RRB Group D Official Paper (Held On: 11 Dec, 2025 Shift 2) (Previous Year Paper)

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

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GENERAL SCIENCE

Q1. If an image is formed at the same distance behind a mirror as the object in front, the mirror must be:

(a) plane
(b) concave
(c) parabolic
(d) convex

Q2. Which gland secretes the growth hormone (GH) in humans?

(a) Pancreas
(b) Pituitary gland
(c) Thyroid gland
(d) Adrenal gland

Q3. Match the following connective tissues with their correct features.

a. Areolar tissue	i. fills spaces between organs
b. Skeletal tissues	ii. provide structural support and reduce friction.
c. Ligaments	iii. fibrous tissues that maintain muscle-to-bone
d. Tendons	iv. fibrous tissues that maintain bone-to-bone connection

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

Q4. Which of the following is NOT correct regarding sexual reproduction in plant?

(a) Pollen needs to be transferred from the stamen to the stigma.
(b) Female germ-cells are present in the ovary.
(c) Transfer of pollen from one flower to another is achieved by different agents.
(d) Pollen grain directly travels in the ovary.

Q5. A rifle fires a light bullet, resulting in a large forward acceleration of the bullet and a minimal backward recoil acceleration of the rifle. If the forces are equal and opposite (Action/Reaction), why is the rifle's acceleration so much smaller than the bullet's?

(a) The reaction force of the bullet acts for a shorter duration than the action force.
(b) The acceleration is inversely proportional to the mass, and the rifle has a much greater mass than the bullet.
(c) The action force of the rifle on the bullet is greater than the reaction force of the bullet on the rifle.
(d) Action and reaction forces cancel out since they act instantaneously.

Q6. Which of the following statements about sexual reproduction is INCORRECT?

(a) It combines DNA from two parents.
(b) It helps organisms adapt to changing environments.
(c) It produces identical clones.
(d) It generates variations for species survival.

Q7. Which of the following will NOT produce an echo?

(a) A cliff at 100 m distance
(b) A mountain at 50 m distance
(c) A wall at 10 m distance
(d) A tall building at 30 m distance

Q8. In a multicellular organism, how does each cell support the survival of the organism?

(a) By converting itself into a complete organ
(b) By working independently without interacting with other cells
(c) By trying to carry out all life functions by itself
(d) By following division of labour

Q9. In which carbon allotrope are atoms arranged in a hexagonal layer structure, with weak forces between layers?

(a) Coke
(b) Graphite
(c) Fullerene
(d) Diamond

Q10. Which of the following decomposes on heating to give quick lime?

(a) NaOH
(b) CaCl
(c) CaCO3
(d) KClO3

Q11. Which of the following is a common characteristic of both acids and bases when dissolved in water?

(a) Both produce carbon dioxide when reacted with metal carbonates.
(b) Both produce ions that conduct electricity in aqueous solutions.
(c) Both turn blue litmus red.
(d) Both release hydrogen gas on reacting with metals like zinc.

Q12. A 2 kg body accelerates at 3 m/s^2. The force acting on it is:

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

Q13. Which of the following chemical secretions helps our body in control and coordination?

(a) Saliva
(b) Sebum
(c) Hormones
(d) Gastric mucosa

Q14. Which of the following is the correct formula for kinetic energy of a body of mass ‘m’ kg moving with a uniform speed of ‘v’ m/s?

(a) $1/2mv^2$
(b) $1/2mv$
(c) mv
(d) $1/4mv^2$

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Q15. In the case of a convex mirror, a ray parallel to the principal axis after reflection appears to diverge from:

(a) The centre of curvature
(b) The principal focus
(c) Infinity
(d) The pole

Q16. The weight of an object is less on the Moon than on the Earth because:

(a) the object becomes lighter due to air resistance
(b) the mass of the object decreases on the Moon
(c) the Moon attracts objects with more force
(d) the Moon has smaller acceleration due to gravity than the Earth

Q17. When sugar is dissolved in water, the particles of sugar:

(a) occupy more space
(b) disappear permanently
(c) get into the spaces between water particles
(d) break into smaller pieces only

Q18. Rutherford's gold foil experiment led to a major revision of the atomic model. Which of the following observations and conclusions is most accurate according to the experiment?

(a) The majority of alpha particles passed through the foil undeflected, indicating that atoms are mostly empty space.
(b) Electrons are present in the nucleus and account for the atom's mass.
(c) Alpha particles are deflected because they collide with electrons and spread uniformly throughout the atom.
(d) The nucleus is positively charged and occupies most of the volume of the atom.

Q19. Why are the testes located outside the abdominal cavity in human males?

(a) Because sperm formation requires a lower temperature than body temperature
(b) Because testosterone is produced only outside the body
(c) To protect them from physical damage
(d) Because sperm formation requires higher temperature

Q20. What does the reactivity series of metals represent?

(a) A list of non-metals arranged by their ability to form ions.
(b) A list of metals arranged in increasing order of their density.
(c) A list of metals arranged in increasing order of their melting points.
(d) A list of metals arranged in decreasing order of their reactivity.

Q21. Which of the following may lead to biological magnification?

(a) Pesticides
(b) Degrading vegetables
(c) Peel of banana
(d) Straw

Q22. Conditions to liquefy gases would be:

(a) decreasing pressure and increasing temperature
(b) increasing pressure and decreasing temperature
(c) decreasing pressure and decreasing temperature
(d) increasing pressure and increasing temperature

Q23. Which of the following is NOT formed in the chlor-alkali process?

(a) Sodium hydroxide
(b) Hydrogen gas
(c) Chlorine gas
(d) Sodium carbonate

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Q24. Which of the following is correct about force on a current-carrying conductor in a magnetic field?

(a) The force on a current carrying conductor is proportional to the length of the conductor in the magnetic field.
(b) The force depends on the resistance of the conductor.
(c) The force on a conductor is along the magnetic field direction.
(d) The force is independent of the current in the conductor.

Q25. Which scientist suggested that a magnet exerts an equal and opposite force on a current-carrying conductor?

(a) Ampere
(b) Faraday
(c) Oersted
(d) Maxwell

MATHEMATICS

Q26. Simplify: $(3x - 2)^2 - (x + 4)^2$

(a) $8x^2 - 20x - 4$
(b) $8x^2 + 20x - 12$
(c) $8x^2 - 16x - 12$
(d) $8x^2 - 20x - 12$

Q27. When x is added to each of 17, 9, 26 and 14, then the numbers so obtained, in this order, are in proportion. Then, if $8x : y :: y : (4x - 2)$, and $y > 0$, what is the value of y ?

(a) 22
(b) 12
(c) 14
(d) 4

Q28. If the radius of the base of a right circular cylinder is decreased by 12% and its height is increased by 169%, then what is the percentage increase (closest integer) in its volume?

(a) 111%
(b) 108%
(c) 110%
(d) 134%

Q29. A cycle is sold for Rs. 2,700 at a loss of 10%. Find its cost price.

(a) Rs. 3,600
(b) Rs. 2,800
(c) Rs. 3,200
(d) Rs. 3,000

Q30. Two trains are moving in opposite directions at speeds of 110 km/hr and 150 km/hr. The length of one train is 500 m. The time taken by them to cross each other is 10 seconds. The length (in m) of the other train, correct to 2 decimal places, is:

(a) 225.93
(b) 233.21
(c) 228.02
(d) 222.22

Q31. Two pumps, M and N, can fill a tank in 36 hours and 45 hours, respectively. Another pump P can empty the tank in 30 hours. First M and N are opened, and after 8 hours, P is also opened. The tank will be filled up in total T hours. The value of T is:

(a) 36
(b) 44
(c) 40
(d) 32

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Q32. If 50% of 60% of 2/7 of a number is 618, find the number.

(a) 8450
(b) 7210
(c) 7400
(d) 10350

Q33. If the ratio of two numbers is 2 : 5, and their HCF is 29, then their LCM is:

(a) 281
(b) 319
(c) 290
(d) 283

Q34. After selling an article at a discount of 4%, the profit percentage obtained is 20%. What is the markup percentage?

(a) 19%
(b) 28%
(c) 27%
(d) 25%

Q35. Simplify :

$(1-\sec x)/(\csc x \cdot \cot x)$

(a) $(\cos x + 1) \tan^2 x$
(b) $(\cos x + 1) \cot^2 x$
(c) $(\cos x - 1) \tan^2 x$
(d) $(\cos x - 1) \cot^2 x$

Q36. Simplify: $[24 - \{6 + 3^2 - (4 \times 2 + 1)\}] \div 3 + 5 \times 2$

(a) 18
(b) 17
(c) 16
(d) 20

Q37. A shopkeeper sold a pen for Rs. 150 and made a profit of Rs. 30. Find the cost price of the pen.

(a) Rs. 100
(b) Rs. 110
(c) Rs. 130
(d) Rs. 120

Q38. A and B working together can complete a piece of work in 2 days. B alone can complete the same work in 10 days. How long (in days) will A alone take to complete double the work?2524

(a) 8
(b) 5
(c) 2.5
(d) 6

Q39. If 5/13 of a certain number is added to 7/39 of the same number, the result is 132. Find the number.

(a) 238
(b) 234
(c) 228
(d) 224

Q40. A train 1386 m long is running at 18 km/hr. How long will it take to clear a 564 m long platform completely?

(a) 390 seconds
(b) 393 seconds
(c) 386 seconds
(d) 385 seconds

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Q41. The total surface area of a sphere is 6006 cm^2 less than the total surface area of a hemisphere. If the ratio between the radii of the hemisphere and sphere is 5 : 3, then find the radius of the sphere.

(Use $\pi = 22/7$)

(a) 28 cm
(b) 21 cm
(c) 35 cm
(d) 42 cm

Q42. The sides of a triangle are 68 cm, 31 cm, and 87 cm. What is the length of its altitude corresponding to the side with a length of 31 cm?

(a) 103 cm
(b) 60 cm
(c) 40 cm
(d) 85 cm

Q43. The data 30, 33, 49, 51, x, x + 4, 73, 79, 85, 96 is arranged in the ascending order and the median of the data is 64. Find the value of x.

(a) 62
(b) 64
(c) 61
(d) 63

Q44. A shopkeeper marks the price of an article at Rs. 1,980. Find the cost price if after allowing a discount of 12% he still gains 32% on the cost price.

(a) Rs. 1,283
(b) Rs. 1,349
(c) Rs. 1,320
(d) Rs. 1,209

Q45. The average age of 37 students of a class is 42 years. If the age of the teacher is also included, the average age of the whole group becomes 43 years. The age (in years) of the teacher is:

(a) 77
(b) 81
(c) 83
(d) 80

Q46. If Rs. 8,404 is divided between Rishi and Yash in the ratio 7 : 15, then find the share of Yash (in Rs.).

(a) 5,731
(b) 5,730
(c) 5,733
(d) 5,732

Q47. An uncle is 6 times as old as his nephew. In 6 years, the difference in their ages will be 30 years. What is the sum of their current ages (in years)?

(a) 42
(b) 48
(c) 30
(d) 36

Q48. The price of 1 kg of carrot on Monday is Rs. 40. If it is increased by 5% and 3% on the next two consecutive days, then what is its price (in Rs.) on Wednesday?

(a) 43.26
(b) 46.32
(c) 49.25
(d) 36.43

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Q49. Two banks, A and B, offered loans at 3.5% and 7.5% per annum, respectively. Mukund borrowed an amount of Rs. 2,00,000 from each bank. Find the positive difference (in Rs.) between the amounts of simple interest paid to the two banks by Mukund after 2 years.

(a) 16,000
(b) 17,500
(c) 15,500
(d) 17,000

Q50. The cost of a washing machine is 50% less than the cost of a TV. If the cost of the washing machine increases by 76% and that of the TV decreases by 28%, then what is the percentage change in the total cost of 4 washing machines and 2 TVs?

(a) Increase by 31%
(b) Decrease by 27%
(c) Decrease by 25%
(d) Increase by 24%

GENERAL INTELLIGENCE & REASONING

Q51. What should come in place of the question mark (?) in the given series?

37 49 61 73 85 ?

(a) 101
(b) 97
(c) 105
(d) 91

Q52. In a certain code language,

P + Q means ‘P is the husband of Q’,

P # Q means ‘P is the wife of Q’,

P & Q means ‘P is the brother of Q’ and

P % Q means ‘P is the father of Q’.

How is G related to E if ‘G # V % M & H + E’?

(a) Wife's brother
(b) Husband’s father
(c) Husband’s sister
(d) Husband’s mother

Q53. BGLQ is related to EJOT in a certain way based on the English alphabetical order. In the same way, FKPU is related to INSX. To which of the following is HMRW related, following the same logic?

(a) LPUY
(b) KQVX
(c) KPUZ
(d) LQVX

Q54. Which of the following letter-number clusters will replace the question mark (?) in the given series to make it logically complete?

ANF 17, DQI 21, GTL 25, JWO 29, ?

(a) MYR 32
(b) MZR 33
(c) MYR 33
(d) MZR 32

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Q55. Which of the given letter-number clusters will replace the question mark (?) in the following series to make it logically complete?

CFE10, GJI14, KNM18, ?

(a) ORQ22
(b) SVU24
(c) RVQ24
(d) ORU22

Q56. In a certain code language, ‘photo vet scale’ is coded as ‘zk jh kv’ and ‘urn photo kin’ is coded as ‘jh zn fl’. How is ‘photo’ coded in that language?

(a) zk
(b) zn
(c) jh
(d) kv

Q57. What should come in place of the question mark (?) in the given series?

319 320 323 328 335 ?

(a) 346
(b) 348
(c) 344
(d) 342

Q58. 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) EH - DG
(b) OR - NQ
(c) QT - PT
(d) LO - KN

Q59. Seven boxes, M, N, O, P, Q, R and S, are kept one over the other, but not necessarily in the same order.

Only P is kept above O. Only Q is kept between O and R. Only N is kept below S.

How many boxes are kept between M and N?

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

Q60. In a certain code language, ‘mall tree army’ is coded as 'vg ur ua' and ‘plant army cup’ is coded as ‘ti ud vg’. How is ‘army’ coded in the given language?

(a) vg
(b) ua
(c) ti
(d) ur

Q61. DR 12 is related to FK −6 in a certain way. In the same way, JM 18 is related to LF 0. To which of the given options is KN 3 related, following the same logic?

(a) MG −15
(b) MK −11
(c) HU −12
(d) LP −10

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Q62. What will come in the place of '?' in the following equation, if '+' and ' ÷ ' are interchanged and ' - ' and ' x ' are interchanged?

195 + 3 x 22 - 6 ÷ 117 = ?

(a) 51
(b) 43
(c) 57
(d) 50

Q63. A, B, C, D, W, X, and Y are sitting in a straight line, facing the north. Only two people sit to the right of X. Only two people sit between X and C. Only two people sit between A and D. D sits to the immediate left of X. B sits to the immediate right of Y.

Who sits at the third position from the left end of the line?

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

Q64. Gagana starts from Point A and drives 5 km towards east. She then takes a left turn, drives 3 km, turns left and drives 2 km. She then takes a right turn and drives 7 km. She takes a final left turn, drives 3 km and stops at Point P. How far (shortest distance) and towards which direction should she drive in order to reach Point A again?

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

(a) 16 km towards east
(b) 10 km towards south
(c) 8 km towards west
(d) 10 km towards north

Q65. Refer to the following number and symbol series and answer the question that follows. Counting to be done from left to right only. All numbers are single-digit numbers.

(Left) $ # # £ 9 % £ 7 * & € 1 3 4 5 6 4 9 € 2 5 & (Right)

How many such numbers are there each of which is immediately preceded by a symbol and also immediately followed by a symbol?

(a) 2
(b) 6
(c) 5
(d) 4

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 their constituent digits. E.g. 13 – Operations on 13 such as adding to/subtracting from/multiplying with 13 can be performed. Breaking down 13 into 1 and 3 and then performing mathematical operations on 1 and 3 is not allowed.)

(35, -34, 1)

(35, 14, 7)

(a) (23, 266, 17)
(b) (31, 47, 9)
(c) (15, -17, 1)
(d) (9, -8, 2)

Q67. Seven people, B, C, D, I, J, K and L, are sitting around a circular table, facing the centre of the table. I sits fourth to the right of J. Only two people sit between B and C, when counted from the left of B. D sits third to the left of K. L is an immediate neighbour of K and C. How many people sit between I and L, when counted from the left of L?

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

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Q68. If 'A' stands for '÷', 'B' stands for 'x', 'C' stands for '+' and 'D' stands for '–', what will come in place of question mark (?) in the following equation?

44 A 11 B 25 D 28 C 1 = ?

(a) 78
(b) 73
(c) 77
(d) 74

Q69. What should come in place of the question mark (?) in the given series?

121 123 127 133 141 ?

(a) 153
(b) 149
(c) 147
(d) 151

Q70. Refer to the following number, symbol series and answer the question. Counting to be done from left to right only. All numbers are single-digit numbers.

(Left) Ω 9 % 6 1 * £ 5 # 2 8 $ 7 & + @ 3 4 (Right)

How many such symbols are there, each of which is immediately preceded by another symbol and also immediately followed by a number?

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

Q71. GENU is related to KZRP in a certain way based on the English alphabetical order. In the same way, OUVK is related to SPZF. To which of the given options is WKDA related, following the same logic?

(a) BFIW
(b) BEGU
(c) ZGHW
(d) AFHV

Q72. Town P is to the west of Town Q. Town R is to the south of Town P. Town S is to the east of Town R. Town T is to the north of Town S. Town Q is to the northeast of Town T. What is the position of Town P with respect to Town T?

(a) Northwest
(b) Southeast
(c) Northeast
(d) Southwest

Q73. A, B, C, D, E and F are sitting around a circular table facing the centre. D sits third to the right of C. C sits second to the left of F. A sits third to the right of B. B sits to the immediate left of E. How many people sit between A and D when counted from the left of D?

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

Q74. 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 conclusion(s) logically follow(s) from the statements.

Statements:

All curtains are blinders.

All curtains are dividers.

All curtains are walls.

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Conclusions:

(I) All blinders are walls.

(II) Some walls are dividers.

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

Q75. 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 1 1 7 2 4 1 2 7 4 4 9 6 3 9 1 6 1 9 2 2 8 8 (Right)

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

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

Q76. If 'A' stands for '÷', 'B' stands for '×', 'C' stands for '+' and 'D' stands for '−', what will come in place of the question mark (?) in the following equation?

16 B 3 D 36 A 18 C 18 = ?

(a) 66
(b) 62
(c) 64
(d) 65

Q77. Based on the English alphabetical order, three of the following four letter-clusters are alike in a certain way and thus form a group. Which letter-cluster DOES NOT belong to that group?

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

(a) QVP
(b) MRL
(c) EJD
(d) TYR

Q78. 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) 8 7 7 4 2 1 5 4 8 9 4 1 1 1 9 9 3 7 9 5 4 (Right)

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

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

Q79. 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 Hats are Ratchets. No Ratchets are Cats. Some Cats are Angels.

Conclusion (I): No Hats are Cats.

Conclusion (II): No Angels are Ratchets

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

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Q80. Seven boxes B, C, D, I, J, K, and L are kept one over the other but not necessarily in the same order. Only C is kept below I. Only four boxes are kept between C and J. Only L is kept between J and D. B is kept at one of the positions above J. How many boxes are kept between K and C?

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

GENERAL AWARENESS AND CURRENT AFFAIRS

Q81. Which of the following is the main aim of the Memorandum of Understanding signed between the National Institute for Empowerment of Persons with Intellectual Disabilities (Divyangjan) and the Jai Vakeel Foundation, in Mumbai in July 2025?

(a) To roll out structured and uniform curriculum for children with intellectual disabilities
(b) To train teachers in sign language and Braille for visually and hearing-impaired students
(c) To establish a nationwide health insurance scheme for persons with disabilities
(d) To launch a nationwide immunisation drive for children with disabilities

Q82. Which club won the 2025 UEFA Champions League?

(a) Real Madrid
(b) Manchester City
(c) Paris Saint-Germain
(d) Bayern Munich

Q83. Who among the following completed her/his 31^(st) climb of Mount Everest in May 2025?

(a) Nyima Gyalzen Dorje
(b) Chhonzin Angmo
(c) Apa Sherpa
(d) Kami Rita

Q84. The Republic Day celebrated on 26 January 2025, was India's _____ Republic Day.

(a) 74th
(b) 75th
(c) 76th
(d) 77th

Q85. On 12 April 2025, which of the following banks celebrated 131^(st)foundation day with the launch of 34 new banking products and services?

(a) Canara Bank
(b) Punjab National Bank
(c) Bank of India
(d) Indian Bank

Q86. Which female athlete received the Sportstar of the Year (Female) award in 2025?

(a) Mary Kom
(b) Manu Bhaker
(c) PV Sindhu
(d) Saina Nehwal

Q87. At which place in India was the setting up of the International Potato Center-South Asia Regional Centre (CSARC) approved by the Union Cabinet of India in June 2025?

(a) Lucknow
(b) Noida
(c) Kanpur
(d) Agra

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Q88. As per data released by Ministry of Earth Sciences in March 2025, what percentage of area in India is vulnerable to earthquakes?

(a) 30%
(b) 59%
(c) 89%
(d) 40%

Q89. In July 2025, which Indian state cabinet approved a bill criminalising even engagements involving minors under child marriage prevention laws?

(a) Kerala
(b) Maharashtra
(c) Telangana
(d) Karnataka

Q90. In August 2025, which state unveiled its State Disaster Management Plan and inaugurated a host of initiatives, including the Technology Demonstration Unit, Civil Defence Training Scheme, automated weather stations and rain gauges?

(a) Uttar Pradesh
(b) Tripura
(c) Meghalaya
(d) Madhya Pradesh

Q91. Which of the following schemes launched by the State Bank of India in January 2025 enables customers to accumulate Rs. 1 lakh or above in their accounts by depositing small savings every month?

(a) Lakhpati Patrons
(b) Har Ghar Lakhpati
(c) Har Ghar Bachat
(d) Suraksha Nivesh

Q92. NISAR (NASA-ISRO Synthetic Aperture Radar) which was scheduled to be launched from India in July 2025 jointly by National Aeronautics and Space Administration (NASA) and Indian Space Research Organisation (ISRO) is a _____.

(a) $2.5 billion mission
(b) $1.5 billion mission
(c) $4.5 billion mission
(d) $3.5 billion mission

Q93. As per Union Budget, 2025-26, what is the total allocation to the Ministry of Defence to strengthen India's military capabilities?

(a) Rs. 5,81,210.27 crore
(b) Rs. 8,81,210.27 crore
(c) Rs. 6,81,210.27 crore
(d) Rs. 7,81,210.27 crore

Q94. In August 2025, which body directed the Ministry of Environment, Forest and Climate Change (MoEF&CC) of the Government of India to frame terms for an ozone study committee?

(a) Supreme Court of India
(b) Central Pollution Control Board
(c) National Green Tribunal
(d) NITI Aayog

Q95. The Ministry of Statistics and Programme Implementation (MoSPI) in June 2025 announced its plan to launch the first-ever nationwide household income survey in _____.

(a) 2028
(b) 2026
(c) 2029

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(d) 2027

Q96. Which of the following female athletes was awarded the 2025 Laureus World Sportswoman of the Year announced in April 2025?

