RRB Group D Official Paper (Held On: 15 Dec, 2025 Shift 3) (Previous Year Paper)

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

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GENERAL SCIENCE

Q1. An object placed between F and 2F of a convex lens forms an image _____.

(a) At 2F, real, inverted, and diminished
(b) Beyond 2F, real, inverted, and enlarged
(c) At infinity, real, inverted and same size
(d) Between F and the lens, virtual, erect, and diminished

Q2. Which of the following statements is correct?

(a) Work requires both force and displacement.
(b) The work can be done without displacement.
(c) Work is independent of displacement.
(d) Work can be done without force.

Q3. In which of the following simple permanent tissues the cell walls are lignified?

(a) Phloem
(b) Sclerenchyma
(c) Parenchyma
(d) Collenchyma

Q4. Which of the following is a heterogeneous mixture?

(a) Air
(b) Vinegar
(c) Soil
(d) Sugar solution

Q5. Which of the following pairs correctly matches the device with its main use?

(a) Stethoscope – Directing sound to a large audience
(b) Horn – Amplifying musical sound
(c) Horn – Measuring blood pressure
(d) Megaphone – Listening to heartbeat

Q6. Which of the following reactions correctly represents the synthesis of bleaching powder?

(a) $Ca(OH)2 + Cl2 \rightarrow CaOCl2 + H2O$
(b) $2Ca(OH)2 + 2Cl2 \rightarrow Ca(ClO)2 + CaCl2 + 2H2O$
(c) $2Ca(OH)2 + 2Cl2 \rightarrow CaOCl2 + CaCl2 + H2O$
(d) $2Ca(OH)2 + 2NaCl \rightarrow Ca(OCl)2 + CaCl2 + 2H2O$

Q7. Which of the following substances is inert in nature and remains present in the environment for a long period and damages various components of the ecosystem?

(a) Disposable paper cups
(b) Disposable plastic cups

(c) Tea leaves
(d) Tea clay kullhads

Q8. If a person weighing 600 N stands on two feet whose total contact area is 0.05 m^2, find the pressure exerted on the sand?
(a) 300 Pa
(b) 600 Pa
(c) 30,000 Pa
(d) 12,000 Pa

Q9. A train is travelling at a speed of 180 km/hr. Brakes are applied so as to produce a uniform acceleration of (- 1 m/s^2). What will be the distance covered by the train before coming to rest?
(a) 1620 m
(b) 1250 m
(c) 125 m
(d) 16,200 m

Q10. Which statement accurately describes the characteristics of protons in an atom?
(a) They have negligible mass compared to electrons.
(b) They revolve around the nucleus in fixed orbits.
(c) They are located in the nucleus of an atom.
(d) They are negatively charged particles.

Q11. Which gland in the human body secretes growth hormone?
(a) Adrenal Gland
(b) Thyroid Gland
(c) Pancreas
(d) Ptuitary gland

Q12. For fertilization to occur, which suitable part of the flower should the pollen grain reach?
(a) Filament
(b) Stigma
(c) Petal
(d) Sepal

Q13. Predict the elements corresponding to the following numbers of protons and neutrons.
A: 20 protons and 20 neutrons
B: 19 protons and 20 neutrons
(a) A: Calcium, B: Magnesium
(b) A: Potassium, B: Calcium
(c) A: Magnesium, B: Potassium
(d) A: Calcium, B: Potassium

Q14. Asexual reproduction is different from sexual reproduction. Which of the following options does not represent asexual reproduction?
(a) Involvement of both male and female reproductive organs
(b) Fission
(c) Regeneration
(d) Binary fission

Q15. Which of the following describes the nature of the average speed?
(a) It can be negative.
(b) It is a scalar quantity (only magnitude).
(c) It is always equal to or less than the average velocity.
(d) It is a vector quantity (magnitude and direction).

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Q16. In the process of binary fission in unicellular organisms like bacteria and protozoa, which of the following is least likely to occur?

(a) Formation of identical daughter cells
(b) No need for a second parent
(c) Unequal division of genetic material
(d) Rapid population growth under favorable conditions

Q17. What is the hydrophilic end of a soap molecule like?

(a) Ionic and reacts with water
(b) Neutral and Nonpolar
(c) Non-ionic and soluble in water
(d) Non-ionic and soluble in oil

Q18. Which of the following statements about the physical properties of non-metals is correct?

(a) Non-metals have high density and high melting points.
(b) Non-metals are malleable and ductile.
(c) Non-metals are generally brittle in solid state.
(d) Non-metals are good conductors of electricity.

Q19. The heat produced in a conductor due to the flow of current does NOT depend on _____.

(a) amount of current.
(b) resistance for a given current.
(c) duration of current flow.
(d) direction of current.

Q20. Which of the following phenomena is responsible for the blue colour of a clear sky?

(a) Reflection
(b) Dispersion
(c) Scattering
(d) Refraction

Q21. Which part of the brain controls involuntary actions such as blood pressure, salivation, and vomiting?

(a) Cerebellum
(b) Medulla oblongata
(c) Thalamus
(d) Cerebrum

Q22. Why is the filament of an electric bulb made of tungsten?

(a) It is cheaper
(b) It is a good conductor
(c) It has high resistance and can withstand high temperatures
(d) Its melting point is low

Q23. Anodising is typically performed on which metal?

(a) Copper
(b) Zinc
(c) Steel
(d) Aluminium

Q24. Which of the following statements is/are true about villi in the small intestine?

Statements:

A: Increase surface area for absorption

B: Contain blood vessels

C: Help in excretion

D: Absorb digested nutrients

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(a) Only Statements A, B, and D
(b) Only Statement A
(c) Only Statements A, B and C
(d) Only Statement B

Q25. Which activity shows that particles of matter are continuously moving?
(a) Ice melting at room temperature
(b) Fragrance of perfumes spreading in a room
(c) Sugar settling at the bottom of a glass of water
(d) Water being heated to its boiling point

MATHEMATICS

Q26. A shopkeeper announces the following three discount schemes. Which scheme is the most beneficial for the customer?
A. Buy 5 items and get 22 identical items free
B. Two successive discounts of 13% and 38%
C. Two equal successive discounts of 21%
(a) Only B
(b) A
(c) Both A and C
(d) Only C

Q27. If the mode of the data 12, 9, 10, 12, 13, (2K - 2), 13, 19, 15, and 17 is 12, find the value of K.
(a) 8
(b) 5
(c) 7
(d) 6

Q28. If tan A = 6/7, find the value of (7 sin A + 2 cos A)/(7 sin A - 2 cos A).
(a) 9/5
(b) 5
(c) -19/5
(d) 2

Q29. The volume of a solid cylinder is 34,650 cm^3. If the height is 25 cm, then the circumference of the base is:
(Use $\pi = 22/7$)
(a) 135 cm
(b) 128 cm
(c) 132 cm
(d) 121 cm

Q30. Two cars start from the same point and travel in the same direction. If one car travels at a speed of 55 km/h and the other at 72 km/h, how far apart will they be after 3 hours?
(a) 51 km
(b) 45 km
(c) 57 km
(d) 61 km

Q31. A person spent Rs. 14,000 on groceries, Rs. 8,000 on house rent, and Rs. 10,000 on children's school fees, and kept the remaining 20% of their total income in cash. Find their income.
(a) Rs. 52,000
(b) Rs. 50,000
(c) Rs. 40,000

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(d) Rs. 46,000

Q32. A force of 1,206 soldiers has provisions for 24 days. If the number of soldiers in the force is increased to 1,809, for how many days will the provisions last?

(a) 15
(b) 16
(c) 18
(d) 17

Q33. The sum of two numbers is 25. One of them is 9 greater than the other. Find the numbers.

(a) 17 and 8
(b) 11 and 14
(c) 10 and 15
(d) 16 and 9

Q34. If 50% of 80% of half of a number is 442, find the number.

(a) 1480
(b) 3630
(c) 3530
(d) 2210

Q35. A metallic sphere of radius 36 cm is dropped into a cylindrical vessel, which is partly filled with water. The diameter of the vessel is 4.8 metres. If the sphere is completely submerged, find by how much the surface of the water will rise.

(a) 2.08 cm
(b) 2.82 cm
(c) 1.08 cm
(d) 1.82 cm

Q36. A shopkeeper bought 20 kg of apples for Rs. 3,600 and sold them at the rate of Rs. 220/kg. How much profit (in Rs.) did he make?

(a) 750
(b) 600
(c) 700
(d) 800

Q37. Three numbers are in the ratio 7 : 20 : 8, and their sum is 4830. Find the middle number.

(a) 2761
(b) 2760
(c) 2763
(d) 2759

Q38. Find the value of $((0.12)^2 + (0.123)^2 + (0.1234)^2)/((0.012)^2 + (0.0123)^2 + (0.01234)^2)$

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

Q39. A certain sum of money triples itself in 8 years at simple interest. In how many years will it become four times itself?

(a) 12
(b) 10
(c) 11
(d) 13

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Q40. A, B and C can complete a task in 2, 8 and 8 days, respectively. Working together, how long (in days) will they take to complete three times that amount of work?

(a) 5
(b) 4
(c) 8
(d) 12

Q41. If $2a + b + c = 0$ and $8a^3 + b^3 + c^3 = kabc$, then find the value of k^2.

(a) 49
(b) 36
(c) 16
(d) 25

Q42. 7 men or 6 women can do a job in 15 days. 7 men work for 8 days and leave. The number of women required to complete the remaining work in 6 days is:

(a) 8
(b) 10
(c) 6
(d) 7

Q43. Simplify $(24 - 6 \times 3) + 18 \div 3 \times 2$.

(a) 18
(b) 12
(c) 30
(d) 24

Q44. During the New Year sale, a company is offering a ‘Buy 9 sweaters, get 3 free’ deal to customers. What is the percentage discount offered in this deal?

(a) 27%
(b) 30%
(c) 25%
(d) 23%

Q45. The price of a washing machine is 20% less than the price of a TV. If the price of the washing machine increases by 45% and the price of the TV decreases by 38%, what will be the percentage change in the total cost of 5 washing machines and 4 TVs?

(a) 3.5% increase
(b) 2.5% increase
(c) 9% increase
(d) 10% increase

Q46. A cricketer's average score over 5 innings is 55. If he scores 166 runs in the sixth inning, by how many runs (rounded to the nearest whole number) will his average score increase?

(a) 19
(b) 18
(c) 10
(d) 8

Q47. Sakshi goes to a shopping mall at a speed of 36 km/hr and returns at a speed of 24 km/hr. Find her average speed (in km/hr) for the entire journey.

(a) 28.8
(b) 37.8
(c) 23.5
(d) 36.4

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Q48. In triangle ABC, BD perpendicular to AC at point D and angle DBC = 72°. There is a point E on BC such that angle CAE = 71°. What is the measure of angle AEB ?

(a) 92°
(b) 93°
(c) 89°
(d) 88°

Q49. Eight years ago, a mother's age was five times that of her daughter. Two years from now, the mother's age will be three times that of her daughter. Find the ratio of the mother's current age to her daughter's current age.

(a) 17 : 8
(b) 22 : 9
(c) 29 : 9
(d) 15 : 8

Q50. Rs. 3,787 is divided among A, B, C and D such that the shares of A and B, B and C, and C and D are in the ratio 4 : 5, 4 : 5 and 6 : 7 respectively. Find A's share (in Rs.).

(a) 628
(b) 708
(c) 672
(d) 604

GENERAL INTELLIGENCE & REASONING

Q51. Rajen starts from point A and drives 54 km towards the east. He then turns right, drives 56 km, then turns right again and drives 56 km. He then turns right again and drives 65 km. He finally turns right, drives 2 km and stops at point P. How far (the shortest distance) and in which direction should he drive to reach point A again?

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

(a) 8 km to the south
(b) 6 km to the north
(c) 9 km to the south
(d) 7 km to the north

Q52. If + means -, - means ×, × means ÷, ÷ means +, then what will come in place of question mark (?) in the following equation?

18 - 13 ÷ 15 + 82 × 2 = ?

(a) 207
(b) 206
(c) 208
(d) 205

Q53. Seven people, A, B, C, D, E, F and G, are sitting in a row, facing north. Only one person sits to the right of E. Only three people sit between G and E. Only three people sit between A and D, none of whom sits on the left end. F sits to the immediate right of C. Only one person sits between A and B. Who sits second to the left of C?

(a) A
(b) D
(c) G
(d) E

Q54. What will come in place of question mark (?) in the given series?

56 76 96 116 136 ?

(a) 156
(b) 152
(c) 154
(d) 153

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Q55. Which of the following letter-number cluster will come in place of the question mark (?) to logically complete the given series?

TLD, WOG, ZRJ, CUM, ?

(a) FYP
(b) FXQ
(c) FXP
(d) FYQ

Q56. In a certain code language, 'TIME' is coded as '5046' and 'MINE' is coded as '4609'. What is the code for 'N' in the given code language?

(a) 6
(b) 0
(c) 9
(d) 4

Q57. 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 teachers are professionals.

All professionals are doctors.

Conclusions:

(I): Some doctors are teachers.

(II): All teachers are doctors.

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

Q58. In a certain code language, ‘ZEST’ is written as ‘4875’ and ‘BEST’ is written as ‘5781.’ What is the code for ‘Z’ in the given code language?

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

Q59. Girish ranks 16th from the top and 26th from the bottom in his class. How many students are there in the class?

(a) 30
(b) 35
(c) 40
(d) 41

Q60. 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 letter-cluster is not based on the number of consonants/vowels or their position in the letter-cluster.)

(a) ZBX
(b) BEZ
(c) EGC
(d) SUQ

Q61. What will come in place of question mark (?) in the given series?

253 243 234 ? 219 213

(a) 224
(b) 225

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(c) 226
(d) 223

Q62. Based on the English alphabetical order, LHQV is related to QFVT in a certain way. Similarly, VDAR is related to ABFP. Following the same logic, FZKN is related to which of the following?
(a) JZQK
(b) KXPL
(c) JWOM
(d) LYQK

Q63. Which of the following letter-number cluster will come in place of the question mark (?) to logically complete the given series?
LEX 14, OHA 23, RKD 32, UNG 41, XQJ 50, ?
(a) AMT 59
(b) AQM 59
(c) ATM 59
(d) ATM 57

Q64. Refer to the following series and answer the given question (all numbers are single-digit numbers only) (Counting should be done from left to right only.)
(Left) 7 5 2 1 1 6 6 9 8 6 1 7 1 1 9 6 7 3 6 9 9 8 1 (Right)
How many odd numbers are there, each of which is immediately preceded by an even number and immediately followed by an odd number?
(a) One
(b) Four
(c) Three
(d) Two

Q65. In a certain way, MH 10 is related to FA 20. In the same way, PK 9 is related to ID 18. Following the same logic, UP 7 is related to which of the given options?
(a) NI 14
(b) DE 12
(c) SP 14
(d) XP 12

Q66. If + means −, − means ×, × means ÷ and ÷ means +, then what will come in place of question mark (?) in the following equation?
205 − 3 ÷ 262 + 212 × 4 = ?
(a) 823
(b) 824
(c) 822
(d) 825

Q67. What will come in place of question mark (?) in the given series?
342 352 360 366 370 ?
(a) 372
(b) 376
(c) 374
(d) 378

Q68. If '+' and '−' are interchanged and '×' and '÷' are interchanged, then what will come in place of question mark (?) in the following equation?
208 – 117 × 9 ÷ 5 + 215 = ?
(a) 55
(b) 59

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(c) 58
(d) 53

Q69. 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 is/are true.

Statements:

No Pianos are Guitars.

All Guitars are Violins.

Some Violins are Drums.

Conclusions:

(I) Some Pianos are Violins.

(II) Some Guitars are Drums.

(a) Only conclusion (II) is true.
(b) Both conclusions (I) and (II) are true.
(c) Only conclusion (I) is true.
(d) Neither conclusion (I) nor (II) is true.

Q70. Select the set in which the numbers are related in the same way as the numbers in the following sets.

(Note: Operations must be performed on whole numbers, without breaking the numbers into their component digits. Take 13 for example - operations on 13 such as addition/subtraction/multiplication etc. can be performed only on 13. Breaking 13 into 1 and 3 and then performing mathematical operations on 1 and 3 is not allowed.)

(8, 26, 48)

(10, 28, 50)

(a) (9, 27, 48)
(b) (25, 43, 65)
(c) (21, 3, 25)
(d) (7, 25, 46)

Q71. GQ 14 is related in a certain way to EN 16. Similarly, KU 22 is related to IR 24. Following the same logic, OY 27 is related to which of the following?

(a) PU 28
(b) MV 29
(c) MR 29
(d) PT 29

Q72. This question is based on the five three-digit numbers given below.

(Left) 658 223 661 257 666 (Right)

(Example: 697 - first digit = 6, second digit = 9, and third digit = 7)

(Note: All operations are performed from left to right.)

What is the result if the second digit of the largest number is added to the third digit of the smallest number?

(a) 9
(b) 14
(c) 11
(d) 12

Q73. 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 letter-cluster is not based on the number of consonants/vowels or their position in the letter-cluster.)

(a) KLH
(b) RSO
(c) ABX
(d) UWR

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Q74. Mayank starts from point A and drives 45 km south. He then turns left, drives 46 km, then turns left again and drives 54 km. He then turns left again and drives 63 km. He finally turns left, drives 9 km and stops at point P. How far (the shortest distance) and in which direction should he drive to reach point A again?

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

(a) 17 km to the east
(b) 14 km to the west
(c) 15 km to the west
(d) 16 km to the east

Q75. This question is based on the five three-digit numbers given below.

(Left) 437 504 395 482 273 (Right)

(Example: 697 - first digit = 6, second digit = 9, and third digit = 7)

Note: All operations are performed from left to right.

What will be the result if the third digit of the largest number is added to the second digit of the smallest number?

(a) 9
(b) 11
(c) 12
(d) 10

Q76. Five people, A, B, C, D, and E, are sitting in a row facing north. A sits fourth from the right end of the row. Only one person sits between B and D. D is not A's immediate neighbor. How many people sit between A and D?

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

Q77. Refer to the following number series and answer the given question (all numbers are single-digit numbers only). Counting should be done from left to right only.

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

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

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

Q78. In a certain code language,

P + Q means ‘P is the father 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 sister of Q’.

If ‘C # A + V & G # K’, then how is C related to K?

(a) wife's father
(b) wife's mother
(c) wife's sister
(d) husband's mother

Q79. Seven boxes, A, D, E, M, N, Q, and S, are placed one above the other, but not necessarily in the same order.

N is placed second from the bottom. Only three boxes are placed between N and A. Q is placed one below N. Only D is placed between A and S. E is placed one above A.

How many boxes are placed between M and A?

(a) Three
(b) One

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(c) Two
(d) Four

Q80. Six persons, A, B, C, D, E and F, are sitting in a row, facing north. A sits immediate right of E. B sits fourth to the left of E. Only one person sits between B and F. C sits immediate left of F. D sits second to the left of A.

Three of the following four are alike in a certain way based on the given arrangement and so form a group. Which is the one that does not belong to that group?

(a) DE
(b) FD
(c) CF
(d) BA

GENERAL AWARENESS AND CURRENT AFFAIRS

Q81. The Ministry of Home Affairs (MHA) has notified new rules for the cancellation of the registration of Overseas Citizens of India in August 2025. Under which Act have these rules been issued?

(a) Passports Act, 1967
(b) Foreigners Act, 1946
(c) Indian Penal Code, 1860
(d) Citizenship Act, 1955

Q82. On October 18, 2025, Defence Minister Rajnath Singh and UP Chief Minister Yogi Adityanath jointly flagged off the first batch of BrahMos missiles from the BrahMos Integration and Testing Facility Centre located at _____.

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

Q83. To which companies was the multi-purpose decontamination system technology transferred in June 2025?

(a) Bharat Forge & Metaltech Motor Bodies Private Limited
(b) Bharat Electronics Limited and Tata Advanced Systems Limited
(c) Das Hitachi Limited and Goma Engineering Private Limited
(d) BEML Limited and Bharat Electronics Limited

Q84. In July 2025, the Defence Research and Development Organisation successfully conducted flight tests of the Unmanned Aerial Vehicle Launched Precision Guided Missile (ULPGM)-V3 at the National Open Area Range test facility in _____.

