RRB Group D Official Paper (Held On: 29 Dec, 2025 Shift 3) (Previous Year Paper)

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

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GENERAL SCIENCE

Q1. If the frequency of a vibrating object is 50 Hz, what is its time period?

(a) 0.02 s
(b) 2 s
(c) 0.2 s
(d) 5 s

Q2. Why are grains first dried in sunlight and then in shade before storage?

(a) To reduce the colour of grains
(b) To reduce moisture content and prevent spoilage
(c) To make them soft
(d) To save time

Q3. Life on earth depends on _____ molecules as the main source of energy for all organisms.

(a) nitrogen-based
(b) oxygen-based
(c) protein-based
(d) carbon-based

Q4. How can you identify a concave and a convex mirror based on the direction of their reflecting surfaces?

(a) A concave mirror reflects light outward, while a convex mirror reflects it inward.
(b) Both concave and convex mirrors have the same reflecting surface direction.
(c) A concave mirror and a convex mirror both reflect inward.
(d) A concave mirror has its reflecting surface curved inward; a convex mirror has its reflecting surface curved outward.

Q5. Which of the following is abiotic factor responsible for storage losses in agricultural produce?

(a) Moisture
(b) Rodents
(c) Fungi
(d) Insects

Q6. Isotopes of an element have the same number of _____.

(a) Electrons
(b) Neutrons
(c) Protons
(d) Nucleus

Q7. Why do passengers in a moving car tend to jerk forward when the brakes are suddenly applied?

(a) Because of the friction between the seat and the body
(b) Due to the force applied by the engine
(c) Because the brakes push the passengers forward

(d) Because of the inertia of motion that keeps the body moving forward

Q8. A stone falls freely and covers a distance (s) 20 m in time (t) 2.0 s. What is the value of acceleration due to gravity (g) ?

(a) 8.0 m/s²
(b) 10.0 m/s²
(c) 20.0 m/s²
(d) 12.0 m/s²

Q9. For uniformly accelerated motion, which of the following is true about the velocity–time graph?

(a) The graph is horizontal because velocity remains constant.
(b) The graph is always curved because velocity changes irregularly.
(c) The graph is a straight line because velocity changes by equal amounts in equal intervals of time.
(d) The graph can have any shape depending on the motion.

Q10. Why are vesicles important in the functioning of the Golgi apparatus?

(a) They carry materials to and from the Golgi apparatus
(b) They digest waste materials
(c) They help in forming the nucleus
(d) They generate energy needed for packaging in Golgi apparatus

Q11. Which of the following is produced when a carbon compound undergoes complete combustion?

(a) Carbon monoxide and water
(b) Carbon and oxygen
(c) Carbon dioxide and water
(d) Carbon dioxide and hydrogen

Q12. What name is given to the flat, stacked sacs that make up the Golgi apparatus?

(a) Cisternae
(b) Cristae
(c) Vesicles
(d) Thylakoids

Q13. The magnetic field around a straight current-carrying conductor:

(a) points along the conductor
(b) points radially outward
(c) forms concentric circles around the conductor
(d) is zero

Q14. Which structural feature contributes to the high reactivity of unsaturated organic compounds?

(a) Presence of halogen atoms attached to the carbon framework
(b) Total absence of hydrogen atoms within the compound molecule
(c) Incomplete formation of the carbon atom backbone structure
(d) Existence of double or triple bonds between carbon atoms

Q15. Which of the following is NOT applicable to the Law of Constant Proportion?

(a) Mixtures
(b) Ionic Compounds
(c) Compounds
(d) Elements

Q16. Ethanoic acid reacts with alcohols to form what compound?

(a) Aldehyde
(b) Ketone
(c) Alcohols

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(d) Esters

Q17. What happens in the female body if the egg is NOT fertilised?

(a) The thick uterine lining is retained permanently.
(b) The egg remains in the uterus and turns into an embryo.
(c) The uterine lining breaks down and is expelled as blood and mucous.
(d) The ovary stops releasing eggs permanently.

Q18. A block of mass 1 kg is dropped from the top of a building of height 20 m. What will be the velocity with which the block hits the ground?

(Take the value of g = 10 m/s²)

(a) 40 m/s
(b) 20 m/s
(c) √20 m/s
(d) √40 m/s

Q19. An object is placed at 35.0 cm in front of a concave mirror of focal length 25.0 cm. At what distance from the mirror an image is formed?

(a) • 8.75 cm
(b) • 87.5 cm
(c) 8.75 cm
(d) 10 cm

Q20. Consider the following statements and select the correct option.

Statement A: Plants require specific soil pH for proper growth.

Statement B: Farmers use pH values to decide the type of fertiliser to add.

(a) Both statements A and B are correct.
(b) Statement A is correct but B is incorrect.
(c) Statement A is incorrect but B is correct.
(d) Both statements A and B are incorrect.

Q21. Even though ovulation occurs regularly in a female, the uterus lining is shed during menstruation each month. What does this suggest about fertilisation?

(a) Fertilisation is not occurring
(b) The uterus is rejecting the embryo
(c) Fertilisation is occurring each time
(d) The ovary is not releasing eggs

Q22. Which of the following correctly represents the strength of attraction between particles in the three states of matter?