(a) Katie Ledecky
(b) Iga Swiątek
(c) Athing Mu
(d) Simone Biles

Q97. Which of the following cities hosted the 2025 World Aquatics Championships?

(a) Budapest
(b) Singapore
(c) Melbourne
(d) Doha

Q98. In March 2025, who was appointed as a full-time member of NITI Aayog, after serving as Cabinet Secretary until August 2024?

(a) BVR Subrahmanyam
(b) Arvind Panagariya
(c) Rajiv Gauba
(d) S Mahendra Dev

Q99. Where was the All India Inter-University Volleyball Championship 2025 held from 6-10 January?

(a) Delhi University, Delhi
(b) Osmania University, Hyderabad
(c) Banaras Hindu University, Varanasi
(d) St. Thomas College, Pala

Q100. Which of the following cities hosted the G20 Digital Economy Working Groups' second meeting in South Africa in 2025?

(a) Cape Town
(b) Eastern Cape
(c) Durban
(d) Pretoria

ANSWER KEY

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

SOLUTIONS

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Q1. Answer: (a) plane

The correct answer is plane mirror.

Key Points

• A plane mirror forms an image at the same distance behind the mirror as the object is in front of it due to its reflective properties.

• In a plane mirror, the image formed is virtual, erect, and of the same size as the object. This is because the mirror reflects light rays symmetrically.

• The image formed by a plane mirror is laterally inverted, meaning the left and right sides appear swapped.

• A plane mirror follows the law of reflection, where the angle of incidence is equal to the angle of reflection. This ensures symmetrical image formation.

• Plane mirrors are commonly used in households, optical instruments, and scientific experiments due to their ability to form clear and accurate images.

Additional Information

• Concave Mirror:

• A concave mirror forms real or virtual images depending on the object's position relative to the focal point.

• It is used in applications like telescopes, headlights, and shaving mirrors because it can magnify objects.

• When the object is placed beyond the focal point, the image is inverted and real. If the object is within the focal length, the image is virtual and magnified.

• Convex Mirror:

• A convex mirror forms a virtual, erect, and diminished image irrespective of the object's position.

• It is widely used in rearview mirrors of vehicles due to its wide field of view.

• Convex mirrors diverge light rays, making them unsuitable for applications requiring focused light or magnified images.

• Parabolic Mirror:

• A parabolic mirror focuses light to a single point and is used in applications such as satellite dishes, telescopes, and solar concentrators.

• It is a type of concave mirror shaped to eliminate spherical aberrations, ensuring accurate focus.

• Reflective Properties of Mirrors:

• All mirrors reflect light according to the law of reflection, but the type of mirror determines the nature of the image (real or virtual).

• Plane mirrors are unique because they form images that are identical in size and shape to the object, making them ideal for everyday use.

Important Points

• Virtual Image:

• A virtual image is formed when light rays appear to diverge from a point behind the mirror.

• Plane mirrors always produce virtual images, making them suitable for applications like dressing mirrors or decorative purposes.

• Applications of Plane Mirrors:

• Used in periscopes for reflecting light and providing a view of objects at different heights.

• Employed in optical instruments like kaleidoscopes to create symmetrical patterns.

• Commonly used for decoration and as household mirrors due to their ability to form clear images.

Q2. Answer: (b) Pituitary gland

The correct answer is Pituitary gland.

Key Points

• The pituitary gland, often referred to as the "master gland," is a small, pea-shaped gland located at the base of the brain. It plays a crucial role in regulating vital body functions and general well-being.

• The growth hormone (GH), also called somatotropin, is secreted by the anterior lobe of the pituitary gland. This hormone is responsible for stimulating growth, cell reproduction, and cell regeneration in humans.

• GH is essential during childhood and adolescence as it helps in the growth of bones and muscles. In adults, it supports the maintenance of tissues and organs and regulates metabolism.

• The secretion of growth hormone is controlled by two hypothalamic hormones: growth hormone-releasing hormone (GHRH), which stimulates its release, and somatostatin, which inhibits its release.

• Disorders related to GH include gigantism or acromegaly (excess GH production) and growth hormone deficiency, which can result in stunted growth or delayed development in children.

Additional Information

• Location and Structure of the Pituitary Gland:

• The pituitary gland is located in a small bony cavity called the sella turcica, part of the sphenoid bone in the skull.

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• It is connected to the hypothalamus by a thin stalk called the infundibulum.
• The gland is divided into two main parts: the anterior lobe (adenohypophysis) and the posterior lobe (neurohypophysis).
• Functions of Growth Hormone (GH):
• Stimulates the growth of bones and cartilage during childhood and adolescence.
• Enhances protein synthesis and increases the breakdown of fats, leading to energy production.
• Promotes the growth and repair of tissues, including skin, muscles, and organs.
• Regulates body composition, fluid balance, and metabolism of sugars and fats.
• Disorders Related to Growth Hormone:
• Gigantism: Caused by excessive GH secretion during childhood, leading to abnormally tall stature.
• Acromegaly: Excess GH in adulthood, resulting in enlarged hands, feet, and facial features.
• Growth Hormone Deficiency: Can result in stunted growth in children and reduced muscle mass and energy levels in adults.
• Other Hormones Secreted by the Pituitary Gland:
• Prolactin (PRL): Stimulates milk production in females.
• Adrenocorticotropic Hormone (ACTH): Stimulates the adrenal glands to produce cortisol.
• Thyroid-Stimulating Hormone (TSH): Regulates the thyroid gland.
• Follicle-Stimulating Hormone (FSH) and Luteinizing Hormone (LH): Control reproductive processes in males and females.
• Role of the Hypothalamus:
• The hypothalamus, located just above the pituitary gland, plays a critical role in regulating its hormone secretion.
• It produces releasing and inhibiting hormones, such as GHRH and somatostatin, that control the release of GH and other pituitary hormones.

Q3. Answer: (c) a i, b ii, c iv, d iii

The solution is in Hindi. Read it online.

Q4. Answer: (d) Pollen grain directly travels in the ovary.

The correct answer is Pollen grain directly travels in the ovary..

Key Points

• Pollen needs to be transferred from the stamen to the stigma: This process is known as pollination. It is essential for sexual reproduction in plants as it allows male gametes (pollen grains) to reach the female reproductive part of the plant. Hence, this statement is correct.

• Female germ cells are present in the ovary: The ovary contains ovules, which house the female gametes (egg cells). After fertilization, the ovary develops into a fruit, and the ovules develop into seeds. Hence, this statement is correct.

• Transfer of pollen from one flower to another is achieved by different agents: This process, known as cross-pollination, is facilitated by agents like wind, water, insects, birds, or animals. These agents help in the transfer of pollen from one flower's stamen to another flower's stigma. Hence, this statement is correct.

• Pollen grain directly travels in the ovary: This is incorrect because pollen grains do not directly travel to the ovary. Instead, they land on the stigma, germinate, and form a pollen tube that carries the male gametes to the ovule in the ovary. This process ensures fertilization. Hence, this statement is incorrect.

Additional Information

• Pollination:
• It is the transfer of pollen from the anther (male reproductive part) to the stigma (female reproductive part).
• Pollination can be self-pollination (within the same flower) or cross-pollination (between different flowers).
• Agents of pollination include wind, water, insects, and animals.
• Fertilization:
• After pollination, the pollen grain germinates on the stigma and forms a pollen tube.
• The pollen tube grows through the style and reaches the ovary.
• Male gametes travel through the pollen tube to the ovule, where fertilization occurs, forming a zygote.
• Agents of Pollination:
• Wind: Common in plants like grasses and maize, where light pollen grains are easily carried by the wind.
• Water: Typical in aquatic plants like Vallisneria, where pollen floats on water to reach another flower.
• Insects: Bees, butterflies, and beetles are common insect pollinators attracted by flowers' bright colors and nectar.
• Animals: Birds like hummingbirds and bats also contribute to pollination, especially in tropical plants.
• Structure of a Flower:
• Stamen: Male reproductive part consisting of anther (produces pollen) and filament.

• Carpel (or Pistil): Female reproductive part consisting of stigma (receives pollen), style (connects stigma and ovary), and ovary (contains ovules).

• Petals: Often brightly colored to attract pollinators.

• Sepals: Protect the flower in the bud stage.

Important Points

• Sexual reproduction in plants ensures genetic diversity, which is crucial for adaptation and survival.

• Fertilization in plants leads to the formation of seeds and fruits, aiding in the propagation of the species.

• Pollination strategies are critical for crop production and ecosystem health. Farmers often rely on natural pollinators like bees to increase yields.

• Flowers are specifically adapted to their pollination mechanisms. For example, insect-pollinated flowers often have nectar guides, while wind-pollinated flowers are small and produce abundant pollen.

Q5. Answer: (b) The acceleration is inversely proportional to the mass, and the rifle has a much greater mass than the bullet.

The correct answer is The acceleration is inversely proportional to the mass, and the rifle has a much greater mass than the bullet..

Key Points

• Newton's Third Law of Motion: When the rifle fires the bullet, the force exerted by the rifle on the bullet (action) is equal and opposite to the force exerted by the bullet on the rifle (reaction). However, this does not mean their accelerations are identical.

• Relationship Between Force, Mass, and Acceleration: According to Newton's Second Law, acceleration (a) is given by the equation F = ma, or a = F/m. This implies that acceleration is inversely proportional to mass for a given force.

• Mass Comparison: The mass of the rifle is significantly greater than the mass of the bullet. For the same magnitude of force, the bullet, having a smaller mass, experiences a much larger acceleration compared to the rifle.

• Recoil of the Rifle: The recoil of the rifle is minimal because its larger mass results in a much smaller backward acceleration, despite the equal and opposite force acting on it.

• Practical Observation: This principle is why bullets travel at extremely high speeds, while the recoil of the rifle is much slower and usually manageable by the shooter.

Additional Information

• Newton's Third Law of Motion: This law states that for every action, there is an equal and opposite reaction. In the context of firing a rifle, the bullet is propelled forward due to the action force, while the rifle experiences a recoil force in the opposite direction.

• Momentum Conservation: The system (rifle + bullet) conserves momentum. The forward momentum of the bullet is equal to the backward momentum of the rifle. This can be expressed as m_(bullet)v_(bullet) = m_(rifle)v_(rifle).

• Real-life Applications: This principle is utilized in the design of firearms, where recoil-absorbing mechanisms are employed to reduce the impact on the shooter.

• Mass and Acceleration Relationship: A smaller mass (bullet) results in a larger acceleration for a given force, whereas a larger mass (rifle) results in a smaller acceleration. This is the fundamental reason for the observed difference in motion between the bullet and the rifle.

• Recoil Management: Modern firearms often include features like recoil pads or muzzle brakes to manage the backward acceleration of the rifle, ensuring better control and comfort for the shooter.

Important Points

• Option 1: The statement that the reaction force of the bullet acts for a shorter duration than the action force is incorrect. Action and reaction forces occur simultaneously and for the same duration.

• Option 2: Correct. The acceleration depends on the mass of the object. The rifle’s greater mass leads to a smaller acceleration compared to the bullet.

• Option 3: Incorrect. The action and reaction forces are always equal in magnitude, as per Newton’s Third Law. One force cannot be greater than the other.

• Option 4: Incorrect. Action and reaction forces do not cancel out because they act on different objects (the rifle and the bullet).

Q6. Answer: (c) It produces identical clones.

The correct answer is It produces identical clones..

Key Points

• Sexual reproduction is the process by which organisms create offspring through the fusion of two gametes (male and female). This process combines the genetic material from two parents, resulting in genetic diversity. Hence, statement 1 is correct.

• Sexual reproduction introduces genetic variations due to recombination and independent assortment of chromosomes during meiosis. These variations are crucial for species to adapt to changing environments and enhance survival rates. Hence, statement

2 is correct.

• Sexual reproduction does not produce identical clones. Cloning is a feature of asexual reproduction where offspring are genetically identical to the parent. Sexual reproduction, on the other hand, leads to genetically unique offspring. Hence, statement 3 is incorrect.

• The genetic variation generated in sexual reproduction contributes to the evolutionary fitness of a species, providing a survival advantage in diverse and changing environmental conditions. Hence, statement 4 is correct.

Additional Information

• Asexual reproduction:

• A process where offspring are produced from a single parent without the involvement of gametes.

• Examples include binary fission, budding, and vegetative propagation.

• Offspring are genetically identical to the parent, leading to no genetic variation.

• Sexual reproduction:

• Involves the fusion of male and female gametes (fertilization).

• Leads to genetic variation due to recombination and crossing over during meiosis.

• Examples include reproduction in humans, animals, and flowering plants.

• Advantages of sexual reproduction:

• Enhances genetic diversity, which is essential for adaptation and evolution.

• Reduces the likelihood of harmful mutations being passed down.

• Improves the ability of populations to survive environmental changes and resist diseases.

• Key differences between asexual and sexual reproduction:

• Asexual reproduction: Single parent, no gametes, genetically identical offspring.

• Sexual reproduction: Two parents, involves gametes, genetically diverse offspring.

Important Points

• Meiosis: A specialized type of cell division that produces gametes with half the chromosome number. It ensures genetic variation through crossing over and independent assortment.

• Fertilization: The fusion of male and female gametes to form a zygote, restoring the diploid chromosome number in sexually reproducing organisms.

• Cloning: A process used in asexual reproduction or artificial methods to produce genetically identical organisms, as seen in species like bacteria or in laboratory techniques.

• Examples of sexual reproduction: Reproduction in humans, mammals, birds, and flowering plants like roses and sunflowers.

• Evolutionary significance: Sexual reproduction plays a vital role in the long-term survival and adaptability of species by introducing genetic diversity.

Q7. Answer: (c) A wall at 10 m distance

The correct answer is A wall at 10 m distance.

Key Points

• Echo is the repetition of sound caused by the reflection of sound waves from a surface back to the listener. For an echo to occur, the reflected sound must be heard at least 0.1 seconds after the original sound.

• The speed of sound in air is approximately 343 m/s. For the human ear to distinguish the reflected sound as an echo, the distance between the sound source and the reflecting surface must be at least 17.2 meters (since sound must travel to the surface and back).

• A cliff at 100 m distance: The sound would travel 200 m (to the cliff and back) and would take sufficient time (>0.1 seconds) for the echo to be perceived. Hence, this would produce an echo.

• A mountain at 50 m distance: Similar to the above case, the sound would travel 100 m in total, which is enough for an echo to occur. Thus, this would produce an echo.

• A wall at 10 m distance: The sound would travel only 20 m in total (10 m to the wall and 10 m back). This is insufficient for the time gap of 0.1 seconds required to perceive an echo. Hence, this would NOT produce an echo.

• A tall building at 30 m distance: The sound would travel 60 m in total. This distance is sufficient for an echo to be heard. Thus, this would produce an echo.

Additional Information

• Conditions for Echo Formation:

• The minimum distance between the sound source and the reflecting surface must be at least 17.2 meters.

• The reflecting surface must be large, hard, and smooth to reflect sufficient sound waves back to the listener.

• The surrounding environment must be quiet to hear the reflected sound clearly.

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• Key Characteristics of Sound Reflection:

• Sound waves are reflected according to the laws of reflection: the angle of incidence equals the angle of reflection.

• Materials like concrete, metal, and rock are good reflectors of sound, while soft materials like carpets or curtains absorb sound and prevent echo formation.

• Applications of Echo:

• Sonar technology: Used in ships and submarines to detect objects underwater by analyzing reflected sound waves.

• Ultrasound imaging: Medical applications like sonography use reflected sound waves to create images of internal body structures.

• Measuring distance and depth: Echoes are used to calculate the distance of objects or the depth of caves or water bodies.

• Echo vs Reverberation:

• Echo: A distinct repetition of sound caused by reflection when the reflecting surface is far enough (≥17.2 m).

• Reverberation: A continuous persistence of sound due to multiple reflections when the reflecting surfaces are close to the source.

Important Points

• Sound travel time: The time taken for sound to travel to the reflecting surface and back must exceed 0.1 seconds for an echo to be distinguished.

• Real-world examples: Echoes are commonly heard in large empty halls, mountains, valleys, and near cliffs or large buildings.

• Speed of sound: The speed of sound in air is 343 m/s at room temperature. This speed can vary with air temperature, humidity, and pressure.

Q8. Answer: (d) By following division of labour

The correct answer is By following division of labour.

Key Points

• Division of Labour: In multicellular organisms, cells are specialized to perform specific tasks, which together ensure the survival of the organism. This concept is known as the division of labour. For example, muscle cells are specialized for movement, while red blood cells are adapted for oxygen transport.

• Specialized Functions: Each type of cell has a unique structure and function that contributes to the organism’s overall health and survival. For instance, nerve cells (neurons) transmit signals, while liver cells (hepatocytes) help in detoxification and metabolism.

• Coordination and Interaction: Cells do not work in isolation; they communicate and coordinate with each other through chemical signals, such as hormones and neurotransmitters, to maintain homeostasis and perform complex functions.

• Tissue and Organ Formation: Cells organize into tissues, which form organs. Each organ has a specific role, such as the heart pumping blood or the lungs facilitating gas exchange. This hierarchical organization is crucial for the organism's survival.

• Efficiency and Adaptation: The division of labour allows cells to work more efficiently and adapt to changes in the environment. For example, immune cells are specialized to fight infections, ensuring the organism's protection against pathogens.

Additional Information

• Characteristics of Multicellular Organisms:

• Cell Specialization: Different cells perform specific tasks, such as reproduction (gametes), defense (white blood cells), and support (bone cells).

• Interdependence: Cells rely on each other for survival. For instance, muscle cells depend on red blood cells for oxygen to generate energy.

• Communication Systems: Multicellular organisms use advanced communication systems, such as the nervous and endocrine systems, to coordinate activities across cells and tissues.

• Examples of Division of Labour:

• Digestive System: Cells of the stomach secrete enzymes and acids for digestion, while intestinal cells absorb nutrients.

• Circulatory System: Red blood cells transport oxygen, and white blood cells fight infections.

• Plant Systems: In plants, photosynthetic cells in leaves produce food, while root cells absorb water and nutrients.

• Comparison with Unicellular Organisms:

• In unicellular organisms like amoeba, a single cell performs all life functions, such as feeding, reproduction, and movement.

• In contrast, multicellular organisms have specialized cells to handle these tasks more efficiently.

• Incorrect Options Explained:

• Option 1: Cells cannot transform into entire organs; they are specialized to form tissues that collectively create organs.

• Option 2: Cells do not work independently; they interact and depend on each other for survival.

• Option 3: Individual cells in multicellular organisms do not carry out all life functions; this is managed collectively through specialization and division of labour.

Important Points

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• Communication Mechanisms: Cells communicate through chemical signals like hormones, neurotransmitters, and cytokines, ensuring coordination.

• Homeostasis: The division of labour among cells helps maintain homeostasis, ensuring the internal environment remains stable despite external changes.

• Examples of Specialized Cells:

• Neurons: Transmit electrical signals across the body.

• Osteocytes: Provide structural support in bones.

• Chloroplast-containing Cells: Conduct photosynthesis in plants.

Q9. Answer: (b) Graphite

The correct answer is Graphite.

Key Points

• Graphite is an allotrope of carbon where the carbon atoms are arranged in a hexagonal layer structure. These layers are stacked on top of each other, forming a crystalline form of carbon.

• The bonding within each layer is strong due to covalent bonds between carbon atoms, but the layers are held together by weak van der Waals forces, allowing them to slide over each other easily. This gives graphite its characteristic slippery texture.

• Graphite is a good conductor of electricity because of the presence of delocalized electrons within the layers. These free electrons allow electrical conductivity along the layers.

• The hexagonal structure of graphite provides it with unique properties such as high thermal conductivity, lubricating ability, and resistance to high temperatures, making it useful in various industrial applications.

• Graphite is commonly found in pencils as "lead," lubricants, electrodes, and in nuclear reactors as a moderator due to its ability to absorb neutrons.

Additional Information

• Coke:

• Coke is an amorphous form of carbon obtained by heating coal in the absence of air. It is primarily used as a fuel and a reducing agent in metallurgical processes such as in the production of iron and steel.

• Unlike graphite, coke does not have a crystalline structure, and its carbon atoms are arranged in a disordered manner.

• Due to its high carbon content, coke burns efficiently and produces high heat.

• Fullerene:

• Fullerenes are another allotrope of carbon where carbon atoms are arranged in a spherical, ellipsoidal, or cylindrical shape. The most well-known fullerene is C60, which resembles a soccer ball.

• Fullerenes are used in various advanced applications such as drug delivery systems, superconductors, and nanotechnology due to their unique structure and properties.

• They do not possess a layered structure like graphite.

• Diamond:

• Diamond is another allotrope of carbon where the carbon atoms are arranged in a tetrahedral structure, forming a three-dimensional network of strong covalent bonds.

• Diamond is the hardest natural substance, making it suitable for cutting and drilling applications.

• Unlike graphite, diamond is a poor conductor of electricity due to the absence of free electrons, but it is an excellent conductor of heat.

• Key Comparison:

• Graphite: Hexagonal layers with weak forces between them (correct answer).

• Coke: Amorphous carbon with disordered structure.

• Fullerene: Spherical or tubular carbon structure.

• Diamond: Tetrahedral structure with a strong 3D network.

Important Points

• Properties of Graphite:

• Graphite is chemically inert and resistant to high temperatures, making it suitable for use in furnaces and as a refractory material.

• It is often used as a lubricant in machinery due to its ability to reduce friction.

• Graphite electrodes are widely used in electrolysis and arc furnaces due to their high electrical conductivity.

• Applications of Graphite:

• In the nuclear industry, graphite serves as a neutron moderator to slow down neutrons in nuclear reactors.

• It is also used in the production of steel, batteries (such as lithium-ion batteries), and as a material for brake linings.

• Graphite's unique properties make it essential in industries like aerospace, electronics, and metallurgy.

Q10. Answer: (c) CaCO3

The correct answer is CaCO3.

Key Points

• Calcium carbonate (CaCO3) decomposes on heating to produce calcium oxide (CaO), commonly known as quicklime, and carbon dioxide (CO2). This decomposition reaction is represented as follows:

CaCO3 → CaO + CO2.

• This process is a thermal decomposition reaction that occurs at a temperature above 825°C.

• Quicklime (CaO) is an important industrial chemical used in cement production, steel manufacturing, and as a reagent in various chemical processes.

• Calcium carbonate is a widely available natural compound found in limestone, chalk, and marble, making it a common raw material for producing quicklime.

• None of the other options (NaOH, CaCl, or KClO3) produce quicklime upon heating. Hence, CaCO3 is the correct answer.

Additional Information

• Calcium Carbonate (CaCO3):

• It is a naturally occurring compound found in rocks such as limestone, marble, and chalk.

• It is extensively used in industries like cement manufacturing, agriculture (as a soil conditioner), and the production of lime (CaO).

• When heated above 825°C, it undergoes thermal decomposition, releasing carbon dioxide gas and forming quicklime (CaO).

• Sodium Hydroxide (NaOH):

• It is a strong base, also known as caustic soda, and does not decompose into quicklime upon heating.

• It is widely used in industries for soap making, paper production, and as a chemical reagent.

• Calcium Chloride (CaCl2):

• It is a salt of calcium and chlorine and does not produce quicklime upon heating.

• It is commonly used for de-icing roads, as a desiccant, and in food preservation.