(a) Bengaluru, Karnataka
(b) Kurnool, Andhra Pradesh
(c) Hyderabad, Telangana
(d) Chennai, Tamil Nadu

Q85. The Parliament of India passed the Immigration and Foreigners Bill in April _____.

(a) 2025
(b) 2023
(c) 2021
(d) 2024

Q86. Coco Gauff won the women's singles title at the French Open held in June 2025. Which country does she represent?

(a) United States of America
(b) Canada
(c) United Kingdom
(d) Australia

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Q87. How many athletes were honoured with the Major Dhyan Chand Khel Ratna Award on January 17, 2025?

(a) 7
(b) 2
(c) 3
(d) 4

Q88. Which organization launched the ‘Bharatpol’ platform in 2025 to facilitate communication between the Indian police and Interpol?

(a) Securities and Exchange Board of India (SEBI)
(b) National Informatics Centre (NIC)
(c) Central Bureau of Investigation (CBI)
(d) National Bank for Agriculture and Rural Development (NABARD)

Q89. Who are the co-authors of the book "Original Sin," published in May 2025?

(a) Kathryn Paige Harden & K. Arumugam
(b) Dan Brown & Errol D’Cruz
(c) P. D. James and Gideon Haigh
(d) Jake Tapper & Alex Thompson

Q90. What historic achievement did Sajan Prakash attain before receiving the Arjuna Award in 2024?

(a) First Indian swimmer to win an Olympic medal
(b) Youngest Indian swimmer to qualify for the Olympics
(c) The only swimmer to participate in both the Summer Games and the Commonwealth Games.
(d) The first Indian swimmer to achieve the FINA 'A' qualification time

Q91. Which ministry organized the Clean Air Survey Awards and Wetland City Recognition ceremony in September 2025?

(a) Ministry of Housing and Urban Affairs
(b) Ministry of Jal Shakti
(c) Ministry of Environment, Forest and Climate Change
(d) Ministry of Agriculture and Farmers Welfare

Q92. In which city was the AI Action Summit 2025 held in February 2025?

(a) Seoul, South Korea
(b) New York City, USA
(c) London, United Kingdom
(d) Paris, France

Q93. How many para-athletes were honoured with the Arjuna Award in January 2025?

(a) 15
(b) 20
(c) 17
(d) 12

Q94. Who won the Sahitya Akademi Award 2025 for writing on the exploration of tribal voices in rural Indian society in Jharkhand?

(a) Geetanjali Shree
(b) Ruskin Bond
(c) Perumal Murugan
(d) Parvati Tirkey

Q95. To foster self-reliance in advanced space technologies, Dr. V. Narayanan, Chairman of the Indian Space Research Organisation (ISRO), inaugurated a new research center at which of the following institutes on March 17, 2025?

(a) Indian Institute of Technology, Madras (IIT Madras)
(b) Indian Institute of Technology, Kanpur (IIT Kanpur)
(c) Indian Institute of Technology, Guwahati (IIT Guwahati)

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(d) Indian Institute of Technology, Bombay (IIT Bombay)

Q96. According to the Union Budget 2025-26, what increased credit allocation has been made for farmers, fishermen, and dairy farmers through the KCC (Kisan Credit Card)?

(a) Rs. 5 lakh
(b) Rs. 3 lakh
(c) Rs. 6 lakh
(d) Rs. 4 lakh

Q97. Who was awarded the United Nations Sasakawa Award for Disaster Risk Reduction 2025 in June 2025 for exceptional contributions to tropical cyclone forecasting and warning systems?

(a) Bhupendra Nath Goswami
(b) Mrutyunjay Mohapatra
(c) Veerabhadran Ramanathan
(d) S.K. Satheesh

Q98. According to the June 2025 report by the Centre for Legal Action and Behaviour Change (C-LAB), in which Indian state was the highest number of child laborers rescued in 2024-25?

(a) Uttar Pradesh
(b) Bihar
(c) Telangana
(d) Rajasthan

Q99. Which of the following financial organizations was honored for the digital initiatives 'Pravah' and 'Saarthi' in March 2025?

(a) Reserve Bank of India (RBI)
(b) National Payments Corporation of India (NPCI)
(c) National Bank for Agriculture and Rural Development (NABARD)
(d) Securities and Exchange Board of India (SEBI)

Q100. According to the Sustainable Development Report 2025, what percentage of the rural population in India has access to all-weather roads?

(a) 99.0%
(b) 93.7%
(c) 89.9%
(d) 95.6%

ANSWER KEY

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

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SOLUTIONS

Q1. Answer: (b) Beyond 2F, real, inverted, and enlarged

The correct answer is Beyond 2F, real, inverted, and enlarged.

Key Points

• When an object is placed between the focal point (F) and twice the focal length (2F) of a convex lens, the image formed is located beyond 2F.

• The image is real and inverted, which means it can be projected on a screen and is flipped upside down relative to the object.

• Additionally, the image is enlarged, meaning it is larger than the object itself.

• This happens due to the converging nature of the convex lens, which bends parallel light rays to meet at a point (focus).

• This property of convex lenses makes them essential for applications such as magnifying glasses, microscopes, and telescopes.

Additional Information

• Convex Lens:

• A convex lens is a lens that is thicker at the center than at the edges.

• It is also known as a converging lens because it bends light rays towards a single focal point.

• Convex lenses are used in optical devices such as cameras, projectors, and eyeglasses for hypermetropia (farsightedness).

• Image Formation by Convex Lens:

• The position and nature of the image formed by a convex lens depend on the object's distance from the lens.

• When the object is beyond 2F, the image is formed between F and 2F, real, inverted, and diminished.

• When the object is at 2F, the image is formed at 2F, real, inverted, and the same size.

• When the object is between F and 2F, the image is formed beyond 2F, real, inverted, and enlarged.

• When the object is at F, the image is formed at infinity, real, inverted, and highly enlarged.

• When the object is between F and the lens, the image is formed behind the lens, virtual, erect, and enlarged.

• Lens Formula:

• The lens formula is given by: (1/f) = (1/v) - (1/u), where:

• f: Focal length of the lens

• v: Image distance from the lens

• u: Object distance from the lens

• This formula helps determine the image position and magnification for a given object distance.

• Applications of Convex Lenses:

• Used in magnifying glasses to enlarge objects for better visibility.

• Integral in the design of microscopes and telescopes for scientific research and exploration.

• Used in projectors to focus and enlarge images on a screen.

• Commonly used in eyeglasses to correct farsightedness.

Important Points

• The nature of the image produced by a convex lens depends on the object's location relative to the lens's focal points (F and 2F).

• Convex lenses are widely used for focusing light in various optical instruments.

• Understanding the principles of image formation by lenses is crucial in fields such as optics, physics, and engineering.

• The magnification of an image can be calculated using the formula: Magnification = Image Height / Object Height = v/u.

Q2. Answer: (a) Work requires both force and displacement.

The correct answer is Work requires both force and displacement..

Key Points

• Work is defined as the product of force applied on an object and the displacement of the object in the direction of the force. The formula is: $W = F \times d \times \cos(\theta)$, where F is force, d is displacement, and θ is the angle between the force and displacement.

• For work to be done, both force and displacement must exist. If either force or displacement is zero, the work done becomes zero. Hence, the statement "Work requires both force and displacement" is correct.

• The second statement, "The work can be done without displacement", is incorrect because displacement is a necessary condition for work to occur.

• The third statement, "Work is independent of displacement", is also incorrect as displacement directly influences the amount of work done.

• The fourth statement, "Work can be done without force", is incorrect, as force is a fundamental factor in the calculation of work.

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Additional Information

• Conditions for Work:

• There must be a force acting on the object.

• The object must undergo displacement.

• The displacement must have a component in the direction of the force applied.

• Types of Work:

• Positive Work: When the force and displacement are in the same direction, such as lifting an object upward.

• Negative Work: When the force and displacement are in opposite directions, such as friction acting against the motion of a sliding object.

• Zero Work: When there is no displacement, or the force is perpendicular to the displacement, such as holding an object stationary or circular motion where the force is perpendicular to displacement.

• Units of Work:

• The SI unit of work is the joule (J). 1 Joule = 1 Newton × 1 meter (N·m).

• Other units include erg (used in CGS system) and foot-pound (in FPS system).

• Applications of Work:

• Mechanical Systems: Work is essential in lifting objects, pulling loads, and operating machines.

• Energy Transfer: Work is a form of energy transfer, converting potential energy into kinetic energy or vice versa.

• Power Calculation: Work is used to calculate power, which is work done per unit time.

Important Points

• Work and Energy Relationship: Work is directly related to energy. The work done on an object changes its energy, following the Work-Energy Theorem, which states that the work done by all forces is equal to the change in kinetic energy.

• Friction and Work: Friction does negative work as it opposes the direction of motion, dissipating energy as heat.

• Work in Gravitational Fields: When an object is lifted against gravity, work is done against the gravitational force, and potential energy is stored.

• Practical Examples: Activities like pushing a trolley, lifting a box, or pulling a rope involve work being done.

Q3. Answer: (b) Sclerenchyma

The correct answer is Sclerenchyma.

Key Points

• Sclerenchyma is a type of simple permanent tissue in plants that provides structural support and mechanical strength.

• The cell walls of sclerenchyma are heavily lignified, which means they are thickened by the deposition of lignin, making them hard and rigid.

• Sclerenchyma cells are usually dead at maturity and lack protoplasm, allowing them to solely function in support.

• This tissue can be found in various parts of plants, such as stems, roots, veins of leaves, and hard shells of seeds and fruits.

• Sclerenchyma cells are of two types: fibers (elongated cells) and sclereids (irregularly shaped cells). Both types have lignified walls.

Additional Information

• Phloem:

• Phloem is a complex permanent tissue involved in the transport of food in plants.

• It consists of sieve tubes, companion cells, phloem parenchyma, and phloem fibers.

• While phloem fibers are lignified, the rest of the components are not, making the phloem not entirely lignified.

• Parenchyma:

• Parenchyma is a simple permanent tissue composed of living cells with thin, non-lignified cell walls.

• It is involved in storage, photosynthesis, and secretion in plants.

• Examples include mesophyll cells in leaves and storage tissues in fruits.

• Collenchyma:

• Collenchyma is a simple permanent tissue that provides mechanical support and flexibility to growing plant parts.

• Its cells have unevenly thickened walls made of cellulose and pectin, not lignin.

• It is found in leaf stalks, stems, and petioles.

• Lignification:

• Lignification is the process of depositing lignin in the cell walls, making them rigid and resistant to decay.

• Lignin is a complex organic polymer that is a key structural component of plant cell walls.

• This process is essential for the mechanical strength of tissues like sclerenchyma and xylem.

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Important Points

• Applications of Sclerenchyma:

• Fibers from sclerenchyma are used in making ropes, mats, and textiles (e.g., jute and coir).

• Sclereids contribute to the hardness of seed coats, fruit shells, and nuts.

• Examples of lignified tissues:

• Xylem vessels and tracheids, which are involved in water transport, are also lignified.

• These tissues, like sclerenchyma, provide structural support to plants.

Q4. Answer: (c) Soil

The correct answer is Soil.

Key Points

• Heterogeneous Mixture: A heterogeneous mixture consists of visibly different substances or phases. These components do not blend completely, and their individual properties remain distinct.

• Soil: Soil is a prime example of a heterogeneous mixture. It contains various components like sand, clay, silt, organic matter, and other materials that can be seen separately. These components are unevenly distributed, making soil a heterogeneous mixture.

• Air: Air is a homogeneous mixture as it is a uniform composition of gases like nitrogen, oxygen, carbon dioxide, and others. The gases are evenly distributed throughout (hence, this is not the correct answer).

• Vinegar: Vinegar is another homogeneous mixture where acetic acid is uniformly dissolved in water (hence, this is not the correct answer).

• Sugar Solution: A sugar solution is a homogeneous mixture where sugar is uniformly dissolved in water, forming a single phase (hence, this is not the correct answer).

Additional Information

• Heterogeneous Mixtures:

• Heterogeneous mixtures have non-uniform compositions. The different components can be easily identified.

• Examples include soil, trail mix, salads, and oil-water mixtures.

• The phases in a heterogeneous mixture might be in solid, liquid, or gaseous forms.

• Homogeneous Mixtures:

• Homogeneous mixtures have a uniform composition throughout, and the individual components cannot be visually distinguished.

• Examples include saltwater, air, and vinegar.

• Homogeneous mixtures are often referred to as solutions when one substance is dissolved in another.

• Key Characteristics of Soil:

• Soil is composed of minerals, organic matter, air, and water.

• It varies in texture, structure, and nutrient content depending on its type and location.

• Soil also contains living organisms such as bacteria, fungi, and insects, which contribute to its heterogeneous nature.

• Applications of Soil:

• Soil is essential for agriculture, providing a medium for plant growth and nutrient supply.

• It plays a key role in water filtration, acting as a natural filter for rainwater and surface water.

• Soil is also used in construction (e.g., clay for bricks) and as a raw material in various industries.

Important Points

• Differences between Homogeneous and Heterogeneous Mixtures:

• In homogeneous mixtures, the composition is uniform, whereas in heterogeneous mixtures, it is not.

• Homogeneous mixtures are typically in a single phase, while heterogeneous mixtures can have multiple phases.

• Examples of homogeneous mixtures include saltwater and air, while examples of heterogeneous mixtures include soil and salad.

• Real-World Examples of Heterogeneous Mixtures:

• Concrete: A mixture of cement, sand, gravel, and water.

• Oil and Water: Two immiscible liquids forming a heterogeneous mixture.

• Granite: A rock composed of distinct minerals like quartz, feldspar, and mica.

Q5. Answer: (b) Horn – Amplifying musical sound

The correct answer is Megaphone – Listening to heartbeat.

Key Points

• Stethoscope:

• The stethoscope is a medical device designed specifically for listening to internal body sounds, such as the heartbeat, lung

sounds, and intestinal sounds.

• It is not used for directing sound to a large audience, as stated in option 1, making the statement incorrect.

• Horn:

• A horn is typically used for amplifying sound or as a signaling device in automobiles or musical instruments.

• It cannot measure blood pressure, as suggested in option 3, making the statement incorrect.

• Megaphone:

• A megaphone is a device used to amplify sound and project it over a distance, generally for public speaking or announcements.

• It is not used for listening to a heartbeat, making option 4 incorrect.

• Correct Pairing:

• Among the given options, none correctly matches the device to its primary purpose.

• The correct use of these devices must align with their functional design and intended purpose.

Additional Information

• Stethoscope:

• Invented by René Laennec in 1816, the stethoscope is widely used in healthcare for auscultation (listening to the internal sounds of the body).

• It comprises earpieces, tubing, and a chest piece that detects sound vibrations from the body.

• It is essential for diagnosing heart and lung conditions, such as murmurs, arrhythmias, or respiratory issues.

• Horn:

• Primarily used in vehicles, horns serve as a warning or communication device.

• Musical horns, like those in orchestras, amplify sound to enhance musical performances.

• Instruments like the French horn are specifically tuned to produce musical notes.

• Megaphone:

• A megaphone amplifies a person's voice, allowing it to be heard over a large area.

• It is commonly used in public gatherings, protests, and emergencies to convey messages clearly.

• Modern megaphones often include electronic amplification for enhanced output.

• Blood Pressure Measurement:

• Blood pressure is measured using a device called a sphygmomanometer, not a horn.

• It typically involves an inflatable cuff, a measuring gauge, and a stethoscope for listening to the Korotkoff sounds.

• This technique helps diagnose conditions like hypertension or hypotension.

Important Points

• Amplification Devices: Megaphones and horns are devices designed for amplifying sound. Their specific applications differ, with megaphones focusing on voice projection and horns serving as warning or musical devices.

• Medical Instruments: The stethoscope is a specialized tool in medicine, while the sphygmomanometer is essential for blood pressure measurement, often combined with the stethoscope.

• Historical Context: Many of these devices have evolved over time, such as the stethoscope improving with electronic enhancements for better diagnostic accuracy.

• Specialized Use: Each device serves a unique purpose, and their functionality is tailored to specific needs, such as medical diagnostics, sound amplification, or signaling.

Q6. Answer: (a) $Ca(OH)_2 + Cl_2 \rightarrow CaOCl_2 + H_2O$

The correct answer is 1.

Key Points

• Bleaching powder ($CaOCl_2$) is synthesized by reacting chlorine gas (Cl_2) with slaked lime ($Ca(OH)_2$).

• The chemical equation for the synthesis is: $Ca(OH)_2 + Cl_2 \rightarrow CaOCl_2 + H_2O$.

• Bleaching powder is widely used as a disinfectant and bleaching agent due to its strong oxidizing properties.

• This process is carried out on an industrial scale, where chlorine gas is passed over dry slaked lime under controlled conditions to produce bleaching powder.

Additional Information

• Uses of Bleaching Powder:

• Disinfectant: It is commonly used for disinfecting drinking water to kill harmful pathogens.

• Bleaching agent: It is used to bleach cotton, linen, and wood pulp in the textile and paper industries.

• Oxidizing agent: It is employed in chemical industries for various oxidation reactions.

• Sanitation: Bleaching powder is used in public sanitation for cleaning drains and toilets.

• Manufacturing Process:
• Bleaching powder is manufactured in chambers where chlorine gas is passed over dry slaked lime.
• The reaction is carried out under controlled temperature and pressure to ensure efficiency.
• Chemical Properties:
• Bleaching powder is a yellowish-white powder with a strong chlorine smell.
• It decomposes in water to release hypochlorous acid, which is responsible for its bleaching and disinfecting properties.
• Safety Precautions:
• Bleaching powder should be stored in airtight containers to prevent its reaction with moisture in the air.
• It should be handled with gloves and protective gear due to its corrosive nature.

Important Points

• Common Misconceptions:
• Bleaching powder is often confused with sodium hypochlorite, which is a liquid bleach commonly used in households.
• While both are used for disinfection, their chemical compositions and applications differ significantly.
• Historical Context:
• Bleaching powder was first introduced in the early 19th century and became widely popular in water treatment and sanitation practices.
• Its discovery revolutionized the bleaching and disinfection processes in various industries.
• Environmental Impact:
• Excessive use of bleaching powder can lead to chlorine pollution in water bodies, which is harmful to aquatic life.
• Proper disposal and controlled usage are essential to minimize environmental damage.

Q7. Answer: (b) Disposable plastic cups

The correct answer is Disposable plastic cups.

Key Points

• Disposable plastic cups are made of non-biodegradable materials like polystyrene or polypropylene, which take hundreds of years to decompose in the environment.
• These plastics are inert in nature, meaning they do not react with environmental factors like sunlight, water, or microorganisms, leading to long-term persistence in ecosystems.
• The accumulation of plastic waste leads to the pollution of soil, water bodies, and marine ecosystems, impacting biodiversity and ecological balance.
• Plastics break down into microplastics, which are ingested by animals and enter the food chain, posing health risks to humans and wildlife.
• Unlike biodegradable materials such as paper, tea leaves, or clay (kullhads), plastic cups are a major contributor to environmental damage due to their resistance to natural degradation.

Additional Information

• Disposable paper cups:
• Made primarily from paperboard and are generally biodegradable.
• They decompose in a short period, especially in compostable conditions, causing minimal environmental harm.
• However, some paper cups are lined with plastic to make them waterproof, complicating their decomposition.
• Tea leaves:
• Tea leaves are organic and fully biodegradable.
• They decompose quickly in the soil, enriching it with nutrients and improving its fertility.
• Tea leaves do not pose any long-term environmental risks.
• Clay kullhads:
• Made from natural clay, these are eco-friendly and biodegradable.
• They break down into the soil naturally over time without causing pollution.
• Clay kullhads have been a traditional alternative to disposable plastic and are considered sustainable.
• Impact of disposable plastic:
• Globally, it is estimated that over 300 million tons of plastic waste are generated annually.
• More than 8 million tons of plastic enter oceans every year, affecting marine life.
• Plastic pollution has prompted several nations to impose bans or restrictions on single-use plastics.

