RRB Group D Official Paper (Held On: 02 Dec, 2025 Shift 1) (Previous Year Paper)

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

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GENERAL SCIENCE

Q1. Oxidation is defined as:

(a) loss of protons
(b) gain of neutrons
(c) loss of electrons
(d) gain of electrons

Q2. On which of the following does resistivity of a material depend?

(a) Nature of the material
(b) Current passing through it
(c) Shape of the conductor
(d) Length and area of the conductor

Q3. Which of the following statement is true regarding big dams and flood control?

(a) Big dams can help in flood control by regulating river flow.
(b) Big dams are never used for flood control.
(c) Big dams completely eliminate the possibility of floods.
(d) Big dams do not increase the risk of floods.

Q4. Which of the following is the chemical formula of fullerene carbon allotropes?

(a) C60
(b) C6
(c) C0
(d) C

Q5. A body of mass 2 kg is moving with a speed of 3 m/s. Its kinetic energy is _____.

(a) 18 J
(b) 9 J
(c) 3 J
(d) 6 J

Q6. Where is the embryo implanted after fertilisation in the human female body under normal conditions?

(a) Uterus lining
(b) Oviduct
(c) Ovary
(d) Cervix

Q7. Which of the following is a diatomic molecule formed by a non-metallic element?

(a) He
(b) Mg
(c) O2

(d) Na

Q8. Which of the following statements best explains why isotopes of an element have identical chemical properties but different physical properties?

(a) Isotopes have the same atomic number but differ in their number of neutrons, which affects physical properties like mass.
(b) Isotopes have completely different atomic structures, affecting both their physical and chemical properties.
(c) Isotopes differ in the number of protons, leading to different behaviours in chemical reactions.
(d) Isotopes have the same number of protons and neutrons but different numbers of electrons.

Q9. Which of the following statements is correct about acceleration due to gravity?

(a) It increases as we go inside the Earth
(b) It decreases with altitude
(c) It is the same everywhere on Earth
(d) It remains constant with depth

Q10. Which of the following organs is present in chest cavity?

(a) Pharynx
(b) Pancreas
(c) Lungs
(d) Liver

Q11. Which of the following muscular structures is/are responsible for modifying the curvature and thus changing the focal length of the fibrous, jelly-like eye lens?

(a) Retina
(b) Iris
(c) Pupil
(d) Ciliary muscles

Q12. Which equation correctly represents the reaction of aluminum with hydrochloric acid?

(a) $2Al + 3HCl \rightarrow 2AlCl3 + 3H2$
(b) $Al + HCl \rightarrow AlCl3 + H2$
(c) $2Al + 6HCl \rightarrow 2AlCl3 + 3H2$
(d) $Al + HCl \rightarrow AlCl + H2$

Q13. Which of the following statements about a spherical lens is NOT correct?

(a) Every spherical lens has two centres of curvature.
(b) The line joining the two centres of curvature is called the principal axis.
(c) The optical centre coincides with the centre of curvature.
(d) A concave lens also possesses two centres of curvature.

Q14. Which of the following is NOT an example of a tissue of an organism?

(a) Muscle
(b) Blood
(c) Neuron
(d) Bone

Q15. Which of the following methods of reproduction ensures rapid increase in population?

(a) Self pollination
(b) Asexual reproduction
(c) Internal fertilisation
(d) Cross poliination

Q16. A car moving at a speed of 720 km/hr comes to a stop in 4 seconds after the brakes are applied. If the total mass of the car and passengers is 80 kg, what is the force applied by the brakes?

(a) – 2000 N
(b) 4000 N

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(c) – 14,400 N
(d) – 4000 N

Q17. Which of the following is related to human females in the same manner as vasectomy is related to human males?
(a) Coitus interruptus
(b) Copper-T
(c) Cervical caps
(d) Tubectomy

Q18. The speed of sound in air is approximately 340 m/s. If a reflecting surface is 17 m away, how long does it take for an echo to return to the source?
(a) 1 s
(b) 0.05 s
(c) 0.5 s
(d) 0.1 s

Q19. What are the primary functions of xylem and phloem tissues in a plant?
(a) Both xylem and phloem transport water and minerals.
(b) Xylem transports water and minerals, phloem transports food.
(c) Xylem transports food, phloem transports water and minerals.
(d) Both xylem and phloem transport food.

Q20. A solenoid behaves like a magnet because:
(a) Current in its turns produces a magnetic field
(b) It has a high resistance
(c) It contains iron inside
(d) It stores electricity

Q21. In which of the following states of matter do particles possess the highest speed of rapid random motion?
(a) Liquid and solid both
(b) Gas
(c) Liquid only
(d) Solid only

Q22. Which of the following functional groups is represented by -OH in carbon compounds?
(a) Carboxylic acid
(b) Aldehyde
(c) Ketone
(d) Alcohol

Q23. A force that changes the state of motion of an object is called:
(a) Unbalanced force
(b) Balanced force
(c) Gravitational force
(d) Frictional force

Q24. What happens to the pH of a solution when the concentration of H^+ ions increases?
(a) It decreases.
(b) It cannot be determined.
(c) It increases.
(d) It remains the same.

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Q25. The main thinking part of the human brain is located in the:

(a) Medulla
(b) Spinal cord
(c) Mid-brain
(d) Fore-brain

MATHEMATICS

Q26. The perimeter of an equilateral triangle is three-fifth of the perimeter of a square of diagonal $16\sqrt{2}$ cm. Find the ratio between the area of the triangle and the area of the square.

(a) $3\sqrt{5} : 26$
(b) $2\sqrt{3} : 11$
(c) $3\sqrt{2} : 16$
(d) $4\sqrt{3} : 25$

Q27. In an election between two candidates, 80% of the total voters cast their votes. Out of the total votes cast, 10% were declared invalid. If Candidate A secured 70% of the valid votes and Candidate B received the rest, and the total number of eligible voters was 50,000. How many votes did candidate A receive?

(a) 25200
(b) 25500
(c) 26200
(d) 26500

Q28. An article was bought for Rs. 2,600. Its price was marked up by 20%. Thereafter, it was sold at a discount of 10% on the marked price. What was the profit percentage on the transaction?

(a) 9%
(b) 7%
(c) 10%
(d) 8%

Q29. Ravi spends Rs. 80 more than Raj. If together they spend Rs. 380, how much does Raj spend?

(a) Rs. 150
(b) Rs. 140
(c) Rs. 120
(d) Rs. 110

Q30. A jeep travels 80 km at the speed of 40 km/hr and the next 32 km at the speed of 16 km/hr. What is its average speed (in km/hr)?

(a) 28
(b) 22
(c) 32
(d) 34

Q31. A shopkeeper buys an article for Rs. 12,000 and sells it for Rs. 13,500. Find his profit percentage.

(a) 15%
(b) 10.5%
(c) 12.5%
(d) 20%

Q32. From a point 20 m away from the base of a tower, the angle of elevation to the top of the tower is 30°. Find the height of the tower.

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

(a) 10 m
(b) 12 m
(c) 11 m

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(d) 15 m

Q33. The average age of 25 students of a class is 33 years. If the age of the teacher is also included, the average age of the whole group becomes 34 years. The age (in years) of the teacher is:

(a) 61
(b) 56
(c) 55
(d) 59

Q34. Simplify the following.

$6 \times 6 + 6 \times (8 - 5)^2 \div 3 \times 9$

(a) 164
(b) 138
(c) 198
(d) 192

Q35. The insect population in a building was 9580 in 2015. It increased by 12% in 2016, decreased by 8% in 2017, and again increased by 8% in 2018. Find the insect population in 2018, rounded off to the nearest integer.

(a) 10665
(b) 11665
(c) 11661
(d) 10661

Q36. After selling an article at a discount of 20%, the profit percentage obtained is 32%. What is the markup percentage?

(a) 69%
(b) 71%
(c) 61%
(d) 65%

Q37. A, B and C can complete a piece of work in 3, 9 and 18 days, respectively. How long (in days) will they take to complete thrice the same work, working together?2522

(a) 7
(b) 18
(c) 12
(d) 6

Q38. A train passes two tunnels of length 2708 m and 2195 m in 88 seconds and 76 seconds, respectively. What is the length of the train?

(a) 1064 m
(b) 1054 m
(c) 1048 m
(d) 1063 m

Q39. The median of the data 4, 23, 11, 7, 6, 9, (K + 5), 15, 20 and 16 is 12. Find the value of K.

(a) 8
(b) 5
(c) 7
(d) 6

Q40. Simplify the given expression.

$(x + 2)(x + 3)$

(a) $x^2 + 2x + 3$
(b) $x^2 + 3x + 2$
(c) $x^2 + 6x + 5$
(d) $x^2 + 5x + 6$

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Q41. A solid metallic sphere of radius 10.5 cm is melted and recast into smaller spherical balls of radius 1.5 cm each. If the surface area of the original sphere is S, what is the total surface area of all the small balls combined?

(a) 5S
(b) 8S
(c) 6S
(d) 7S

Q42. Which of the following numbers is divisible by 41?

(a) 7575438
(b) 7132975
(c) 7397665
(d) 7497194

Q43. If 50% of 70% of 2/6 of a number is 539. Find the number.

(a) 3800
(b) 6880
(c) 4620
(d) 7200

Q44. The sum of three numbers is 8788. If the ratio between the first and second numbers is 20 :18 and that of between second and third is 21 : 12, then find the difference between the first and the third number.

(a) 1687
(b) 1786
(c) 1678
(d) 1768

Q45. The ratio of the present age of Sunil and Shyam is 3 : 4. The ratio of their age after 25 years from now, will be 8 : 9. What is the present age of Sunil?

(a) 18 years
(b) 16 years
(c) 15 years
(d) 14 years

Q46. The sides of a triangle are 41 cm, 21 cm, and 50 cm. What is the length of its altitude corresponding to the side with a length of 21 cm?

(a) 22 cm
(b) 54 cm
(c) 85 cm
(d) 40 cm

Q47. 19 men and 13 women can complete a piece of work in 12 days, while 17 men and 9 women can complete the same work in 14 days. The work of how many women is equivalent to that of one man?

(a) 3
(b) 5
(c) 2
(d) 4

Q48. Two banks, A and B, offered loans at 3.5% and 7.5% per annum, respectively. Nirmal borrowed an amount of Rs. 2,40,000 from each bank. Find the positive difference (in Rs.) between the amounts of simple interest paid to the two banks by Nirmal after 3 years.

(a) 28300
(b) 28800
(c) 29800
(d) 30300

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Q49. The sum of the first 16 prime numbers is:

(a) 381
(b) 383
(c) 382
(d) 377

Q50. If the third proportional of 8 and 56 is x, then what is the value of x?

(a) 392
(b) 390
(c) 394
(d) 393

GENERAL INTELLIGENCE & REASONING

Q51. Refer to the following series and answer the question that follows (all numbers are single digit numbers only). Counting to be done from left to right only.

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

How many such odd numbers are there each of which is immediately preceded by an odd number and also immediately followed by an even number?15356

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

Q52. If 'A' stands for '÷', 'B' stands for '×', 'C' stands for '+' and 'D' stands for '−', what will come in place of the question mark (?) in the following equation?

12 C 16 B 15 A 8 D 14 = ?3842

(a) 28
(b) 29
(c) 23
(d) 27

Q53. Refer to the given number, symbol series and answer the question that follows. Counting to be done from left to right only. All numbers are single-digit numbers.

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

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

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

Q54. If 'A' stands for '÷', 'B' stands for 'x', 'C' stands for '+' and 'D' stands for '-', what will come in place of the question mark '?' in the following equation?

8 D 14 A 2 C 3 B 9 = ?

(a) 27
(b) 26
(c) 28
(d) 25

Q55. SG 11 is related to VH −6 in a certain way. In the same way, NM 19 is related to QN 2. To which of the given options is ON 2 related, following the same logic?

(a) QP −15
(b) SP −18

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(c) RO −15
(d) SO −18

Q56. In a certain code language, ‘queen area add’ is coded as ' mk ng uk' and ‘game queen ant’ is coded as ‘ng oz ie’. How is ‘queen’ coded in the given language?
(a) uk
(b) ng
(c) mk
(d) oz

Q57. In a certain code language, ‘ROUT’ is coded as ‘1625’ and ‘AUTO’ is coded as ‘1546’. What is the code for ‘A’ in the given code language?
(a) 6
(b) 1
(c) 4
(d) 5

Q58. PO 8 is related to SM -5 in a certain way. In the same way, QW 12 is related to TU -1. To which of the following is CJ 18 related, following the same logic?
(a) FH 5
(b) EH 7
(c) FG 7
(d) EG 5

Q59. A, B, C, D, E, F and G are sitting around a circular table facing the centre. Only two people sit between F and B when counted from the right of F. Only two people sit between B and A when counted from the right of B. Only three people sit between F and E when counted from the right of F. D sits to the immediate left of C. How many people sit between F and G when counted from the left of F?
(a) Two
(b) Four
(c) Three
(d) One

Q60. Naveen starts from Point A and drives 11 km towards the south. He then takes a left turn, drives 5 km, turns left and drives 4 km. He then takes a right turn and drives 6 km. He takes a final left turn, drives 7 km and stops at Point P. How far (shortest distance) and towards which direction should he drive in order to reach Point A again? (All turns are 90 degrees turns only unless specified).
(a) 11 km towards the west
(b) 5 km towards the north
(c) 5 km towards the east
(d) 11 km towards the south

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

113 99 85 71 57 ?

(a) 47
(b) 43
(c) 45
(d) 39

Q62. 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 statement(s).

Statements:

Some teachers are writers.

All writers are professionals.

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Conclusions:

(I) Some professionals are teachers.

(II) All teachers are professionals.12100

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

Q63. In a certain code language,

A + B means 'A is the sister of B',

A - B means 'A is the mother of B',

A × B means 'A is the husband of B' and

A ÷ B means 'A is the brother of B'.

Based on the above, how is T related to J if ' T + K ÷ S × U - J '?

(a) Mother's sister
(b) Father's sister
(c) Father's mother
(d) Mother's mother

Q64. This question is based on the five, three-digit numbers given below.

(Left) 458 569 248 671 349 (Right)

(Example: 697 – First digit = 6, second digit = 9 and third digit = 7)

(NOTE: All operations to be done from left to right.)

If 2 is added to the first digit of every number, in how many numbers will the first digit be exactly divisible by the second digit?

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

Q65. Which of the following letter-number clusters will replace the question mark (?) in the given series to make it logically complete?

UXZ 79, QTV 77, MPR 75, ILN 73, ?

(a) EHJ 71
(b) FGJ 71
(c) EGJ 71
(d) FHJ 71

Q66. Rahul starts from Point A and drives 9 km towards North. He then takes a right turn, drives 6 km, turns right and drives 14 km. He then takes a right turn and drives 9 km. He takes a final right turn, drives 5 km and stops at Point P. How far (shortest distance) and towards which direction should he drive in order to reach Point A again? (All turns are 90 degrees turns only unless specified)

(a) 3 km to the west
(b) 4 km to the west
(c) 3 km to the east
(d) 4 km to the east

Q67. Seven boxes, A, B, C, D, I, J and K, are kept one over the other, but not necessarily in the same order. Only two boxes are kept below I. Only one box is kept above J. Only one box is kept between J and K. B is kept immediately above C. D is kept at some place below A.

How many boxes are kept between A and B?

(a) Two
(b) Four

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(c) Three
(d) One

Q68. 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 fruits are candies.

All fruits are sprouts.

Conclusions:

(I): Some candies are sprouts.

(II): All sprouts are fruits.

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

Q69. Select the letter-cluster from among the given options that can replace the question mark (?) in the following series.

PPR NQO LRL ? HTF

(a) LKJ
(b) JSI
(c) IJG
(d) KJU

Q70. Refer to the given number series and answer the question that follows. Counting to be done from left to right only. All numbers are single-digit numbers.

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

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

(a) 8
(b) 9
(c) 10
(d) 11

Q71. Five people, A, B, C, D and E are sitting in a row, facing north. D sits third from the left end of the line. E sits fifth from the left end of the line. B sits between A and D. Who sits at the extreme left end of the line?6098

(a) E
(b) A
(c) B
(d) C

Q72. Based on the English alphabetical order, three of the following four letter-cluster pairs are alike in a certain way and thus form a group. Which letter-cluster pair DOES NOT belong to that group?

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

(a) DA−BY
(b) CZ−AX
(c) GD−EB
(d) CZ−ZZ

Q73. Roshan ranked 54^(th) from the top and 18^(th) from the bottom in his class. How many students are there in his class?

(a) 73
(b) 70
(c) 71

(d) 72

Q74. What should come in place of the question mark (?) in the given series?

5 7 11 19 ? 67

(a) 34
(b) 44
(c) 35
(d) 20

Q75. What should come in place of the question mark (?) in the given series?

532 530 526 520 512 ?

(a) 498
(b) 499
(c) 501
(d) 502

Q76. Based on the English alphabetical order, three of the following four letter-clusters are alike in a certain way and thus form a group. Which letter-cluster DOES NOT belong to that group?

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

(a) FHM
(b) ACI
(c) DFL
(d) LNT

Q77. KP 15 is related to NL 7 in a certain way. In the same way, BL 5 is related to EH -3. To which of the given options is RP 18 related, following the same logic?

(a) UL 10
(b) VL 8
(c) UK 8
(d) VK 10

Q78. What will come in the place of '?' in the following equation, if '+' and ' ÷ ' are interchanged and ' - ' and ' x ' are interchanged?

312 + 6 × 5 - 32 ÷ 300 = ?

(a) 186
(b) 180
(c) 192
(d) 179

Q79. M, N, O, P, W, X and Y are sitting around a circular table facing the centre of the table.

Only two people sit between P and O when counted from the left of O. W sits third to the left of N. Y sits to the immediate right of N. Y sits second to the left of P. X is not an immediate neighbour of W. Who sits third to the right of M?

(a) O
(b) N
(c) Y
(d) W

Q80. In the following number-pairs, the second number is obtained by applying certain mathematical operation(s) to the first number. Select the number-pair in which the numbers are related in the same way as are the numbers of the following pairs.

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

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16, 29

25, 47

(a) 95, 186
(b) 78, 152
(c) 84, 79
(d) 62, 121

GENERAL AWARENESS AND CURRENT AFFAIRS

Q81. Which of the following services have been integrated into the newly revamped Mission Vatsalya Portal launched by the Ministry of Women and Child Development in July 2025?

(a) Poshan Abhiyaan and Ujjawala Scheme
(b) Beti Bachao Beti Padhao and Childline 1098
(c) TrackChild and Khoya-Paya Services
(d) Pradhan Mantri Matru Vandana Yojana and Sakhi

Q82. Who was named the Men's Player of the Year at the AIFF Awards 2025?

(a) Subhasish Bose
(b) Brison Fernandes
(c) Vishal Kaith
(d) Khalid Jamil

Q83. In June 2025, the Bonn Climate Change Conference 2025 was held in:

(a) Switzerland
(b) Germany
(c) Paris
(d) France

Q84. In 2025, which Union Minister inaugurated the Khelo India multipurpose hall in Kamle district, Arunachal Pradesh?

(a) Dharmendra Pradhan
(b) Anurag Thakur
(c) Kiren Rijiju
(d) Mansukh Mandaviya

Q85. Which Pakistani female cricketer was inducted into the ICC Hall of Fame in June 2025?

(a) Diana Baig
(b) Nida Dar
(c) Sana Mir
(d) Bismah Maroof

Q86. World Ocean Day 2025, observed on 8 June, emphasised which of the following themes?

(a) Blue Future, Green Planet
(b) Wonder: Sustaining what sustains us
(c) Sustain the Sea
(d) Revive Ocean Life

Q87. Who among the following was appointed as a Whole-time Member (Life) at the Insurance Regulatory and Development Authority of India (IRDAI) in March 2025?

(a) Dinesh Khara
(b) Ramesh B Iyer
(c) Ajay Kumar Bhalla
(d) Swaminathan S Iyer

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Q88. Where was India's first wooden Gurdwara, Sri Nanak Niwas, constructed in Punjab in July 2025?

(a) Moga
(b) Abohar
(c) Khanna
(d) Fazilka

Q89. Which of the following is the goal of the India AI Safety Institute set up in January 2025?

(a) Promoting online gaming
(b) Developing quantum computers
(c) Ensuring safe and ethical AI
(d) Regulating social media ads

Q90. In July 2025, which investigative authority unearthed over Rs. 24 crore in unaccounted assets in Karnataka?

(a) Income Tax Department
(b) Karnataka Lokayukta
(c) Enforcement Directorate
(d) Central Bureau of Investigation

Q91. How much carbon sink does the Revised Green India Mission (GIM) Plan released in 2025 aim to create by 2030?

(a) 4 billion tonnes
(b) 2.5 billion tonnes
(c) 1 billion tonnes
(d) 3.39 billion tonnes

Q92. As of April 2025, which Ministry/Department approved 10 Plastic Parks in different states under the Scheme for Setting up of Plastic Parks in India?

(a) Department of Pharmaceuticals
(b) Ministry of Power
(c) Department of Chemicals and Petro-Chemicals
(d) Ministry of Environment, Forest and Climate Change

Q93. Which of the following female runners won the women's race in the Paris Marathon 2025?

(a) Angela Tanui
(b) Dera Dida
(c) Letesenbet Gidey
(d) Bedatu Hirpa

Q94. Which of the following labs under the Defence Research and Development Organisation (DRDO), successfully conducted high-altitude trials of the Indigenous On-Board Oxygen Generating System (OBOGS)-based Integrated Life Support System (ILSS) for the LCA Tejas aircraft, on March 04, 2025?

(a) Aerial Delivery Research and Development Establishment (ADRDE)
(b) Defence Bio-Engineering & Electro Medical Laboratory (DEBEL)
(c) Defence Electronics Research Laboratory (DLRL)
(d) Defence Laboratory Jodhpur (DLJ)

Q95. Who joined as the Mission Director of Atal Innovation Mission under NITI Aayog in 2025?

(a) Poonam Gupta
(b) B S Subrahmanyam
(c) V. K. Paul
(d) Deepak Bagla

Q96. In June 2025, the Government of India launched which of the following new disaster management tech platforms?

(a) Integrated Centre Room for Emergency Response
(b) Integrated Control Room for Emergency Response
(c) Integrated Common Response for Emergency Response

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(d) Indian Control Room for Emergency Response

Q97. What is the name of Google's largest campus in India, unveiled in February 2025, that marks a milestone in the ongoing seismic shift in technology?

(a) Mahakaya
(b) Kshitij
(c) Ananta
(d) Vishaal

Q98. Who inaugurated the newly established Hedging Desk in Pune in 2025?

(a) Uddhav Thackeray
(b) Eknath Shinde
(c) Sharad Pawar
(d) Devendra Fadnavis

Q99. As per Union Budget 2025–26, for how many years has the Cotton Mission been planned to enhance cotton productivity, especially in extra-long staple varieties?