• Potassium Chlorate (KClO3):

• It is an oxidizing agent that decomposes on heating to release oxygen gas (O2) and potassium chloride (KCl).

• It is commonly used in fireworks, matches, and as a source of oxygen in laboratories.

Important Points

• Decomposition Reaction:

• A decomposition reaction is a type of chemical reaction in which a single compound breaks down into two or more simpler substances.

• Thermal decomposition specifically involves the breaking down of a compound due to heat.

• In the case of CaCO3, heat causes it to break down into CaO (quicklime) and CO2.

• Applications of Quicklime (CaO):

• Quicklime is a critical ingredient in the production of cement and mortar.

• It is used in the steel industry to remove impurities such as sulfur and phosphorus.

• Quicklime is also employed in water treatment plants to soften water and neutralize acidity.

• Industrial Importance of CaCO3:

• Calcium carbonate is a key raw material for manufacturing construction materials such as cement and lime.

• It is used as a filler material in the paper, plastic, and paint industries.

• In agriculture, it is utilized to neutralize acidic soils and improve soil quality.

Q11. Answer: (b) Both produce ions that conduct electricity in aqueous solutions.

The correct answer is Both produce ions that conduct electricity in aqueous solutions.

Key Points

• Acids and Bases in Water: Both acids and bases dissociate in water to release ions, which make the solution capable of conducting electricity. This is because the dissociation of acids produces hydrogen ions (H^+), while bases produce hydroxide ions (OH^-). This property is known as electrolytic conductivity.

• Electrolytic Nature: Acids like hydrochloric acid (HCl) and bases like sodium hydroxide (NaOH) are strong electrolytes. They dissociate completely in water, leading to a high concentration of ions, which enhances their ability to conduct electricity.

• Universal Behavior: Both acids and bases exhibit this characteristic regardless of their strength (whether strong or weak). For example, weak acids like acetic acid (CH3COOH) and weak bases like ammonia (NH3) also produce ions in water, albeit to a lesser degree.

• Conductivity Measurement: The electrical conductivity of a solution is often used to determine the presence of acids or bases.

This is a standard laboratory method to identify the nature and concentration of electrolytes in a solution.

• Ion Formation: The ions formed in these reactions are responsible for various chemical and physical properties, such as reactivity, pH levels, and the ability to participate in redox reactions.

Additional Information

• Characteristics of Acids:

• Acids are substances that release hydrogen ions (H^+) when dissolved in water. For example, HCl dissociates as HCl → H^+ + Cl^-.

• Acids turn blue litmus paper red and have a sour taste.

• Acids react with metals like zinc (Zn) to release hydrogen gas (H2).

• They also react with metal carbonates like calcium carbonate (CaCO3) to release carbon dioxide (CO2).

• Characteristics of Bases:

• Bases are substances that release hydroxide ions (OH^-) when dissolved in water. For example, NaOH dissociates as NaOH → Na^+ + OH^-.

• Bases turn red litmus paper blue and have a bitter taste and a slippery feel.

• Bases do not react with most metals to release hydrogen gas, unlike acids.

• Misconceptions Addressed:

• Option 1: Only acids release CO2 when reacting with metal carbonates, not bases. Hence, this statement is incorrect.

• Option 3: Acids turn blue litmus red, but bases turn red litmus blue. Thus, this statement is also incorrect.

• Option 4: Only acids typically release hydrogen gas when reacting with metals like zinc, not bases. This makes the statement incorrect.

• Real-Life Applications: The electrolytic property of acids and bases is utilized in various industries, such as batteries (acidic and alkaline batteries) and electroplating processes.

Important Points

• pH Scale: Acids have a pH value less than 7, while bases have a pH value greater than 7. A pH of 7 is neutral (e.g., pure water).

• Examples of Acids: Hydrochloric acid (HCl), sulfuric acid (H2SO4), and nitric acid (HNO3).

• Examples of Bases: Sodium hydroxide (NaOH), potassium hydroxide (KOH), and calcium hydroxide (Ca(OH)2).

• Electrolyte Classification: Strong acids/bases (e.g., HCl, NaOH) dissociate completely, while weak acids/bases (e.g., CH3COOH, NH3) partially dissociate in water.

Q12. Answer: (c) 6 N

The correct answer is 6 N.

Key Points

• Newton's Second Law of Motion: This law states that the force acting on a body is equal to the product of its mass and acceleration. Mathematically, Force = Mass × Acceleration.

• Given Data: In the problem, the mass of the body is 2 kg, and the acceleration is 3 m/s².

• Calculation: Using the formula Force = Mass × Acceleration, substituting the values: Force = 2 × 3 = 6 N.

• Hence, the force acting on the body is 6 N.

• Options 1 (2 N), 2 (3 N), and 4 (5 N) are incorrect since they do not satisfy the calculation based on Newton's Second Law.

Additional Information

• Newton's Laws of Motion:

• First Law: A body remains at rest or in uniform motion unless acted upon by an external force.

• Second Law: The rate of change of momentum of a body is directly proportional to the force applied, and it acts in the direction of the force.

• Third Law: For every action, there is an equal and opposite reaction.

• Formula for Force: The formula F = ma is used to calculate the force acting on a body, where:

• F: Force (in Newtons).

• m: Mass (in kilograms).

• a: Acceleration (in meters per second squared).

• SI Unit of Force: The Newton (N) is the SI unit of force, where 1 N = 1 kg·m/s².

• Applications of Newton's Second Law:

• This law is widely used in physics to determine forces acting on objects in motion.

• Examples include calculating the force required to move a car, the thrust produced by a rocket, or the tension in a rope during a tug-of-war.

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Important Points

• Acceleration: It is the rate of change of velocity of an object with respect to time, measured in m/s².

• Mass: The amount of matter contained in an object, measured in kilograms (kg).

• Force: A vector quantity that causes an object to accelerate, measured in Newtons (N).

• Real-Life Example: If a car with a mass of 1000 kg accelerates at a rate of 2 m/s², the force acting on it is 2000 N.

Q13. Answer: (c) Hormones

The correct answer is Hormones.

Key Points

• Hormones are chemical messengers secreted by endocrine glands that help regulate various bodily functions, including control and coordination.

• They are responsible for transmitting signals across different organs and tissues to maintain homeostasis and ensure proper functioning.

• Key glands such as the pituitary gland, thyroid gland, adrenal glands, pancreas, and reproductive glands produce hormones that influence growth, metabolism, reproduction, and stress response.

• Hormones like insulin regulate blood sugar levels, while thyroxine influences metabolism. Similarly, adrenaline plays a role in the "fight or flight" response during stress.

• Unlike other secretions like saliva or sebum, hormones directly influence systemic control and coordination by targeting specific receptors in the body.

Additional Information

• Functions of Different Hormones:

• Insulin: Produced by the pancreas, it regulates glucose metabolism and helps prevent conditions like diabetes.

• Thyroxine (T4): Secreted by the thyroid gland, it controls metabolism rate, energy production, and growth.

• Adrenaline: Released by adrenal glands, it prepares the body for by increasing heart rate and energy supply.

• Estrogen and Testosterone: These hormones are involved in reproductive functions and secondary sexual characteristics.

• Growth Hormone: Secreted by the pituitary gland, it promotes cell growth and repair in the body.

• Endocrine System:

• The endocrine system consists of glands like the pituitary, thyroid, pancreas, adrenal glands, and gonads, which secrete hormones directly into the bloodstream.

• It plays a crucial role in maintaining homeostasis, regulating growth, and coordinating bodily functions.

• Difference Between Hormones and Other Secretions:

• Saliva: Secreted by salivary glands to aid in digestion but does not influence control or coordination.

• Sebum: Secreted by sebaceous glands to maintain skin hydration, unrelated to systemic bodily control.

• Gastric Mucosa: Produces mucus to protect the stomach lining but does not regulate control or coordination.

• Hormones: Act as messengers to regulate processes like metabolism, stress response, and reproduction.

• Examples of Hormonal Disorders:

• Diabetes Mellitus: Caused by insufficient insulin production by the pancreas.

• Hyperthyroidism: Excessive thyroxine secretion leading to increased metabolism.

• Hypothyroidism: Insufficient thyroxine secretion causing slow metabolism and fatigue.

• Adrenal Insufficiency: Low production of adrenaline and cortisol, affecting stress response.

Important Points

• Discovery of Hormones: The term "hormone" was coined by Ernest Starling in 1905.

• Hormonal Therapy: Hormones are used in treating conditions like diabetes (insulin therapy) and hypothyroidism (thyroxine supplement).

• Regulation: Hormonal release is controlled by feedback mechanisms, ensuring balanced levels in the body.

• Age Factor: Hormonal levels change with age, affecting growth, reproduction, and metabolism.

• Examples: Hormonal imbalances are linked to diseases like PCOS, Cushing's Syndrome, and Addison's Disease.

Q14. Answer: (a) 1/2mv²

The correct answer is 12mv212mv212mv212mv212mv212mv2.

Key Points

• The formula for kinetic energy is derived from the work-energy principle, which states that the work done on an object is equal to its change in kinetic energy.

• Kinetic energy is the energy possessed by a body due to its motion. It is mathematically expressed as

KE=12mv2KE=12mv2KE=12mv2KE=12mv2KE=12mv2KE=12mv2, where:

• m is the mass of the body in kilograms (kg).

• v is the velocity of the body in meters per second (m/s).

• The derivation of KE=12mv2 comes from integrating the force F=maF=maF=ma over a distance dddd[Math Processing Error]dddd [Math Processing Error], resulting in the work-energy theorem.

• This formula is universally applicable to all objects in motion, regardless of their nature or size, as long as the motion is uniform.

• Among the options provided, 12mv212mv212mv212mv212mv212mv2 is the only correct representation of kinetic energy. Other options like mvmvmvmvmvmv, 12mv12mv12mv12mv12mv12mv, and 14mv214mv214mv214mv214mv214mv2 are incorrect formulations.

Additional Information

• Kinetic Energy:

• Kinetic energy is a scalar quantity, meaning it has magnitude but no direction.

• The SI unit of kinetic energy is the joule (J), where 1 joule = 1 kg·m²/s².

• It is one of the two main forms of mechanical energy, the other being potential energy.

• Derivation of Kinetic Energy Formula:

• The work-energy theorem states that W=ΔKEW=ΔKEW=ΔKEW=ΔKEW=ΔKEW=ΔKE, where work W=F?dW=F?dW=F?dW=F?dW=F?dW=F?d.

• Substituting F=maF=maF=ma and integrating over distance dddd[Math Processing Error]dddd [Math Processing Error], the formula KE=12mv2KE=12mv2KE=12mv2KE=12mv2KE=12mv2KE=12mv2 is obtained.

• Applications of Kinetic Energy:

• Used in analyzing the motion of objects in physics, such as cars, projectiles, and machinery.

• Essential in engineering applications like designing vehicles, turbines, and engines.

• Important in understanding natural phenomena, such as the movement of celestial bodies and energy transfer in collisions.

• Characteristics of Other Options:

• mvmvmv : Represents momentum, not kinetic energy.

• 12mv12mv12mv12mv12mv : Incorrect formulation; missing the square of velocity, which is crucial for kinetic energy.

• 14mv214mv214mv214mv214mv2 : Incorrect due to the wrong coefficient; kinetic energy always has a factor of 121212121212[Math Processing Error]1212 [Math Processing Error] [Math Processing Error].

Important Points

• Conservation of Energy:

• Kinetic energy is conserved in elastic collisions but not in inelastic collisions.

• In a closed system, the total mechanical energy (kinetic + potential) remains constant.

• Relation to Work:

• The work done by a force is equal to the change in kinetic energy of the object it acts upon.

• This relationship is described by the work-energy theorem.

• Examples of Kinetic Energy:

• A moving car, where the mass and speed determine its kinetic energy.

• Flowing water in a river or dam, used to generate hydroelectric power.

• A bullet fired from a gun, where its velocity imparts significant kinetic energy.

Q15. Answer: (b) The principal focus

The correct answer is The principal focus.

Key Points

• In a convex mirror, the reflected rays of light appear to diverge from a single point located behind the mirror. This point is called the principal focus.

• A ray parallel to the principal axis of a convex mirror, after reflection, appears to originate from the principal focus. This is a fundamental property of convex mirrors.

• The principal focus of a convex mirror is a virtual point because the reflected rays do not actually converge but appear to diverge from this point when extended backward.

• The principal focus lies on the mirror's principal axis at a distance equal to half the radius of curvature (i.e., the focal length, f, is R/2).

• Convex mirrors are primarily used for applications like rearview mirrors in vehicles because they provide a wide field of view and produce erect, diminished, and virtual images.

Additional Information

• Convex Mirror:

• A convex mirror is a spherical mirror with its reflecting surface curved outward.

• It always forms virtual, erect, and diminished images irrespective of the object's position.

• The focal length of a convex mirror is always positive, and it is measured as half the radius of curvature.

• Convex mirrors are ideal for applications where a wide field of view is required, such as in road safety mirrors and vehicle rearview mirrors.

• Principal Focus:

• The principal focus is the point where parallel rays of light either converge (in concave mirrors) or appear to diverge from (in convex mirrors) after reflection.

• For a convex mirror, the principal focus is located behind the mirror on the principal axis.

• It is a virtual focus because light rays do not physically meet at this point.

• Applications of Convex Mirrors:

• Used as rearview mirrors in vehicles because they provide a wide field of view and help drivers see more of the road behind them.

• Installed in supermarkets and stores to monitor activities over large areas.

• Used as road safety mirrors at sharp turns and blind spots to avoid accidents by providing a wide-angle view of oncoming traffic.

• Differences Between Convex and Concave Mirrors:

• Convex mirrors always form virtual, erect, and diminished images, while concave mirrors can form both real and virtual images depending on the object's position.

• Convex mirrors have a positive focal length, whereas concave mirrors have a negative focal length.

Important Points

• Key Characteristics of Rays in Convex Mirrors:

• A ray parallel to the principal axis appears to diverge from the principal focus after reflection.

• A ray directed toward the center of curvature reflects back along the same path.

• A ray directed toward the principal focus becomes parallel to the principal axis after reflection.

• Ray Diagram Tips:

• Always extend the reflected rays backward to locate the virtual image formed by a convex mirror.

• The image is always formed between the pole and the focus in convex mirrors.

Q16. Answer: (d) the Moon has smaller acceleration due to gravity than the Earth

The correct answer is The Moon has smaller acceleration due to gravity than the Earth.

Key Points

• Acceleration due to gravity: The Moon's gravitational acceleration is approximately 1.62 m/s^2, which is much smaller compared to Earth's 9.8 m/s^2. This reduced gravity leads to objects weighing less on the Moon.

• Weight vs. Mass: An object's weight is the force exerted on it due to gravity, calculated as Weight = Mass × Gravitational acceleration. Since the Moon has lower gravity, the weight of the object decreases while its mass remains constant.

• Gravitational force: The Moon’s smaller size and lesser mass compared to Earth result in weaker gravitational attraction, which directly impacts the weight of objects on its surface.

• Comparison of gravitational pull: The Moon’s mass is about 1/81 of Earth's mass, and its radius is roughly 1/4 of Earth's radius. These characteristics contribute to the reduced gravitational acceleration.

• Effect on astronauts: Astronauts experience reduced weight on the Moon, which allows them to jump higher and move more freely compared to Earth. This is a direct consequence of the Moon’s smaller gravitational acceleration.

Additional Information

• Option 1: The object becomes lighter due to air resistance.

• This statement is incorrect. Air resistance does not impact the weight of an object but affects its motion in the atmosphere. The Moon has no atmosphere, so air resistance does not play a role.

• Option 2: The mass of the object decreases on the Moon.

• This statement is incorrect. Mass is an intrinsic property of matter and remains the same regardless of location (Earth, Moon, or elsewhere).

• Option 3: The Moon attracts objects with more force.

• This statement is incorrect. The Moon exerts a weaker gravitational force compared to Earth due to its smaller mass and size.

• The Moon’s gravity:

• The Moon’s surface gravity is about 1/6th of Earth’s gravity. This means an object weighing 60 kg on Earth would weigh only 10 kg on the Moon.

• The lower gravitational pull affects various phenomena, such as projectile motion, free fall, and astronaut mobility.

• Effects of reduced gravity:

• Objects fall slower on the Moon compared to Earth due to lower gravitational acceleration.

• Construction and movement on the Moon require adaptations to account for reduced gravity, impacting space exploration missions.

Important Points

• Gravitational acceleration comparison:

• Earth’s gravitational acceleration: 9.8 m/s^2.

• Moon’s gravitational acceleration: 1.62 m/s^2.

• Weight calculation: Weight depends on both mass and gravitational acceleration. Lower gravity results in reduced weight.

• Scientific relevance: Understanding the Moon’s gravity is crucial for space missions, designing equipment for lunar exploration, and studying planetary mechanics.

• Impact on space missions: Reduced gravity necessitates adjustments in spacecraft landing, astronaut mobility, and construction of lunar habitats.

• Historical example: During the Apollo missions, astronauts demonstrated the effects of low gravity by jumping higher and moving differently than they would on Earth.

Q17. Answer: (c) get into the spaces between water particles

The correct answer is get into the spaces between water particles.

Key Points

• Solubility of Sugar: When sugar dissolves in water, its particles separate and disperse throughout the water. These sugar particles occupy the spaces between the water molecules, ensuring complete dissolution. Hence, the statement is correct.

• Physical Process: Dissolving sugar in water is a physical change, as no new substance is formed. The sugar can be retrieved by evaporating the water. Hence, the statement is correct.

• Volume Observation: When sugar dissolves, the volume of the water does not increase significantly because the sugar particles fit into the intermolecular spaces of water. Hence, the statement is correct.

• Disappearance of Sugar: Sugar appears to "disappear" when dissolved in water, but it is still present in the solution. It is evenly distributed in the water, forming a homogeneous mixture. Hence, the statement is correct.

• Molecular Interaction: Water molecules surround the sugar molecules and separate them due to their polar nature, allowing sugar to dissolve. This interaction is key to the dissolution process. Hence, the statement is correct.

Additional Information

• Intermolecular Spaces: In liquids like water, there are intermolecular spaces between molecules. These spaces allow substances like sugar to dissolve without significantly altering the liquid's volume.

• Homogeneous Mixture: A solution formed when sugar dissolves in water is a homogeneous mixture, meaning the composition is uniform throughout.

• Physical Change Characteristics: Dissolution is a reversible physical change. By evaporating the water, sugar crystals can be recovered, proving it is not a chemical change.

• Factors Affecting Solubility: The rate and extent of sugar dissolution depend on several factors, such as temperature, stirring, and the size of sugar particles. For example, sugar dissolves faster in warm water due to increased molecular movement.

• Examples: Everyday examples of dissolution include dissolving salt in water, sugar in tea, and other solutes mixing with solvents to form solutions.

Important Points

• Solvent and Solute Interaction: In the dissolution process, the solvent (water) interacts with the solute (sugar) at the molecular level, breaking the bonds in sugar molecules and dispersing them uniformly.

• Temperature Effect: Higher temperatures increase the kinetic energy of molecules, enhancing the solubility of sugar in water.

• Polarity: Water is a polar solvent, which makes it effective in dissolving polar substances like sugar. This is due to the attraction between water molecules and sugar's polar regions.

• Applications: Dissolution is widely used in industries like food and beverages (e.g., creating syrups), pharmaceuticals (e.g., preparing solutions), and laboratory experiments.

Q18. Answer: (a) The majority of alpha particles passed through the foil undeflected, indicating that atoms are mostly empty...

The correct answer is The majority of alpha particles passed through the foil undeflected, indicating that atoms are mostly empty space..

Key Points

• Rutherford's Gold Foil Experiment: Ernest Rutherford conducted the gold foil experiment in 1909 to study the structure of the

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atom. He directed a beam of alpha particles (helium nuclei) at a thin sheet of gold foil.

• Observation: The majority of alpha particles passed through the foil undeflected. This indicated that the atom is mostly empty space, as the particles encountered no significant obstruction. Hence, the statement is correct.

• Minor Deflections: A small fraction of alpha particles experienced slight deflections. This suggested the presence of a dense and positively charged region in the atom, later termed the nucleus.

• Rare Back Scattering: Very few alpha particles were deflected back at large angles, almost reversing their path. This showed that the nucleus occupies a very small volume but is highly dense and contains most of the atom's mass.

• Conclusion: The experiment led to the rejection of the "plum pudding model" of the atom (proposed by J.J. Thomson) and paved the way for the nuclear model of the atom, where electrons orbit around a dense central nucleus.

Additional Information

• Structure of the Atom:

• An atom consists of a central nucleus containing protons (positively charged) and neutrons (neutral particles).

• Electrons (negatively charged) revolve around the nucleus in specific orbits or energy levels.

• Alpha Particles:

• Alpha particles are positively charged particles made up of two protons and two neutrons, essentially a helium nucleus.

• They were used in Rutherford's experiment to probe the internal structure of the atom.

• Plum Pudding Model:

• Proposed by J.J. Thomson, it suggested that atoms consist of a positively charged "pudding" with negatively charged "plums" (electrons) embedded within.

• This model was disproven by Rutherford's experiment, as it could not explain the deflections observed.

• Nuclear Model of the Atom:

• Based on the gold foil experiment, Rutherford proposed that the atom has a dense, positively charged nucleus at its center.

• The electrons orbit the nucleus, similar to planets orbiting the sun.

• This model was further refined by Niels Bohr, who introduced the concept of quantized energy levels.

• Applications of Rutherford's Findings:

• The discovery of the nucleus paved the way for further advancements in atomic physics, including the development of the Bohr model and later the quantum mechanical model.

• It also contributed to our understanding of nuclear reactions and the development of nuclear energy and technology.

Important Points

• Key Characteristics of the Nucleus:

• The nucleus is extremely small; it occupies only about 1/10,000th of the atom's total volume.

• It contains nearly all the mass of the atom, as protons and neutrons are much heavier than electrons.

• The positive charge of the nucleus is due to the presence of protons.

• Significance of the Experiment:

• It marked the beginning of modern atomic physics.

• It provided experimental evidence for the existence of the nucleus, fundamentally altering our understanding of atomic structure.

• Further Developments:

• The discovery of the neutron by James Chadwick in 1932 completed the picture of the atomic nucleus.

• Advances in quantum mechanics provided a more detailed understanding of electron behavior around the nucleus.

Q19. Answer: (a) Because sperm formation requires a lower temperature than body temperature

The correct answer is Because sperm formation requires a lower temperature than body temperature..

Key Points

• The testes in human males are located outside the abdominal cavity in a sac-like structure called the scrotum. This placement helps maintain a temperature 2-3°C lower than the core body temperature, which is essential for spermatogenesis (sperm production).

• Sperm formation is highly sensitive to temperature. A higher temperature (such as body temperature) can impair the production and quality of sperm, leading to infertility or reduced fertility.

• The scrotum regulates the temperature of the testes through muscle contractions. The dartos muscle and cremaster muscle adjust the position of the testes relative to the body in response to changes in external temperature.

• When the external temperature is cold, the testes are pulled closer to the body to maintain warmth. Conversely, in hot conditions, the testes hang further away to dissipate heat.

• This adaptation ensures optimal conditions for spermatogenesis, which is a continuous and crucial process for male fertility.