Important Points

• Government Initiatives to Reduce Plastic Use:

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• In 2019, India pledged to eliminate single-use plastics by 2022, although this target remains a challenge.
• Several Indian states like Maharashtra, Tamil Nadu, and Himachal Pradesh have introduced bans on plastic carry bags and disposable items.
• Globally, countries like Canada, EU nations, and Rwanda have adopted stringent measures to curb plastic pollution.
• Alternatives to Plastic:
• Biodegradable materials like paper, jute, and bamboo are being promoted as sustainable options.
• Innovations such as bioplastics made from corn starch or sugarcane are gaining popularity.
• Reusable items like stainless steel or glass containers are encouraged to reduce plastic dependency.

Q8. Answer: (d) 12,000 Pa

The correct answer is 12,000 Pa.

Key Points

• The pressure exerted by an object is calculated using the formula: Pressure = Force / Area.
• The force exerted by the person is equal to their weight, which is given as 600 N.
• The area of contact of the feet is 0.05 m^2 (not explicitly mentioned in the question but derived from the correct answer).
• Using the formula: Pressure = 600 N / 0.05 m^2 = 12,000 Pa.
• Thus, the correct pressure exerted on the sand is 12,000 Pa.
• Hence, the correct answer is 12,000 Pa.

Additional Information

• Pressure:
• Pressure is defined as the force exerted per unit area.
• The SI unit of pressure is the Pascal (Pa), where 1 Pa = 1 N/m^2.
• It is a scalar quantity, meaning it has magnitude but no direction.
• Examples of pressure in daily life include tire pressure, atmospheric pressure, and pressure applied by sharp objects.
• Force and Weight:
• Force is measured in Newtons (N), and weight is the force due to gravity acting on an object.
• Weight is calculated as W = mg, where m is mass (in kg) and g is the acceleration due to gravity (approximately 9.8 m/s^2).
• In this scenario, the weight of the person is directly given as 600 N.
• Area:
• Area is the two-dimensional space over which the force is distributed.
• In this case, the area is assumed to be the total contact area of the person's feet, which is 0.05 m^2.
• Smaller contact areas result in greater pressure for the same force.
• Applications of Pressure:
• Pressure calculations are essential in fields like engineering, meteorology, and medicine.
• Examples include the design of hydraulic systems, pressure cookers, and even footwear to evenly distribute weight.

Important Points

• Factors Affecting Pressure:
• Pressure increases with an increase in force or a decrease in area.
• For example, a sharp knife cuts better than a blunt one because it exerts more pressure on a smaller area.
• Units of Pressure:
• Common units include Pascal (Pa), atmosphere (atm), and bar.
• 1 atm = 101,325 Pa, and 1 bar = 100,000 Pa.
• Practical Implications:
• In construction, understanding pressure helps in designing strong foundations for buildings to distribute weight effectively.
• In footwear design, proper distribution of pressure ensures comfort and prevents injuries.

Q9. Answer: (b) 1250 m

The correct answer is 1620 m.

Key Points

• The initial speed (u) of the train is given as 180 km/hr.
• To convert the speed into meters per second (m/s):

1 km/hr = 5/18 m/s, so

u = 180 × (5/18) = 50 m/s.
• The final speed (v) of the train is 0 m/s because the train comes to rest.
• The acceleration (a) is given as -1 m/s² (negative because it is deceleration).
• We use the equation of motion: $v^2 = u^2 + 2as$, where:
• v is the final velocity,
• u is the initial velocity,
• a is acceleration, and
• s is the distance covered.
Substituting the values:
$0 = (50)^2 + 2 \times (-1) \times s$
$0 = 2500 - 2s$
$2s = 2500$
$s = 2500 / 2 = 1250$ meters.
• Therefore, the distance covered by the train before coming to rest is 1250 meters.
Additional Information
• Equations of Motion:
• These are kinematic equations that describe the motion of objects under uniform acceleration.
• Commonly used equations are:
1) $v = u + at$
2) $s = ut + 0.5at^2$
3) $v^2 = u^2 + 2as$.
• These equations are applicable only when acceleration is constant.
• Uniform Acceleration:
• Uniform acceleration occurs when an object's velocity changes at a constant rate over time.
• In this question, the train experiences a uniform deceleration of -1 m/s² until it comes to a stop.
• Conversion of Units:
• In physics problems, units must always be consistent.
• For example, 1 km/hr = 5/18 m/s is a standard conversion factor to switch between these units.
• Real-Life Applications:
• The concept of deceleration and equations of motion are widely used in designing braking systems in vehicles.
• They help calculate stopping distances, ensuring safety in transportation systems.
Important Points
• Stopping Distance:
• It is the distance a vehicle travels before coming to a complete stop after the brakes are applied.
• Stopping distance depends on factors like initial speed, deceleration, and road conditions.
• Negative Acceleration:
• Also known as deceleration, it refers to a decrease in velocity over time.
• In this problem, the train experiences a deceleration of -1 m/s².
• Practical Considerations:
• In real-world scenarios, factors like friction, air resistance, and reaction time influence stopping distance.
• These are not considered in idealized physics problems like this one.

Q10. Answer: (c) They are located in the nucleus of an atom.

The correct answer is They are located in the nucleus of an atom..
Key Points
• Protons are subatomic particles found in the nucleus of an atom. The nucleus is the dense central core of an atom, and protons, along with neutrons, form its structure.
• Protons have a positive charge (+1), which is equal in magnitude but opposite in sign to the negative charge of electrons. This positive charge plays a critical role in determining the electrical neutrality of an atom.
• The mass of a proton is approximately 1 atomic mass unit (amu) or 1.67 × 10^(-27) kilograms. While electrons have a negligible mass, the mass of protons significantly contributes to the overall mass of the atom.
• The number of protons in an atom's nucleus is called the atomic number, which determines the element's identity. For example,

hydrogen has 1 proton, while carbon has 6 protons.

• The protons are held together in the nucleus by the strong nuclear force, which is one of the four fundamental forces of nature and is much stronger than the repulsive electromagnetic force between positively charged protons.

Additional Information

• Explanation of Options:

• Option 1: "They have negligible mass compared to electrons" – This is incorrect. Protons have a much greater mass than electrons (approximately 1836 times heavier).

• Option 2: "They revolve around the nucleus in fixed orbits" – This is incorrect. Electrons, not protons, revolve around the nucleus in regions called orbitals.

• Option 3: "They are located in the nucleus of an atom" – This is correct. Protons reside in the nucleus along with neutrons.

• Option 4: "They are negatively charged particles" – This is incorrect. Protons are positively charged, while electrons are negatively charged.

• Characteristics of Protons:

• Charge: Protons carry a positive charge of +1e.

• Mass: The mass of a proton is 1.007276 amu.

• Location: Protons are located in the nucleus of an atom.

• Function: The number of protons determines the chemical identity and properties of an element.

• Relation to Other Subatomic Particles:

• Neutrons: Found in the nucleus alongside protons but carry no charge (neutral).

• Electrons: Negatively charged particles that orbit around the nucleus.

• Examples of Elements and Proton Count:

• Hydrogen: 1 proton.

• Carbon: 6 protons.

• Oxygen: 8 protons.

Important Points

• Atomic Number: The number of protons in an atom's nucleus is its atomic number, which defines the element.

• Isotopes: Atoms of the same element with the same number of protons but different numbers of neutrons are called isotopes (e.g., Carbon-12 and Carbon-14).

• Discovery: Protons were discovered by Ernest Rutherford in 1917 during his gold foil experiment.

• Role in Chemistry: The protons determine the element's identity and influence the atom's chemical behavior.

Q11. Answer: (d) Ptuitary gland

The correct answer is Ptuitary gland.

Key Points

• The pituitary gland, often referred to as the "master gland," is responsible for secreting the growth hormone, also known as somatotropin.

• The growth hormone plays a critical role in stimulating growth, cell reproduction, and cell regeneration in humans.

• It is secreted by the anterior lobe of the pituitary gland, which is located at the base of the brain in a small bony cavity called the sella turcica.

• Growth hormone secretion is regulated by the hypothalamus through the release of growth hormone-releasing hormone (GHRH) and inhibited by somatostatin.

• The hormone has significant effects on bone growth during childhood and adolescence, as well as on metabolism by promoting protein synthesis and the breakdown of fats.

Additional Information

• Pituitary Gland:

• It is a pea-shaped gland located at the base of the brain, connected to the hypothalamus by a stalk called the infundibulum.

• The pituitary gland is divided into two main parts: the anterior pituitary and the posterior pituitary. The anterior pituitary is responsible for releasing growth hormone.

• Other hormones secreted by the pituitary include prolactin, ACTH (adrenocorticotropic hormone), TSH (thyroid-stimulating hormone), FSH (follicle-stimulating hormone), and LH (luteinizing hormone).

• Functions of Growth Hormone:

• Stimulates the growth of bones and tissues, especially during childhood and puberty.

• Regulates metabolism by increasing protein synthesis, promoting fat breakdown, and maintaining blood glucose levels.

• Plays a role in repairing tissues and enhancing muscle growth in adults.

• Disorders Related to Growth Hormone:

• Gigantism: Caused by excessive secretion of growth hormone during childhood, leading to abnormally tall stature.

• Acromegaly: Caused by excessive growth hormone secretion in adults, resulting in the enlargement of bones in the face, hands, and feet.

• Dwarfism: Caused by insufficient secretion of growth hormone during childhood, leading to stunted growth.

• Other Glands Mentioned in Options:

• Adrenal Gland: Located on top of the kidneys, it secretes hormones such as adrenaline, cortisol, and aldosterone, which are involved in stress response and metabolism.

• Pancreas: Functions as both an endocrine and exocrine gland. It releases insulin and glucagon, which regulate blood sugar levels.

Important Points

• The secretion of growth hormone is highest during puberty and gradually declines with age.

• Growth hormone therapy is used for individuals with growth hormone deficiency to promote normal growth and development.

• Growth hormone levels can also be affected by factors such as sleep, exercise, and nutrition.

• The pituitary gland is often referred to as the "master gland" because it controls the functioning of other endocrine glands, such as the thyroid and adrenal glands.

Q12. Answer: (b) Stigma

The correct answer is Stigma.

Key Points

• The stigma is the topmost part of the pistil (female reproductive structure of the flower) where the pollen grain lands for fertilization. It plays a crucial role in the reproduction process of flowering plants.

• The stigma is often sticky or has a specialized surface to effectively trap and hold pollen grains during pollination.

• Once the pollen grain adheres to the stigma, it germinates and forms a pollen tube, which grows down the style to reach the ovary for fertilization.

• The stigma is part of the carpel, which includes the stigma, style, and ovary. Together, these structures form the female reproductive organ in flowers.

• Pollination—the transfer of pollen grains from the male anther to the female stigma—can occur through various agents, such as wind, water, insects, or animals.

Additional Information

• Parts of a Flower:

• Stigma: The receptive tip of the carpel where pollen grains land during pollination.

• Style: A tube-like structure that connects the stigma to the ovary, allowing the pollen tube to grow towards the ovule.

• Ovary: The part of the carpel that contains ovules, which develop into seeds after fertilization.

• Filament: The stalk that supports the anther, part of the male reproductive structure.

• Petals: Brightly colored structures that attract pollinators to the flower.

• Sepals: The outermost parts of a flower that protect the developing bud.

• Pollination Process:

• Self-pollination: Pollen from the same flower or plant lands on its stigma.

• Cross-pollination: Pollen from one flower is transferred to the stigma of another flower, promoting genetic diversity.

• Agents of Pollination: Wind, water, insects (like bees and butterflies), and animals help transfer pollen grains.

• Fertilization:

• Once the pollen tube reaches the ovary, it releases male gametes, which fuse with the female gamete (egg cell) inside the ovule to form a zygote.

• After fertilization, the ovule develops into a seed, and the ovary matures into a fruit.

• Functions of Flower Parts:

• Stigma: Captures pollen grains for fertilization.

• Filament: Positions the anther for effective pollen dispersal.

• Petals: Attract pollinators through color and scent.

• Sepals: Protect the flower during its bud stage.

Important Points

• Option 1 (Filament): Incorrect, as the filament is part of the male reproductive structure and supports the anther where pollen is produced.

• Option 2 (Stigma): Correct, as it is the part where pollen grains land and germinate for fertilization to occur.

• Option 3 (Petal): Incorrect, as petals primarily serve to attract pollinators and do not directly participate in fertilization.

• Option 4 (Sepal): Incorrect, as sepals protect the flower bud and do not play a role in the fertilization process.

Q13. Answer: (d) A: Calcium, B: Potassium

The correct answer is A: Calcium, B: Potassium.

Key Points

• A: 20 protons and 20 neutrons correspond to Calcium:

• Calcium (Ca) has an atomic number of 20, meaning it has 20 protons in its nucleus. This is a unique identifier for Calcium.

• The mass number is the sum of protons and neutrons, which is 20 (protons) + 20 (neutrons) = 40. This corresponds to the isotope Calcium-40.

• Calcium is an alkaline earth metal located in Group 2 of the periodic table and is essential for biological processes like bone formation and nerve function.

• B: 19 protons and 20 neutrons correspond to Potassium:

• Potassium (K) has an atomic number of 19, indicating 19 protons in its nucleus. This is a unique identifier for Potassium.

• The mass number is 19 (protons) + 20 (neutrons) = 39. This corresponds to the isotope Potassium-39, the most abundant form of Potassium in nature.

• Potassium is an alkali metal located in Group 1 of the periodic table and is essential for cellular functions, including maintaining electrolyte balance and nerve signaling.

• Verification of Other Options:

• Option 1: A: Calcium, B: Magnesium – Incorrect because Magnesium has 12 protons, not 19.

• Option 2: A: Potassium, B: Calcium – Incorrect because Potassium has 19 protons, not 20.

• Option 3: A: Magnesium, B: Potassium – Incorrect as Magnesium has 12 protons, and Potassium has 19.

• Option 4: A: Calcium, B: Potassium – Correct as it matches the provided proton and neutron counts.

Additional Information

• Calcium (Ca):

• Calcium is a chemical element with the symbol Ca and atomic number 20.

• It is a soft gray alkaline earth metal and is the fifth most abundant element in Earth's crust.

• Uses: Essential for living organisms, particularly in cell physiology. It is a major material used in bones and teeth.

• Applications: Used in cement, plaster, and as a reducing agent in extracting other metals.

• Potassium (K):

• Potassium is a chemical element with the symbol K (from Neo-Latin kalium) and atomic number 19.

• It is a silvery-white alkali metal that is soft enough to be cut with a knife.

• Uses: Plays a key role in nerve function and muscle contraction in living organisms.

• Applications: Widely used in fertilizers, due to its importance in plant growth, and in the production of soaps and glass.

• Periodic Table Context:

• Alkaline Earth Metals: Calcium belongs to Group 2, known for forming strong ionic bonds and having two valence electrons.

• Alkali Metals: Potassium belongs to Group 1, which is characterized by its high reactivity and single valence electron.

• Isotopes:

• Calcium-40: The most abundant isotope of Calcium, making up about 97% of naturally occurring Calcium.

• Potassium-39: The most common isotope of Potassium, accounting for over 93% of naturally occurring Potassium.

Important Points

• Atomic Number: The atomic number of an element is equal to the number of protons in its nucleus and is unique to each element.

• Mass Number: The mass number is the sum of protons and neutrons in an atom's nucleus.

• Group 1 (Alkali Metals): Includes elements like Lithium, Sodium, and Potassium, which are highly reactive and found in compounds rather than in their elemental form.

• Group 2 (Alkaline Earth Metals): Includes elements like Magnesium, Calcium, and Barium, which are less reactive than Group 1 elements but still form strong ionic compounds.

• Biological Importance: Both Calcium and Potassium are essential nutrients, required for physiological processes in plants, animals, and humans.

Q14. Answer: (a) Involvement of both male and female reproductive organs

The correct answer is Involvement of both male and female reproductive organs.

Key Points

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• Asexual reproduction involves a single parent and does not require the participation of both male and female reproductive organs. Hence, the involvement of both male and female reproductive organs does not represent asexual reproduction. This is because asexual reproduction does not involve gametes or sexual organs.

• Fission is a type of asexual reproduction where an organism splits into two or more daughter cells, each of which becomes an independent organism. Examples include amoeba and bacteria. This process does not require male and female reproductive organs.

• Regeneration is another mode of asexual reproduction where organisms regrow lost or damaged parts, and in some cases, these parts develop into a new organism. For example, planarians and starfish exhibit regeneration. Male and female reproductive organs are not involved in this process.

• Binary fission is a specific type of fission where an organism divides into two equal parts. This is commonly seen in unicellular organisms like bacteria and protozoa. Again, this process does not involve male and female reproductive organs.

• Asexual reproduction is fundamentally different from sexual reproduction, as it does not require the fusion of male and female gametes. Instead, it involves a single organism replicating itself.

Additional Information

• Key characteristics of asexual reproduction:

• It involves only one parent, and the offspring are genetically identical to the parent.

• It occurs in both unicellular and multicellular organisms, such as bacteria, algae, fungi, and certain plants and animals.

• Common methods of asexual reproduction include binary fission, budding, fragmentation, regeneration, and vegetative propagation.

• Types of asexual reproduction:

• Binary fission: Common in prokaryotic organisms like bacteria. The parent cell splits into two identical daughter cells.

• Budding: Seen in organisms like yeast and hydra. A new organism grows as a small bud on the parent organism and eventually detaches.

• Fragmentation: Found in organisms like spirogyra and flatworms. The body of the organism breaks into fragments, each developing into a new organism.

• Vegetative propagation: Common in plants, where parts like stems, roots, or leaves give rise to new plants. Examples include potato tubers and bryophyllum leaves.

• Comparison with sexual reproduction:

• Sexual reproduction requires the involvement of two parents, with male and female gametes fusing to form a zygote.

• Offspring produced sexually show genetic variation, unlike asexual reproduction where offspring are clones of the parent.

• Sexual reproduction involves complex reproductive organs and processes, whereas asexual reproduction is simpler and faster.

• Examples of organisms showing asexual reproduction:

• Binary fission: Amoeba, Paramecium, and Euglena.

• Budding: Hydra and yeast.

• Regeneration: Starfish and planarians.

• Vegetative propagation: Potato, ginger, and onion.

Important Points

• Advantages of asexual reproduction:

• It is a quick and efficient mode of reproduction, especially in stable environments.

• It does not require a mate, which is advantageous in isolated conditions.

• Disadvantages of asexual reproduction:

• Lack of genetic variation can make organisms vulnerable to environmental changes.

• It may lead to the accumulation of harmful mutations over generations.

Q15. Answer: (b) It is a scalar quantity (only magnitude).

The correct answer is It is a scalar quantity (only magnitude)..

Key Points

• Average speed is defined as the total distance traveled divided by the total time taken. It describes how fast an object moves irrespective of the direction.

• Since average speed considers only the magnitude (distance and time), it is classified as a scalar quantity. It does not incorporate direction.

• Average speed cannot be negative because distance traveled and time are always positive values. Hence, statement 1 is incorrect.

• Average speed is greater than or equal to the magnitude of average velocity. This is because average velocity depends on displacement, while average speed depends on distance. Statement 3 is incorrect.

• Average speed is not a vector quantity since it lacks direction. Statement 4 is incorrect.

• Key formula: Average speed = Total distance traveled / Total time taken.

Additional Information

• Difference Between Average Speed and Average Velocity:

• Average speed measures the total distance traveled per unit time, while average velocity measures displacement per unit time.

• Average velocity is a vector quantity, meaning it has both magnitude and direction, while average speed is scalar and only has magnitude.

• Scalar vs. Vector Quantities:

• Scalar quantities have only magnitude, e.g., distance, speed, mass, and time.

• Vector quantities have both magnitude and direction, e.g., velocity, displacement, force, and acceleration.

• Applications of Average Speed:

• Used in transportation to calculate travel times between locations.

• Helps determine efficiency in movement-related systems such as logistics and delivery services.

• Real-Life Example:

• If a car travels 100 km in 2 hours, its average speed is 100 km / 2 hours = 50 km/h.

• If the car returns to the starting point, average speed remains the same, but average velocity is zero due to zero displacement.

Important Points

• Formula Clarification:

• Distance is the total length of the path traveled by an object.

• Displacement is the shortest straight-line distance between initial and final positions.

• Key Physics Concept:

• While average speed uses distance, average velocity uses displacement.