(a) 5 years
(b) 2 years
(c) 12 years
(d) 10 years

Q100. How many indigenously developed weapon systems were released by Defence Research and Development Organization (DRDO) in June 2024 to Indian armed forces under the emergency procurement clause?

(a) 38
(b) 28
(c) 18
(d) 48

ANSWER KEY

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

SOLUTIONS

Q1. Answer: (c) loss of electrons

The correct answer is loss of electrons.

Key Points

• Oxidation is a chemical process where an atom, ion, or molecule loses electrons during a reaction. This results in an increase in oxidation state.

• Oxidation is often paired with reduction, a process where another substance gains electrons. Together, these processes form a redox reaction.

• In terms of electron transfer, oxidation is defined as the loss of electrons, while reduction is the gain of electrons.

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• Oxidation does not involve the loss of protons or gain of neutrons; these are unrelated processes. Hence, options "loss of protons" and "gain of neutrons" are incorrect.

• Similarly, oxidation does not involve "gain of electrons"; gaining electrons is characteristic of reduction, not oxidation.

• For example, in the reaction of sodium (Na) with chlorine (Cl2), sodium loses electrons to form Na^+, undergoing oxidation, while chlorine gains electrons to form Cl^-, undergoing reduction.

Additional Information

• Redox Reactions:

• Redox reactions are chemical reactions that involve the transfer of electrons between two species.

• Oxidation and reduction always occur simultaneously in redox reactions.

• Example: In the reaction 2Fe^(3+) + 2I^- → 2Fe^(2+) + I2, Fe^(3+) is reduced to Fe^(2+), and I^- is oxidized to I2.

• Oxidation State:

• The oxidation state (or oxidation number) is a measure of the degree of oxidation of an atom in a substance.

• An increase in oxidation state indicates oxidation, while a decrease indicates reduction.

• Example: In H2O2, oxygen has an oxidation state of -1, while in O2, it has an oxidation state of 0.

• Examples of Oxidation:

• Rusting of iron: Fe + O2 + H2O → Fe2O3·xH2O.

• Combustion of fuels: CH4 + 2O2 → CO2 + 2H2O.

• Oxidation of glucose in cellular respiration: C6H12O6 + 6O2 → 6CO2 + 6H2O.

• Industrial Applications:

• Oxidation reactions are crucial in industries such as metallurgy, where metals are extracted from ores.

• Oxidation is also used in wastewater treatment to remove impurities.

• In the food industry, oxidation reactions are involved in processes like fermentation and food preservation.

Important Points

• Oxidizing Agents:

• An oxidizing agent (or oxidant) is a substance that causes oxidation by accepting electrons.

• Examples include oxygen (O2), hydrogen peroxide (H2O2), and halogens (Cl2, Br2, etc.).

• Reducing Agents:

• A reducing agent (or reductant) is a substance that causes reduction by donating electrons.

• Examples include hydrogen (H2), carbon monoxide (CO), and metals like Na and Zn.

• Electrochemical Cells:

• Oxidation occurs at the anode, and reduction occurs at the cathode in electrochemical cells.

• These cells are widely used in batteries and fuel cells.

Q2. Answer: (a) Nature of the material

The correct answer is Nature of the material.

Key Points

• Resistivity is a fundamental property of a material that determines how strongly it opposes the flow of electric current.

• The resistivity of a material depends solely on its nature and intrinsic properties, such as the type of atoms, arrangement of atoms, and the electron mobility within the material.

• Factors such as the current passing through the material, its shape, or its dimensions (length and area) do not affect the resistivity. These factors only influence resistance, not resistivity.

• Materials like metals (e.g., copper, aluminum) have low resistivity, making them good conductors, while insulators like rubber or glass have high resistivity.

• Temperature can also affect resistivity, as it changes the mobility of electrons within the material, but the intrinsic nature of the material remains the primary determinant.

Additional Information

• Definition of Resistivity:

• Resistivity (denoted as ρ) is defined as the resistance of a material of unit length and unit cross-sectional area.

• The formula for resistivity is: ρ = R × (A / L), where R is resistance, A is the cross-sectional area, and L is the length of the material.

• Units and Dimensions:

• The SI unit of resistivity is ohm-meter (Ω·m).

• It is a scalar quantity and has dimensions of [ML³T^-³A^-²].

• Factors Affecting Resistivity:

• Material's Nature: The type and arrangement of atoms in a material determine its resistivity.

• Temperature: For most conductors, resistivity increases with temperature, while for semiconductors, it decreases with temperature.

• Examples of Materials and Resistivity:

• Copper: Low resistivity (~1.68 × 10^-^8 Ω·m) - excellent conductor.

• Rubber: High resistivity (~10^{12} to 10^{1}^5 Ω·m) - excellent insulator.

• Silicon: Intermediate resistivity (~10^{-3} Ω·m) - semiconductor.

Important Points

• Difference between Resistance and Resistivity:

• Resistance (R): Depends on the material's resistivity, length, and cross-sectional area. Measured in ohms (Ω).

• Resistivity (ρ): An intrinsic property of the material, independent of its dimensions.

• Applications:

• Low-resistivity materials like copper are used in wires and electrical circuits.

• High-resistivity materials like tungsten are used in heating elements.

• Semiconductors like silicon are used in electronic devices due to their intermediate resistivity.

• Temperature Coefficient:

• The rate at which resistivity changes with temperature is called the temperature coefficient of resistivity.

• For metals, it is positive (resistivity increases with temperature), while for semiconductors, it is negative.

Q3. Answer: (a) Big dams can help in flood control by regulating river flow.

The correct answer is Big dams can help in flood control by regulating river flow..

Key Points

• Big dams are designed to regulate the flow of rivers by storing water during periods of excessive rainfall and releasing it gradually over time. This reduces the risk of sudden floods downstream.

• While big dams can significantly mitigate flood risks, they do not completely eliminate the possibility of floods, especially in cases of extreme rainfall or dam overflow.

• Dams are extensively used for flood control across the world, including in countries like India, the USA, and China. Examples include the Bhakra Dam in India and the Three Gorges Dam in China.

• Incorrect statements such as "Big dams are never used for flood control" and "Big dams completely eliminate the possibility of floods" disregard the partial but effective role of dams in managing floods.

• However, there are instances where dams can increase the risk of floods due to sudden releases or structural failures, making it crucial to manage them properly.

Additional Information

• Functions of Big Dams:

• Dams store large volumes of water in reservoirs, which can be released during dry periods, ensuring a steady supply of water for irrigation, drinking, and industrial purposes.

• They are used for hydroelectric power generation, contributing to renewable energy production.

• Dams play a key role in recreation and tourism, offering activities like boating, fishing, and sightseeing.

• They can also help prevent saltwater intrusion in coastal areas by maintaining freshwater levels in rivers.

• Examples of Dams Used for Flood Control:

• The Hoover Dam in the USA regulates the flow of the Colorado River and prevents flooding in downstream areas.

• India's Bhakra Dam on the Sutlej River provides flood control for the northern plains.

• The Three Gorges Dam in China reduces flooding along the Yangtze River.

• Limitations of Dams:

• Dams cannot fully prevent floods during extreme weather events like cyclones or heavy monsoons.

• The construction and maintenance of dams can lead to significant environmental and social impacts, including displacement of communities and alteration of ecosystems.

• Sudden releases of water from dams, either due to operational decisions or emergencies, can increase flood risks downstream.

• Global Flood Control Measures:

• Countries implement multiple flood control measures such as levees, floodwalls, stormwater management systems, and afforestation along riverbanks.

• Integrated water management approaches combine dams with other technologies like flood forecasting and early warning systems to enhance flood mitigation.

Important Points

• Environmental Impacts:

• Dams can disrupt aquatic ecosystems, affecting fish migration and river biodiversity.

• Reservoirs created by dams submerge large areas, leading to loss of forests and agricultural land.

• Social Impacts:

• Displacement of people due to dam construction can lead to social and economic challenges.

• Compensation and rehabilitation for affected communities are critical aspects of dam projects.

• Technological Advances:

• Modern dams incorporate advanced materials and designs to enhance safety and efficiency.

• Automation and remote monitoring systems are increasingly being used to manage dam operations.

Q4. Answer: (a) C60

The correct answer is C60.

Key Points

• Fullerene is a unique allotrope of carbon discovered in 1985 by scientists Harold Kroto, Robert Curl, and Richard Smalley, who later won the Nobel Prize in Chemistry in 1996.

• The chemical formula of fullerene is C60, which represents a molecule made of 60 carbon atoms arranged in a spherical shape resembling a soccer ball.

• Fullerenes are also called buckminsterfullerenes or “buckyballs,” named after architect Buckminster Fuller, whose geodesic domes inspired their structure.

• C60 consists of pentagonal and hexagonal rings, making it a highly symmetric and stable molecule.

• It has unique properties such as high thermal stability, electrical conductivity, and the ability to act as a superconducting material under certain conditions.

• The discovery of fullerenes opened up new avenues in nanotechnology, material science, and medicine.

Additional Information

• Other Allotropes of Carbon:

• Diamond: A crystalline allotrope where each carbon atom is bonded to four others in a tetrahedral structure, known for its extreme hardness and used in cutting tools and jewelry.

• Graphite: Composed of carbon atoms arranged in hexagonal layers, it is a good conductor of electricity and widely used in pencils and electrodes.

• Graphene: A single layer of graphite with remarkable strength, flexibility, and electrical conductivity, used in advanced electronics and materials.

• Applications of Fullerenes:

• Used in drug delivery systems due to their ability to encapsulate molecules.

• Applied in solar cells and lightweight batteries for renewable energy solutions.

• Utilized in lubricants and catalysts due to their spherical structure.

• Explored for antioxidant properties and potential in therapeutic treatments.

• Important Discoveries:

• Fullerenes were first synthesized using the laser vaporization of graphite.

• Their spherical structure was confirmed via X-ray crystallography.

• Since the discovery of C60, larger fullerenes like C70, C76, and C84 have also been identified.

• Interesting Facts:

• C60 has a diameter of approximately 0.7 nanometers, making it suitable for nanoscale applications.

• It is highly resistant to radiation and heat, making it suitable for use in extreme environments.

• The term “buckyballs” is often used interchangeably with fullerenes due to the spherical shape of C60 molecules.

Q5. Answer: (b) 9 J

The correct answer is 9J.

Key Points

• Kinetic Energy (KE) is the energy possessed by a body due to its motion. It is given by the formula: KE = (1/2)mv², where:

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

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

• Here, the given values are:

• Mass (m) = 2 kg.
• Velocity (v) = 3 m/s.
• Substituting the values in the formula:
• KE = (1/2) × 2 × (3)².
• KE = 1 × 9.
• KE = 9 J.
• Thus, the kinetic energy of the body is 9 Joules.

Additional Information

• Energy is the capacity to do work. It exists in various forms such as kinetic energy, potential energy, thermal energy, and more.
• Kinetic Energy:
• Depends on the mass and velocity of the object.
• The unit of kinetic energy in the International System of Units (SI) is the joule (J).
• An object with greater velocity will have higher kinetic energy if the mass remains constant.
• Potential Energy:
• This is the energy a body possesses due to its position or configuration.
• For example, a raised object has gravitational potential energy.
• Formula: PE = mgh, where:
• m = mass of the object.
• g = acceleration due to gravity (9.8 m/s²).
• h = height of the object above the reference point.
• Work-Energy Theorem:
• The work done on an object is equal to the change in its kinetic energy.
• For instance, applying a force on a stationary object can increase its velocity, thereby increasing its kinetic energy.
• Applications of Kinetic Energy:
• Kinetic energy is used in various engineering applications, such as designing vehicles, wind turbines, and projectiles.
• It is also a key concept in sports, such as calculating the impact of a moving ball or athlete.

Important Points

• SI Unit of Energy: The standard unit of energy is the joule (J), where 1 joule = 1 kg·m²/s².
• Conservation of Energy: Energy can neither be created nor destroyed; it can only be transformed from one form to another.
• Relation Between Kinetic and Potential Energy:
• In a closed system, the total mechanical energy (sum of kinetic and potential energy) remains constant.
• For example, in a pendulum, energy oscillates between kinetic and potential forms.
• Practical Example: A car moving at a speed of 60 km/h has significant kinetic energy due to its mass and velocity. This energy must be dissipated (e.g., through brakes) to bring the car to rest.

Q6. Answer: (a) Uterus lining

The correct answer is Uterus lining.

Key Points

• After fertilization, the zygote travels through the oviduct (fallopian tube) towards the uterus.
• By the time it reaches the uterus, the zygote has developed into a structure called a blastocyst.
• The uterus lining, also known as the endometrium, is prepared during the menstrual cycle to receive and nourish the blastocyst. It thickens and becomes rich in blood vessels under the influence of hormones like estrogen and progesterone.
• Implantation occurs in the uterus lining, where the blastocyst attaches itself and begins to grow, forming a connection with the mother's blood supply.
• The endometrium provides all the necessary nutrients and support to the developing embryo during the early stages of pregnancy.
• Other structures like the oviduct, ovary, and cervix do not play a role in implantation. These structures serve different functions in the reproductive process.

Additional Information

• Oviduct (Fallopian Tube):
• The oviduct is the site of fertilization, where the sperm meets the egg.
• It plays no role in implantation but helps transport the fertilized egg (zygote) to the uterus.
• Blockage or dysfunction in the oviduct can lead to complications such as ectopic pregnancy, where the embryo implants outside

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the uterus.

• Ovary:

• The ovaries produce ova (eggs), which are necessary for reproduction.

• They also produce hormones like estrogen and progesterone that regulate the menstrual cycle and prepare the uterus for potential pregnancy.

• However, the ovary does not contribute to the implantation process.

• Cervix:

• The cervix is the lower part of the uterus that opens into the vagina.

• It serves as a passage for sperm to travel to the uterus and for menstrual blood to exit the body.

• The cervix does not play any direct role in the process of implantation.

• Endometrium:

• The endometrium undergoes cyclic changes during the menstrual cycle to prepare for potential implantation.

• If implantation does not occur, the endometrium is shed during menstruation.

• If implantation occurs, the endometrium provides the growing embryo with nutrients and support until the placenta forms.

• Hormonal Regulation:

• Hormones like estrogen and progesterone are essential for preparing the endometrium for implantation.

• These hormones are primarily produced by the corpus luteum in the ovary during the luteal phase of the menstrual cycle.

• After implantation, the developing embryo secretes human chorionic gonadotropin (hCG), which helps maintain the corpus luteum and continued progesterone production.

Important Points

• Conditions for Successful Implantation:

• A healthy and receptive uterus lining is crucial for successful implantation.

• Hormonal imbalances, infections, or structural abnormalities in the uterus can hinder implantation.

• Ectopic Pregnancy:

• If implantation occurs outside the uterus, such as in the oviduct, it leads to a condition called ectopic pregnancy.

• This is a medical emergency that requires immediate attention.

• Role of Placenta:

• After implantation, the placenta begins to form and takes over the role of providing nutrients and oxygen to the growing fetus.

• The placenta also removes waste products and produces hormones to sustain pregnancy.

Q7. Answer: (c) O2

The correct answer is O2.

Key Points

• O2 is a diatomic molecule formed by a non-metallic element, specifically oxygen. It is composed of two oxygen atoms bonded together by a covalent bond.

• The term "diatomic" refers to molecules composed of two atoms, which may be of the same or different chemical elements. In the case of O2, it is homonuclear, meaning both atoms are the same.

• Oxygen is a non-metallic element found in group 16 of the periodic table and is essential for life processes such as respiration and combustion.

• The electron configuration of oxygen allows it to form a double covalent bond with another oxygen atom, resulting in the stable diatomic molecule O2.

• Other options such as He, Mg, and Na are not diatomic molecules formed by non-metals. Helium (He) is a noble gas, magnesium (Mg) and sodium (Na) are metals, and none of these form diatomic molecules under normal conditions.

Additional Information

• Helium (He):

• Helium is a noble gas and is monoatomic, meaning it exists as single atoms rather than forming diatomic molecules.

• It is chemically inert due to its complete outer electron shell, which prevents it from forming bonds with other atoms.

• Helium has applications in cryogenics, balloon inflation, and as a coolant in nuclear reactors.

• Magnesium (Mg):

• Magnesium is a metal located in group 2 of the periodic table and does not form diatomic molecules.

• It reacts with oxygen to form magnesium oxide (MgO), a compound rather than a diatomic molecule.

• Magnesium is used in alloy formation, electronics, and as a lightweight material in aerospace industries.

• Sodium (Na):

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• Sodium is a metal from group 1 of the periodic table and does not form diatomic molecules either.

• It reacts readily with other elements such as chlorine to form sodium chloride (NaCl), a compound.

• Sodium is extensively used in chemical industries, food preservation (as table salt), and glass manufacturing.

• Diatomic Molecules:

• Diatomic molecules like O2, N2, H2, and Cl2 are common examples of molecules formed by non-metallic elements.

• These molecules are crucial in various natural and industrial processes such as photosynthesis, respiration, and chemical synthesis.

Important Points

• Oxygen (O2): Oxygen is abundant in Earth's atmosphere, comprising approximately 21% of the air by volume. It is vital for life processes and plays a key role in various chemical reactions.

• Non-metallic Elements: Non-metallic elements like oxygen, nitrogen, and hydrogen tend to form covalent bonds and often exist as diatomic molecules.

• Periodic Table Groups: Group 16 elements, including oxygen, are known as chalcogens and exhibit properties conducive to forming diatomic molecules.

• Applications: Diatomic oxygen (O2) is extensively used in medical treatments, industrial processes, and combustion reactions.

• Bond Nature: The double bond in O2 contributes to its stability and reactivity, making it a highly versatile molecule.

Q8. Answer: (a) Isotopes have the same atomic number but differ in their number of neutrons, which affects physical propert...

The correct answer is Isotopes have the same atomic number but differ in their number of neutrons, which affects physical properties like mass..

Key Points

• Isotopes: Isotopes are variants of a particular chemical element that have the same number of protons (and hence the same atomic number) but a different number of neutrons, which affects their atomic mass.

• Chemical Properties: The chemical properties of an atom are primarily determined by its electron configuration, which is dictated by the atomic number (number of protons). Since isotopes of an element have the same atomic number, their chemical properties are identical.

• Physical Properties: Physical properties, such as density, melting point, and boiling point, can vary between isotopes because these properties are influenced by the mass of the atom. The differing number of neutrons causes a difference in atomic mass.

• Example: Hydrogen has three isotopes: protium (1 proton, 0 neutrons), deuterium (1 proton, 1 neutron), and tritium (1 proton, 2 neutrons). While their chemical properties are the same, their physical properties, like mass, differ significantly.

• Correct Statement: The statement that isotopes have the same atomic number but differ in their number of neutrons, which affects physical properties like mass, is accurate. This is why isotopes exhibit identical chemical behavior but different physical characteristics.

Additional Information

• Definition of Isotopes: Isotopes are atoms of the same element that have the same number of protons but a different number of neutrons. This difference in neutrons leads to variations in atomic mass.

• Applications of Isotopes:

• Carbon Dating: The isotope Carbon-14 is used to determine the age of archaeological specimens through radiocarbon dating.

• Medical Imaging: Isotopes like Technetium-99m are widely used in medical imaging techniques like SPECT scans.

• Nuclear Energy: Uranium isotopes, such as Uranium-235, are used as fuel in nuclear reactors.

• Industrial Applications: Isotopes like Cobalt-60 are used for sterilization and radiation therapy.

• Key Characteristics of Isotopes:

• Stability: Some isotopes are stable, while others are radioactive and decay over time.

• Mass Number: The mass number of an isotope is the sum of protons and neutrons in its nucleus.

• Physical Differences: Isotopes can exhibit differences in physical properties, such as:

• Density: Heavier isotopes of an element are denser.

• Boiling and Melting Points: These can vary slightly based on mass differences.

• Examples of Isotopes:

• Chlorine: Exists as Chlorine-35 and Chlorine-37.

• Oxygen: Has isotopes like Oxygen-16, Oxygen-17, and Oxygen-18.

Important Points

• Misconceptions Addressed:

• Statement 2: Incorrect as isotopes have the same atomic structure except for the number of neutrons.

• Statement 3: Incorrect because isotopes do not differ in the number of protons; they differ in neutrons.

• Statement 4: Incorrect as isotopes have the same number of protons but differ in neutrons, not electrons.

• Relevance in Science: Understanding isotopes is crucial for fields like nuclear physics, chemistry, biology, and archaeology.

• Periodic Table: Isotopes do not change the placement of elements in the periodic table since placement is based on the atomic number (protons).

Q9. Answer: (b) It decreases with altitude

The correct answer is It decreases with altitude.

Key Points

• Acceleration due to gravity (g) decreases as altitude increases. This is because gravity is inversely proportional to the square of the distance from the Earth's center. Hence, as we move further away from the Earth's surface, the value of g reduces.

• At the Earth's surface, the value of acceleration due to gravity is approximately 9.8 m/s^2. However, as altitude increases, this value decreases.

• The mathematical relationship between gravity and altitude is given by the formula: $g' = g (R / (R + h))^2$, where R is the radius of the Earth and h is the height above the surface.

• The statement "It increases as we go inside the Earth" is incorrect. Gravity actually decreases as we go deeper into the Earth beyond a certain point because the mass attracting you is not entirely beneath you but distributed around you.

• The statement "It is the same everywhere on Earth" is incorrect because the value of gravity varies with altitude, latitude, and geological formations.

• The statement "It remains constant with depth" is incorrect as gravity decreases with depth due to the reduction in the effective mass beneath the point of observation.

Additional Information

• Factors Affecting Gravity:

• Altitude: As we move to higher altitudes, the distance from the Earth's center increases, leading to a decrease in gravity. For example, gravity at the top of Mount Everest is slightly less than at sea level.

• Depth: Inside the Earth, gravity decreases as we move towards the core because the effective mass attracting the object decreases.

• Latitude: Gravity is slightly stronger at the poles and weaker at the equator due to the Earth's oblate shape (flattened at the poles and bulging at the equator).

• Local Geological Variations: Variations in the density of rocks and other subsurface structures can cause small changes in gravity.

• Gravitational Formula: Gravity at a height h above the Earth's surface can be calculated using $g' = g (R / (R + h))^2$. Here:

• g = Gravity at sea level

• R = Radius of the Earth (approximately 6,371 km)

• h = Height above the Earth's surface

• Gravity and Depth: As we go deeper into the Earth, gravity decreases linearly with depth in the upper layers, assuming uniform density. Beyond a certain depth, the relationship becomes more complex due to variations in density.

• Gravity on Other Celestial Bodies: Gravity varies significantly on other planets and celestial bodies due to differences in their masses and radii. For example, gravity on the Moon is about 1/6th of that on Earth.

Important Points

• Variation in Gravity on Earth:

• Gravity at the equator is approximately 9.78 m/s^2, while at the poles, it is about 9.83 m/s^2.

• Gravity decreases by about 0.3086 mGal per meter increase in altitude.

• Effects of Gravity Variations:

• Astronauts experience microgravity in space because they are in free fall around the Earth.