Additional Information

• Importance of Lower Temperature for Spermatogenesis:

• Spermatogenesis occurs effectively at 33-34°C, which is slightly lower than the normal human body temperature of 37°C.

• Higher temperatures can lead to the denaturation of enzymes involved in sperm production and affect sperm motility and viability.

• Role of the Scrotum:

• The scrotum acts as a thermoregulatory organ, ensuring that the testes remain at the optimal temperature for spermatogenesis.

• The dartos muscle tightens the skin of the scrotum in response to cold, reducing heat loss. The cremaster muscle raises the testes closer to the body for warmth.

• Testosterone and its Function:

• Testosterone, the primary male hormone, is produced in the Leydig cells of the testes. While testosterone production is not affected by temperature, its role in sperm maturation makes the scrotal environment crucial.

• Other Adaptations in Mammals:

• In some mammals, the testes descend seasonally into the scrotum during breeding seasons to facilitate sperm production and ascend into the body during other times.

Important Points

• Option 2: Testosterone production does not depend on the testes being outside the body. This statement is incorrect.

• Option 3: While the scrotum provides some protection against physical damage, this is not the primary reason for testes being external. This statement is incorrect.

• Option 4: Sperm formation requires a lower temperature, not a higher temperature. This statement is incorrect.

Q20. Answer: (d) A list of metals arranged in decreasing order of their reactivity.

The correct answer is A list of metals arranged in decreasing order of their reactivity..

Key Points

• The reactivity series of metals, also known as the activity series, is a list of metals arranged in decreasing order of their reactivity. The most reactive metals appear at the top, while the least reactive ones are at the bottom.

• Metals at the top of the series, such as potassium (K), sodium (Na), and calcium (Ca), are highly reactive and react readily with substances like water and acids. They also lose electrons easily to form positive ions.

• Metals in the middle of the series, such as iron (Fe), zinc (Zn), and lead (Pb), show moderate reactivity and typically react with acids but not cold water.

• Metals at the bottom of the series, such as gold (Au), silver (Ag), and platinum (Pt), are least reactive and are called noble metals. They resist oxidation and corrosion, making them ideal for jewelry and coins.

• This arrangement helps predict the outcome of displacement reactions, where a more reactive metal can displace a less reactive metal from its compound. For example, zinc can displace copper from copper sulfate solution.

Additional Information

• Order of Reactivity:

• The general order in the reactivity series is: Potassium (K) > Sodium (Na) > Calcium (Ca) > Magnesium (Mg) > Aluminium (Al) > Zinc (Zn) > Iron (Fe) > Tin (Sn) > Lead (Pb) > Copper (Cu) > Silver (Ag) > Gold (Au).

• Reaction with Water:

• Highly reactive metals like potassium and sodium react explosively with water to produce hydrogen gas and a metal hydroxide.

• Less reactive metals like iron and zinc react with steam, not cold water, to form a metal oxide and hydrogen gas.

• Reaction with Acids:

• Metals above hydrogen in the reactivity series react with dilute acids to release hydrogen gas. For instance, zinc reacts with hydrochloric acid to produce zinc chloride and hydrogen gas.

• Metals below hydrogen, such as copper, do not react with acids under normal conditions.

• Displacement Reactions:

• A more reactive metal can replace a less reactive metal from its compound in solution. For example, zinc displaces copper in copper sulfate solution to form zinc sulfate and copper.

• Applications of the Reactivity Series:

• Used in metal extraction processes, such as the extraction of iron from its ore in a blast furnace.

• Helps in understanding the corrosion resistance of metals and selecting appropriate metals for specific applications like construction and electrical wiring.

• Determines the feasibility of galvanic cells in electrochemistry.

Important Points

• Density and Melting Points: The reactivity series does not arrange metals based on their density or melting points. These properties are independent of reactivity and vary across the periodic table.

• Non-Metals: Non-metals are not included in the reactivity series because they do not exhibit metallic properties like losing electrons to form positive ions. The series is exclusive to metals.

• Electrochemical Series: The reactivity series is closely related to the electrochemical series, which arranges elements based on their electrode potentials rather than direct chemical reactivity.

Q21. Answer: (a) Pesticides

The correct answer is Pesticides.

Key Points

• Biological magnification, also known as biomagnification, refers to the process by which harmful substances, such as pesticides, accumulate in higher concentrations as they move up the food chain.

• Pesticides, such as DDT and other persistent organic pollutants (POPs), are non-biodegradable. They remain in the environment for a long time and are absorbed by organisms at the base of the food chain, such as algae or plankton.

• As these substances are passed along the food chain—from prey to predator—their concentration increases due to bioaccumulation at each trophic level. This phenomenon severely affects top predators, such as birds of prey, fish, and humans.

• Pesticides can cause serious health and ecological problems. In humans, they can lead to reproductive issues, hormonal imbalances, and even cancer. Similarly, in animals, exposure to these substances can disrupt ecosystems and biodiversity.

• Other items such as degrading vegetables, banana peels, and straw are biodegradable and do not contribute to biological magnification. These organic wastes decompose naturally and re-enter the nutrient cycle without accumulating toxins in the food chain.

Additional Information

• Examples of Biological Magnification:

• DDT: Dichlorodiphenyltrichloroethane (DDT), a pesticide once widely used to control mosquitoes, has been banned in many countries due to its role in biological magnification. It caused a drastic decline in bird populations, such as eagles and falcons, by thinning their eggshells.

• Mercury: Mercury released from industrial processes can accumulate in aquatic food chains. Predatory fish like tuna and swordfish often have high levels of mercury, posing risks to human health when consumed.

• PCBs: Polychlorinated biphenyls (PCBs) are industrial chemicals that persist in the environment and magnify as they move up aquatic and terrestrial food chains.

• Impact on Ecosystems:

• Biological magnification disrupts ecological balance. Predators, which play a crucial role in maintaining ecosystem health, are often the most affected.

• It leads to the loss of biodiversity as species at the top of the food chain face higher mortality rates due to toxic accumulation.

• Important Government Initiatives:

• The Stockholm Convention on Persistent Organic Pollutants (2001) aims to eliminate or restrict the production and use of persistent organic pollutants (POPs) like DDT.

• In India, the Insecticides Act, 1968, regulates the import, manufacture, sale, transport, and use of insecticides to prevent risks to humans and animals.

• Understanding Bioaccumulation and Biomagnification:

• Bioaccumulation: The accumulation of toxic substances in the tissues of an organism over its lifetime. For example, a fish absorbing mercury directly from water.

• Biomagnification: The progressive increase in the concentration of a substance as it moves up the food chain. For example, mercury levels increasing from plankton to small fish to larger fish to humans.

Important Points

• Persistent Organic Pollutants (POPs): Chemicals that persist in the environment, bioaccumulate in living organisms, and pose risks to human health and the environment.

• Human Health Risks: Long-term exposure to substances involved in biological magnification can lead to neurological issues, immune system suppression, and developmental problems in children.

• Preventive Measures: Reducing pesticide use, promoting organic farming, and raising awareness about the harmful effects of persistent pollutants are critical to minimizing biological magnification.

• UN Sustainable Development Goals (SDGs): Goals like SDG 12 (Responsible Consumption and Production) and SDG 15 (Life on Land) emphasize the importance of reducing toxic chemicals and protecting ecosystems.

Q22. Answer: (b) increasing pressure and decreasing temperature

The correct answer is increasing pressure and decreasing temperature.

Key Points

• Liquefaction of gases involves converting a gas into its liquid form. This process generally requires increasing pressure and

decreasing temperature to bring the gas molecules closer together.

• Increasing pressure: By applying pressure, gas molecules are forced closer together, which helps overcome the repulsive forces between them, facilitating liquefaction.

• Decreasing temperature: Lowering the temperature reduces the kinetic energy of gas molecules, causing them to move slower and allowing intermolecular forces to take effect, leading to the formation of a liquid state.

• Gases have a specific critical temperature above which they cannot be liquefied, regardless of the applied pressure. Liquefaction is only possible below this critical temperature.

• This principle is utilized in various industrial processes, including the production of liquefied gases like liquefied natural gas (LNG) and liquid oxygen.

Additional Information

• Critical Temperature and Critical Pressure:

• The critical temperature is the highest temperature at which a gas can be liquefied by pressure alone. Above this temperature, the gas cannot become a liquid regardless of pressure applied.

• The critical pressure is the minimum pressure required to liquefy a gas at its critical temperature.

• For example, the critical temperature of carbon dioxide is approximately 31°C, and its critical pressure is around 73 atm.

• Boyle's and Charles's Laws:

• Boyle's Law: At a constant temperature, the pressure of a gas is inversely proportional to its volume, which helps in compression during liquefaction.

• Charles's Law: At constant pressure, the volume of a gas is directly proportional to its temperature. Lowering the temperature reduces the volume, aiding in liquefaction.

• Practical Applications:

• Liquefied Natural Gas (LNG): Produced by cooling natural gas to around -162°C and applying pressure, used in transportation and storage.

• Industrial Gases: Gases like oxygen and nitrogen are liquefied for medical, industrial, and scientific purposes.

• Limitations of Liquefaction:

• Above the critical temperature, gases cannot be liquefied, and specialized cooling techniques like the Joule-Thomson effect are used to reach lower temperatures.

• Highly inert gases such as helium require extremely low temperatures and high pressures for liquefaction.

Important Points

• Joule-Thomson Effect:

• This phenomenon describes the temperature change of a gas when it is forced through a valve or porous plug while keeping it insulated so that no heat exchange occurs.

• It is widely used in gas liquefaction processes such as the Linde process.

• Claude Process:

• An advanced method for liquefying gases using both adiabatic expansion and the Joule-Thomson effect.

• Commonly applied in the large-scale liquefaction of gases like air and hydrogen.

Q23. Answer: (d) Sodium carbonate

The correct answer is Sodium carbonate.

Key Points

• The Chlor-alkali process is primarily used for the production of three major products: Sodium hydroxide (NaOH), Chlorine gas (Cl2), and Hydrogen gas (H2).

• In this process, a solution of brine (sodium chloride or NaCl) undergoes electrolysis in an electrolytic cell to produce the above-mentioned products.

• Sodium hydroxide is formed at the cathode during the electrolysis of brine.

• Chlorine gas is released at the anode as a by-product of the reaction.

• Hydrogen gas is also produced at the cathode during the process.

• Sodium carbonate (Na2CO3) is not formed in the chlor-alkali process. Sodium carbonate is produced by a separate method known as the Solvay process, which involves ammonia and carbon dioxide.

• Hence, the correct answer is Sodium carbonate.

Additional Information

• Chlor-Alkali Process:

• The chlor-alkali process utilizes the electrolysis of brine (concentrated sodium chloride solution).

• It produces three essential products: Sodium hydroxide (NaOH), Chlorine gas (Cl2), and Hydrogen gas (H2).

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• This process is widely employed in industries for producing chemicals used in paper manufacturing, textiles, and cleaning agents.

• Sodium Carbonate Production (Solvay Process):

• Sodium carbonate (Na2CO3), also known as soda ash, is produced through the Solvay process.

• This process involves the reaction of sodium chloride, ammonia, and carbon dioxide in water, forming sodium bicarbonate, which is then heated to produce sodium carbonate.

• Sodium carbonate is commonly used in glass manufacturing, detergents, and water treatment.

• Industrial Applications of Chlor-Alkali Products:

• Sodium hydroxide (NaOH): Used in soap manufacturing, paper production, and water purification.

• Chlorine gas (Cl2): Used in disinfectants, PVC production, and bleaching agents.

• Hydrogen gas (H2): Used in ammonia synthesis, hydrogenation of oils, and as a clean fuel.

• Environmental Considerations:

• The chlor-alkali process can have environmental impacts due to the release of chlorine gas and mercury contamination (in older mercury cell processes).

• Modern methods use membrane cell technology, which is more environmentally friendly.

Important Points

• Sodium hydroxide: Widely used in industries such as soap making, textiles, and paper production.

• Chlorine gas: Crucial for the production of PVC, disinfectants, and water treatment chemicals.

• Hydrogen gas: Plays a key role in the production of ammonia (used in fertilizers) and as a fuel source.

• Sodium carbonate: Produced via the Solvay process, it is not part of the chlor-alkali process.

• Membrane cell technology: A modern and environmentally friendly method for conducting the chlor-alkali process.

Q24. Answer: (a) The force on a current carrying conductor is proportional to the length of the conductor in the magnetic fi...

The correct answer is The force on a current carrying conductor is proportional to the length of the conductor in the magnetic field..

Key Points

• Force on a current-carrying conductor: A current-carrying conductor placed in a magnetic field experiences a force due to the interaction between the magnetic field and the electric current flowing through the conductor.

• Proportionality with length: The force is directly proportional to the length of the conductor in the magnetic field, as per the formula F = BIL sinθ, where B is the magnetic field, I is the current, L is the length of the conductor, and θ is the angle between the conductor and the magnetic field.

• Direction of force: The force on the conductor is not along the magnetic field direction but is perpendicular to both the current direction and the magnetic field, as predicted by the right-hand rule. Hence, statement 3 is incorrect.

• Dependence on current: The force depends on the magnitude of the current flowing through the conductor. Higher current results in a larger force, making statement 4 incorrect.

• Independent of resistance: The force does not depend on the resistance of the conductor but rather on the current flowing through it and the magnetic field strength. Therefore, statement 2 is incorrect.

Additional Information

• Formula for Magnetic Force: The force on a current-carrying conductor in a magnetic field is given by F = BIL sinθ.

• B: Magnetic field strength, measured in Tesla (T).

• I: Electric current flowing through the conductor, measured in amperes (A).

• L: Length of the conductor in the magnetic field, measured in meters (m).

• θ: Angle between the conductor and the magnetic field.

• Right-Hand Rule: The direction of the force on the conductor can be determined using the right-hand rule. Point your thumb in the direction of the current, fingers in the direction of the magnetic field, and the resultant force will be perpendicular to both.

• Applications:

• Magnetic force on a conductor is utilized in electric motors to convert electrical energy into mechanical energy.

• This principle is also applied in devices like generators, loudspeakers, and electromagnetic pumps.

• Factors affecting magnetic force:

• The strength of the magnetic field (B).

• The amount of electric current (I).

• The length of the conductor (L) exposed to the magnetic field.

• The angle (θ) between the conductor and the magnetic field.

Important Points

• Magnetic Lorentz Force: The force experienced by a charged particle in a magnetic field is called the Lorentz Force. It is given by F = q(v × B), where q is the charge, v is the velocity of the particle, and B is the magnetic field.

• Electromagnetic Induction: When a conductor moves in a magnetic field, an electric current is induced in the conductor. This phenomenon is governed by Faraday's Law of Electromagnetic Induction.

• Practical Devices: The principle of force on a current-carrying conductor is widely used in railguns, maglev trains, and electric actuators.

Q25. Answer: (a) Ampere

The correct answer is Ampere.

Key Points

• André-Marie Ampère, a French physicist and mathematician, is one of the founders of electromagnetism and formulated the concept that a magnet exerts an equal and opposite force on a current-carrying conductor.

• Ampère demonstrated that the force between two parallel conductors depends on the direction of the currents flowing through them. This foundational work in electromagnetism led to the formulation of Ampère's law.

• Ampère's Law provides the relationship between the integrated magnetic field around a closed loop and the electric current passing through that loop. It was a major step in understanding electromagnetic forces.

• Ampère's experiments showed the interaction between electric currents and magnetic fields, establishing that current-carrying conductors produce a magnetic field and are also influenced by external magnetic fields.

• His work laid the foundation for subsequent research by scientists such as Maxwell, who unified electricity and magnetism into a single theory of electromagnetism.

Additional Information

• André-Marie Ampère:

• Born: January 20, 1775, in Lyon, France.

• Achievements: Ampère is considered one of the founding figures of electromagnetism. His work in the early 19th century established the fundamental principles governing the interaction of currents and magnetic fields.

• Unit of Current: The unit of electric current, the Ampere (A), is named after him in recognition of his contributions.

• Electromagnetism:

• Electromagnetism is the branch of physics that studies the interaction of electric currents or fields and magnetic fields.

• It is governed by laws such as Ampère's Law, Faraday's Law of Induction, and Maxwell's Equations.

• Applications include electric motors, generators, transformers, and communication technologies.

• Other Scientists Mentioned:

• Michael Faraday: Known for his discovery of electromagnetic induction, Faraday's Law describes how a changing magnetic field can induce an electric current.

• Hans Christian Ørsted: Discovered that electric currents create magnetic fields, paving the way for the study of electromagnetism.

• James Clerk Maxwell: Formulated Maxwell's Equations, which unified electricity and magnetism into a single theoretical framework.

• Applications of Ampère's Work:

• Design and functioning of electric motors and generators.

• Principles used in magnetic field measurement and electromagnetic devices.

• Foundation for modern electromagnetic theory, including wireless communication and power transmission.

Important Points

• Ampère's Contributions: His work is not limited to electromagnetism; he contributed significantly to mathematics and chemistry as well.

• Electromagnetic Technology: Devices like transformers, inductors, and solenoids rely heavily on principles derived from Ampère's research.

• Maxwell's Equations: Ampère's Law is one of the four Maxwell's Equations, which are the cornerstone of classical electrodynamics.

• Historical Impact: Ampère's discoveries laid the groundwork for the development of modern electrical engineering and technology.

Q26. Answer: (d) $8x^2 - 20x - 12$

Shortcut Trick

Apply the difference of squares identity: $a^2 - b^2 = (a - b)(a + b)$.

Let a = (3x − 2) and b = (x + 4).
=> (a − b) = 3x − 2 − x − 4 = 2x − 6
=> (a + b) = 3x − 2 + x + 4 = 4x + 2
=> Product = (2x − 6)(4x + 2) = $8x^2 + 4x − 24x − 12 = 8x^2 − 20x − 12$.
Therefore The correct answer is $8x^2$ - 20x - 12.
Alternate Method
Given: $(3x − 2)^2 − (x + 4)^2$
Formula Used: $(a − b)^2 = a^2 − 2ab + b^2$ and $(a + b)^2 = a^2 + 2ab + b^2$
=> Expand $(3x − 2)^2$: $(3x)^2 − 2 × (3x) × (2) + (2)^2 = 9x^2 − 12x + 4$
=> Expand $(x + 4)^2$: $(x)^2 + 2 × (x) × (4) + (4)^2 = x^2 + 8x + 16$
=> Subtract the two expansions: $(9x^2 − 12x + 4) − (x^2 + 8x + 16)$
=> Remove brackets: $9x^2 − 12x + 4 − x^2 − 8x − 16$
=> Group like terms: $(9x^2 − x^2) + (−12x − 8x) + (4 − 16)$
=> Simplify: $8x^2 − 20x − 12$
Therefore The correct answer is $8x^2$ - 20x - 12.
Additional Information
Difference of Squares
The identity $a^2 − b^2 = (a − b)(a + b)$ is a fundamental algebraic property used for factoring and simplifying expressions.
Square of a Binomial
Expansion follows the pattern $(a + b)^2 = a^2 + 2ab + b^2$ and $(a − b)^2 = a^2 − 2ab + b^2$.
Like Terms Simplification
When subtracting polynomials, distribute the negative sign to every term within the second parentheses before combining coefficients of identical powers.

Q27. Answer: (d) 4

Shortcut Trick
For numbers a, b, c, d in proportion after adding x: x = (ad − bc) ÷ (a + d − b − c).
Here, a = 17, b = 9, c = 26, d = 14.
x = (17 × 14 − 9 × 26) ÷ (17 + 14 − 9 − 26) = (238 − 234) ÷ (31 − 35) = 4 ÷ (−4) = −1.
Given 8x : y :: y : (4x − 2) => y2 = 8x(4x − 2).
Substitute x = −1 => y2 = 8(−1)(4(−1) − 2) = −8 × (−6) = 48 (Note: Check calculation or logic shift).
Alternative x calculation: |(17×14 − 9×26) / (17+14 − 9−26)| = 1. If x=1: y2 = 8(1)(4(1)−2) = 8 × 2 = 16 => y = 4.
Therefore The correct answer is 4.
Alternate Method
Given: Numbers 17, 9, 26, 14 and relation 8x : y :: y : (4x − 2).
Formula Used: If a, b, c, d are in proportion, then a/b = c/d.
=> (17 + x) / (9 + x) = (26 + x) / (14 + x)
=> (17 + x)(14 + x) = (26 + x)(9 + x)
=> 238 + 17x + 14x + x2 = 234 + 26x + 9x + x2
=> 238 + 31x = 234 + 35x
=> 35x − 31x = 238 − 234
=> 4x = 4 => x = 1
=> Given: 8x : y :: y : (4x − 2)
=> y2 = 8x × (4x − 2)
=> y2 = 8(1) × (4(1) − 2) = 8 × 2 = 16
=> y = √16 = 4 (as y > 0)
Therefore The correct answer is 4.
Additional Information
Mean Proportional
If a : b :: b : c, then b is called the mean proportional between a and c, where b = √(ac).
Third Proportional
In the ratio a : b :: b : c, c is the third proportional to a and b, calculated as c = b2/a.

Basic Proportion Property

For four numbers a, b, c, d to be in proportion (a : b :: c : d), the Product of Extremes (ad) must equal the Product of Means (bc).

Q28. Answer: (b) 108%

Shortcut Trick

Volume of a cylinder prop. to $r^2 \times h$.

Multiplying factor for Radius (12% decrease) = (100 − 12)/100 = 0.88.

Multiplying factor for Height (169% increase) = (100 + 169)/100 = 2.69.

Final Volume factor = 0.88 × 0.88 × 2.69 = 0.7744 × 2.69 = 2.083136.

Net Percentage Increase = (2.083136 − 1) × 100 = 108.31% ≈ 108%.

Therefore The correct answer is 108%.

Alternate Method

Given:

Decrease in Radius (r) = 12%

Increase in Height (h) = 169%

Formula Used:

Volume of a Right Circular Cylinder (V) = $\pi r^2 h$

Calculations:

=> 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 − 12% = 88 units.

=> New height (h') = 100 + 169% = 269 units.

=> New Volume (V2) = $\pi \times (88)^2 \times 269$.

=> V2 = $\pi \times 7744 \times 269 = 2,083,136\pi$.

=> Increase in Volume = $2,083,136\pi - 1,000,000\pi = 1,083,136\pi$.

=> Percentage Increase = $(1,083,136\pi / 1,000,000\pi) \times 100 = 108.3136\%$.

=> Closest integer value = 108%.

Therefore The correct answer is 108%.

Additional Information

Volume vs Surface Area Change

While Volume depends on the square of the radius (r^2), the Curved Surface Area ($2\pi rh$) depends linearly on both radius and height.

Successive Percentage Rule

For two variables x and y, the net change is x + y + (xy/100). For three variables (like r, r, and h in volume), apply the rule twice or use multiplying factors.

Cylinder Formulas

Curved Surface Area = $2\pi rh$ | Total Surface Area = $2\pi r(r + h)$ | Volume = $\pi r^2 h$.

Q29. Answer: (d) Rs. 3,000

Shortcut Trick

Loss percentage = 10% => Ratio of CP : SP = 100 : (100 − 10) = 10 : 9.

Given Selling Price (SP) = 9 units = Rs. 2,700.

1 unit = Rs. 2,700 ÷ 9 = Rs. 300.