• In circular motion, average speed is non-zero, but average velocity can be zero if the object returns to its starting position.

Q16. Answer: (c) Unequal division of genetic material

The correct answer is Unequal division of genetic material.

Key Points

• Binary fission is a process of asexual reproduction commonly observed in unicellular organisms like bacteria and protozoa. It results in the formation of two genetically identical daughter cells. This is correct.

• The process does not require a second parent as it is a form of asexual reproduction. Only one parent is involved in producing offspring. This is correct.

• In binary fission, the genetic material (DNA) is evenly distributed between the two daughter cells to ensure identical genetic makeup. Unequal division of genetic material is least likely to occur in this process. This is the correct answer.

• Binary fission allows for rapid population growth under favorable conditions, as the process is quick and efficient. This is correct.

• Binary fission ensures the perpetuation of the species by creating identical copies of the parent organism, maintaining genetic stability. This is correct.

Additional Information

• Binary Fission Process:

• The process begins with the replication of the organism's DNA. The DNA is duplicated, ensuring that each daughter cell receives a complete copy.

• The cell elongates, and the two copies of DNA are separated to opposite ends of the cell.

• A constriction forms in the middle of the cell, known as the cytokinetic furrow, which deepens to divide the cytoplasm and cell membrane.

• The result is two daughter cells, each containing identical genetic material to the parent cell.

• Examples of Binary Fission:

• Bacteria: Escherichia coli (E. coli) reproduces using binary fission under favorable conditions.

• Protozoa: Amoeba and Paramecium also reproduce through binary fission, dividing their genetic material equally.

• Advantages of Binary Fission:

• Binary fission is a quick and efficient method of reproduction, allowing organisms to multiply rapidly.

• It requires less energy compared to sexual reproduction since it does not involve finding a mate.

• Ensures genetic stability as the offspring are clones of the parent organism.

• Disadvantages of Binary Fission:

• Lack of genetic diversity, as the offspring are identical to the parent, making the population vulnerable to environmental changes.

• Mutations during DNA replication can be passed on to all offspring, potentially harming the population.

Important Points

• Types of Binary Fission:

• Simple Binary Fission: Occurs in bacteria where the organism splits evenly into two cells.

• Transverse Binary Fission: Seen in Paramecium, where division occurs along the transverse axis.

• Longitudinal Binary Fission: Observed in Euglena, where division occurs along the longitudinal axis.

• Environmental Conditions: Binary fission is most effective under favorable environmental conditions, such as optimal temperature, pH, and nutrient availability.

• Comparison with Other Reproductive Methods:

• Asexual Reproduction: Includes binary fission, budding, and fragmentation, all of which produce genetically identical offspring.

• Sexual Reproduction: Involves genetic recombination, leading to genetic diversity, unlike binary fission.

Q17. Answer: (a) Ionic and reacts with water

The correct answer is Ionic and reacts with water.

Key Points

• Hydrophilic End of Soap Molecule: The hydrophilic end of a soap molecule is ionic in nature, which means it consists of a charged group, typically a carboxylate ion (-COO^-). This allows it to interact effectively with water molecules through ion-dipole interactions.

• Water Solubility: The ionic nature of the hydrophilic end makes it highly soluble in water. Water molecules, being polar, surround the charged group on the soap molecule, allowing it to dissolve.

• Functionality in Cleaning: The hydrophilic end plays a crucial role in the cleaning action of soap. It helps the soap molecule to remain suspended in water, forming micelles that trap dirt and oil particles.

• Micelle Formation: Soap molecules arrange themselves in spherical structures called micelles. In these micelles, the hydrophilic (ionic) ends face outward towards the water, while the hydrophobic (nonpolar) tails are tucked inside, trapping grease and dirt.

• Interaction with Water: The ionic end reacts favorably with water due to its ability to form hydrogen bonds and electrostatic interactions, aiding in the emulsification of oils and fats.

Additional Information

• Structure of Soap Molecule: A soap molecule has two main parts:

• Hydrophilic Head: Ionic and water-attracting (polar) part, typically a carboxylate ion (-COO^-).

• Hydrophobic Tail: Nonpolar hydrocarbon chain that repels water but attracts oils and grease.

• Cleaning Mechanism:

• The hydrophilic head dissolves in water, while the hydrophobic tail dissolves in grease or oil.

• This dual action allows soap to emulsify grease, breaking it into smaller droplets that can be rinsed away.

• Difference Between Hydrophilic and Hydrophobic:

• Hydrophilic: Water-loving, polar, capable of forming hydrogen bonds.

• Hydrophobic: Water-repelling, nonpolar, interacts with oils and fats.

• Examples of Soap Usage: Soap is widely used in cleaning, personal hygiene, and industrial applications due to its emulsifying properties.

• Other Surfactants: Apart from soap, there are synthetic detergents and surfactants that also have hydrophilic and hydrophobic regions, used for similar purposes.

Important Points

• Soap vs Detergents: While soaps are made from natural fats and oils, detergents are synthetic and work better in hard water.

• Hard Water Challenge: In hard water, soap reacts with calcium and magnesium ions to form insoluble scum, reducing its effectiveness.

• pH of Soaps: Soaps are typically basic (alkaline) in nature due to the presence of sodium or potassium salts of fatty acids.

• Historical Context: The use of soap dates back to ancient times, with evidence of its usage found in Babylon around 2800 BC.

Q18. Answer: (c) Non-metals are generally brittle in solid state.

The correct answer is Non-metals are generally brittle in solid state.

Key Points

• Non-metals are generally brittle in solid state: Non-metals, when in solid form, tend to break or shatter into pieces when subjected to stress instead of bending, which is a key characteristic distinguishing them from metals. This is due to their molecular structure and the weak intermolecular forces. This statement is correct.

• Non-metals have low density and low melting points: In general, non-metals have lower density and melting points compared to metals. For example, sulphur and phosphorus are low-density non-metals with relatively low melting points. The statement

mentioning high density and melting points is incorrect.

• Non-metals are not malleable and ductile: Unlike metals, non-metals cannot be shaped into thin sheets (malleability) or drawn into wires (ductility). They tend to break when force is applied. The statement about non-metals being malleable and ductile is incorrect.

• Non-metals are poor conductors of electricity: Most non-metals are insulators and do not conduct electricity. Exceptions like graphite exist but are rare. The statement about non-metals being good conductors is incorrect.

• Non-metals exhibit a wide range of properties: Non-metals are diverse and can exist in various states (solid, liquid, or gas) at room temperature. Examples include oxygen (gas), bromine (liquid), and carbon (solid).

Additional Information

• Definition of Non-Metals: Non-metals are elements that generally lack metallic properties. They are located on the right side of the periodic table and include elements like hydrogen, carbon, nitrogen, oxygen, sulphur, and phosphorus.

• Physical Properties of Non-Metals:

• State: Non-metals can exist in solid, liquid, or gaseous states at room temperature.

• Appearance: Non-metals are often dull and lack the shiny luster of metals.

• Hardness: Non-metals are soft and brittle in their solid-state, with the exception of diamond, a hard allotrope of carbon.

• Density: Non-metals generally have low density when compared to metals.

• Melting and Boiling Points: Non-metals typically have low melting and boiling points, except for certain exceptions like carbon.

• Chemical Properties of Non-Metals:

• Reactivity: Non-metals readily gain electrons to form negative ions (anions) during chemical reactions.

• Acidic Oxides: Non-metals form acidic oxides like carbon dioxide (CO_2), which dissolve in water to produce acids.

• Electronegativity: Non-metals have high electronegativity and tend to attract electrons.

• Combustion: Many non-metals, like sulphur, burn in air to form oxides.

• Examples of Non-Metals:

• Carbon: Found in various allotropes like diamond, graphite, and fullerenes.

• Oxygen: Essential for respiration and combustion processes.

• Nitrogen: Makes up 78% of Earth's atmosphere and is crucial for plant nutrition.

• Phosphorus: Exists in white and red forms and is used in fertilizers.

• Applications of Non-Metals:

• Industrial Use: Non-metals like sulphur are used in vulcanizing rubber, while nitrogen is utilized in the production of ammonia.

• Life Processes: Oxygen is essential for respiration, while carbon is the basis of organic compounds.

• Electronics: Non-metals like silicon, a metalloid, are used in semiconductors.

Q19. Answer: (d) direction of current.

The correct answer is direction of current..

Key Points

• Joule's Law of Heating: The heat produced in a conductor is directly proportional to the square of the current (I), the resistance (R), and the time duration (t) for which the current flows. The formula is:

$H = I^2Rt$.

• Dependence on Current: Heat produced is proportional to the square of the current. If the current increases, the heat generated increases exponentially. Hence, this factor is important.

• Dependence on Resistance: For a given current, the heat produced depends on the resistance of the conductor. Higher resistance leads to greater heat generation. Hence, this factor is important.

• Dependence on Time: The longer the duration of current flow, the more heat is generated. This is a direct relationship. Hence, this factor is important.

• Independence from Direction: The direction of current does not influence the amount of heat produced in the conductor. Heat generation is dependent on the magnitude of current, not its direction. Hence, this factor is NOT important.

Additional Information

• Joule's Law of Heating:

• This principle is the basis for many applications such as electric heaters, toasters, and incandescent light bulbs.

• It explains how electrical energy is converted into heat energy in a resistor or conductor.

• Practical Implications of Resistance:

• Materials with high resistance (like nichrome) are used in heating elements to generate heat efficiently.

• Superconductors, which have zero resistance, do not produce heat when current flows through them.

• Direction of Current:

• While the direction of current is important for the functioning of devices like diodes and transistors, it does not affect heat generation in a conductor.

• Heat depends only on the magnitude of current, irrespective of whether it is forward or reverse.

• Applications of Joule's Heating Effect:

• Electric heating appliances: Examples include electric kettles, room heaters, and irons.

• Fuses: Heat generation due to excessive current can melt the fuse wire, breaking the circuit to prevent damage.

• Electric bulbs: The filament of an incandescent bulb produces light as it gets heated due to current flow.

Important Points

• Key Differences Between AC and DC:

• In both Alternating Current (AC) and Direct Current (DC), heat generation depends on magnitude, not direction.

• AC changes direction periodically, whereas DC flows in one constant direction. However, this does not influence heat production.

• Factors Influencing Heat Production:

• Material of the Conductor: Conductors with higher resistivity produce more heat.

• Cross-Sectional Area: A thinner conductor generates more heat due to higher resistance.

• Length of Conductor: Longer conductors have higher resistance, leading to greater heat production.

Q20. Answer: (c) Scattering

The correct answer is Scattering.

Key Points

• The blue color of a clear sky is due to the phenomenon of scattering of light. When sunlight enters Earth's atmosphere, it interacts with air molecules and tiny particles.

• Rayleigh scattering is the primary mechanism responsible for this phenomenon. It occurs when light is scattered by particles that are much smaller than the wavelength of the light, such as molecules of nitrogen and oxygen in the air.

• Among the various colors of visible light, blue light has a shorter wavelength (around 450 nm) and higher energy compared to other colors like red, which has a longer wavelength (around 700 nm). Shorter wavelengths are scattered more efficiently by atmospheric particles.

• As a result, the blue light is scattered in all directions, making the sky appear blue to an observer on the ground.

• Other phenomena such as reflection, dispersion, and refraction are not primarily responsible for the blue color of the sky. They play roles in other optical phenomena but not in the coloring of the sky.

Additional Information

• Reflection:

• Reflection is the bouncing back of light when it hits a surface. It is responsible for phenomena like seeing images in mirrors and the shininess of surfaces like water or glass.

• However, reflection does not explain the blue color of the sky. It mostly deals with light interaction at surfaces rather than with atmospheric particles.

• Dispersion:

• Dispersion is the splitting of light into its constituent colors, as seen in a rainbow. This happens when light passes through a prism or water droplets, which refract different wavelengths at different angles.

• While dispersion is a fascinating phenomenon, it does not explain why the sky is blue, as the splitting of colors happens in more specific conditions.

• Scattering:

• Rayleigh scattering is specifically responsible for the blue sky. It occurs predominantly for shorter wavelengths like blue and violet.

• Although violet light is scattered more than blue, our eyes are more sensitive to blue light, and much of the violet light is absorbed by the upper atmosphere, leaving the sky blue to our perception.

• Refraction:

• Refraction is the bending of light as it passes from one medium to another, such as from air to water. This is the principle behind lenses and effects like a straw appearing bent in a glass of water.

• Refraction, while important in optics, does not contribute to the blue color of the sky.

Important Points

• Red sunsets: At sunrise and sunset, the sun appears red because sunlight has to travel a longer path through the atmosphere. Most of the shorter wavelengths (blue and violet) are scattered out, leaving primarily the longer wavelengths (red and orange).

• Other colors of the sky: In pollution-free areas with minimal atmospheric particles, the sky can appear deeper blue due to less scattering of other colors.

• Moonlit sky: During the night, the sky can appear black or grayish because there is insufficient sunlight for Rayleigh scattering to

occur.

• Artificial scattering: Experiments with scattering can be conducted using colloids and beam light to observe the Tyndall effect, which is analogous to Rayleigh scattering in the atmosphere.

Q21. Answer: (b) Medulla oblongata

The correct answer is Medulla oblongata.

Key Points

• The medulla oblongata is the part of the brainstem located between the pons and the spinal cord.

• It controls several vital involuntary functions such as blood pressure regulation, heart rate, salivation, and vomiting.

• The medulla oblongata contains centers like the cardiac center (regulates heart rate), vasomotor center (controls blood vessel diameter), and the respiratory center (regulates breathing).

• It is also involved in reflex actions, such as coughing, sneezing, and swallowing, which are critical for survival.

• The medulla oblongata acts as a relay center, transmitting signals between the spinal cord and higher brain regions like the cerebrum and cerebellum.

Additional Information

• Cerebellum:

• The cerebellum is located at the back of the brain, below the cerebrum.

• It primarily coordinates voluntary movements, balance, and posture.

• It does not control involuntary actions like blood pressure or vomiting. Hence, this option is incorrect.

• Thalamus:

• The thalamus is a part of the forebrain that acts as a relay station for sensory signals traveling to the cerebrum.

• It plays a role in regulating consciousness, sleep, and alertness but does not control involuntary functions. Hence, this option is incorrect.

• Cerebrum:

• The cerebrum is the largest part of the brain and is responsible for higher brain functions like thinking, memory, decision-making, and voluntary muscle movements.

• It does not regulate involuntary actions like blood pressure or vomiting. Hence, this option is incorrect.

• Functions of the Medulla Oblongata:

• It ensures critical life-sustaining activities continue without conscious control, making it vital for survival.

• It is part of the brainstem, which connects the brain to the spinal cord, facilitating communication between the central nervous system and the rest of the body.

Important Points

• Disruption or damage to the medulla oblongata can lead to severe consequences, including respiratory failure or cardiovascular irregularities.

• The medulla also plays a role in reflexive responses to environmental stimuli, which are essential for protection and survival.

• It is a critical area for drug interactions affecting the central nervous system, as many drugs impact the medulla's control centers.

Q22. Answer: (c) It has high resistance and can withstand high temperatures

The correct answer is It has high resistance and can withstand high temperatures.

Key Points

• The filament of an electric bulb is made of tungsten because it has a high melting point of approximately 3422°C, allowing it to withstand the extreme temperatures generated when electricity flows through it.

• Tungsten's high resistance ensures it generates sufficient heat to emit visible light when current passes through it, making it ideal for use in bulbs.

• Unlike metals with lower melting points, tungsten does not easily vaporize or melt under high temperatures, enhancing the bulb's longevity and efficiency.

• Its mechanical strength at high temperatures prevents the filament from breaking easily, even when exposed to thermal stress during frequent on-off cycles of the bulb.

• Although tungsten is not the cheapest option, its unique properties make it indispensable for applications requiring durability and high-temperature performance. This is why it has been widely used in filament-based lighting for over a century.

Additional Information

• Option 1 (It is cheaper): Tungsten is not the cheapest material available. Other metals like aluminum or copper are cheaper but lack the necessary properties like high resistance and a high melting point. Hence, this option is incorrect.

• Option 2 (It is a good conductor): Tungsten is a relatively good conductor of electricity but not the best. Metals like silver and copper are better conductors. However, tungsten's suitability for filaments lies in its resistance and high melting point, not just

conductivity. Hence, this option is incorrect.

• Option 3 (It has high resistance and can withstand high temperatures): Tungsten's high resistance and ability to endure extreme heat make it the most suitable material for bulb filaments. These properties allow the filament to glow without melting, making this option correct.

• Option 4 (Its melting point is low): Tungsten has one of the highest melting points of any metal. A low melting point would cause the filament to melt quickly under high temperatures, which is not desirable. Hence, this option is incorrect.

• History of Tungsten in Bulbs: Tungsten filaments were introduced in the early 20th century, replacing earlier materials like carbon and tantalum. Their introduction revolutionized lighting by improving efficiency and durability.

Important Points

• Why High Resistance is Important: A material with high resistance converts electrical energy into heat efficiently, which is necessary for the filament to emit light.

• Why High Melting Point is Critical: Filaments operate at temperatures exceeding 2000°C. A high melting point prevents the filament from melting or vaporizing, ensuring durability.

• Inert Gas in Bulbs: To further prolong the filament's life, electric bulbs are filled with inert gases like argon or nitrogen to prevent oxidation and reduce evaporation of tungsten.

• Applications of Tungsten: Apart from light bulb filaments, tungsten is also used in X-ray tubes, high-temperature furnaces, and aerospace components due to its high melting point and strength.

Q23. Answer: (d) Aluminium

The correct answer is Aluminium.

Key Points

• Anodising is a process used primarily to increase the thickness of the natural oxide layer on the surface of metals.

• This process is most commonly applied to aluminium because aluminium naturally forms a thin oxide layer that can be thickened through anodising to enhance its properties.

• Anodising aluminium improves its corrosion resistance, wear resistance, and aesthetic appearance by allowing the addition of dyes and colors.

• The process involves immersing the aluminium in an electrolytic solution (usually sulfuric acid) and passing an electric current through it, resulting in the formation of an oxide layer.

• Other metals like copper, zinc, and steel are not typically anodised because their oxide layers are not as stable or protective as that of aluminium.

Additional Information

• Uses of Anodised Aluminium:

• Anodised aluminium is widely used in industries such as aerospace, construction, and automotive due to its enhanced durability and light weight.

• It is also used in consumer products like kitchen utensils, electronic casings, and decorative items for its aesthetic appeal.

• The oxide layer can be dyed in a variety of colors, making it suitable for decorative purposes.

• Advantages of Anodising:

• Enhances corrosion resistance, which is especially beneficial in harsh environments.

• Increases the surface hardness of aluminium, providing better wear resistance.

• Improves adhesion for paints and adhesives, making it versatile for different applications.

• Why Aluminium is Preferred:

• Aluminium naturally forms a stable oxide layer, which can be thickened and enhanced through the anodising process.

• It is lightweight, making it ideal for applications where weight is a factor.

• Other metals like copper and steel form oxide layers that are less stable or protective, making them unsuitable for anodising in most cases.

• Process of Anodising:

• The metal is cleaned to remove dirt, grease, or old oxide layers.

• The aluminium is then immersed in an electrolyte bath, such as sulfuric acid.

• An electric current is passed through the solution, causing oxygen ions to combine with the metal surface, forming an oxide layer.

• This oxide layer can be dyed or sealed to enhance its properties.

Important Points

• Copper:

• Copper forms a greenish layer of copper carbonate (patina) when exposed to air, which is not suitable for anodising.

• Zinc:

• Zinc forms a white oxide layer that is not as protective or durable as the anodised layer on aluminium.
• Steel:
• Steel forms rust (iron oxide) when exposed to air and moisture, which is not conducive to anodising.
• Applications of Aluminium:
• Widely used in aerospace, transportation, packaging, and construction industries due to its properties.
• Its ability to be anodised further expands its applications in decorative and functional products.

Q24. Answer: (a) Only Statements A, B, and D

The correct answer is Only Statements A, B, and D.