(a) Gas > Liquid > Solid
(b) Solid > Gas > Liquid
(c) Solid < Liquid < Gas
(d) Gas < Liquid < Solid

Q23. Conventionally, what is the assigned direction of electric current in an electric circuit, given the flow of electrons?

(a) Same as the movement of molecules
(b) Same as the movement of atoms
(c) Opposite to the flow of positive charges
(d) Opposite to the flow of electrons

Q24. In human females, if the egg is not fertilised, the monthly shedding of the uterine lining is called which of the following?

(a) Maturation
(b) Fertilisation
(c) Menstruation

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(d) Maintenance

Q25. Where does the heat energy go when the solid melts but its temperature remains the same?

(a) It is lost to the surroundings while overcoming the forces of repulsion.
(b) It is used to overcome the forces of attraction between the particles.
(c) It is lost to the surroundings while overcoming the forces of attraction.
(d) It is used to overcome the forces of repulsion between the particles.

MATHEMATICS

Q26. Evaluate: (5¼) × (125^(0.25))

(a) 25
(b) 5√5
(c) √5
(d) 5

Q27. In an election, the winner gets 80% of the total valid votes. If 18% are invalid votes out of 2,00,000 votes, then the votes polled in favour of the winner are:6491

(a) 1,32,100
(b) 1,21,300
(c) 1,13,200
(d) 1,31,200

Q28. A, B and C can do a piece of work in 3, 6 and 2 days, respectively. How long (in days) will they take to do twice the same work, working together?

(a) 2
(b) 3
(c) 6
(d) 4

Q29. Walking at 3/4 of his normal speed from his home, Abhishek is 30 minutes late in reaching his office. The usual time taken by him to cover the distance between his home and his office is:

(a) 91 minutes
(b) 93 minutes
(c) 90 minutes
(d) 85 minutes

Q30. For 5 innings, a cricketer has an average of 80 runs. In the 6^(th) inning, he scores 194 runs. His average score increased by _____.

(a) 29
(b) 26
(c) 21
(d) 19

Q31. The amount on a sum of Rs. 7,300 at 10% per annum compound interest, compounded annually, in 2 years will be:

(a) Rs. 9,391
(b) Rs. 8,251
(c) Rs. 8,444
(d) Rs. 8,833

Q32. The price of fuel decreases by 10%, 45% and 55% in three successive months, but increases by 55% in the fourth month. What is the percentage increase/decrease in the price of fuel in the fourth month as compared to its original price? (Round off the answer to two decimal places.)

(a) Decreases by 64.94%
(b) Increases by 63.38%

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(c) Increases by 70.18%
(d) Decreases by 65.47%

Q33. Find the HCF of the numbers 4220, 5440 and 6880.
(a) 60
(b) 80
(c) 40
(d) 20

Q34. Radha has Rs. 10 and Rs. 5 coins. She has a total of 15 coins worth Rs. 85. How many coins of Rs. 5 does she have?
(a) 7
(b) 5
(c) 8
(d) 13

Q35. A water tank can be filled in 13 minutes using 46 identical pipes. How long (in minutes) will it take to fill the same tank if only 27 such pipes are used? (Round off the answer to two decimal places.)
(a) 13.33
(b) 22.15
(c) 15.63
(d) 20.82

Q36. A cylindrical pillar has a diameter of 10 cm and a height of 35 cm. The curved surface is to be painted at a cost of Rs. 12/cm². If a 10% discount is offered on the total painting cost, how much will be paid? (Use $\pi = 22/7$)
(a) Rs. 11,770
(b) Rs. 11,660
(c) Rs. 11,550
(d) Rs. 11,880

Q37. Raj's monthly income is Rs. 50,000. He spends 40% of his income on household expenses and saves the remaining amount. If his income increases by 10%, and his expenditure on household expenses remains the same percentage of his income, calculate the amount (in Rs.) he saves after the increment.
(a) 31,500
(b) 33,500
(c) 33,000
(d) 31,000

Q38. A shopkeeper buys 20 pens for a total of Rs. 200. He sells each pen for Rs. 12. What is his total profit?
(a) Rs. 30
(b) Rs. 40
(c) Rs. 20
(d) Rs. 60

Q39. A total profit of Rs. 13,800 is to be distributed amongst A, B and C such that A : B = 20 : 2 and B : C = 1 : 4. The share (in Rs.) of B in the profit is:
(a) 920
(b) 1,070
(c) 870
(d) 820

Q40. The average age of 23 students of a class is 41 years. If the age of the teacher is also included, the average age of the whole group becomes 42 years. The age (in years) of the teacher is:
(a) 66
(b) 62
(c) 65

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(d) 64

Q41. A camp has provisions for 20 pupils for 13 days. In how many days will the same provisions be used up, if the strength of the camp is increased to 65 pupils?

(a) 4
(b) 5
(c) 7
(d) 3

Q42. Reena is 5 years older than Meena. Eight years ago from now, Reena's age was twice the age of Meena. Find the present age of Reena.

(a) 21 years
(b) 26 years
(c) 32 years
(d) 18 years

Q43. A shopkeeper declares the following three schemes of discounts. Which scheme is the most beneficial to a customer?