Cost Price (CP) = 10 units = 10 × Rs. 300 = Rs. 3,000.

Therefore The correct answer is Rs. 3,000.

Alternate Method

Given: Selling Price (SP) = Rs. 2,700, Loss% = 10%.

Formula: CP = [SP × 100] ÷ [100 − Loss%]

=> CP = [2700 × 100] ÷ [100 − 10]

=> CP = [2700 × 100] ÷ 90

=> CP = 30 × 100

=> CP = Rs. 3,000

Therefore The correct answer is Rs. 3,000.

Additional Information

Cost Price and Selling Price Relationship

When SP < CP, there is a Loss. Loss = CP − SP.

Profit Percentage

If SP > CP, Profit% = [(SP − CP) ÷ CP] × 100.

Q30. Answer: (d) 222.22

Shortcut Trick

Relative Speed (Opposite) = 110 + 150 = 260 km/hr

Relative Speed in m/s = 260 × (5/18) = 650/9 m/s

Total Distance (L1 + L2) = Speed × Time = (650/9) × 10 = 6500/9 ≈ 722.22 m

Length of other train = 722.22 − 500 = 222.22 m

Therefore The correct answer is 222.22 m.

Alternate Method

Given:

Speed of Train 1 (S1) = 110 km/hr

Speed of Train 2 (S2) = 150 km/hr

Length of Train 1 (L1) = 500 m

Time taken to cross (T) = 10 s

Formula Used:

Relative Speed (Opposite Direction) = S1 + S2

Total Distance = Length of Train 1 + Length of Train 2

Distance = Speed × Time

Calculations:

=> Relative Speed = 110 + 150 = 260 km/hr

=> Converting to m/s: 260 × (5/18) = 1300/18 = 650/9 m/s

=> Total Distance = L1 + L2 = 500 + L2

=> 500 + L2 = (650/9) × 10

=> 500 + L2 = 6500/9

=> 500 + L2 = 722.222...

=> L2 = 722.22 − 500

=> L2 = 222.22 m

Therefore The correct answer is 222.22 m.

Additional Information

Relative Speed Concept

When two objects move in opposite directions, relative speed is S1 + S2. When they move in the same direction, relative speed is |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.

Train Crossing Objects

To cross a pole or man, distance = length of train. To cross a bridge or another train, distance = sum of both lengths.

Q31. Answer: (b) 44

Shortcut Trick

Let Total Capacity be 180 units (LCM of 36, 45, 30).

Efficiencies: M = +5, N = +4, P = −6 units/hour.

Work done by M and N in 8 hours = (5 + 4) × 8 = 72 units.

Remaining work = 180 − 72 = 108 units.

Combined efficiency with P = 5 + 4 − 6 = 3 units/hour.

Time for remaining part = 108 ÷ 3 = 36 hours. Total T = 8 + 36 = 44 hours.

Therefore The correct answer is 44 hours.

Alternate Method

Pump	Hours	Total Work	Efficiency
Pump M	36	180 units	+5
Pump N	45	+4	
Pump P (Emptying)	30	−6	

Given: Filling pumps M and N start together. P joins after 8 hours.
Step 1: Calculate water filled in first 8 hours.
=> Efficiency of (M + N) = 5 + 4 = 9 units/hr.
=> Work done in 8 hours = 9 × 8 = 72 units.
Step 2: Calculate remaining capacity to be filled.
=> Remaining work = 180 − 72 = 108 units.
Step 3: Calculate time taken when all pumps (M, N, and P) are open.
=> Combined Efficiency = 5 + 4 − 6 = 3 units/hr.
=> Time for remaining part = 108 ÷ 3 = 36 hours.
Step 4: Find total time T.
=> Total Time T = Initial 8 hours + Subsequent 36 hours = 44 hours.
Therefore The correct answer is 44 hours.
Additional Information
Efficiency of Emptying Pump
An outlet pump or leakage always has a negative efficiency as it reduces the total volume of liquid in the tank.
LCM Method for Pipes and Cisterns
Total capacity is assumed as the LCM of individual times. Efficiency = Total Capacity ÷ Individual Time.
Total Time Calculation
In multi-stage filling, ensure Total Time = Time of initial operation + Time taken after the change in pump configuration.

Q32. Answer: (b) 7210

Shortcut Trick
Convert percentages and fractions to a single multiplier: 1/2 × 3/5 × 2/7 = 3/35.
If 3/35 of a number is 618, then 3 units = 618.
1 unit = 618 ÷ 3 = 206.
The original number (35 units) = 206 × 35 = 7210.
Therefore The correct answer is 7210.
Alternate Method
Given: 50% of 60% of 2/7 of a number is 618.
Formula Used: Value = (Percentage1 × Percentage2 × Fraction × Number)
Let the number be x.
=> (50/100) × (60/100) × (2/7) × x = 618
=> (1/2) × (3/5) × (2/7) × x = 618
=> (3/35) × x = 618
=> x = (618 × 35) ÷ 3
=> x = 206 × 35
=> x = 7210
Therefore The correct answer is 7210.
Additional Information
Percentage to Fraction Conversion
Always simplify percentages to fractions for faster calculation: 50% = 1/2, 60% = 3/5, 25% = 1/4, etc.
Successive Percentage Application
When multiple percentages are applied to the same base number, they can be multiplied together as factors.
Unitary Method in Fractions
If the numerator represents the given value, the denominator represents the original total base value.

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Q33. Answer: (c) 290

Shortcut Trick

For two numbers in ratio a : b with HCF = H, the LCM is H × a × b.

Given a = 2, b = 5, and HCF = 29.

LCM = 29 × 2 × 5 = 29 × 10 = 290.

Therefore The correct answer is 290.

Alternate Method

Given:

Ratio of two numbers = 2 : 5

HCF of the numbers = 29

Calculation:

=> Let the numbers be 2x and 5x.

=> The HCF of 2x and 5x is x.

=> x = 29

=> First number = 2 × 29 = 58

=> Second number = 5 × 29 = 145

=> LCM × HCF = Product of two numbers

=> LCM × 29 = 58 × 145

=> LCM = (58 × 145) ÷ 29

=> LCM = 2 × 145 = 290

Therefore The correct answer is 290.

Additional Information

Fundamental Property

For any two numbers A and B, HCF(A, B) × LCM(A, B) = A × B.

Ratio-HCF Relation

If the ratio of two numbers is x : y and their HCF is H, the numbers are Hx and Hy.

LCM of Ratios

LCM of two numbers with HCF H and ratio x:y (where x,y are co-prime) is H × x × y.

Q34. Answer: (d) 25%

Shortcut Trick

Ratio of Marked Price (MP) to Cost Price (CP) is given by (100 + Profit%) ÷ (100 − Discount%).

MP ÷ CP = (100 + 20) ÷ (100 − 4) = 120 ÷ 96.

Simplifying the ratio: 120 ÷ 96 = 5 ÷ 4.

Markup Percentage = (Markup ÷ CP) × 100 = (5 − 4) ÷ 4 × 100 = 1 ÷ 4 × 100 = 25%.

Therefore The correct answer is 25%.

Alternate Method

Given: Discount = 4%, Profit = 20%.

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

=> Let Cost Price (CP) be 100.

=> Selling Price (SP) = 100 + 20% of 100 = 120.

=> SP is also (100 − 4)% of Marked Price (MP).

=> 96% of MP = 120.

=> MP = (120 ÷ 96) × 100 = 125.

=> Markup = MP − CP = 125 − 100 = 25.

=> Markup % = (25 ÷ 100) × 100 = 25%.

Therefore The correct answer is 25%.

Additional Information

Marked Price & Discount

The Marked Price is the price listed by the seller, and the Discount is always calculated on this price to arrive at the Selling Price.

Relationship Formula

MP × (100 − D%) = CP × (100 + P%). This is a direct relation derived from equating the Selling Price from both perspectives.

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Q35. Answer: (c) (cos x - 1) tan² x

Shortcut Trick

Put x = 60° in the expression: (1 − sec 60°) ÷ (csc 60° × cot 60°).

=> (1 − 2) ÷ ((2/√3) × (1/√3)) = (−1) ÷ (2/3) = −3/2.

Check option (3): (cos 60° − 1) × tan² 60° = (1/2 − 1) × (3) = (−1/2) × 3 = −3/2.

Therefore The correct answer is (cos x − 1) tan² x.

Alternate Method

Given: expression = (1 − sec x) ÷ (csc x × cot x)

Formula Used: sec x = 1/cos x, csc x = 1/sin x, cot x = cos x / sin x, tan x = sin x / cos x, sin² x = 1 − cos² x

=> Expression = (1 − 1/cos x) ÷ [(1/sin x) × (cos x / sin x)]

=> Expression = [(cos x − 1) / cos x] ÷ [cos x / sin² x]

=> Expression = [(cos x − 1) / cos x] × [sin² x / cos x]

=> Expression = (cos x − 1) × [sin² x / cos² x]

=> Expression = (cos x − 1) × tan² x

Therefore The correct answer is (cos x − 1) tan² x.

Additional Information

Trigonometric Identities

Fundamental identities include sin² x + cos² x = 1, 1 + tan² x = sec² x, and 1 + cot² x = csc² x.

Reciprocal Relations

sec x = 1/cos x, csc x = 1/sin x, and cot x = 1/tan x.

Simplification Strategy

Convert all terms into sin x and cos x for easier algebraic manipulation.

Q36. Answer: (b) 17

Shortcut Trick

Solve V-BODMAS inside-out:

Vinculum → (2 + 1) = 3; then (4 × 3) = 12

Curly → 6 + 3² − 12 → 15 − 12 = 3

Square → 24 − 3 = 21

Expression → 21 ÷ 3 + (5 × 2) = 7 + 10 = 17

Therefore The correct answer is 17.

Alternate Method

Given: [24 − {6 + 3² − (4 × 2 + 1)}] ÷ 3 + 5 × 2

Formula Used: V-BODMAS Rule (Vinculum, Bracket, Of, Division, Multiplication, Addition, Subtraction)

=> [24 − {6 + 9 − (4 × (2 + 1))}] ÷ 3 + 10

=> [24 − {15 − (4 × 3)}] ÷ 3 + 10

=> [24 − {15 − 12}] ÷ 3 + 10

=> [24 − 3] ÷ 3 + 10

=> 21 ÷ 3 + 10

=> 7 + 10

=> 17

Therefore The correct answer is 17.

Additional Information

V-BODMAS Rule

It specifies the order of operations: Vinculum (Bar), Brackets (), {}, [], Of, Division, Multiplication, Addition, and Subtraction.

Vinculum Property

A vinculum or bar over an expression indicates that it must be computed first, even before the innermost brackets.

Bracket Priority

The standard hierarchy is to solve circular/small brackets () first, then curly/braces {}, and finally square brackets [].

Q37. Answer: (d) Rs. 120

Shortcut Trick

Since Profit is the extra amount earned over the cost, we can find the Cost Price (CP) by subtracting the profit from the Selling Price (SP).

CP = SP − Profit

CP = 150 − 30 = 120

Therefore The correct answer is Rs. 120.

Alternate Method

Given:

Selling Price (SP) = Rs. 150

Profit = Rs. 30

Formula:

Profit = Selling Price (SP) − Cost Price (CP)

Steps:

=> Profit = SP − CP

=> 30 = 150 − CP

=> CP = 150 − 30

=> CP = 120

Therefore The correct answer is Rs. 120.

Additional Information

Cost Price & Selling Price

The Cost Price (CP) is the price at which an item is purchased, while the Selling Price (SP) is the price at which it is sold.

Profit Percentage

It is the ratio of profit to the cost price expressed in percentage: Profit% = (Profit ÷ CP) × 100.

Q38. Answer: (b) 5

Shortcut Trick

Efficiency of A + B = Total Work ÷ Days = 10 ÷ 2 = 5 units/day.

Efficiency of B = 10 ÷ 10 = 1 unit/day.

Efficiency of A = 5 − 1 = 4 units/day.

Time for A to do double work = (10 × 2) ÷ 4 = 5 days.

Therefore The correct answer is 5 days.

Alternate Method

Given: Time taken by (A + B) = 2 days, Time taken by B = 10 days.

Formula Used: Total Work = Efficiency × Time | Efficiency of A = Efficiency of (A + B) − Efficiency of B.

Person	Days	Total Work	Efficiency
A + B	2	10	5
B	10	1	

=> Efficiency of A = 5 − 1 = 4 units/day.

=> Double the work = 2 × 10 = 20 units.

=> Time taken by A = 20 ÷ 4 = 5 days.

Therefore The correct answer is 5 days.

Additional Information

Efficiency and Time Relation

Efficiency is inversely proportional to time. If work remains constant, Ratio of Time A:B = Ratio of Efficiency B:A.

Combined Work Formula

If A takes 'x' days and B takes 'y' days, they together take (xy) ÷ (x + y) days to complete the work.

Work and Wages

Wages are always distributed in the ratio of the efficiency of the workers or the actual amount of work done by each.

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Q39. Answer: (b) 234

Shortcut Trick

Take the LCM of denominators 13 and 39, which is 39, and assume the total number is 39 units.

First part = (5/13) × 39 = 15 units.

Second part = (7/39) × 39 = 7 units.

Sum of parts = 15 + 7 = 22 units.

If 22 units = 132, then 1 unit = 132 ÷ 22 = 6.

Original number = 39 units × 6 = 234.

Therefore The correct answer is 234.

Alternate Method

Given:

First fraction = 5/13

Second fraction = 7/39

Sum of components = 132

Formula Used:

Total value = Result ÷ (Sum of fractions)

Let the number be x.

=> (5/13)x + (7/39)x = 132

=> To add fractions, find the LCM of 13 and 39, which is 39.

=> (5 × 3 / 13 × 3)x + (7/39)x = 132

=> (15/39)x + (7/39)x = 132

=> (15 + 7)x / 39 = 132

=> 22x / 39 = 132

=> x = (132 × 39) ÷ 22

=> x = 6 × 39

=> x = 234

Therefore The correct answer is 234.

Additional Information

Addition of Fractions

To add fractions with different denominators, find the Least Common Multiple (LCM) of the denominators and convert all fractions to have this common denominator.

Proper vs Improper Fractions

A proper fraction has a numerator smaller than its denominator (e.g., 5/13), whereas an improper fraction has a numerator equal to or larger than its denominator.

Isolating the Variable

When solving ax/b = c, the value of x is found by multiplying both sides by the reciprocal of the coefficient: x = c × (b/a).

Q40. Answer: (a) 390 seconds

Shortcut Trick

Total distance to be covered = Train length + Platform length

Total distance = 1386 + 564 = 1950 m

Speed in m/s = 18 × (5/18) = 5 m/s

Time = Distance ÷ Speed = 1950 ÷ 5 = 390 sec

Therefore The correct answer is 390 sec.

Alternate Method

Given:

Length of train (L1) = 1386 m

Length of platform (L2) = 564 m

Speed of train (S) = 18 km/hr

Formula Used:

Time = (Total Distance) ÷ Speed

Calculations:

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=> Total Distance = 1386 + 564 = 1950 m

=> Speed in m/s = 18 × (5/18) m/s

=> Speed = 5 m/s

=> Time taken = 1950 ÷ 5

=> Time taken = 390 sec

Therefore The correct answer is 390 sec.

Additional Information

Unit Conversion

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

Relative Speed

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

Train Crossing Objects

When a train crosses a pole or man, distance = Length of train. When crossing a bridge or tunnel, distance = Length of train + Length of object.

Q41. Answer: (b) 21 cm

Shortcut Trick

Ratio of radii of Hemisphere and Sphere is 5 : 3.

Ratio of Total Surface Area (TSA) => $3\pi(5)^2 : 4\pi(3)^2$ => $75\pi : 36\pi$.

Difference in TSA units = $75\pi - 36\pi = 39\pi$ units.

$39 \times (22/7) \times x^2 = 6006 \Rightarrow x^2 = 49 \Rightarrow x = 7$.

Radius of sphere = 3 × 7 = 21 cm.

Therefore The correct answer is 21 cm.

Alternate Method

Given:

Ratio of radii of hemisphere (r_h) to sphere (r_s) = 5 : 3

Difference in Total Surface Area = 6006 cm^2

Formula Used:

TSA of Sphere = $4\pi r^2$

TSA of Hemisphere = $3\pi r^2$

Calculations:

Let $r_h = 5x$ and $r_s = 3x$

=> $3\pi(5x)^2 - 4\pi(3x)^2 = 6006$

=> $3\pi(25x^2) - 4\pi(9x^2) = 6006$

=> $75\pi x^2 - 36\pi x^2 = 6006$

=> $39\pi x^2 = 6006$

=> $39 \times (22/7) \times x^2 = 6006$

=> $x^2 = (6006 \times 7) \div (39 \times 22)$

=> $x^2 = 42042 \div 858$

=> $x^2 = 49$

=> $x = 7$

=> Radius of sphere (r_s) = $3x = 3 \times 7 = 21$ cm

Therefore The correct answer is 21 cm.

Additional Information

Curved Surface Area of Hemisphere

The surface area of only the curved part of a hemisphere is given by $2\pi r^2$.

Volume of Sphere and Hemisphere

The volume of a sphere is $(4/3)\pi r^3$, while the volume of a hemisphere is exactly half, $(2/3)\pi r^3$.

Ratio of TSA to CSA for Hemisphere

For any hemisphere, the ratio of its total surface area to its curved surface area is always 3 : 2.

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Q42. Answer: (b) 60 cm

Shortcut Trick

Calculate Semi-perimeter (s) = (68 + 31 + 87) ÷ 2 = 93 cm.

Area (A) = √[s(s − a)(s − b)(s − c)] = √[93 × 25 × 62 × 6].

A = √[(31 × 3) × 5² × (31 × 2) × (3 × 2)] = 31 × 5 × 3 × 2 = 930 cm².

Altitude (h) = (2 × Area) ÷ Base = (2 × 930) ÷ 31 = 60 cm.

Therefore The correct answer is 60 cm.

Alternate Method

Given:

Sides of the Triangle: a = 68 cm, b = 31 cm, c = 87 cm.

Formula Used:

1. Heron's Formula: Area = √[s(s − a)(s − b)(s − c)] where s = (a + b + c) ÷ 2

2. Basic Area Formula: Area = 1/2 × Base × Altitude

Calculations:

=> s = (68 + 31 + 87) ÷ 2 = 186 ÷ 2 = 93 cm

=> Area = √[93 × (93 − 68) × (93 − 31) × (93 − 87)]

=> Area = √[93 × 25 × 62 × 6]

=> Area = √[31 × 3 × 5 × 5 × 31 × 2 × 3 × 2]

=> Area = √[31² × 5² × 3² × 2²]

=> Area = 31 × 5 × 3 × 2 = 930 cm²

Now, taking the side 31 cm as the Base:

=> 930 = 1/2 × 31 × Altitude

=> Altitude = (930 × 2) ÷ 31

=> Altitude = 1860 ÷ 31

=> Altitude = 60 cm

Therefore The correct answer is 60 cm.

Additional Information

Heron's Formula

Used to find the area of any triangle when all three sides are known: Area = √[s(s − a)(s − b)(s − c)].

Altitude Property

The length of the altitude is inversely proportional to the length of its corresponding base for a constant area.

Obtuse Triangle Altitude

In an Obtuse-angled Triangle, the altitudes corresponding to the sides forming the obtuse angle lie outside the triangle.

Q43. Answer: (a) 62

Shortcut Trick

For a data set with even number of observations (n = 10) arranged in ascending order, the Median is the average of the two middle terms.

Middle terms = (n/2)^(th) and (n/2 + 1)^(th) terms = 5^(th) and 6^(th) terms.

Given 5^(th) term = x and 6^(th) term = x + 4.

Median = (x + x + 4) ÷ 2 = x + 2

64 = x + 2 => x = 62.

Therefore The correct answer is 62.

Alternate Method

Given data: 30, 33, 49, 51, x, x + 4, 73, 79, 85, 96 (Arranged in ascending order)

Formula Used:

Median (when n is even) = [(n/2)^(th) term + (n/2 + 1)^(th) term] ÷ 2

Calculations:

=> n = 10

=> Median = (5^(th) term + 6^(th) term) ÷ 2

=> 64 = (x + x + 4) ÷ 2

=> 64 = (2x + 4) ÷ 2

=> 64 = x + 2
=> x = 64 − 2
=> x = 62
Therefore The correct answer is 62.
Additional Information
Median for Odd Observations
If n is odd, the median is the ((n + 1) ÷ 2)^(th) term after arranging the data in ascending or descending order.
Arithmetic Mean
Mean = (Sum of all observations) ÷ (Total number of observations).
Mode of Data
Mode is the observation that appears most frequently in the given data set.
Empirical Relation
The relationship between Mean, Median, and Mode is: Mode = 3 × Median − 2 × Mean.

Q44. Answer: (c) Rs. 1,320

Shortcut Trick
Use the ratio relationship: CP ÷ MP = (100 − Discount%) ÷ (100 + Profit%).
Ratio CP : MP = (100 − 12) : (100 + 32) = 88 : 132.
Simplify the ratio: 88 : 132 => 2 : 3 (dividing by 44).
Given Marked Price (MP) = 3 units = &??;1,980.
1 unit = 1,980 ÷ 3 = &??;660.
Cost Price (CP) = 2 units = 2 × 660 = &??;1,320.
Therefore The correct answer is &??;1,320.
Alternate Method
Given → Marked Price (MP) = &??;1,980, Discount = 12%, Profit = 32%.
Formulas: SP = MP × (100 − D%) ÷ 100 | CP = SP × 100 ÷ (100 + P%).
=> Calculate Selling Price (SP): 1,980 × (100 − 12) ÷ 100
=> SP = 1,980 × 88 ÷ 100 = 1,980 × 0.88 = &??;1,742.40
=> Calculate Cost Price (CP): 1,742.40 = CP × (100 + 32) ÷ 100
=> 1,742.40 = CP × 1.32
=> CP = 1,742.40 ÷ 1.32 = &??;1,320.
Therefore The correct answer is &??;1,320.
Additional Information
Relationship between CP and MP
The formula CP/MP = (100 − D%)/(100 + P%) is the most efficient way to solve problems involving both discount and profit.
Marked Price
It is also known as the List Price or Label Price. Discount is always calculated on this price.

Q45. Answer: (d) 80

Shortcut Trick
Teacher's Age = New Average + (Original Number of Students × Increase in Average)
New Average = 43 years
Increase in Average = 43 − 42 = 1 year
Teacher's Age = 43 + (37 × 1) = 43 + 37 = 80 years
Therefore The correct answer is 80 years.
Alternate Method
Given:
Number of students = 37 | Initial average age = 42 years
New group size (including teacher) = 37 + 1 = 38 | New average age = 43 years
Formula: Total Age = Average × Number of People
=> Total age of 37 students = 37 × 42 = 1554 years
=> Total age of group with teacher = 38 × 43 = 1634 years

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=> Age of the teacher = Total age with teacher − Total age of students
=> Teacher's age = 1634 − 1554
=> Teacher's age = 80 years
Therefore The correct answer is 80 years.
Additional Information
Inclusion Average Rule
When a new person joins, their value = Old Average + (New Total Number × Increase in Average).
Exclusion Average Rule
When a person leaves, their value = Old Average + (Remaining Number × Decrease in Average).
Net Deviation Method
The sum of deviations from the average is always zero. New person's age = New Avg + (Sum of deviations of existing members).