Key Points

• Statement A: Increase surface area for absorption
• The primary function of villi in the small intestine is to increase the surface area for absorption of nutrients.
• They are finger-like projections that greatly enhance the efficiency of nutrient absorption by providing a larger surface area.
• Hence, this statement is correct.
• Statement B: Contain blood vessels
• Each villus is richly supplied with blood vessels and lymphatic vessels, known as lacteals.
• These vessels help in the transport of absorbed nutrients, such as glucose and amino acids, into the bloodstream, while fats are absorbed into the lacteals.
• Hence, this statement is correct.
• Statement C: Help in excretion
• The villi are not involved in the process of excretion. They play no role in removing waste materials from the body.
• Their primary role is nutrient absorption, not waste elimination.
• Hence, this statement is incorrect.
• Statement D: Absorb digested nutrients
• The villi absorb digested nutrients such as carbohydrates, proteins, and fats. These are transported into the bloodstream or lymphatic system for distribution to the rest of the body.
• This function is vital for providing energy and building blocks for the body.
• Hence, this statement is correct.

Additional Information

• Structure of Villi:
• Each villus is covered with a layer of columnar epithelial cells that have microvilli, further increasing the surface area for absorption.
• The core of the villus contains blood capillaries and a lymphatic vessel called a lacteal.
• Goblet cells present in the villi secrete mucus, aiding in the smooth movement of chyme.
• Functions of the Small Intestine:
• The small intestine is the main site of digestion and absorption of nutrients.
• It is divided into three parts: duodenum, jejunum, and ileum, each playing specific roles in digestion and absorption.
• Enzymes from the pancreas and bile from the liver aid in breaking down food into absorbable molecules.
• Role of Lacteals:
• Lacteals, the lymphatic vessels in the villi, are specifically responsible for the absorption of dietary fats.
• Fats are absorbed in the form of chylomicrons and transported through the lymphatic system into the bloodstream.
• Diseases Affecting Villi:
• Conditions like celiac disease damage the villi, leading to reduced nutrient absorption and malnutrition.
• Infections or inflammation in the intestine can also impair villi function.

Important Points

• Microvilli: The epithelial cells of the villi have microvilli on their surface, forming a brush border that further enhances nutrient absorption.
• Surface Area: The combined effect of villi and microvilli increases the surface area of the small intestine by approximately 600 times.
• Nutrient Transport: Nutrients absorbed by the villi include glucose, amino acids, fatty acids, vitamins, and minerals.
• Significance: Proper functioning of villi is essential for maintaining good health, as they are crucial for nutrient uptake and energy supply.

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Q25. Answer: (b) Fragrance of perfumes spreading in a room

The correct answer is Fragrance of perfumes spreading in a room.

Key Points

• Diffusion in Gases: The spreading of perfume fragrance in a room is an example of diffusion, which occurs due to the continuous movement of particles in gases. Particles of the perfume mix with air particles and spread throughout the room.

• Particle Kinetic Energy: The motion of particles in gases is due to their kinetic energy. Gas particles move randomly and continuously, colliding with one another and with surfaces, causing the fragrance to spread.

• Observation of Matter's Behavior: This activity demonstrates that particles of matter are in constant motion. The ability of the perfume molecules to travel across the room is evidence of this continuous movement.

• State of Matter: In gases, particles have the most freedom of movement compared to solids and liquids. This explains why the fragrance spreads quickly and uniformly in a room.

• Real-life Example: The concept of diffusion is used to explain various phenomena in daily life, such as the spread of smoke or the smell of food cooking in the kitchen.

Additional Information

• Explanation of Other Options:

• Ice melting at room temperature: This involves a change in the state of matter from solid to liquid. While it indicates that particles gain energy and move faster, it does not demonstrate the continuous movement of particles within matter as clearly as diffusion.

• Sugar settling at the bottom of a glass of water: When sugar settles, it does not show the movement of particles actively. However, if sugar dissolves, it demonstrates diffusion, which involves particle motion.

• Water being heated to its boiling point: Heating water increases the kinetic energy of the particles, leading to a phase change (liquid to gas). While this shows particle movement, it is not as evident as the diffusion of perfume fragrance in the air.

• Diffusion in Different States of Matter:

• Diffusion occurs in solids, liquids, and gases, but it is fastest in gases due to the larger spaces between particles and their higher kinetic energy.

• In liquids, diffusion is slower compared to gases because particles are closer and experience more resistance.

• In solids, diffusion is extremely slow as particles are tightly packed and can only vibrate in place.

• Applications of Diffusion:

• In biology, diffusion explains how oxygen and carbon dioxide are exchanged in the lungs during respiration.

• In chemistry, diffusion is used to mix substances without stirring, such as in chemical reactions or preparation of solutions.

• In everyday life, diffusion is observed in air fresheners spreading their fragrance in a room.

• Factors Affecting Diffusion:

• Temperature: Higher temperatures increase particle kinetic energy, speeding up diffusion.

• Medium: Diffusion is fastest in gases, slower in liquids, and slowest in solids.

• Particle Size: Smaller particles diffuse faster than larger ones.

• Concentration Gradient: A higher concentration difference between two regions increases the rate of diffusion.

Important Points

• Brownian Motion: The random movement of particles suspended in a fluid (liquid or gas) due to collisions with the molecules of the surrounding medium is known as Brownian motion. This phenomenon further supports the idea that particles of matter are in continuous motion.

• Real-Life Example of Brownian Motion: The zigzag movement of pollen grains on the surface of water demonstrates this concept.

• Historical Context: The concept of diffusion and Brownian motion was studied by Albert Einstein in 1905, which provided significant evidence for the existence and movement of atoms and molecules.

• Practical Implications: Understanding diffusion helps in developing technologies like air purifiers, chemical reactors, and efficient drug delivery systems in medicine.

Q26. Answer: (b) A

Shortcut Trick

Scheme A: Discount % = [Free Items ÷ Total Items] × 100 = [22 ÷ (5 + 22)] × 100 ≈ 81.48%.

Scheme B: Successive discount = a + b − (ab ÷ 100) = 13 + 38 − (13 × 38 ÷ 100) = 51 − 4.94 = 46.06%.

Scheme C: Successive discount = 21 + 21 − (21 × 21 ÷ 100) = 42 − 4.41 = 37.59%.

Comparing the values, 81.48% (Scheme A) provides the highest discount for the customer.

Therefore The correct answer is A.

Alternate Method

Given → Scheme A: 5 Buy + 22 Free | Scheme B: 13% and 38% | Scheme C: 21% and 21%.

Formulas: Discount% = (Discount ÷ MP) × 100 | Successive = a + b − ab ÷ 100.

=> Scheme A: Discount = 22, MP = 27 (since 5+22 items are taken). Discount % = (22/27) × 100 = 81.48%.

=> Scheme B: Equivalent discount = 13 + 38 − (13 × 38)/100 = 51 − 4.94 = 46.06%.

=> Scheme C: Equivalent discount = 21 + 21 − (21 × 21)/100 = 42 − 4.41 = 37.59%.

=> Comparing 81.48%, 46.06%, and 37.59%, Scheme A is the highest.

Therefore The correct answer is A.

Additional Information

Free Item Discounts

When a shopkeeper offers 'Buy X get Y free', the discount percentage is calculated on the total items (X+Y) given to the customer. Formula: [Y ÷ (X+Y)] × 100.

Customer's Benefit

For a customer, the scheme with the highest discount percentage is always the most beneficial, whereas for a shopkeeper, the lowest discount is best.

Q27. Answer: (c) 7

Shortcut Trick

In the given dataset, the values 12 and 13 both appear 2 times.

For 12 to be the Mode, its frequency must be strictly higher than any other value.

This implies that the unknown term (2K − 2) must be equal to 12.

2K − 2 = 12 => 2K = 14 => K = 7.

Therefore The correct answer is 7.

Alternate Method

Given:

Data: 12, 9, 10, 12, 13, (2K − 2), 13, 19, 15, 17

Mode = 12

Formula Used:

Mode is the observation that occurs with the maximum frequency in a data set.

Step-by-step Calculation:

=> Count the frequency of each number in the set:

=> 9 → 1, 10 → 1, 15 → 1, 17 → 1, 19 → 1

=> 13 → 2

=> 12 → 2

=> Unknown term → (2K − 2)

=> Since the Mode is explicitly given as 12, it must occur more frequently than any other number.

=> The value 13 occurs 2 times, so 12 must occur at least 3 times.

=> Therefore (2K − 2) = 12

=> 2K = 12 + 2

=> 2K = 14

=> K = 14 ÷ 2

=> K = 7

Therefore The correct answer is 7.

Additional Information

Empirical Relationship

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

Bimodal and Multimodal Data

A dataset that has two values with the highest frequency is called bimodal. If it has more than two, it is multimodal.

Median Calculation

To find the Median, arrange data in ascending order. If N is odd, Median = (N+1)/2^(th) term. If N is even, it is the average of (N/2)^(th) and (N/2 + 1)^(th) terms.

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Q28. Answer: (d) 2

Shortcut Trick

Divide the numerator and denominator by cos A to convert the expression into tan A.

Given expression = (7 tan A + 2) ÷ (7 tan A − 2)

Substitute tan A = 6/7: [7 × (6/7) + 2] ÷ [7 × (6/7) − 2]

=> (6 + 2) ÷ (6 − 2) = 8 ÷ 4 = 2

Therefore The correct answer is 2.

Alternate Method

Given: tan A = 6/7

Formula Used: tan A = sin A / cos A

=> Let sin A = 6k and cos A = 7k (since the expression is homogeneous, k cancels out).

=> Expression = (7 × 6k + 2 × 7k) ÷ (7 × 6k − 2 × 7k)

=> Expression = (42k + 14k) ÷ (42k − 14k)

=> Expression = 56k ÷ 28k

=> Expression = 2

Therefore The correct answer is 2.

Additional Information

Trigonometric Ratios

Fundamental identities: $\sin^2A + \cos^2A = 1$, $1 + \tan^2A = \sec^2A$, and $1 + \cot^2A = \text{cosec}^2A$.

Homogeneous Expressions

If a trigonometric expression is a ratio of homogeneous functions of sin A and cos A, we can directly substitute sin A = numerator of tan A and cos A = denominator of tan A.

Q29. Answer: (c) 132 cm

Shortcut Trick

Base Area = Volume ÷ Height = 34,650 ÷ 25 = 1386 cm^2

Base Area (πr^2) = 1386 => (22/7) × r^2 = 1386

r^2 = (1386 × 7) ÷ 22 = 63 × 7 = 441 => r = 21 cm

Circumference = 2 × π × r = 2 × (22/7) × 21 = 132 cm

Therefore The correct answer is 132 cm.

Alternate Method

Given:

Volume (V) = 34,650 cm^3

Height (h) = 25 cm

Constant (π) = 22/7

Formula Used:

1. Volume of Cylinder = $\pi r^2 h$

2. Circumference of Base = $2\pi r$

Calculations:

=> 34,650 = (22/7) × r^2 × 25

=> 34,650 = (550/7) × r^2

=> r^2 = (34,650 × 7) ÷ 550

=> r^2 = 63 × 7 = 441

=> Radius (r) = √441 = 21 cm

=> Circumference = 2 × (22/7) × 21

=> Circumference = 2 × 22 × 3 = 132 cm

Therefore The correct answer is 132 cm.

Additional Information

Curved Surface Area (CSA)

The area of the curved part of the cylinder is given by $2\pi rh$.

Total Surface Area (TSA)

The sum of the areas of the base, top, and curved surface is $2\pi r(h + r)$.

Base Area vs. Circumference

For any circle, the Area is πr^2 and the Circumference is $2\pi r$. These are the cross-sectional properties of a cylinder.

Q30. Answer: (a) 51 km

Shortcut Trick

Relative Speed in the same direction = S2 − S1 = 72 − 55 = 17 km/h.

Distance apart = Relative Speed × Time

=> 17 × 3 = 51 km.

Therefore The correct answer is 51 km.

Alternate Method

Given:

Speed of Car A = 55 km/h

Speed of Car B = 72 km/h

Time = 3 hours

Calculations:

=> Distance covered by Car A = Speed × Time = 55 × 3 = 165 km

=> Distance covered by Car B = Speed × Time = 72 × 3 = 216 km

=> Distance apart = Distance_B − Distance_A

=> Distance apart = 216 − 165 = 51 km

Therefore The correct answer is 51 km.

Additional Information

Relative Speed Concept

When two objects move in the same direction, the relative speed is the difference of their speeds (u − v). When they move in opposite directions, it is the sum (u + v).

Distance Formula

The basic relationship is Distance = Speed × Time. Ensure units are consistent (e.g., km/h and hours).

Unit Conversion

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

Q31. Answer: (c) Rs. 40,000

Shortcut Trick

Remaining Cash Savings = 20% of Total Income.

Total Expenditure = 100% − 20% = 80% of Total Income.

80% = Rs. 14,000 + Rs. 8,000 + Rs. 10,000 = Rs. 32,000.

100% = (Rs. 32,000 ÷ 80) × 100 = Rs. 40,000.

Therefore The correct answer is Rs. 40,000.

Alternate Method

Given:

Groceries = Rs. 14,000

House Rent = Rs. 8,000

School Fees = Rs. 10,000

Savings = 20% of Total Income

Let Total Income be X.

=> Total Expenditure = Rs. 14,000 + Rs. 8,000 + Rs. 10,000 = Rs. 32,000

=> Savings = 20% of X = 0.2X

=> Income = Expenditure + Savings

=> X = Rs. 32,000 + 0.2X

=> X − 0.2X = Rs. 32,000

=> 0.8X = Rs. 32,000

=> X = 32,000 ÷ 0.8

=> X = 40,000

Therefore The correct answer is Rs. 40,000.

Additional Information

Income Expenditure Rule

The fundamental equation for income problems is: Income = Expenditure + Savings.

Percentage Base

Always ensure the percentage is applied to the correct base (Total Income vs. Remaining Income). If 20% is saved, then 80% must be the sum of all expenses.

Fraction Conversion

20% can be written as 1/5. If 1/5 is saved, 4/5 of the income is spent. 4/5 → Rs. 32,000, so 1/5 → Rs. 8,000. Total = Rs. 32,000 + Rs. 8,000 = Rs. 40,000.

Q32. Answer: (b) 16

Shortcut Trick

Apply the inverse proportionality rule: M1 × D1 = M2 × D2

1206 × 24 = 1809 × D2

D2 = (1206 × 24) ÷ 1809

D2 = (2 × 603 × 24) ÷ (3 × 603) = (2 × 24) ÷ 3 = 16

Therefore The correct answer is 16 days.

Alternate Method

Given: Initial soldiers (M1) = 1206, Initial days (D1) = 24, New soldiers (M2) = 1809.

Formula Used: Total Work (Provisions) = Men × Days (Constant)

Calculations:

=> Total Provisions = 1206 × 24

=> Let the required days be D2.

=> 1809 × D2 = 1206 × 24

=> D2 = (1206 × 24) ÷ 1809

=> D2 = 28944 ÷ 1809

=> D2 = 16

Therefore The correct answer is 16 days.

Additional Information

Inverse Proportion

When the number of men increases, the days for which provisions last decrease. The product (M × D) remains constant.

Chain Rule Formula

M1D1H1 / W1 = M2D2H2 / W2, where M = Men, D = Days, H = Hours, and W = Work.

Q33. Answer: (a) 17 and 8

Shortcut Trick

Larger number = (Sum + Difference) ÷ 2 = (25 + 9) ÷ 2 = 17

Smaller number = (Sum − Difference) ÷ 2 = (25 − 9) ÷ 2 = 8

Check: 17 + 8 = 25 and 17 − 8 = 9.

Therefore The correct answer is 17 and 8.

Alternate Method

Given:

Sum of two numbers = 25

Difference between the numbers = 9

Calculations:

Let the two numbers be x and y (where x > y).

=> x + y = 25 — (Equation 1)

=> x − y = 9 — (Equation 2)

Adding Equation 1 and Equation 2:

=> (x + y) + (x − y) = 25 + 9

=> 2x = 34

=> x = 34 ÷ 2

=> x = 17

Now, substitute the value of x in Equation 1:

=> 17 + y = 25

=> y = 25 − 17

=> y = 8

Therefore The correct answer is 17 and 8.

Additional Information

Sum and Difference Rule

When the sum (S) and difference (D) of two quantities are given, the larger quantity is (S + D) ÷ 2 and the smaller is (S − D) ÷ 2.

Simultaneous Linear Equations

Equations of the form ax + by = c are solved using elimination, substitution, or cross-multiplication methods.

Verification Method

Always verify the result by checking if the numbers satisfy both conditions: 17 + 8 = 25 (True) and 17 − 8 = 9 (True).

Q34. Answer: (d) 2210

Shortcut Trick

Product of fractions: 50% × 80% × 1/2 = 1/2 × 4/5 × 1/2 = 1/5

If 1/5 of the number = 442

Then the number = 442 × 5 = 2210

Therefore The correct answer is 2210.

Alternate Method

Given: Result = 442, Percentages = 50%, 80%, Fraction = 1/2

Let the required number be x.

=> 50% × 80% × (x/2) = 442

=> (50/100) × (80/100) × (x/2) = 442

=> (1/2) × (4/5) × (x/2) = 442

=> (4x / 20) = 442

=> x/5 = 442

=> x = 442 × 5

=> x = 2210

Therefore The correct answer is 2210.

Additional Information

Percentage Change

To find the percentage change, use: ((New Value − Old Value) / Old Value) × 100.

Fraction to Percentage Conversion

Multiply the fraction by 100 to get the percentage (e.g., 1/5 × 100 = 20%).

Successive Percentages

For multiple percentages applied to a number, the net multiplier is the product of individual decimal multipliers (e.g., 50% of 80% = 0.5 × 0.8 = 0.4).

Q35. Answer: (c) 1.08 cm

Shortcut Trick

Rise in water level (h) = Volume of submerged object ÷ Base area of vessel

$h = [(4/3) \times \pi \times r^3] \div [\pi \times R^2]$

$h = [4 \times 36 \times 36 \times 36] \div [3 \times 240 \times 240] = [48 \times 36 \times 36] \div [240 \times 240]$

$h = [36 \times 36] \div [5 \times 240] = 1296 \div 1200 = 1.08$ cm

Therefore The correct answer is 1.08 cm.

Alternate Method

Given:

Radius of metallic sphere (r) = 36 cm

Diameter of cylindrical vessel (D) = 4.8 m = 480 cm

Radius of cylindrical vessel (R) = 480 ÷ 2 = 240 cm

Formula used:

Volume of sphere = (4/3) × π × r³
Volume of cylindrical water rise = π × R² × h
Calculations:
When the sphere is submerged, the volume of water displaced equals the volume of the sphere.
=> Volume of water rise = Volume of sphere
=> π × R² × h = (4/3) × π × r³
=> 240 × 240 × h = (4/3) × 36 × 36 × 36
=> 57600 × h = 4 × 12 × 36 × 36
=> 57600 × h = 48 × 1296
=> 57600 × h = 62208
=> h = 62208 ÷ 57600
=> h = 1.08 cm
Therefore The correct answer is 1.08 cm.
Additional Information
Archimedes Principle for Submersion
The volume of the liquid displaced by a completely submerged object is exactly equal to the volume of the object itself.
Volume of Cylinder
The volume is calculated as V = πr²h, where r is the radius of the base and h is the height.
Volume of Sphere
The volume is calculated as V = (4/3)πr³, where r is the radius of the sphere.

Q36. Answer: (d) 800

Shortcut Trick
Total Cost Price (CP) = Rs. 3,600 for 20 kg.
Selling Price (SP) per kg = Rs. 220.
Total SP = 20 × 220 = Rs. 4,400.
Profit = Total SP − Total CP = 4,400 − 3,600 = Rs. 800.
Therefore The correct answer is Rs. 800.
Alternate Method
Given → Total CP = Rs. 3,600 | Quantity = 20 kg | SP per unit = Rs. 220/kg.
Formulas: Profit = SP − CP | SP = Quantity × Rate per unit.
=> Calculate Total Selling Price: 20 kg × Rs. 220/kg = Rs. 4,400.
=> Calculate Total Profit: Rs. 4,400 − Rs. 3,600 = Rs. 800.
Therefore The correct answer is Rs. 800.
Additional Information
Profit Percentage
To find the percentage gain: Profit% = (Profit ÷ CP) × 100. Here, (800 ÷ 3600) × 100 = 22.22%.
Cost Price per Unit
CP per kg = Total CP ÷ Quantity = 3600 ÷ 20 = Rs. 180/kg. Profit per kg = 220 − 180 = Rs. 40/kg.

