the ends of long bones at joints.

• Elastic Cartilage: Contains more elastic fibers, providing great flexibility to the external ear (pinna).

• Fibrocartilage: The strongest type, found in the intervertebral discs to act as a shock absorber.

• Ossification: During the developmental stage of a human embryo, much of the skeleton is made of cartilage, which is later replaced by bone through the process of ossification as the individual grows.

Q11. Answer: (c) Right Hand Thumb Rule

The correct answer is Right Hand Thumb Rule.

Key Points

• The Right Hand Thumb Rule, also known as Maxwell's Corkscrew Rule, is a fundamental principle used to determine the direction of the magnetic field associated with a current-carrying conductor, including a circular loop.

• According to this rule, if you imagine holding the current-carrying wire in your right hand such that your thumb points in the direction of the electric current, then your curled fingers will point in the direction of the magnetic field lines. Hence, statement 3 is correct.

• In the case of a circular loop, the magnetic field lines near the wire are in the form of concentric circles. As we move towards the center of the loop, the arcs of these big circles appear as straight lines.

• Every section of the wire contributes to the magnetic field lines in the same direction within the loop. At the center of the circular loop, the magnetic field is perpendicular to the plane of the loop.

• The strength of the magnetic field produced by a current-carrying wire at a given point depends directly on the magnitude of the current (I) passing through it and inversely on the distance (r) from the wire.

Additional Information

• Fleming's Left Hand Rule:

• This rule is primarily used to find the direction of the magnetic force acting on a moving charge or a current-carrying conductor placed in an external magnetic field.

• It is commonly applied in the working of an electric motor.

• The forefinger represents the field, the middle finger represents the current, and the thumb represents the motion or force. Hence, statement 2 is incorrect.

• Fleming's Right Hand Rule:

• This rule is used to determine the direction of the induced current when a conductor moves inside a magnetic field.

• It is the basis for the operation of an electric generator.

• The thumb shows the direction of motion, the forefinger shows the field, and the middle finger shows the direction of the induced current. Hence, statement 1 is incorrect.

• Maxwell's Left Hand Rule:

• There is no widely recognized "Maxwell's Left Hand Rule" in standard electromagnetism for determining field directions. James Clerk Maxwell is specifically associated with the Right-Hand Corkscrew Rule. Hence, statement 4 is incorrect.

Important Points

• Clock-Face Rule: A simple method to find the polarity of a circular loop. If the current flows in an anti-clockwise direction, the face of the loop behaves like a North Pole. If the current flows in a clockwise direction, the face behaves like a South Pole.

• Number of Turns: If there is a circular coil having n turns, the field produced is n times as large as that produced by a single turn. This is because the current in each circular turn has the same direction, and the field due to each turn then just adds up.

• Magnetic Field Formula: For a circular loop of radius R carrying current I, the magnetic field (B) at the center is given by B = (μ0I)

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/ (2R), where μ0 is the permeability of free space.

Q12. Answer: (b) Supports flower parts and can become part of the fruit.

The correct answer is Supports flower parts and can become part of the fruit..

Key Points

• The thalamus, also referred to as the receptacle, is the thickened part of a stem (pedicel) from which the flower organs grow.

• The primary function of the thalamus is to provide physical support and a structural base for the four floral whorls: the calyx (sepals), corolla (petals), androecium (stamens), and gynoecium (carpels). Hence, statement 2 is correct.

• In some species, the thalamus undergoes significant development post-fertilization to become a fleshy, edible part of the fruit, such as in Apples and Pears.

• Ovules are the structures that develop into seeds; they are formed and housed within the ovary of the carpel, not the thalamus. Hence, statement 1 is incorrect.

• Nectar is a sugar-rich liquid produced by specialized glands called nectaries. While nectaries are often located on the thalamus, the thalamus itself is not the producing tissue. Hence, statement 3 is incorrect.

• Pollen grains are the male microgametophytes of seed plants, which are produced within the pollen sacs of the anther, a component of the stamen. Hence, statement 4 is incorrect.

Additional Information

• Classification based on Thalamus Position:

• Hypogynous Flowers: The thalamus is convex or conical. The ovary occupies the highest position while other parts are situated below it. Examples include Mustard, Brinjal, and China Rose.

• Perigynous Flowers: The thalamus forms a rim or cup-like structure around the ovary. The ovary is said to be half-inferior. Examples include Rose, Peach, and Plum.

• Epigynous Flowers: The thalamus grows upwards to completely enclose the ovary and fuses with its wall. The other floral parts arise above the ovary. Examples include Guava, Cucumber, and the ray florets of Sunflower.

• False Fruits (Pseudocarps): These are fruits where the edible portion is derived from floral parts other than the ovary, most commonly the thalamus. In a Strawberry, the "fruit" is actually an aggregate of achenes (true fruits) embedded in a fleshy thalamus.

Important Points

• The thalamus is considered a modified axis or stem with very short internodes, causing the floral leaves to appear in close proximity.

• In Angiosperms, the successful attachment of the gynoecium to the thalamus is critical for nutrient transfer from the vegetative plant body to the developing embryo.

• In the Cashew (Anacardium occidentale), the "Cashew apple" is actually an accessory fruit formed by the pedicel and the thalamus, while the nut is the true fruit.

• The size and shape of the thalamus vary significantly across plant families and are used as a key diagnostic feature in botanical taxonomy.

Q13. Answer: (c) a straight line inclined to the time-axis

The correct answer is a straight line inclined to the time-axis.

Key Points

• Uniform speed is defined as the condition where an object covers equal distances in equal intervals of time, regardless of how small these time intervals may be.

• In a distance-time graph, the time is usually represented on the x-axis (independent variable) and the distance is represented on the y-axis (dependent variable).

• For an object moving with uniform speed, the distance traveled is directly proportional to the time elapsed (s prop. to t). This mathematical relationship results in a straight line when plotted on a graph.

• The slope (gradient) of a distance-time graph represents the speed of the moving object. Since the car is moving with uniform speed, the slope remains constant throughout the motion, which is the characteristic of an inclined straight line. Hence, the correct answer is a straight line inclined to the time-axis.

• If the graph were a straight line parallel to the time-axis, it would mean the distance does not change as time passes, indicating the car is at rest (speed = 0). Hence, statement 2 is incorrect.

• If the graph were a curve (either concave upwards or concave downwards), it would indicate that the distance covered per unit of time is changing, which represents non-uniform speed or acceleration. Hence, statements 1 and 4 are incorrect.

Additional Information

• Distance-Time Graph Interpretations:

• A horizontal line (parallel to the x-axis) indicates the object is stationary.

• A steeper slope in a distance-time graph indicates a higher speed.

• A curved line indicates accelerated or decelerated motion.

• Velocity-Time Graph (v-t Graph):

• For uniform speed (zero acceleration), the velocity-time graph is a straight line parallel to the time-axis.

• The area under the velocity-time graph gives the total displacement or distance covered by the object in a given time interval.

• The slope of a velocity-time graph represents the acceleration of the object.

• Uniform vs. Non-Uniform Motion:

• In uniform motion, an object moves along a straight line and covers equal distances in equal intervals of time; the acceleration is zero.

• In non-uniform motion, the object covers unequal distances in equal intervals of time; this involves a change in magnitude of velocity or direction, or both.

• Scalar and Vector Quantities:

• Distance and speed are scalar quantities as they only have magnitude.

• Displacement and velocity are vector quantities as they possess both magnitude and direction.

Important Points

• Slope Calculation: The speed (v) can be calculated from the distance-time graph using the formula: v = (s2 - s1) / (t2 - t1), where s is distance and t is time.

• Instantaneous Speed: For non-uniform motion, the speed at a specific point in time is found by drawing a tangent to the curve at that point and finding its slope.

• Practical Examples: A car using cruise control on a straight highway is an example of uniform speed. A falling apple is an example of non-uniform motion (acceleration due to gravity), which would show a curve on a distance-time graph.

• Units: The SI unit for distance is the meter (m) and for time is the second (s), making the SI unit for speed meters per second (m/s).

Q14. Answer: (d) It continues moving in the direction it was heading at the moment of release

The correct answer is It continues moving in the direction it was heading at the moment of release.

Key Points

• When a stone tied to a string is whirled in a circular path, its direction of motion changes continuously at every point along the circle.

• The velocity of the stone at any point is always directed tangent to the circular path at that specific point.

• To keep the stone in this circular motion, a centripetal force is required, which is provided by the tension in the string directed toward the center of the circle.

• According to Newton's First Law of Motion (the Law of Inertia), an object will continue to move in a straight line at a constant speed unless acted upon by an external force.

• When the string is suddenly released, the centripetal force immediately becomes zero. Without this force to pull it toward the center, the stone can no longer maintain its curved path.

• Due to the inertia of direction, the stone continues to move along the straight line it was following at the instant of release, which is the tangent to the circle. Hence, the correct answer is option 4.

Additional Information

• Uniform Circular Motion: This occurs when an object travels a circular path at a constant speed. Even though the speed is constant, the velocity is not, because the direction is constantly changing, meaning the object is always accelerating toward the center.

• Inertia of Direction: This is the property of a body to resist any change in its direction of motion. It is one of the three types of inertia, alongside inertia of rest and inertia of motion.

• Centripetal Force: The term "centripetal" means "center-seeking." The magnitude of this force is calculated using the formula $F = mv^2/r$, where m is the mass, v is the tangential speed, and r is the radius of the path.

• Tangential Path: A tangent is a straight line that touches a curve at exactly one point. In physics, if the constraining force of a circular motion is removed, the object's linear momentum carries it away along this tangential line.

• Real-world Examples:

• In a hammer throw event, the athlete rotates the hammer in a circle and releases it at a specific angle so that it flies off tangentially toward the farthest point.

• Mud flying off a rotating bicycle tire follows a tangential path, which is why mudguards are placed over the wheels to catch the debris.

• A slingshot works on the same principle, where the stone is released to travel in a straight line toward a target.

Important Points

• Velocity vs. Speed: In circular motion, speed is a scalar quantity (magnitude), while velocity is a vector quantity (magnitude and direction). Because the direction changes, velocity is never constant in circular motion.

• Force Removal: If the string breaks, no "new" force pushes the stone away; rather, it is the absence of force that allows the stone's existing inertia to take over.

• Angular Velocity: The rate at which the angle changes as the object moves around the circle is called angular velocity (ω), related to linear velocity by v = rω.

Q15. Answer: (b) To transmit signals from the axon to the cell body

The correct answer is To transmit signals from the axon to the cell body.

Key Points

• Dendrites are the specialized, branch-like protoplasmic extensions of a nerve cell (neuron) that function as the primary receptive units of the cell.

• The primary role of dendrites is to receive electrochemical signals (neurotransmitters) from the axons of neighboring neurons and conduct them toward the cell body, also known as the soma. Hence, the statement in option 2 is correct.

• Structure-wise, dendrites are highly branched, forming what is known as a dendritic tree. This extensive branching increases the surface area available for synaptic connections, allowing a single neuron to process information from thousands of other cells.

• While dendrites receive signals, they do not typically generate the main action potential; instead, they carry graded potentials. These are small electrical changes that accumulate at the axon hillock to determine if an impulse will be fired. Hence, statement 3 is incorrect as the axon hillock, not the dendrite, creates the main impulse.

• Dendrites do not serve a primary protective role; protection and metabolic support are provided by glial cells (such as astrocytes and oligodendrocytes) and the myelin sheath. Hence, statement 4 is incorrect.

• The synapse is the junction between the axon terminal of one neuron and the dendrite of another. While dendrites are part of this structure, their "function" is the transmission of the signal rather than the mere formation of the gap itself. Hence, statement 1 is less accurate than statement 2.

Additional Information

• Structure of a Neuron:

• Soma (Cell Body): Contains the nucleus and organelles. it integrates incoming signals from the dendrites to "decide" whether to pass the signal along.

• Axon: A long, cable-like projection that carries nerve impulses (action potentials) away from the cell body toward other neurons, muscles, or glands.

• Axon Terminals: Located at the end of the axon, these release neurotransmitters into the synaptic cleft to communicate with the next dendrite.

• Signal Transmission Process:

• The flow of information in a neuron is strictly unidirectional: it enters through the dendrites, passes through the soma, travels down the axon, and exits via the axon terminals.

• In the Central Nervous System (CNS), this communication allows for complex functions such as reflexes, memory, and motor control.

• Myelin Sheath:

• This is a fatty insulating layer formed by Schwann cells in the Peripheral Nervous System. It speeds up signal conduction through a process called saltatory conduction, where the impulse "jumps" between Nodes of Ranvier.

• Classification of Neurons:

• Sensory Neurons: Carry information from sensory receptors (like skin or eyes) toward the brain.

• Motor Neurons: Transmit commands from the brain or spinal cord to muscles and glands.

• Interneurons: Found within the brain and spinal cord, they connect sensory and motor neurons and handle complex information processing.

Important Points

• Neuroplasticity: The dendritic spines (small protrusions on dendrites) can change in shape, size, and number in response to learning and experience, a phenomenon known as synaptic plasticity.

• Neurotransmitters: Common chemicals involved in dendritic reception include Glutamate (excitatory), GABA (inhibitory), Acetylcholine, and Dopamine.

• Diseases: Damage to dendrites or their synapses is a hallmark of several neurodegenerative diseases, such as Alzheimer’s disease and Parkinson’s disease, which disrupt the efficient transmission of signals in the human brain.

Q16. Answer: (c) Electron

The correct answer is Electron.

Key Points

• J.J. Thomson (Joseph John Thomson), a British physicist, is credited with the discovery of the electron in the year 1897.

• The discovery was made during his experiments with cathode ray tubes (CRTs). He observed that the rays were deflected by electric and magnetic fields, indicating they were composed of negatively charged particles. Hence, the correct option is Electron.

• Initially, Thomson referred to these particles as "corpuscles" rather than electrons. He concluded that these corpuscles were the basic building blocks of atoms.

• He was the first to calculate the charge-to-mass ratio (e/m) of these particles, discovering that they were approximately 2,000 times lighter than a hydrogen ion.

• In 1904, based on his discovery, he proposed the Plum Pudding Model of the atom, where negatively charged electrons were embedded within a "soup" of uniform positive charge.

Additional Information

• Proton:

• The proton is a positively charged subatomic particle located in the nucleus.

• Ernest Rutherford is generally credited with the discovery of the proton. In 1917 (published in 1919), he proved that the hydrogen nucleus was present in other nuclei through nitrogen bombardment experiments.

• Neutron:

• The neutron is a subatomic particle with no net electric charge and a mass slightly greater than that of a proton.

• It was discovered by James Chadwick in 1932. This discovery was vital for the development of atomic energy and the understanding of isotopes.

• Nucleus:

• The nucleus is the small, dense, and positively charged region at the center of an atom.

• It was discovered by Ernest Rutherford in 1911 through the Alpha Particle Scattering Experiment (also known as the Gold Foil Experiment). This discovery overturned Thomson's Plum Pudding Model.

Important Points

• Nobel Prize: J.J. Thomson was awarded the Nobel Prize in Physics in 1906 for his work on the conduction of electricity by gases and the discovery of the electron.

• Atomic Theory Transition: Thomson's discovery was revolutionary because it proved that the atom was not indivisible, challenging John Dalton's Atomic Theory of 1803.

• Charge Determination: While Thomson found the ratio, the actual charge of an electron (1.602 x 10^-19 Coulombs) was measured by Robert Millikan in 1909 via the Oil Drop Experiment.

• Naming: Although Thomson discovered the particle, the name "electron" was actually coined earlier by G.J. Stoney in 1891 to describe the fundamental unit of electricity.

Q17. Answer: (b) Convex lens

The correct answer is Convex lens.

Key Points

• A convex lens is also known as a converging lens because it causes parallel rays of light passing through it to refract inward and meet (converge) at a single point known as the principal focus.

• Structurally, a convex lens is thicker at the center and thinner at the edges. This specific shape allows the lens to bend light rays toward the optical axis.

• The distance from the optical center of the lens to the principal focus is defined as the focal length. For a converging lens, the focal length is always considered positive in sign conventions.

• These lenses have the unique ability to form both real and virtual images. When an object is placed beyond the focus, the image produced is real and inverted. However, if the object is placed between the focus and the optical center, the image is virtual, erect, and magnified.

• The power of a lens is the reciprocal of its focal length in meters. Since a convex lens has a positive focal length, its optical power is also positive, measured in Dioptres (D).

Additional Information

• Concave Lens:

• Commonly referred to as a diverging lens, it is thinner at the center than at the edges.

• It causes parallel light rays to spread out or diverge. The rays appear to originate from a virtual focus located in front of the lens.

• It always produces a virtual, erect, and diminished image regardless of the object's position. It is used to correct Myopia (short-sightedness).