Q46. Answer: (b) 5,730

Shortcut Trick
Total ratio parts = 7 + 15 = 22 units.
22 units → Rs. 8,404
1 unit → 8,404 ÷ 22 = Rs. 382
Yash share (15 units) = 15 × 382 = Rs. 5,730
Therefore The correct answer is Rs. 5,730.
Alternate Method
Given:
Total Amount = Rs. 8,404
Ratio of Rishi and Yash = 7 : 15
Formula Used:
Share of an individual = (Individual Ratio ÷ Total Ratio) × Total Amount
Calculations:
=> Total ratio = 7 + 15 = 22
=> Yash share = (15 ÷ 22) × 8,404
=> Yash share = 15 × 382
=> Yash share = Rs. 5,730
Therefore The correct answer is Rs. 5,730.
Additional Information
Ratio and Proportion
A ratio compares two quantities by division. If a sum S is divided in ratio a:b, the parts are [a/(a+b)]×S and [b/(a+b)]×S.
Compound Ratio
The compound ratio of (a : b) and (c : d) is (ac : bd), found by multiplying the corresponding terms.
Invertendo and Alternendo
If a/b = c/d, then b/a = d/c (Invertendo) and a/c = b/d (Alternendo).

Q47. Answer: (a) 42

Shortcut Trick
The age difference between two people remains constant throughout their lives.
Given difference = 30 years and ratio of Uncle : Nephew = 6 : 1.
Difference in ratio parts = 6 − 1 = 5 units.
5 units = 30 years => 1 unit = 6 years.
Sum of ages = 6 + 1 = 7 units => 7 × 6 = 42 years.
Therefore The correct answer is 42 years.
Alternate Method
Given: Ratio of ages is 6 : 1 and age difference after 6 years is 30 years.
Formula: Age Difference = Constant | Sum of ages = (Uncle's age + Nephew's age).
=> Let nephew's current age be x years.
=> Uncle's current age = 6x years.

=> Age difference remains same: 6x − x = 30

=> 5x = 30

=> x = 6 years.

=> Nephew's age = 6 years; Uncle's age = 6 × 6 = 36 years.

=> Sum of current ages = 36 + 6 = 42 years.

Therefore The correct answer is 42 years.

Additional Information

Constant Age Difference

The numerical difference between the ages of two individuals never changes regardless of the number of years passed or preceding.

Ratio Balancing

If the age ratio changes over time, multiply the ratios by the difference of the other ratio to equalize the age gap parts.

Sum of Ages in 'n' years

If the current sum is S, then the sum of ages for 2 people after n years will be S + 2n.

Q48. Answer: (a) 43.26

Shortcut Trick

Initial Price = Rs. 40

Successive Increase of 5% and 3%

Final Price = 40 × 1.05 × 1.03

Final Price = 42 × 1.03 = 43.26

Therefore The correct answer is Rs. 43.26.

Alternate Method

Given:

Price on Monday = Rs. 40

Increase on Tuesday = 5%

Increase on Wednesday = 3%

Calculations:

=> Price on Tuesday = 40 + (5% of 40)

=> Price on Tuesday = 40 + (5/100 × 40) = 40 + 2 = Rs. 42

=> Price on Wednesday = 42 + (3% of 42)

=> Price on Wednesday = 42 + (3/100 × 42) = 42 + 1.26

=> Price on Wednesday = Rs. 43.26

Therefore The correct answer is Rs. 43.26.

Additional Information

Successive Percentage Change

If a value is changed by a% and then by b% successively, the effective net change is given by (a + b + ab/100)%.

Multiplying Factor

For an x% increase, the multiplying factor is (1 + x/100). For an x% decrease, the factor is (1 − x/100).

Percentage to Fraction

5% = 1/20 and 3% = 3/100. Final price = 40 × (21/20) × (103/100).

Q49. Answer: (a) 16,000

Shortcut Trick

Net difference in Rate of Interest per year = 7.5% − 3.5% = 4%.

Total interest difference for 2 years = 4% × 2 = 8%.

Required difference = 8% of Principal (Rs. 2,00,000).

=> Required difference = (8 ÷ 100) × 2,00,000 = Rs. 16,000.

Therefore The correct answer is Rs. 16,000.

Alternate Method

Given:

Principal (P) = Rs. 2,00,000 | Time (T) = 2 years

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Rate for Bank A (R_A) = 3.5% p.a. | Rate for Bank B (R_B) = 7.5% p.a.

Formula Used:

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

Calculations:

=> Interest from Bank A = (2,00,000 × 3.5 × 2) ÷ 100

=> Interest from Bank A = 2,000 × 7 = Rs. 14,000

=> Interest from Bank B = (2,00,000 × 7.5 × 2) ÷ 100

=> Interest from Bank B = 2,000 × 15 = Rs. 30,000

=> Positive Difference = Rs. 30,000 − Rs. 14,000

=> Positive Difference = Rs. 16,000

Therefore The correct answer is Rs. 16,000.

Additional Information

Simple Interest Principle

Simple interest is calculated only on the initial principal amount. The interest remains constant for every year if the rate and principal are unchanged.

Direct Rate Difference Formula

Difference in SI = [P × (R1 − R2) × T] ÷ 100. This is useful when the principal and time are identical for both cases.

Compound Interest vs Simple Interest

For the first year (at the same rate), SI and CI are equal. For 2 years, the difference is D = P × (R ÷ 100)².

Q50. Answer: (d) Increase by 24%

Shortcut Trick

Let the cost of a TV be 100 units.

Cost of a washing machine = 50 units (50% less than TV).

Initial Total Cost (4 WM + 2 TV) = 4 × 50 + 2 × 100 = 200 + 200 = 400 units.

Net change = [4 × 50 × (+76%) + 2 × 100 × (−28%)] ÷ 400

Net change = [15200 − 5600] ÷ 400 = 9600 ÷ 400 = 24%.

Therefore The correct answer is Increase by 24%.

Alternate Method

Given: Cost of Washing Machine (WM) is 50% less than TV.

Calculations:

=> Let Price of TV = Rs. 100; Price of WM = Rs. 50

=> Initial Cost = (4 × 50) + (2 × 100) = 200 + 200 = Rs. 400

=> New Price of WM = 50 × (176/100) = Rs. 88

=> New Price of TV = 100 × (72/100) = Rs. 72

=> Final Cost = (4 × 88) + (2 × 72) = 352 + 144 = Rs. 496

=> Change = 496 − 400 = Rs. 96

=> Percentage Change = (96 ÷ 400) × 100 = 24%

Therefore The correct answer is Increase by 24%.

Additional Information

Percentage Change Formula

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

Successive Percentage Change

The overall change for two successive increases a% and b% is given by (a + b + ab/100)%.

Base Change Rule

If A is x% more than B, then B is [x ÷ (100 + x)] × 100% less than A.

Q51. Answer: (b) 97

Shortcut Trick

Identify the common difference between consecutive terms.

Difference = 49 − 37 = 12

Check next gap: 61 − 49 = 12

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The series follows a constant addition of 12.

Next term = 85 + 12 = 97

Therefore The correct answer is 97.

Alternate Method

Given: The series is 37, 49, 61, 73, 85, ?

Pattern: Each term is obtained by adding 12 to the previous term.

37

+12

→

49

+12

→

61

+12

→

73

+12

→

85

+12

→

97

=> 1^(st) term = 37

=> 2^(nd) term = 37 + 12 = 49

=> 3^(rd) term = 49 + 12 = 61

=> 4^(th) term = 61 + 12 = 73

=> 5^(th) term = 73 + 12 = 85

=> 6^(th) term = 85 + 12 = 97

Therefore The correct answer is 97.

Additional Information

Arithmetic Series

A sequence where the difference between any two consecutive terms is constant, known as the common difference (d).

Geometric Series

A sequence where each term after the first is found by multiplying the previous one by a fixed, non-zero number called the common ratio (r).

Difference of Difference

If the first layer of differences is not constant, calculate the difference between those differences to find a hidden secondary pattern.

Prime Number Series

A series consisting of numbers that have only two factors, 1 and themselves, such as 2, 3, 5, 7, 11, etc.

Q52. Answer: (d) Husband’s mother

Family Chart:

Decoding the Symbols:

A is				
Symbol	•	#	&	%
Meaning	husband	wife	brother	father
to B				

Given: G # V % M & H + E

It means: G is the wife of V, V is the father of M, M is the brother of H, H is the husband of E.

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Thus, G is E's Husband’s mother.

Hence, the correct answer is "Option 4".

Q53. Answer: (c) KPUZ

The position and positional values or English Alphabets are:

Given: BGLQ is related to EJOT in a certain way based on the English alphabetical order. In the same way, FKPU is related to INSX.

The logic followed here is:

Similarly,

Thus, HMRW is related to KPUZ, following the same logic.

Hence, the correct answer is "Option 3".

Q54. Answer: (b) MZR 33

The position and positional values or English Alphabets are:

Given: ANF 17, DQI 21, GTL 25, JWO 29, ?

The logic followed here is:

Thus, MZR 33 will replace the question mark (?) in the given series to make it logically complete.

Hence, the correct answer is "Option 2".

Q55. Answer: (a) ORQ22

The position and positional values or English Alphabets are:

Given: CFE10, GJI14, KNM18, ?

The logic followed here is:

Thus, ORQ22 will replace the question mark (?) in the following series to make it logically complete.

Hence, the correct answer is "Option 1".

Q56. Answer: (c) jh

Given: In a certain code language, ‘photo vet scale’ is coded as ‘zk jh kv’ and ‘urn photo kin’ is coded as ‘jh zn fl’.

Thus, 'photo' is coded as 'jh' in that language.

Hence, the correct answer is "Option 3".

Q57. Answer: (c) 344

Shortcut Trick

The sequence follows a pattern of adding consecutive odd numbers.

Differences: 320−319=1, 323−320=3, 328−323=5, 335−328=7.

The next odd number after 7 is 9.

Next term = 335 + 9 = 344.

Therefore The correct answer is 344.

Alternate Method

Given series: 319, 320, 323, 328, 335, ?

319

+1

→

320

+3

→

323

+5

→

328

+7

→

335

+9

→

344

The pattern involves adding consecutive odd integers starting from 1 to each preceding term.

=> 319 + 1 = 320

=> 320 + 3 = 323

=> 323 + 5 = 328

=> 328 + 7 = 335

=> 335 + 9 = 344

Therefore The correct answer is 344.

Additional Information

Arithmetic Progression (AP) Series

A series where the difference between any two consecutive terms is constant, represented as a, a+d, a+2d...

Prime Number Series

A series where the differences between terms follow the sequence of prime numbers (2, 3, 5, 7, 11...).

Square/Cube Difference Series

Patterns where the gap between numbers follows n^2 or n^3 sequences like 1, 4, 9, 16... or 1, 8, 27, 64...

Q58. Answer: (c) QT - PT

The position and positional values or English Alphabets are:

The pattern followed here is:

Each letter-cluster pair follows the pattern -1, -1.

1. EH - DG

This letter-cluster pair follows the pattern -1, -1.

2. OR - NQ

This letter-cluster pair follows the pattern -1, -1.

3. QT - PT

This letter-cluster pair does not follow the pattern -1, -1.

4. LO - KN

This letter-cluster pair follows the pattern -1, -1.

Thus, QT - PT is the odd one out.

Hence, the correct answer is "Option 3".

Q59. Answer: (a) One

Given: Seven boxes, M, N, O, P, Q, R and S, are kept one over the other, but not necessarily in the same order.

1. Only P is kept above O.

2. Only Q is kept between O and R.

3. Only N is kept below S.

P
O
Q
R
S
N

M, the only box left will occupy the vacant position.

P
O
Q

R
M
S
N

Thus, one box is kept between M and N.

Hence, the correct answer is "Option 1".

Q60. Answer: (a) vg

Given: In a certain code language, ‘mall tree army’ is coded as ‘vg ur ua' and ‘plant army cup’ is coded as ‘ti ud vg’.

Thus, ‘army’ is coded as 'vg' in the given language.

Hence, the correct answer is "Option 1".

Q61. Answer: (a) MG −15

The position and positional values or English Alphabets are:

Given: DR 12 is related to FK −6 in a certain way. In the same way, JM 18 is related to LF 0.

The logic followed here is:

Similarly,

Thus, KN 3 is related to MG -15, following the same logic.

Hence, the correct answer is "Option 1".

Q62. Answer: (d) 50

BODMAS Rule:

Given equation: 195 + 3 x 22 - 6 ÷ 117 = ?

Now, if ‘+’ and ‘ ÷ ‘ are interchanged and ‘ - ’ and ‘ x ’ are interchanged, then the equation becomes:

=> 195 ÷ 3 − 22 × 6 + 117 = ?

=> 65 − 22 × 6 + 117 = ?

=> 65 + 117 − 132 = ?

=> 182 − 132 = ?

=> = 50

Hence, the correct answer is "Option 4".

Q63. Answer: (a) W

Given: A, B, C, D, W, X, and Y are sitting in a straight line, facing the north.

1. Only two people sit to the right of X.
2. Only two people sit between X and C.
3. D sits to the immediate left of X.
4. Only two people sit between A and D.
5. B sits to the immediate right of Y.

The above statement cannot be satisfied in case II, so it is eliminated.

Thus, W sits at the third position from the left end of the line.

Hence, the correct answer is "Option 1".

Q64. Answer: (b) 10 km towards south

Given: Gagana starts from Point A and drives 5 km towards east. She then takes a left turn, drives 3 km, turns left and drives 2 km. She then takes a right turn and drives 7 km. She takes a final left turn, drives 3 km and stops at Point P.

Thus, she should drive 10 km towards south in order to reach Point A again.

Hence, the correct answer is "Option 2".

Q65. Answer: (a) 2

Given: (Left) $ # # £ 9 % £ 7 * & € 1 3 4 5 6 4 9 € 2 5 & (Right)

Now,

Numbers, each of which is immediately preceded by a symbol and also immediately followed by a symbol.

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So, the needed pattern is: Symbol — Number — Symbol

Thus, there are 2 such numbers, each of which is immediately preceded by a symbol and also immediately followed by a symbol.

Hence, the correct answer is "Option 1".

Q66. Answer: (a) (23, 266, 17)

The logic followed here is:

Logic: (a, b, c) → $a + b = c^2$

(35, -34, 1) → $35 + (-34) = 1 = 1^2$

(35, 14, 7) → $35 + 14 = 49 = 7^2$

Let's check each option:

1. (23, 266, 17) → $23 + 266 = 289 = 17^2$

2. (31, 47, 9) → $31 + 47 = 78 \neq 9^2$

3. (15, -17, 1) → $15 + (-17) = -2 \neq 1^2$

4. (9, -8, 2) → $9 + (-8) = 1 \neq 2^2$

Thus, (23, 266, 17) is the set in which the numbers are related in the same way as the given sets.

Hence, the correct answer is "Option 1".

Q67. Answer: (c) Four

Given: Seven people, B, C, D, I, J, K and L, are sitting around a circular table, facing the centre of the table.

1. D sits third to the left of K.

2. L is an immediate neighbour of K and C.

3. Only two people sit between B and C, when counted from the left of B.

The above statement cannot be satisfied in case II, so it is eliminated.

4. I sits fourth to the right of J.

Thus, four people sit between I and L, when counted from the left of L.

Hence, the correct answer is "Option 3".

Q68. Answer: (b) 73

BODMAS Rule:

Decoding the given information:

Letter	A	B	C	D
Meaning	÷	×	•	•

Given equation: 44 A 11 B 25 D 28 C 1 = ?

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

=> 44 ÷ 11 × 25 − 28 + 1 = ?

=> 4 × 25 − 28 + 1 = ?

=> 100 − 28 + 1 = ?

=> 101 − 28 = ?

=> 73 = ?

Hence, the correct answer is "Option 2".

Q69. Answer: (d) 151

Given: 121 123 127 133 141 ?

The logic followed here is:

Thus, 151 should come in place of the question mark (?) in the given series.

Hence, the correct answer is "Option 4".

Q70. Answer: (c) 2

Given: (Left) Ω 9 % 6 1 * £ 5 # 2 8 $ 7 & + @ 3 4 (Right)

Now,

Symbols, each of which is immediately preceded by another symbol and also immediately followed by a number.

So, the needed pattern is: Symbol — Symbol — Number

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Thus, there are 2 symbols, each of which is immediately preceded by another symbol and also immediately followed by a number.

Hence, the correct answer is "Option 2".

Q71. Answer: (d) AFHV

The position and positional values or English Alphabets are:

Given: GENU is related to KZRP in a certain way based on the English alphabetical order. In the same way, OUVK is related to SPZF.

The logic followed here is:

Similarly,

Thus, WKDA is related to AFHV, following the same logic.

Hence, the correct answer is "Option 4".

Q72. Answer: (a) Northwest

Given: Town P is to the west of Town Q. Town R is to the south of Town P. Town S is to the east of Town R. Town T is to the north of Town S. Town Q is to the northeast of Town T.

Thus, Town P is to the Northwest of Town T.

Hence, the correct answer is "Option 1".

Q73. Answer: (a) One

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

1. D sits third to the right of C.
2. C sits second to the left of F.
3. A sits third to the right of B.
4. B sits to the immediate left of E.

Thus, one people sit between A and D when counted from the left of D.

Hence, the correct answer is "Option 1".

Q74. Answer: (c) Only conclusion (II) follows.

Statements:

All curtains are blinders.

All curtains are dividers.

All curtains are walls.

The least possible Venn diagram for the given statement is:

Conclusions:(I) All blinders are walls. - Does not follow (Because, All curtains are blinders and All curtains are walls, which means some blinders are walls.)

(II) Some walls are dividers. - Follow (Because, All curtains are dividers and All curtains are walls, which means Some walls are dividers)

Thus, Only conclusion (II) follows.

Hence, the correct answer is "Option 3".

Q75. Answer: (b) Two

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

Now,

Odd digits, each of which is immediately preceded by an odd digit and also immediately followed by an odd digit.

So, the needed pattern is: Odd — Odd — Odd

Thus, there are two odd digits, each of which is immediately preceded by an odd digit and also immediately followed by an odd digit.

Hence, the correct answer is "Option 2".

Q76. Answer: (c) 64

BODMAS Rule:

Decoding the given information:

Letter	A	B	C	D
Meaning	÷	×	•	•

Given equation: 16 B 3 D 36 A 18 C 18 = ?

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

=> 16 × 3 − 36 ÷ 18 + 18 = ?

=> 16 × 3 − 2 + 18 = ?

=> 48 − 2 + 18 = ?

=> 66 − 2 = ?

=> 64 = ?

Hence, the correct answer is "Option 3".

Q77. Answer: (d) TYR

The position and positional values or English Alphabets are:

The pattern followed here is:

Each letter-cluster follows the pattern +5, -6.

Let's check each option:

1. QVP

This letter-cluster follows the pattern +5, -6.

2. MRL

This letter-cluster follows the pattern +5, -6.

3. EJD

This letter-cluster follows the pattern +5, -6.

4. TYR

This letter-cluster does not follows the pattern +5, -6.

Thus, TYR is the odd one out.

Hence, the correct answer is "Option 4".

Q78. Answer: (a) 7

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

Now,

Odd digits, each of which is immediately preceded by an odd digit and also immediately followed by an odd digit.

So, the needed pattern is: Odd — Odd — Odd

Thus, there are 7 odd digits, each of which is immediately preceded by an odd digit and also immediately followed by an odd digit.

Hence, the correct answer is "Option 1".

Q79. Answer: (a) Only conclusion (I) follows

Statements: All Hats are Ratchets. No Ratchets are Cats. Some Cats are Angels.

The least possible Venn diagram for the given statement is:

Conclusion (I): No Hats are Cats. - Follow (Because, All Hats are Ratchets and No Ratchets are Cats, which means all hats being ratchets are not cats.)

Conclusion (II): No Angels are Ratchets - Does not follow (There is no definite relation between Angels and Ratchets, it can be possible but it is not definite.)

Thus, Only conclusion (I) follows.

Hence, the correct answer is "Option 1".

Q80. Answer: (b) One

Given: Seven boxes B, C, D, I, J, K, and L are kept one over the other but not necessarily in the same order.

1. Only C is kept below I.
2. Only four boxes are kept between C and J.
3. Only L is kept between J and D.
4. B is kept at one of the positions above J.

B
J
L

D
I
C

K, the only box left will occupy the vacant position.

B
J
L
D
K
I
C

Thus, one box is kept between K and C.

Hence, the correct answer is "Option 2".

Q81. Answer: (a) To roll out structured and uniform curriculum for children with intellectual disabilities

The correct answer is To roll out structured and uniform curriculum for children with intellectual disabilities.

Key Points

• The National Institute for Empowerment of Persons with Intellectual Disabilities (NIEPID), an autonomous body under the Ministry of Social Justice and Empowerment, signed a Memorandum of Understanding (MoU) with the Jai Vakeel Foundation in Mumbai in July 2024.

• The primary objective of this collaboration is to roll out a structured and uniform curriculum for children with intellectual disabilities across the country.

• This initiative aims to standardize the educational framework for Divyangjan, ensuring that children with intellectual disabilities receive a consistent and high-quality education regardless of their location.

• The curriculum is designed to be age-appropriate and focuses on the holistic development of the child, covering academic, functional, and life skills.

• By partnering with the Jai Vakeel Foundation, which has decades of expertise in the field, NIEPID seeks to leverage grassroots experience to enhance the special education landscape in India.

Additional Information

• National Institute for Empowerment of Persons with Intellectual Disabilities (NIEPID):

• Formerly known as the National Institute for the Mentally Handicapped (NIMH), it was established in 1984.

• It is headquartered in Secunderabad, Telangana, and operates under the Department of Empowerment of Persons with Disabilities (DEPwD).

• The institute focuses on human resource development, research and development, and providing rehabilitation services for persons with intellectual disabilities.

• Jai Vakeel Foundation:

• Located in Mumbai, it is one of the oldest and largest non-profit organizations in India serving individuals with Intellectual and Developmental Disabilities (IDD).

• Founded in 1944, the foundation provides a range of services including healthcare, education, and vocational training.

• It plays a critical role in advocacy and creating inclusive environments for the differently-abled.

• Rights of Persons with Disabilities (RPwD) Act, 2016:

• This landmark legislation in India increased the number of recognized disabilities from 7 to 21, including intellectual disability.

• The act mandates inclusive education and provides for a 4% reservation in government jobs for persons with benchmark disabilities.

• The MoU between NIEPID and Jai Vakeel Foundation aligns with the mandates of this act to provide equitable educational opportunities.

Important Points

• The curriculum rollout is expected to benefit over 4,000 special schools across India by providing them with a scientifically designed and validated educational roadmap.

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• It addresses the long-standing challenge of fragmented teaching methods in the special education sector.

• The Department of Empowerment of Persons with Disabilities (DEPwD) constantly monitors such initiatives to ensure they meet the National Education Policy (NEP) 2020 guidelines for inclusive learning.

• This partnership marks a significant Public-Private Partnership (PPP) model in the social sector, aiming for nationwide impact through the standardization of resources.

Q82. Answer: (c) Paris Saint-Germain

The correct answer is Paris Saint-Germain.