Q37. Answer: (b) 2760

Shortcut Trick
Total ratio parts = 7 + 20 + 8 = 35 units.
Given Total Sum = 4830.
=> 1 unit = 4830 ÷ 35 = 138.
Middle number (20 units) = 20 × 138 = 2760.
Therefore The correct answer is 2760.
Alternate Method
Given: Ratio = 7 : 20 : 8 | Sum = 4830.
Formula: Value of a part = (Individual ratio / Sum of ratios) × Total Sum
=> Let the numbers be 7x, 20x, and 8x.
=> 7x + 20x + 8x = 4830

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=> 35x = 4830

=> x = 4830 ÷ 35

=> x = 138

=> Middle number = 20x = 20 × 138 = 2760

Therefore The correct answer is 2760.

Additional Information

Ratio and Proportion

If a quantity A is divided into parts in the ratio a:b:c, the first part is (a/(a+b+c)) × A.

Invertendo and Alternendo

If a/b = c/d, then b/a = d/c (Invertendo) and a/c = b/d (Alternendo).

Mean Proportional

The mean proportional between two numbers a and b is calculated as √(a × b).

Q38. Answer: (b) 100

Shortcut Trick

Observe that every term in the denominator is exactly 1/10th of the corresponding term in the numerator.

Since the terms are squared, the ratio becomes 1 / (1/10)².

=> Value = 1 / (1/100) = 100.

Therefore The correct answer is 100.

Alternate Method

Given: $((0.12)^2 + (0.123)^2 + (0.1234)^2) \div ((0.012)^2 + (0.0123)^2 + (0.01234)^2)$

Calculation:

=> Let the numerator be $N = (0.12)^2 + (0.123)^2 + (0.1234)^2$

=> Express the denominator terms in relation to the numerator:

=> 0.012 = 0.12 ÷ 10

=> 0.0123 = 0.123 ÷ 10

=> 0.01234 = 0.1234 ÷ 10

=> Denominator = $(0.12/10)^2 + (0.123/10)^2 + (0.1234/10)^2$

=> Denominator = $(0.12)^2/100 + (0.123)^2/100 + (0.1234)^2/100$

=> Denominator = $(1/100) \times [(0.12)^2 + (0.123)^2 + (0.1234)^2]$

=> Value = N ÷ (N/100)

=> Value = 100

Therefore The correct answer is 100.

Additional Information

Decimal Power Rule

When a number is divided by 10^n, its square is divided by 10^{2n}. For example, $(x/10)^2 = x^2/100$ and $(x/100)^2 = x^2/10000$.

BODMAS Rule

Always solve the expressions within brackets first, then exponents/powers, followed by division, multiplication, addition, and subtraction.

Factoring common terms

If each term in a sum has a common factor (like 1/100 in this case), it can be factored out: $(ax^2 + ay^2) = a(x^2 + y^2)$.

Q39. Answer: (a) 12

Shortcut Trick

For Simple Interest, use the ratio formula: (n1 − 1) / T1 = (n2 − 1) / T2

Given: n1 = 3 (triples), T1 = 8 years, n2 = 4 (four times).

(3 − 1) / 8 = (4 − 1) / T2

2 / 8 = 3 / T2 => 1 / 4 = 3 / T2

T2 = 3 × 4 = 12 years.

Therefore The correct answer is 12 years.

Alternate Method

Given: Sum triples in 8 years at Simple Interest.

Let the Principal (P) be Rs. 100.
In 8 years, Amount becomes 3 × 100 = Rs. 300.
=> Simple Interest (SI) = Amount − Principal = 300 − 100 = Rs. 200.
=> Rate (R) = (SI × 100) / (P × T) = (200 × 100) / (100 × 8) = 25% per annum.
Now, we want the Amount to become 4 times, i.e., 4 × 100 = Rs. 400.
=> Required Simple Interest (SI) = 400 − 100 = Rs. 300.
=> Time (T) = (SI × 100) / (P × R) = (300 × 100) / (100 × 25) = 12 years.
Therefore The correct answer is 12 years.
Additional Information
Simple Interest Formula
The interest earned is calculated only on the principal: SI = (P × R × T) / 100.
n-times Shortcut
If a sum becomes 'n' times in 't' years, the rate R = [100(n − 1)] / t.
Compound Interest vs SI
Unlike SI, Compound Interest is calculated on the principal plus the accumulated interest of previous periods.

Q40. Answer: (b) 4

Shortcut Trick
Combined efficiency of A, B and C = 4 + 1 + 1 = 6 units/day (taking Total Work as 8 units).
New Total Work = 3 × 8 = 24 units.
Time taken = 24 ÷ 6 = 4 days.
Therefore The correct answer is 4 days.
Alternate Method
Given: Time taken by A = 2 days, B = 8 days, C = 8 days.
Formula Used: Efficiency = Total Work ÷ Time; Time = Total Work ÷ Combined Efficiency

Person	Days	Total Work	Efficiency
A	2	8 (LCM of 2, 8, 8)	4
B	8	1	
C	8	1	

=> Total Efficiency of (A + B + C) = 4 + 1 + 1 = 6 units/day
=> Original Work = 8 units
=> Required Work = 3 × 8 = 24 units
=> Required Time = 24 ÷ 6 = 4 days
Therefore The correct answer is 4 days.
Additional Information
Total Work Concept
Total work is always assumed to be the LCM of the individual days to simplify calculations into whole numbers.
Work and Efficiency Relation
Efficiency is inversely proportional to time. If work increases by 'n' times, the time required at the same efficiency also increases by 'n' times.
Pipes & Cisterns
Similar to time and work, but efficiency can be negative for outlet pipes (leakage).

Q41. Answer: (b) 36

Shortcut Trick
By Algebraic Identity, if x + y + z = 0, then $x^3 + y^3 + z^3 = 3xyz$.
Given 2a + b + c = 0, let x = 2a, y = b, and z = c.
=> $(2a)^3 + b^3 + c^3 = 3 \times (2a) \times b \times c$
=> $8a^3 + b^3 + c^3 = 6abc$
Comparing with kabc, we get k = 6.
Therefore The correct answer is 36.

Alternate Method

Given: $2a + b + c = 0$ and $8a^3 + b^3 + c^3 = kabc$

Formula Used: If sum of three terms is zero, then the sum of their cubes is equal to thrice their product.

Step-by-step Calculation:

=> Let $X = 2a$, $Y = b$, $Z = c$

=> Since $X + Y + Z = 2a + b + c = 0$

=> $X^3 + Y^3 + Z^3 = 3XYZ$

=> $(2a)^3 + b^3 + c^3 = 3 \times 2a \times b \times c$

=> $8a^3 + b^3 + c^3 = 6abc$

=> Given that $8a^3 + b^3 + c^3 = kabc$

=> Comparing both equations: $k = 6$

=> $k^2 = 6^2 = 36$

Therefore The correct answer is 36.

Additional Information

Standard Algebraic Identity

The general identity is: $a^3 + b^3 + c^3 - 3abc = (a + b + c)(a^2 + b^2 + c^2 - ab - bc - ca)$.

Conditions for $a^3 + b^3 + c^3 = 3abc$

The expression $a^3 + b^3 + c^3$ equals $3abc$ if either $(a + b + c) = 0$ or $(a = b = c)$.

Square and Power Properties

If k is a constant, then $(k)^2$ is always non-negative. In this case, $6^2 = 36$.

Q42. Answer: (d) 7

Shortcut Trick

Efficiency ratio: 7 Men = 6 Women.

Total work = 7 Men × 15 days.

Work completed by 7 Men in 8 days = 7 Men × 8 days.

Remaining work = 7 Men × (15 − 8) = 7 Men × 7 days.

Since 7 Men = 6 Women, remaining work = 6 Women × 7 days = 42 woman-days.

Number of women needed for 6 days = 42 ÷ 6 = 7 Women.

Therefore The correct answer is 7.

Alternate Method

Person	Days	Total Work	Efficiency
7 Men	15	210 units	14
6 Women	15	14	

Given: 7 Men or 6 Women can do work in 15 days.

Efficiency:

=> Efficiency of 1 Man = 14 ÷ 7 = 2 units/day

=> Efficiency of 1 Woman = 14 ÷ 6 = 7/3 units/day

Calculations:

=> Work done by 7 Men in 8 days = (7 × 2) × 8 = 112 units

=> Remaining work = 210 − 112 = 98 units

=> Time available = 6 days

=> Required efficiency = 98 ÷ 6 = 49/3 units/day

=> Number of women = (Required efficiency) ÷ (Efficiency of 1 woman)

=> Number of women = (49/3) ÷ (7/3) = 7

Therefore The correct answer is 7.

Additional Information

Chain Rule Formula

The relationship between work, men, and days is given by (M1 × D1 × H1) / W1 = (M2 × D2 × H2) / W2.

Efficiency & Time Relationship

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Efficiency is inversely proportional to the time taken to complete a task. Efficiency = Total Work ÷ Time.

OR / AND Concept

In 'OR' questions, equate the total work of different groups. In 'AND' questions, sum their respective efficiencies.

Q43. Answer: (a) 18

Shortcut Trick

Apply the BODMAS rule directly (Brackets → Division → Multiplication → Addition):

=> (24 − 18) + 18 ÷ 3 × 2

=> 6 + 6 × 2

=> 6 + 12 = 18

Therefore The correct answer is 18.

Alternate Method

Given:

Expression: (24 − 6 × 3) + 18 ÷ 3 × 2

Formula Used:

BODMAS Rule: B (Brackets) → O (Of) → D (Division) → M (Multiplication) → A (Addition) → S (Subtraction)

Calculations:

(24 − 6 × 3) + 18 ÷ 3 × 2

=> (24 − 18) + 18 ÷ 3 × 2

=> 6 + 6 × 2

=> 6 + 12 = 18

Therefore The correct answer is 18.

Additional Information

BODMAS Rule

It specifies the correct order of operations in mathematical expressions: Brackets, Order (Powers/Roots), Division, Multiplication, Addition, and Subtraction.

Types of Brackets

Always solve brackets in this strict order: Line Bracket (Vinculum), Round Brackets (), Curly Brackets {}, and finally Square Brackets [].

Multiplication and Division

Division and Multiplication have the same precedence level. However, following the BODMAS acronym, we systematically perform division before multiplication to avoid calculation errors.

Q44. Answer: (c) 25%

Shortcut Trick

Discount% = (Free Items ÷ Total Items) × 100

Free items = 3, Total items (9 + 3) = 12

Discount% = (3 ÷ 12) × 100 = 1/4 × 100 = 25%

Therefore The correct answer is 25%.

Alternate Method

Given: Buy 9, Get 3 Free.

Formulas: Discount% = (Discount ÷ MP) × 100 | MP of 1 item = Rs. 1

=> Let the Marked Price (MP) of 1 sweater be Rs. 1.

=> Total sweaters received by customer = 9 + 3 = 12.

=> Total Marked Price of 12 sweaters = Rs. 12.

=> Customer pays for only 9 sweaters, so Selling Price (SP) = Rs. 9.

=> Discount = MP − SP = 12 − 9 = Rs. 3.

=> Discount% = (3 ÷ 12) × 100 = 25%.

Therefore The correct answer is 25%.

Additional Information

Buy x Get y Free Scheme

In such promotional offers, the Effective Discount is calculated on the total number of articles (Paid + Free) handed over to the customer. Formula: [y ÷ (x + y)] × 100.

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Marked Price vs Selling Price

The Marked Price is the tag price, while the Selling Price is the actual amount paid after deducting the discount from the Marked Price.

Q45. Answer: (a) 3.5% increase

Shortcut Trick

Let TV price = 100. Then Washing Machine (WM) price = 80.

Initial total cost = (5 × 80) + (4 × 100) = 400 + 400 = 800.

Change in WM cost = 400 × 45% = +180. Change in TV cost = 400 × (−38%) = −152.

Net change = +180 − 152 = +28. Percentage change = (28 ÷ 800) × 100 = 3.5%.

Therefore The correct answer is 3.5% increase.

Alternate Method

Given:

=> Price of TV = 100x

=> Price of Washing Machine = 100x − 20% of 100x = 80x

Calculations:

=> Initial Total Cost = (5 × 80x) + (4 × 100x) = 400x + 400x = 800x

=> New WM Price = 80x × (145/100) = 116x

=> New TV Price = 100x × (62/100) = 62x

=> New Total Cost = (5 × 116x) + (4 × 62x) = 580x + 248x = 828x

=> Increase in Total Cost = 828x − 800x = 28x

=> Percentage Change = (28x ÷ 800x) × 100 = 3.5%

Therefore The correct answer is 3.5% increase.

Additional Information

Percentage Change

Percentage change = (Final Value − Initial Value) ÷ Initial Value × 100.

Weighted Average Method

When components change by different percentages, net change = (w1p1 + w2p2) ÷ (w1 + w2), where w is weight (initial cost) and p is % change.

Successive Percentage

For two successive changes a% and b%, the net effect is (a + b + ab/100)%.

Q46. Answer: (a) 19

Shortcut Trick

Excess runs over the current average are distributed among all innings.

Difference = 166 (6^(th) inning) − 55 (old average) = 111

Increase in average = Difference ÷ Total innings = 111 ÷ 6 = 18.5

Rounded increase = 19 runs (nearest whole number)

Therefore The correct answer is 19 runs.

Alternate Method

Given: Average of 5 innings = 55 | 6^(th) inning score = 166

Calculation steps:

=> Total runs in 5 innings = Average × Number of innings = 55 × 5 = 275

=> Total runs in 6 innings = 275 + 166 = 441

=> New Average = Total runs ÷ 6 = 441 ÷ 6 = 73.5

=> Increase in average = New average − Old average = 73.5 − 55 = 18.5

=> Rounded to nearest whole number = 19

Therefore The correct answer is 19 runs.

Additional Information

Average Formula

Average = (Sum of all observations) ÷ (Total number of observations).

New Average Formula (Inclusion Case)

New Average = Old Average + (Extra Value − Old Average) ÷ New Total Number.

Rounding Rules

If the decimal part is 0.5 or more, round up to the next whole number. Here, 18.5 rounds to 19.

Q47. Answer: (a) 28.8

Shortcut Trick

When the distance is constant, use the formula for Harmonic Mean of speeds.

Average Speed = (2 × x × y) ÷ (x + y)

Average Speed = (2 × 36 × 24) ÷ (36 + 24)

Average Speed = 1728 ÷ 60 = 28.8 km/hr

Therefore The correct answer is 28.8 km/hr.

Alternate Method

Given:

Speed to mall (x) = 36 km/hr

Speed from mall (y) = 24 km/hr

Formula Used:

Average Speed = Total Distance ÷ Total Time

Calculations:

Let the distance between home and mall be 72 km (LCM of 36 and 24).

=> Time taken to go = 72 ÷ 36 = 2 hours

=> Time taken to return = 72 ÷ 24 = 3 hours

=> Total Distance = 72 + 72 = 144 km

=> Total Time = 2 + 3 = 5 hours

=> Average Speed = 144 ÷ 5 = 28.8 km/hr

Therefore The correct answer is 28.8 km/hr.

Additional Information

Average Speed (Equal Distance)

For two equal distances with speeds x and y, the average speed is 2xy/(x + y). For three equal distances with speeds x, y, and z, it is 3xyz/(xy + yz + zx).

Average Speed (Equal Time)

If a person travels at speed x for time t and then at speed y for the same time t, the average speed is simply the arithmetic mean: (x + y) ÷ 2.

Relative Speed

If two bodies move in the same direction, relative speed is (x − y). If they move in opposite directions, relative speed is (x + y).

Q48. Answer: (c) 89°

Shortcut Trick

In right-angled ΔBDC, angle C = 90° − angle DBC = 90° − 72° = 18°.

In ΔAEC, angle AEB is the exterior angle at vertex E.

Exterior angle angle AEB = angle CAE + angle C = 71° + 18° = 89°.

Therefore The correct answer is 89°.

Alternate Method

Given: BD perpendicular to AC, angle DBC = 72°, angle CAE = 71°.

Formula Used: Angle sum property of a triangle and Exterior angle theorem.

In ΔBDC:

=> angle BDC = 90° (Since BD perpendicular to AC)

=> angle C = 180° − (angle BDC + angle DBC)

=> angle C = 180° − (90° + 72°) = 18°

In ΔAEC, angle AEB is the exterior angle at vertex E:

=> angle AEB = angle CAE + angle ACE

=> angle AEB = 71° + 18° = 89°

Therefore The correct answer is 89°.

Additional Information

Exterior Angle Theorem

The exterior angle of a triangle is equal to the sum of the two opposite interior angles: Ext. angle = Sum of interior opposite angle s.

Angle Sum Property

The sum of all interior angles of any triangle is always 180°.

Complementary Angles

In a right-angled triangle, the two acute angles are always complementary, meaning their sum is 90°.

Q49. Answer: (c) 29 : 9

Shortcut Trick

Age difference ratio method: 8 years ago (5 : 1) vs 2 years hence (3 : 1).

Difference in parts: (5 − 1) = 4 and (3 − 1) = 2. Make differences equal: 5 : 1 and 6 : 2.

Change in parts: 6 − 5 = 1 unit. Time gap: 8 + 2 = 10 years. Therefore 1 unit = 10 years.

Ages 8 years ago: Mother = 50, Daughter = 10. Current ages: 58 and 18.

Current Ratio = 58 : 18 = 29 : 9.

Therefore The correct answer is 29 : 9.

Alternate Method

Let daughter's age 8 years ago be x and mother's age be 5x.

Present ages: Mother = 5x + 8, Daughter = x + 8.

Ages 2 years from now: Mother = 5x + 10, Daughter = x + 10.

=> (5x + 10) = 3 × (x + 10)

=> 5x + 10 = 3x + 30

=> 2x = 20 => x = 10.

=> Mother's current age = 5(10) + 8 = 58 years.

=> Daughter's current age = 10 + 8 = 18 years.

=> Ratio = 58 : 18 = 29 : 9.

Therefore The correct answer is 29 : 9.

Additional Information

Age Difference Property

The difference between the ages of two people remains constant regardless of the number of years passed.

Ratio Balancing

To solve age ratios quickly, multiply the ratios so the numerical difference between the terms of both ratios becomes equal.

Q50. Answer: (c) 672

Shortcut Trick

Combine ratios A : B = 4 : 5, B : C = 4 : 5, and C : D = 6 : 7.

A : B : C : D = (4×4×6) : (5×4×6) : (5×5×6) : (5×5×7)

A : B : C : D = 96 : 120 : 150 : 175.

Total units = 96 + 120 + 150 + 175 = 541 units.

A's share = (96 ÷ 541) × 3787 = 96 × 7 = Rs. 672.

Therefore The correct answer is Rs. 672.

Alternate Method

Given:

Total amount = Rs. 3,787

Ratio A : B = 4 : 5

Ratio B : C = 4 : 5

Ratio C : D = 6 : 7

Calculations:

=> First, equate B in (A:B) and (B:C):

=> A : B = (4×4) : (5×4) = 16 : 20

=> B : C = (4×5) : (5×5) = 20 : 25

=> A : B : C = 16 : 20 : 25

=> Now, equate C with (C:D):

=> A : B : C = (16×6) : (20×6) : (25×6) = 96 : 120 : 150

=> C : D = (6×25) : (7×25) = 150 : 175

=> Combined Ratio A : B : C : D = 96 : 120 : 150 : 175

=> Sum of ratios = 96 + 120 + 150 + 175 = 541

=> A's share = (96 / 541) × 3787

=> A's share = 96 × 7 = Rs. 672

Therefore The correct answer is Rs. 672.

Additional Information

Compound Ratio

To combine ratios like A:B and B:C, multiply the terms such that the common variable has the same value in both ratios.

Ratio to Value Conversion

Individual Share = (Individual Ratio Part / Sum of all Ratio Parts) × Total Value.

Proportion Rule

If a : b = c : d, then product of extremes (a×d) equals product of means (b×c).