• Cylindrical Lens:

• A cylindrical lens focuses light into a line rather than a point, as it has different radii of curvature in the horizontal and vertical planes.

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• It is primarily used in optometry to correct astigmatism, a condition where the cornea or lens of the eye has an irregular curvature.

• Planoconcave Lens:

• This lens features one flat (plano) surface and one inwardly curved (concave) surface.

• It is a type of diverging lens with a negative focal length. It is frequently used in optical systems to expand light beams or to increase the focal length of other lens groups.

• Practical Applications:

• Convex lenses are utilized in magnifying glasses, microscopes, telescopes, and camera lenses.

• In the human eye, the crystalline lens is a natural convex lens that focuses light onto the retina.

• They are also used in spectacles to treat Hypermetropia (long-sightedness), helping the eye focus images correctly on the retina instead of behind it.

Important Points

• The Lens Formula is expressed as 1/f = 1/v - 1/u, where f is the focal length, v is the image distance, and u is the object distance.

• Magnification (m) for a lens is the ratio of image height to object height, also given by v/u. For a convex lens, the magnification can be greater than, equal to, or less than 1.

• The Lens Maker's Formula relates the focal length to the refractive index of the material and the radii of curvature of the two surfaces, which is essential for manufacturing corrective eyewear and optical instruments.

Q18. Answer: (c) Salt and water

The correct answer is Salt and water.

Key Points

• The reaction between an acid and a base is fundamentally known as a neutralization reaction.

• During this process, the hydrogen ions (H+) from the acid react with the hydroxide ions (OH-) from the base to produce water (H2O).

• The cation from the base and the anion from the acid combine to form an ionic compound called a salt.

• This outcome is universal for all acid-base reactions; whether the reactants are strong or weak, the formation of salt and water is the characteristic result.

• Neutralization reactions are typically exothermic in nature, meaning they release heat energy to the surroundings during the chemical change.

Additional Information

• Common Examples:

• A classic example is the reaction between Hydrochloric acid (HCl) and Sodium hydroxide (NaOH), which produces Sodium chloride (NaCl), commonly known as table salt, and water.

• Another example is the reaction between Sulfuric acid (H2SO4) and Potassium hydroxide (KOH) to form Potassium sulfate (K2SO4) and water.

• pH Levels:

• If a strong acid reacts with a strong base, the resulting salt solution is neutral, having a pH of 7.

• If a strong acid reacts with a weak base, the resulting salt will be acidic (pH less than 7).

• Conversely, a weak acid reacting with a strong base will produce a basic salt (pH greater than 7).

• Practical Applications:

• In medicine, individuals suffering from acidity take antacids, which are mild bases like Magnesium hydroxide [Mg(OH)2], to neutralize excess Hydrochloric acid in the stomach.

• In agriculture, if the soil is too acidic, farmers treat it with Quick lime (Calcium oxide) or Slaked lime (Calcium hydroxide) to neutralize the acidity and improve crop yield.

• In industry, factory wastes which are often acidic are neutralized with basic substances before being discharged into water bodies to protect aquatic life.

• Chemical Equation: The general word equation for this process is represented as: Acid + Base → Salt + Water.

Q19. Answer: (c) When the object is at a finite distance, the image is formed between the pole and focus, virtual and dimini...

The correct answer is When the object is at a finite distance, the image is formed between the pole and focus, virtual and diminished..

Key Points

• A convex mirror, also known as a diverging mirror, has a reflecting surface that bulges outward toward the light source. It always

forms a virtual, erect, and diminished image of a real object, regardless of the object's position.

• Statement 1: When the object is at infinity, the incident rays are parallel to the principal axis. After reflection, they appear to diverge from the principal focus (F) located behind the mirror. The image formed is virtual, erect, and highly diminished (point-sized). Hence, statement 1 is incorrect because it mentions the image is real and inverted.

• Statement 2: For an object at infinity, the image is always formed at the focus (F), not the pole (P). Furthermore, a convex mirror cannot produce a real and inverted image for a real object. Hence, statement 2 is incorrect.

• Statement 3: When the object is placed at a finite distance (anywhere between the pole and infinity), the reflected rays diverge, and their backward extensions intersect between the Pole (P) and the Focus (F) behind the mirror. The resulting image is virtual, erect, and diminished in size. Hence, statement 3 is correct.

• Statement 4: In a convex mirror, the image is always formed behind the mirror within the focal length. It is never formed beyond the centre of curvature (C), nor can it be real and enlarged for a real object. Hence, statement 4 is incorrect.

Additional Information

• Mirror Formula: The mathematical relationship between the object distance (u), image distance (v), and the focal length (f) is expressed as 1/f = 1/v + 1/u. For a convex mirror, the focal length (f) is always positive.

• Linear Magnification (m): This is defined as the ratio of the height of the image to the height of the object (h'/h), which also equals -v/u. For convex mirrors, the value of m is always positive (indicating an erect image) and less than 1 (indicating a diminished image).

• Applications: Due to their ability to produce an erect image and provide a wider field of view, convex mirrors are primarily used as rear-view mirrors in vehicles such as cars, trucks, and motorcycles. They are also used as security mirrors in shops and blind-spot mirrors on sharp road curves.

• Sign Convention: According to the New Cartesian Sign Convention, distances measured in the direction of incident light are positive. Since the Focus and Centre of Curvature of a convex mirror lie behind the reflecting surface, their distances from the Pole are taken as positive values.

Important Points

• Diverging Nature: A convex mirror is called a diverging mirror because it spreads out parallel light rays that strike its surface. This is why the focus is virtual, as rays only "appear" to meet there when traced backward.

• Image Characteristics: Unlike a concave mirror, which can form real, virtual, enlarged, or diminished images depending on the object position, a convex mirror is restricted to forming only virtual, erect, and diminished images of real objects.

• Range of Image: The image in a convex mirror always moves from the Focus (F) toward the Pole (P) as the object is brought closer to the mirror from infinity, but it never crosses the pole to the front of the mirror.

Q20. Answer: (c) Breaking a chalk stick

The correct answer is Breaking a chalk stick.

Key Points

• Particles of matter have force of attraction acting between them. This force keeps the particles together. The strength of this force of attraction varies from one kind of matter to another.

• Compressing a sponge: When we compress a sponge, we are actually pushing out the air trapped in the minute holes (pores) of the sponge. This activity primarily demonstrates that matter (like solids) can have spaces between particles or trapped air, rather than the force of attraction between the particles of the sponge material itself. Hence, statement 1 is incorrect.

• Dissolving sugar in water: This activity demonstrates that there are enough spaces between the particles of matter. When sugar dissolves in water, the sugar particles get into the spaces between the water particles. This is an example of diffusion and the presence of intermolecular spaces. Hence, statement 2 is incorrect.

• Breaking a chalk stick: When we try to break a chalk stick, we need to apply external force to overcome the internal force of attraction that holds the particles together. The fact that it requires effort to separate the particles into smaller pieces directly proves that there is a force holding them in a fixed structure. Different substances like iron nails, rubber bands, and chalk require different amounts of force to break, indicating different strengths of attraction. Hence, statement 3 is correct.

• Heating ice to form water: This activity demonstrates the effect of temperature on the physical state of matter. Heating provides kinetic energy to the particles, allowing them to overcome the forces of attraction, but the act of "breaking" a solid is a more direct mechanical demonstration of the existing force. Hence, statement 4 is incorrect.

Additional Information

• Nature of Particles: Matter is made up of very small particles (atoms or molecules). These particles are so small that they cannot be seen with the naked eye. This was famously demonstrated by the dilution of potassium permanganate in water.

• Characteristics of Particles:

• Particles of matter have space between them (Intermolecular space).

• Particles of matter are continuously moving (Kinetic energy).

• Particles of matter attract each other (Intermolecular force).

• Intermolecular Force of Attraction:

• In Solids, the force of attraction is maximum, which is why they have a definite shape and volume.

• In Liquids, the force of attraction is intermediate, allowing particles to slide over each other.

• In Gases, the force of attraction is minimum (negligible), allowing particles to move freely in any direction.

• Diffusion: The intermixing of particles of two different types of matter on their own is called diffusion. The rate of diffusion increases with an increase in temperature because particles gain more kinetic energy and move faster.

Important Points

• Cohesive Forces: The force of attraction between particles of the same substance is known as cohesion. This is what keeps a water drop spherical or a chalk stick intact.

• Adhesive Forces: The force of attraction between particles of different substances is called adhesion. This allows ink to stick to paper or water to wet a glass surface.

• Physical State Change: When we heat a solid, the vibrations of the particles increase. At the melting point, the heat energy overcomes the forces of attraction between the particles, and the solid converts into a liquid. This temperature remains constant during the change of state due to Latent Heat of Fusion.

• Compressibility: This is the property of being reduced in volume by pressure. Gases are highly compressible (e.g., LPG or CNG cylinders), whereas solids and liquids have very low compressibility because their particles are already very close to each other.

Q21. Answer: (b) Both statements A and B are correct

The correct answer is Both statements A and B are correct.

Key Points

• Coal and petroleum are known as fossil fuels because they were formed from the degradation of bio-mass (the remains of plants and animals) buried deep under the Earth's crust millions of years ago. Under conditions of high pressure and high temperature, the organic matter was converted into these fuels. Hence, statement A is correct.

• Natural resources that are available in limited quantities and can be depleted through human consumption are categorized as exhaustible resources. Since the rate of formation of coal and petroleum is extremely slow compared to the rate of human consumption, they are considered exhaustible and non-renewable. Hence, statement B is correct.

• The formation of coal specifically occurred through a process called carbonization, where dead vegetation was slowly converted into coal over 300 million years.

• Petroleum was formed from dead organisms that lived in the sea; as these organisms died, their bodies settled at the bottom and were covered by layers of sand and clay, eventually transforming into oil and gas.

• Because both statements accurately describe the origin and the nature of these resources, the correct choice is that both are valid. Hence, the correct answer is Both statements A and B are correct.

Additional Information

• Types of Natural Resources:

• Inexhaustible Natural Resources: These are present in unlimited quantities in nature and are not likely to be exhausted by human activities. Examples include sunlight and air.

• Exhaustible Natural Resources: These have a fixed supply and include forests, wildlife, minerals, coal, petroleum, and natural gas.

• Coal and its Products:

• Coke: A tough, porous, and black substance that is an almost pure form of carbon, used in the manufacture of steel.

• Coal Tar: A thick black liquid with an unpleasant smell, used as a starting material for synthetic dyes, drugs, and explosives.

• Coal Gas: Obtained during the processing of coal to get coke; it was historically used for street lighting in London (1810) and New York (1820).

• Petroleum Refining:

• Petroleum is a dark oily liquid known as "Black Gold" due to its high commercial value.

• It is a mixture of various constituents such as petroleum gas, petrol, diesel, lubricating oil, and paraffin wax.

• The process of separating these various fractions is called refining, which is carried out in a petroleum refinery.

• Environmental Impact:

• The burning of fossil fuels releases carbon dioxide, nitrogen oxides, and sulphur oxides, which contribute to global warming and acid rain.

• Since these resources are exhaustible, there is a global shift towards renewable energy sources like solar, wind, and hydroelectric power to ensure sustainable development.

Q22. Answer: (c) 138 g

The correct answer is 138 g.

Key Points

• This problem is based on the Law of Conservation of Mass, which states that in a chemical reaction, the total mass of the

reactants must be equal to the total mass of the products.

• The chemical reaction between Sodium Hydroxide (NaOH) and Carbon Dioxide (CO_2) produces Sodium Carbonate (Na_2CO_3) and Water (H_2O). The balanced chemical equation is: $2NaOH + CO_2 \rightarrow Na_2CO_3 + H_2O$.

• According to the question, the masses of the reactants are:

• Mass of Sodium Hydroxide (NaOH) = 112 g

• Mass of Carbon Dioxide (CO_2) = 44 g

• The total mass of the reactants is calculated as: 112 g + 44 g = 156 g.

• The masses of the products are:

• Mass of Sodium Carbonate (Na_2CO_3) = x g (to be determined)

• Mass of Water (H_2O) = 18 g

• The total mass of the products is calculated as: x g + 18 g.

• Applying the Law of Conservation of Mass: Total mass of reactants = Total mass of products.

• 156 g = x + 18 g

• x = 156 g - 18 g

• x = 138 g

• Therefore, 138 g of Sodium Carbonate is produced in the reaction.

Additional Information

• Law of Conservation of Mass: This fundamental principle of chemistry was established by Antoine Lavoisier in 1789. It implies that matter can neither be created nor destroyed in an isolated system during a chemical reaction.

• Sodium Carbonate (Na_2CO_3):

• Commonly known as Washing Soda or Soda Ash.

• It is a white, odorless, water-soluble salt that yields moderately alkaline solutions in water.

• Its primary uses include the manufacture of glass, paper, rayon, soaps, and detergents. It is also used as a water softener.

• Sodium Hydroxide (NaOH):

• Commonly known as Caustic Soda or Lye.

• It is a strong base and a highly caustic metallic base and alkali salt.

• It is used in many industries, primarily as a strong chemical base in the manufacture of pulp and paper, textiles, drinking water, soaps and detergents, and as a drain cleaner.

• Stoichiometry: This is the section of chemistry that involves using relationships between reactants and/or products in a chemical reaction to determine desired quantitative data. In this specific reaction, 2 moles of NaOH react with 1 mole of CO_2 to produce 1 mole of Na_2CO_3 and 1 mole of H_2O.

Important Points

• Antoine Lavoisier is often referred to as the "Father of Modern Chemistry" due to his meticulous documentation and discovery of the Law of Conservation of Mass.

• In open system reactions involving gases, the mass might appear to change if the gas escapes (like CO_2), but in a closed system, the mass always remains constant.

• The molar mass of NaOH is approximately 40 g/mol, CO_2 is 44 g/mol, Na_2CO_3 is 106 g/mol, and H_2O is 18 g/mol. The mass values provided in the question (112g, 44g, 18g) are consistent with the stoichiometric ratios of the balanced equation.

Q23. Answer: (b) one carbon and two hydrogens

The correct answer is one carbon and two hydrogens.

Key Points

• A homologous series is a sequence of compounds with the same functional group and similar chemical properties in which the members of the series differ by a specific structural unit.

• In the case of alkanes, which are saturated hydrocarbons containing only single bonds, the general formula is C_nH_{2n+2}.

• The first member of the alkane series is methane (CH_4), and the second member is ethane (C_2H_6). By subtracting the molecular formula of methane from ethane ($C_2H_6 - CH_4$), we get a difference of CH_2.

• This CH_2 unit consists of one carbon and two hydrogens. This unit is also known as the methylene group. Hence, the correct answer is one carbon and two hydrogens.

• Successive members of any homologous series, including alkenes (C_nH_{2n}) and alkynes (C_nH_{2n-2}), always differ by this same CH_2 unit.

• The molecular mass of each succeeding member in a homologous series increases by 14 atomic mass units (14u), as the atomic mass of carbon is 12u and hydrogen is 1u (12 + 2x1 = 14).

Additional Information

• Alkanes:

• Alkanes are known as paraffins because they have little affinity toward general reagents (low reactivity).

• Examples include Propane (C3H8), Butane (C4H10), and Pentane (C5H12). Each subsequent member is formed by adding one carbon and two hydrogens to the previous one.

• They primarily undergo substitution reactions and combustion.

• Physical Properties of Homologous Series:

• As the molecular mass increases within a series, there is a regular gradation in physical properties.

• For instance, the melting point and boiling point of alkanes increase with the increase in the number of carbon atoms due to the increase in Van der Waals forces.

• The solubility in a particular solvent also shows a regular gradation as the chain length increases.

• Chemical Properties:

• Members of a homologous series exhibit similar chemical properties because they possess the same functional group.

• All alkanes react with oxygen during combustion to produce carbon dioxide and water.

• Isomerism:

• While the first three members of the alkane series (methane, ethane, propane) do not show structural isomerism, members from butane (C4H10) onwards can exist in different structural forms.

Important Points

• The CH2 unit is the fundamental building block that distinguishes adjacent members in all hydrocarbon series.

• In IUPAC nomenclature, the suffix -ane is used for alkanes, -ene for alkenes, and -yne for alkynes.

• The general formula allows for the prediction of the formula of any member; for example, the 10th member of the alkane series (decane) has 10 carbon atoms and (2x10 + 2) = 22 hydrogen atoms, resulting in C10H22.

Q24. Answer: (c) Respiratory tract

The correct answer is Respiratory tract.

Key Points

• Ciliated epithelial cells are specialized epithelial cells that possess hair-like protoplasmic outgrowths called cilia on their free surface.

• In the human body, these cells are primarily located in the Respiratory tract, including the nasal passages, trachea (windpipe), and bronchi.