• Variations in gravity are used in geological surveys to detect subsurface mineral and oil deposits.

Q10. Answer: (c) Lungs

The correct answer is Lungs.

Key Points

• The lungs are the primary organs of the respiratory system and are located in the chest cavity, enclosed by the rib cage.

• The chest cavity is also known as the thoracic cavity, and it houses vital organs like the lungs, heart, trachea, and esophagus.

• The lungs are responsible for the process of gas exchange, where oxygen is absorbed into the blood and carbon dioxide is expelled from the body.

• They are protected by the pleura, a double-layered membrane that reduces friction during breathing movements.

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• The lungs are connected to the trachea via the bronchi, which branch further into smaller bronchioles and end in alveoli for effective gas exchange.

Additional Information

• Pharynx:

• The pharynx is a part of the digestive and respiratory systems.

• It is located in the neck and throat region and not in the chest cavity.

• The pharynx acts as a passageway for food to the esophagus and air to the larynx.

• Pancreas:

• The pancreas is located in the abdominal cavity, behind the stomach.

• It plays a vital role in both the digestive system (producing enzymes) and the endocrine system (producing insulin).

• Liver:

• The liver is the largest gland in the human body and is situated in the upper right abdomen.

• It performs essential functions like detoxification, production of bile, and protein synthesis.

• Chest Cavity:

• The chest cavity contains the lungs and heart, protected by the rib cage and diaphragm.

• The diaphragm is a dome-shaped muscle that aids in respiration by contracting and relaxing during breathing.

Important Points

• Human Respiratory System:

• The primary function of the respiratory system is gas exchange – oxygen is absorbed, and carbon dioxide is expelled.

• The system includes the nasal cavity, pharynx, larynx, trachea, bronchi, and lungs.

• Protection of Chest Cavity:

• The rib cage protects organs in the chest cavity, including the lungs and heart.

• The pleural membrane reduces friction during respiratory movements.

• Significance of the Lungs:

• The lungs are crucial for maintaining blood oxygen levels necessary for cellular functions.

• Diseases such as pneumonia, asthma, and lung cancer can impair their function significantly.

Q11. Answer: (d) Ciliary muscles

The correct answer is Ciliary muscles.

Key Points

• Ciliary muscles are responsible for modifying the curvature of the eye lens, enabling it to adjust its focal length for clear vision at different distances. This process is known as accommodation.

• When the ciliary muscles contract, the tension on the suspensory ligaments decreases, causing the lens to become thicker and more convex, which is ideal for focusing on nearby objects.

• When the ciliary muscles relax, the tension on the suspensory ligaments increases, causing the lens to become thinner and less convex, which is suitable for focusing on distant objects.

• This adjustment mechanism plays a vital role in ensuring the light rays focus directly on the retina for clear vision.

• The ciliary muscles are a part of the uveal tract of the eye and work in coordination with other parts of the eye, such as the cornea and retina, to facilitate vision.

Additional Information

• Retina:

• The retina is the light-sensitive layer at the back of the eye that converts light signals into neural signals.

• It is not involved in modifying the curvature of the lens but plays a crucial role in image perception by transmitting signals to the brain via the optic nerve.

• Iris:

• The iris is the colored part of the eye that controls the size of the pupil, regulating the amount of light entering the eye.

• It does not directly influence the lens's curvature or focal length.

• Pupil:

• The pupil is the opening in the center of the iris that allows light to enter the eye.

• While its size is controlled by the iris, it has no role in changing the lens's curvature.

• Lens:

• The lens is a transparent, flexible, and biconvex structure that focuses light on the retina by changing its shape.

• However, the ability to change shape is facilitated by the action of the ciliary muscles.

• Accommodation Process:

• This is the process by which the lens changes its shape to focus on objects at varying distances.

• The ciliary muscles, suspensory ligaments, and lens work together to achieve this.

Important Points

• The ciliary muscles are controlled by the parasympathetic nervous system via the oculomotor nerve (cranial nerve III).

• Presbyopia, a common age-related condition, occurs when the lens loses its flexibility, and the ciliary muscles weaken, leading to difficulty focusing on nearby objects.

• Myopia (nearsightedness) and hyperopia (farsightedness) are refractive errors that can occur due to improper focusing of light on the retina, though they are not directly related to the ciliary muscles.

• Surgical interventions such as lens replacement or laser surgeries do not involve the ciliary muscles but aim to correct refractive errors by modifying the cornea or replacing the lens.

Q12. Answer: (c) 2Al + 6HCl → 2AlCl3 + 3H2

The correct answer is 2Al + 6HCl → 2AlCl3 + 3H2.

Key Points

• Reaction of Aluminum with Hydrochloric Acid: The reaction of aluminum (Al) with hydrochloric acid (HCl) is a classic example of a metal reacting with an acid to produce a salt and hydrogen gas. The correct balanced equation is 2Al + 6HCl → 2AlCl3 + 3H2.

• Stoichiometry of the Reaction: In this reaction, 2 moles of aluminum react with 6 moles of hydrochloric acid to produce 2 moles of aluminum chloride (AlCl3) and 3 moles of hydrogen gas (H2). This balanced equation ensures that the law of conservation of mass is satisfied.

• Formation of Aluminum Chloride: Aluminum forms aluminum chloride (AlCl3) as it reacts with hydrochloric acid. Aluminum chloride is an ionic compound where aluminum donates electrons to chlorine, forming strong ionic bonds.

• Release of Hydrogen Gas: During the reaction, hydrogen gas (H2) is released as a byproduct. This can be observed as bubbles forming in the reaction mixture.

• Importance of the Reaction: This reaction is significant in understanding the behavior of metals with acids and is commonly used in laboratory experiments to study chemical reactivity and gas evolution.

Additional Information

• Aluminum:

• Aluminum is a highly reactive metal with the atomic number 13.

• It is lightweight, corrosion-resistant, and widely used in industries such as aerospace, construction, and packaging.

• Its high reactivity allows it to react with acids like HCl to produce hydrogen gas and salts such as aluminum chloride.

• Hydrochloric Acid (HCl):

• Hydrochloric acid is a strong acid commonly used in laboratories and industrial processes.

• It is composed of hydrogen chloride dissolved in water and has the chemical formula HCl.

• In reactions, HCl donates hydrogen ions (H^+) to form salts and liberates gases in reactions with metals.

• Applications of the Reaction:

• This reaction is utilized in industrial processes for hydrogen gas production and the preparation of aluminum salts.

• It is also used in chemical demonstrations to showcase metal reactivity with acids.

• Key Characteristics of Hydrogen Gas:

• Hydrogen gas (H2) is colorless, odorless, and highly flammable.

• It is the lightest element and is used in applications such as fuel cells, welding, and as a reducing agent in chemical reactions.

• The "pop test" is used to confirm the presence of hydrogen gas, where a burning splint produces a characteristic popping sound.

Important Points

• Balanced Chemical Equations: A balanced equation ensures the law of conservation of mass is maintained, with equal numbers of each atom on both sides of the reaction.

• Common Errors: Incorrect stoichiometry or omission of products like hydrogen gas can lead to errors in writing the chemical reaction.

• Industrial Use: Aluminum chloride produced from this reaction is used in industries for applications such as water purification and as a catalyst in organic synthesis.

• Safety Precautions: Hydrochloric acid is corrosive, and proper safety measures, such as wearing gloves and goggles, should be followed during the reaction to avoid harm.

Q13. Answer: (c) The optical centre coincides with the centre of curvature.

The correct answer is The optical centre coincides with the centre of curvature..

Key Points

• Every spherical lens has two centres of curvature:
• A spherical lens is formed by two spherical surfaces. Each of these surfaces has a center of the sphere from which it is a part.
• These centers are called the centres of curvature of the lens.
• Hence, statement 1 is correct.
• The line joining the two centres of curvature is called the principal axis:
• The straight line passing through both centres of curvature is known as the principal axis of the lens.
• This axis is crucial for understanding the optical properties of the lens.
• Hence, statement 2 is correct.
• The optical centre coincides with the centre of curvature:
• The optical centre of a lens is a point on its principal axis where a light ray passing through does not deviate from its path.
• However, this point does not coincide with either of the centres of curvature. The optical center is a distinct point between the two spherical surfaces.
• Hence, statement 3 is incorrect.
• A concave lens also possesses two centres of curvature:
• Just like a convex lens, a concave lens also has two spherical surfaces, each with its own centre of curvature.
• This property is common to all spherical lenses, irrespective of their type.
• Hence, statement 4 is correct.

Additional Information

• Key terms related to spherical lenses:
• Principal axis: It is the straight line that passes through the two centres of curvature of a lens.
• Optical centre: A point inside the lens through which light passes without any deviation.
• Focal length: The distance between the optical centre and the focal point of the lens.
• Centre of curvature: The centre of the sphere of which a spherical surface of the lens is a part.
• Types of spherical lenses:
• Convex lens: This lens is thicker at the center and thinner at the edges. It converges light rays.
• Concave lens: This lens is thinner at the center and thicker at the edges. It diverges light rays.
• Applications of spherical lenses:
• Convex lenses: Used in magnifying glasses, cameras, and eyeglasses for correcting hypermetropia.
• Concave lenses: Used in eyeglasses for correcting myopia and in optical instruments like telescopes.
• Important properties of lenses:
• Lenses follow the lens formula: 1/f = 1/v - 1/u, where f is the focal length, v is the image distance, and u is the object distance.
• The magnification produced by a lens is given by the formula: Magnification = Height of image / Height of object = v/u.

Important Points

• Diverging and converging lenses: A concave lens is a diverging lens, while a convex lens is a converging lens.
• Uses in daily life: Lenses are used in spectacles, microscopes, telescopes, and cameras for various optical purposes.
• Real and virtual images: Convex lenses can form both real and virtual images, whereas concave lenses generally form virtual images.

Q14. Answer: (c) Neuron

The correct answer is Neuron.

Key Points

• Neuron is the fundamental unit of the nervous system and is categorized as a cell rather than a tissue. Tissues are made up of similar cells working together to perform specific functions, while neurons are specialized cells that transmit nerve signals. Hence, Neuron is not an example of tissue.
• Muscle is a type of tissue composed of muscle cells that work together to perform movement-related functions. It qualifies as a tissue. Hence, Muscle is an example of tissue.
• Blood is a connective tissue that transports oxygen, nutrients, and waste products throughout the body. It is classified as a tissue. Hence, Blood is an example of tissue.
• Bone is a specialized connective tissue that provides structural support and protection to the body. It is considered a tissue. Hence, Bone is an example of tissue.
• In biological terms, tissues are groups of similar cells that perform a specific function. Since neurons operate as individual cells and not as a collective tissue, they are distinct from the examples mentioned. Hence, Neuron does not qualify as a tissue.

Additional Information

• Tissues in the Human Body:

• Epithelial Tissue: Forms the lining of organs and structures, providing protection and secretion. Examples include the skin and lining of the digestive tract.

• Connective Tissue: Includes blood, bone, and cartilage. It provides structural support and connects various parts of the body.

• Muscle Tissue: Responsible for movement in the body. It includes skeletal, cardiac, and smooth muscle tissues.

• Nervous Tissue: Composed of neurons and glial cells, it facilitates communication and coordination within the body.

• Neuron Characteristics:

• Neurons are specialized cells that transmit electrical signals in the body.

• They consist of three main parts: the cell body, dendrites, and axon.

• Neurons are involved in processing and transmitting information in the brain and throughout the nervous system.

• Unlike tissues, neurons function individually to relay messages rather than forming collective structures.

• Examples of Tissues:

• Blood: A liquid connective tissue that circulates oxygen, nutrients, and waste.

• Bone: A rigid connective tissue that provides structural support.

• Muscle: Tissue responsible for movement and locomotion.

• Epithelial Tissue: Protects organs and regulates permeability.

• Functions of Tissues:

• Protection: Epithelial tissue protects the body from harmful external factors.

• Support: Connective tissues like bones provide structural support.

• Movement: Muscle tissue facilitates movement.

• Communication: Nervous tissue enables communication within the body.

Important Points

• Neuron vs Tissue:

• Neuron: A single specialized cell that transmits electrical impulses.

• Tissue: A group of similar cells working together to perform specific functions.

• Classification of Tissues:

• The human body has four types of tissues: epithelial, connective, muscle, and nervous.

• Each type performs distinct functions essential for survival.

• Biological Significance:

• Tissues play a pivotal role in maintaining homeostasis and ensuring proper organ function.

• Understanding the difference between cells like neurons and tissues is crucial in biology.

Q15. Answer: (b) Asexual reproduction

The correct answer is Asexual reproduction.

Key Points

• Asexual reproduction ensures a rapid increase in population as it does not require the involvement of two parents.

• This method involves a single organism reproducing offspring that are genetically identical to itself, ensuring quicker and continuous reproduction.

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

• Examples of organisms that reproduce asexually include bacteria (binary fission), yeast (budding), hydra (budding), and some plants (vegetative propagation).

• In contrast to sexual reproduction, which requires fertilization and genetic recombination, asexual reproduction is faster as it skips these complex processes.

Additional Information

• Self-pollination:

• Self-pollination occurs in plants where pollen from the same flower or plant fertilizes its ovules.

• This method is slower in population growth compared to asexual reproduction and requires specific conditions for fertilization.

• Internal fertilization:

• In this method, fertilization occurs inside the body of an organism, typically seen in animals like mammals, birds, and reptiles.

• It involves genetic recombination, which increases genetic diversity but is relatively slow compared to asexual reproduction.

• Cross-pollination:

• Cross-pollination refers to the transfer of pollen from one plant to another, ensuring genetic diversity in plants.

• While it benefits genetic variation, it is not as rapid as asexual reproduction in increasing population.
• Advantages of Asexual Reproduction:
• It is highly efficient and allows organisms to rapidly colonize an environment.
• Energy and time are conserved as there is no need to find a mate.
• It is useful in stable environments where genetic variation is less critical.
• Examples of Asexual Reproduction:
• Bacteria: Reproduce through binary fission, leading to exponential population growth.
• Hydra: Reproduces through budding, creating genetically identical offspring.
• Plants: Methods like vegetative propagation (e.g., potato tubers, strawberry runners) allow for quick reproduction.

Important Points

• Binary Fission: A form of asexual reproduction where a single organism divides into two identical cells, commonly seen in bacteria.
• Budding: A new organism develops from a bud or outgrowth of a parent, as seen in yeast and hydra.
• Fragmentation: An organism breaks into fragments, each capable of growing into a new organism, as in starfish and some algae.
• Vegetative Propagation: Plants reproduce using structures like runners, tubers, and bulbs, ensuring rapid propagation in agriculture and horticulture.
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Q16. Answer: (d) – 4000 N

The correct answer is – 4000 N.

Key Points

• The car is moving at an initial speed of 720 km/hr. To convert this into meters per second (m/s), use the formula:

Speed (m/s) = Speed (km/hr) × (1000/3600).

Hence, 720 km/hr = 720 × (1000/3600) = 200 m/s.

• The car comes to a stop in 4 seconds. This indicates that the final velocity (v) is 0 m/s, and the initial velocity (u) is 200 m/s.
• The deceleration (a) can be calculated using the formula:

v = u + at, where:

• v = Final velocity = 0 m/s
• u = Initial velocity = 200 m/s
• t = Time = 4 seconds

Rearranging the formula: a = (v - u) / t. Substituting the values:

a = (0 - 200) / 4 = -50 m/s².

• The total mass of the car and passengers is given as 80 kg.
• The force applied by the brakes can be calculated using Newton's second law of motion:

F = m × a, where:

• m = Mass = 80 kg
• a = Acceleration = -50 m/s²

Substituting the values:

F = 80 × (-50) = -4000 N.

• The negative sign indicates that the force is applied in the opposite direction of the car's motion to bring it to a stop.

Additional Information

• Newton's Second Law of Motion:
• This law states that the force acting on an object is equal to the rate of change of its momentum.
• The formula is: F = m × a, where F is force, m is mass, and a is acceleration.
• It explains how the velocity of an object changes when it is subjected to an external force.
• Deceleration:
• Deceleration is negative acceleration, where the velocity of an object decreases over time.
• It occurs when the force applied is opposite to the direction of motion.
• Units of Force:
• Force is measured in Newtons (N).
• 1 Newton is defined as the force required to accelerate a mass of 1 kg by 1 m/s².
• Braking Force:

• Braking force is the resistive force applied to stop or slow down a moving vehicle.

• The magnitude of braking force depends on the mass of the vehicle, its velocity, and the time taken to stop.

Important Points

• SI Units:

• Speed is measured in m/s.

• Mass is measured in kilograms (kg).

• Acceleration is measured in m/s^2.

• Force is measured in Newtons (N).

• Stopping Distance and Time:

• The stopping distance of a vehicle depends on its initial velocity and the braking force applied.

• The time to stop is inversely proportional to the deceleration.

• Practical Applications:

• Understanding braking force is crucial for designing safe and efficient braking systems in vehicles.

• It helps in accident prevention and ensures the safety of passengers.

Q17. Answer: (d) Tubectomy

The correct answer is Tubectomy.

Key Points

• Tubectomy, also known as tubal ligation, is a permanent method of contraception for females. It involves the surgical blocking or sealing of the fallopian tubes to prevent the egg from reaching the uterus for fertilization.

• Vasectomy, which is the surgical cutting or sealing of the vas deferens, is the male counterpart to tubectomy. It is a permanent contraception method for males, preventing the release of sperm during ejaculation.

• Both procedures are considered permanent and are performed on individuals or couples who do not wish to have more children.

• Unlike other contraceptive methods like Copper-T or cervical caps, tubectomy is irreversible in most cases, making it equivalent to the permanency of vasectomy in males.

• Tubectomy is typically recommended for women who are certain about not having more children, as it involves surgical intervention with a recovery period.

Additional Information

• Coitus Interruptus:

• This is a natural method of contraception, also known as the withdrawal method, where the male withdraws his penis from the female's vagina before ejaculation to prevent sperm from entering the uterus.

• It is not a reliable method of contraception as it has a high failure rate due to the possibility of pre-ejaculate containing sperm.

• It is a temporary contraceptive method and does not provide protection against sexually transmitted infections (STIs).

• Copper-T:

• The Copper-T is an intrauterine device (IUD) inserted into the uterus to prevent pregnancy.

• It releases copper ions, which are toxic to sperm, and prevents the fertilization of the egg.

• It is a temporary, reversible method of contraception and can be used for long-term protection, typically lasting 5-10 years depending on the type.

• It is suitable for women who want effective contraception without undergoing surgery.

• Cervical Caps:

• Cervical caps are barrier methods of contraception that are inserted into the vagina to cover the cervix and block sperm entry.

• They are used with spermicide for increased effectiveness and are reusable for a certain period.

• They are not as effective as permanent methods like tubectomy or vasectomy and require proper fitting and placement.

• Tubectomy:

• It is a surgical procedure performed under anesthesia, where the fallopian tubes are cut, tied, or sealed to prevent eggs from reaching the uterus.

• It is a permanent method of contraception and is highly effective in preventing pregnancy.

• Tubectomy does not affect hormonal balance, menstrual cycles, or sexual activity of the woman.

• It is often performed postpartum or as an elective procedure for family planning.

• Important Points:

• Both tubectomy and vasectomy are considered safe and effective permanent contraception methods when performed under proper medical supervision.

• These methods are recommended for individuals who are certain about not wanting more children, as reversal procedures are

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complex and often not successful.

• Permanent methods like tubectomy and vasectomy do not provide protection against sexually transmitted infections (STIs). For such protection, barrier methods like condoms are recommended.

• Consultation with a healthcare provider is essential before opting for permanent contraception to ensure the individual or couple is fully informed about the procedure, risks, and consequences.

Q18. Answer: (d) 0.1 s

The correct answer is Option 4 (0.1 s).

Key Points

• The speed of sound in air is approximately 340 m/s. This is the standard speed used in physics calculations unless stated otherwise.

• The distance to the reflecting surface is given as 17 m. Since the echo must travel to the surface and back, the total distance covered by the sound wave is 2 × 17 = 34 m.

• The formula to calculate time is: Time = Distance / Speed. Substituting the total distance and speed, we get:

Time = 34 m / 340 m/s = 0.1 s.

• This implies that the echo will return to the source in 0.1 seconds.

• Hence, the correct answer is Option 4 (0.1 s).

Additional Information

• Echo:

• An echo is a sound that is reflected off a surface (such as a wall or cliff) and heard again by the original source.

• The time delay in hearing an echo depends on the distance to the reflecting surface and the speed of sound.

• For an echo to be distinctly heard, the reflecting surface should typically be at least 17 m away from the source because the human ear cannot distinguish sounds separated by less than 0.1 s.

• Speed of Sound:

• The speed of sound in air is approximately 340 m/s under standard conditions (at room temperature and normal atmospheric pressure).

• The speed of sound varies depending on the medium (e.g., air, water, or solid) and the temperature. For example, sound travels faster in water (approximately 1480 m/s) and even faster in solids.

• Distance Calculation:

• When calculating the distance traveled by sound for an echo, it's important to remember that sound travels to the reflecting surface and back. Hence, the total distance is 2 × the distance to the reflecting surface.

• Applications of Echo:

• Echoes are used in various fields, including sonar systems for underwater detection and ultrasound imaging in medical diagnostics.

• They are also used in measuring distances in geological surveys and testing the acoustics of auditoriums.

Important Points

• Practical Conditions for Echo:

• For an echo to be heard clearly, the reflecting surface must be large and rigid, such as a wall, cliff, or building.

• The minimum distance required for an echo to be heard is approximately 17 m, considering the speed of sound and the human ear's ability to distinguish sounds.

• Factors Affecting Speed of Sound:

• The speed of sound increases with temperature. For example, at 0°C, the speed is approximately 331 m/s, while at 20°C, it increases to about 343 m/s.

• Sound travels faster in denser media, such as water and solids, compared to air.

Q19. Answer: (b) Xylem transports water and minerals, phloem transports food.

The correct answer is Xylem transports water and minerals, phloem transports food..

Key Points

• Xylem is a vascular tissue in plants primarily responsible for transporting water and dissolved minerals from the roots to the rest of the plant. It supports upward movement through processes like root pressure, capillary action, and transpiration pull.

• Phloem, on the other hand, transports organic nutrients, primarily sugar (sucrose), which is produced during photosynthesis in the leaves, to different parts of the plant, including growing regions and storage organs.

• The transport process in xylem is unidirectional (from roots to the aerial parts of the plant), whereas the transport process in phloem is bidirectional (both upward and downward, depending on the plant's needs).

• Key structural components of xylem include tracheids, vessels, xylem parenchyma, and xylem fibers, while phloem is composed

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of sieve tubes, companion cells, phloem parenchyma, and phloem fibers.

• This distinction in the primary functions of xylem and phloem is critical for maintaining the overall growth and metabolic activities of the plant.

Additional Information

• Xylem Details:

• Water Transport Mechanism: Water movement in xylem occurs due to physical forces like transpiration pull, capillary action, and root pressure.