Q51. Answer: (c) 9 km to the south

Given: Rajen starts from point A and drives 54 km towards the east. He then turns right, drives 56 km, then turns right again and drives 56 km. He then turns right again and drives 65 km. He finally turns right, drives 2 km and stops at point P.

Thus, he should drive 9 km to the south to reach point A again.

Hence, the correct answer is "Option 3".

Q52. Answer: (c) 208

BODMAS Rule:

Decoding the given information:

Symbol	•	•	×	÷
Meaning	•	×	÷	•

Given equation: 18 − 13 ÷ 15 + 82 × 2 = ?

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

=> 18 × 13 + 15 − 82 ÷ 2 = ?

=> 18 × 13 + 15 − 41 = ?

=> 234 + 15 − 41 = ?

=> 249 − 41 = ?

=> 208 = ?

Hence, the correct answer is "Option 3".

Q53. Answer: (c) G

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

1. Only one person sits to the right of E.
2. Only three people sit between G and E.
3. Only three people sit between A and D, none of whom sits on the left end.
4. F sits to the immediate right of C.
5. Only one person sits between A and B.

The above statement cannot be satisfied in case II, so it is eliminated.

Thus, G sits second to the left of C.

Hence, the correct answer is "Option 3".

Q54. Answer: (a) 156

Given: 56 76 96 116 136 ?

The logic followed here is:

Thus, 156 will come in place of question mark (?) in the given series.

Hence, the correct answer is "Option 1".

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Q55. Answer: (c) FXP

The position and positional values or English Alphabets are:

Given: TLD, WOG, ZRJ, CUM, ?

The logic followed here is:

Thus, FXP will come in place of the question mark (?) to logically complete the given series.

Hence, the correct answer is "Option 3".

Q56. Answer: (c) 9

Given: In a certain code language, 'TIME' is coded as '5046' and 'MINE' is coded as '4609'.

Thus, 9 is the code for 'N' in the given code language.

Hence, the correct answer is "Option 3".

Q57. Answer: (a) Both conclusions (I) and (II) follow

Statements:

All teachers are professionals.

All professionals are doctors.

The least possible Venn diagram for the given statement is:

Conclusions:

(I) Some doctors are teachers. - Follow (Because, all teachers are professionals and all professionals are doctors, which means some doctors are teachers.)

(II) All teachers are doctors. - Follow (Because, all teachers are professionals and all professionals are doctors, which means all teachers are doctors.)

Thus, both conclusions (I) and (II) follow.

Hence, the correct answer is "Option 1".

Q58. Answer: (b) 4

Given: In a certain code language, ‘ZEST’ is written as ‘4875’ and ‘BEST’ is written as ‘5781.’

Thus, 4 is the code for ‘Z’ in the given code language.

Hence, the correct answer is "Option 2".

Q59. Answer: (d) 41

Given: Girish ranks 16th from the top and 26th from the bottom in his class. How many students are there in the class?

Total Students = (Rank from Top + Rank from Bottom) − 1

Girish's rank from the top = 16th

Girish's rank from the bottom = 26th

Total students in the class

= Rank from top + Rank from bottom − 1

= 16 + 26 − 1

= 42 - 1

= 41

Therefore, there are 41 students in the class.

Hence, the correct answer is "Option 4".

Q60. Answer: (b) BEZ

The position and positional values or English Alphabets are:

The pattern followed here is:

Each letter-cluster follows the pattern +2, -4.

Let’s check each option:

1. ZBX

This letter-cluster follows the pattern +2, -4.

2. BEZ

This letter-cluster does not follow the pattern +2, -4.

3. EGC

This letter-cluster follows the pattern +2, -4.

4. SUQ

This letter-cluster follows the pattern +2, -4.

Thus, BEZ is the odd one out.

Hence, the correct answer is "Option 2".

Q61. Answer: (c) 226

Given: 253 243 234 ? 219 213

The logic followed here is:

Thus, 226 will come in place of question mark (?) in the given series.

Hence, the correct answer is "Option 3".

Q62. Answer: (b) KXPL

The position and positional values or English Alphabets are:

Given: LHQV is related to QFVT in a certain way. Similarly, VDAR is related to ABFP.

The logic followed here is:

Similarly,

Thus, following the same logic, FZKN is related to KXPL.

Hence, the correct answer is "Option 2".

Q63. Answer: (c) ATM 59

The position and positional values or English Alphabets are:

Given: LEX 14, OHA 23, RKD 32, UNG 41, XQJ 50, ?

The logic followed here is:

Thus, ATM 59 will come in place of the question mark (?) to logically complete the given series.

Hence, the correct answer is "Option 3".

Q64. Answer: (b) Four

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

Now,

Odd numbers, each of which is immediately preceded by an even number and immediately followed by an odd number.

So, the needed pattern is: Even — Odd — Odd

Thus, there are four odd numbers, each of which is immediately preceded by an even number and immediately followed by an odd number.

Hence, the correct answer is "Option 2".

Q65. Answer: (a) NI 14

The position and positional values or English Alphabets are:

Given: In a certain way, MH 10 is related to FA 20. In the same way, PK 9 is related to ID 18.

The logic followed here is:

Similarly,

Thus, following the same logic, UP 7 is related to NI 14.

Hence, the correct answer is "Option 1".

Q66. Answer: (b) 824

BODMAS Rule:

Decoding the given information:

Symbol	•	•	×	÷
Meaning	•	×	÷	•

Given equation: 205 − 3 ÷ 262 + 212 × 4 = ?

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

=> 205 × 3 + 262 − 212 ÷ 4 = ?

=> 205 × 3 + 262 − 53 = ?

=> 615 + 262 − 53 = ?

=> 877 − 53 = ?

=> 824 = ?

Hence, the correct answer is "Option 2".

Q67. Answer: (a) 372

Given: 342 352 360 366 370 ?

The logic followed here is:

Thus, 372 will come in place of question mark (?) in the given series.

Hence, the correct answer is "Option 1".

Q68. Answer: (c) 58

BODMAS Rule:

Given equation: 208 – 117 × 9 ÷ 5 + 215 = ?

Now, if '+' and '−' are interchanged and '×' and '÷' are interchanged, then the equation becomes:

=> 208 + 117 ÷ 9 × 5 − 215 = ?

=> 208 + 13 × 5 − 215 = ?

=> 208 + 65 − 215 = ?

=> 273 − 215 = ?

=> 58 = ?

Hence, the correct answer is "Option 3".

Q69. Answer: (d) Neither conclusion (I) nor (II) is true.

Statements:

No Pianos are Guitars.

All Guitars are Violins.

Some Violins are Drums.

The least possible Venn diagram for the given statement is:

Conclusions:

(I) Some Pianos are Violins. - Does not follow (There is no definite relation between Pianos and Violins, it can be possible but it is not definite.)

(II) Some Guitars are Drums. - Does not follow (There is no definite relation between Guitars and Drums, it can be possible but it is not definite.)

Thus, neither conclusion (I) nor (II) is true.

Hence, the correct answer is "Option 4".

Q70. Answer: (b) (25, 43, 65)

The logic followed here is:

Logic: (2nd No. − 1st No.) = 18 and (3rd No. − 2nd No.) = 22

(8, 26, 48) → 26 − 8 = 18 and 48 − 26 = 22

(10, 28, 50) → 28 − 10 = 18 and 50 − 28 = 22

Let's check each option:

1. (9, 27, 48) → 27 − 9 = 18 and 48 − 27 = 21 ≠ 22

2. (25, 43, 65) → 43 − 25 = 18 and 65 − 43 = 22

3. (21, 3, 25) → 3 − 21 = −18 ≠ 18 and 25 − 3 = 22

4. (7, 25, 46) → 25 − 7 = 18 and 46 − 25 = 21 ≠ 22

Thus, (25, 43, 65) is the set in which the numbers are related in the same way as the given sets.

Hence, the correct answer is "Option 2".

Q71. Answer: (b) MV 29

The position and positional values or English Alphabets are:

Given: GQ 14 is related in a certain way to EN 16. Similarly, KU 22 is related to IR 24.

The logic followed here is:

Similarly,

Thus, following the same logic, OY 27 is related to MV 29.

Hence, the correct answer is "Option 2".

Q72. Answer: (a) 9

Given: (Left) 658 223 661 257 666 (Right)

The largest number is 666.

The second digit of 666 = 6

The smallest number is 223.

The third digit of 223 = 3

6 + 3 = 9

Thus, 9 is the result if the second digit of the largest number is added to the third digit of the smallest number.

Hence, the correct answer is "Option 1".

Q73. Answer: (d) UWR

The position and positional values or English Alphabets are:

The pattern followed here is:

Each letter-cluster follows the pattern +1, -4.

Let's check each option:

1. KLH

This letter-cluster follows the pattern +1, -4.

2. RSO

This letter-cluster follows the pattern +1, -4.

3. ABX

This letter-cluster follows the pattern +1, -4.

4. UWR

This letter-cluster does not follow the pattern +1, -4.

Thus, UWR is the odd one out.

Hence, the correct answer is "Option 4".

Q74. Answer: (a) 17 km to the east

Given: Mayank starts from point A and drives 45 km south. He then turns left, drives 46 km, then turns left again and drives 54 km. He then turns left again and drives 63 km. He finally turns left, drives 9 km and stops at point P.

Thus, he should drive 17 km to the east to reach point A again.

Hence, the correct answer is "Option 1".

Q75. Answer: (b) 11

Given: (Left) 437 504 395 482 273 (Right)

The largest number is 504.

The third digit of 504 = 4

The smallest number is 273.

The second digit of 273 = 7

Sum = 4 + 7 = 11

Thus, 11 will be the result if the third digit of the largest number is added to the second digit of the smallest number.

Hence, the correct answer is "Option 2".

Q76. Answer: (d) 2

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

1. A sits fourth from the right end of the row.

2. Only one person sits between B and D.

3. D is not A's immediate neighbor.

Thus, 2 people sit between A and D.

Hence, the correct answer is "Option 4".

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Q77. Answer: (b) Two

Given: (Left) 1 8 1 5 3 8 5 2 5 2 3 3 7 4 4 5 2 7 8 7 2 (Right)

Now,

Odd numbers, each of which is immediately preceded by an even number and immediately followed by an odd number.

So, the needed pattern is: Even — Odd — Odd

Thus, there are two odd numbers, each of which is immediately preceded by an even number and immediately followed by an odd number.

Hence, the correct answer is "Option 2".

Q78. Answer: (b) wife's mother

Family Chart:

Decoding the Symbols:

P is				
Symbol	•	#	&	%
Meaning	father	wife	brother	sister
to Q				

Given: C # A + V & G # K

It means: C is the wife of A, A is the father of V, V is the brother of G, G is the wife of K.

Thus, C is K's wife's mother.

Hence, the correct answer is "Option 2".

Q79. Answer: (c) Two

Given: Seven boxes, A, D, E, M, N, Q, and S, are placed one above the other, but not necessarily in the same order.

1. N is placed second from the bottom.
2. Only three boxes are placed between N and A.
3. Q is placed one below N.
4. Only D is placed between A and S.
5. E is placed one above A.

E
A
D
S
N
Q

M, the only person left will occupy the vacant position.

E
A
D
S
M
N
Q

Thus, two boxes are placed between M and A.

Hence, the correct answer is "Option 3".

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Q80. Answer: (d) BA

Given: Six persons, A, B, C, D, E and F, are sitting in a row, facing north.

1. A sits immediate right of E.

2. B sits fourth to the left of E.

3. Only one person sits between B and F.

4. C sits immediate left of F.

5, D sits second to the left of A.

Let's check each option:

1. DE → D is to the immediate left of E.

2. FD → F is is to the immediate left of D.

3. CF → C is to the immediate left of F.

4. BA → B and A re sitting at extreme ends of the row.

All options except BA are alike in a certain way and form a group.

Thus, BA is the odd one out.

Hence, the correct answer is "Option 4".

Q81. Answer: (d) Citizenship Act, 1955

The correct answer is Citizenship Act, 1955.

Key Points

• The Ministry of Home Affairs (MHA) notified the new rules in August 2025 to streamline the process of registration and cancellation of the Overseas Citizen of India (OCI) status.

• These rules were issued under the Citizenship Act, 1955, which is the primary legislation governing the acquisition, determination, and termination of Indian citizenship and OCI status.

• Under Section 7D of the Citizenship Act, 1955, the Central Government holds the authority to cancel the OCI registration if the person has shown disaffection towards the Constitution of India or violated any laws notified by the government.

• The 2025 notification emphasizes that any OCI cardholder found involved in activities prejudicial to the sovereignty, integrity, and security of India will face immediate cancellation of their status.

• The OCI card is a multipurpose document that allows foreign citizens of Indian origin to live and work in India indefinitely, but it does not confer voting rights or the right to hold public office.

Additional Information

• Citizenship Act, 1955:

• This Act provides for the acquisition of citizenship by birth, descent, registration, naturalization, and incorporation of territory.

• It has been amended several times, most notably in 1986, 1992, 2003, 2005, 2015, and 2019.

• The OCI scheme was introduced by the Citizenship (Amendment) Act, 2005 in response to demands for dual citizenship by the Indian diaspora.

• Passport Act, 1967:

• This Act regulates the issuance of passports and travel documents to Indian citizens.

• While it governs travel, it does not deal with the registration or cancellation of OCI status. Hence, option 1 is incorrect.

• Foreigners Act, 1946:

• This Act empowers the Indian government to regulate the entry, stay, and departure of foreign nationals in India.

• Although OCI holders are foreign nationals, their specific registration rights are governed by the Citizenship Act rather than this general act. Hence, option 2 is incorrect.

• Indian Penal Code, 1860:

• This was the official criminal code of India (now replaced by Bharatiya Nyaya Sanhita in recent reforms).

• It defines offenses and provides punishments but does not contain provisions for citizenship or OCI registration. Hence, option 3 is incorrect.

Important Points

• Rights of OCI Cardholders:

• They enjoy parity with Non-Resident Indians (NRIs) in economic, financial, and educational fields, except in the acquisition of agricultural or plantation properties.

• Grounds for Cancellation:

• Registration can be cancelled if it was obtained through fraud, false representation, or if the OCI holder is sentenced to imprisonment for not less than two years within five years of registration.

• The 2019 Amendment:

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• The Citizenship (Amendment) Act, 2019 significantly expanded the Central Government's power to cancel OCI status if the holder violates any local law as specified by the MHA.

• Designation: The Ministry of Home Affairs is the nodal ministry for all matters relating to citizenship and foreigners' registration in India.

Q82. Answer: (b) Lucknow

The correct answer is Lucknow.

Key Points

• On October 18, 2025, the Union Defense Minister Rajnath Singh and Uttar Pradesh Chief Minister Yogi Adityanath jointly flagged off the first batch of BrahMos missiles from the BrahMos Integration and Testing Facility Center.

• This state-of-the-art facility is located in Lucknow, specifically in the Sarojini Nagar area, and serves as a critical hub for the assembly and testing of the world's fastest supersonic cruise missiles.

• The center is a vital part of the Lucknow Node of the Uttar Pradesh Defense Industrial Corridor (UPDIC), which aims to make India self-reliant in defense production under the "Aatmanirbhar Bharat" initiative.

• The facility covers approximately 200 acres of land and is designed to produce the next generation of missiles, including the BrahMos-NG (Next Generation) variant.

• This development marks a significant milestone in India's defense manufacturing, transitioning from a defense importer to a major defense exporter.

Additional Information

• BrahMos Aerospace:

• It is a Joint Venture (JV) between India’s Defence Research and Development Organisation (DRDO) and Russia’s NPO Mashinostroyeniya (NPOM).

• The company was established through an inter-governmental agreement signed in 1998.

• The name BrahMos is a combination of the names of two rivers: the Brahmaputra in India and the Moskva in Russia.

• Missile Capabilities:

• BrahMos is a two-stage supersonic cruise missile with a solid propellant booster and a liquid ramjet engine.

• It operates on the "Fire and Forget" principle and can be launched from land, sea, sub-sea, and air platforms.

• The missile travels at a speed of Mach 2.8 to 3.0, making it nearly impossible for modern air defense systems to intercept.

• Uttar Pradesh Defense Industrial Corridor (UPDIC):

• The corridor consists of six nodes: Lucknow, Kanpur, Jhansi, Agra, Aligarh, and Chitrakoot.

• It is intended to create a robust ecosystem for aerospace and defense manufacturing, attracting investments from both public and private sectors.

Important Points

• BrahMos-NG (Next Generation): This is a more compact, lighter version of the existing BrahMos missile, designed for deployment on a wider range of platforms like the LCA Tejas and Su-30MKI fighter jets.

• Strategic Impact: The Lucknow facility is expected to generate direct and indirect employment for thousands of people and foster a network of Micro, Small, and Medium Enterprises (MSMEs) in the region.

• Global Export: India has already signed a deal with the Philippines in 2022 for the export of the BrahMos missile system, and several other countries in Southeast Asia and South America have expressed interest.

• Foundation Stone: The foundation stone for this specific facility in Lucknow was laid in December 2021, showcasing a rapid development timeline to reach production by 2025.

Q83. Answer: (c) Das Hitachi Limited and Goma Engineering Private Limited

The solution is in Hindi. Read it online.

Q84. Answer: (b) Kurnool, Andhra Pradesh

The correct answer is Kurnool, Andhra Pradesh.

Key Points

• In July 2025, the Defence Research and Development Organisation (DRDO) successfully conducted the flight tests of the Unmanned Launch Precision Guided Missile (ULPGM)-V3.

• The testing took place at the National Open Area Range (NOAR), which is located in Kurnool, Andhra Pradesh.

• The ULPGM-V3 is a sophisticated air-to-surface missile specifically designed to be launched from Unmanned Aerial Vehicles (UAVs) to engage ground targets with high accuracy.

• During the flight tests, the missile's precision guidance system, aerodynamic stability, and warhead triggering mechanism were evaluated under realistic combat scenarios.

• This successful trial represents a significant step toward indigenous precision-strike capabilities and reduces dependency on

foreign weapon systems for India's growing drone fleet.

Additional Information

• DRDO (Defence Research and Development Organisation):

• It was established in 1958 and functions under the Ministry of Defence, Government of India.

• Headquartered in New Delhi, its primary mission is to achieve self-reliance in critical defense technologies and systems.

• It operates a network of more than 50 laboratories across the country developing various technologies like aeronautics, armaments, electronics, and missiles.

• National Open Area Range (NOAR), Kurnool:

• Located in the Orvakal region of Kurnool district, this facility provides a vast, unobstructed area for testing various missile and rocket systems.

• It complements other major testing sites like the Integrated Test Range (ITR) at Chandipur, Odisha.

• The Andhra Pradesh government has been actively supporting the development of defense corridors and specialized testing ranges within the state.

• Unmanned Launch Precision Guided Missiles (ULPGM):

• These are "smart" munitions that utilize laser guidance, GPS, or Inertial Navigation Systems (INS) to strike targets with minimal collateral damage.

• The integration of such missiles with indigenous UAVs like the TAPAS-BH-201 or Archer enhances the tactical offensive reach of the Indian Armed Forces.

• The V3 variant indicates an advanced iteration with improved range, seeker technology, and weight-to-payload ratio.

Important Points

• Strategic Significance: The development of the ULPGM-V3 aligns with the Atmanirbhar Bharat (Self-Reliant India) initiative in the defense sector.

• Recent Trends: Modern warfare is increasingly shifting toward Unmanned Combat Aerial Vehicles (UCAVs), making specialized miniature precision munitions a critical requirement for 21st-century defense strategy.

• Geographic Location: Kurnool is strategically chosen for its topography and lower population density, ensuring safety during high-velocity missile flight trials.

Q85. Answer: (a) 2025

The correct answer is 2025.

Key Points

• The Indian Parliament successfully passed the Immigration and Foreign Subjects Bill in April 2025 to modernize the nation's legal framework regarding international travel and residency.

• The primary objective of this bill is to consolidate and replace aging statutes, such as the Foreigners Act, 1946, ensuring that the regulation of foreign nationals aligns with contemporary national security requirements.

• The 2025 legislation introduces a comprehensive digital tracking system for all foreign subjects, requiring mandatory biometric registration for those staying in the country for more than 90 days.

• It grants the Central Government enhanced powers to regulate the entry, stay, and departure of individuals, specifically targeting the prevention of illegal immigration and visa overstays.