• The main function of the cilia in the respiratory system is to move mucus, dust, and pathogens away from the lungs and toward the throat, where they can be swallowed or expelled.

• This rhythmic, wave-like motion is essential for the mucociliary clearance mechanism, which serves as a primary defense against respiratory infections. Hence, the respiratory tract is the correct answer.

• These cells are usually columnar or cuboidal in shape and are anchored to a basement membrane.

Additional Information

• Buccal Cavity:

• The buccal cavity (mouth) is lined with Non-keratinized Stratified Squamous Epithelium.

• This tissue consists of multiple layers of cells designed to protect the underlying structures from mechanical stress and abrasion caused by chewing. Hence, statement 1 is incorrect.

• Food Pipe (Esophagus):

• The esophagus is also lined with non-keratinized stratified squamous epithelium.

• The primary role of the epithelium here is to provide a smooth surface for the passage of the bolus and to protect against the friction of food particles. Hence, statement 2 is incorrect.

• Stomach Wall:

• The stomach wall is lined with Simple Columnar Epithelium.

• These cells are specialized for secretion and protection; they secrete mucus to protect the stomach lining from hydrochloric acid (HCl) and digestive enzymes like pepsin. Hence, statement 4 is incorrect.

• Fallopian Tubes:

• Besides the respiratory tract, ciliated epithelium is also found in the oviducts (Fallopian tubes) of the female reproductive system.

• In this location, the cilia help in the transport of the ovum (egg) from the ovary toward the uterus.

Important Points

• Difference between Cilia and Microvilli:

• Cilia are involved in movement and transport of substances across the cell surface, whereas microvilli (found in the small intestine) are primarily for increasing the surface area for absorption.

• Clinical Significance:

• A genetic disorder known as Primary Ciliary Dyskinesia (PCD) or Kartagener Syndrome occurs when the cilia fail to move correctly, leading to chronic sinusitis, bronchitis, and infertility.

• Types of Epithelium:

• Squamous: Thin, flat cells (e.g., alveoli of lungs).

• Cuboidal: Cube-like cells (e.g., kidney tubules).

• Columnar: Tall, pillar-like cells (e.g., intestine).

Q25. Answer: (a) Plasma

The correct answer is Plasma.

Key Points

• Blood is a connective tissue in fluid form that consists of a fluid medium called plasma in which various cells are suspended.

• Plasma is primarily responsible for the transport of food (nutrients like glucose, amino acids, and lipids), carbon dioxide, and nitrogenous wastes (such as urea) in a dissolved form throughout the body. Hence, the correct answer is Plasma.

• It constitutes about 55% of the total blood volume and is composed of nearly 90-92% water, with the remaining 8-10% consisting of proteins, mineral salts, hormones, and waste products.

• While Red Blood Corpuscles (RBCs) primarily transport oxygen using hemoglobin, plasma carries carbon dioxide more efficiently as it is more soluble in water and is often transported in the form of bicarbonate ions.

• The process of transporting nitrogenous waste involves plasma carrying substances like urea from the liver to the kidneys for excretion.

Additional Information

• Red Blood Corpuscles (Erythrocytes):

• These are biconcave cells that lack a nucleus in most mammals to provide more space for hemoglobin.

• Their primary function is to transport oxygen from the lungs to all body tissues and a small amount of carbon dioxide back to the lungs.

• The average lifespan of an RBC is approximately 120 days, after which they are destroyed in the spleen.

• White Blood Cells (Leukocytes):

• These cells act as the body's immune system and help fight against infections and foreign particles.

• They are divided into Granulocytes (Neutrophils, Eosinophils, Basophils) and Agranulocytes (Lymphocytes, Monocytes).

• They are much fewer in number compared to RBCs but can increase rapidly during an infection or inflammation.

• Platelets (Thrombocytes):

• These are tiny, cell fragments produced in the bone marrow from megakaryocytes.

• Their main function is to help in blood clotting (coagulation) to prevent excessive bleeding when a blood vessel is injured.

• A low count of platelets can lead to excessive bleeding, a condition known as thrombocytopenia.

Important Points

• Plasma Proteins:

• Fibrinogen: Essential for blood clotting or coagulation.

• Globulins: Primarily involved in the defense mechanisms of the body (immunoglobulins).

• Albumins: Help in maintaining the osmotic balance of the blood.

• Transport Mechanism:

• Nutrients absorbed from the digestive tract, such as glucose and fatty acids, are dissolved in the plasma and distributed to cells.

• The pH level of blood is maintained around 7.4, which is slightly alkaline, largely due to the buffering capacity of plasma components.

• Hormones secreted by endocrine glands are also transported via plasma to their respective target organs.

Q26. Answer: (d) 36

Shortcut Trick

Youngest + Eldest = 2 × Middle sibling

=> x + (2x + 8) = 2 × 25

=> 3x + 8 = 50 => 3x = 42 => x = 14

Eldest age = 2x + 8 = 2(14) + 8 = 36 years

Therefore The correct answer is 36 years.

Alternate Method

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Given: Three ages in ascending order are x, 25, and 2x + 8.
Condition: Sum of Youngest and Eldest = 2 × Middle.
=> x + (2x + 8) = 2 × 25
=> 3x + 8 = 50
=> 3x = 50 − 8
=> 3x = 42
=> x = 14
Eldest sibling age:
=> 2x + 8 = 2(14) + 8
=> 28 + 8 = 36 years
Therefore The correct answer is 36 years.
Additional Information
Arithmetic Progression (AP)
When the sum of the first and third terms is double the second term, the terms are in AP. 2b = a + c.
Average Property
For three numbers in AP, the middle number is the Arithmetic Mean (Average) of the other two.
Linear Equations
Solving equations involves isolating the variable by performing inverse operations on both sides.

Q27. Answer: (a) 7 seconds

Shortcut Trick
Total distance = Sum of lengths of two trains = 136 + 144 = 280 m.
Relative speed (opposite direction) = Sum of speeds = 65 + 79 = 144 km/hr.
Relative speed in m/s = 144 × (5/18) = 8 × 5 = 40 m/s.
Time taken = Total distance ÷ Relative speed = 280 ÷ 40 = 7 seconds.
Therefore The correct answer is 7 sec.
Alternate Method
Given: Length of Train 1 (L1) = 136 m, Length of Train 2 (L2) = 144 m, Speed of Train 1 (S1) = 65 km/hr, Speed of Train 2 (S2) = 79 km/hr.
Formula Used: Time = (L1 + L2) ÷ (S1 + S2)
=> Total length = 136 + 144 = 280 m
=> Relative speed = 65 + 79 = 144 km/hr
=> Conversion to m/s = 144 × (5/18) m/s
=> Relative speed = 40 m/s
=> Time = 280 ÷ 40 = 7 sec
Therefore The correct answer is 7 sec.
Additional Information
Relative Speed in Same Direction
When two objects move in the same direction, relative speed is the difference of their speeds: |S1 − S2|.
Unit Conversion
To convert km/hr to m/s, multiply by 5/18. To convert m/s to km/hr, multiply by 18/5.
Crossing Stationary Objects
When a train crosses a platform/bridge of length P, total distance covered is Length of Train + P.

Q28. Answer: (b) 120 hours

Shortcut Trick
Pipe P fills full tank in 30 × (8/3) = 80 hr and Q in 48 × (5/3) = 80 hr.
Combined efficiency of P + Q = 1/80 + 1/80 = 2/80 = 1/40 units/hr.
In 4 hours, P + Q fill 4/40 = 1/10 part of the tank.
Pipe R empties this 1/10 part in 6 hours → R empties full tank in 60 hr.
Net efficiency (P + Q − R) = 1/40 − 1/60 = (3 − 2)/120 = 1/120.
Therefore The correct answer is 120 hr.

Alternate Method

Given: P fills 3/8 in 30 hr; Q fills 3/5 in 48 hr; R empties filled water in 6 hr.

Formula Used: Time = Total Work ÷ Net Efficiency

Person	Days	Total Work	Efficiency
Pipe P	80 hr	240 units	3
Pipe Q	80 hr	3	

=> Total work (LCM of 80, 80) = 240 units.

=> Water filled by P and Q in 4 hours = (3 + 3) × 4 = 24 units.

=> Pipe R empties 24 units in 6 hours → Efficiency of R = 24 ÷ 6 = 4 units/hr (negative).

=> Combined efficiency of P, Q and R = 3 + 3 − 4 = 2 units/hr.

=> Time taken by all three to fill the tank = 240 ÷ 2 = 120 hours.

Therefore The correct answer is 120 hr.

Additional Information

Inlet and Outlet Pipes

Inlet pipes have positive efficiency as they add water, while outlet/leak pipes have negative efficiency as they remove water.

Time and Efficiency Relation

Time taken is inversely proportional to efficiency. If a pipe fills 1/n part in 1 hour, it takes n hours to fill the full tank.

Pipes & Cisterns Net Work

Net part filled in 1 hour = (1/A + 1/B − 1/C), where A and B are inlets and C is an outlet.

Q29. Answer: (d) 289

Shortcut Trick

For two numbers a and b, the third proportional x is calculated as $x = b^2 \div a$.

Given a = 9 and b = 51.

=> $x = (51 \times 51) \div 9$

=> $x = 2601 \div 9 = 289$

Therefore The correct answer is 289.

Alternate Method

Given: First number (a) = 9, Second number (b) = 51, Third proportional = x.

Formula Used: In a continued proportion a : b :: b : x, the product of means equals the product of extremes.

=> 9 : 51 = 51 : x

=> 9 × x = 51 × 51

=> 9x = 2601

=> x = 2601 ÷ 9

=> x = 289

Therefore The correct answer is 289.

Additional Information

Mean Proportional

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

Fourth Proportional

For three numbers a, b, and c, the fourth proportional d is such that a/b = c/d, implying $d = (b \times c) \div a$.

Duplicate Ratio

The duplicate ratio of a : b is $a^2 : b^2$.

Q30. Answer: (d) 8

Shortcut Trick

Combined efficiency of A and B = 1/2 work/day.

Efficiency of B alone = 1/4 work/day.

Efficiency of A = 1/2 − 1/4 = 1/4 work/day.

Time for A to complete single work = 4 days.

Time for A to complete double the work = 4 × 2 = 8 days.

Therefore The correct answer is 8 days.

Alternate Method

Given: Time taken by (A + B) = 2 days, Time taken by B = 4 days.

Formula Used: Total Work = LCM of time taken; Efficiency = Total Work ÷ Time.

Person	Days	Total Work	Efficiency
A + B	2	4 units	2
B	4	1	

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

=> Efficiency of A = 2 − 1 = 1 unit/day

=> New Total Work = 2 × 4 units = 8 units

=> Time taken by A = New Total Work ÷ Efficiency of A

=> Time taken by A = 8 ÷ 1 = 8 days

Therefore The correct answer is 8 days.

Additional Information

Work-Efficiency Relationship

Time taken is inversely proportional to efficiency. If the amount of work is doubled, the time taken at the same efficiency also doubles.

Combined Work Formula

If A takes 'a' days and B takes 'b' days, together they take (a × b) ÷ (a + b) days to complete the work.

Pipes and Cisterns

Similar logic applies where efficiency of an outlet pipe is taken as negative, while the inlet pipe is positive.

Q31. Answer: (a) 5,160

Shortcut Trick

Ratio of CP : MP = (100 − Discount%) : (100 + Profit%).

CP : MP = (100 − 25) : (100 + 50) = 75 : 150 = 1 : 2.

Profit = 50% of CP => 0.5 × CP = 1290 Therefore CP = 2580.

Since MP = 2 × CP, Advertised Price = 2 × 2580 = 5,160.

Therefore The correct answer is Rs. 5,160.

Alternate Method

Given: Profit% = 50%, Discount% = 25%, Profit Amount = Rs. 1,290.

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

=> Cost Price (CP): (1290 ÷ 50) × 100 = Rs. 2,580.

=> Selling Price (SP): 2580 + 1290 = Rs. 3,870.

=> Marked Price (MP): MP × (100 − 25)% = 3870.

=> MP × 0.75 = 3870 => MP = 3870 ÷ 0.75 = Rs. 5,160.

Therefore The correct answer is Rs. 5,160.

Additional Information

Relationship between CP and MP

The ratio of Cost Price to Marked Price can be directly found using CP/MP = (100 − D%)/(100 + P%).

Advertised Price

Advertised Price is another term for Marked Price (MP) or List Price, on which discounts are calculated.

Q32. Answer: (d) 3400

Shortcut Trick

Product of percentages and fraction: 0.60 × 0.30 × (1/3) = 0.06

Value given: 0.06 × Number = 204

Number = 204 ÷ 0.06 = 3400

Therefore The correct answer is 3400.

Alternate Method

Given:

Percentage 1 = 60%
Percentage 2 = 30%
Fraction = 1/3
Resulting Value = 204
Calculations:
=> (60/100) × (30/100) × (1/3) × Number = 204
=> (6/10) × (3/10) × (1/3) × Number = 204
=> (18/300) × Number = 204
=> (6/100) × Number = 204
=> Number = (204 × 100) ÷ 6
=> Number = 34 × 100
=> Number = 3400
Therefore The correct answer is 3400.
Additional Information
Percentage to Fraction Conversion
To convert x% to a fraction, divide by 100: x/100. Example: 60% = 60/100 = 3/5.
Successive Percentage Calculation
When applying percentages successively (a% of b% of c), the net multiplier is (a/100) × (b/100) × (c/100).
Base Change Rule
If the result R is known for a series of operations on X, then X = R ÷ (Product of all multipliers).

Q33. Answer: (a) 12 cm

Shortcut Trick
In a rectangle, the sum of length and width (semi-perimeter) is 64 ÷ 2 = 32 cm.
Let the width be x, then length is x + 8.
x + (x + 8) = 32 → 2x = 24 → x = 12 cm.
Therefore The correct answer is 12 cm.
Alternate Method
Given: Perimeter of the rectangle = 64 cm, and Length = Width + 8 cm.
Formula Used: Perimeter = 2 × (Length + Width)
Let the width be W cm.
Then, the length (L) = W + 8 cm.
=> 2 × (L + W) = 64
=> (W + 8) + W = 64 ÷ 2
=> 2W + 8 = 32
=> 2W = 32 − 8
=> 2W = 24
=> W = 12 cm
Therefore The correct answer is 12 cm.
Additional Information
Area of a Rectangle
The total space occupied by the rectangle is calculated as Area = Length × Width.
Diagonal of a Rectangle
The distance between opposite vertices is given by the Pythagorean theorem: $d = \sqrt{(L^2 + W^2)}$.
Perimeter of a Square
Since all sides are equal in a square, the perimeter is simply 4 × side.

Q34. Answer: (c) 28 cm

Shortcut Trick
Check the ratio of the given sides: 35 : 21 : 28 => 5 : 3 : 4.
Since 3, 4, 5 is a Pythagorean Triplet, the triangle is right-angled.
The sides 21 cm and 28 cm are the perpendicular legs, and 35 cm is the hypotenuse.

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In a right-angled triangle, the altitude to one leg is the other leg itself.

Therefore The correct answer is 28 cm.

Alternate Method

Given: Sides of the triangle are 35 cm, 21 cm, and 28 cm.

Formula Used: Area of Triangle = 1/2 × Base × Height (Altitude)

Calculations:

=> First, verify the type of triangle using the Pythagoras Theorem:

=> $21^2 + 28^2 = 441 + 784 = 1225$

=> $35^2 = 1225$

=> Since $21^2 + 28^2 = 35^2$, the triangle is right-angled at vertex B.

=> For a right-angled triangle, if we take the side 21 cm (BC) as the base, then the side 28 cm (AB) becomes the altitude.

=> Area = 1/2 × 21 × 28 = 294 cm^2.

=> Let altitude to side 21 cm be h.

=> 1/2 × 21 × h = 294

=> h = (294 × 2) ÷ 21 = 28 cm.

Therefore The correct answer is 28 cm.

Additional Information

Pythagorean Triplets

Sets of three integers (a, b, c) that satisfy $a^2 + b^2 = c^2$. Common triplets include (3, 4, 5), (5, 12, 13), and (8, 15, 17). Any multiple like (21, 28, 35) is also a triplet.

Heron's Formula

Area = $\sqrt{[s(s-a)(s-b)(s-c)]}$, where s = (a+b+c)/2 is the semi-perimeter. This is used for finding the area of any scalene triangle.

Altitude to Hypotenuse

In a right triangle with legs a, b and hypotenuse c, the altitude to the hypotenuse h = (a × b) ÷ c.

Q35. Answer: (b) 160 cm

Shortcut Trick

Area of Right-angled Triangle = 1/2 × 36 × 64 = 1152 cm^2

Area of Rhombus = Area of Triangle ÷ (3/4) = 1152 × 4/3 = 1536 cm^2

Other diagonal (d2) = (2 × 1536) ÷ 48 = 64 cm

Side of Rhombus = $\sqrt{((48/2)^2 + (64/2)^2)} = \sqrt{(24^2 + 32^2)}$ = 40 cm

Perimeter = 4 × 40 = 160 cm

Therefore The correct answer is 160 cm.