A. Buy 42 items and get 47 of the same items
B. Two successive discounts of 16% and 36%
C. Two successive equal discounts of 46%

(a) Only A
(b) C and B both
(c) Only C
(d) Only B

Q44. In triangle XYZ, sides XY = 12 cm, YZ = 15 cm and angle angle Y = 120°. What is the length of side XZ?

(a) 5√61 cm
(b) 3√61 cm
(c) √61 cm
(d) 7√61 cm

Q45. If the fourth proportional to 8, X and 15 is 135, then find the value of X .4888

(a) 72
(b) 73
(c) 71
(d) 74

Q46. The curved surface area of a cylinder is 55.44 m^2, which is two-thirds of its total surface area. Find the volume of the cylinder correct to two decimal places (use π = 22/7)

(a) 47.65 m3
(b) 36.35 m3
(c) 58.21 m^3
(d) 28.31 m3

Q47. The length of a rectangular field is $(2x + y^2)$ m and breadth is $(2x - y^2)$ m. Find the area of the rectangular field when x = 2 and y = 1.

(a) 15 m^2
(b) 29 m2
(c) 12 m2
(d) 26 m2

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Q48. A train travels at 84.6 km/hr. How many metres will it travel in 20 minutes?

(a) 28,200
(b) 26,200
(c) 26,400
(d) 24,600

Q49. In quadrilateral PQRS, the bisectors of angle R and angle S meet at the point T (inside the quadrilateral) and angle STR = 18°. If the ratio of angle P to angle Q is 2 : 7, then what is the difference between the measures of angle Q and angle P ?

(a) 17°
(b) 16°
(c) 20°
(d) 13°

Q50. A dealer allowed a 23% discount on an article and was still able to manage a 44% profit. Find the ratio of the cost price to the listed price.

(a) 76 : 146
(b) 74 : 149
(c) 78 : 151
(d) 77 : 144

GENERAL INTELLIGENCE & REASONING

Q51. In a certain code language,

A x B means ‘A is the father of B’,

A – B means ‘A is the mother of B’,

A ÷ B means ‘A is the son of B’ and

A + B means ‘A is the brother of B’.

How is K related to Q if ‘K x M − N + P ÷ Q’?

(a) Wife's brother
(b) Wife's father
(c) Mother's father
(d) Daughter's son

Q52. Seven people, A, B, C, D, E, F and G, are sitting in a straight line, facing the north.

A sits second from one of the extreme ends of the line. Only two people sit between A and B. C sits second to the right of B. Only three people sit between C and D. F sits second to the left of D. E sits at one of the positions to the right of G.

How many people sit between A and G?

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

Q53. 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) KF – MK
(b) OP – QU
(c) SZ – UE
(d) BG – EL

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Q54. Sachin ran 15 metres east from the starting point A. He then took a left turn and ran 25 metres, after which he took a right turn and ran another 5 metres. He took one last right turn and ran 25 metres until he reached point B. How far and in which direction should he run in order to reach point A? (All turns are 90-degree turns only, unless specified.)

(a) 20 metres towards the east
(b) 25 metres towards the east
(c) 20 metres towards the west
(d) 22 metres towards the west

Q55. EIJI is related to JNON in a certain way based on the English alphabetical order. In the same way, PTUT is related to UYZY. To which of the given options is IMNM related, following the same logic?

(a) NQRR
(b) NRSR
(c) NSRY
(d) NRRR

Q56. Eight people (P, Q, R, S, T, U, V and W) are sitting around a circular table, facing towards the centre.

There are exactly three people sitting between U and V. P is an immediate neighbour of both T and Q. Q sits to the immediate right of U. W is an immediate neighbour of both R and S. R sits second to the right of T.

How many people sit between W and Q, when counted from the right of W?

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

Q57. Refer to the following number and symbol series and answer the question that follows. Counting to be done from left to right only.

(Left) 6 © % © 7 # 5 % 5 4 2 # © 5 6 2 © $ € 1 € 8 (Right)

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

(a) 8
(b) 9
(c) 3
(d) 4

Q58. Prayansh starts from point A and drives 34 km towards the north. He then takes a left turn, drives 41 km, turns left and drives 56 km. He then takes a left turn and drives 63 km. He takes a final left turn, drives 22 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-degree turns only, unless specified.)

(a) 23 km to the west
(b) 20 km to the east
(c) 21 km to the east
(d) 22 km to the west

Q59. A, B, C, D, E and F are sitting around a circular table facing the centre. D sits third to the right of C. A sits second to the left of C. E sits second to the right of F. B sits to the immediate right of E. How many people sit between A and F when counted from the left of A?

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

Q60. Which of the following letter-number clusters will replace the question mark (?) in the given series to make it logically complete?

AQE3, DOH6, GMK9, ?

(a) JKM10

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(b) KLM10
(c) JKN12
(d) KLN12

Q61. Refer to the following number series and answer the question that follows (all numbers are single-digit numbers only). Counting to be done from left to right only.

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

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

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

Q62. Which of the following letter-number clusters will replace the question mark (?) in the given series to make it logically complete?

COP20, WIJ27, QCD34, KWX41, ?

(a) EQP48
(b) EOR48
(c) ELR48
(d) EQR48

Q63. What should come in place of the question mark (?) in the given series?