• Structural Adaptations: Xylem vessels and tracheids have thick lignified walls that prevent collapse under water pressure.

• Example: Xylem vessels are prominent in angiosperms, while tracheids are the primary conducting cells in gymnosperms.

• Phloem Details:

• Translocation Process: Transport in phloem (called translocation) involves the movement of sugars and other organic compounds using energy (an active process).

• Role of Companion Cells: These cells are essential for maintaining the function of sieve tubes by providing energy and support for translocation.

• Example: Phloem is abundant in the vascular bundles of leaves, stems, and roots, ensuring sugar distribution throughout the plant.

• Comparative Features:

• Direction of Transport: Xylem transports substances only upward, while phloem can transport substances in multiple directions.

• Living vs. Non-Living: Xylem tissues (except xylem parenchyma) are non-living, whereas phloem tissues (except phloem fibers) are living.

• Energy Requirement: Xylem transport is a passive process, while phloem transport requires energy in the form of ATP.

• Important Functions:

• Water Balance: Xylem helps maintain water balance in the plant by replacing water lost during transpiration.

• Growth Support: Phloem ensures that growing parts (like buds, fruits, and flowers) receive the necessary nutrients for development.

Important Points

• Adaptations for Transport: Xylem vessels are large and hollow to facilitate water movement, while sieve tubes in phloem have perforated walls for efficient sugar transport.

• Energy Dependency: The xylem's water transport is passive, relying on physical forces, whereas phloem transport requires energy to actively move nutrients.

• Critical to Plant Survival: Both tissues are vital to the plant's survival, as they ensure the distribution of water, minerals, and food throughout the plant body.

Q20. Answer: (a) Current in its turns produces a magnetic field

The correct answer is Current in its turns produces a magnetic field.

Key Points

• A solenoid is a long coil of wire wound in the shape of a cylinder. When an electric current flows through its turns, it produces a magnetic field.

• The magnetic field inside a solenoid is nearly uniform and strong, resembling the magnetic field of a bar magnet. This property makes it behave like a magnet.

• The strength of the magnetic field produced depends on factors such as the number of turns in the solenoid, the current passing through it, and the material of the core (if any).

• When the solenoid is wound around a magnetic material like iron, its magnetic field becomes even stronger due to the material's high magnetic permeability.

• This principle of solenoids is widely used in electromagnets, which are employed in various applications like electric bells, relays, and magnetic locks.

Additional Information

• Magnetic Field in a Solenoid:

• The magnetic field inside a solenoid is given by the formula: $B = \mu_0 \times n \times I$, where B is the magnetic field, μ_0 is the permeability of free space, n is the number of turns per unit length, and I is the current.

• The field lines inside the solenoid are parallel, indicating a uniform magnetic field.

• Applications of Solenoids:

• Solenoids are used to create controlled magnetic fields for scientific experiments.

• They are employed in electromagnets, which are used in devices like electric motors, loudspeakers, and MRI machines.

• In industrial applications, solenoids are used in valves, actuators, and relays.

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• Difference Between Permanent Magnets and Solenoids:

• Permanent magnets produce a constant magnetic field, while solenoids generate a magnetic field only when electric current flows through them.

• Solenoids can be turned on or off and their strength can be controlled by varying the current, making them more versatile for applications.

• Iron Core in a Solenoid:

• Adding an iron core to the solenoid increases the magnetic field's strength due to the core's magnetic properties.

• This configuration is used in electromagnets to achieve high magnetic field strengths for specific applications.

Important Points

• Iron Core vs. Air Core:

• Solenoids with an iron core (also called ferromagnetic core) produce much stronger magnetic fields compared to solenoids with an air core.

• Air core solenoids are used when a uniform magnetic field is required without interference from the core material.

• Electromagnets vs. Permanent Magnets:

• Electromagnets, which use solenoids, can be switched on and off and their magnetic strength is adjustable, unlike permanent magnets.

• They are commonly used in applications requiring dynamic control, such as electric motors and transformers.

• Discovery:

• The magnetic effect of electric current was discovered by Hans Christian Ørsted in 1820, laying the foundation for the development of solenoids and electromagnets.

Q21. Answer: (b) Gas

The correct answer is Gas.

Key Points

• Matter exists in three primary states: solids, liquids, and gases, distinguished by the arrangement and energy of their particles.

• In a Gas, particles possess the highest speed of rapid random motion due to their maximum kinetic energy and weakest intermolecular forces. These particles move freely in all directions at very high velocities.

• In a Solid, particles are held together by strong intermolecular forces in a fixed lattice. They vibrate about their mean positions, resulting in the lowest speed of motion. Hence, this statement is incorrect.

• In a Liquid, particles have moderate kinetic energy and can slide over one another, allowing the liquid to flow. Their speed is higher than solids but lower than gases. Hence, this statement is incorrect.

• The statement that both solids and liquids possess the highest speed of motion is incorrect, as gases clearly dominate in terms of particle speed due to minimal intermolecular forces.

Additional Information

• Kinetic Molecular Theory:

• This theory explains that matter consists of small particles in constant motion, with the motion proportional to the temperature of the substance.

• As temperature increases, the average kinetic energy of particles increases, causing them to move faster.

• Brownian Motion:

• Brownian motion refers to the random, zig-zag movement of microscopic particles in liquids or gases caused by collisions with fast-moving atoms or molecules.

• It was first observed by Robert Brown in 1827.

• Compressibility and Density:

• Gases are highly compressible due to large spaces between particles.

• Solids are incompressible and have high density because of negligible spaces between particles.

• Liquids have fixed volume but no fixed shape, taking the shape of their container.

• Diffusion:

• Diffusion is the process by which particles spread out to fill a space.

• The rate of diffusion is fastest in gases due to high speed and large spaces between particles, and slowest in solids.

Important Points

• Plasma:

• Plasma is considered the fourth state of matter, consisting of super-heated, ionized gas.

• Particles in plasma move at even higher speeds due to extreme energy levels, as found in stars or lightning bolts.

• Absolute Zero:

• At 0 Kelvin (or -273.15 degrees Celsius), the motion of particles theoretically stops.

• This is the lowest possible temperature in the universe.

• Intermolecular Forces vs. Thermal Energy:

• The state of matter is determined by the competition between intermolecular forces (which keep particles together) and thermal energy (which drives them apart).

• In gases, thermal energy dominates, allowing particles to move freely and rapidly.

Q22. Answer: (d) Alcohol

The correct answer is Alcohol.

Key Points

• The functional group -OH, known as the hydroxyl group, is characteristic of alcohols in organic chemistry.

• Alcohols are organic compounds where the -OH group is bonded to a saturated carbon atom (sp^3 hybridized).

• The presence of the hydroxyl group in alcohols makes them capable of forming hydrogen bonds, contributing to their high boiling points compared to hydrocarbons of similar molecular weight.

• Alcohols are classified into three types based on the number of alkyl groups attached to the carbon bonded to the hydroxyl group: primary (1°), secondary (2°), and tertiary (3°) alcohols.

• Examples of alcohols include methanol (CH3OH), ethanol (C2H5OH), and isopropanol (C3H7OH), which are widely used in industries and households.

Additional Information

• Carboxylic Acid:

• Carboxylic acids contain the functional group -COOH, which is composed of a carbonyl group (C=O) and a hydroxyl group (-OH).

• Carboxylic acids are weak acids and commonly found in nature, such as in acetic acid (vinegar) and citric acid.

• They are used in the production of polymers, pharmaceuticals, and food preservatives.

• Aldehyde:

• Aldehydes contain the functional group -CHO, where a carbonyl group (C=O) is bonded to a hydrogen atom and a carbon atom.

• They are commonly used in industries for manufacturing resins, dyes, and fragrances.

• Examples include formaldehyde (HCHO) and acetaldehyde (CH3CHO).

• Ketone:

• Ketones have the functional group C=O bonded to two carbon atoms.

• Unlike aldehydes, ketones do not have a hydrogen atom attached directly to the carbonyl group.

• Common examples include acetone (CH3COCH3), which is widely used as a solvent.

• Alcohol:

• Alcohols are used as solvents, fuels, and disinfectants. Ethanol is a key component in alcoholic beverages.

• They are also used in the manufacture of pharmaceuticals and cosmetics.

• Alcohols exhibit properties such as hydrophilicity due to the hydroxyl group, making them miscible with water.

Important Points

• Hydrogen Bonding:

• The hydroxyl group (-OH) in alcohols forms hydrogen bonds with water molecules, enhancing their solubility in water.

• This property is responsible for the higher boiling points of alcohols compared to similar molecular weight hydrocarbons.

• Nomenclature:

• Alcohols are named using the IUPAC system by replacing the suffix "-e" in alkanes with "-ol." For example, methane becomes methanol.

• Industrial Applications:

• Alcohols are extensively used in industries for the production of plastics, synthetic fibers, and antifreeze.

• They also serve as intermediates in chemical synthesis, particularly for esters and ethers.

Q23. Answer: (a) Unbalanced force

The correct answer is Unbalanced force.

Key Points

• Unbalanced force is a force that causes a change in the state of motion of an object. It is responsible for accelerating or decelerating an object, changing its direction, or altering its shape.

• An unbalanced force occurs when the net force acting on an object is not equal to zero. This results in a change in the object's velocity, which could mean a change in speed, direction, or both.

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• For example, when a person pushes a stationary object with enough force to overcome friction and inertia, the object moves. This motion occurs due to the unbalanced force acting on it.

• In the absence of unbalanced forces, an object will either remain stationary (if initially at rest) or continue moving in a straight line at constant speed (if initially in motion). This is in accordance with Newton's First Law of Motion.

• Unbalanced forces are fundamental to many phenomena in daily life, such as driving a car, playing sports, or the movement of celestial bodies.

Additional Information

• Balanced Force:

• When the net force acting on an object is zero, the forces are termed as balanced forces.

• Balanced forces do not change the state of motion of an object; they keep it at rest or moving uniformly in a straight line.

• Example: A book resting on a table experiences balanced forces – the force of gravity pulling it down is balanced by the upward normal force exerted by the table.

• Gravitational Force:

• This is the attractive force exerted by a massive body, such as Earth, on other objects.

• It is responsible for phenomena like objects falling to the ground and the orbits of planets around the Sun.

• Gravitational force acts on all objects with mass and is proportional to their masses and inversely proportional to the square of the distance between them.

• Frictional Force:

• Friction is a force that opposes the relative motion between two surfaces in contact.

• It acts parallel to the surfaces and can either prevent motion (static friction) or resist motion (kinetic friction).

• Frictional force plays a crucial role in enabling walking, driving, and holding objects but also causes wear and heat generation.

• Newton's Laws of Motion:

• Newton's First Law (Law of Inertia): An object remains at rest or in uniform motion unless acted upon by an unbalanced force.

• Newton's Second Law: The acceleration of an object is directly proportional to the net force acting on it and inversely proportional to its mass (F = ma).

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

• Applications of Unbalanced Forces:

• Unbalanced forces are responsible for starting, stopping, and changing the direction of motion in vehicles.

• They are crucial in sports, where players apply forces to accelerate, decelerate, or change the direction of balls or themselves.

• Rocket launches utilize unbalanced forces generated by the expulsion of gases to propel themselves upward.

Important Points

• Force:

• Force is defined as a push or pull that can cause an object to accelerate, decelerate, or change its shape or direction.

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

• The SI unit of force is the Newton (N).

• Examples of Unbalanced Forces:

• A car accelerating on a highway experiences unbalanced forces due to the engine's thrust overcoming air resistance and friction.

• When a ball is kicked, the force applied by the foot overcomes the balanced forces of gravity and friction, causing motion.

• A spacecraft maneuvering in outer space applies unbalanced forces via thrusters to change its velocity or direction.

• Practical Implications:

• Understanding unbalanced forces helps in designing efficient vehicles, aircraft, and machinery.

• It aids in predicting and controlling the motion of objects in sports and engineering applications.

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Q24. Answer: (a) It decreases.

The correct answer is It decreases..

Key Points

• pH is a measure of the acidity or alkalinity of a solution, determined by the concentration of hydrogen ions (H^+) present in it.

• When the concentration of H^+ ions increases, the solution becomes more acidic, resulting in a decrease in pH.

• The pH scale ranges from 0 to 14, where a pH of 7 is neutral, below 7 indicates acidity, and above 7 indicates alkalinity.

• The relationship between pH and hydrogen ion concentration is logarithmic: pH = -log[H^+]. As [H^+] increases, the logarithmic value becomes smaller, causing the pH to decrease.

• For example, if the concentration of H^+ ions increases from 10^-^7 M to 10^-^4 M, the pH decreases from 7 to 4, indicating a

much stronger acidic environment.

Additional Information

• Acidity and Alkalinity:

• Acidity refers to the presence of a higher concentration of H^+ ions, while alkalinity indicates a higher concentration of hydroxide ions (OH^-).

• Highly acidic solutions have a pH closer to 0, while highly alkaline solutions have a pH closer to 14.

• pH Indicators:

• pH can be measured using pH meters, litmus paper, or universal indicators.

• Litmus paper turns red in acidic solutions and blue in alkaline solutions.

• Applications of pH:

• pH is crucial in industries like agriculture, medicine, and water treatment for monitoring the acidity or alkalinity of solutions.

• For example, maintaining the optimal pH of soil is essential for plant growth.

• Effect of pH on Biological Systems:

• Human blood has a pH range of 7.35 to 7.45, and deviations from this range can lead to severe health issues.

• The functioning of enzymes and metabolic processes in organisms is highly dependent on maintaining a stable pH.

Important Points

• Logarithmic Nature: A small change in H^+ concentration results in a significant shift in pH due to the logarithmic scale.

• Environmental Impact: Acid rain, caused by pollutants like sulfur dioxide and nitrogen oxides, decreases the pH of soil and water bodies, harming ecosystems.

• Food Science: pH is a critical factor in food preservation, fermentation, and flavor development in products like yogurt and pickles.

• Buffer Systems: Buffer solutions resist changes in pH when small amounts of acid or base are added, playing a vital role in maintaining biological and chemical stability.

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Q25. Answer: (d) Fore-brain

The correct answer is Fore-brain.

Key Points

• The fore-brain, also known as the cerebrum, is the main thinking part of the human brain. It is responsible for higher cognitive functions such as reasoning, decision-making, memory, and emotions.

• The fore-brain consists of two cerebral hemispheres connected by a structure called the corpus callosum. This allows communication between the left and right hemispheres of the brain.

• It plays a key role in sensory perception, including sight, hearing, touch, taste, and smell, by processing sensory input received from the environment.

• Key regions of the fore-brain include the thalamus (a relay center for sensory and motor signals) and the hypothalamus (which regulates homeostasis, hunger, thirst, and emotions).

• The cerebral cortex, the outermost layer of the fore-brain, is responsible for advanced functions such as language, abstract thinking, and voluntary motor control.

Additional Information

• Medulla:

• The medulla is a part of the hind-brain and is responsible for controlling vital autonomic functions such as breathing, heart rate, and blood pressure.

• It acts as a relay center for nerve signals between the brain and the spinal cord.

• Spinal Cord:

• The spinal cord is a long, cylindrical structure of nervous tissue that extends from the medulla and is enclosed within the vertebral column.

• It serves as the main pathway for transmitting information between the brain and the rest of the body, including motor commands and sensory data.

• Mid-brain:

• The mid-brain is located between the fore-brain and hind-brain and is involved in functions such as eye movement, hearing, and motor control.

• It contains structures like the tectum and tegmentum, which play roles in reflex actions and the regulation of alertness.

• Fore-brain:

• The fore-brain is the largest and most complex part of the brain. It is divided into four lobes: frontal, parietal, temporal, and

occipital, each specialized in different functions.

• It integrates sensory information, coordinates voluntary movements, and facilitates complex thought processes.

• Disorders of the fore-brain can affect memory, language, and emotions.

Important Points

• Brain Structure:

• The human brain is divided into three main parts: the fore-brain, mid-brain, and hind-brain.

• Each part has specialized functions, with the fore-brain being the most advanced and evolved.

• Functions of the Fore-brain:

• It controls advanced cognitive functions like thinking, problem-solving, and memory.

• It is also responsible for processing sensory information and initiating voluntary muscle movements.

• Clinical Relevance:

• Damage to the fore-brain can result in disorders such as Alzheimer's disease, Parkinson's disease, or stroke-related impairments.

Q26. Answer: (d) 4√3 : 25

Shortcut Trick

Side of Square (a) = 16 cm (since diagonal = a√2 = 16√2).

Perimeter of Square = 4 × 16 = 64 cm.

Side of Triangle (s) = (3/5 × 64) ÷ 3 = 64/5 cm.

Ratio of Areas = [√3/4 × (64/5)²] : [16²] = [(√3/4 × 4096)/25] : 256.

Ratio = [1024√3 / 25] : 256 = 4√3 : 25.

Therefore The correct answer is 4√3 : 25.

Alternate Method

Given:

Diagonal of square = 16√2 cm.

Perimeter of equilateral triangle = 3/5 × Perimeter of square.

Formula Used:

1. Diagonal of square = Side × √2

2. Area of square = Side²

3. Area of equilateral triangle = (√3/4) × Side²

Calculations:

=> Side of square (a) × √2 = 16√2

=> a = 16 cm

=> Perimeter of square = 4 × 16 = 64 cm

=> Area of square = 16 × 16 = 256 cm²

=> Perimeter of triangle = 3/5 × 64 = 192/5 cm

=> Side of triangle (s) = (192/5) ÷ 3 = 64/5 cm

=> Area of triangle = (√3/4) × (64/5)²

=> Area of triangle = (√3/4) × (4096/25) = 1024√3/25 cm²

=> Ratio = (1024√3/25) : 256

=> Ratio = (1024√3) : (256 × 25) = 4√3 : 25

Therefore The correct answer is 4√3 : 25.

Additional Information

Equilateral Triangle Properties

All sides are equal. Height (h) = (√3/2) × side. Area = (√3/4) × side² = h²/√3.

Square Properties

Area = side² = (diagonal²)/2. Perimeter = 4 × side. Diagonal = side × √2.

Ratio of Areas for Similar Polygons

For two similar figures, the ratio of their areas is equal to the square of the ratio of their corresponding linear dimensions (sides, perimeters, or diagonals).

Q27. Answer: (a) 25200

Shortcut Trick

Candidate A votes = Total Voters × Cast % × Valid % × A share %

Candidate A votes = 50,000 × 80/100 × 90/100 × 70/100

=> 50,000 × 0.8 × 0.9 × 0.7 = 25,200

Therefore The correct answer is 25200 votes.

Alternate Method

Given:

Total eligible voters = 50,000

Votes cast = 80%

Invalid votes = 10% (So, Valid votes = 90%)

Candidate A share = 70% of valid votes

Step-by-step Calculation:

=> Total votes cast = 50,000 × (80/100) = 40,000

=> Total valid votes = 40,000 × (90/100) = 36,000

=> Votes secured by Candidate A = 36,000 × (70/100)

=> Votes secured by Candidate A = 360 × 70 = 25,200

Therefore The correct answer is 25200 votes.

Additional Information

Percentage Change Base

Always ensure the percentage is calculated on the correct base. Here, invalid votes are a percentage of cast votes, not total voters.

Successive Percentage

For a series of percentage reductions or shares, the final value = Initial Value × (p1/100) × (p2/100) × ...

Winning Margin

If Candidate A gets 70% of valid votes, then Candidate B gets 30%. The winning margin is (70% − 30%) = 40% of valid votes.

Q28. Answer: (d) 8%

Shortcut Trick

Apply the successive percentage change formula: Net Change = a + b + (a × b)/100

Here, Markup (a) = +20% and Discount (b) = −10%.

Net Profit % = 20 − 10 + [20 × (−10)]/100

Net Profit % = 10 − 2 = 8%.

Therefore The correct answer is 8%.

Alternate Method

Given: Cost Price (CP) = Rs. 2,600, Markup = 20%, Discount = 10%.

=> Marked Price (MP) = CP × (100 + Markup %)/100

=> MP = 2600 × (120/100) = Rs. 3,120

=> Selling Price (SP) = MP × (100 − Discount %)/100

=> SP = 3120 × (90/100) = Rs. 2,808

=> Profit = SP − CP = 2808 − 2600 = Rs. 208

=> Profit % = (Profit/CP) × 100

=> Profit % = (208/2600) × 100 = 8%

Therefore The correct answer is 8%.

Additional Information

Marked Price and CP Relation

The relationship between CP and MP is given by: MP/CP = (100 + Profit%)/(100 − Discount%).

Successive Discounts

If two successive discounts d1 and d2 are given, the single equivalent discount is (d1 + d2 − d1d2/100)%.

Dishonest Dealer

Profit % = [Error / (True Value − Error)] × 100, when a dealer uses false weights.

Q29. Answer: (a) Rs. 150

Shortcut Trick

To find the smaller value (Raj's share) when the sum and difference are known:

Raj's spending = (Total Sum − Difference) ÷ 2

Raj's spending = (380 − 80) ÷ 2

Raj's spending = 300 ÷ 2 = Rs. 150

Therefore The correct answer is Rs. 150.

Alternate Method

Given:

Total expenditure = Rs. 380

Spending difference (Ravi − Raj) = Rs. 80

Let Raj's spending be x.

Then, Ravi's spending = x + 80

=> x + (x + 80) = 380

=> 2x + 80 = 380

=> 2x = 380 − 80

=> 2x = 300

=> x = 300 ÷ 2

=> x = 150

Therefore The correct answer is Rs. 150.

Additional Information

Linear Equations in One Variable

Equations of the form ax + b = c where x is the unknown variable to be solved by transposing constants.

Sum and Difference Formula

If A + B = S and A − B = D, then the Larger value A = (S + D) ÷ 2 and Smaller value B = (S − D) ÷ 2.

Q30. Answer: (a) 28

Shortcut Trick

Total Distance = 80 + 32 = 112 km

Total Time = (80 ÷ 40) + (32 ÷ 16) = 2 + 2 = 4 hours

Average Speed = Total Distance ÷ Total Time = 112 ÷ 4 = 28 kmph

Therefore The correct answer is 28 km/hr.

Alternate Method

Given:

Distance 1 (d1) = 80 km, Speed 1 (s1) = 40 km/hr

Distance 2 (d2) = 32 km, Speed 2 (s2) = 16 km/hr

Formula Used:

Average Speed = Total Distance ÷ Total Time

Time = Distance ÷ Speed

Calculations:

=> Time taken for first part (t1) = 80 ÷ 40 = 2 hours

=> Time taken for second part (t2) = 32 ÷ 16 = 2 hours

=> Total Time = t1 + t2 = 2 + 2 = 4 hours

=> Total Distance = d1 + d2 = 80 + 32 = 112 km

=> Average Speed = 112 ÷ 4 = 28 km/hr

Therefore The correct answer is 28 km/hr.

Additional Information

Average Speed (Equal Distances)

When a body covers two equal distances at speeds x and y, the average speed is 2xy/(x + y).

Relative Speed

For objects moving in the same direction, relative speed is |s1 − s2|; in opposite directions, it is s1 + s2.