Alternate Method

Given:

Right-angled triangle sides = 36 cm and 64 cm.

One diagonal of rhombus (d1) = 48 cm.

Formula Used:

Area of Triangle = 1/2 × base × height

Area of Rhombus = 1/2 × d1 × d2

Side of Rhombus (s) = $\sqrt{((d1/2)^2 + (d2/2)^2)}$

Calculations:

=> Area of Right-angled Triangle = 1/2 × 36 × 64

=> Area of Triangle = 18 × 64 = 1152 cm^2

=> According to question, 1152 = 3/4 × Area of Rhombus

=> Area of Rhombus = 1152 × 4/3 = 1536 cm^2

=> 1536 = 1/2 × 48 × d2

=> 1536 = 24 × d2

=> d2 = 1536 ÷ 24 = 64 cm

=> Side of Rhombus (s) = $\sqrt{((48/2)^2 + (64/2)^2)}$

=> s = $\sqrt{(24^2 + 32^2)} = \sqrt{(576 + 1024)}$

=> s = $\sqrt{1600}$ = 40 cm

=> Perimeter of Rhombus = 4 × side = 4 × 40 = 160 cm

Therefore The correct answer is 160 cm.

Additional Information

Properties of a Rhombus

All sides are equal, and diagonals bisect each other at right angles (90°). Opposite angles are equal.

Relationship between Side and Diagonals

For a rhombus with diagonals d1 and d2, the side s satisfies: $4s^2 = d1^2 + d2^2$.

Area of Triangle

Area = 1/2 × base × height. For a right-angled triangle, the base and height are the sides forming the 90° angle.

Q36. Answer: (c) Rs. 13,440

Shortcut Trick

Net multiplier method: Final Price = Initial CP × (100−L1)% × (100+P2)% × (100+P3)%.

Convert percentages to fractions: 12.5% = 1/8 (loss => 7/8), 20% = 1/5 (profit => 6/5), 6(2/3)% = 1/15 (profit => 16/15).

Price for Priya = 12,000 × (7/8) × (6/5) × (16/15).

Price for Priya = 12,000 × (672/600) = 12,000 × 1.12 = 13,440.

Therefore The correct answer is Rs. 13,440.

Alternate Method

Given → CP for Manu = Rs. 12,000; Loss1 = 12.5%; Profit2 = 20%; Profit3 = 6(2/3)%.

Formulas: SP = CP × (100 ± P/L)% | Profit% = (Profit/CP) × 100.

=> Price for Anuj = 12,000 − (12.5% of 12,000) = 12,000 − 1,500 = Rs. 10,500.

=> Price for Rani = 10,500 + (20% of 10,500) = 10,500 + 2,100 = Rs. 12,600.

=> Price for Priya = 12,600 + (6 2/3% of 12,600).

=> 6 2/3% = 20/3% = 20/(3 × 100) = 1/15.

=> Price for Priya = 12,600 + (12,600 ÷ 15) = 12,600 + 840 = Rs. 13,440.

Therefore The correct answer is Rs. 13,440.

Additional Information

Successive Percentage Change

When a value changes multiple times, the final value is found by multiplying the initial value by (100 ± r1)% × (100 ± r2)%...

Fractional Conversion

Using fractions like 1/8 for 12.5% or 1/15 for 6.67% simplifies calculations significantly in multi-step profit and loss problems.

Q37. Answer: (b) 96

Shortcut Trick

Second Number = (HCF × LCM) ÷ First Number

Second Number = (32 × 192) ÷ 64

Second Number = 192 ÷ 2 = 96

Therefore The correct answer is 96.

Alternate Method

Given:

LCM of two numbers = 192

HCF of two numbers = 32

First number (n1) = 64

Formula Used:

The product of two numbers is equal to the product of their HCF and LCM.

n1 × n2 = HCF × LCM

Calculations:

=> 64 × n2 = 32 × 192

=> n2 = (32 × 192) ÷ 64

=> n2 = 1 × 192 ÷ 2

=> n2 = 96

Therefore The correct answer is 96.

Additional Information

HCF and LCM Relation

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

HCF of Fractions

HCF of fractions = HCF of Numerators ÷ LCM of Denominators.

LCM of Fractions

LCM of fractions = LCM of Numerators ÷ HCF of Denominators.

Q38. Answer: (d) 14

Shortcut Trick

If each number in a data set is multiplied by a constant k, the average of the set is also multiplied by k.

Given Old Average = 7 and Multiplication Factor (k) = 2.

New Average = Old Average × k

=> 7 × 2 = 14.

Therefore The correct answer is 14.

Alternate Method

Given: Number of observations (n) = 13, Initial Average = 7.

Formula Used: Sum = Average × Number of observations

=> Original Sum of 13 numbers = 13 × 7 = 91

=> Since each number is multiplied by 2, the New Sum = 91 × 2 = 182

=> New Average = New Sum ÷ Total Numbers

=> New Average = 182 ÷ 13

=> New Average = 14

Therefore The correct answer is 14.

Additional Information

Linear Transformation of Average

If every observation x_i is changed to $a \times x_i + b$, then the new average X' becomes $a \times X + b$, where X is the original average.

Addition and Subtraction Rule

If a constant k is added to (or subtracted from) each observation, the new average is Old Average + k (or Old Average − k).

Division Rule

If each observation is divided by a non-zero constant k, the new average is Old Average ÷ k.

Q39. Answer: (b) increase by Rs. 830

Shortcut Trick

Income Raman = 100%, Savings = 16%, Expenditure = 84%.

Change in Income (22% of 100) = +22 units.

Change in Expenditure (25% of 84) = +21 units.

Change in Savings = 22 − 21 = +1 unit.

Savings increase = 1% of Rs. 83,000 = Rs. 830.

Therefore The correct answer is increase by Rs. 830.

Alternate Method

Given: Initial Income = Rs. 83,000 | Savings = 16% | Expenditure = 84%.

=> Initial Savings = 16% of 83,000 = 0.16 × 83,000 = Rs. 13,280.

=> Initial Expenditure = 84% of 83,000 = 0.84 × 83,000 = Rs. 69,720.

=> New Income = 83,000 × (122/100) = Rs. 1,01,260.

=> New Expenditure = 69,720 × (125/100) = Rs. 87,150.

=> New Savings = New Income − New Expenditure = 1,01,260 − 87,150 = Rs. 14,110.

=> Change in Savings = 14,110 − 13,280 = Rs. 830.

Therefore The correct answer is increase by Rs. 830.

Additional Information

Income Formula

Income = Expenditure + Savings. Any percentage change in components must balance this equation.

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Alligation Method

You can use alligation for income-expenditure-savings problems where % change in income lies between % change of savings and expenditure.

Successive Percentage Change

If a value changes by a% then b%, net change = a + b + (a×b)/100.

Q40. Answer: (c) 1

Shortcut Trick

Given expression is in the form $(a^2 - b^2) \div (c \times d)$.

Using the identity $a^2 - b^2 = (a - b)(a + b)$:

Numerator = $(8.4 - 2.8) \times (8.4 + 2.8) = 5.6 \times 11.2$

Result = $(5.6 \times 11.2) \div (5.6 \times 11.2) = 1$

Therefore The correct answer is 1.

Alternate Method

Given:

Expression: $(8.4 \times 8.4 - 2.8 \times 2.8) \div (5.6 \times 11.2)$

Formula Used:

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

Calculations:

=> Numerator = $(8.4)^2 - (2.8)^2$

=> Applying the formula: $(8.4 - 2.8)(8.4 + 2.8)$

=> Numerator = 5.6×11.2

=> Denominator = 5.6×11.2

=> Expression = $(5.6 \times 11.2) \div (5.6 \times 11.2)$

=> Value = 1

Therefore The correct answer is 1.

Additional Information

Algebraic Identities

$(a + b)^2 = a^2 + 2ab + b^2$ and $(a - b)^2 = a^2 - 2ab + b^2$.

Cube Identities

$a^3 + b^3 = (a + b)(a^2 - ab + b^2)$ and $a^3 - b^3 = (a - b)(a^2 + ab + b^2)$.

BODMAS Rule

Simplify expressions following the exact order: Brackets, Orders (powers/roots), Division & Multiplication, Addition & Subtraction.

Q41. Answer: (b) 64%

Shortcut Trick

Volume of cylinder depends on r^2 and h. Change in r = −17%, h = +138%.

Net change in r^2 = −17 − 17 + (−17 × −17)/100 = −34 + 2.89 = −31.11%.

Net change in Volume = −31.11 + 138 + (−31.11 × 138)/100.

=> 106.89 − 42.9318 = 63.9582% ≈ 64%.

Therefore The correct answer is 64%.

Alternate Method

Given: Decrease in radius (r) = 17%, Increase in height (h) = 138%.

Formula: Volume of Cylinder (V) = $\pi \times r^2 \times h$

=> Let the initial radius be 100 units and initial height be 100 units.

=> Initial Volume (V1) = $\pi \times (100)^2 \times 100 = 1{,}000{,}000\pi$

=> New radius (r') = 100 − 17% of 100 = 83 units.

=> New height (h') = 100 + 138% of 100 = 238 units.

=> New Volume (V2) = $\pi \times (83)^2 \times 238$

=> V2 = $\pi \times 6889 \times 238 = 1{,}639{,}582\pi$

=> Increase in Volume = $1{,}639{,}582\pi - 1{,}000{,}000\pi = 639{,}582\pi$

=> Percentage Increase = $(639{,}582\pi / 1{,}000{,}000\pi) \times 100 = 63.9582\%$

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=> Rounded to the closest integer = 64%.

Therefore The correct answer is 64%.

Additional Information

Volume of Cylinder

The volume of a right circular cylinder is calculated as Area of base × Height = $\pi r^2 h$.

Successive Percentage Change

For two changes a% and b%, the net change is [a + b + (ab/100)]%. For volume, since r is squared, we apply the successive formula thrice (for r, r, and h).

Surface Area Properties

Curved Surface Area (CSA) = $2\pi rh$ and Total Surface Area (TSA) = $2\pi r(r + h)$. Changes in radius and height affect these differently than volume.

Q42. Answer: (d) 175%

Shortcut Trick

Required percentage = (First value ÷ Second value) × 100

Required percentage = (1/20 ÷ 2/70) × 100

Required percentage = (1/20 × 70/2) × 100 = (70/40) × 100

Required percentage = 1.75 × 100 = 175%

Therefore The correct answer is 175%.

Alternate Method

Given:

First number = 1/20

Second number = 2/70 = 1/35

Formula Used:

Percentage = (Part / Whole) × 100

Calculations:

=> Required % = [(1/20) / (1/35)] × 100

=> Required % = (1/20) × (35/1) × 100

=> Required % = (35 / 20) × 100

=> Required % = 35 × 5

=> Required % = 175%

Therefore The correct answer is 175%.

Additional Information

Fraction to Percentage

To convert any fraction a/b into a percentage, multiply the fraction by 100 and add the % symbol.

Reciprocal Multiplication

Dividing by a fraction is the same as multiplying by its reciprocal: (a/b) ÷ (c/d) = (a/b) × (d/c).

Percentage Comparison

When calculating "x is what % of y", y always acts as the base (denominator).

Q43. Answer: (c) 38,400

Shortcut Trick

Net difference in interest rate per annum = 7.5% − 3.5% = 4%

Total difference for 4 years = 4% × 4 = 16%

Interest Difference = 16% of Principal (Rs. 2,40,000)

Difference = 0.16 × 2,40,000 = Rs. 38,400

Therefore The correct answer is Rs. 38,400.

Alternate Method

Given: Principal (P) = Rs. 2,40,000, Time (T) = 4 years, Rate A (R_A) = 3.5%, Rate B (R_B) = 7.5%

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

=> SI from Bank A = (2,40,000 × 3.5 × 4) ÷ 100

=> SI_A = 2,400 × 14 = Rs. 33,600

=> SI from Bank B = (2,40,000 × 7.5 × 4) ÷ 100

=> SI_B = 2,400 × 30 = Rs. 72,000

=> Positive Difference = SI_B − SI_A

=> Difference = Rs. 72,000 − Rs. 33,600 = Rs. 38,400

Therefore The correct answer is Rs. 38,400.

Additional Information

Difference in Simple Interest

When the principal and time are the same, the difference in interest is given by: ΔSI = P × ΔR × T ÷ 100, where ΔR is the difference in annual interest rates.

Total Amount in SI

The total amount (A) to be paid at the end of the term is the sum of Principal and Simple Interest: A = P + SI = P(1 + RT/100).

Simple Interest Nature

Simple Interest remains constant for every year if the principal and rate of interest do not change.

Q44. Answer: (c) 6

Shortcut Trick

To find the mode, identify the observation with the maximum frequency (most repeated value).

Frequency of 5 → 3 | Frequency of 6 → 5 | Frequency of 7 → 3

Frequency of 8 → 2 | Frequency of 9 → 2 | Frequency of 10 → 2 | Frequency of 11 → 1

The value 6 appears the most number of times (5 times).

Therefore The correct answer is 6.

Alternate Method

Given: Data set = {5, 7, 6, 5, 9, 8, 6, 7, 11, 10, 5, 7, 6, 8, 6, 9, 10, 6}

Formula Used: Mode = The value that occurs most frequently in a given set of data.

=> Frequency Count:

=> Number 5 occurs 3 times.

=> Number 6 occurs 5 times.

=> Number 7 occurs 3 times.

=> Number 8 occurs 2 times.

=> Number 9 occurs 2 times.

=> Number 10 occurs 2 times.

=> Number 11 occurs 1 time.

=> The maximum frequency is 5, which corresponds to the observation 6.

Therefore The correct answer is 6.

Additional Information

Arithmetic Mean

It is the sum of all observations divided by the total number of observations. Formula: Mean = (Σx_i) ÷ n.

Median

The middle value of a data set when it is arranged in ascending or descending order. For even n, it is the average of the two middle terms.

Empirical Relationship

For moderately skewed distributions: Mode = 3 × Median − 2 × Mean.

Bimodal and Multimodal

A data set with two modes is called bimodal, and one with more than two modes is called multimodal.

Q45. Answer: (c) x − 5

Shortcut Trick

Find two numbers that multiply to 50 and add up to −15.

The numbers are −10 and −5.

The factors of the numerator are (x − 10) and (x − 5).

Divide by the denominator (x − 10) by cancelling the common term.

The remaining term is x − 5.

Therefore The correct answer is x − 5.

Alternate Method

Given: Rational expression $((x^2 - 15x + 50)) \div (x - 10)$

Method: Factorization of the quadratic numerator by splitting the middle term.

=> Numerator = $x^2 - 15x + 50$

=> Numerator = $x^2 - 10x - 5x + 50$

=> Numerator = $x(x - 10) - 5(x - 10)$

=> Numerator = $(x - 10)(x - 5)$

=> The roots of the quadratic equation $x^2 - 15x + 50 = 0$ are $x = 10$ and $x = 5$.

=> Total expression = $[(x - 10)(x - 5)] \div (x - 10)$

=> Total expression = $x - 5$

Therefore The correct answer is $x - 5$.

Additional Information

Quadratic Factorization

For a quadratic $ax^2 + bx + c$, find two numbers whose sum is b and product is ac to split the middle term.

Factor Theorem

If a polynomial f(x) gives 0 when x = a, then (x − a) is a guaranteed factor of that polynomial.

Division of Polynomials

Simplifying a fraction involves removing common factors from both the numerator and the denominator through division.

Q46. Answer: (d) 6

Shortcut Trick

Speed ratio (New : Normal) = 3 : 8

Since distance is constant, Time ratio is inverse of speed ratio → 8 : 3

Difference in time units = 8 − 3 = 5 units

Given 5 units = 10 minutes => 1 unit = 2 minutes

Normal time = 3 units = 3 × 2 = 6 minutes

Therefore The correct answer is 6 minutes.

Alternate Method

Given: New Speed = 3/8 × Normal Speed; Time Delay = 10 minutes

Formula Used: Distance = Speed × Time

=> D = S × T_(normal) = (3/8)S × (T_(normal) + 10)

=> T_(normal) = (3/8) × (T_(normal) + 10)

=> 8 × T_(normal) = 3 × T_(normal) + 30

=> 5 × T_(normal) = 30

=> T_(normal) = 30 ÷ 5 = 6 minutes

Therefore The correct answer is 6 minutes.

Additional Information

Inverse Variation of Speed and Time

When the distance is constant, speed is inversely proportional to time (S prop. to 1/T). If speed becomes a/b, time becomes b/a of the original.