28, 39, 52, 67, 84, ?

(a) 102
(b) 103
(c) 105
(d) 104

Q64. If 1 is added to each odd digit and 2 is subtracted from each even digit in the number 63157842, how many digits will appear more than once in the new number thus formed?

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

Q65. 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 mangoes are artists.

All kiwis are mangoes.

Conclusions:

(I): All kiwis are artists

(II): Some artists are kiwis

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

Q66. 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) AD-HB

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(b) EH-LG
(c) CF-JE
(d) GJ-NI

Q67. What should come in place of the question mark (?) in the given series?

1101 1104 1108 1113 1119 ?

(a) 1123
(b) 1124
(c) 1126
(d) 1125

Q68. LHIG is related to DZAY in a certain way based on the English alphabetical order. In the same way, XTUS is related to PLMK. To which of the following is NJKI related, following the same logic?

(a) FCBK
(b) FBBA
(c) FABA
(d) FBCA

Q69. Select the triad which follows the same pattern as that followed by the two triads given below. Both triads follow the same pattern.

NF-KC-HJ

LD-IA-FH

(a) TL-QI-NO
(b) SL-QI-NO
(c) SL-RI-NO
(d) TL-QI-NP

Q70. 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) 4 3 3 5 3 9 5 4 4 3 8 7 9 8 8 1 1 3 2 5 9 1 8 7 1 5 6 (Right)

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

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

Q71. In a certain code language, DTWG is coded as 42 and RAYI is coded as 43. What is the code for OZES in that language?

(a) 31
(b) 28
(c) 37
(d) 35

Q72. In a row of 50 people facing north, Amit sits 17th from the left end. If only 18 people sit to the right of Vilas, then how many people sit between Amit and Vilas?

(a) 12
(b) 16
(c) 15
(d) 14

Q73. What should come in place of the question mark (?) in the given series?

102 80 58 36 14 ?

(a) -6
(b) -4

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(c) 0
(d) -8

Q74. If 1 is added to each even digit and 2 is subtracted from each odd digit in the number 4593867, which of the following digits will be second from the left in the new number thus formed?
(a) 9
(b) 3
(c) 8
(d) 5

Q75. Refer to the following number series and answer the question that follows (all numbers are single-digit numbers only).
(Left) 4 6 5 6 3 2 8 3 3 5 2 8 5 2 4 8 1 4 1 3 5 5 9 9 3 9 6 (Right)
How many such odd numbers are there (from left to right), each of which is immediately preceded by an even number and also immediately followed by an even number?
(a) 6
(b) 5
(c) 3
(d) 4

Q76. In a row of all 95 students facing the north, Mr. Hepa is 9^(th) from the right end. If Mr. Annu is 13^(th) to the left of Mr. Hepa, what is Mr. Annu's position from the left end of the row?
(a) 74th
(b) 73rd
(c) 75th
(d) 76th

Q77. Select the set in which the numbers are related in the same way as are the numbers of the following sets.
(NOTE : Operations should be performed on the whole numbers, without breaking down the numbers into its constituent digits. E.g. 13 – Operations on 13 such as adding / subtracting /multiplying etc. to 13 can be performed. Breaking down 13 into 1 and 3 and then performing mathematical operations on 1 and 3 is not allowed.)
(17, 25, 59)
(5, 13, 35)
(a) (9, 17, 25)
(b) (13, 21, 51)
(c) (11, 19, 48)
(d) (15, 7, 23)

Q78. In a certain code language, ‘HAVE’ is coded as ‘4579’ and ‘VOLT’ is coded as ‘2438’. What is the code for ‘V’ in the given code language?
(a) 2
(b) 4
(c) 8
(d) 7

Q79. If ‘+’ means ‘−’, ‘−’ means ‘×’, ‘×’ means ‘÷’ and ‘÷’ means ‘+’, then what will come in place of the question mark (?) in the following equation?
16 × 4 + 3 - 4 ÷ 8 = ?
(a) 13
(b) 8
(c) 4
(d) 0

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Q80. 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 helmets are mats.

All helmets are bottles.

Conclusions:

(I): Some mats are bottles.

(II): All bottles are helmets.

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

GENERAL AWARENESS AND CURRENT AFFAIRS

Q81. Which of the following commands participated in the successful combat launch of the BrahMos Supersonic Cruise Missile by the Indian Army in December 2025 from a test range in the Bay of Bengal?

(a) Western Command
(b) Eastern Command
(c) Southern Command
(d) Northern Command

Q82. Which new private reinsurer entered the Indian market in March 2025?

(a) General Re
(b) ABC Reinsurance
(c) Falcon Re
(d) Valueattics Reinsurance

Q83. Who was sworn in as the Chief Minister of Delhi following the 2025 elections?

(a) Rekha Gupta
(b) Atishi Marlena
(c) Manish Sisodia
(d) Arvind Kejriwal

Q84. South Africa ended a 27-year wait for a major cricket title by winning which tournament?

(a) World Test Championship
(b) ICC T20 World Cup
(c) Champions Trophy
(d) ICC Cricket World Cup

Q85. Which international agency raised concerns leading to amendments in India’s anti-doping law in July 2025?