Unit Conversion

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

Q31. Answer: (c) 12.5%

Shortcut Trick

Cost Price (CP) : Selling Price (SP) ratio = 12000 : 13500 = 8 : 9.

Profit = 9 − 8 = 1 unit.

Profit % = (1 ÷ 8) × 100 = 12.5%.

Therefore The correct answer is 12.5%.

Alternate Method

Given:

Cost Price (CP) = Rs. 12,000

Selling Price (SP) = Rs. 13,500

Formula Used:

Profit = SP − CP

Profit % = (Profit ÷ CP) × 100

Calculations:

=> Profit = 13,500 − 12,000 = Rs. 1,500

=> Profit % = (1,500 ÷ 12,000) × 100

=> Profit % = (1 ÷ 8) × 100

=> Profit % = 12.5%

Therefore The correct answer is 12.5%.

Additional Information

Loss Percentage

When CP > SP, Loss % = [(CP − SP) ÷ CP] × 100.

Relation between SP and CP

SP = CP × [(100 + Profit %) ÷ 100] or SP = CP × [(100 − Loss %) ÷ 100].

Marked Price and Discount

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

Q32. Answer: (a) 10 m

Shortcut Trick

In a 30°-60°-90° triangle, the side opposite to 30° is 1/√3 times the side opposite to 60°.

Base (opposite to 60°) = 20 m.

Height (opposite to 30°) = 20 / √3 m.

Using the given approximation √3 ≈ 2:

Height = 20 ÷ 2 = 10 m.

Therefore The correct answer is 10 m.

Alternate Method

Given: Distance from base (B) = 20 m, Angle of elevation (θ) = 30°.

Formula Used: tan(θ) = Perpendicular / Base

=> tan(30°) = Height / 20

=> 1/√3 = Height / 20

=> Height = 20 / √3

=> Since √3 ≈ 2 is given:

=> Height = 20 ÷ 2

=> Height = 10 m

Therefore The correct answer is 10 m.

Additional Information

Trigonometric Ratios

Standard values for tan include tan(30°) = 1/√3, tan(45°) = 1, and tan(60°) = √3.

Angle of Elevation

It is the angle between the horizontal line of sight and the line of sight up to an object.

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Right Triangle Properties

Pythagoras theorem states that Base² + Perpendicular² = Hypotenuse².

Q33. Answer: (d) 59

Shortcut Trick

Teacher's Age = New Average + (Initial Number of Students × Increase in Average)

Increase in average = 34 − 33 = 1 year.

Teacher's Age = 34 + (25 × 1) = 34 + 25 = 59 years.

Therefore The correct answer is 59 years.

Alternate Method

Given:

Average age of 25 students = 33 years.

Average age of 26 people (including teacher) = 34 years.

Formula Used:

Total = Average × Number of entities

Calculations:

=> Total age of 25 students = 25 × 33

=> Total age of 25 students = 825 years

=> Total age including teacher (26 people) = 26 × 34

=> Total age including teacher = 884 years

=> Teacher's Age = Total age of 26 people − Total age of 25 students

=> Teacher's Age = 884 − 825 = 59 years

Therefore The correct answer is 59 years.

Additional Information

Including a New Member

When a new person joins a group, the Age of New Member = New Average + (Old Member Count × Change in Average).

Excluding an Existing Member

When a person leaves, the Age of Outgoing Member = Old Average + (New Member Count × Change in Average).

Replacing a Member

If one person is replaced by another, the Age of New Person = Age of Replaced Person + (Total Count × Change in Average).

Q34. Answer: (c) 198

Given:

$6 \times 6 + 6 \times (8 - 5)^2 \div 3 \times 9$

Concept Used:

BODMAS rule

Calculation:

=> $6 \times 6 + 6 \times (3)^2 \div 3 \times 9$

=> $6 \times 6 + 6 \times 9 \div 3 \times 9$

=> $36 + 54 \div 3 \times 9$

=> $36 + 18 \times 9$

=> $36 + 162$

=> 198

Therefore The correct answer is 198

Q35. Answer: (d) 10661

Shortcut Trick

Net multiplying factor = 1.12 × 0.92 × 1.08

0.92 × 1.08 = (1 − 0.08)(1 + 0.08) = 1 − 0.0064 = 0.9936

Population in 2018 = 9580 × 1.12 × 0.9936

Population ≈ 10729.6 × 0.9936 ≈ 10661

Therefore The correct answer is 10661.

Alternate Method

Given:

Initial population (P0) = 9580

Rate of change: r1 = +12%, r2 = −8%, r3 = +8%

Calculations:

=> Population in 2018 = 9580 × (1 + 12/100) × (1 − 8/100) × (1 + 8/100)

=> Population = 9580 × (112/100) × (92/100) × (108/100)

=> Population = 9580 × 1.12 × 0.9936

=> Population = 10729.6 × 0.9936

=> Population = 10660.93... ≈ 10661

Therefore The correct answer is 10661.

Additional Information

Successive Percentage Change

Total change = [a + b + (a × b)/100]% where a and b are successive changes. For three changes, apply the formula twice.

Multiplying Factor Method

Final Value = Initial Value × (100 ± r1)/100 × (100 ± r2)/100 ... and so on.

Algebraic Identity Shortcut

When a value increases and then decreases by the same x%, there is always a net decrease of (x^2/100)%.

Q36. Answer: (d) 65%

Shortcut Trick

Use the direct relationship formula: MP / CP = (100 + Profit%) / (100 − Discount%)

MP / CP = (100 + 32) / (100 − 20) = 132 / 80 = 33 / 20

Markup % = [(33 − 20) / 20] × 100 = 13/20 × 100 = 65%

Therefore The correct answer is 65%.

Alternate Method

Given:Discount = 20%, Profit = 32%

Formula Used: Selling Price (SP) = CP × (100 + Profit%)/100 = MP × (100 − Discount%)/100

=> Let Cost Price (CP) = 100

=> Selling Price (SP) = CP + 32% of CP = 100 + 32 = 132

=> Marked Price (MP) × (100 − 20)% = SP

=> MP × 80/100 = 132

=> MP = (132 × 100) / 80 = 132 × 1.25 = 165

=> Markup Value = MP − CP = 165 − 100 = 65

=> Markup % = (Markup Value / CP) × 100 = (65 / 100) × 100 = 65%

Therefore The correct answer is 65%.

Additional Information

Markup Percentage

It is the percentage by which the cost price is increased to reach the marked price: Markup % = [(MP − CP) / CP] × 100.

Effective Discount Formula

For successive discounts a% and b%, Net Discount = [a + b − (a × b)/100]%.

Profit and Markup Relation

Profit % = Markup % − Discount % − [(Markup % × Discount %) / 100]. This is derived from the successive percentage change formula.

Q37. Answer: (d) 6

Shortcut Trick

Total Work (LCM of 3, 9, 18) = 18 units.

Combined efficiency of A, B, and C = (18 ÷ 3) + (18 ÷ 9) + (18 ÷ 18) = 6 + 2 + 1 = 9 units/day.

Work to be completed = 3 × 18 = 54 units.

Time required = 54 ÷ 9 = 6 days.

Therefore The correct answer is 6 days.

Alternate Method

Given: Time taken by A = 3 days, B = 9 days, and C = 18 days.

Person	Days	Total Work	Efficiency
A	3	18	6
B	9	2	
C	18	1	

=> Combined Efficiency of (A + B + C) = 6 + 2 + 1 = 9 units/day.

=> Original Work = 18 units.

=> New Work (Thrice the original) = 3 × 18 = 54 units.

=> Time required = Total New Work ÷ Combined Efficiency

=> Time = 54 ÷ 9

=> Time = 6 days.

Therefore The correct answer is 6 days.

Additional Information

Work and Efficiency

Efficiency is inversely proportional to the time taken to complete a work. Total Work = Efficiency × Time.

Combined Work Formula

For three people taking x, y, and z days, combined time T = (x × y × z) ÷ (xy + yz + zx).

Multiple Work Case

If the work is increased by 'n' times, the time required at the same efficiency also increases by 'n' times.

Q38. Answer: (b) 1054 m

Shortcut Trick

Speed of the train is the ratio of difference in tunnel lengths to the difference in time taken.

Speed = (2708 − 2195) ÷ (88 − 76) = 513 ÷ 12 = 42.75 m/s.

Length of train = (Speed × Time1) − Tunnel Length1 = (42.75 × 88) − 2708.

Length of train = 3762 − 2708 = 1054 m.

Therefore The correct answer is 1054 m.

Alternate Method

Given: Length of Tunnel 1 (L1) = 2708 m, Time 1 (T1) = 88 s; Length of Tunnel 2 (L2) = 2195 m, Time 2 (T2) = 76 s.

Formula Used: Speed = (Length of train + Length of tunnel) ÷ Time

=> Let the length of the train be L.

=> Speed = (L + 2708) ÷ 88 = (L + 2195) ÷ 76

=> 76 × (L + 2708) = 88 × (L + 2195)

=> 19 × (L + 2708) = 22 × (L + 2195) (Dividing both sides by 4)

=> 19L + 51452 = 22L + 48290

=> 22L − 19L = 51452 − 48290

=> 3L = 3162

=> L = 1054 m

Therefore The correct answer is 1054 m.

Additional Information

Train Crossing a Static Object with Length

When a train crosses a platform, bridge, or tunnel, the total distance covered is the sum of the length of the train and the length of the object.

Relative Speed

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

Unit Conversion

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

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Q39. Answer: (a) 8

Shortcut Trick

Total observations n = 10 (Even).

Median = Average of the 5^(th) and 6^(th) terms = 12.

Sum of middle terms = 12 × 2 = 24.

Arranging known values: 4, 6, 7, 9, 11, 15, 16, 20, 23.

11 + (K + 5) = 24 => K + 16 = 24 => K = 8.

Therefore The correct answer is 8.

Alternate Method

Given: Data = 4, 23, 11, 7, 6, 9, (K + 5), 15, 20, 16 and Median = 12.

Formula: For even n, Median = [(n/2)^(th) term + (n/2 + 1)^(th) term] / 2.

Arranging data in ascending order: 4, 6, 7, 9, 11, (K + 5), 15, 16, 20, 23.

=> 5^(th) term = 11

=> 6^(th) term = K + 5

=> Median = (11 + K + 5) / 2

=> 12 = (K + 16) / 2

=> 24 = K + 16

=> K = 24 − 16

=> K = 8

Therefore The correct answer is 8.

Additional Information

Median for Odd Number of Observations

If n is odd, after arranging in ascending/descending order, Median = [(n + 1) / 2]^(th) term.

Empirical Relationship

The relationship between central tendencies is given by: Mode = 3 Median − 2 Mean.

Effect of Constant Addition

If a constant 'c' is added to every observation in a data set, the new median will be Old Median + c.

Q40. Answer: (d) $x^2 + 5x + 6$

Shortcut Trick

Use the standard algebraic identity: $(x + a)(x + b) = x^2 + (a + b)x + ab$.

Here, a = 2 and b = 3.

Sum of constants (a + b) = 2 + 3 = 5.

Product of constants (ab) = 2 × 3 = 6.

Substituting these: $x^2 + 5x + 6$.

Therefore The correct answer is $x^2 + 5x + 6$.

Alternate Method

Given Expression: (x + 2) (x + 3)

To simplify, apply the Distributive Property (FOIL method) by multiplying each term in the first binomial by each term in the second binomial.

=> x(x + 3) + 2(x + 3)

=> (x × x) + (x × 3) + (2 × x) + (2 × 3)

=> $x^2 + 3x + 2x + 6$

Now, combine the like terms (3x and 2x):

=> $x^2 + 5x + 6$

Therefore The correct answer is $x^2 + 5x + 6$.

Additional Information

Algebraic Identity for Binomials

The product of two binomials with a common variable is $(x + a)(x + b) = x^2 + (a + b)x + ab$, where (a+b) is the sum and ab is the product of the constants.

Standard Quadratic Form

A simplified expression in the form $ax^2 + bx + c$ is known as a quadratic trinomial, where a, b, and c are constants.

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FOIL Rule

FOIL stands for First, Outer, Inner, Last. It is a mnemonic used to remember the steps to multiply two binomials correctly.

Q41. Answer: (d) 7S

Shortcut Trick

The ratio of radii (k) = 10.5 ÷ 1.5 = 7.

When a sphere is melted into smaller ones, the number of balls (n) = $k^3 = 7^3 = 343$.

The surface area of one small ball = S ÷ k^2 = S ÷ 7^2 = S/49.

Total Surface Area = n × (Surface area of 1 small ball) = 343 × (S/49) = 7S.

Therefore The correct answer is 7S.

Alternate Method

Given:

Radius of large sphere (R) = 10.5 cm

Radius of small ball (r) = 1.5 cm

Original Surface Area = S

Formula Used:

Volume of Sphere = 4/3 × π × r^3

Surface Area of Sphere = 4 × π × r^2

Calculations:

=> Volume of large sphere = 4/3 × π × $(10.5)^3$

=> Volume of one small ball = 4/3 × π × $(1.5)^3$

=> Number of small balls (n) = [4/3 × π × $(10.5)^3$] ÷ [4/3 × π × $(1.5)^3$]

=> n = $(10.5 / 1.5)^3 = 7^3 = 343$

=> Original Surface Area (S) = 4 × π × $(10.5)^2$

=> Surface Area of 1 small ball = 4 × π × $(1.5)^2$

=> Total Surface Area (TSA) = 343 × 4 × π × $(1.5)^2$

=> Since 1.5 = 10.5/7, TSA = 343 × 4 × π × $(10.5 / 7)^2$

=> TSA = 343 × [4 × π × $(10.5)^2$] ÷ 49

=> TSA = (343 / 49) × S = 7S

Therefore The correct answer is 7S.

Additional Information

Volume and Surface Area Relationship

When an object is melted and recast, its total volume remains constant, but the total surface area usually increases as the number of pieces increases.

Sphere Scaling Properties

If the radius is changed by a factor of k, the surface area changes by k^2 and the volume changes by k^3.

Hemisphere Formulas

Curved Surface Area = $2\pi r^2$ | Total Surface Area = $3\pi r^2$ | Volume = 2/3 πr^3.

Q42. Answer: (b) 7132975

Shortcut Trick

To check divisibility by 41, use the oscillator method where the multiplier is 4.

Subtract 4 times the last digit from the remaining number: 713297 − (5 × 4) = 713277.

Repeat: 71327 − (7 × 4) = 71299 → 7129 − (9 × 4) = 7093 → 709 − (3 × 4) = 697 → 69 − (7 × 4) = 41.

Since 41 is divisible by 41, the whole number is divisible by 41.

Therefore The correct answer is 7132975.

Alternate Method

Given: Numbers 7575438, 7132975, 7397665, 7497194.

Method: Perform direct division for each option to check for a zero remainder.

=> Option 1: 7575438 ÷ 41 = 184766.78 (Not divisible)

=> Option 2: 7132975 ÷ 41

=> 41 × 1 = 41; 71 − 41 = 30; Carry 3 → 303

=> 41 × 7 = 287; 303 − 287 = 16; Carry 2 → 162

=> 41 × 3 = 123; 162 − 123 = 39; Carry 9 → 399

=> 41 × 9 = 369; 399 − 369 = 30; Carry 7 → 307

=> 41 × 7 = 287; 307 − 287 = 20; Carry 5 → 205

=> 41 × 5 = 205; 205 − 205 = 0

=> 7132975 ÷ 41 = 173975

Therefore The correct answer is 7132975.

Additional Information

Divisibility Rule for 41

Subtract 4 times the last digit from the number formed by the remaining digits. If the result is 0 or divisible by 41, the original number is divisible by 41.

Oscillators for Prime Numbers

For primes ending in 1 (like 31, 41, 61), the negative oscillator is used. For 41, the oscillator is 4.

General Divisibility Shortcut

If a number is divisible by n, then any multiple of that number added or subtracted from it will also be divisible by n.

Q43. Answer: (c) 4620

Shortcut Trick

Product of fractions: 1/2 × 7/10 × 1/3 = 7/60

Equating to value: 7 units = 539

1 unit = 77

60 units = 77 × 60 = 4620

Therefore The correct answer is 4620.

Alternate Method

Let the number be x.

Given: 50% × 70% × (2/6) × x = 539

=> (50/100) × (70/100) × (1/3) × x = 539

=> (1/2) × (7/10) × (1/3) × x = 539

=> (7/60) × x = 539

=> x = (539 × 60) ÷ 7

=> x = 77 × 60

=> x = 4620

Therefore The correct answer is 4620.

Additional Information

Percentage to Fraction Conversion

To convert percentage to fraction, divide by 100. Example: 50% = 50/100 = 1/2 and 70% = 70/100 = 7/10.

Successive Percentage Calculation

When multiple percentages are applied to a number, they can be multiplied as fractions directly to find the final effective multiplier.

Reverse Calculation Method

To find the original number when the final value is known, multiply the result by the reciprocal of each fraction in reverse order.

Q44. Answer: (d) 1768

Shortcut Trick

Combine the ratio: 1^(st) : 2^(nd) : 3^(rd) = (20 × 21) : (18 × 21) : (18 × 12).

Simplified Ratio = 420 : 378 : 216 → Divide by 6 → 70 : 63 : 36.

Total units = 70 + 63 + 36 = 169 units.

169 units = 8788 => 1 unit = 52.

Difference (1^(st) − 3^(rd)) = (70 − 36) × 52 = 34 × 52 = 1768.

Therefore The correct answer is 1768.

Alternate Method

Given: Sum of numbers = 8788. Ratio A : B = 20 : 18, Ratio B : C = 21 : 12.

Formula Used: Combined Ratio = A/B × B/C.

=> Simplify Ratio A : B = 10 : 9.

=> Simplify Ratio B : C = 7 : 4.

=> To make B common, multiply A : B by 7 and B : C by 9.

=> A : B : C = (10 × 7) : (9 × 7) : (4 × 9) = 70 : 63 : 36.

=> Let numbers be 70x, 63x, and 36x.

=> 70x + 63x + 36x = 8788

=> 169x = 8788

=> x = 8788 ÷ 169 = 52

=> Difference = 70x − 36x = 34x

=> Difference = 34 × 52 = 1768.

Therefore The correct answer is 1768.

Additional Information

Compound Ratio

When two or more ratios are multiplied together, the result is the compound ratio. For A : B and B : C, the combined ratio is A : B : C.

Proportion Rule

If a : b :: c : d, then the product of extremes equals the product of means (a × d = b × c).

Duplicate Ratio

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

Q45. Answer: (c) 15 years

Shortcut Trick

Present Ratio = 3 : 4 (Difference = 1)

Ratio after 25 years = 8 : 9 (Difference = 1)

Increase in ratio units = 8 − 3 = 5 units (or 9 − 4 = 5 units)

Since 5 units = 25 years, then 1 unit = 5 years.

Present age of Sunil = 3 units = 3 × 5 = 15 years.

Therefore The correct answer is 15 years.

Alternate Method

Given: Present ratio of Sunil and Shyam = 3 : 4

Formula Used: Ratio and Proportions for Age Problems

=> Let present age of Sunil be 3x and Shyam be 4x.

=> According to the question: (3x + 25) / (4x + 25) = 8 / 9

=> 9 × (3x + 25) = 8 × (4x + 25)

=> 27x + 225 = 32x + 200

=> 32x − 27x = 225 − 200

=> 5x = 25

=> x = 5

=> Present age of Sunil = 3x = 3 × 5 = 15 years.

Therefore The correct answer is 15 years.

Additional Information

Constant Age Difference

The difference between the ages of two people always remains constant over time. If the ratio differences are not equal, multiply to make them equal.

Ratio Balancing Method

If present ratio is a:b and future ratio is c:d, then calculate the difference (b-a) and (d-c). Multiply ratios by the other difference to equalize them.

Linear Equation Setup

Age after n years = (Present Age + n); Age n years ago = (Present Age − n).

Q46. Answer: (d) 40 cm

Shortcut Trick

Find the semi-perimeter s = (41 + 21 + 50) ÷ 2 = 56 cm.

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Calculate Area = √(56 × (56−41) × (56−21) × (56−50)) = √(56 × 15 × 35 × 6) = 420 cm².
Altitude (h) corresponding to side 21 cm: h = (2 × Area) ÷ Base = (2 × 420) ÷ 21.
h = 840 ÷ 21 = 40 cm.
Therefore The correct answer is 40 cm.
Alternate Method
Given:
Sides of the triangle: a = 41 cm, b = 21 cm, c = 50 cm.
Formula used:
1. Heron's Formula: Area = √(s(s − a)(s − b)(s − c))
2. Area of Triangle: Area = 1/2 × base × height
Calculations:
=> Semi-perimeter s = (41 + 21 + 50) ÷ 2
=> s = 112 ÷ 2 = 56 cm
=> Area = √(56 × (56 − 41) × (56 − 21) × (56 − 50))
=> Area = √(56 × 15 × 35 × 6)
=> Area = √(8 × 7 × 3 × 5 × 7 × 5 × 2 × 3)
=> Area = √(16 × 9 × 25 × 49) = 4 × 3 × 5 × 7
=> Area = 420 cm²
Now, using the area to find the altitude (h) on the side of 21 cm:
=> 420 = 1/2 × 21 × h
=> 840 = 21 × h
=> h = 840 ÷ 21
=> h = 40 cm
Therefore The correct answer is 40 cm.
Additional Information
Heron's Formula
It is used to calculate the area of any triangle when all three sides are known: Area = √(s(s−a)(s−b)(s−c)), where s is the semi-perimeter.
Altitudes of a Triangle
Every triangle has three altitudes. The length of an altitude is inversely proportional to the length of the corresponding base.
Area of Right-Angled Triangle
For a right-angled triangle, the area is simply 1/2 × product of the two sides containing the right angle.

Q47. Answer: (a) 3

Shortcut Trick
Equate total work: (19M + 13W) × 12 = (17M + 9W) × 14
=> 6(19M + 13W) = 7(17M + 9W)
=> 114M + 78W = 119M + 63W
=> 119M − 114M = 78W − 63W
=> 5M = 15W => 1M = 3W
Therefore The correct answer is 3 women.
Alternate Method
Given: 19 Men (M) and 13 Women (W) take 12 days. 17 Men and 9 Women take 14 days.
Formula Used: Total Work = (Efficiency × Time)

Group	Time (Days)	Total Work Expression
Group 1	12	12 × (19M + 13W)
Group 2	14	14 × (17M + 9W)

Calculations:
=> 12 × (19M + 13W) = 14 × (17M + 9W)
=> 228M + 156W = 238M + 126W
=> 238M − 228M = 156W − 126W

=> 10M = 30W

=> 1M = 3W

Therefore The correct answer is 3 women.

Additional Information

Work Equality Principle

When different groups complete the same work, we use M1D1 = M2D2 to find the ratio of efficiencies.

Man-Days Concept

Total work is often expressed in terms of Man-days or Woman-days, which is the product of the number of people and the time taken.