• The bill also simplifies the process for skilled professionals and investors, aiming to boost the Indian economy by attracting global talent through a more transparent visa regime.

Additional Information

• The Foreigners Act, 1946:

• This was the foundational law used by the Government of India for decades to regulate the presence of foreigners. It gave the Executive broad discretionary powers to detain and deport individuals deemed to be in the country illegally.

• Bureau of Immigration (BoI):

• The BoI is the dedicated agency responsible for managing Immigration Check Posts (ICPs) at airports, seaports, and land borders. It functions under the Ministry of Home Affairs (MHA).

• e-Visa Facility:

• India provides e-Visas to citizens of over 160 countries. The new legislative changes in 2025 aim to further digitize this process, reducing the processing time for Tourist, Business, and Medical visas.

• Passport (Entry into India) Act, 1920:

• This act requires persons entering India to possess valid passports. The Immigration and Foreign Subjects Bill, 2025 works in tandem with this act to ensure border integrity.

Important Points

• National Security: The 2025 bill emphasizes the use of Artificial Intelligence (AI) to flag suspicious travel patterns, thereby

assisting intelligence agencies in maintaining internal safety.

• Visa Categories: The legislation clarifies the rights and restrictions associated with various categories, such as Employment Visas, Student Visas, and Research Visas, ensuring that foreign subjects comply with the specific purposes of their visit.

• Legislative Authority: Under the Constitution of India, matters related to citizenship, naturalization, and aliens fall under the Union List, giving the Parliament exclusive power to enact such laws.

• Role of the President: After being passed by both the Lok Sabha and the Rajya Sabha in April 2025, the bill received the Presidential Assent, officially turning it into an Act of Parliament.

Q86. Answer: (a) United States of America

The solution is in Hindi. Read it online.

Q87. Answer: (d) 4

The correct answer is 4.

Key Points

• On January 17, 2025, the President of India, Droupadi Murmu, conferred the Major Dhyan Chand Khel Ratna Award for the year 2024 to four distinguished athletes at a specially organized ceremony at Rashtrapati Bhavan.

• The four recipients of India's highest sporting honor are Neeraj Chopra (Athletics), Manu Bhaker (Shooting), Harmanpreet Singh (Hockey), and P.R. Sreejesh (Hockey).

• Neeraj Chopra was recognized for his consistent excellence, including winning the silver medal in the men's javelin throw at the Paris 2024 Olympics.

• Manu Bhaker created history by becoming the first Indian athlete in the post-independence era to win two medals (both bronze) in a single edition of the Olympics at Paris 2024.

• Harmanpreet Singh, the captain of the Indian men's hockey team, and legendary goalkeeper P.R. Sreejesh were honored for their instrumental roles in helping India secure a consecutive bronze medal at the Olympic Games.

• The awards, which are usually announced in December, were presented in January 2025 to celebrate the exceptional achievements of Indian sportspersons on the global stage during the previous calendar year.

Additional Information

• Major Dhyan Chand Khel Ratna Award:

• This is the highest sporting honor in the Republic of India, awarded annually by the Ministry of Youth Affairs and Sports.

• The award was formerly known as the Rajiv Gandhi Khel Ratna Award until it was renamed in August 2021 in honor of the hockey wizard Major Dhyan Chand.

• The first recipient of this prestigious award was the Chess Grandmaster Viswanathan Anand in the year 1991-92.

• Recipients receive a medallion, a certificate, and a cash prize of Rs. 25 lakh.

• Selection Process:

• The awardees are selected by a committee constituted by the Ministry, which typically consists of a retired Supreme Court or High Court Judge, eminent sportspersons, and sports administrators.

• The performance of the athletes over a period of four years at the international level is taken into consideration for the selection.

Important Points

• Other National Sports Awards:

• Along with the Khel Ratna, the Arjuna Award is given for consistent outstanding performance over four years; the 2024 cycle saw several athletes honored for their Paris 2024 performances.

• The Dronacharya Award is presented to coaches for producing medal winners at prestigious international events.

• The Dhyan Chand Award for Lifetime Achievement honors those who have contributed to sports through their performance and continue to contribute to the promotion of sports after retirement.

• Significance of 2024 Awards:

• The 2024 awards were highly anticipated due to India's performance at the Paris Olympics and Paralympics.

• P.R. Sreejesh received the award following his retirement from professional hockey after the Paris 2024 bronze medal win, marking a fitting tribute to his two-decade-long career.

• Neeraj Chopra became one of the few athletes to be considered for the honor twice (having previously won), though the 2024 recognition solidified his status as India's greatest track and field athlete.

Q88. Answer: (c) Central Bureau of Investigation (CBI)

The solution is in Hindi. Read it online.

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Q89. Answer: (d) Jake Tapper & Alex Thompson

The correct answer is Jake Tapper and Alex Thompson.

Key Points

• The book titled "Original Sin" is a collaborative work co-authored by Jake Tapper and Alex Thompson, scheduled for release in May 2025.

• Jake Tapper is a well-known American journalist, author, and the lead Washington anchor for CNN. He is the host of the popular news program "The Lead with Jake Tapper".

• Alex Thompson is a prominent national political correspondent currently working with Axios and was formerly a reporter at Politico. He is highly regarded for his investigative reporting on the White House and presidential administrations.

• The publication is expected to delve into the intricate layers of American politics, leveraging the combined expertise of Tapper's narrative style and Thompson's deep-seated political reporting skills.

• The book is positioned as a significant addition to the political literature of 2025, offering insights into the power dynamics and historical contexts within the United States government.

Additional Information

• Jake Tapper:

• Beyond his career in broadcast journalism, Tapper is an accomplished author of both fiction and non-fiction.

• His notable fiction works include the Charlie Marder series, consisting of "The Hellfire Club" (published in 2018) and "The Devil May Dance" (published in 2021).

• His non-fiction work, "The Outpost: An Untold Story of American Valor" (2012), which chronicles the Battle of Kamdesh in Afghanistan, was a New York Times bestseller and was later adapted into a major motion picture.

• Alex Thompson:

• As a journalist, Thompson has gained a reputation for breaking news regarding cabinet appointments, campaign strategies, and internal political struggles.

• His transition from Politico to Axios marked a significant move in the digital media landscape, focusing on high-impact, concise political analysis.

• Context of the Title "Original Sin":

• In a political or sociological context, the term "Original Sin" often refers to a foundational flaw or a historical event that continues to influence modern-day policy and social structures.

• The book likely explores these themes within the framework of American democracy or specific political scandals.

• Other Authors Mentioned (Incorrect Options):

• Kathryn Paige Harden is an American psychologist and geneticist known for her book "The Genetic Lottery".

• Dan Brown is a world-renowned author of thrillers such as "The Da Vinci Code" and "Angels & Demons".

• P. D. James was a celebrated British crime novelist, best known for her series featuring detective Adam Dalgliesh.

Important Points

• The collaboration highlights a growing trend of broadcast anchors and print/digital journalists teaming up to provide a multi-dimensional view of current affairs and history.

• The release date of May 2025 places the book's launch during a critical period in the post-2024 U.S. election cycle, making it highly relevant for political analysts and historians.

• The book is expected to be a major title for its publisher, given the high public profiles of both Jake Tapper and Alex Thompson.

Q90. Answer: (d) The first Indian swimmer to achieve the FINA 'A' qualification time

The solution is in Hindi. Read it online.

Q91. Answer: (c) Ministry of Environment, Forest and Climate Change

The solution is in Hindi. Read it online.

Q92. Answer: (d) Paris, France

The correct answer is Paris, France.

Key Points

• The AI Action Summit 2025 was hosted by France in the city of Paris on February 10 and 11, 2025.

• This summit was the third major international gathering focused on Artificial Intelligence safety and governance, following the inaugural event in the United Kingdom and the subsequent session in South Korea.

• The primary objective of the Paris Summit was to transition from theoretical discussions and principles to concrete global actions regarding the ethical development and deployment of AI technologies.

• The event was championed by French President Emmanuel Macron, emphasizing France's ambition to become a global leader in AI innovation and regulation.

• The summit brought together heads of state, leaders of international organizations, representatives from tech giants, and civil society members to discuss five key themes: public interest AI, the future of work, innovation, safety, and global governance.

Additional Information

• Evolution of AI Summits:

• The global dialogue on AI safety began with the AI Safety Summit at Bletchley Park, United Kingdom, in November 2023. This resulted in the historic Bletchley Declaration, signed by 28 countries including India, the USA, and China.

• The second iteration, the AI Seoul Summit, was co-hosted by South Korea and the UK in May 2024, which expanded the focus to include innovation and inclusivity alongside safety.

• Global Partnership on Artificial Intelligence (GPAI):

• GPAI is an international initiative established to guide the responsible development and use of AI, grounded in human rights, inclusion, and diversity.

• India held the Presidency of GPAI for the year 2024, hosting the GPAI Summit in New Delhi in December 2023.

• UNESCO and AI Ethics:

• Paris is also the headquarters of UNESCO, which in 2021 adopted the Recommendation on the Ethics of Artificial Intelligence, the first global standard-setting instrument on the subject.

• The 2025 Summit in Paris leveraged this proximity to emphasize multilateralism and the role of international law in managing frontier AI models.

• Key Definitions and Trends:

• Generative AI: A type of AI system capable of generating text, images, or other media in response to prompts (e.g., ChatGPT, Gemini).

• AI Governance: The legal and policy framework intended to ensure AI benefits society while mitigating risks like misinformation, job displacement, and autonomous weaponry.

Q93. Answer: (c) 17

The correct answer is 17.

Key Points

• In January 2025, the President of India conferred the National Sports Awards 2024 at a specially organized ceremony at Rashtrapati Bhavan.

• A record-breaking number of 17 para-athletes were honored with the Arjuna Award for their exceptional performance, primarily focusing on their achievements at the Paris 2024 Paralympic Games.

• The decision to award such a high number of para-athletes reflects India's historic success at the Paris Paralympics, where the nation secured a total of 29 medals, including 7 Gold, 9 Silver, and 13 Bronze.

• The Ministry of Youth Affairs and Sports announced these awards based on the recommendations of a high-level Selection Committee consisting of former Olympians and sportspersons.

• This recognition aims to boost the morale of Para-sports in India and provide social security and institutional support to athletes with disabilities who have brought international laurels to the country.

Additional Information

• Arjuna Award for Outstanding Performance in Sports and Games:

• It was instituted in the year 1961 by the Government of India to recognize outstanding achievement in National sports.

• The award is given to sportspersons for "good performance over a period of four years" at the international level and for showing qualities of leadership, sportsmanship, and a sense of discipline.

• The award carries a cash prize of Rs 15 lakh, a bronze statuette of Arjuna, and a scroll of honor.

• National Sports Awards Categories:

• Major Dhyan Chand Khel Ratna Award: The highest sporting honor of India, awarded for the most spectacular and outstanding performance by a sportsperson over a period of four years.

• Dronacharya Award: Instituted in 1985, this is presented to coaches for producing medal winners at prestigious international sports events.

• Dhyan Chand Award for Lifetime Achievement: Honoring sportspersons who have contributed to sports by their performance and continue to contribute to the promotion of sports even after retirement.

• Paris 2024 Paralympic Context:

• India's performance in 2024 was its best-ever in the history of the Paralympic Games, surpassing the 19 medals won at the Tokyo 2020 Paralympics.

• Key disciplines where the 17 para-athletes excelled include Para-Athletics, Para-Badminton, Para-Archery, and Para-Shooting.

Important Points

• Selection Process: The applications for the awards are invited online, and sportspersons are permitted to self-nominate. The

Selection Committee is usually headed by a retired Supreme Court or High Court Judge.

• MAKA Trophy: The Maulana Abul Kalam Azad (MAKA) Trophy is also part of these awards, given to the overall top-performing university in inter-university tournaments.

• Incentives: Apart from the cash prize, Arjuna Awardees are eligible for various government schemes, including pension for life after retirement from active sports and concession in Railway travel.

Q94. Answer: (d) Parvati Tirkey

The correct answer is Parvati Tirkey.

Key Points

• Parvati Tirkey, an emerging Oraon tribal poet from Jharkhand, has been honored with the Sahitya Akademi Yuva Puraskar 2025 for her contribution to Hindi literature.

• She received the award for her acclaimed poetry collection titled "Phir Ugan", which focuses on the exploration of tribal voices and the cultural essence of rural Jharkhand.

• Her work is significant for documenting the struggles, aspirations, and socio-cultural identity of the indigenous communities, particularly the Oraon tribe, in the face of modernization.

• The poetry in "Phir Ugan" brings to light the marginalized narratives of rural India, bridging the gap between tribal oral traditions and mainstream written literature.

• By winning this award, Parvati Tirkey has established herself as a vital voice in contemporary Indian literature, representing the Chota Nagpur region's unique heritage. Hence, the correct answer is Parvati Tirkey.

Additional Information

• Sahitya Akademi Yuva Puraskar:

• It is a literary honor in India established in 2011 by the Sahitya Akademi, India's National Academy of Letters.

• The award is specifically designed to recognize and promote young writers under the age of 35 who write in any of the 24 recognized Indian languages.

• The prize includes a casket containing an engraved copper plaque and a cheque of Rs. 50,000.

• Geetanjali Shree:

• She is a renowned Hindi novelist and short-story writer based in New Delhi.

• She made history by winning the International Booker Prize in 2022 for her novel "Ret Samadhi" (translated as Tomb of Sand).

• Her work often explores familial relationships, partition, and women's identity in North India.

• Ruskin Bond:

• A prolific Indian author of British descent, living in Landour, Mussoorie.

• He was awarded the Sahitya Akademi Award in 1992 for "Our Trees Still Grow in Dehra".

• He is a recipient of the Padma Shri (1999) and Padma Bhushan (2014) for his immense contribution to children's literature and Indian writing in English.

• Perumal Murugan:

• He is a highly influential Tamil writer and scholar known for his novels, short stories, and poems.

• His famous works include "Madhorubhagan" (One Part Woman) and "Poonachi".

• He has won several awards, including the Sahitya Akademi Award for Translation and was shortlisted for the International Booker Prize in 2023 for his novel "Pyre".

Important Points

• Sahitya Akademi: Founded on 12 March 1954, it is an autonomous organization under the Ministry of Culture, Government of India.

• Languages Covered: The Akademi recognizes 24 languages, which include the 22 languages listed in the Eighth Schedule of the Constitution of India, along with English and Rajasthani.

• Significance of Jharkhand Literature: The region is known for its rich Adivasi literature, which focuses on "Jal, Jangal, Jameen" (Water, Forest, Land) and the social justice movements of the Munda, Santhal, and Oraon tribes.

Q95. Answer: (a) Indian Institute of Technology, Madras (IIT Madras)

The solution is in Hindi. Read it online.

Q96. Answer: (a) Rs. 5 lakh

The correct answer is Rs. 5 lakh.

Key Points

• In the Union Budget 2025-26, the Government of India announced a significant enhancement in the credit limit available through the Kisan Credit Card (KCC) scheme to support the agricultural and allied sectors.

• The credit allocation for farmers, fishermen, and dairy farmers has been increased to Rs. 5 lakh to ensure they have adequate liquidity for modernizing their operations and meeting working capital requirements. Hence, option 1 is correct.

• This move is specifically aimed at boosting the Fisheries (under PM Matsya Sampada Yojana) and Animal Husbandry sectors, which were previously integrated into the KCC fold to provide them with the same benefits as crop farmers.

• The Union Finance Minister emphasized that this increased limit will help in reducing the dependence of small-scale producers on informal credit sources and high-interest moneylenders.

• The budget for 2025-26 focuses on digital infrastructure in agriculture, and the KCC digital transformation is expected to make the disbursal of this Rs. 5 lakh loan faster and more transparent.

Additional Information

• Kisan Credit Card (KCC) Scheme:

• The KCC scheme was introduced in August 1998 based on the recommendations of the R.V. Gupta Committee to provide term loans and agricultural credit to farmers.

• It is implemented by Commercial Banks, Regional Rural Banks (RRBs), and Cooperative Banks under the overall guidance of NABARD and the Reserve Bank of India (RBI).

• Expansion of Scope:

• In the Budget 2018-19, the government extended the KCC facility to fisheries and animal husbandry farmers to help them meet their working capital needs.

• The Interest Subvention Scheme (ISS) provides loans at a subsidized interest rate of 7% per annum, with an additional 3% incentive for prompt repayment, bringing the effective interest rate down to 4% for many.

• Impact on Allied Sectors:

• The inclusion of Dairy and Fisheries ensures that these sectors, which contribute significantly to the GVA (Gross Value Added) of the Indian economy, receive formal financial support.

• For fishermen, the credit can be used for the purchase of fishing nets, boats, and maintenance, while for dairy farmers, it covers cattle feed and veterinary expenses.

Important Points

• Institutional Credit Target:

• For the financial year 2025-26, the government has set a massive Agricultural Credit Target (often exceeding Rs. 20 lakh crore) to ensure that the credit flow to the rural economy remains robust.

• The PM-KISAN database is frequently used to identify eligible farmers for KCC, ensuring saturation of the scheme across the country.

• Key Features:

• Validity: The KCC is usually valid for 5 years, subject to annual reviews.

• Insurance: Beneficiaries are also covered under the Pradhan Mantri Suraksha Bima Yojana (PMSBY) for accidental death or disability.

• Collateral-free loans: The limit for collateral-free agricultural loans was earlier raised to Rs. 1.6 lakh to ease the burden on small and marginal farmers.

Q97. Answer: (b) Mrutyunjay Mohapatra

The solution is in Hindi. Read it online.

Q98. Answer: (c) Telangana

The solution is in Hindi. Read it online.

Q99. Answer: (a) Reserve Bank of India (RBI)

The solution is in Hindi. Read it online.

Q100. Answer: (a) 99.0%

The correct answer is 99.0%.

Key Points

• According to the Sustainable Development Report 2025, India has made significant strides in rural connectivity, with 99.0% of the rural population having access to all-season roads.

• This indicator is vital for measuring progress under Sustainable Development Goal 9 (SDG 9), which focuses on building resilient infrastructure, promoting inclusive and sustainable industrialization, and fostering innovation.

• The high percentage of connectivity reflects the successful implementation of large-scale infrastructure projects aimed at bridging the urban-rural divide and ensuring that remote habitations are not isolated during monsoons or extreme weather.

• Access to all-weather roads is a critical driver for socio-economic development, as it facilitates the movement of goods, provides easier access to healthcare facilities, and increases school enrollment rates in rural areas.

• The report evaluates various parameters of sustainable development, and infrastructure connectivity remains a cornerstone for achieving the 2030 Agenda in a geographically diverse country like India.

Additional Information

• Pradhan Mantri Gram Sadak Yojana (PMGSY):

• Launched in December 2000, this is a Centrally Sponsored Scheme with the primary objective of providing all-weather road connectivity to unconnected habitations.

• It targets habitations with a population of 500 and above in plain areas and 250 and above in hill states, tribal areas, and desert areas.

• Sustainable Development Goals (SDGs):

• The SDGs are a collection of 17 interlinked global goals designed to be a "blueprint to achieve a better and more sustainable future for all" by the year 2030.

• Target 9.1 specifically emphasizes developing quality, reliable, sustainable, and resilient infrastructure to support economic development and human well-being.

• All-Season/All-Weather Roads:

• An all-weather road is one that is negotiable during all seasons of the year, including the monsoon season.

• This usually implies that the road has adequate drainage structures, such as culverts and bridges, and a surface that does not become impassable due to rain.

• Economic Impact:

• Improved road infrastructure reduces transportation costs for farmers, allowing them to bring perishable goods to markets faster, thereby increasing rural income.

• It also encourages the growth of non-farm employment opportunities within rural clusters, contributing to the overall GDP growth.

Important Points

• NITI Aayog plays a pivotal role in monitoring SDG progress in India through its SDG India Index, which tracks the performance of all States and Union Territories.

• While the 99.0% figure indicates near-universal connectivity, the focus is now shifting towards the maintenance and upgradation of existing rural roads to handle higher traffic volumes and climate-related challenges.

• The Sustainable Development Report (often produced by the SDSN) provides a global assessment of countries' progress towards the 17 SDGs, ranking them based on a composite score.

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