(a) United Nations Educational, Scientific and Cultural Organization (UNESCO)
(b) International Olympic Committee (IOC)
(c) World Health Organization (WHO)
(d) World Anti-Doping Agency (WADA)

Q86. According to the IMF World Economic Outlook, 2025, which of the following countries is projected to have the highest GDP growth among major economies?

(a) The United States of America
(b) China
(c) India
(d) Japan

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Q87. The International Monetary Fund (IMF) sanctioned $2.3bn fund to which of the following countries in May 2025?

(a) Ukraine
(b) Pakistan
(c) Sri Lanka
(d) Syria

Q88. Which of the following measures did the Delhi government and IIT Kanpur attempt in October 2025 to clear smog that eventually proved unsuccessful due to low atmospheric moisture?

(a) Deploying large-scale air purifiers in all public parks
(b) Restricting industrial operations for one week
(c) Cloud-seeding to induce artificial rain
(d) Imposing a city-wide vehicle ban

Q89. Which two companies signed a Joint Venture Cooperation Agreement (JVCA) for the production of HAMMER smart precision guided Air-to-Ground weapons in India in November 2025?

(a) Larsen & Toubro (L&T) & Raytheon Technologies Corporation
(b) Bharat Dynamics Limited (BDL) & Thales Group
(c) Hindustan Aeronautics Limited (HAL) & Lockheed Martin Corporation
(d) Bharat Electronics Limited (BEL) & Safran Electronics and Defence (SED)

Q90. In November 2024, the Indian Space Research Organisation (ISRO) launched India's inaugural analog space mission at _____ with an aim to simulate interplanetary habitat conditions and helping scientists explore the feasibility of establishing a sustainable base station beyond Earth.

(a) Chandipur
(b) Tawang
(c) Leh
(d) Pokhran

Q91. In which of the following states was the Skill Development Centre inaugurated under the 'Pradhan Mantri Jan Vikas Karyakram' scheme in July 2025?

(a) Punjab
(b) Gujarat
(c) Maharashtra
(d) Kerala

Q92. The annual elephant rejuvenation camp held in September 2025 was conducted in which of the following tiger reserves of Madhya Pradesh?

(a) Bandhavgarh Tiger Reserve
(b) Sanjay Tiger Reserve
(c) Kanha Tiger Reserve
(d) Satpura Tiger Reserve

Q93. Which city hosted the Kho Kho World Cup from 13 to 19 January 2025?

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

Q94. Which veteran actor and dancer, noted for her appearances in films like 'Navrang' and 'Pinjra', passed away in October 2025?

(a) Jyoti Chandekar
(b) Sandhya Shantaram
(c) Sulakshana Pandit
(d) Madhumati

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Q95. With which of the following government bodies, did the Reserve Bank of India (RBI) collaborate in June 2025 to curb spam loan and credit-card calls?

(a) Securities and Exchange Board of India (SEBI)
(b) Unique Identification Authority of India (UIDAI)
(c) Central Bureau of Investigation (CBI)
(d) Telecom Regulatory Authority of India (TRAI)

Q96. 'Sanghatil Manavi Vyavasthapan' offering RSS insights, was authored by which politician published in May 2025?

(a) Yogi Adityanath
(b) Nitin Gadkari
(c) Shashi Tharoor
(d) Amit Shah

Q97. Who was named Sportsperson of the Year with a Disability at the 2025 Laureus Awards?

(a) Sophie Pascoe
(b) Ellie Simmonds
(c) Liu Yaxin
(d) Jiang Yuyan

Q98. In March 2025, the government of which of the following states announced to bring 5,000 hectares under afforestation during the year 2025-2026?

(a) West Bengal
(b) Himachal Pradesh
(c) Odisha
(d) Kerala

Q99. In January 2025, Chief Minister Conrad K Sangma inaugurated the 6^(th) Meghalaya Games at which venue in Jowai?

(a) Tura Indoor Stadium
(b) Wahiajer Multi Sports Complex Stadium
(c) Shillong Sports Complex
(d) Jawaharlal Nehru Stadium

Q100. Dr. C Anandharamakrishnan received the Rashtriya Vigyan Puraskar 2024 in the Vigyan Shri category for his contribution to the field of _____.

(a) Biological Science
(b) Agricultural Science
(c) Atomic Energy
(d) Medicine

ANSWER KEY

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

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SOLUTIONS

Q1. Answer: (a) 0.02 s

The correct answer is 0.02 s.

Key Points

• The frequency of a vibrating object is defined as the total number of oscillations or vibrations it completes in one second.

• The time period (T) is the duration required to complete one single vibration or cycle.

• There is a fundamental mathematical relationship between these two properties: they are the reciprocal of each other. The formula is expressed as T = 1 / f, where f represents the frequency.

• Given the data in the question, the frequency (f) is 50 Hz. To find the time period, we apply the formula: T = 1 / 50.

• By performing the division, 1 divided by 50 equals 0.02. Therefore, the time period of the vibrating object is 0.02 s. Hence, the correct answer is 0.02 s.

Additional Information

• Frequency and Units:

• The SI unit of frequency is the Hertz, abbreviated as Hz. It is named after the famous 19th-century German physicist Heinrich Rudolf Hertz, who proved the existence of electromagnetic waves.