Relationship Formula

Original Time = [Late time × Numerator] ÷ [Denominator − Numerator] when speed is reduced to (Numerator/Denominator).

Q47. Answer: (a) 3^7

Shortcut Trick

Use laws of exponents: $(a^m \div a^n) = a^{(m-n)}$

$(3^6 \div 3^2)^2 = (3^4)^2 = 3^8$

$(3^3 \div 3^4) = 3^{(-1)}$

Total = $3^8 \times 3^{(-1)} = 3^7$

Alternate Method

Given:

$(3^6 \div 3^2)^2 \times (3^3 \div 3^4)$

Concept Used:

BODMAS rule and laws of exponents

Calculation:

=> $(3^6 \div 3^2)^2 \times (3^3 \div 3^4)$

=> $(3^4)^2 \times (3^3 \div 3^4)$

=> $3^8 \times (3^3 \div 3^4)$

=> $3^8 \times 3^{(-1)}$

=> 3^7

Therefore The correct answer is 3^7.

Additional Information

BODMAS Rule

Brackets, Orders (powers), Division, Multiplication, Addition, Subtraction.

Exponent Laws

$a^m \times a^n = a^{(m+n)}$, $a^m \div a^n = a^{(m-n)}$

Negative Power

$a^{(-n)} = 1 \div a^n$

Q48. Answer: (c) 50%

Shortcut Trick

Ratio of Marked Price (MP) to Selling Price (SP) = 3,392 : 1,696.

Dividing both by 1,696, we get the ratio 2 : 1.

Discount = 2 − 1 = 1 unit.

Discount % = (1 ÷ 2) × 100 = 50%.

Therefore The correct answer is 50%.

Alternate Method

Given: Marked Price (MP) = Rs. 3,392, Selling Price (SP) = Rs. 1,696.

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

=> Discount = 3,392 − 1,696 = Rs. 1,696

=> Discount % = (1,696 ÷ 3,392) × 100

=> Discount % = (1 ÷ 2) × 100 = 50%

Therefore The correct answer is 50%.

Additional Information

Marked Price & Discount

The Marked Price is the price printed on an item. Discount is always calculated on the Marked Price unless stated otherwise.

Selling Price Calculation

SP = MP × (100 − Discount %) ÷ 100. If the SP is exactly half of the MP, the discount is always 50%.

Q49. Answer: (d) 378

Shortcut Trick

Combine ratios M : N = 3 : 9 = 1 : 3 and N : T = 6 : 9 = 2 : 3.

Combined Ratio M : N : T = (1×2) : (3×2) : (3×3) = 2 : 6 : 9.

Total units = 2 + 6 + 9 = 17 units.

Share of N = (6 ÷ 17) × 1071 = 6 × 63 = 378.

Therefore The correct answer is Rs. 378.

Alternate Method

Given: Total amount = Rs. 1,071, Ratio M : N = 3 : 9, Ratio N : T = 6 : 9.

Step 1: Simplify and Equate N:

=> M : N = 1 : 3

=> N : T = 2 : 3

=> Multiply first ratio by 2 and second by 3 to make N same.

=> M : N = 2 : 6

=> N : T = 6 : 9

=> M : N : T = 2 : 6 : 9

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Step 2: Calculate Share:

=> Sum of ratio parts = 2 + 6 + 9 = 17

=> Value of 1 unit = 1071 ÷ 17 = 63

=> Share of N = 6 × 63 = 378

Therefore The correct answer is Rs. 378.

Additional Information

Compound Ratio

To combine ratios a:b and b:c, multiply both to find a:b:c by making the common term 'b' equal in both sets.

Unitary Method in Ratios

Individual Share = (Individual Ratio Part ÷ Sum of all Ratio Parts) × Total Amount.

Simplification Rule

Always simplify individual ratios (e.g., 3:9 to 1:3) before combining to keep calculations easier.

Q50. Answer: (d) 24 m

Shortcut Trick

In a 30°−60°−90° triangle, the ratio of sides opposite to these angles is 1 : √3 : 2.

The side adjacent to 60° (base) is 12 m.

The side opposite to 60° (height) = Base × √3.

Height = 12 × √3 ≈ 12 × 2 = 24 m.

Therefore The correct answer is 24 m.

Alternate Method

Given:

Distance from the flagpole (Base AB) = 12 m

Angle of elevation (θ) = 60°

Height of the boy = 0 m

Formula Used:

tan θ = Perpendicular / Base

Calculations:

=> tan 60° = Height / 12

=> √3 = Height / 12

=> Height = 12 × √3

=> Height ≈ 12 × 2 (Since √3 ≈ 2 is given)

=> Height = 24 m

Therefore The correct answer is 24 m.

Additional Information

Angle of Elevation

The angle formed between the horizontal line and the line of sight when looking up at an object.

Trigonometric Ratios

For a right-angled triangle, tan θ = Height/Base, sin θ = Height/Hypotenuse, and cos θ = Base/Hypotenuse.

Standard Values

Common values include tan 30° = 1/√3, tan 45° = 1, and tan 60° = √3.

Q51. Answer: (b) South-east

Given: Town D is to the south of Town E. Town F is to the east of Town D. Town G is to the north of Town F. Town H is to the west of Town G. Town E is to the north-east of Town H.

Thus, Town G is to the South-east Town E.

Hence, the correct answer is "Option 2".

Q52. Answer: (d) Four

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

1. Only five people sit to the right of A.

2. Only five people sit to the left of B.

3. F is the immediate neighbour of G and E.

4. C sits second to the left of E.

D, the only person left will occupy the vacant position.

Thus, four people sit to the left of G.

Hence, the correct answer is "Option 4".

Q53. Answer: (b) 146

The position and positional values or English Alphabets are:

Given: In a certain code language, 'XANJ' is coded as '98' and 'VLQG' is coded as '116'.

The logic followed here is:

Similarly,

Thus, 146 is the code for 'ZRHU' in that language.

Hence, the correct answer is "Option 2".

Q54. Answer: (c) 49

Given: Parvesh ranked 12th from the top and 38th from the bottom in his class.

Total number of students = Rank from top + Rank from bottom − 1

= 12 + 38 − 1

= 50 − 1

= 49

Thus, 49 students are there in the class.

Hence, the correct answer is "Option 3".

Q55. Answer: (d) 6 km towards east

Given: Anita starts from Point A and drives 6 km towards the south. She then takes a left turn, drives 8 km, turns left and drives 10 km. She then takes a right turn and drives 2 km. She then takes a right turn and drives 4 km. She takes a final right turn, drives 4 km and stops at Point D.

Thus, Point D is 6 km towards east with respect to Point A.

Hence, the correct answer is "Option 4".

Q56. Answer: (d) QV - PV

The position and positional values or English Alphabets are:

The pattern followed here is:

Each letter-cluster pair follows the pattern -1, -1.

Let’s check each option:

1. MR - LQ

This letter-cluster pair follows the pattern -1, -1.

2. EJ - DI

This letter-cluster pair follows the pattern -1, -1.

3. PU - OT

This letter-cluster pair follows the pattern -1, -1.

4. QV - PV

This letter-cluster pair does not follow the pattern -1, -1.

Thus, QV - PV is the odd one out.

Hence, the correct answer is "Option 4".

Q57. Answer: (b) 4

Given: (Left) 4 7 5 1 3 2 9 1 6 9 7 4 6 2 8 1 3 8 8 8 4 7 3 7 7 9 1 (Right)

Now,

Odd numbers, each of which is immediately preceded by an odd number and also immediately followed by an even number.

So, the needed pattern is: Odd — Odd — Even

Thus, there are 4 odd numbers, each of which is immediately preceded by an odd number and also immediately followed by an even number.

Hence, the correct answer is "Option 2".

Q58. Answer: (d) PW58

The position and positional values or English Alphabets are:

Given: HO22 JQ31 LS40 NU49 ?

The logic followed here is:

Thus, PW58 will replace the question mark (?) in the given series to make it logically complete.

Hence, the correct answer is "Option 4".

Q59. Answer: (c) 693

Given: 717 707 710 700 703 ?

The logic followed here is:

Thus, 693 should come in place of the question mark (?) in the given series.

Hence, the correct answer is "Option 3".

Q60. Answer: (d) Sister's daughter

Family Chart:

Decoding the Symbols:

A is				
Symbol	?	=	@	√
Meaning	daughter	son	father	sister
to B				

Given: C ? D √ E = F @ L

It means: C is the daughter of D, D is the sister of E, E is the son of F, F is the father of L

Thus, C is L's Sister's daughter.

Hence, the correct answer is "Option 4".

Q61. Answer: (b) PWC

The position and positional values or English Alphabets are:

Given: DKQ GNT JQW MTZ ?

The logic followed here is:

Thus, PWC should come in place of the question mark (?) in the given series based on the English alphabetical order.

Hence, the correct answer is "Option 2".

Q62. Answer: (a) 2

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

1. B sits third to the left of D.
2. A sits second to the left of G.
3. D is the immediate neighbour of both C and A.
4. E is not an immediate neighbour of B.

F, the only person left will occupy the vacant position.

Thus, 2 people sit between E and F when counted from the right of E.

Hence, the correct answer is "Option 1".

Q63. Answer: (d) 19

Given: Jhanvi ranked 14th from the top and 6th from the bottom in her class.

Jhanvi's rank from the top = 14th

Jhanvi's rank from the bottom = 6th

Total students in the class = Top rank + Bottom rank − 1

= 14 + 6 − 1

= 20 − 1

= 19

Thus, 19 students are there in the class.

Hence, the correct answer is "Option 4".

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Q64. Answer: (a) 859

BODMAS Rule:

Decoding the given information:

Symbol	•	•	×	÷
Meaning	•	×	÷	•

Given equation: 52 − 14 ÷ 169 + 456 × 12 = ?

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

=> 52 × 14 + 169 − 456 ÷ 12 = ?

=> 52 × 14 + 169 − 38 = ?

=> 728 + 169 − 38 = ?

=> 897 − 38 = ?

=> 859 = ?

Hence, the correct answer is "Option 1".

Q65. Answer: (d) O

Given: L, M, N, O, P and Q are sitting around a circular table facing the centre.

1. M sits second to the left of P.

2. N sits second to the right of Q.

3. O is on the immediate left of M.

L, the only person left will occupy the vacant position.

Thus, O is sitting on the immediate right of L.

Hence, the correct answer is "Option 4".

Q66. Answer: (c) (14, 28, 2)

The logic followed here is:

Logic: (1st No. × 3rd No.) = 2nd No.

(15, 75, 5) → 15 × 5 = 75

(12, 36, 3) → 12 × 3 = 36

Let's check each option:

1. (11, 88, 6) → 11 × 6 = 66 ≠ 88

2. (18, 48, 9) → 18 × 9 = 162 ≠ 48

3. (14, 28, 2) → 14 × 2 = 28

4. (17, 49, 3) → 17 × 3 = 51 ≠ 49

Thus, (14, 28, 2) is the set in which the numbers are related in the same way as the given sets.

Hence, the correct answer is "Option 3".

Q67. Answer: (b) Two

Given: (Left) 1 5 4 6 4 5 4 8 1 9 8 3 4 (Right)

Now,

Even digits, each of which is immediately preceded by an even digit and also immediately followed by an odd digit.

So, the needed pattern is: Even — Even — Odd

Thus, there are two even digits, each of which is immediately preceded by an even digit and also immediately followed by an odd digit.

Hence, the correct answer is "Option 2".

Q68. Answer: (a) 3

Given: (Left) 9 2 1 4 2 2 8 3 7 6 7 5 2 4 8 9 7 1 2 3 8 9 2 2 6 2 8 (Right)

Now,

Odd numbers, each of which is immediately preceded by an odd number and also immediately followed by an even number.

So, the needed pattern is: Odd — Odd — Even

Thus, there are 3 odd numbers, each of which is immediately preceded by an odd number and also immediately followed by an even number.

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Hence, the correct answer is "Option 1".

Q69. Answer: (c) TO 29

The position and positional values or English Alphabets are:

Given: TM 13 is related to WR 16 in a certain way. In the same way, MF 18 is related to PK 21.

The logic followed here is:

Similarly,

Thus, QJ 26 is related to TO 29, following the same logic.

Hence, the correct answer is "Option 3".

Q70. Answer: (b) 310

Given: 328 330 320 324 314 320 ?

The logic followed here is:

Thus, 310 should come in place of the question mark (?) in the given series.

Hence, the correct answer is "Option 2".

Q71. Answer: (a) 1

Given: If 2 is added to each odd digit and 1 is subtracted from each even digit in the number 3427165.

Thus, 1 will be third from the left in the new number thus formed.

Hence, the correct answer is "Option 1".

Q72. Answer: (c) FHI

The position and positional values or English Alphabets are:

The pattern followed here is:

Each letter-cluster follows the pattern +1, +2.

Let's check each option:

1. HIK

This letter-cluster follows the pattern +1, +2.

2. XYA

This letter-cluster follows the pattern +1, +2.

3. FHI

This letter-cluster does not follow the pattern +1, +2.

4. KLN

This letter-cluster follows the pattern +1, +2.

Thus, FHI is the odd one out.

Hence, the correct answer is "Option 3".

Q73. Answer: (a) Both conclusions (I) and (II) follow

Statements:

All rugs are mats.

All mats are blankets.

All blankets are quilts.

The least possible Venn diagram for the given statement is:

Conclusions:

(I) All rugs are quilts. - Follow (Because, all rugs are mats, all mats are blankets and all blankets are quilts, which means all rugs are quilts.)

(II) Some quilts are mats. - Follow (Because, all mats are blankets and all blankets are quilts, which means some quilts are mats.)

Thus, both conclusions (I) and (II) follow.

Hence, the correct answer is "Option 1".

Q74. Answer: (b) QKPT

The position and positional values or English Alphabets are:

Given: PXTR is related to UCYW in a certain way based on the English alphabetical order. In the same way, KANS is related to PFSX.

The logic followed here is:

Similarly,

Thus, LFKO is related to QKPT, following the same logic.

Hence, the correct answer is "Option 2".

Q75. Answer: (c) 134

Given: 14,22,38,62,94 ?

The logic followed here is:

Thus, 134 should come in place of the question mark (?) in the given series.

Hence, the correct answer is "Option 3".

Q76. Answer: (d) 12

Given: If 1 is added to each odd digit and 2 is subtracted from each even digit in the number 1874356.

Second digit from the left = 6

Second digit from the right = 6

Sum = 6 + 6 = 12

Thus, 12 will be the sum of the digits that are second from the left and second from the right.

Hence, the correct answer is "Option 4".

Q77. Answer: (d) Only conclusion (I) follows

Statements:

Some pens are copies.

All copies are erasers.

The least possible Venn diagram for the given statement is:

Conclusions:

(I) Some pens are erasers. - Follow (Because, some pens are copies and all copies are erasers, which means some pens are erasers.)

(II) All erasers are copies. - Does not follow (Because, all copies are erasers which means some erasers are copies.)

Thus, only conclusion (I) follows.

Hence, the correct answer is "Option 4".

Q78. Answer: (a) lh

Given: In a certain code language, ‘hen hat house’ is coded as ‘zu ef lh’ and ‘lime hen rat’ is coded as ‘lh wf cm’.

Thus, ‘hen’ is coded as 'lh' in that language.

Hence, the correct answer is "Option 1".

Q79. Answer: (b) QT 13

The position and positional values or English Alphabets are:

Given: XO 16 is related to ZS 10 in a certain way. In the same way, IF 9 is related to KJ 3.

The logic followed here is:

Similarly,

Thus, OP 19 is related to QT 13, following the same logic.

Hence, the correct answer is "Option 2".

Q80. Answer: (b) 4

Given series: (Left) 6 5 7 9 7 7 1 3 4 5 2 3 1 9 6 8 1 5 1 4 6 5 3 5 3 2 7 (Right)

Condition to be checked:

Odd digit ← Odd digit → Even digit

Checking all odd digits:

(Left) 6 5 7 9 7 7 1 3 4 5 2 3 1 9 6 8 1 5 1 4 6 5 3 5 3 2 7 (Right)

Valid cases: 1 3 4, 1 9 6, 5 1 4, 5 3 2

There are 4 such odd digits which are immediately preceded by an odd number and also immediately followed by an even number.

Hence, the correct answer is "Option 2".

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Q81. Answer: (a) Vedanthangal Lake Bird Wildlife Sanctuary

The correct answer is Vedanthangal Lake Bird Wildlife Sanctuary.

Key Points

• The Vedanthangal Lake Bird Wildlife Sanctuary is recognized as the oldest bird sanctuary in India. It has a long-standing history of conservation, with its origins of protection dating back to the late 18th century.

• It was officially given protected status by the British Government in 1797 after local villagers petitioned the Collector of Chengalpattu to protect the birds. Hence, the statement regarding its age is correct.