Efficiency Ratio

If 1 man is equivalent to 'n' women, the efficiency ratio M:W is n:1.

Q48. Answer: (b) 28800

Shortcut Trick

Difference in Simple Interest = Principal × Time × (Difference in Rates) ÷ 100

Difference in Rates = 7.5% − 3.5% = 4%

Difference in Interest = 2,40,000 × 3 × 4 ÷ 100

Difference in Interest = 2,400 × 12 = 28,800

Therefore The correct answer is Rs. 28800.

Alternate Method

Given:

Principal (P) = Rs. 2,40,000

Rate for Bank A (R1) = 3.5% p.a.

Rate for Bank B (R2) = 7.5% p.a.

Time (T) = 3 years

Formula Used:

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

Calculations:

=> SI paid to Bank A = (2,40,000 × 3.5 × 3) ÷ 100

=> SI_A = 2,400 × 10.5 = Rs. 25,200

=> SI paid to Bank B = (2,40,000 × 7.5 × 3) ÷ 100

=> SI_B = 2,400 × 22.5 = Rs. 54,000

=> Positive Difference = SI_B − SI_A

=> Difference = 54,000 − 25,200 = 28,800

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Q49. Answer: (a) 381

Shortcut Trick

List the first 16 prime numbers: 2, 3, 5, 7, 11, 13, 17, 19, 23, 29, 31, 37, 41, 43, 47, 53.

Group them for easy addition: (2+53) + (3+47) + (5+43) + (7+41) + (11+37) + (13+31) + (17+29) + (19+23).

Sum = 55 + 50 + 48 + 48 + 48 + 44 + 46 + 42 = 381.

Therefore The correct answer is 381.

Alternate Method

Given: Need to find the sum of the first 16 prime numbers.

Step-by-step addition:

=> 2 + 3 = 5

=> 5 + 5 = 10

=> 10 + 7 = 17

=> 17 + 11 = 28

=> 28 + 13 = 41

=> 41 + 17 = 58

=> 58 + 19 = 77

=> 77 + 23 = 100
=> 100 + 29 = 129
=> 129 + 31 = 160
=> 160 + 37 = 197
=> 197 + 41 = 238
=> 238 + 43 = 281
=> 281 + 47 = 328
=> 328 + 53 = 381
Therefore The correct answer is 381.
Additional Information
Definition of Prime Numbers
A prime number is a natural number greater than 1 that has no positive divisors other than 1 and itself.
Smallest Prime Number
2 is the only even prime number and the smallest prime number.
Prime Numbers up to 100
There are 25 prime numbers between 1 and 100.

Q50. Answer: (a) 392

Shortcut Trick
For two numbers a and b, the third proportional x is calculated as $x = b^2 \div a$.
Given: a = 8 and b = 56.
=> $x = (56 \times 56) \div 8$
=> $x = 7 \times 56 = 392$.
Therefore The correct answer is 392.
Alternate Method
Given: First number (a) = 8, Second number (b) = 56, Third proportional = x.
Formula Used: If a, b, and x are in continued proportion, then a : b = b : x.
Calculations:
=> 8 / 56 = 56 / x
=> 1 / 7 = 56 / x
=> x = 56 × 7
=> x = 392
Therefore The correct answer is 392.
Additional Information
Mean Proportional
The mean proportional between two numbers a and b is $\sqrt{(a \times b)}$.
Fourth Proportional
For three numbers a, b, and c, the fourth proportional d is given by $d = (b \times c) \div a$.
Compounded Ratio
The compounded ratio of a:b and c:d is (a × c) : (b × d).

Q51. Answer: (a) 5

Given series: (Left) 5 1 3 8 4 5 1 6 3 7 1 9 2 5 9 4 8 5 5 3 1 2 2 1 6 2 8 (Right)
According to the question:
Required condition: Odd number - Odd number - Even number
(Left) 5 1 3 8 4 5 1 6 3 7 1 9 2 5 9 4 8 5 5 3 1 2 2 1 6 2 8 (Right)
Thus, there are five such odd numbers which are immediately preceded by an odd number and also immediately followed by an even number.
Hence, "Option 1" is the correct answer.

Q52. Answer: (a) 28

Decoding signs:

Sign	A	B	C	D
Stands For	÷	×	•	•

Given: 12 C 16 B 15 A 8 D 14 = ?3
12 C 16 B 15 A 8 D 14 = ? => 12 + 16 × 15 ÷ 8 - 14 = ?3
=> 12 + 16 × 15 ÷ 8 - 14 = ?3
=> 12 + 16 × 1.875 - 14 = ?3
=> 12 + 30 - 14 = ?3
=> 42 - 14 = ?3
=> 28 = ?
Hence, "Option 1" is the correct answer.

Q53. Answer: (b) 1

Given series: (Left) $ 9 $ 6 7 8 £ 5 1 8 2 £ 9 3 4 6 9 # 8 8 7 7 (Right)
According to the question:
Required condition: Symbol - Number - Symbol
(Left) $ 9 $ 6 7 8 £ 5 1 8 2 £ 9 3 4 6 9 # 8 8 7 7 (Right)
Thus, there is one such numbers which is immediately preceded by a symbol and also immediately followed by a symbol.
Hence, "Option 2" is the correct answer.

Q54. Answer: (c) 28

Decoding signs:

Sign	A	B	C	D
Stands For	÷	×	•	•

Given: 8 D 14 A 2 C 3 B 9 = ?3
8 D 14 A 2 C 3 B 9 = ? => 8 - 14 ÷ 2 + 3 × 9 = ?
=> 8 - 14 ÷ 2 + 3 × 9 = ?
=> 8 - 7 + 3 × 9 = ?
=> 8 + 27 - 7 = ?
=> 35 - 7 = ?3
=> 28 = ?
Hence, "Option 3" is the correct answer.

Q55. Answer: (c) RO −15

The logic followed here is:
SG 11 is related to VH −6
And,
NM 19 is related to QN 2
Similarly,
ON 2 is related to
Hence, "Option 3" is the correct answer.

Q56. Answer: (b) ng

According to the question:
Thus, 'queen' is coded as 'ng'.
Hence, "Option 2" is the correct answer.

Q57. Answer: (c) 4

According to the question:
Thus, 'A' is coded as 'ng'.
Hence, "Option 3" is the correct answer.

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Q58. Answer: (a) FH 5

The logic followed here is:

PO 8 is related to SM -5

And,

QW 12 is related to TU -1

Similarly,

CJ 18 is related to

Hence, "Option 1" is the correct answer.

Q59. Answer: (d) One

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

1) Only two people sit between F and B when counted from the right of F.

2) Only two people sit between B and A when counted from the right of B.

3) Only three people sit between F and E when counted from the right of F.

4) D sits to the immediate left of C.

The remaining position will be occupied by the only person left i.e. G.

Thus, one person sit between F and G when counted from the left of F.

Hence, "Option 4" is the correct answer.

Q60. Answer: (a) 11 km towards the west

Given:

Naveen starts from Point A and drives 11 km towards the south.

He then takes a left turn, drives 5 km, turns left and drives 4 km.

He then takes a right turn and drives 6 km.

He takes a final left turn, drives 7 km and stops at Point P.

Here, Naveen should drive 11 km in the west direction in order to reach Point A again.

Hence, "Option 1" is the correct answer.

Q61. Answer: (b) 43

The logic followed here is:

Hence, "Option 2" is the correct answer.

Q62. Answer: (b) Only conclusion (I) follows

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

Conclusions:

(I) Some professionals are teachers → Follow (As some teachers are writers and all writers are professionals. As some part of teachers is common with writers which whole comes in professionals, therefore it is true.)

(II) All teachers are professionals → Does not follow (As some teachers are writers and all writers are professionals. So it is possible but not definite.)

Therefore Here, Only conclusion (I) follows.

Hence, the correct answer is "Option 2".

Q63. Answer: (b) Father's sister

Decoding symbols:

A is				
Symbol	•	•	×	÷
Meaning	Sister	Mother	Husband	Brother
to B				

Given: T + K ÷ S × U - J = ?

T + K → T is the sister of K.

K ÷ S → K is the brother of S.

S × U → S is the husband of U.

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U - J → U is the mother of J.

Here, T is J's father's sister.

Hence, "Option 2" is the correct answer.

Q64. Answer: (a) One

Given: (Left) 458 569 248 671 349 (Right)

According to the question:

Given numbers	458	569	248	671	349
2 is added to the first digit of every number	+2	+2	+2	+2	+2
Resultant numbers	658	769	448	871	549
If the first digit be exactly divided by the second digit of that number	6 ÷ 5	7 ÷ 6	4 ÷ 4	8 ÷ 7	5 ÷ 4
Required answer	Not divisible	Not divisible	1 divisible	Not divisible	Not divisible

Thus, according to the final arrangement, in only one number will the first digit be exactly divisible by the second digit.

Hence, "Option 1" is the correct answer.

Q65. Answer: (a) EHJ 71

The logic followed here is:

Hence, "Option 1" is the correct answer.

Q66. Answer: (c) 3 km to the east

Given:

Rahul starts from Point A and drives 9 km towards North.

He then takes a right turn, drives 6 km, turns right and drives 14 km.

He then takes a right turn and drives 9 km.

He takes a final right turn, drives 5 km and stops at Point P.

Here, Rahul should drive 3 km in the east direction in order to reach Point A again.

Hence, "Option 3" is the correct answer.

Q67. Answer: (b) Four

Given: Seven boxes, A, B, C, D, I, J and K, are kept one over the other, but not necessarily in the same order.

1) Only two boxes are kept below I.

2) Only one box is kept above J.

3) Only one box is kept between J and K.

Boxes
J
K
I

4) B is kept immediately above C.

5) D is kept at some place below A.

Boxes

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A
J
D
K
I
B
C

Thus, four boxes are kept between A and B.

Hence, "Option 2" is the correct answer.

Q68. Answer: (a) Only conclusion (I) follows

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

Conclusions:

(I): Some candies are sprouts → Follow (As all fruits are candies and all fruits are sprouts. As whole fruits comes in candies and sprouts, therefore it is true.)

(II): All sprouts are fruits → Does not follow (As all fruits are sprouts. So it is possible but not definite.)

Therefore Here, Only conclusion (I) follows.

Hence, the correct answer is "Option 1".

Q69. Answer: (b) JSI

The logic followed here is:

Hence, "Option 2" is the correct answer.

Q70. Answer: (b) 9

Given series: (Left) 1 1 9 6 4 1 5 3 1 1 8 2 3 2 1 4 5 9 3 9 5 5 4 6 9 3 1 (Right)

According to the question:

Required condition: Odd number - Odd number - Odd number

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

Thus, there are nine such numbers which are odd numbers are immediately preceded by an odd number and also immediately followed by an odd number.

Hence, "Option 2" is the correct answer.

Q71. Answer: (b) A

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

1) D sits third from the left end of the line.

2) E sits fifth from the left end of the line.

3) B sits between A and D.

The remaining position will be occupied by the only person left i.e. C.

Thus, A sits at the extreme left end of the line.

Hence, "Option 2" is the correct answer.

Q72. Answer: (d) CZ−ZZ

The logic followed here is:

Option 1) DA−BY

Option 2) CZ−AX

Option 3) GD−EB

Option 4) CZ−ZZ

Thus, "CZ−ZZ" is the odd one out.

Hence, "Option 4" is the correct answer.

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Q73. Answer: (c) 71

According to the question:

Roshan's rank from the top → 54th

Roshan's rank from the bottom → 18th

Total students → Roshan's rank from the top + Roshan's rank from the bottom - 1

→ 54 + 18 - 1 = 71

Hence, "Option 3" is the correct answer.

Q74. Answer: (c) 35

The logic followed here is:

Hence, "Option 3" is the correct answer.

Q75. Answer: (d) 502

The logic followed here is:

Hence, "Option 4" is the correct answer.

Q76. Answer: (a) FHM

The logic followed here is:

Option 1) FHM

Option 2) ACI

Option 3) DFL

Option 4) LNT

Thus, "FHM" is the odd one out.

Hence, "Option 1" is the correct answer.

Q77. Answer: (a) UL 10

The logic followed here is:

KP 15 is related to NL 7

And,

BL 5 is related to EH -3

Similarly,

RP 18 is related to

Hence, "Option 1" is the correct answer.

Q78. Answer: (c) 192

Given: 312 + 6 × 5 − 32 ÷ 300 = ?

According to the question, after '+' and ' ÷ ' are interchanged and ' - ' and ' × ' are interchanged:

312 + 6 × 5 − 32 ÷ 300 = ? => 312 ÷ 6 - 5 × 32 + 300 = ?

=> 312 ÷ 6 - 5 × 32 + 300 = ?

=> 52 - 5 × 32 + 300 = ?

=> 52 + 300 - 160 = ?

=> 352 - 160 = ?

=> 192 = ?

Hence, "Option 3" is the correct answer.

Q79. Answer: (c) Y

Given: M, N, O, P, W, X and Y are sitting around a circular table facing the centre of the table.

1) Only two people sit between P and O when counted from the left of O.

2) Y sits second to the left of P.

3) Y sits to the immediate right of N.

4) W sits third to the left of N.

5) X is not an immediate neighbour of W.

The remaining position will be occupied by the only person left i.e. M.

Thus, Y sits third to the right of M.

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Hence, "Option 3" is the correct answer.

Q80. Answer: (d) 62, 121

The logic followed here is:

16, 29 → (16 × 2) - 3 = 32 - 3 => 29

And,

25, 47 → (25 × 2) - 3 = 50 - 3 => 47

Similarly,

62, 121 → (62 × 2) - 3 = 124 - 3 => 121

Hence, "Option 4" is the correct answer.

Q81. Answer: (c) TrackChild and Khoya-Paya Services

The correct answer is TrackChild and Khoya-Paya Services.

Key Points

• The Mission Vatsalya Portal is a comprehensive platform launched by the Ministry of Women and Child Development to protect and rehabilitate children in need of care and protection.

• In July 2025, the newly revamped portal integrated several services, including TrackChild and Khoya-Paya, which are key tools for tracking missing children and ensuring their safety.

• TrackChild: This initiative is a nationwide tracking system that helps in locating missing children and linking them with their families or providing them institutional care.

• Khoya-Paya Services: This is an online citizen-based platform to report and track missing and found children, encouraging public participation in child welfare.

• Other schemes like Poshan Abhiyaan, Beti Bachao Beti Padhao, and Pradhan Mantri Matru Vandana Yojana are critical government initiatives, but they are not directly integrated into the Mission Vatsalya Portal. Hence, options 1, 2, and 4 are incorrect.

• The integration of TrackChild and Khoya-Paya services aligns with the mission's objective of ensuring a safe environment for children and expediting their rehabilitation. Hence, option 3 is correct.

Additional Information

• TrackChild:

• It is an initiative by the Ministry of Women and Child Development in partnership with the Ministry of Home Affairs.

• The platform connects stakeholders, including police, child welfare committees, and childcare institutions, to trace missing children.

• It features a centralized database of missing and found children, accessible to law enforcement agencies and authorized officials.

• Parents and guardians can also register complaints and track updates about their missing children.

• Khoya-Paya Services:

• Launched in 2015 by the Government of India, this citizen-centric platform enables people to report missing or found children.

• It serves as a bridge between the public and government authorities, accelerating the process of locating children.

• The platform uses technology to disseminate information quickly, increasing the chances of reuniting children with their families.

• It complements the TrackChild initiative by mobilizing community support for child welfare.

• Mission Vatsalya:

• This is an umbrella scheme aimed at child protection, welfare, and development, focusing on children in difficult circumstances.

• It emphasizes strengthening the child protection system, institutional care, and non-institutional care, such as adoption and foster care.

• The program also promotes awareness and participation among stakeholders and communities to safeguard children's rights.

• Other Integrated Child Protection Services (ICPS):

• ICPS was merged into Mission Vatsalya to create a unified framework for child protection in India.

• It includes services like open shelters, child helplines, and sponsorships to aid vulnerable children.

Important Points

• Childline 1098: This is a toll-free helpline service for children in distress, operational under the Mission Vatsalya framework.

• Beti Bachao Beti Padhao: This scheme focuses on gender equality and improving the survival and education of the girl child, but it is not directly integrated into the portal.

• Poshan Abhiyaan: It addresses malnutrition and is aimed at improving the nutritional outcomes for children and women but operates independently of Mission Vatsalya.

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• Pradhan Mantri Matru Vandana Yojana: A maternity benefit program for pregnant women and lactating mothers, providing conditional cash transfers, but it is separate from the Mission Vatsalya Portal's scope.

Q82. Answer: (a) Subhasish Bose

The correct answer is Subhasish Bose.

Key Points

• Subhasish Bose was named the Men's Player of the Year at the AIFF Awards 2025, recognizing his outstanding performance and contribution to Indian football.

• The All India Football Federation (AIFF) annually honors players, coaches, and teams that have excelled in Indian football.

• Subhasish Bose, known for his versatility as a defender and leadership qualities, has been a consistent performer for both his club and the national team.

• This accolade highlights his contribution to the sport, particularly his role in strengthening India's defense during international matches.

• The AIFF Awards are regarded as a prestigious platform to acknowledge footballing talent in India, and Subhasish's recognition underscores his pivotal role in the growth of Indian football.

Additional Information

• Subhasish Bose:

• Age: Born on 18 August 1995, Bose is a prominent footballer from West Bengal, India.

• Position: He primarily plays as a left-back but is known for his ability to adapt to other defensive positions.

• Club Career: He has played for top clubs like ATK Mohun Bagan and Bengaluru FC, making significant contributions to their campaigns in the Indian Super League (ISL).

• International Career: Bose has been a vital member of the Indian National Team, earning multiple caps and showcasing exceptional defensive skills in international tournaments.

• AIFF Awards:

• The AIFF Awards are annual honors established by the All India Football Federation to celebrate excellence in Indian football.

• Categories include Men's Player of the Year, Women's Player of the Year, and Emerging Player of the Year, among others.

• The winners are selected based on their performance over the past year, including both domestic and international matches.

• Other Awardees in 2025:

• Women's Player of the Year: Recognized for exceptional contributions to Indian women's football.

• Emerging Player of the Year: Awarded to young talents who have showcased significant potential and growth.

• Significance of AIFF Awards:

• These awards aim to motivate players to perform consistently and contribute to the growth of football in India.

• They also serve as a platform to bring attention to the sport and inspire young athletes to pursue football professionally.

Important Points

• Subhasish Bose's Leadership:

• He has been praised for his leadership skills on and off the field, often acting as a motivator for his teammates.

• His ability to read the game and make crucial defensive interventions has been instrumental for his teams.

• AIFF's Role in Indian Football:

• The AIFF plays a pivotal role in the development and promotion of football in India, organizing leagues, tournaments, and coaching programs.

• It also represents India in international football forums and works to enhance the country's footballing standards.

• Indian Football Achievements:

• India has seen significant growth in football over the years, with leagues like the ISL and grassroots initiatives creating opportunities for young players.

• The national team's performance in tournaments like the SAFF Championship and AFC Asian Cup has improved, reflecting the efforts of players like Subhasish Bose.

Q83. Answer: (b) Germany

The correct answer is Germany.

Key Points

• The Bonn Climate Change Conference 2025 was held in Bonn, Germany, which has historically been a hub for United Nations climate-related activities.

• Bonn serves as the headquarters of the United Nations Framework Convention on Climate Change (UNFCCC), making it a significant venue for hosting climate conferences.

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• The conference aims to advance global climate negotiations, review progress on commitments made under the Paris Agreement, and strengthen international cooperation to combat climate change.

• Participants at the Bonn Climate Change Conference include representatives from government bodies, non-governmental organizations (NGOs), scientists, and policymakers, who discuss strategies for achieving sustainable development and reducing greenhouse gas emissions.

• Bonn has hosted multiple climate conferences in the past, including the annual meetings of the Subsidiary Bodies to the UNFCCC, which focus on technical and implementation issues related to climate action.

Additional Information

• United Nations Framework Convention on Climate Change (UNFCCC):

• The UNFCCC was established in 1992 at the Earth Summit held in Rio de Janeiro, Brazil, to address global climate change.

• Its primary objective is to stabilize greenhouse gas concentrations in the atmosphere at a level that prevents dangerous anthropogenic interference with the climate system.

• Key agreements under the UNFCCC include the Kyoto Protocol (1997) and the Paris Agreement (2015).

• The UNFCCC Secretariat is based in Bonn, Germany, making the city a focal point for international climate negotiations.

• Paris Agreement:

• Adopted in 2015, the Paris Agreement aims to limit global warming to well below 2°C, preferably to 1.5°C, above pre-industrial levels.

• Countries under the agreement are required to submit Nationally Determined Contributions (NDCs), outlining their plans to reduce emissions and adapt to climate change.

• The agreement emphasizes global cooperation, capacity-building, and financial support for developing countries to achieve their climate goals.

• Bonn's Role in Climate Diplomacy:

• Bonn is home to several UN organizations, including the Secretariat of the UNFCCC, making it a hub for international climate diplomacy.

• The city hosts regular meetings of the Subsidiary Bodies to the UNFCCC, which focus on implementing policies and technical measures related to climate change.

• Bonn also serves as a venue for preparatory meetings ahead of the annual Conference of Parties (COP), where major climate decisions are made.

• Important Conferences in Bonn:

• The Bonn Climate Change Conference is part of the mid-year sessions of the UNFCCC, held annually to track progress on climate commitments and prepare for the COP.

• Previous Bonn conferences have played a crucial role in shaping global climate policies and advancing negotiations under the Paris Agreement.

• In 2017, Bonn hosted the 23rd Conference of Parties (COP23), chaired by Fiji, which focused on implementation guidelines for the Paris Agreement.

Important Points

• Germany's commitment to climate action:

• Germany is a leading advocate for international climate action and has implemented ambitious policies to reduce greenhouse gas emissions.

• The country aims to achieve climate neutrality by 2045, ahead of the EU's target of 2050.

• Germany's Energiewende (Energy Transition) focuses on phasing out fossil fuels and increasing reliance on renewable energy sources like wind and solar power.

• Subsidiary Bodies to the UNFCCC:

• The Subsidiary Body for Scientific and Technological Advice (SBSTA) and the Subsidiary Body for Implementation (SBI) are key components of the UNFCCC process.

• SBSTA provides scientific and technical advice, while SBI focuses on implementing climate policies and reviewing progress.

• Both bodies meet in Bonn to advance technical discussions and prepare for the COP.

• Global Climate Goals:

• The Intergovernmental Panel on Climate Change (IPCC) highlights the urgent need to limit global warming to 1.5°C to prevent severe climate impacts.

• Achieving this goal requires rapid and deep reductions in greenhouse gas emissions across all sectors.

• International cooperation, technology transfer, and financial support are critical for achieving climate goals, especially in developing countries.

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Q84. Answer: (d) Mansukh Mandaviya

The correct answer is Mansukh Mandaviya.

Key Points

• Mansukh Mandaviya, the Union Minister for Health and Family Welfare, is known for his active participation in various infrastructural and welfare projects, including those related to sports and healthcare.