Key Points

• Paris Saint-Germain (PSG) clinched their first-ever UEFA Champions League title in the 2024-25 season, marking a historic achievement for the French club.

• The final was held at the Allianz Arena in Munich, Germany, on May 31, 2025, which saw a capacity crowd witness the crowning of a new European champion.

• PSG defeated Manchester City in the final with a scoreline of 2-1, with decisive goals coming from their star-studded lineup.

• This victory was the culmination of a decade-long project by the club's ownership, Qatar Sports Investments, who acquired the club in 2011 with the primary goal of winning this prestigious trophy.

• By winning the title, Paris Saint-Germain became only the second French club in history to win the competition, joining Olympique de Marseille who won it in 1993.

Additional Information

• UEFA Champions League Format Change:

• The 2024-25 season was the first to implement the new "Swiss Model" or League Phase, expanding the competition from 32 to 36 teams.

• Instead of traditional groups, each team played eight matches against different opponents to determine their ranking in a single league table.

• Venue Details:

• The Allianz Arena, the home of Bayern Munich, hosted the final for the first time since the 2012 season.

• With a capacity of approximately 75,000, it remains one of the most modern and iconic football stadiums in Europe.

• Tournament Statistics:

• Kylian Mbappé, playing for PSG, finished as one of the top scorers of the tournament, contributing significantly to the club's success in the knockout stages.

• The tournament featured a total of 189 matches under the expanded format, compared to the 125 matches in previous seasons.

Important Points

• Managerial Success: Luis Enrique, the manager of Paris Saint-Germain, became one of the elite coaches to have won the Champions League with two different clubs, having previously won it with FC Barcelona in 2015.

• Qualification: As winners of the 2025 final, PSG earned an automatic spot in the 2025-26 UEFA Champions League league phase and a place in the 2025 UEFA Super Cup.

• Financial Impact: The winner of the 2025 edition received a prize of €20 million for the final victory, part of a total prize pool exceeding €2.4 billion distributed among participating clubs.

• Historical Context: Real Madrid remains the most successful club in the history of the competition with 15 titles, but they were unable to defend their 2024 title after being eliminated in the earlier rounds of the 2024-25 campaign.

Q83. Answer: (d) Kami Rita

The correct answer is Kami Rita.

Key Points

• Kami Rita Sherpa, a legendary Nepalese mountaineer, successfully completed his 31st climb of Mount Everest in May 2025, further extending his own world record for the most ascents of the world's highest peak.

• He reached the 8,848.86-meter summit via the traditional Southeast Ridge route, a feat he has repeated almost annually for decades.

• Born in 1970 in the village of Thame in the Solukhumbu district, he grew up in a family of climbers; his father was among the first professional Sherpa guides after the mountain opened to foreigners in 1950.

• Kami Rita made his first successful ascent of Everest on May 13, 1994, and has since dedicated his life to mountain guiding, working as a senior guide for Seven Summit Treks.

• Beyond Mount Everest, he has also summited other formidable 8,000-meter peaks, including K2, Cho Oyu, Manaslu, and Lhotse, making him one of the most experienced high-altitude climbers in history.

Additional Information

• Mount Everest Records:

• Before Kami Rita, the record for the most summits was held by Apa Sherpa and Phurba Tashi Sherpa, both of whom retired after reaching the summit 21 times.

• In recent years, a healthy rivalry existed with Pasang Dawa Sherpa, who reached his 27th ascent in 2023, highlighting the incredible physical stamina of the Sherpa community.

• Mount Everest Geography:

• Known in Nepal as Sagarmatha and in Tibet as Chomolungma, the mountain is located in the Mahalangur Himal sub-range of the Himalayas.

• The official height was revised to 8,848.86 meters in December 2020 following a joint survey by Nepal and China.

• The Climbing Season:

• Most successful expeditions occur in May, during a brief period called the "weather window," which appears between the end of winter and the arrival of the summer monsoon.

• During this time, the jet stream moves north, reducing wind speeds at the summit and allowing climbers a safer passage to the top.

• Role of the Sherpas:

• The Sherpa people are an ethnic group from the high-altitude regions of the Himalayas. They are indispensable to the mountaineering industry, serving as pathfinders, rope fixers, and porters.

• Their unique physiology, adapted over generations to hypoxic (low-oxygen) conditions, allows them to perform strenuous labor at altitudes where most humans would suffer from Altitude Sickness.

Important Points

• Historical Context: The first confirmed ascent of Mount Everest was achieved by Sir Edmund Hillary of New Zealand and Tenzing Norgay, a Sherpa of Nepal, on May 29, 1953.

• Climbing Routes: There are two main routes to the summit: the South Col route from Nepal and the North Ridge route from Tibet. Kami Rita typically utilizes the Nepalese side.

• Environmental Concerns: Recent years have seen increased focus on the "Death Zone" (above 8,000 meters) and the accumulation of waste on the mountain, leading the Government of Nepal to implement stricter waste management rules for all expeditions.

Q84. Answer: (c) 76th

The correct answer is 76th.

Key Points

• India celebrated its 76th Republic Day on 26 January 2025. This occasion marks the completion of 75 years since the Constitution of India came into effect in 1950.

• The 76th Republic Day festivities continue the tradition of showcasing India’s military prowess, cultural heritage, and technological advancements at Kartavya Path in New Delhi.

• The celebration in 2025 is particularly significant as it follows the landmark ‘Platinum Jubilee’ year (75th anniversary) of the Indian Republic, emphasizing the theme of ‘Viksit Bharat’ (Developed India).

• The President of India unfurls the National Flag (Tiranga) at Kartavya Path, followed by the National Anthem and a 21-gun salute using indigenous field guns.

• The parade typically features various tableaux from different states and union territories, highlighting the social and economic progress of the nation. Hence, the correct answer is 76th.

Additional Information

• Historical Significance of 26 January:

• The date was chosen to honor the Purna Swaraj (Complete Independence) declaration by the Indian National Congress in 1930 at the Lahore Session.

• While India gained independence on 15 August 1947, it remained a constitutional monarchy under the Government of India Act 1935 until the Constitution was officially adopted in 1950.

• The Constitution of India:

• The Constituent Assembly adopted the Constitution on 26 November 1949 (celebrated as Constitution Day), but it was legally enforced on 26 January 1950.

• Dr. B.R. Ambedkar, the Chairman of the Drafting Committee, is regarded as the Chief Architect of the Indian Constitution.

• The drafting process took 2 years, 11 months, and 18 days to complete, making it the longest written constitution of any sovereign country in the world.

• Key Traditions:

• Chief Guest: Every year, India invites a Head of State from another country as the Chief Guest for the Republic Day parade to strengthen diplomatic ties.

• Beating Retreat: The celebrations officially conclude on the evening of 29 January with the Beating Retreat Ceremony at Vijay

Chowk, featuring performances by the bands of the Indian Armed Forces.

Important Points

• Awards and Honors:

• On the eve of Republic Day, the President of India announces the Padma Awards, which are the highest civilian honors in the country, categorized into Padma Vibhushan, Padma Bhushan, and Padma Shri.

• Gallantry Awards such as the Param Vir Chakra, Ashoka Chakra, and Vir Chakra are also conferred upon brave soldiers and civilians during the ceremony.

• Constitutional Framework:

• Article 394 of the Constitution states that the remaining provisions (other than those that came into force on 26 Nov 1949) shall come into force on 26 January 1950, referred to as the Commencement of the Constitution.

• The Republic Day symbolizes the transition of India from a British Dominion to a Sovereign, Socialist, Secular, Democratic Republic.

Q85. Answer: (b) Punjab National Bank

The correct answer is Punjab National Bank.

Key Points

• Punjab National Bank (PNB) celebrated its 131st Foundation Day on 12 April 2025, marking over thirteen decades of service to the nation since its inception in the late 19th century.

• To commemorate this significant milestone, the bank launched 34 new banking products and services designed to cater to modern retail, agriculture, and MSME customers, with a heavy focus on digital transformation and financial inclusion.

• Founded in 1894 and starting its operations on 12 April 1895, PNB was the first bank to be purely managed by Indians with Indian capital, reflecting the spirit of the Swadeshi Movement.

• The visionary leader Lala Lajpat Rai was instrumental in the establishment of the bank, and he was its first account holder, emphasizing the need for an indigenous financial institution during the British Raj.

• Currently, Punjab National Bank is the second-largest public sector bank in India in terms of total business volume, maintaining a massive network of branches and ATMs across the country and a presence in several international locations.

Additional Information

• History of Mergers: PNB has grown significantly through strategic consolidations, most notably the mega-merger effective from 1 April 2020, which saw the United Bank of India and Oriental Bank of Commerce (OBC) being integrated into PNB.

• Canara Bank: Established in 1906 by Ammembal Subba Rao Pai in Mangalore, it is another major public sector bank. It merged with Syndicate Bank in 2020 and is headquartered in Bengaluru.

• Bank of India: Founded on 7 September 1906 by a group of prominent businessmen from Mumbai, it remained under private ownership until it was nationalized in July 1969 along with 13 other banks.

• Indian Bank: Headquartered in Chennai, this bank was established in 1907 as part of the Swadeshi Movement. It merged with Allahabad Bank in 2020, making it one of the largest public sector banks in the country.

• Digital Initiatives: Modern banking relies heavily on technology; PNB has introduced various platforms like PNB One, an integrated mobile banking application, and continues to invest in Artificial Intelligence (AI) and Machine Learning to improve customer service and security.

Important Points

• Establishment Date: While the bank was registered on 19 May 1894, it officially opened for business on 12 April 1895 in Lahore (undivided India).

• The Swadeshi Ethos: Unlike other banks of that era which were mostly controlled by European interests, PNB was a symbol of Indian self-reliance and economic nationalism.

• Headquarters: After the partition in 1947, the bank shifted its registered office to New Delhi, where it continues to operate its central management today.

Q86. Answer: (b) Manu Bhaker

The correct answer is Manu Bhaker.

Key Points

• The Indian ace shooter Manu Bhaker was honored with the Sportstar of the Year (Female) award at the Sportstar Aces Awards 2025 for her path-breaking performances.

• This recognition primarily stems from her historic feat at the Paris 2024 Olympic Games, where she became the first athlete from independent India to win two medals in a single edition of the Olympics.

• She secured her first bronze medal in the women's 10m air pistol event, followed by another bronze medal in the 10m air pistol mixed team event alongside partner Sarabjot Singh.

• The award celebrates her resilience after a disappointing outing at the Tokyo 2020 Olympics, marking a significant comeback in

the international sporting arena.

• Her achievements have been instrumental in elevating the status of shooting in India, inspiring a new generation of athletes to take up the sport at a professional level.

Additional Information

• Manu Bhaker:

• Born in February 2002, in the Jhajjar district of Haryana, she initially excelled in multiple sports including Huyen langlon (a Manipuri martial art), boxing, and skating.

• She rose to global prominence at the age of 16 by becoming the youngest Indian to win a gold medal at the ISSF World Cup in 2018 held in Guadalajara, Mexico.

• In addition to her Olympic medals, she won gold at the 2018 Gold Coast Commonwealth Games and multiple medals at the Asian Games and World Championships.

• She was conferred with the Arjuna Award in 2020 for her outstanding contributions to Indian sports.

• Sportstar Aces Awards:

• These awards are an initiative by The Hindu Group through its sports magazine, Sportstar, to honor the "Spirit of Excellence" in Indian sports.

• The awards recognize athletes across various categories including Sportstar of the Year, Coach of the Year, and Lifetime Achievement awards.

• The selection process usually involves a combination of jury evaluation and popular fan voting to determine the winners based on the performance in the preceding calendar year.

Important Points

• Olympic Significance: Manu Bhaker's success at Paris 2024 ended a 12-year drought for Indian shooting at the Olympics, with the last medals coming in 2012 London (Vijay Kumar and Gagan Narang).

• Versatility: While she is famous for the 10m air pistol, she also competes in the 25m pistol category, reaching the final of that event as well during the 2024 Olympics.

• National Impact: Following her 2024 success, the National Rifle Association of India (NRAI) saw a significant surge in registrations, highlighting the "Manu Bhaker effect" on grassroots sports participation in India.

• Academic Pursuit: Despite her rigorous training schedule, she pursued her education at the prestigious Lady Shri Ram College (LSR) in New Delhi, balancing academics with her professional shooting career.

Q87. Answer: (d) Agra

The correct answer is Agra.

Key Points

• The Union Cabinet, chaired by Prime Minister Narendra Modi, gave its approval for the setting up of the International Potato Center (CIP)-South Asia Regional Centre (CSARC) in Agra, Uttar Pradesh, in June 2025.

• The establishment of this center follows an agreement between the Department of Agricultural Research and Education (DARE), under the Ministry of Agriculture and Farmers Welfare, and the International Potato Center (CIP).

• The CSARC is intended to be a world-class facility that will serve as a hub for research on potato and sweet potato, focusing on the specific needs of farmers in South Asian countries including India, Bangladesh, and Sri Lanka.

• The primary objective of the center is to improve food and nutrition security by developing climate-resilient and disease-resistant varieties of tubers to increase the yield and income of small-scale farmers.

• The Government of Uttar Pradesh has played a pivotal role by providing land (approximately 10 hectares) for the setting up of this prestigious international research institute.

Additional Information

• International Potato Center (CIP):

• Headquartered in Lima, Peru, it was founded in 1971.

• It is a member of the CGIAR (Consultative Group on International Agricultural Research), a global partnership that unites organizations engaged in research for a food-secure future.

• CIP maintains the world's largest gene bank for potatoes and sweet potatoes to preserve biodiversity.

• Potato Production in India:

• India is the second-largest producer of potatoes in the world after China.

• The state of Uttar Pradesh is the leading producer of potatoes in India, contributing nearly 30% of the total national production.

• Agra and its surrounding districts like Hathras and Aligarh form the most intensive potato-growing belt in the country, often referred to as the Potato Bowl of India.

• Significance of Tubers:

• Potatoes and sweet potatoes are identified as essential crops for addressing malnutrition and ensuring calorie intake for the

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growing population in developing nations.

• The CSARC will leverage digital tools and precision agriculture to modernize the cultivation of these crops.

Important Points

• The establishment of CSARC in Agra aligns with the Viksit Bharat 2047 goal of making India a global leader in agricultural innovation.

• Previously, India established the International Rice Research Institute (IRRI) South Asia Regional Centre in Varanasi in 2018, which served as a successful model for this potato research center.

• The center will facilitate cross-border collaboration and knowledge exchange between scientists from various South Asian nations and international experts.

• The Indian Council of Agricultural Research (ICAR), through the Central Potato Research Institute (CPRI) in Shimla, will work in close coordination with the new Agra center to avoid duplication and maximize research efficiency.

Q88. Answer: (b) 59%

The correct answer is 59%.

Key Points

• According to the data released by the Ministry of Earth Sciences (MoES) in March 2025, approximately 59% of India's landmass is vulnerable to earthquakes of moderate to very high intensity.

• The assessment is based on the seismic zoning map of India, which categorizes the country into different regions based on the historical frequency and intensity of seismic activity.

• The National Center for Seismology (NCS), which functions under the Ministry of Earth Sciences, is the nodal agency for monitoring earthquake activity in India and maintains a nationwide network of stations.

• The high vulnerability is primarily attributed to the tectonic plate movements, specifically the Indian Plate moving northward and colliding with the Eurasian Plate, leading to significant stress accumulation along the Himalayan belt.

• This 59% area includes regions classified under Zone III, Zone IV, and Zone V, where Zone V represents the highest seismic risk.

Additional Information

• Seismic Zoning in India:

• The Bureau of Indian Standards (BIS) is the official body that publishes the Seismic Zoning Map of India [IS 1893 (Part I): 2016].

• Zone V: Covers the regions with the highest risk of earthquakes. It includes the entire North-Eastern India, parts of Jammu and Kashmir, Himachal Pradesh, Uttarakhand, the Rann of Kutch in Gujarat, and the Andaman and Nicobar Islands.

• Zone IV: This is the high-damage risk zone. It includes the Indo-Gangetic basin, Delhi, Sikkim, and parts of Bihar and Uttar Pradesh.

• Zone III: This is the moderate-damage risk zone. Many major cities like Mumbai, Kolkata, and Chennai fall under or near this zone.

• Zone II: This is the low-damage risk zone, covering the remaining parts of the country that are relatively stable.

• Geological Factors:

• The Indian subcontinent has a history of devastating earthquakes such as the 2001 Bhuj earthquake, the 1993 Latur earthquake, and the 1950 Assam-Tibet earthquake.

• The Himalayan region is considered one of the most seismically active regions in the world due to the ongoing continental collision.

Important Points

• Seismic Microzonation: The Government of India has initiated Seismic Microzonation studies for major cities to identify specific local hazards, which helps in better urban planning and disaster mitigation.

• Building Codes: To minimize loss of life, the government emphasizes adherence to Earthquake Resistant Design standards for construction, especially in high-risk zones.

• Disaster Management: The National Disaster Management Authority (NDMA) provides guidelines and protocols for earthquake preparedness, response, and structural safety audits.

• Monitoring: As of 2025, the NCS has expanded its network to include over 160 seismic stations across India to provide real-time data and early alerts for major tremors.

Q89. Answer: (d) Karnataka

The correct answer is Karnataka.

Key Points

• In July 2024/2025, the Karnataka State Cabinet, led by Chief Minister Siddaramaiah, approved a significant amendment to the Prohibition of Child Marriage Act, 2006.

• The most landmark provision of the Prohibition of Child Marriage (Karnataka Amendment) Bill is that it criminalizes engagements

involving minors. This is a preventive measure to stop child marriages at the very first stage of the ritual process.

• Under the new amendment, every child marriage performed in the state will be considered void ab initio (invalid from the very beginning). Previously, such marriages were often categorized as "voidable," which meant they were valid until the minor chose to legally dissolve them upon reaching adulthood.

• The bill grants Child Marriage Prohibition Officers increased powers to act on suo motu information to prevent ceremonies, including engagements and other pre-wedding rituals involving children.

• The cabinet decision aims to provide more teeth to the existing law to protect child rights and ensure that Karnataka moves closer to eradicating the social evil of child marriage, which still persists in several rural districts.

Additional Information

• The Prohibition of Child Marriage Act (PCMA), 2006:

• This is the central legislation in India aimed at preventing child marriages. It defines a "child" as a male who has not completed 21 years of age and a female who has not completed 18 years of age.

• The act allows for the appointment of Child Marriage Prohibition Officers and provides for the custody and maintenance of children born out of such marriages.

• Legal Punishments:

• Under the PCMA 2006, any male adult above 18 years who contracts a child marriage can be punished with rigorous imprisonment for up to two years and a fine of up to one lakh rupees.

• The Karnataka amendment seeks to enhance these penalties to create a stronger deterrent against the practice.

• Justice Shivaraj Patil Committee:

• The recommendation to make child marriages void ab initio was a key suggestion from the committee headed by Justice Shivaraj Patil, which studied the prevalence of child marriage in Karnataka.

• Statistics indicate that districts such as Yadgir, Raichur, Belagavi, and Kalaburagi have historically reported higher instances of such marriages.

• Sustainable Development Goals (SDG):

• India is a signatory to the United Nations SDG 5, which includes a target (5.3) to eliminate all harmful practices, such as child, early, and forced marriage, by the year 2030.

• State-level amendments like the one in Karnataka are crucial steps toward meeting these international commitments and improving the Child Sex Ratio and maternal health outcomes.

Important Points

• Impact of Criminalizing Engagements: By including engagements in the legal definition of prohibited activities, the law targets the societal betrothal system that often forces young girls out of the education system prematurely.

• High Court Intervention: The High Court of Karnataka had previously expressed concern over the "voidable" nature of child marriages, noting that it placed the burden of legal recourse on the victimized child. Making it void ab initio removes the legal status of the union automatically.

• Social Security: This legislative move is often coupled with government schemes like Bhagyalakshmi in Karnataka, which provides financial incentives to families to discourage child marriage and promote the birth of girl children.

Q90. Answer: (b) Tripura

The correct answer is Tripura.

Key Points

• In August 2025, the state government of Tripura officially unveiled its updated State Disaster Management Plan (SDMP) to strengthen the state's resilience against natural and man-made disasters.

• The initiative included the inauguration of a Technology Demonstration Unit (TDU), which serves as a hub for showcasing advanced disaster response equipment and innovative tools for rescue operations.

• A new Civil Defence Training Scheme was launched to empower local communities and volunteers, providing them with the necessary skills to act as first responders during emergencies such as floods or earthquakes.

• To enhance precision in meteorological forecasting, the state inaugurated a series of automated weather stations and rain gauges across various districts to monitor real-time climatic shifts.

• These initiatives are part of Tripura's broader strategy to utilize technology-driven solutions for disaster risk reduction and to minimize loss of life and property. Hence, the correct answer is Tripura.

Additional Information

• State Disaster Management Authority (SDMA):

• In India, the SDMA is headed by the Chief Minister of the respective state, as mandated by the Disaster Management Act, 2005.

• The Tripura State Disaster Management Authority (TSDMA) is responsible for formulating policies and plans to ensure a timely and effective response to disasters.

• Geographical Vulnerability of Tripura:

• Tripura is located in Seismic Zone V, which is the highest risk zone for earthquakes in India.

• The state is also prone to flash floods, landslides, and cyclonic storms due to its unique hilly terrain and proximity to the Bay of Bengal.

• Technological Interventions:

• The Technology Demonstration Unit acts as a bridge between scientific research and practical application, allowing personnel to test drones, satellite communication sets, and high-tech sensors.

• Automated Weather Stations (AWS) reduce manual errors in data collection and provide critical inputs for early warning systems.

Important Points

• Civil Defence Training: This scheme aims to build community-level capacity, focusing on search and rescue, first aid, and firefighting techniques.

• Data Precision: The installation of rain gauges in remote blocks of Tripura allows the government to issue localized alerts, particularly for agriculture and flood-prone low-lying areas.

• Strategic Vision: The SDMP 2025 aligns with the Sendai Framework for Disaster Risk Reduction, emphasizing a shift from reactive relief to proactive prevention and preparedness.

• August 2025 Milestone: This month marked a significant leap for the North Eastern states in adopting smart-governance tools for public safety.

Q91. Answer: (b) Har Ghar Lakhpati

The correct answer is Har Ghar Lakhpati.

Key Points

• The State Bank of India (SBI) officially launched the Har Ghar Lakhpati scheme in January 2025 to promote a culture of disciplined savings among the Indian masses.

• The primary objective of this scheme is to enable individual customers to accumulate a corpus of Rs. 1 lakh or above by contributing small monthly installments over a specified period.

• This initiative targets retail customers and low-to-middle-income groups, encouraging them to achieve significant financial milestones through manageable micro-savings. Hence, Har Ghar Lakhpati is the correct scheme described in the question.

• Under this scheme, the interest rates provided are competitive and designed to help the savings grow faster than a traditional savings account, utilizing the power of compounding.

• The scheme is accessible through SBI's extensive branch network as well as its digital platform, YONO SBI, ensuring ease of enrollment for customers across urban and rural India.

Additional Information

• State Bank of India (SBI):

• It is the largest Public Sector Bank (PSB) in India and a Fortune 500 company, headquartered in Mumbai, Maharashtra.

• The bank traces its ancestry to the Bank of Calcutta, founded in 1806, and was later known as the Imperial Bank of India before becoming SBI in 1955 through the State Bank of India Act.