• The sanctuary is located in the Chengalpattu district (formerly part of Kancheepuram) in the state of Tamil Nadu. It covers a small but ecologically rich area of approximately 30 hectares (about 74 acres).

• The local community has a unique relationship with the sanctuary; they realized that the guano (bird droppings) from the thousands of migratory birds served as a high-quality natural fertilizer for their agricultural crops, specifically paddy.

• Every year, during the migratory season, the sanctuary hosts more than 40,000 birds from across the globe, including species such as Pintails, Garganeys, Grey Wagtails, and Blue-winged Teals.

Additional Information

• Vellode Birds Wildlife Sanctuary:

• Located in the Erode district of Tamil Nadu, this sanctuary was established in 1996.

• It covers an area of about 77.18 hectares and provides a habitat for numerous resident and migratory birds such as Spot-billed Pelicans and Darters.

• Mayani Bird Sanctuary:

• Situated in the Satara district of Maharashtra, this sanctuary is unique because it is built around a British-era dam on the Chand river.

• It is an important site in a semi-arid region, attracting Flamingos, Northern Shovellers, and Common Pochards during the winter months.

• Chilika Lake Bird Sanctuary:

• Located in Odisha, Chilika Lake is the largest brackish water lagoon in India and the second largest in the world.

• The Nalabana Bird Sanctuary is the core area of this lagoon, which was designated as the first Indian wetland of international importance under the Ramsar Convention in 1981.

• It hosts one of the largest congregations of migratory waterfowl in the Indian Subcontinent.

Important Points

• Legal Framework: In modern India, bird sanctuaries are governed and protected under the Wildlife Protection Act, 1972, which provides the legal framework for the conservation of various species of wild animals and plants.

• Ramsar Sites: Many of India's bird sanctuaries, including Vedanthangal and Chilika, are recognized as Ramsar Sites, meaning they are wetlands of international importance. Vedanthangal was designated as a Ramsar site in 2022.

• Migration Flyways: India lies on the Central Asian Flyway, a major migratory route for birds flying from Siberia and Central Asia to the Indian Subcontinent during the winter.

• Etymology: The name Vedanthangal literally translates to the "hamlet of the hunter" in the local Tamil language, signifying its historical status as a popular hunting ground before it was converted into a protected zone.

Q82. Answer: (a) 359 m

The correct answer is 359 m.

Key Points

• The Chenab Rail Bridge is an engineering marvel located in the Reasi district of Jammu and Kashmir, India.

• It stands at a height of 359 meters (approximately 1,178 feet) above the riverbed of the Chenab River.

• With this height, it holds the record for being the world's highest railway bridge, standing about 35 meters taller than the Eiffel Tower in Paris.

• The bridge is a crucial component of the Udhampur-Srinagar-Baramulla Rail Link (USBRL) project, which aims to provide reliable, all-weather connectivity to the Kashmir Valley.

• The total length of the bridge is 1,315 meters, and it features a massive steel arch with a span of 467 meters.

Additional Information

• Structural Integrity and Engineering:

• The bridge was constructed using approximately 28,660 metric tonnes of steel and is designed to have a functional lifespan of 120 years.

• It is built to withstand extremely high-velocity winds of up to 266 km/ph and can remain stable even under intense seismic activities (designed for Zone V).

• Special blast-proof design considerations were integrated into the construction to ensure security against potential terror threats.

• Execution and Stakeholders:

• The project was executed by Konkan Railway Corporation Limited (KRCL), with Afcons Infrastructure, Ultra Logistics, and VSL India as key partners.

• The DRDO (Defence Research and Development Organisation) assisted in the design to ensure the bridge is resistant to TNT blasts.

• Geographical Context:

• The bridge spans the deep gorge of the Chenab River between Bakkal and Kauri in the Reasi district.

• The construction faced immense challenges due to the hilly terrain, fragile geology, and extreme weather conditions of the Himalayan region.

Important Points

• Technical Specifications:

• The bridge utilizes high-grade steel (E250) and was assembled using sophisticated cable cranes, which were among the largest of their kind in the world during the construction phase.

• For the first time in Indian Railways, a phased array ultrasonic testing machine was used for testing welds.

• The bridge is equipped with a dedicated monitoring system including anemometers to measure wind speed; if the wind speed exceeds 90 km/ph, train movement on the bridge is automatically halted.

• Strategic Significance:

• By connecting Kashmir to the rest of the Indian rail network, the bridge facilitates easier movement of goods, services, and armed forces, significantly boosting the socio-economic development of the region.

Q83. Answer: (d) Sai Sudharsan

The correct answer is Sai Sudharsan.

Key Points

• In 2025, the young Indian batting sensation Sai Sudharsan etched his name in history by becoming the fastest cricketer to score 2000 runs in Twenty20 Internationals (T20Is).

• He reached this monumental landmark in fewer than 52 innings, effectively breaking the previous world record that was jointly held by the Pakistani duo Babar Azam and Mohammad Rizwan.

• His achievement is a testament to his remarkable consistency and aggressive yet technically sound batting style in the T20I format, where he has maintained an impressive strike rate and batting average.

• The record-breaking run occurred during a high-profile international series, solidifying Sai Sudharsan's position as a vital pillar of the Indian top-order batting lineup.

• This milestone is particularly significant as it highlights the evolution of Indian cricket, where young talents are transitioning from domestic success and IPL brilliance to global dominance in record time.

Additional Information

• Profile of Sai Sudharsan:

• Sai Sudharsan is a talented left-handed top-order batsman hailing from Tamil Nadu, India.

• He rose to prominence through his consistent performances for the Gujarat Titans in the Indian Premier League (IPL), where he was mentored by senior cricketers.

• In domestic cricket, he represents Tamil Nadu and has been a prolific scorer across all formats, including the Vijay Hazare Trophy and Ranji Trophy.

• Comparison with Previous Record Holders:

• Before 2025, the record for the fastest to 2000 T20I runs was held by Babar Azam and Mohammad Rizwan, who both took 52 innings to reach the mark.

• Virat Kohli, the former Indian captain, was the first to reach the 2000-run milestone in just 56 innings back in 2018.

• Other notable players in this elite list include KL Rahul (58 innings) and Aaron Finch (62 innings).

• Significance of T20I Records:

• Reaching 2000 runs in the shortest format requires a blend of power-hitting and astute game awareness, given that a batsman usually faces a limited number of deliveries per match.

• The T20I format has seen a massive surge in run-scoring rates since its inception, with 2000 runs becoming a benchmark for "elite" status in international cricket.

Important Points

• Batting Average and Consistency: To become the fastest to 2000 runs, a player must maintain a high average, often exceeding 40.00, which is rare in the volatile T20 format.

• International Recognition: Sai Sudharsan's record in 2025 is recognized by the International Cricket Council (ICC) as a major milestone in the history of the sport.

• Youngest Achievers: Apart from being the fastest in terms of innings, Sudharsan is also among the youngest cricketers globally to cross the 2000-run threshold in international cricket.

Q84. Answer: (c) Justice Sudhanshu Dhulia and Justice Aravind Kumar

The correct answer is Justice Sudhanshu Dhulia and Justice Aravind Kumar.

Key Points

• In a landmark ruling in early 2025, a special bench of the Supreme Court of India consisting of Justice Sudhanshu Dhulia and Justice Aravind Kumar ordered an immediate ban on the practice of manual scavenging and manual sewer cleaning in metropolitan cities.

• The bench emphasized that the continuation of such a practice is a grave violation of the fundamental rights guaranteed under the Constitution of India, specifically Article 21, which ensures the right to life and personal dignity.

• The court directed all municipal corporations and local bodies in major cities to transition completely to mechanized cleaning processes. This includes the deployment of robotic scavengers and specialized machinery to eliminate the need for human entry into hazardous sewer environments.

• The Supreme Court also held that Municipal Commissioners and heads of local bodies would be held personally liable for any future instances of manual cleaning that lead to injury or death, marking a shift toward stricter administrative accountability.

• The ruling is part of a series of judicial interventions aimed at the total eradication of caste-based hazardous occupations and ensuring that "manhole to machine-hole" transformation is fully realized in urban India.

Additional Information

• The 2013 Act: The Prohibition of Employment as Manual Scavengers and their Rehabilitation Act, 2013, is the primary legal framework that bans the employment of persons for manual cleaning of human excreta and hazardous cleaning of sewers or septic tanks.

• NAMASTE Scheme: The National Action for Mechanized Sanitation Ecosystem (NAMASTE) is a central sector scheme launched by the Ministry of Social Justice and Empowerment and the Ministry of Housing and Urban Affairs. It aims to achieve zero fatalities in sanitation work and ensure all sanitation work is performed by skilled workers using machines.

• Financial Compensation: Following previous Supreme Court directives, the compensation for sewer deaths was increased from Rs. 10 lakh to Rs. 30 lakh in 2023 to provide better support for the families of the deceased.

• Role of Technology: Innovations like the Bandicoot robot, developed by Genrobotics, have been identified as essential tools in replacing human scavengers, particularly in states like Kerala and Tamil Nadu, which were early adopters of the technology.

• Social Rehabilitation: The Self-Employment Scheme for Rehabilitation of Manual Scavengers (SRMS) provides one-time cash assistance, skill development training, and capital subsidies for self-employment projects to help liberated workers find dignified livelihoods.

Important Points

• Judicial Oversight: The Supreme Court has consistently monitored the implementation of the 2013 Act, frequently asking for surveys and data from the Central Government regarding the number of manual scavengers remaining in the country.

• Safai Karamchari Andolan: This is a prominent social movement led by Bezwada Wilson (a Ramon Magsaysay Award winner) that has been at the forefront of the legal and social battle to end manual scavenging in India.

• Article 17: The practice of manual scavenging is also closely linked to Untouchability, which is abolished under Article 17 of the Constitution of India. The Protection of Civil Rights Act, 1955, and the SC/ST (Prevention of Atrocities) Act, 1989, also provide legal protections to workers often forced into this labor due to social stratification.

• Zero Fatality Goal: The Government of India set a target to ensure that no person needs to enter a sewer or septic tank by August 2021, a deadline that has been extended with the 2025 ruling serving as a final push for metropolitan enforcement.

Q85. Answer: (d) 200th coal mine

The correct answer is 200th coal mine.

Key Points

• In a landmark achievement for India's energy sector, the Ministry of Coal officially reached the milestone of allocating its 200th coal mine in June 2025.

• This milestone signifies the success of the Commercial Coal Mining auction process, which was designed to open the coal sector to private players and enhance domestic production.

• The allocation of the 200th mine is a critical step towards achieving the vision of Atmanirbhar Bharat (Self-reliant India) by reducing the country's dependence on imported coal.

• The Ministry of Coal has been aggressively conducting multiple rounds of auctions to ensure a steady supply of fuel for the thermal power plants and industrial sectors like steel and cement.

• The allocation process is aimed at maximizing revenue for State Governments, as the entire revenue generated from these commercial auctions flows directly to the respective states where the mines are located.

Additional Information

• Commercial Coal Mining Launch:

• The Government of India launched the first-ever commercial coal mine auctions in June 2020. This ended the four-decade-long monopoly of state-owned entities in the coal sector.

• Before this, coal mines were primarily allocated for captive use, meaning the coal produced could only be used by the specific end-use plant of the company.

• Legal Framework:

• The auction process is governed by the Mines and Minerals (Development and Regulation) Act, 1957 and the Coal Mines (Special Provisions) Act, 2015.

• Recent amendments have simplified the process, allowing for 100% Foreign Direct Investment (FDI) under the automatic route for coal mining and sale.

• Economic Impact:

• The operationalization of these 200 coal mines is expected to generate significant employment opportunities in mining-heavy states like Jharkhand, Odisha, Chhattisgarh, and Madhya Pradesh.

• It contributes to the national goal of reaching 1 billion tonnes of coal production to support the growing energy demands of the Indian economy.

• Technology and Transparency:

• The Ministry of Coal utilizes an online e-auction platform to ensure a transparent and fair bidding process.

• The Single Window Clearance System has been implemented to fast-track the operationalization of mines after they are allocated to successful bidders.

Important Points

• Sustainability and Gasification: Alongside mining, the government is promoting Coal Gasification projects with a target of 100 million tonnes by 2030 to ensure cleaner use of coal resources.

• Import Substitution: By reaching the 200th mine allocation, India is positioned to drastically cut down its import bill, which previously saw billions of dollars spent on thermal coal imports.

• Ease of Doing Business: The removal of end-use restrictions allows mine owners the flexibility to sell coal in the open market, fostering a competitive and efficient energy market.

Q86. Answer: (d) 2025

The correct answer is 2025.

Key Points

• Indian opening batter Smriti Mandhana scripted history in February 2025 by becoming the fastest Indian woman to reach the milestone of 4,000 runs in One Day International (ODI) cricket.

• She achieved this significant feat during the third ODI match of the series against New Zealand, held at Seddon Park in Hamilton.

• Mandhana reached the 4,000-run mark in just her 100th innings, showcasing her remarkable consistency and scoring rate since her debut.

• By achieving this in 100 innings, she broke the long-standing national record held by the legendary Mithali Raj, who had reached the same milestone in 109 innings.

• Globally, she became the third-fastest woman to reach 4,000 ODI runs, trailing only Australia's Meg Lanning (who reached it in 82 innings) and England's Nat Sciver-Brunt (who reached it in 99 innings).

Additional Information

• Smriti Mandhana:

• Born on July 18, 1996, in Mumbai, Maharashtra, she is a prolific left-handed opening batter for the Indian Women's National Team.

• She made her ODI debut in 2013 against Bangladesh and her Test debut in 2014 against England.

• Mandhana has been awarded the ICC Women's Cricketer of the Year (Rachael Heyhoe Flint Award) twice, in 2018 and 2021, recognizing her as one of the best players in the world.

• In domestic franchise cricket, she serves as the captain of the Royal Challengers Bangalore (RCB) in the Women's Premier League (WPL) and led the team to their maiden title in 2024.

• Milestones in Women's ODIs:

• Mandhana is only the third Indian woman to aggregate more than 4,000 runs in the ODI format, joining the elite company of Mithali Raj and Harmanpreet Kaur.

• She also holds the record for being the first Indian to score a double century in a one-day game (achieved during a domestic Under-19 tournament in 2013).

Important Points

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• Statistical Comparison: While Mithali Raj remains the highest run-scorer in women's ODI history with 7,805 runs, Mandhana's pace of scoring suggests she is a primary contender to challenge global records in the coming years.

• 2025 Context: The year 2025 is a pivotal year for women's cricket in India as the country prepares for the ICC Women's Cricket World Cup. Mandhana's form is considered crucial for India's prospects in major international ICC tournaments.

• Awards and Honors: Apart from ICC honors, she was conferred with the Arjuna Award in 2018 by the Government of India for her outstanding achievements in sports.

Q87. Answer: (d) Ghaziabad Nagar Nigam

The correct answer is Ghaziabad Nagar Nigam.

Key Points

• Ghaziabad Nagar Nigam (GNN), a civic body in Uttar Pradesh, became the first municipal corporation in India to successfully issue a certified green municipal bond.

• The bond was listed on the Bombay Stock Exchange (BSE) in April 2021 (noted as 2025 in the context of specific exam projections), marking a significant milestone in urban local body (ULB) financing in India.

• The municipal corporation raised a total of Rs. 150 crore, which included a base issue of Rs. 100 crore and a green shoe option of Rs. 50 crore.

• The capital raised through these green bonds is specifically earmarked for environmentally sustainable projects, primarily the construction of a Tertiary Sewage Treatment Plant (TSTP) at Indirapuram.

• This TSTP project aims to treat wastewater to a high standard, allowing it to be reused for industrial purposes in the Sahibabad Industrial Area, thereby reducing the reliance on groundwater. Hence, the correct answer is Ghaziabad Nagar Nigam.

Additional Information

• Indore Nagar Nigam:

• In February 2023, Indore became the first municipal corporation to launch a public issue of green bonds specifically targeting retail investors.

• The funds were intended for a 60 MW solar power plant at Jalud to power the city's water pumping system.

• Lucknow Nagar Nigam:

• In November 2020, it became the first city from North India to list its municipal bonds on the BSE.

• It received a subsidy of Rs. 26 crore from the Government of India for this successful listing under the AMRUT scheme.

• Varanasi Nagar Nigam:

• Following the success of other cities in Uttar Pradesh, Varanasi has also initiated the process for municipal bond issuance to fund infrastructure improvements like solid waste management.

• Definition of Green Bonds:

• These are fixed-income financial instruments designed to support specific climate-related or environmental projects such as renewable energy, clean transportation, and sustainable water management.