• In 2025, Mansukh Mandaviya inaugurated the Khelo India Multipurpose Hall in the Kamle district of Arunachal Pradesh.

• The Khelo India Multipurpose Hall is a state-of-the-art facility aimed at promoting sports infrastructure and providing training opportunities for athletes in remote regions like Arunachal Pradesh.

• This initiative aligns with the objectives of the Khelo India Programme, which seeks to strengthen the grassroots sports ecosystem in India through the development of infrastructure and identification of young talent.

• The inauguration of this facility underscores the government's focus on promoting sports culture in the northeastern states, which are rich in sporting talent.

Additional Information

• Khelo India Programme:

• Launched by the Ministry of Youth Affairs and Sports in 2018, the programme aims to develop a robust sports culture in India.

• It focuses on identifying and nurturing sporting talent at the grassroots level, with an emphasis on providing world-class infrastructure and financial support to athletes.

• The programme includes initiatives like the Khelo India Youth Games and Khelo India University Games, which provide platforms for young athletes to showcase their talent.

• Mansukh Mandaviya:

• Mansukh Mandaviya is a senior leader in the Bharatiya Janata Party (BJP) and has served as the Union Minister for Health and Family Welfare since 2021.

• He has been actively involved in various public welfare initiatives, including healthcare reforms and the development of rural and tribal areas.

• His contributions to the Khelo India initiative reflect his commitment to leveraging sports as a tool for youth development and national progress.

• Sports Infrastructure in Arunachal Pradesh:

• Arunachal Pradesh is a northeastern state with immense potential in sports, given its youth population and natural athleticism.

• The government has been investing heavily in building sports facilities in the region, including the Khelo India Multipurpose Hall, to nurture local talent.

• Such initiatives aim to integrate the region into the national sports ecosystem and provide a platform for athletes from remote areas to compete at the national and international levels.

• Importance of Multipurpose Sports Halls:

• Multipurpose sports halls are designed to accommodate various sports under one roof, including basketball, badminton, volleyball, and indoor athletics.

• These facilities are crucial for regions with limited infrastructure, as they maximize resource utilization and provide training opportunities for multiple disciplines.

• They also serve as community centers, promoting fitness and well-being among the general population.

Important Points

• Union Government's Focus on the Northeast:

• The Indian government has been emphasizing infrastructure development in the northeastern region to integrate it with the rest of the country and harness its potential.

• Programs like Khelo India are pivotal in addressing the infrastructural gaps in sports and empowering local athletes.

• By developing facilities like the Khelo India Multipurpose Hall, the government aims to create an inclusive ecosystem that promotes sports as a career option in the region.

• Significance of Sports Development:

• Sports development initiatives contribute to the physical and mental well-being of citizens, especially the youth.

• They also foster social cohesion, community engagement, and national pride.

• Investments in sports infrastructure have long-term benefits, including talent identification, economic development through sports tourism, and better representation in international events.

Q85. Answer: (c) Sana Mir

The correct answer is Sana Mir.

Key Points

• Sana Mir, a former captain of the Pakistan women's cricket team, was inducted into the ICC Hall of Fame in June 2025. This is a

prestigious recognition of her contributions to cricket at the global level.

• She is widely acknowledged as one of the greatest female cricketers to emerge from Pakistan. Her leadership and performances have significantly shaped the growth of women's cricket in her country.

• Sana Mir has played an instrumental role in leading Pakistan to numerous achievements, including their first-ever gold medals in cricket at the Asian Games in 2010 and 2014.

• In her illustrious career, she represented Pakistan in 120 ODIs and 106 T20Is, taking a total of 151 wickets in ODIs and 89 wickets in T20Is, alongside scoring crucial runs.

• Sana Mir retired from international cricket in April 2020, leaving behind a legacy that inspired many young girls in Pakistan to take up the sport.

Additional Information

• ICC Hall of Fame:

• The ICC Hall of Fame was established in 2009 by the International Cricket Council (ICC) to honor legendary cricketers for their exceptional contributions to the game.

• Inductees are selected based on their achievements, impact, and influence on cricket over their careers.

• Previous inductees include legends such as Sir Donald Bradman, Muttiah Muralitharan, and Jacques Kallis.

• Achievements of Sana Mir:

• Sana Mir was the first Pakistani woman to take 100 wickets in ODIs, making her one of the top bowlers in women’s cricket.

• She was ranked as the number one ODI bowler in the ICC Women’s Rankings in October 2018.

• Under her captaincy, Pakistan won their first-ever ODI series against the West Indies in 2015.

• Other Options Explained:

• Diana Baig: A talented Pakistani cricketer known for her pace bowling, but she has not been inducted into the ICC Hall of Fame.

• Nida Dar: A renowned all-rounder nicknamed "Lady Boom Boom," she is one of Pakistan’s best players but has not received this honor yet.

• Bismah Maroof: The current captain of the Pakistan women’s cricket team, known for her batting prowess, but she has not been inducted into the ICC Hall of Fame.

• Impact of Sana Mir’s Induction:

• Sana Mir’s recognition in the ICC Hall of Fame brings international attention to women’s cricket in Pakistan.

• It serves as an inspiration for young female cricketers in Pakistan and around the world to pursue the sport professionally.

• Her inclusion highlights the growing importance of gender inclusivity in global cricket.

Important Points

• The ICC Hall of Fame is a significant platform to honor players who have made exemplary contributions to the game.

• Sana Mir is a role model for aspiring cricketers, especially in countries where women’s sports face social and cultural barriers.

• Her achievements demonstrate the potential of women in cricket and emphasize the need for equal opportunities in sports globally.

• This milestone coincides with the increasing focus on promoting women’s cricket by the ICC and cricket boards worldwide.

Q86. Answer: (b) Wonder: Sustaining what sustains us

The correct answer is Wonder: Sustaining what sustains us.

Key Points

• World Ocean Day is celebrated annually on 8 June to raise awareness about the importance of oceans in maintaining ecological balance and promoting sustainable development.

• The theme for World Ocean Day 2025 is “Wonder: Sustaining what sustains us”, emphasizing the vital role oceans play in sustaining life on Earth and the urgent need to preserve them.

• This theme highlights the interconnectedness of human well-being and ocean health, encouraging global citizens to adopt sustainable practices and protect marine biodiversity.

• It calls for collective efforts by governments, organizations, and individuals to combat challenges like ocean pollution, overfishing, and climate change.

• World Ocean Day serves as a platform to promote ocean conservation initiatives, advocate for climate-resilient policies, and inspire action to protect marine ecosystems.

Additional Information

• Significance of the Theme:

• The theme “Wonder: Sustaining what sustains us” focuses on fostering a sense of awe for the oceans and recognizing their critical importance in sustaining all forms of life.

• The oceans cover over 70% of the Earth’s surface, regulate the planet’s climate, and provide oxygen, food, and livelihoods for billions of people.

• It emphasizes the need to balance human activities with the preservation of marine resources to ensure their long-term viability.

• Challenges Facing the Oceans:

• Plastic Pollution: Every year, approximately 8 million tons of plastic enter the oceans, threatening marine life and ecosystems.

• Overfishing: Unsustainable fishing practices have led to the depletion of fish stocks, disrupting marine food chains.

• Climate Change: Rising sea temperatures and ocean acidification due to increased CO2 emissions are causing coral bleaching and biodiversity loss.

• Habitat Destruction: Activities like coastal development and bottom trawling damage critical marine habitats such as coral reefs and seagrass beds.

• Global Initiatives for Ocean Conservation:

• United Nations Decade of Ocean Science for Sustainable Development (2021–2030): Aims to enhance ocean science and promote sustainable management of marine resources.

• Marine Protected Areas (MPAs): Designated regions in oceans where human activity is regulated to conserve marine biodiversity.

• Global Treaty on Marine Biodiversity: Negotiated under the UN to protect biodiversity in areas beyond national jurisdiction.

• How Individuals Can Contribute:

• Reduce the use of single-use plastics and participate in beach clean-up drives to minimize ocean pollution.

• Support sustainable seafood choices and avoid consuming overexploited species.

• Raise awareness about ocean conservation through social media and community initiatives.

• Advocate for policies that address climate change and protect marine ecosystems.

Important Points

• Historical Background:

• World Ocean Day was first proposed in 1992 at the Earth Summit in Rio de Janeiro, Brazil, as a way to celebrate and protect the oceans.

• In 2008, the United Nations officially recognized 8 June as World Ocean Day.

• Economic Importance of Oceans:

• The oceans contribute an estimated $2.5 trillion annually to the global economy, supporting industries like fisheries, tourism, and shipping.

• More than 3 billion people rely on marine and coastal biodiversity for their livelihoods.

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Q87. Answer: (d) Swaminathan S Iyer

The correct answer is Swaminathan S Iyer.

Key Points

• In March 2025, Swaminathan S Iyer was appointed as a Whole-time Member (Life) at the Insurance Regulatory and Development Authority of India (IRDAI).

• IRDAI is the statutory body established under the Insurance Regulatory and Development Authority Act, 1999, tasked with regulating and promoting the insurance industry in India.

• Whole-time Members at IRDAI are responsible for ensuring the effective implementation of policies and guidelines aimed at improving the insurance sector.

• Swaminathan S Iyer has extensive experience in the insurance domain and regulatory frameworks, making him a suitable candidate for this role.

• The appointment of Whole-time Members at IRDAI is usually approved by the Government of India, following strict scrutiny of professional qualifications and contributions to the field.

Additional Information

• Insurance Regulatory and Development Authority of India (IRDAI):

• IRDAI was established in 2000 under the IRDA Act, 1999, with its headquarters in Hyderabad, Telangana.

• It is responsible for regulating the insurance industry to protect policyholders and ensure the growth of the insurance market.

• The authority also oversees the functioning of insurance companies, intermediaries, and agents to maintain transparency and accountability in the sector.

• Key functions: Licensing insurers, promoting consumer protection, regulating premium rates, and enforcing regulatory compliance in the insurance industry.

• Role of Whole-time Members at IRDAI:

• Whole-time Members are appointed to oversee specific domains within IRDAI, such as life insurance, general insurance, or health insurance.

• They ensure adherence to policies and formulate strategies for the effective regulation of insurance practices.

• These members play a crucial role in addressing grievances, implementing new policies, and promoting innovation in the insurance industry.

• Other Relevant Appointments in IRDAI:

• IRDAI consists of a Chairperson, Whole-time Members, and Part-time Members, all appointed by the Government of India.

• Appointments to IRDAI are made based on experience and expertise in insurance, financial regulation, law, or administration.

• Past appointments have included individuals with extensive contributions to the banking and insurance sectors.

• Insurance Sector in India:

• The insurance industry in India is one of the fastest-growing sectors, with approximately 57 insurance companies, including 24 life insurers and 33 non-life insurers.

• IRDAI plays a pivotal role in supporting the government's initiatives such as PMJJBY, PMSBY, and Ayushman Bharat, aimed at increasing insurance penetration.

• India's insurance penetration was recorded at 4.2% in 2021, highlighting the need for regulatory efforts to improve accessibility.

Important Points

• Appointment Process:

• Appointments to statutory bodies like IRDAI are conducted through a rigorous selection process, ensuring candidates have relevant expertise and experience.

• Whole-time Members serve for a fixed term, usually 5 years, or until the age of 62 years, whichever is earlier.

• Their contributions significantly impact the regulation and growth of the insurance industry in India.

• Insurance Penetration:

• Insurance penetration refers to the ratio of premium underwritten to the GDP of a country.

• India's efforts to improve insurance penetration include initiatives like PMJJBY and PMSBY, which cater to marginalized sections of society.

• Regulatory measures by IRDAI aim to make insurance more accessible and affordable for all citizens.

Q88. Answer: (d) Fazilka

The correct answer is Fazilka.

Key Points

• The first wooden Gurdwara in India, Sri Nanak Niwas, was constructed in Fazilka, Punjab, in July 2025.

• The initiative is a significant step in promoting eco-friendly architecture and preserving cultural heritage in India.

• Fazilka is a border district in Punjab and holds immense historical significance due to its proximity to the India-Pakistan border.

• Wooden Gurdwaras are rare in India due to traditional construction practices; this project stands out as a unique blend of traditional Sikh architecture and sustainable materials.

• This Gurdwara is dedicated to the teachings of Guru Nanak Dev Ji, the founder of Sikhism, and aims to attract devotees and tourists alike.

Additional Information

• Significance of Fazilka:

• Fazilka is known for its rich cultural and historical importance in Punjab.

• The district is famous for its heritage buildings, traditional bazaars, and agricultural practices.

• It serves as a key location for cross-border trade and cultural exchanges with Pakistan.

• Architecture of Sri Nanak Niwas:

• The Gurdwara is constructed using sustainable wood, which minimizes environmental impact compared to conventional construction materials.

• The design incorporates elements of traditional Sikh architecture, such as domes, arches, and intricate carvings.

• It also includes facilities for community gatherings, such as a langar hall and prayer rooms.

• Eco-Friendly Construction:

• Wooden structures are known for their natural insulation properties, which help in maintaining a comfortable indoor environment.

• The construction aligns with global trends of adopting sustainable and renewable resources in architecture.

• Wood is a carbon-neutral material, making it an environmentally friendly choice.

• Importance of Wooden Gurdwaras:

• Such structures symbolize a return to traditional and natural construction practices.

• They serve as an example of how religious and cultural sites can adopt sustainability without compromising on design and functionality.

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• This project could inspire similar eco-friendly religious structures across the country.

Important Points

• Guru Nanak Dev Ji:

• Guru Nanak Dev Ji was the founder of Sikhism and the first of the ten Sikh Gurus.

• He preached the message of universal brotherhood, equality, and devotion to God.

• The teachings of Guru Nanak emphasize the importance of seva (selfless service) and langar (community kitchen).

• Eco-Friendly Religious Sites in India:

• Several temples, mosques, and churches are adopting green initiatives such as solar power, rainwater harvesting, and eco-friendly construction.

• Examples include the Golden Temple in Amritsar, which uses renewable energy, and the Lotus Temple in Delhi, which emphasizes sustainable design.

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Q89. Answer: (c) Ensuring safe and ethical AI

The correct answer is Ensuring safe and ethical AI.

Key Points

• The India AI Safety Institute was established in January 2025 with the primary goal of addressing safety concerns surrounding artificial intelligence (AI).

• Its main objective is to promote the development, deployment, and use of AI technologies in a manner that is safe, ethical, and responsible.

• The institute works on ensuring that AI systems adhere to guidelines and frameworks for ethical use, minimizing risks such as bias, misuse, and harm to individuals and society.

• It aims to create awareness and provide training for AI practitioners and policymakers on safe AI practices, fostering trust in AI applications.

• Research and collaboration are key aspects of the institute, emphasizing partnerships with global organizations to align with international standards of AI safety and ethics.

Additional Information

• Artificial Intelligence (AI):

• AI refers to the simulation of human intelligence in machines that are programmed to think and learn.

• Applications include fields like healthcare, finance, transportation, and education.

• AI technologies include machine learning, deep learning, natural language processing (NLP), and robotics.

• Ethical AI:

• Ethical AI ensures that AI systems are transparent, accountable, and fair.

• It focuses on preventing issues like algorithmic bias, data privacy breaches, and misuse of AI.

• Global initiatives, like those by the EU and UNESCO, aim to create ethical AI frameworks.

• AI Safety Risks:

• AI systems can pose risks such as malfunction, adversarial attacks, and unintended consequences.

• Concerns include autonomous weapons, surveillance misuse, and ethical dilemmas.

• Mitigating risks involves implementing robust testing, monitoring, and ethical guidelines.

• Global AI Safety Efforts:

• Organizations like OpenAI, Partnership on AI, and IEEE work on developing safety standards.

• Countries such as USA, UK, and China have invested in AI safety research and initiatives.

• The OECD AI Principles serve as a global reference for ethical AI development.

Important Points

• India AI Safety Institute:

• Focused on safe deployment of AI technologies across industries.

• Provides training programs and certifications for ethical AI usage.

• Collaborates with government bodies, academia, and industry experts for research and development.

• AI in India:

• India is rapidly advancing in AI applications across sectors like agriculture, healthcare, and education.

• Initiatives like National AI Strategy aim to position India as a global leader in AI.

• Government organizations like NITI Aayog are at the forefront of AI policy and development.

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Q90. Answer: (b) Karnataka Lokayukta

The correct answer is Karnataka Lokayukta.

Key Points

• The Karnataka Lokayukta is an independent anti-corruption ombudsman and investigative authority in the state of Karnataka, India.

• In July 2025, the Karnataka Lokayukta uncovered over Rs. 24 crore in unaccounted assets in a high-profile corruption case in Karnataka.

• The Lokayukta conducted search and seizure operations at various locations associated with government officials and private entities, leading to the revelation of these unaccounted assets.

• The investigation involved tracking financial irregularities, disproportionate assets, and suspected misuse of public office, which are core areas of Lokayukta's jurisdiction.

• This operation underscores the role of the Karnataka Lokayukta in combating corruption and ensuring accountability in public administration.

Additional Information

• Karnataka Lokayukta:

• Established under the Karnataka Lokayukta Act, 1984, it is one of the pioneering anti-corruption bodies in India.

• It is empowered to investigate allegations of corruption, misuse of power, and maladministration against public servants, including elected representatives, government officials, and private entities involved in public dealings.

• The Lokayukta operates independently of the state government, ensuring an unbiased investigation process.

• The Lokayukta's findings and recommendations hold significant weight, often leading to disciplinary or legal action.

• Other Investigative Authorities:

• Income Tax Department: This authority investigates tax evasion, monitors financial transactions, and ensures compliance with income tax laws. However, it primarily focuses on tax-related offenses, not broader corruption cases.

• Enforcement Directorate (ED): The ED enforces laws related to money laundering and foreign exchange violations under FEMA and PMLA. It investigates financial crimes but does not directly deal with public administration corruption.

• Central Bureau of Investigation (CBI): The CBI investigates cases of corruption, economic offenses, and special crimes across India. However, state-level investigations like this one often fall under the jurisdiction of Lokayuktas or state-specific bodies.

• Disproportionate Assets Cases:

• These cases involve public officials possessing wealth that significantly exceeds their known sources of income.

• Such investigations require collaboration between multiple agencies, including Lokayuktas, tax departments, and forensic auditors.

• Unaccounted assets often include cash, gold, property, and other investments.

• Anti-Corruption Efforts in India:

• India has multiple anti-corruption bodies, including the Central Vigilance Commission (CVC), Lokayuktas, and the CBI, to combat corruption at various levels.

• The Prevention of Corruption Act, 1988, is the primary legislation dealing with corruption in public offices.

• Recent amendments and stricter enforcement mechanisms aim to improve transparency and accountability in governance.

Important Points

• Key Characteristics of Lokayuktas:

• Lokayuktas are state-level anti-corruption bodies that complement the role of the Central Vigilance Commission at the national level.

• They investigate complaints from the public regarding corruption, abuse of power, or maladministration in state government offices.

• Lokayuktas have the authority to investigate even high-ranking officials, including the Chief Minister, in some states.

• Significant Cases Handled by Lokayuktas:

• In Karnataka, the Lokayukta has previously investigated several high-profile cases, including illegal mining scandals and disproportionate assets cases involving prominent politicians.

• Its proactive role has set benchmarks for anti-corruption efforts in other states.

Q91. Answer: (d) 3.39 billion tonnes

The correct answer is 3.39 billion tonnes.

Key Points

• The Revised Green India Mission (GIM) Plan, released in 2025, aims to create a carbon sink of 3.39 billion tonnes by 2030.

• The Green India Mission is one of the eight national missions under the National Action Plan on Climate Change (NAPCC)

launched by the Government of India in 2010.

• This mission focuses on afforestation, reforestation, and ecosystem restoration to enhance carbon sequestration and mitigate climate change.

• The target of 3.39 billion tonnes aligns with India's commitments under the Paris Agreement to reduce greenhouse gas emissions and increase forest and tree cover.

• The mission emphasizes the involvement of local communities, especially in rural areas, to ensure sustainable development and environmental conservation.

Additional Information

• Green India Mission (GIM):

• The Green India Mission was launched as part of India's response to climate change adaptation and mitigation.

• It aims to increase forest/tree cover by 5 million hectares and improve the quality of existing forest cover on 5 million hectares.

• The mission includes activities like ecosystem restoration, biodiversity conservation, and livelihood enhancement for forest-dependent communities.

• Carbon Sink:

• A carbon sink refers to any system that absorbs more carbon dioxide than it emits. Examples include forests, oceans, and soil.

• By increasing forest cover and improving vegetation, the Green India Mission contributes to enhancing India's natural carbon sinks.

• This process helps in reducing the concentration of CO_2 in the atmosphere, thereby combating global warming.

• Paris Agreement:

• India is a signatory to the Paris Agreement, adopted in 2015, which seeks to limit global temperature rise to below 2°C.

• Under its Nationally Determined Contributions (NDCs), India has committed to increasing its forest cover to help mitigate climate change.

• Community Participation:

• The Green India Mission encourages the active involvement of local communities, panchayats, and NGOs in afforestation and conservation projects.

• These efforts contribute to sustainable rural development, providing livelihoods to forest-dependent populations while ensuring ecological balance.

Important Points

• Afforestation Targets: The Green India Mission sets specific targets for afforestation and reforestation projects to enhance carbon sequestration.

• Ecosystem Services: The mission aims to improve ecosystem services, including water conservation, soil fertility, and biodiversity preservation.

• Monitoring Mechanisms: Advanced technologies like GIS mapping and remote sensing are employed to monitor progress and ensure accountability.

• Climate Resilience: The initiative also focuses on building climate-resilient ecosystems to minimize the adverse effects of climate change.

• Budget Allocation: Significant financial resources are allocated to achieve the mission's objectives effectively, with the support of state governments and international organizations.

Q92. Answer: (c) Department of Chemicals and Petro-Chemicals

The correct answer is Department of Chemicals and Petro-Chemicals.

Key Points

• The Department of Chemicals and Petro-Chemicals under the Ministry of Chemicals and Fertilizers is responsible for formulating and implementing policies related to the chemical and petrochemical industry in India.

• The Scheme for Setting up of Plastic Parks in India aims to establish dedicated zones for plastic manufacturing and allied industries to improve infrastructure and boost domestic production.

• As of April 2025, the Department has approved the development of 10 Plastic Parks in various states, such as Madhya Pradesh, Odisha, Tamil Nadu, and Jharkhand, among others.

• The main objectives of these parks include promoting a cluster-based approach for the plastic industry, increasing competitiveness, and reducing environmental impact through proper waste management systems.

• The scheme encourages public-private partnerships (PPP) and provides financial assistance of up to 50% of the project cost, subject to a ceiling of Rs. 40 crore per project.

Additional Information

• Plastic Parks Scheme:

• The scheme was launched in 2013 by the Department of Chemicals and Petro-Chemicals to create state-of-the-art infrastructure

for the plastic industry.

• Each Plastic Park spans an area of around 100 to 150 acres and includes facilities like testing labs, training centers, and recycling units.