• A frequency of 1 Hz means that one vibration occurs every one second. In this context, 50 Hz implies that the object is vibrating 50 times every one second.

• Time Period Characteristics:

• The SI unit for the time period is the second (s).

• In wave mechanics, the time period remains constant for a stable source, even if the wave travels through different media, provided the source frequency does not change.

• Physical Examples:

• Sound Waves: The frequency of a sound wave determines its pitch. A high-frequency vibration produces a high-pitched sound (like a whistle), while a low-frequency vibration produces a low-pitched sound (like a bass drum).

• Power Supply: In India, the standard frequency of the Alternating Current (AC) supplied to homes is 50 Hz, which matches the value provided in this problem.

Important Points

• Inverse Proportion: The frequency and the time period are in inverse proportion. If the frequency of an object doubles, its time period is halved.

• Calculation Tip: To quickly calculate 1/50, one can multiply both the numerator and the denominator by 2, resulting in 2/100, which clearly equals 0.02.

• Vibratory Motion: This type of motion is characterized by a "to-and-fro" movement about a central mean position. Common examples include the movement of a simple pendulum, the prongs of a tuning fork, or the strings of a guitar.

• Audible Range: For humans, the audible frequency range is typically between 20 Hz and 20,000 Hz. Any vibration with a frequency below 20 Hz is called infrasonic, and above 20,000 Hz is called ultrasonic.

Q2. Answer: (b) To reduce moisture content and prevent spoilage

The correct answer is To reduce moisture content and prevent spoilage.

Key Points

• The primary reason for drying grains before storage is to reduce the moisture content. Freshly harvested grains usually contain a high level of moisture, often ranging between 15% to 20% or more. For safe storage, this must be reduced to approximately 10% to 12%.

• High moisture content in grains promotes the growth of microorganisms such as fungi (molds) and bacteria. These organisms cause the grains to rot, leading to spoilage and making them unfit for human consumption. Hence, option 2 is correct.

• Drying also prevents the germination of grains during storage. If the moisture is high, the seeds may begin to sprout, which utilizes the stored nutrients and ruins the grain for both eating and future sowing purposes.

• Moist grains are highly susceptible to attacks by insects, pests, and weevils. Insects thrive in humid environments, and reducing the water content makes the grain a less favorable habitat for these pests.

• The two-step process of sunlight drying followed by shade drying is scientifically significant. Initial sun drying removes the bulk of the surface moisture quickly, while subsequent shade drying allows the internal moisture to evaporate slowly, preventing the grain from becoming brittle or developing cracks (fissures).

Additional Information

• Moisture Limits for Storage: Different crops require different moisture levels for long-term safety. For example, wheat and paddy are generally safe at 12% moisture, while oilseeds, which have higher oil content, require a lower moisture level of about 7% to

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8% to prevent rancidity.

• Methods of Drying:

• Natural Drying: Utilizing solar energy and wind. This is the most common method used by farmers in India.

• Mechanical Drying: Using hot air dryers or mechanical dehydrators. This allows for better control over temperature and relative humidity, ensuring uniform drying.

• Impact of Improper Drying: If grains are dried too rapidly in direct sunlight (especially rice), it can lead to "case hardening," where the outer layer dries and traps moisture inside, or it can cause the grain to break during milling, reducing the market value.

• Storage Structures: After proper drying, grains are stored in jute bags (gunny bags), metallic bins, or large-scale silos. In India, the Food Corporation of India (FCI) manages massive granaries to maintain buffer stocks for food security.

Important Points

• Mycotoxins: One of the most dangerous results of high moisture storage is the production of Aflatoxins by the fungus Aspergillus flavus. These toxins are carcinogenic and can be fatal to both humans and livestock.

• Enzymatic Activity: High moisture levels trigger biochemical reactions and enzymatic activity within the grain. This generates heat, creating "hot spots" in the storage container, which further accelerates the rate of spoilage.

• Traditional Preservation: Farmers often mix dried neem leaves with the grains in storage bins to act as a natural bio-pesticide, complementing the drying process to ensure the grains remain pest-free for 6 to 12 months.

• Quality Maintenance: Proper drying ensures that the color, flavor, and nutritional quality (carbohydrates and proteins) of the grain are preserved throughout the storage period.

Q3. Answer: (d) carbon-based

The correct answer is carbon-based.

Key Points

• Carbon-based molecules are the fundamental building blocks of all known life on Earth. This is because carbon has a unique ability to form four stable covalent bonds with other atoms, including other carbon atoms, allowing for the creation of complex, diverse, and large molecular structures.

• The primary source of energy for most organisms is glucose, which is a carbon-based sugar molecule. During the process of cellular respiration, the chemical energy stored in the carbon-to-carbon and carbon-to-hydrogen bonds of organic molecules is released and converted into ATP (Adenosine Triphosphate).

• Photosynthesis is the biological process by which autotrophs (like plants and algae) capture solar energy and use it to convert carbon dioxide (CO_2) and water into energy-rich carbon-based organic compounds like carbohydrates.

• All biological macromolecules—including carbohydrates, lipids, proteins, and nucleic acids (DNA and RNA)—have a carbon backbone. While nitrogen and oxygen are vital components of these molecules, carbon provides the structural framework that makes life possible.