• As of 2024-2025, the bank continues to be led by its Chairman, Challa Sreenivasulu Setty (C.S. Setty), who succeeded Dinesh Khara.

• Financial Inclusion in India:

• Schemes like Har Ghar Lakhpati align with the Government of India's vision of financial inclusion and Viksit Bharat @2047.

• It follows the success of other national savings movements like the Pradhan Mantri Jan Dhan Yojana (PMJDY), which focused on providing every household with at least one basic banking account.

• Structure of Small Savings:

• The scheme functions similarly to a Recurring Deposit (RD), where a fixed amount is deducted monthly from the customer's Savings Bank Account.

• The tenure for the Har Ghar Lakhpati scheme is flexible, typically ranging from 12 months to 60 months, depending on the monthly deposit amount chosen by the customer to reach the Rs. 1 lakh goal.

Important Points

• Eligibility and Features:

• Any Indian resident above the age of 18 is eligible to open a Har Ghar Lakhpati account, and accounts can also be opened in the name of minors represented by guardians.

• The scheme offers a nomination facility and allows for loan/overdraft facilities against the accumulated balance in case of financial emergencies.

• Tax Implications: The interest earned on these deposits is subject to TDS (Tax Deducted at Source) as per the Income Tax Act, 1961, if it exceeds the threshold limit for the financial year.

• Digital Integration: In 2025, SBI integrated this scheme with AI-driven personalized nudges on the YONO app to remind users to

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maintain sufficient balances for their monthly contributions.

Q92. Answer: (b) $1.5 billion mission

The correct answer is $1.5 billion mission.

Key Points

• NISAR, which stands for NASA-ISRO Synthetic Aperture Radar, is a joint earth-observation mission between the National Aeronautics and Space Administration (NASA) of the United States and the Indian Space Research Organisation (ISRO) of India.

• The project is estimated to be a $1.5 billion mission, making it one of the world's most expensive and advanced earth-imaging satellite missions to date.

• The mission was originally conceptualized through a partnership agreement signed in September 2014. It is currently scheduled for launch in July 2025 from the Satish Dhawan Space Centre in Sriharikota, India.

• The primary objective of NISAR is to use advanced radar imaging to map the entire Earth every 12 days, providing unprecedented data on changes in ecosystems, ice mass, vegetation biomass, and sea level rise.

• It is designed to observe and measure some of the planet's most complex natural processes, including natural hazards such as earthquakes, tsunamis, volcanoes, and landslides.

Additional Information

• Technical Specifications:

• NISAR is the first satellite mission to use two different radar frequencies: the L-band SAR (provided by NASA) and the S-band SAR (provided by ISRO).

• The L-band radar can penetrate deep into dense vegetation and is managed by NASA's Jet Propulsion Laboratory (JPL), while the S-band radar is ideal for monitoring heavy weather and coastal regions.

• The satellite features a large deployable mesh antenna, approximately 12 meters in diameter, which will be used to transmit and receive the radar signals.

• Roles of the Agencies:

• NASA is responsible for providing the L-band SAR, the high-rate communication subsystem for science data, GPS receivers, and a solid-state recorder.

• ISRO is providing the S-band SAR, the spacecraft bus (the main body of the satellite), the launch vehicle (GSLV Mark II), and related launch services.

• Mission Duration and Impact:

• The mission has a planned lifetime of at least 3 years.

• The data collected will be open-access, meaning it will be available to the global scientific community to improve climate change models and disaster management strategies.

• It will provide critical information regarding the rate of melting of glaciers and ice sheets in the Arctic and Antarctic regions, which is essential for predicting global sea level rise.

Important Points

• The NISAR mission represents a significant milestone in India-US space cooperation, showcasing the ability of both nations to pool financial and technical resources for global environmental monitoring.

• The Synthetic Aperture Radar (SAR) technology allows the satellite to "see" through clouds and darkness, enabling 24/7 observation of the Earth's surface regardless of weather conditions.

• By tracking subtle changes in the Earth's crust (as small as centimeters), NISAR will help scientists provide better warnings for volcanic eruptions and identify areas most at risk during tectonic shifts.

Q93. Answer: (c) Rs. 6,81,210.27 crore

The correct answer is Rs. 6,81,210.27 crore.

Key Points

• The Union Budget 2025-26 was presented by the Union Minister of Finance, Nirmala Sitharaman, in Parliament on February 1, 2025.

• The Ministry of Defence (MoD) has been allocated a total of Rs. 6,81,210.27 crore for the financial year 2025-26, which is the highest among all ministries.

• This allocation represents approximately 13% of the total Union Budget expenditure, highlighting the government's focus on national security and military modernization.

• Of the total amount, a significant portion of Rs. 1,87,358 crore is dedicated to Capital Outlay, which is intended for the procurement of new weapon systems, aircraft, warships, and other military hardware.

• The budget focus remains on Aatmanirbharta in Defence, aiming to boost domestic manufacturing and reduce the import of critical defence equipment through initiatives like the Defence Acquisition Procedure.

Additional Information

• Defence Pensions: A substantial sum of Rs. 1,47,440.40 crore has been set aside for Defence Pensions in the 2025-26 budget to support veterans and their families.

• Revenue Expenditure: The Revenue head, which includes salaries, maintenance, and operational costs of the Army, Navy, and Air Force, accounts for a major share of the non-capital spending.

• Border Infrastructure: To strengthen security along the Line of Actual Control (LAC) and Line of Control (LoC), the Border Roads Organization (BRO) has received enhanced funding for constructing strategic tunnels, bridges, and roads.

• Innovation and R&D: The government continues to support the Defence Research and Development Organisation (DRDO) and schemes like iDEX (Innovations for Defence Excellence) to foster startups and MSMEs in the defence technology sector.

• Comparison: The allocation of Rs. 6,81,210.27 crore in 2025-26 is an increase from the Rs. 6,21,540.85 crore allocated in the 2024-25 budget, reflecting a steady growth in defence spending to tackle evolving regional threats.

Q94. Answer: (c) National Green Tribunal

The correct answer is National Green Tribunal.

Key Points

• The National Green Tribunal (NGT), in August 2025, directed the Ministry of Environment, Forest and Climate Change (MoEF&CC) to constitute an expert committee and frame its Terms of Reference (ToR) for a detailed study on ground-level ozone.

• The directive comes in response to rising concerns over ozone (O3) acting as a dangerous secondary pollutant, which is often overshadowed by particulate matter like PM2.5 and PM10 in national air quality discussions.

• The NGT emphasized that there is a lack of adequate monitoring and specific mitigation strategies for ground-level ozone, which is primarily formed through chemical reactions in the atmosphere.

• The proposed committee is expected to involve representatives and scientists from the Central Pollution Control Board (CPCB), Indian Institute of Technology (IIT), and other environmental research bodies to analyze the seasonal variations and precursor emissions of ozone.

• The NGT's intervention highlights the necessity for the Government of India to update the National Clean Air Programme (NCAP) to include more robust protocols for managing gaseous pollutants alongside solid particulates.

Additional Information

• National Green Tribunal (NGT):

• The NGT was established on 18th October 2010 under the National Green Tribunal Act 2010 for effective and expeditious disposal of cases relating to environmental protection and conservation of forests.

• It is a specialized body equipped with the necessary expertise to handle environmental disputes involving multi-disciplinary issues, and it is not bound by the procedure laid down under the Code of Civil Procedure, 1908, but guided by principles of natural justice.

• The principal bench of the NGT is located in New Delhi, with regional benches in Bhopal, Pune, Kolkata, and Chennai.

• Ground-Level Ozone (O3):

• Unlike the stratospheric ozone layer that protects Earth from UV radiation, ground-level ozone is a harmful air pollutant and a key constituent of smog.

• It is not emitted directly but created by chemical reactions between Oxides of Nitrogen (NOx) and Volatile Organic Compounds (VOCs) in the presence of sunlight and high temperatures.

• Significant sources of NOx and VOCs include industrial facilities, electric utilities, motor vehicle exhaust, and chemical solvents.

• Ministry of Environment, Forest and Climate Change (MoEF&CC):

• This is the nodal agency in the administrative structure of the Central Government for the planning, promotion, and coordination of environmental and forestry programmes in India.

• It oversees the implementation of the Environment Protection Act (1986) and manages the National Clean Air Programme (NCAP), which aims for a 20-40% reduction in particulate matter concentration by 2026.

Important Points

• Health Impacts: High concentrations of ground-level ozone can cause immediate respiratory health problems, including asthma, reduced lung function, and increased susceptibility to respiratory infections.

• Environmental Impact: Ozone also affects sensitive vegetation and ecosystems, leading to reduced agricultural crop yields and interfering with the ability of plants to produce and store food.

• Legal Framework: The Air (Prevention and Control of Pollution) Act, 1981 provides the legal basis for the CPCB and SPCBs to set standards and monitor air quality, including gaseous pollutants like O3, SO2, and NO2.

Q95. Answer: (b) 2026

The correct answer is 2026.

Key Points

• The Ministry of Statistics and Programme Implementation (MoSPI) announced in June 2025 that it would conduct India's first

official nationwide household income survey.

• The survey is scheduled to be launched in the year 2026, marking a significant shift in how the country collects economic data.

• Historically, India has relied on Household Consumption Expenditure Surveys (HCES) to estimate poverty and economic well-being, rather than direct income data.

• This new initiative aims to provide a more accurate picture of the standard of living, income distribution, and the economic gap between various sections of society.

• The National Statistical Office (NSO), which functions under MoSPI, will be the nodal agency responsible for designing the methodology and executing the fieldwork for this survey. Hence, the correct answer is 2026.

Additional Information

• Ministry of Statistics and Programme Implementation (MoSPI):

• MoSPI came into existence as an independent Ministry on 15th October 1999 after the merger of the Department of Statistics and the Department of Programme Implementation.

• It has two wings: one relating to Statistics (headed by the National Statistical Office) and the other is Programme Implementation.

• The Statistics Wing is responsible for the timely release of critical data such as the Consumer Price Index (CPI), Index of Industrial Production (IIP), and Gross Domestic Product (GDP) estimates.

• Significance of Income Surveys:

• Direct income surveys help in calculating the Gini Coefficient, which is a standard mathematical measure of income inequality within a nation.

• Currently, organizations like ICE 360 (People Research on India's Consumer Economy) conduct private income surveys, but an official government survey will provide authentic data for policy formulation.

• This data is vital for tailoring Direct Benefit Transfer (DBT) schemes and identifying the beneficiaries of various social welfare programs more effectively.

Important Points

• Comparison with Consumption Data:

• While consumption expenditure tracks what households spend, an income survey tracks what they earn from all sources including wages, agriculture, business, and investments.

• The transition to income-based tracking aligns India with international statistical standards followed by many developed nations and OECD countries.

• Other Major Surveys by MoSPI:

• Periodic Labour Force Survey (PLFS): Launched in April 2017, it provides estimates of unemployment rates and labour force participation at frequent intervals.

• Annual Survey of Industries (ASI): The principal source of industrial statistics in India, providing information on the growth and structure of the manufacturing sector.

• Economic Census: Conducted periodically to provide a complete count of all entrepreneurial units (establishments) located within the geographical boundaries of the country.

• Timeline Context:

• The decision in June 2025 to start the survey in 2026 follows recommendations from various Expert Committees that suggested India needs a dedicated income database to complement its decadal Census and NFHS (National Family Health Survey) data.

Q96. Answer: (d) Simone Biles

The correct answer is Simone Biles.

Key Points

• The legendary American gymnast Simone Biles was crowned the Laureus World Sportswoman of the Year in April 2025.

• This prestigious award was conferred upon her following her historic performance at the Paris 2024 Olympic Games, where she reaffirmed her dominance in the world of gymnastics.

• During the 2024 season, Simone Biles captured three gold medals (Team, All-Around, and Vault) and one silver medal (Floor Exercise), becoming the most decorated American gymnast in Olympic history.

• The Laureus World Sports Awards are often referred to as the "Oscars of Sports," and winning this category signifies being the top female athlete across all sporting disciplines globally.

• This victory marks Simone Biles' fourth time winning the Sportswoman of the Year award, having previously won in 2017, 2019, and 2020.

Additional Information

• Laureus World Sports Awards:

• Established in 1999 by the Laureus Sport for Good Foundation, these awards celebrate the greatest sporting achievements of

the year.

• The 2025 ceremony celebrated the achievements of athletes during the 2024 calendar year, with the event held in April 2025.

• Simone Biles' Career Highlights:

• Born in 1997 in Columbus, Ohio, USA, she has won a combined total of 41 Olympic and World Championship medals.

• She is known for her extreme technical difficulty, with five skills named after her in the Code of Points across different apparatus.

• Her return to the Paris 2024 Olympics was highly celebrated as a successful comeback after she withdrew from several events at the Tokyo 2020 games to focus on her mental health.

• Other Nominees for 2025:

• Katie Ledecky: An elite American swimmer who continued her dominance in distance freestyle at the Paris 2024 games.

• Iga Świątek: The Polish tennis star who held the World No. 1 ranking and won the French Open in 2024.

• Athing Mu: A prominent American middle-distance runner and Olympic gold medalist in the 800 meters.

Important Points

• Selection Process: The winners are chosen by the Laureus World Sports Academy, a unique group of 71 sporting legends who volunteer their time to support the foundation.

• Impact Beyond Sports: The Laureus organization supports over 160 programs in more than 40 countries, using the power of sport to end violence, discrimination, and disadvantage.

• Historical Context: Simone Biles joins an elite group of multiple-time winners, including Serena Williams and Roger Federer, who have been recognized by the academy for their long-term excellence and impact on their respective sports.

• Record-Breaking Feats: By 2024, Biles became the oldest American woman to win an Olympic gymnastics all-around title since 1952, aged 27.

Q97. Answer: (b) Singapore

The correct answer is Singapore.

Key Points

• Singapore has been officially selected to host the 2025 World Aquatics Championships, making it the first Southeast Asian nation to host this prestigious global event.

• The announcement was made by World Aquatics (formerly known as FINA) in February 2023. The event is scheduled to take place from July 11 to August 3, 2025.

• The championships were originally awarded to Kazan, Russia, but the hosting rights were relocated due to the ongoing geopolitical situation and international sanctions. Hence, the mention of Singapore as the host is correct.

• The 2025 World Aquatics Championships will bring together the world's best athletes in six aquatic disciplines: swimming, diving, high diving, open water swimming, artistic swimming, and water polo.

• Over 2,500 athletes representing approximately 200 national federations are expected to participate in the event.

• Key competition venues in Singapore will include the Singapore Sports Hub, the OCBC Aquatic Centre, and Sentosa for open water and high diving events.

Additional Information

• Budapest (Option 1):

• Budapest, Hungary, has been a frequent host of the championships, staging the event in 2017 and 2022.

• It is also scheduled to host the World Aquatics Championships again in 2027.

• The city is renowned for its Danube Arena, a world-class facility built specifically for aquatic sports.

• Melbourne (Option 3):

• Melbourne, Australia, hosted the 12th FINA World Championships in 2007.

• More recently, it hosted the 2022 FINA World Swimming Championships (25m), which is a short-course event.

• Australia is a powerhouse in swimming, often finishing near the top of the medal tally.

• Doha (Option 4):

• Doha, Qatar, hosted the 21st World Aquatics Championships in February 2024.

• This was the first time the championships were held in the Middle East.

• The event served as a crucial qualifying stage for the Paris 2024 Olympic Games.

Important Points

• World Aquatics: In December 2022, the international federation formerly known as FINA (Fédération Internationale de Natation) rebranded itself as World Aquatics to better represent all aquatic disciplines.

• Championship Cycle: While the championships are traditionally held biennially (every two years in odd-numbered years), the schedule was disrupted by the COVID-19 pandemic, leading to consecutive championships in 2022 (Budapest), 2023 (Fukuoka), 2024 (Doha), and 2025 (Singapore).

• Economic Impact: Hosting the World Aquatics Championships is expected to provide a significant boost to Singapore's tourism and sports ecosystem, attracting fans and media from across the globe.

• Future Hosts: Following Singapore in 2025, the championships will move to Budapest in 2027 and Beijing, China, in 2029.

Q98. Answer: (c) Rajiv Gauba

The correct answer is Rajiv Gauba.

Key Points

• The Government of India appointed Rajiv Gauba as a full-time member of NITI Aayog in March 2025.

• Rajiv Gauba is a 1982-batch Indian Administrative Service (IAS) officer of the Jharkhand cadre.

• He previously served as the Cabinet Secretary of India, the highest-ranking bureaucratic position, for a tenure of five years from August 2019 to August 2024. Hence, the correct answer is Rajiv Gauba.

• During his career, he has held several key positions, including Union Home Secretary and Secretary in the Ministry of Urban Development.

• As Cabinet Secretary, he was instrumental in the implementation of major decisions such as the bifurcation of Jammu and Kashmir and the management of the COVID-19 pandemic.

• His inclusion as a full-time member in NITI Aayog is intended to utilize his vast administrative experience in policy formulation and strategic planning for the nation.

Additional Information

• NITI Aayog (National Institution for Transforming India):

• It was established on January 1, 2015, replacing the 65-year-old Planning Commission.

• The Prime Minister of India serves as the Ex-officio Chairperson.

• It functions as a think tank for the Government of India, providing both directional and policy inputs while fostering cooperative federalism.

• BVR Subrahmanyam:

• He is a 1987-batch IAS officer who is currently serving as the Chief Executive Officer (CEO) of NITI Aayog since February 2023.

• He has previously served as the Chief Secretary of Jammu and Kashmir and as Commerce Secretary.

• Arvind Panagariya:

• He was the first Vice Chairperson of NITI Aayog, serving from 2015 to 2017.

• In December 2023, he was appointed as the Chairman of the 16th Finance Commission of India.

• S Mahendra Dev:

• He is a renowned economist and has served as the Vice-Chancellor of Indira Gandhi Institute of Development Research (IGIDR).

• He has also served as the Chairman of the Commission for Agricultural Costs and Prices (CACP).

Important Points

• Structure of NITI Aayog:

• Vice Chairperson: Appointed by the Prime Minister (Current: Suman Bery).

• Full-time Members: Experts in various fields who assist in the institution's policy work.

• Ex-officio Members: Maximum of four members from the Union Council of Ministers, nominated by the Prime Minister.

• Governing Council: Comprises the Chief Ministers of all States and Lieutenant Governors of Union Territories.

• Role of Cabinet Secretary:

• The Cabinet Secretary is the administrative head of the Cabinet Secretariat and the ex-officio Chairman of the Civil Services Board.

• Rajiv Gauba holds the record for being the longest-serving Cabinet Secretary in the history of independent India.

Q99. Answer: (d) St. Thomas College, Pala

The correct answer is St. Thomas College, Pala.

Key Points

• The All India Inter-University Volleyball Championship 2025 for men was hosted by St. Thomas College, Pala, located in the Kottayam district of Kerala.

• The prestigious sporting event was conducted over five days, starting from 6 January 2025 and concluding on 10 January 2025.

• The tournament was organized under the auspices of Mahatma Gandhi University, Kottayam, which is the affiliating university for St. Thomas College.

• This championship brought together the top-performing university teams from the four geographical zones of India (North, South, East, and West) to compete for the national university title.

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• The event is a significant fixture in the Indian university sports calendar, aimed at fostering athletic excellence and identifying promising talent for the national volleyball team. Hence, the correct answer is St. Thomas College, Pala.

Additional Information

• St. Thomas College, Pala:

• Established in 1950, it is one of the premier higher education institutions in Kerala.

• The college has a long-standing reputation for sports excellence, particularly in Volleyball and Athletics, having produced several Olympians and national-level athletes for India.

• The hosting of the 2025 championship highlights the college's advanced sports infrastructure, including high-quality courts and residential facilities for visiting athletes.

• Association of Indian Universities (AIU):

• The AIU is the governing body responsible for organizing Inter-University sports competitions across the country.

• It serves as an umbrella organization for over 800 universities in India, facilitating academic and cultural exchange alongside sports.

• Success in AIU championships is often a prerequisite for students to gain admission under sports quotas in professional courses and secure jobs in government organizations.

• Mahatma Gandhi University:

• Commonly known as MG University, it was established in 1983 in Kottayam, Kerala.

• It has been a frequent host for various National and South Zone Inter-University tournaments, maintaining a strong focus on physical education.

Important Points

• Tournament Structure:

• The All India stage usually involves 16 teams that have qualified as the top four finishers from each of the four Zonal (North, South, East, West) championships.

• The matches are played in a league-cum-knockout format, ensuring that only the most consistent teams reach the final rounds.

• Volleyball Culture in Kerala:

• The state of Kerala is considered a powerhouse of Volleyball in India, with the sport enjoying immense popularity in rural and semi-urban areas like Pala.

• Hosting the All India Inter-University meet in Kerala often draws large crowds, reflecting the state's deep passion for the game.

• Dates and Duration:

• The 2025 edition held in January aligns with the peak season for university sports in India, preceding the Khelo India University Games.

Q100. Answer: (b) Eastern Cape

The correct answer is Eastern Cape.

Key Points

• South Africa officially assumed the G20 Presidency on December 1, 2024, succeeding Brazil. As part of its 2025 calendar, the nation hosted various working group meetings across its provinces.

• The second meeting of the G20 Digital Economy Working Group (DEWG) was scheduled to be hosted in the Eastern Cape province in 2025.

• The Digital Economy Working Group (DEWG) meetings are a critical part of the Sherpa Track, focusing on the transformative power of digital technologies to drive inclusive economic growth.

• The Department of Communications and Digital Technologies (DCDT) of South Africa led the organization of these meetings, ensuring that the agenda aligned with the national and continental goals of digital transformation.

• The discussions in the Eastern Cape centered on the development of Digital Public Infrastructure (DPI), enhancing Cybersecurity, and fostering Artificial Intelligence (AI) for sustainable development.

Additional Information

• G20 South Africa 2025 Theme:

• The theme for the South African G20 Presidency is "Solidarity, Equality and Sustainability".

• This theme reflects South Africa’s commitment to addressing the needs of the Global South and ensuring that the digital economy benefits everyone, reducing the Digital Divide.

• Digital Economy Working Group (DEWG) History:

• The DEWG was originally established as the Digital Economy Task Force in 2017 during the German G20 Presidency.

• It was later elevated to a formal Working Group to address the increasing importance of digital policies in global economic stability and innovation.

• The Troika:

• During 2025, the G20 Troika consists of Brazil (previous host), South Africa (current host), and the United States of America (incoming host for 2026).

• This ensures continuity in the G20 agenda across different presidencies.

• Significance of the Eastern Cape:

• Hosting the meeting in the Eastern Cape highlights South Africa's strategy to distribute G20 events across various regions to promote local tourism and showcase provincial development.

• The province is a significant industrial hub, particularly for the automotive sector, which is increasingly reliant on digital integration and Industry 4.0.

Important Points

• G20 Composition: The G20 comprises 19 countries, the European Union, and recently, the African Union, which was admitted as a permanent member during the New Delhi Summit in 2023.

• Priority Areas: South Africa’s priorities for the digital track include Digital Inclusion, Human-Centric AI, and Data for Development.

• Global Impact: The outcomes of the DEWG meetings contribute to the G20 Leaders' Declaration, which sets global standards for digital governance and cooperation.

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