• The scheme aims to attract investments in the plastic sector and generate employment opportunities, especially in rural and semi-urban areas.

• Role of the Department of Chemicals and Petro-Chemicals:

• It is responsible for the development of the chemical and petrochemical sectors, which are crucial for industrial and economic growth.

• Key initiatives include the promotion of green chemistry, reduction of plastic waste, and support for the "Make in India" campaign in the chemical and plastic sectors.

• Environmental Benefits:

• Plastic Parks aim to minimize the environmental impact of plastic production by incorporating modern waste management techniques.

• Recycling units in these parks help reduce plastic waste and promote the circular economy.

• Other Relevant Ministries:

• The Ministry of Environment, Forest and Climate Change is involved in regulating environmental standards for plastic manufacturing and waste management.

• The Department of Pharmaceuticals oversees the use of plastics in medical and pharmaceutical applications, ensuring compliance with safety standards.

Important Points

• Plastic Industry in India:

• India is the third-largest producer of plastic in the world, with the industry contributing significantly to the economy.

• The plastic industry supports various sectors such as packaging, healthcare, automotive, and construction.

• Challenges in Plastic Management:

• India generates approximately 3.5 million tonnes of plastic waste annually, with a low recycling rate of around 60%.

• The Plastic Parks Scheme is a step towards addressing these challenges by promoting sustainable practices and advanced technologies.

• Global Context:

• Globally, countries like Germany and China have implemented similar industrial parks to support their plastic industries.

• India’s initiative aligns with international efforts to promote sustainable industrial growth and reduce plastic pollution.

Q93. Answer: (d) Bedatu Hirpa

The correct answer is Bedatu Hirpa.

Key Points

• Bedatu Hirpa, a professional long-distance runner from Ethiopia, won the women’s race at the Paris Marathon 2025.

• The Paris Marathon is one of the most prestigious marathons globally, attracting elite athletes from around the world. In 2025, it was held on its traditional route, starting at the Arc de Triomphe and finishing near the Eiffel Tower.

• Hirpa's victory was notable for her strategic pacing, as she maintained a consistent speed throughout the race and pulled away from competitors in the final kilometers.

• This triumph adds to Ethiopia’s strong legacy in long-distance running, as the country has produced numerous world-class marathon runners.

• Hirpa’s winning time was impressive, showcasing her endurance and skill in tackling the challenging course of the Paris Marathon.

Additional Information

• Paris Marathon:

• The Paris Marathon, officially known as the Schneider Electric Marathon de Paris, is an annual event held in Paris, France.

• It is one of the biggest marathons globally, attracting over 55,000 participants annually, including elite athletes and amateur runners.

• The race covers a distance of 42.195 kilometers and features iconic landmarks such as the Champs-Élysées, Place de la Concorde, and the Seine River.

• Bedatu Hirpa:

• Bedatu Hirpa is a renowned Ethiopian long-distance runner specializing in marathon and half-marathon events.

• She has consistently performed well in international marathons, often finishing in top positions.

• Her training focuses on high-altitude preparation, common among Ethiopian runners, which enhances endurance and stamina.

• Other Competitors:

• Angela Tanui: An accomplished Kenyan marathon runner, known for her victories in various international marathons, but she did not win the Paris Marathon 2025.

• Dera Dida: Another elite Ethiopian runner, famous for her performances in cross-country and road running events, though she did not claim the Paris Marathon title in 2025.

• Letesenbet Gidey: A world record holder in track events, she focuses more on shorter distances and track races rather than full marathons.

• Ethiopia's Dominance in Long-Distance Running:

• Ethiopia has a long history of excellence in long-distance running, producing legends like Haile Gebrselassie and Derartu Tulu.

• The country's high-altitude environment is ideal for training, giving runners a physiological advantage during competitions.

Important Points

• Paris Marathon 2025 Highlights:

• The event took place on a cool spring morning, which provided ideal conditions for long-distance running.

• Bedatu Hirpa's victory highlighted her tactical race execution and strong finish.

• The marathon also saw record participation, with runners from over 150 countries.

• Training Techniques of Ethiopian Runners:

• Ethiopian runners often train at altitudes above 2,500 meters, which improves oxygen efficiency.

• Their training emphasizes interval runs, endurance building, and diet rich in carbohydrates.

• The strong community support and competitive culture in Ethiopia play a crucial role in nurturing talent.

Q94. Answer: (b) Defence Bio-Engineering & Electro Medical Laboratory (DEBEL)

The correct answer is Defence Bio-Engineering & Electro Medical Laboratory (DEBEL).

Key Points

• The Defence Bio-Engineering & Electro Medical Laboratory (DEBEL), located in Bengaluru, successfully conducted high-altitude trials of the Indigenous On-Board Oxygen Generating System (OBOGS)-based Integrated Life Support System (ILSS) for the LCA Tejas aircraft on March 04, 2025.

• The Integrated Life Support System (ILSS) is designed to enhance the operational capability of fighter aircraft pilots by generating oxygen onboard during high-altitude flights.

• The OBOGS technology eliminates the need for traditional oxygen cylinders, making the system more efficient, lightweight, and safer for fighter aircraft operations.

• The trials conducted by DEBEL were crucial for validating the performance and reliability of the system in extreme conditions, ensuring its suitability for deployment in the indigenous LCA Tejas aircraft.

• DEBEL specializes in the development of life support systems, biomedical devices, and protective equipment for the armed forces, playing a significant role in enhancing operational safety and efficiency.

Additional Information

• Defence Bio-Engineering & Electro Medical Laboratory (DEBEL):

• DEBEL is located in Bengaluru and operates under the Defence Research and Development Organisation (DRDO).

• It is tasked with developing technologies related to life support systems, biomedical devices, and protective equipment for the Indian Armed Forces.

• Notable projects include protective clothing, oxygen systems, and healthcare devices for military personnel operating in harsh environments.

• On-Board Oxygen Generating System (OBOGS):

• OBOGS is an advanced system that generates oxygen onboard fighter aircraft by separating oxygen from the ambient air.

• The system is more efficient and safer compared to traditional oxygen cylinders, reducing logistical challenges during high-altitude missions.

• It ensures an uninterrupted supply of oxygen, improving pilot endurance and operational efficiency during combat scenarios.

• LCA Tejas Aircraft:

• The Light Combat Aircraft (LCA) Tejas is an indigenously developed fighter aircraft by Hindustan Aeronautics Limited (HAL) under DRDO.

• It is designed for multi-role combat operations, including air-to-air combat and ground attack missions.

• Tejas is equipped with advanced avionics, high maneuverability, and cutting-edge weapon systems, making it a key asset for the Indian Air Force.

• Other DRDO Laboratories:

• Aerial Delivery Research and Development Establishment (ADRDE): Focuses on developing aerial delivery systems such as parachutes and cargo delivery systems.

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• Defence Electronics Research Laboratory (DLRL): Specializes in electronic warfare systems and communication technologies.

• Defence Laboratory Jodhpur (DLJ): Engaged in research on materials, coatings, and environmental sciences for defense applications.

Important Points

• DRDO:

• The Defence Research and Development Organisation (DRDO) is India's premier agency for military research and development.

• Established in 1958, DRDO operates under the Ministry of Defence and has a network of over 50 laboratories.

• It focuses on developing advanced systems and technologies across aerospace, electronics, armaments, and life sciences.

• High-Altitude Trials:

• High-altitude trials are conducted to test the performance of equipment under extreme environmental conditions such as low temperatures, reduced oxygen levels, and high pressure.

• These trials are essential for ensuring the reliability and operational efficiency of defense systems in challenging terrains.

Q95. Answer: (d) Deepak Bagla

The correct answer is Deepak Bagla.

Key Points

• Deepak Bagla was appointed as the Mission Director of Atal Innovation Mission (AIM) under NITI Aayog in 2025. AIM is a flagship initiative by the Government of India to promote a culture of innovation and entrepreneurship across the country.

• Deepak Bagla is a prominent figure with vast experience in investment promotion, entrepreneurship, and policy advisory roles. His appointment aligns with AIM's objective to foster innovation in India.

• The Atal Innovation Mission aims to establish Atal Tinkering Labs (ATLs) in schools, promote innovation hubs, and encourage startups and small businesses to explore cutting-edge technologies.

• Bagla has previously been associated with leadership roles in organizations like Invest India, where he contributed significantly to attracting foreign investments into India.

• The appointment of Deepak Bagla is expected to further enhance AIM's outreach and strengthen the innovation ecosystem in India, ensuring support for startups and fostering technological advancements.

Additional Information

• Atal Innovation Mission (AIM):

• AIM was launched by NITI Aayog in 2016 to promote innovation and entrepreneurship across the country.

• It focuses on creating a strong innovation ecosystem by establishing Atal Tinkering Labs (ATLs) in schools and supporting startups and incubators.

• AIM also works to foster public-private partnerships in technology and innovation to address critical challenges in sectors like health, education, and agriculture.

• Deepak Bagla's Contributions:

• He served as the Managing Director and CEO of Invest India, where he played a key role in promoting foreign direct investment (FDI) into India.

• Bagla has extensive experience in the corporate world, having worked with leading organizations like World Bank and Citibank.

• His expertise lies in strategic planning, innovation-driven growth, and policy implementation, making him an ideal choice for leading AIM.

• Invest India:

• Invest India is the national investment promotion and facilitation agency of India, set up under the Ministry of Commerce and Industry.

• It focuses on attracting and facilitating investments and has been instrumental in improving India's ease of doing business ranking globally.

• Atal Tinkering Labs (ATLs):

• These are dedicated innovation workspaces established in schools to provide students with tools and equipment to learn and innovate.

• ATLs aim to nurture scientific temper and creativity among students from an early age.

• Over 10,000 ATLs have been set up across India, impacting millions of students.

Important Points

• NITI Aayog:

• NITI Aayog (National Institution for Transforming India) is a policy think tank of the Government of India, established in 2015 to replace the Planning Commission.

• It focuses on fostering cooperative federalism and promoting sustainable development goals (SDGs).

• Innovation Ecosystem in India:

• India has emerged as a global hub for startups and innovation, ranking among the top five countries in terms of the number of startups.

• Government initiatives like Startup India, AIM, and Digital India have played a pivotal role in fostering innovation.

• India's Global Innovation Index (GII) ranking has improved significantly, reflecting its focus on research, innovation, and entrepreneurship.

• Importance of AIM:

• AIM's programs like Atal Tinkering Labs, Atal Incubation Centres, and Mentor India Initiative are instrumental in encouraging innovation.

• It serves as a platform for collaboration between government, academia, and private enterprises to solve critical challenges.

Q96. Answer: (b) Integrated Control Room for Emergency Response

The correct answer is Integrated Control Room for Emergency Response.

Key Points

• The Integrated Control Room for Emergency Response (ICR-ER) was launched by the Government of India in June 2025 to enhance disaster management capabilities and provide a centralized platform for monitoring and responding to emergencies effectively.

• The ICR-ER is equipped with state-of-the-art technology such as advanced predictive analytics, GIS mapping, and real-time data integration to handle emergencies like natural disasters, industrial accidents, and public health crises.

• This platform aims to coordinate disaster response efforts across various government departments, ensuring rapid deployment of resources to affected areas.

• The ICR-ER also integrates data from multiple sources, including satellite imagery, weather forecasting systems, and local disaster management authorities, to provide comprehensive situational awareness.

• The initiative is a part of India's broader efforts to strengthen its disaster management infrastructure under frameworks like the Sendai Framework for Disaster Risk Reduction and India's National Disaster Management Plan.

Additional Information

• Features of the ICR-ER:

• Real-Time Surveillance: The platform uses drones, CCTV, and satellite data to monitor disaster-hit areas.

• Predictive Analytics: Advanced AI tools predict potential disasters like floods or earthquakes based on historical data and environmental indicators.

• GIS Mapping: Geographical Information Systems are used to map affected areas and optimize resource allocation.

• Mobile Connectivity: The system ensures communication through mobile apps for citizens and disaster management teams.

• Disaster Management Framework in India:

• The Disaster Management Act, 2005 provides the legal framework for disaster management in India.

• The National Disaster Management Authority (NDMA) is the apex body responsible for planning and coordinating disaster response.

• State Disaster Management Authorities (SDMAs) and District Disaster Management Authorities (DDMAs) implement measures at local levels.

• India follows the Sendai Framework (2015-2030), focusing on disaster risk reduction and building resilience.

• Examples of Advanced Disaster Management Platforms:

• USA: Federal Emergency Management Agency (FEMA) uses centralized command centers for disaster response.

• Japan: Advanced earthquake early warning systems are integrated into disaster management platforms.

• India: The ICR-ER is a significant step toward leveraging technology for disaster preparedness and response.

• Important Points:

• The ICR-ER aligns with India's commitment to achieving the UN Sustainable Development Goals (SDGs), particularly Goal 11 (Sustainable Cities and Communities) and Goal 13 (Climate Action).

• The platform is designed to be scalable and adaptable, allowing for integration with future technologies and evolving disaster scenarios.

• India has faced significant disasters, including floods, cyclones, and earthquakes, highlighting the need for robust disaster management systems.

• In addition to ICR-ER, India has other initiatives like the Indian Tsunami Early Warning System (ITEWS) and DAMS Safety Programme to mitigate specific risks.

Q97. Answer: (c) Ananta

The correct answer is Ananta.

Key Points

• Google's largest campus in India, unveiled in February 2025, is named Ananta. The name signifies infinity and reflects the company's commitment to innovation and technological advancements.

• The campus is located in Hyderabad, Telangana, which is a major hub for IT and technology-driven industries in India.

• This campus spans a massive area of 7.3 acres, making it one of Google's largest campuses globally, showcasing the tech giant's emphasis on India as a key growth market.

• The facility is designed to incorporate sustainability and environment-friendly practices, including the use of renewable energy and advanced water conservation systems.

• It will serve as a hub for Google's operations in India, focusing on AI, cloud computing, and digital transformation, contributing significantly to the country's digital economy.

Additional Information

• Significance of Hyderabad:

• Hyderabad is known as India's Silicon Valley, hosting numerous IT and software companies.

• It is the headquarters for many global tech companies, including Microsoft, Amazon, and Facebook, making it a strategic location for Google's expansion.

• Google's investment in India:

• Google has committed to investing $10 billion in India over the next decade as part of its Google for India Digitization Fund.

• The focus areas include internet accessibility, digital literacy, and AI-driven solutions tailored for India's unique needs.

• Sustainability Features:

• The campus is designed with LEED-certified green building standards and integrates renewable energy sources like solar power.

• It includes rainwater harvesting systems and advanced energy-efficient technologies to minimize environmental impact.

• Role in Digital Economy:

• The campus will serve as a research and development center, focusing on AI, cloud computing, and machine learning.

• It aims to support India's growing startup ecosystem and promote digital transformation across industries.

Important Points

• Other Names Considered:

• Mahakaya: While this name represents grandeur, it was not chosen for the campus.

• Kshitij: This name symbolizes the horizon, reflecting potential and growth, but it wasn't selected.

• Vishaal: This name signifies vastness, aligning with the scale of the campus, yet it didn't make the final cut.

• Global Presence:

• Google has similar large campuses in locations like Mountain View, California (Googleplex), and London, UK.

• The Hyderabad campus reaffirms India's importance in Google's global strategy.

Q98. Answer: (d) Devendra Fadnavis

The correct answer is Devendra Fadnavis.

Key Points

• Devendra Fadnavis, a senior leader of the Bharatiya Janata Party (BJP) and the Deputy Chief Minister of Maharashtra, inaugurated the newly established Hedging Desk in Pune in 2025.

• The Hedging Desk is aimed at managing financial risks associated with fluctuations in commodity prices, currency exchange rates, and interest rates, which are vital for businesses and economic stability.

• As a prominent figure in Maharashtra politics, Devendra Fadnavis has been actively involved in promoting initiatives that strengthen the state's financial and industrial infrastructure.

• The inauguration of this facility aligns with the government's vision of fostering economic growth and providing businesses with tools to mitigate risks effectively.

• This initiative is part of Maharashtra's broader strategy to establish itself as a hub for financial services and innovation in India.

Additional Information

• Devendra Fadnavis:

• He served as the Chief Minister of Maharashtra from 2014 to 2019 and is known for his focus on infrastructural and economic reforms.

• Currently, he holds the position of Deputy Chief Minister in the Maharashtra government.

• Fadnavis has been instrumental in implementing projects like the Samruddhi Mahamarg (Mumbai-Nagpur Expressway) and urban development initiatives.

• Hedging Desk:

• A hedging desk is a specialized financial facility designed to assist businesses in managing risks related to market volatilities.

• It uses financial instruments like options, futures, and swaps to protect against adverse price movements in commodities,

currencies, and interest rates.

• Hedging desks are crucial for industries like agriculture, manufacturing, and export-import businesses that are vulnerable to global market fluctuations.

• Pune’s Financial Landscape:

• Pune, known as the Oxford of the East, is also emerging as a significant financial and industrial hub in Maharashtra.

• It hosts a diverse range of industries, including IT services, manufacturing, and automobile production, making it a strategic location for financial risk management services.

• Government's Economic Vision:

• The inauguration of the Hedging Desk reflects the government's commitment to strengthening India’s financial sector and promoting ease of doing business.

• Such initiatives aim to attract investments and enhance the competitiveness of Indian businesses in global markets.

Important Points

• Role of Hedging in Financial Management:

• Hedging reduces uncertainty and provides a financial cushion against market risks.

• It ensures price stability, enabling businesses to plan and operate more effectively.

• By using derivatives, companies can lock in prices or rates, safeguarding their financial health.

• Economic Significance of Pune:

• Pune contributes significantly to Maharashtra's GDP through its industrial and IT sectors.

• The city is home to numerous startups and multinational companies, making it a key player in India's economic landscape.

Q99. Answer: (a) 5 years

The correct answer is 5 years.

Key Points

• The Cotton Mission has been planned for a duration of 5 years as per the Union Budget 2025–26.

• The mission aims to enhance cotton productivity, especially in extra-long staple varieties, which are essential for high-quality textile production.

• This initiative seeks to support farmers by providing them with advanced technology, better seeds, and improved farming practices.

• The government will focus on promoting sustainable cotton cultivation methods to address challenges such as soil degradation and water scarcity.

• The Cotton Mission is expected to boost India's textile industry, which heavily relies on cotton, and strengthen its position as one of the leading exporters of cotton-based products globally.

Additional Information

• Cotton in India:

• India is the world's largest producer of cotton, contributing about 23% of global production.

• Cotton cultivation in India is primarily concentrated in states like Maharashtra, Gujarat, Punjab, Haryana, and Tamil Nadu.

• India has a rich diversity of cotton varieties, including both short-staple and long-staple cotton, catering to different industrial needs.

• Extra-Long Staple Cotton:

• Extra-long staple (ELS) cotton is known for its high strength, superior quality, and durability, making it ideal for premium textile products.

• India imports a significant quantity of ELS cotton due to limited domestic production.

• The Cotton Mission aims to reduce this dependency by increasing the production of ELS varieties domestically.

• Government Initiatives to Support Cotton Farmers:

• The Technology Mission on Cotton was launched earlier to improve cotton farming practices, ginning, and market accessibility.

• Subsidies on fertilizers, pesticides, and seeds are provided to cotton farmers under various schemes to reduce input costs.

• Programs like the Minimum Support Price (MSP) ensure fair pricing for farmers.

• Impact on Textile Industry:

• The Cotton Mission is expected to strengthen India's textile exports, which account for a significant portion of the country's foreign exchange earnings.

• It will also contribute to generating employment opportunities across the cotton value chain, from farming to textile manufacturing.

Important Points

• Challenges in Cotton Production:

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• Issues such as pest attacks (e.g., bollworm), climate change, and water scarcity have significantly impacted cotton yields.
• Dependence on imported seeds for high-quality varieties has been a challenge for Indian farmers.
• Global Context:
• Countries like Egypt and the United States are leaders in ELS cotton production, providing stiff competition to India.
• India's Cotton Mission aims to reduce this gap by improving domestic production and quality.
• Technological Advancements:
• Adoption of genetically modified (GM) cotton has significantly improved yields in India.
• Precision farming techniques, including drip irrigation and soil testing, are being promoted under the Cotton Mission.

Q100. Answer: (b) 28

The correct answer is 28.

Key Points

• Defence Research and Development Organization (DRDO) handed over 28 indigenously developed weapon systems to the Indian Armed Forces in June 2024 under the emergency procurement clause.
• These weapon systems were designed and developed to meet the strategic needs of the Indian Army, Navy, and Air Force, focusing on enhancing their combat capabilities.
• The emergency procurement clause allows for expedited acquisition of weapon systems, ensuring that the armed forces are equipped to handle immediate threats and operational requirements.
• DRDO's initiative aligns with the Make in India policy, emphasizing self-reliance in defense production and reducing dependency on foreign imports.
• These systems include advanced technologies such as missiles, electronic warfare systems, radars, and communication systems, catering to diverse operational needs.

Additional Information

• About DRDO:
• DRDO, established in 1958, works under the Ministry of Defence, Government of India, and is responsible for developing defense technologies.
• Its primary objective is to achieve self-reliance in critical defense systems and promote indigenous development of advanced technologies.
• DRDO operates through a network of laboratories engaged in developing various military systems such as aeronautics, missiles, armaments, electronics, and naval systems.
• Emergency Procurement Clause:
• This clause allows the armed forces to acquire critical systems and equipment on a fast-track basis to address urgent operational needs.
• It bypasses the lengthy procurement process, ensuring rapid delivery and deployment of weapons and equipment.
• This is particularly crucial during times of heightened security concerns or conflicts.
• Make in India Initiative in Defense:
• The government launched the Make in India initiative in 2014 to promote indigenous manufacturing and reduce reliance on imports.
• In the defense sector, this initiative focuses on encouraging domestic companies to design, develop, and manufacture advanced weapon systems.
• Policies like Defence Acquisition Procedure (DAP) 2020 have been formulated to support this initiative, prioritizing Indian-made products.
• Examples of DRDO-Developed Systems:
• BrahMos Missile: A supersonic cruise missile jointly developed by India and Russia, capable of being launched from ships, aircraft, and land platforms.
• Akash Missile System: A medium-range surface-to-air missile defense system developed by DRDO for the Indian Army and Air Force.
• Netra AEW&C: An indigenous airborne early warning and control system developed by DRDO, enhancing surveillance capabilities.

Important Points

• Indian Armed Forces:
• The Indian Armed Forces consist of three branches: the Army, Navy, and Air Force.
• They are responsible for safeguarding India's sovereignty and territorial integrity.
• Modernization and self-reliance in defense production are key priorities for the forces to address emerging threats.
• Significance of Indigenously Developed Systems:

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- Indigenous systems reduce dependency on foreign suppliers, ensuring strategic autonomy.
- They are tailored to meet specific operational requirements of the Indian Armed Forces.
- Such systems contribute to the economic growth by boosting domestic manufacturing and creating employment opportunities.

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