Additional Information

• Nitrogen-based: While nitrogen is essential for life, particularly in the formation of amino acids (the building blocks of proteins) and nucleotides (the building blocks of DNA and RNA), it is not the primary source of energy. Most organisms cannot use atmospheric nitrogen (N_2) directly and rely on nitrogen fixation by bacteria.

• Oxygen-based: Oxygen is crucial for aerobic respiration, acting as the final electron acceptor in the electron transport chain. However, oxygen itself is not the energy source; rather, it is the agent that helps "burn" or oxidize carbon-based fuels to extract energy.

• Protein-based: Proteins are versatile molecules used for enzymatic catalysis, structural support, and transport. While organisms can metabolize proteins for energy during periods of starvation, they are not the "main" or preferred source of energy compared to carbohydrates and fats.

• Lipids (Fats): These are also carbon-based molecules that serve as a highly concentrated form of energy storage. They provide more than double the energy per gram (9 kcal/g) compared to carbohydrates (4 kcal/g).

Important Points

• Tetravalency: The property of carbon having 4 valence electrons allows it to form a variety of shapes, including long chains, branched structures, and rings, leading to millions of known organic compounds.

• Energy Release: When organisms consume food, they are essentially taking in carbon chains. Through metabolic pathways like the Krebs Cycle (Citric Acid Cycle), carbon atoms are systematically removed and released as carbon dioxide, while the energy in the bonds is captured.

• Organic Chemistry: This entire branch of science is dedicated to the study of carbon-containing compounds, illustrating the sheer importance of carbon in both biological and synthetic systems.

• Carbon Cycle: The movement of carbon between the atmosphere, biosphere, oceans, and geosphere ensures a continuous supply of carbon for the synthesis of energy-providing molecules for all living organisms.

Q4. Answer: (d) A concave mirror has its reflecting surface curved inward; a convex mirror has its reflecting surface curve...

The correct answer is A concave mirror has its reflecting surface curved inward; a convex mirror has its reflecting surface curved outward..

Key Points

• A spherical mirror is a mirror whose reflecting surface is a part of a hollow sphere of glass. Based on the direction of the curvature of the reflecting surface, they are classified into concave and convex mirrors.

• A concave mirror is a spherical mirror whose reflecting surface is curved inward, facing towards the center of the sphere. It is also known as a converging mirror because it converges parallel rays of light after reflection. Hence, statement 4 regarding the concave mirror is correct.

• A convex mirror is a spherical mirror whose reflecting surface is curved outward, facing away from the center of the sphere. It is also known as a diverging mirror because it diverges parallel rays of light after reflection. Hence, statement 4 regarding the convex mirror is correct.

• Statement 1 suggests a concave mirror reflects light outward; this is incorrect as concave mirrors are converging. Statement 2 claims both have the same direction, which is incorrect as they are opposites. Statement 3 claims both reflect inward, which is false for convex mirrors. Hence, statements 1, 2, and 3 are incorrect.

• The identification of these mirrors is fundamental in optics for determining the nature of images (real or virtual) and their magnification levels.

Additional Information

• Applications of Concave Mirrors:

• They are commonly used as shaving mirrors or makeup mirrors because they can produce an enlarged and erect image when the object is placed close.

• They are used in car headlights and searchlights to produce a powerful parallel beam of light.

• Dentists use concave mirrors to see large images of the teeth of patients.

• Large concave mirrors are used in solar furnaces to focus sunlight for heating purposes.

• Applications of Convex Mirrors:

• They are primarily used as rear-view mirrors in vehicles because they always give an erect (upright) image, although diminished.

• Convex mirrors provide a much wider field of view as they are curved outwards, allowing the driver to see a larger area of traffic behind them compared to a plane mirror.

• They are used as security mirrors in shops and automated teller machines (ATMs) to monitor large areas.

• Image Formation Characteristics:

• Concave mirrors can form both real and inverted images as well as virtual and erect images depending on the position of the object relative to the focal point.

• Convex mirrors always form a virtual, erect, and diminished image, regardless of the distance between the object and the mirror.

Important Points

• Principal Terminology:

• The center of the reflecting surface of a spherical mirror is called the Pole (P).

• The center of the hollow sphere of which the mirror is a part is the Center of Curvature (C).

• The distance between the Pole and the Center of Curvature is the Radius of Curvature (R).

• The Principal Focus (F) is the point on the principal axis where rays parallel to the axis meet (or appear to meet) after reflection.

• Mathematical Relationship: For spherical mirrors of small apertures, the Radius of Curvature (R) is found to be twice the focal length (f), represented by the formula R = 2f.

• Sign Convention: According to the New Cartesian Sign Convention, the focal length of a concave mirror is negative, while the focal length of a convex mirror is positive.

Q5. Answer: (a) Moisture

The correct answer is Moisture.

Key Points

• Agricultural produce is susceptible to various types of damage during storage, which are generally categorized into Biotic and Abiotic factors.

• Abiotic factors are the non-living physical and chemical components of the environment. In the context of storage, Moisture (humidity) and Temperature are the most significant abiotic factors. Hence, option 1 is correct.