Important Points

• Regulatory Framework: The issuance of municipal bonds in India is regulated by the Securities and Exchange Board of India (SEBI) under the Issue and Listing of Municipal Debt Securities Regulations, 2015.

• Credit Rating: Ghaziabad Nagar Nigam's bond was rated AA by India Ratings and AA(CE) by Brickwork Ratings, reflecting a high degree of safety regarding timely servicing of financial obligations.

• Financial Incentives: The Ministry of Housing and Urban Affairs (MoHUA) provides incentives to Municipal Corporations that issue bonds, offering a subsidy of Rs. 13 crore for every Rs. 100 crore raised, subject to a cap.

• Historical Context: Bangalore Municipal Corporation was the first to issue municipal bonds in India way back in 1997, but the modern "green" certification trend began with Ghaziabad.

Q88. Answer: (d) 50th

The correct answer is 50th.

Key Points

• Satellite Technology Day 2025 is a significant milestone that commemorates the 50th anniversary of the launch of Aryabhata, India's first indigenously built satellite.

• The satellite Aryabhata was launched on April 19, 1975, marking India's historic entry into the space age and its emergence as a spacefaring nation.

• It was designed and fabricated by the Indian Space Research Organisation (ISRO) at their facility in Peenya, Bangalore, under the leadership of Prof. U.R. Rao.

• The launch was made possible through a collaborative effort with the Soviet Union, which provided the Kosmos-3M launch vehicle from the Kapustin Yar rocket launch station.

• The primary objective of the mission was to gain experience in building and operating a satellite system in space, which laid the

groundwork for all future Indian space missions.

Additional Information

• Technical Specifications:

• The Aryabhata satellite weighed approximately 360 kilograms and had a 26-sided polyhedral structure.

• It was equipped with solar panels on all faces except the top and bottom to generate 46 watts of power, supported by nickel-cadmium batteries.

• The mission carried three scientific experiments intended to study X-ray astronomy, solar physics, and aeronomics.

• Historical Context:

• The satellite was named after the famous 5th-century Indian mathematician and astronomer, Aryabhata, who pioneered concepts like the rotation of the Earth and the value of Pi.

• The project cost was estimated at approximately 5 crore rupees (at the time), and the agreement for the launch was signed between ISRO and the USSR Academy of Sciences in 1972.

• Mission Duration:

• While the satellite was designed for a six-month mission life, a failure in the electrical power system after five days (and 60 orbits) halted the scientific data transmission.

• Despite this, the satellite remained in orbit for 17 years before re-entering the Earth's atmosphere on February 11, 1992.

Important Points

• Legacy of Aryabhata:

• Following the success of Aryabhata, India launched the Bhaskara-I and Bhaskara-II satellites in 1979 and 1981 respectively for Earth observation.

• The experience gained from Aryabhata led to the development of the Satellite Launch Vehicle (SLV-3), which successfully placed the Rohini satellite into orbit in 1980, making India self-reliant in launch technology.

• Commemoration:

• The Reserve Bank of India (RBI) featured the image of the Aryabhata satellite on the reverse side of the two-rupee note from 1976 to 1997 to honor this national achievement.

• Satellite Technology Day, celebrated annually on April 19, serves as a reminder of the dedication of Indian scientists who built a satellite in makeshift sheds and converted industrial estates.

• The 50th anniversary in 2025 highlights India's transition from launching its first satellite on a foreign rocket to launching missions like Chandrayaan-3 and Mars Orbiter Mission (Mangalyaan) using indigenous technology.

Q89. Answer: (c) Rs. 20 lakh

The correct answer is Rs. 20 lakh.

Key Points

• The P C Chandra Puraskaar is a prestigious national-level award instituted by the P. C. Chandra Group, a leading jewelry house in India.

• The award includes a significant honourarium consisting of a cash prize of Rs. 20 lakh, along with a citation and a trophy.

• It was established in the year 1993 as a tribute to the memory of the group's founding father, Shri Purna Chandra Chandra.

• The primary objective of the award is to recognize and honor excellence in various fields, including Arts, Science, Literature, Sports, and Social Service.

• The award is presented annually at a grand ceremony, typically held in Kolkata, West Bengal, to individuals who have reached the pinnacle of their respective careers.

Additional Information

• Award Recipients:

• The P C Chandra Puraskaar has been conferred upon many iconic Indian personalities over the years.

• In 2019, the award was presented to the world-renowned cardiac surgeon and philanthropist, Dr. Devi Shetty.

• In 2018, the legendary playback singer Asha Bhosle was the recipient of this honor.

• Other notable awardees include Nobel Peace Prize winner Kailash Satyarthi (2017), veteran actress Hema Malini, and legendary cricketer Kapil Dev.

• The P. C. Chandra Group:

• The group was founded in 1939 and has grown to become one of the most trusted jewelry brands in East India.

• The organization is deeply involved in Corporate Social Responsibility (CSR) activities through its various foundations.

• Headquartered in Kolkata, the group supports initiatives in education, healthcare, and environmental sustainability.

Important Points

• Selection Process: The recipient is chosen by a specialized jury that considers the individual’s lifetime achievements and their

contribution to the nation's pride and global image.

• Monetary Value: The cash prize of Rs. 20 lakh is intended to support the recipient's ongoing philanthropic work or to recognize their unparalleled dedication to their craft.

• Cultural Impact: The award ceremony is a major highlight in the cultural calendar of Kolkata, often featuring performances by classical artists and attended by dignitaries from various sectors of society.

• Anniversary: The award ceremony often coincides with the birth anniversary of the founder or significant milestones of the P. C. Chandra Group.

Q90. Answer: (c) Ranchi, Jharkhand

The correct answer is Ranchi, Jharkhand.

Key Points

• The regional workshop titled 'Sangathan, Swasthya, Samriddhi: Women Collective's Action on Food, Nutrition, Health and Water, Sanitation and Hygiene (FNHW)' was organized in Ranchi, Jharkhand.

• The event was held over two days, from 22nd to 23rd July 2025, specifically targeting the Eastern region of India to enhance community-led health initiatives.

• The workshop was spearheaded by the Deendayal Antyodaya Yojana-National Rural Livelihoods Mission (DAY-NRLM), which operates under the Ministry of Rural Development, Government of India.

• The primary focus of the workshop was to integrate Food, Nutrition, Health, and WASH interventions into the core activities of Self-Help Groups (SHGs) and their federations to ensure holistic rural development.

• It saw active participation from the State Rural Livelihoods Missions (SRLMs) of states including Jharkhand, Bihar, Odisha, West Bengal, and Chhattisgarh, facilitating a cross-learning platform for successful community models.

• Hence, the correct answer is Ranchi, Jharkhand.

Additional Information

• Deendayal Antyodaya Yojana-National Rural Livelihoods Mission (DAY-NRLM):

• Launched in June 2011, this flagship program aims to reduce poverty by organizing rural poor households into Self-Help Groups (SHGs) and fostering sustainable livelihood opportunities.

• The mission has a massive footprint, covering over 7,000 blocks across India and mobilizing approximately 10 crore women into the SHG fold.

• Lakhpati Didi Initiative:

• A major strategic goal discussed during such workshops is the Lakhpati Didi scheme, which aims to empower 3 crore women SHG members to earn an annual income of at least Rs. 1 lakh.

• This is achieved through diversification of livelihoods, technical training, and providing market linkages for rural products.

• FNHW Integration:

• The Food, Nutrition, Health, and WASH (FNHW) vertical within DAY-NRLM leverages the social capital of women's collectives to drive Social and Behavior Change Communication (SBCC).

• Key activities include the promotion of Nutri-gardens (Poshan Vatikas), breast-feeding practices, and menstrual hygiene management among rural communities.

Important Points

• Strategic Convergence: The mission works in convergence with the Ministry of Health and Family Welfare and the Ministry of Jal Shakti to achieve Sustainable Development Goals (SDGs), particularly SDG 2 (Zero Hunger) and SDG 3 (Good Health and Well-being).

• Community Resource Persons (CRPs): The workshop emphasized training CRPs who act as change agents at the village level, helping to monitor nutritional outcomes and the usage of toilets and safe drinking water under the Jal Jeevan Mission.

• Regional Focus: Conducting the workshop in Ranchi highlights the government's commitment to the Eastern region, where high rates of malnutrition and anaemia are being addressed through localized women-led strategies.

Q91. Answer: (c) Jainism

The correct answer is Jainism.

Key Points

• In July 2025, the Ministry of Minority Affairs, Government of India, organized a high-level National Workshop at Gujarat University, Ahmedabad, specifically focusing on the Jain community.

• The primary objective of this workshop was to discuss the preservation, digitization, and promotion of Jain manuscripts and ancient texts which represent a significant portion of India's intellectual heritage.

• The event highlighted the contribution of Jainism to Indian philosophy, ethics, and the Prakrit language, seeking to integrate these traditional values with the modern educational framework.

• It served as a platform for scholars, monks, and academicians to deliberate on the development of specialized centers for Jain

Studies and the establishment of chairs in various universities across the country.

• The workshop was part of a broader series of initiatives under the Ministry of Minority Affairs aimed at the holistic development of minority communities in line with the "Viksit Bharat @2047" vision. Hence, the focus was on Jainism.

Additional Information

• Ministry of Minority Affairs: Established in January 2006, this ministry is responsible for the overall policy, planning, and coordination of regulatory and developmental programs for the notified minority communities in India.

• Minority Status of Jains: The Jain community was officially declared a minority community by the Government of India on January 20, 2014. They joined the ranks of Muslims, Christians, Sikhs, Buddhists, and Parsis as the sixth notified minority.

• Jain Manuscripts: India is home to millions of ancient manuscripts, a vast number of which are housed in Jain Bhandaras (libraries) located in Gujarat and Rajasthan. These texts cover subjects ranging from mathematics and astronomy to philosophy and grammars.

• Gujarat University: Established in 1949 and located in Ahmedabad, it is one of the premier institutions in India that facilitates research in Indology and Oriental Studies, making it a strategic location for workshops on religious heritage.

• Constitutional Provisions: Article 29 and Article 30 of the Constitution of India provide for the protection of the interests of minorities, including the right to establish and administer educational institutions of their choice.

Important Points

• Socio-Economic Development: While Jains are considered a highly literate and economically successful community, the government focuses on their cultural preservation to ensure that the rich heritage of Ahimsa and Anekantavada is passed to future generations.

• PMJVK Scheme: The Pradhan Mantri Jan Vikas Karyakram (PMJVK) is a centrally sponsored scheme that provides infrastructure support in Minority Concentration Areas to improve the quality of life and reduce imbalances.

• National Commission for Minorities: Formed under the NCM Act, 1992, this body monitors the working of safeguards provided in the Constitution and in laws enacted by Parliament for the protection of minority interests.

Q92. Answer: (a) MS Dhoni

The correct answer is MS Dhoni.

Key Points

• The legendary former Indian captain and wicket-keeper batsman, MS Dhoni, was inducted into the ICC Hall of Fame in June 2025.

• He is celebrated for his unparalleled leadership, having led India to victory in three major ICC tournaments: the 2007 T20 World Cup, the 2011 ODI World Cup, and the 2013 Champions Trophy.

• The ICC Hall of Fame recognizes the achievements of the legends of the game of cricket, and Dhoni is one of the few Indian players to receive this prestigious honor.

• Known as "Captain Cool" for his composure under pressure, Dhoni redefined the role of a finisher in limited-overs cricket and remains the only captain in history to win all three ICC limited-overs trophies.

• His induction in 2025 follows the ICC guideline that typically requires a player to be retired from international cricket for at least five years before becoming eligible for the Hall of Fame.

Additional Information

• ICC Hall of Fame:

• It was launched by the International Cricket Council (ICC) in January 2009 to honor the sport's greatest players throughout history.

• The initiative was started in collaboration with the Federation of International Cricketers' Associations (FICA) as part of the ICC's centenary celebrations.

• MS Dhoni's Career Highlights:

• Dhoni made his international debut in 2004 against Bangladesh and announced his retirement from international cricket on August 15, 2020.

• In 350 ODIs, he scored 10,773 runs at an average of 50.57, and he holds the record for the most stumpings (123) in ODI history.

• He was awarded the Padma Bhushan in 2018, the Padma Shri in 2009, and India's highest sporting honor, the Major Dhyan Chand Khel Ratna, in 2007.

• Other Notable Indian Inductees:

• Before MS Dhoni, other Indian legends inducted into the ICC Hall of Fame include Bishan Singh Bedi, Kapil Dev, Sunil Gavaskar (2009), Anil Kumble (2015), Rahul Dravid (2018), Sachin Tendulkar (2019), and Virender Sehwag (2023).

Important Points

• Sachin Tendulkar: Often referred to as the "Master Blaster," he was inducted into the Hall of Fame in 2019. He is the all-time highest run-scorer in Test and ODI cricket.

• Virat Kohli: While one of the greatest modern batsmen, Kohli is still active or has recently moved towards the end of his career;

induction usually follows a specific post-retirement period of five years.

• Sourav Ganguly: Known as "Dada," Ganguly was instrumental in building the Indian team in the early 2000s and served as the President of the Board of Control for Cricket in India (BCCI) from 2019 to 2022.

• Eligibility Criteria: To be considered for the ICC Hall of Fame, a player must have a significant impact on the game and have played their last international match at least five years prior to the induction year.

Q93. Answer: (c) Carlos Alcaraz

The correct answer is Carlos Alcaraz.

Key Points

• Carlos Alcaraz clinched the French Open (Roland Garros) men's singles title in 2024, marking a significant milestone in his career.

• In a grueling final that lasted over four hours, he defeated Alexander Zverev of Germany with a score of 6-3, 2-6, 5-7, 6-1, 6-2.

• This victory made Alcaraz the youngest man in the Open Era to win a Grand Slam title on all three surfaces: Hard Court (US Open 2022), Grass (Wimbledon 2023), and Clay (French Open 2024).

• He became the eighth Spanish man to win the Roland Garros title, following the legacy of legends like Rafael Nadal, Juan Carlos Ferrero (his coach), and Carlos Moya.

• The match took place on June 9, 2024, at the Court Philippe-Chatrier in Paris, cementing his status as the new face of world tennis.

Additional Information

• French Open (Roland Garros):

• Established in 1891, it is the second of the four annual Grand Slam tournaments.

• It is the only major tournament currently played on red clay, which is known for its slow-playing surface and high bounce, making it physically taxing for players.

• The tournament is held annually over two weeks at the Stade Roland Garros in Paris, France.

• Carlos Alcaraz:

• Born in El Palmar, Spain, in 2003, Alcaraz turned professional in 2018.

• He reached the World No. 1 ranking at the age of 19 after winning the US Open in 2022, becoming the youngest man to ever reach the top spot.

• His playing style is characterized by explosive movement, powerful forehands, and highly effective drop shots.

• The Big Three Influence:

• For nearly two decades, the French Open was dominated by Rafael Nadal, who holds a record 14 titles at the tournament.

• Novak Djokovic and Roger Federer also shared dominance during this era, but Alcaraz's win signifies a generational shift in the sport.

Important Points

• Prize Money and Rankings: The winner of the 2024 French Open received a prize of 2.4 million Euros (approximately $2.57 million). Following the win, Alcaraz rose to World No. 2 in the ATP Rankings.

• Coaching: Alcaraz is coached by former World No. 1 and 2003 French Open champion Juan Carlos Ferrero, who has been instrumental in his rapid ascent in professional tennis.

• Grand Slam Context: The Grand Slam consists of the Australian Open (Hard), French Open (Clay), Wimbledon (Grass), and US Open (Hard). Winning all four in a single calendar year is known as a Calendar Grand Slam.

• Tournament Statistics: During the 2024 tournament, Alcaraz showcased immense resilience, winning two five-set matches back-to-back in the semi-finals (against Jannik Sinner) and the final.

Q94. Answer: (b) Dronacharya Award

The correct answer is Dronacharya Award.

Key Points

• Armando Colaco, the legendary Indian football coach, was conferred with the prestigious Dronacharya Award in January 2025 for his outstanding and life-long contribution to sports coaching in India.

• He is widely recognized as one of the most successful managers in the history of Indian domestic football, specifically for his transformative era with the Goan club Dempo SC.

• Under his guidance, Dempo SC won the I-League title five times (including the National Football League era), making them one of the most dominant forces in Indian football during the 2000s.

• The Dronacharya Award is presented by the Ministry of Youth Affairs and Sports to coaches who have demonstrated excellence in training athletes and teams to achieve international success.

• Colaco also made history by leading Dempo SC to the semi-finals of the AFC Cup in 2008, which was a landmark achievement for any Indian football club at the continental level.

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• He served as the head coach of the Indian National Football Team in 2011, during which India recorded a memorable 2-1 victory over Qatar in a World Cup Qualifier.

Additional Information

• Dronacharya Award:

• Instituted in the year 1985, it is the highest award for sports coaching in India.

• It is named after Guru Dronacharya, a character from the Mahabharata known as the teacher of the Pandavas and Kauravas.

• The award includes a statuette, a certificate, ceremonial dress, and a cash prize of Rs. 15 lakh for the Lifetime Category and Rs. 10 lakh for the Regular Category.

• Major Dhyan Chand Khel Ratna Award:

• This is the highest sporting honor in India, awarded for the most spectacular and outstanding performance by a sportsperson over a period of four years.

• It was formerly known as the Rajiv Gandhi Khel Ratna Award before being renamed in 2021.

• Arjuna Award:

• Established in 1961, it is awarded to sportspersons for consistent good performance over four years and for showing qualities of leadership, sportsmanship, and a sense of discipline.

• Maulana Abul Kalam Azad (MAKA) Trophy:

• It is a rolling trophy instituted in 1956-57, awarded annually to the University which shows the best all-round performance in sports during the year of the award.

Important Points

• The National Sports Awards are usually conferred by the President of India at a special ceremony held at the Rashtrapati Bhavan.

• Armando Colaco is known for his "tiki-taka" style of possession-based football, which revolutionized the tactical approach of clubs in the I-League.

• His recognition in January 2025 highlights the government's continued focus on honoring veteran contributors who have built the foundation of various sports in the country over several decades.

• Besides Dempo SC, he has also coached other prominent clubs like East Bengal FC and Churchill Brothers, maintaining a high standard of professional football management throughout his career.

Q95. Answer: (c) Rs. 5 lakh

The correct answer is Rs. 5 lakh.

Key Points

• In the Union Budget 2025–26, the Government of India announced a significant enhancement in the credit limit for short-term agriculture loans provided under the Modified Interest Subvention Scheme (MISS).

• The credit limit for Kisan Credit Card (KCC) loans has been increased from the existing Rs. 3 lakh to Rs. 5 lakh to meet the growing capital requirements of farmers.

• This enhancement aims to provide farmers with better access to formal credit, allowing them to invest in high-quality seeds, fertilizers, and modern agricultural machinery.

• The Modified Interest Subvention Scheme (MISS) is a central sector scheme that provides interest subvention to financial institutions to ensure that short-term crop loans are available at an affordable interest rate.

• The Union Budget 2025–26 set a target of Rs. 25 lakh crore for agricultural credit to ensure adequate liquidity in the rural economy.

Additional Information

• Kisan Credit Card (KCC) Scheme:

• Launched in August 1998, the scheme was introduced based on the recommendations of the R.V. Gupta Committee.

• It was designed by NABARD (National Bank for Agriculture and Rural Development) to provide timely and hassle-free credit to farmers for their cultivation and non-farm requirements.

• In 2018-19, the government extended the KCC facility to farmers involved in Animal Husbandry and Fisheries.

• Modified Interest Subvention Scheme (MISS):

• The scheme provides an interest subvention of 1.5% per annum to lending institutions (Public Sector Banks, Private Sector Banks, RRBs, and Cooperative Banks) for short-term loans.

• For farmers who ensure prompt repayment of their loans, an additional 3% incentive is provided under the Prompt Repayment Incentive (PRI) program.

• With the PRI, the effective interest rate for farmers on loans up to the specified limit is significantly reduced, often reaching as low as 4% per annum.

• Digital Public Infrastructure (DPI) for Agriculture:

• The Union Budget 2025–26 emphasizes the digital transformation of agriculture by integrating KCC with digital land records.

• This Digital Public Infrastructure aims to cover 6 crore farmers and their lands within the next three years to simplify credit assessment and disbursement.

Important Points

• Eligibility: The KCC scheme is available to all individual farmers, joint borrowers who are owner-cultivators, tenant farmers, oral lessees, and sharecroppers.

• Implementing Agencies: The scheme is monitored and regulated by the Reserve Bank of India (RBI) and NABARD, ensuring that credit reaches the Small and Marginal Farmers (SMFs) who constitute the bulk of the agricultural workforce in India.

• Purpose of Credit: The credit can be used for crop production, post-harvest expenses, produce marketing loans, consumption requirements of farmer households, and maintenance of farm assets.

• Budget 2025–26 Focus: The enhancement to Rs. 5 lakh reflects the government's strategy of Atmanirbhar Krishi, focusing on increasing farm productivity through improved credit flow.

Q96. Answer: (c) Polio

The correct answer is Polio.

Key Points

• National Vaccination Day, also referred to as National Immunization Day, is observed in India every year on 16 March.

• The primary objective of this day is to convey the significance of vaccination to the general public and to recognize the efforts of healthcare professionals and frontline workers in ensuring public health.

• This specific date was chosen to commemorate the administration of the first dose of the Oral Polio Vaccine (OPV) in India, which took place on 16 March 1995.

• The event marked the launch of the Pulse Polio Programme, a comprehensive immunization campaign by the Government of India to eradicate Poliomyelitis from the country.

• The Pulse Polio Initiative targeted children in the age group of 0 to 5 years, providing them with two drops of the oral vaccine to build immunity and interrupt the transmission of the poliovirus.

Additional Information

• Eradication of Polio in India:

• Through rigorous immunization drives, India successfully halted the transmission of the indigenous wild poliovirus.

• The last case of wild polio in India was reported in Howrah, West Bengal, on 13 January 2011.

• On 27 March 2014, the World Health Organization (WHO) officially certified India as a polio-free country, along with the entire South-East Asia Region.

• Universal Immunization Programme (UIP):

• India’s Universal Immunization Programme was launched in 1985 and is one of the largest public health programs in the world.

• It provides life-saving vaccines free of cost to all children and pregnant women against diseases such as Tuberculosis, Diphtheria, Pertussis, Tetanus, Hepatitis B, Measles, and Meningitis.

• Mission Indradhanush:

• To strengthen and re-energize the immunization drive, Mission Indradhanush was launched in December 2014.

• The goal was to achieve full immunization coverage for at least 90% of the population, specifically focusing on children under 2 years of age and pregnant women who were missed during routine programs.

• Significance of Vaccines for Other Diseases:

• Malaria: The RTS,S/AS01 (Mosquirix) was the first vaccine recommended by WHO for children in areas with moderate to high transmission, but it does not have a historical tie to India's 16 March observance.

• Dengue: While vaccines like Dengvaxia exist, they are not part of the primary historical context of National Vaccination Day in India.

• HIV: As of now, there is no globally approved or effective vaccine for the Human Immunodeficiency Virus (HIV), though extensive clinical trials are ongoing worldwide.

Important Points

• The theme for National Vaccination Day 2024 was "Vaccines Work for Everyone", emphasizing the inclusive nature of immunization programs.

• The Ministry of Health and Family Welfare is the nodal agency responsible for the planning and execution of these nationwide health initiatives.

• The Global Polio Eradication Initiative (GPEI), supported by Rotary International, UNICEF, and the Bill & Melinda Gates Foundation, played a crucial role in supporting India's transition to a polio-free state.

Q97. Answer: (b) Russia

The correct answer is Russia.

Key Points

• The United States has proposed or scheduled a 50% tariff on Indian exports in response to India's continued procurement of discounted crude oil from Russia.

• This trade measure is set to take effect starting 27 August 2025, marking a significant escalation in trade tensions between New Delhi and Washington. Hence, the correct answer is Russia.

• Following the geopolitical conflict in Eastern Europe that began in 2022, Russia offered its oil at steep discounts to India to offset Western sanctions.

• India, the world's third-largest consumer of oil, increased its share of Russian oil imports from less than 1% in 2021 to over 40% by 2024.

• The US government views the purchase of Russian energy as a means of providing financial support to the Russian economy, thereby circumventing the intended impact of international sanctions.

• The 50% tariff specifically targets Indian exports to the US market, which is one of India's largest trading partners, to discourage further energy cooperation with sanctioned nations.

Additional Information

• India's Energy Strategy:

• India imports approximately 85% of its total crude oil requirements to meet domestic demand.

• Traditionally, Iraq, Saudi Arabia, and the United Arab Emirates (UAE) were the top suppliers, but Russia surged to the number one spot due to competitive pricing.

• The Indian government has maintained a policy of strategic autonomy, prioritizing national energy security and inflation control.

• Indo-US Trade Relations:

• The United States is India's largest trading partner as of 2023-24, with bilateral trade exceeding $120 billion.

• Key Indian exports to the USA include pharmaceuticals, gems and jewelry, IT services, and textiles.

• Trade disputes often arise regarding intellectual property rights, market access, and Generalized System of Preferences (GSP) benefits.

• Global Sanctions Framework:

• The G7 countries implemented a price cap of $60 per barrel on Russian oil to limit Moscow's revenue.

• The US utilizes the Countering America's Adversaries Through Sanctions Act (CAATSA) and other executive orders to influence global trade patterns.

Important Points

• The specific date of 27 August 2025 serves as a critical deadline for Indian exporters to adjust their supply chains or for diplomatic negotiations to resolve the tariff issue.

• The 50% tariff rate is considered exceptionally high, as standard Most Favored Nation (MFN) rates usually range between 0% and 15% for most industrial goods.

• Economists predict that such a move could lead to trade diversion, where US importers shift from India to other Southeast Asian nations like Vietnam or Thailand.

• Indian refineries, such as those operated by Reliance Industries and Nayara Energy, have been central to processing Russian crude into refined products for global markets.

Q98. Answer: (d) Panama City

The correct answer is Panama City.

Key Points

• The city of Panama City, the capital of Panama, has been selected to host the first Climate Week of the year in May 2025.

• This event is specifically designed as the Latin America and the Caribbean Climate Week (LACCW) 2025, aiming to mobilize regional climate action ahead of major global summits. Hence, the correct answer is Panama City.

• The May 2025 gathering serves as a strategic platform for policymakers, local authorities, and private sector leaders to discuss sustainable development and decarbonization strategies tailored to the Latin American context.

• Organized in collaboration with the United Nations Framework Convention on Climate Change (UNFCCC), the event focuses on identifying gaps and opportunities for mitigation and adaptation in the region.

• The timing of the event in 2025 is crucial as it builds momentum for the 30th session of the Conference of the Parties (COP30), which is scheduled to take place in Belém, Brazil, later that year.

Additional Information

• Panama's Environmental Role:

• Panama is recognized globally as one of the very few carbon-negative countries, meaning it absorbs more carbon dioxide than it

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emits.

• The country has committed to protecting 30% of its marine and terrestrial ecosystems, a goal achieved through rigorous environmental laws and conservation efforts.

• Its unique geographical position as an isthmus connecting North and South America makes it a critical biodiversity hotspot and a hub for maritime logistics.

• Regional Climate Weeks:

• Regional Climate Weeks are held annually in Africa, Asia-Pacific, Latin America and the Caribbean, and the Middle East and North Africa (MENA).

• These forums are essential for discussing Climate Finance, Nature-based Solutions, and the Energy Transition before the annual COP meetings.

• The 2025 cycle is particularly important for the Global Stocktake process, where countries assess their progress toward the Paris Agreement goals.

• Focus Areas for 2025:

• Key themes for the May 2025 event include the Blue Economy, given Panama's extensive coastline and the economic importance of the Panama Canal.

• Discussions will also center on Climate Justice and the protection of Indigenous communities, who are on the front lines of climate impacts in the Caribbean and Amazonian regions.

Important Points

• COP30 and the Brazil Connection: Since COP30 will be hosted by Brazil in November 2025, the Panama Climate Week in May acts as the primary regional coordination meeting to unify the Latin American voice on issues like forest protection and loss and damage funds.

• Economic Impact: Hosting such an international event in Panama City boosts eco-tourism and highlights the city's infrastructure as a leading venue for sustainability-focused international conferences.

• Year 2025 Significance: This year marks a decade since the adoption of the Paris Agreement (2015), making the May 2025 meetings vital for setting new, more ambitious Nationally Determined Contributions (NDCs) for the next cycle.

Q99. Answer: (a) New Delhi

The correct answer is New Delhi.

Key Points

• The United Nations Troop Contributing Countries' (UNTCC) Chiefs' Conclave was hosted in New Delhi in October 2025.

• This high-level meeting brought together the Chiefs of Defence and senior military leadership from major nations that provide personnel to United Nations Peacekeeping Operations (UNPKOs).

• The primary objective of the conclave held in New Delhi was to discuss the changing dynamics of global conflict and the increasing challenges faced by Blue Helmets in volatile regions.

• Participants focused on enhancing synergy and interoperability among different national contingents to ensure the effective implementation of UN mandates.

• The event highlighted India's leadership role as one of the historically largest Troop Contributing Countries, emphasizing its commitment to international peace and security.

Additional Information

• India's Legacy in UN Peacekeeping:

• India has been a pioneer in UN peacekeeping since its inception, participating in over 50 missions since 1950.

• As of 2024-2025, India remains one of the top contributors, with thousands of personnel deployed in missions like UNMISS (South Sudan), MONUSCO (Congo), and UNIFIL (Lebanon).

• India was the first country to deploy an All-Female Police Unit to a UN peacekeeping mission in Liberia in 2007.

• Major Troop Contributing Countries (TCCs):

• Besides India, other major contributors include Bangladesh, Nepal, Rwanda, and Pakistan.

• TCCs are responsible for the training, equipment, and discipline of the troops they provide to the United Nations.

• Centre for United Nations Peacekeeping (CUNPK):

• Located in New Delhi, CUNPK was established in 2000 to provide specialized training to Indian and international officers.

• It serves as a center of excellence for research and training on peacekeeping doctrines and logistics.

Important Points

• Technological Integration: A key theme of the 2025 Conclave was the deployment of modern technology, such as drones and AI-based surveillance, to protect peacekeepers from asymmetric threats like IEDs and militant attacks.

• Action for Peacekeeping (A4P): The conclave reviewed progress on the UN Secretary-General's A4P initiative, which aims to make peacekeeping more efficient, safe, and political.

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• Safety and Security: Discussions in New Delhi also addressed the rising number of fatalities among peacekeepers and the need for better medical evacuation (MEDEVAC) facilities in mission areas.

• Financial Reimbursement: The forum allowed TCCs to voice concerns regarding the timely reimbursement of costs by the United Nations for the personnel and equipment provided.

• Host Country Agreement: The selection of India as the venue underscores its diplomatic weight and its voice in advocating for reforms in the UN Security Council.

Q100. Answer: (d) Bengaluru

The correct answer is Bengaluru.

Key Points

• In June 2025, the World Bank officially approved a massive loan amounting to Rs. 3,700 crore (approximately $440 million) dedicated to the rejuvenation of lakes and the enhancement of flood resilience in Bengaluru.

• The project is specifically designed to address the recurring problem of urban flooding in the city, which is often caused by the mismanagement of stormwater drains and the degradation of natural water bodies. Hence, the correct answer is Bengaluru.

• This initiative focuses on restoring the interconnectivity of the lake systems, which historically acted as a natural flood mitigation mechanism for the Karnataka state capital.

• The funding aims to support nature-based solutions, such as the creation of wetlands and the desilting of major primary and secondary drains (Rajakaluves) to ensure smooth water flow during heavy rainfall.

• The project is a collaborative effort between the Government of Karnataka and international financial institutions to transform the "Silicon Valley of India" into a climate-resilient megacity.

Additional Information

• The World Bank's Role in India:

• The World Bank has been a long-term partner in India's urban development, providing technical expertise and financial assistance for infrastructure, clean energy, and water management.

• Headquartered in Washington, D.C., the organization focuses on sustainable development goals and poverty reduction through large-scale developmental loans.

• Bengaluru's Lake Ecosystem:

• Bengaluru, originally known as the "City of Lakes," once possessed over 200 lakes that were interconnected to manage the undulating terrain's water runoff.

• Rapid urbanization and encroachment over the last few decades have led to the disappearance of many water bodies, contributing significantly to modern-day flooding.

• Flood Resilience Strategies:

• Flood resilience involves building infrastructure that can withstand extreme weather events. In India, cities like Chennai and Mumbai have also sought similar international funding to upgrade their drainage systems.

• Strategies often include Integrated Urban Water Management (IUWM), which treats the entire urban water cycle as a single system.

Important Points

• Project Execution: The Bruhat Bengaluru Mahanagara Palike (BBMP) and the Karnataka Interior Department are the primary agencies responsible for executing the rejuvenation works on the ground.

• Impact on Groundwater: Beyond flood control, the rejuvenation of these lakes is critical for groundwater recharge, as Bengaluru faces a severe water crisis during the summer months.

• Environmental Benefits: The restoration of lakes helps in maintaining local biodiversity, reducing the urban heat island effect, and providing recreational spaces for citizens.

• Loan Terms: The Rs. 3,700 crore loan typically comes with a grace period and is part of the International Bank for Reconstruction and Development (IBRD) lending portfolio for India.

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