• Moisture content in the produce or the surrounding air affects the rate of respiration and biochemical reactions. High moisture levels can lead to the caking of grains and promote the growth of microorganisms.

• Biotic factors refer to living organisms that cause damage. Rodents, such as rats and mice, are living animals that consume and

contaminate grains. Hence, option 2 is incorrect as it is a biotic factor.

• Fungi (molds) are living microorganisms that thrive in damp conditions, causing rot and producing toxins like aflatoxins. Hence, option 3 is incorrect as it is a biotic factor.

• Insects, such as the Rice Weevil or Pulse Beetle, are living pests that bore into seeds and reduce their nutritional value. Hence, option 4 is incorrect as it is a biotic factor.

• Hence, the correct answer is Moisture.

Additional Information

• Moisture Content for Storage: For safe and long-term storage, grains should generally be dried to a moisture content of below 14%. Higher moisture levels (above 16-18%) significantly increase the risk of heating and fungal infestation.

• Impact of Temperature: Temperature acts as an abiotic factor that influences the metabolic rate of the stored seeds. High temperatures combined with moisture can cause spontaneous heating of the grain bulk, leading to a total loss of quality.

• Biotic Damage Characteristics:

• Insects: They cause internal damage by eating the endosperm or embryo and external damage by making holes.

• Rodents: Apart from eating the grain, they contaminate it with excreta, urine, and hair, making it unfit for human consumption.

• Microorganisms: Bacteria and fungi cause discoloration, foul odors, and loss of viability (germinability).

• Prevention and Control:

• Drying: Produce should be sun-dried followed by drying in the shade to reach the optimum moisture level before storage.

• Maintenance of Hygiene: Cleaning the storage structures (such as silos, bins, or gunny bags) is essential to remove traces of previous infestations.

• Prophylactic Treatment: Using fumigants like Ethylene Dibromide (EDB) or Aluminium Phosphide tablets can help in controlling biotic pests in airtight conditions.

• Consequences of Storage Loss: Improper management of these factors leads to degradation in quality, loss in weight, and a drastic reduction in market value of the agricultural commodities.

Q6. Answer: (c) Protons

The correct answer is Protons.

Key Points

• Isotopes are defined as atoms of the same chemical element that have the same number of protons but different numbers of neutrons.

• The number of protons in the nucleus is known as the atomic number, which determines the identity of an element. Since all isotopes of an element have the same number of protons, they all occupy the same position in the periodic table.

• While isotopes have the same proton count, they differ in their mass number, which is the total sum of protons and neutrons within the nucleus.

• In a neutral atom of an isotope, the number of electrons is also equal to the number of protons. This identical electronic configuration is the reason why isotopes of an element exhibit identical chemical properties.

• The concept of isotopes was first proposed by the British chemist Frederick Soddy in 1913, for which he was later awarded the Nobel Prize in Chemistry in 1921.

Additional Information

• Isotopes of Hydrogen:

• Hydrogen has three naturally occurring isotopes: Protium, Deuterium, and Tritium.

• Protium has 1 proton and 0 neutrons; it is the most common form of hydrogen found in nature.

• Deuterium contains 1 proton and 1 neutron and is often referred to as heavy hydrogen.

• Tritium contains 1 proton and 2 neutrons and is a radioactive isotope of hydrogen.

• Applications of Isotopes:

• Uranium-235: This isotope is used as nuclear fuel in reactors to generate electricity.

• Cobalt-60: It is widely used in the medical field for the treatment of cancer through radiotherapy.

• Iodine-131: This isotope is used in the diagnosis and treatment of thyroid gland disorders, such as goiter.

• Carbon-14: Used in carbon dating to determine the age of ancient organic materials and fossils.

• Physical vs. Chemical Properties:

• Because chemical reactions involve electrons, and isotopes of an element have the same number of electrons, their chemical behavior is the same.

• However, physical properties such as density, melting point, and boiling point differ because they are influenced by the atomic mass.

Important Points

• Isobars: Unlike isotopes, isobars are atoms of different chemical elements that have the same mass number but different atomic numbers. An example includes Argon (atomic number 18) and Calcium (atomic number 20), both having a mass number of 40.

• Isotones: These are atoms of different elements that have the same number of neutrons but different proton counts. For instance, Carbon-14 (6 protons, 8 neutrons) and Oxygen-16 (8 protons, 8 neutrons) are isotones.

• Radioisotopes: Some isotopes are unstable and undergo radioactive decay, emitting radiation in the form of alpha, beta, or gamma rays. These are called radioisotopes and are used extensively in industry, agriculture, and medicine.

Q7. Answer: (d) Because of the inertia of motion that keeps the body moving forward

The correct answer is Because of the inertia of motion that keeps the body moving forward.

Key Points

• The phenomenon of passengers jerking forward is a direct application of Newton's First Law of Motion, also known as the Law of Inertia.

• According to this law, an object continues in its state of rest or uniform motion in a straight line unless acted upon by an external unbalanced force.

• When a car is in motion, both the vehicle and the passengers possess Inertia of Motion, meaning they have a tendency to keep moving at the same speed and in the same direction.

• When the brakes are applied suddenly, an external force stops the car. The lower part of the passenger's body, being in direct contact with the car seat, comes to rest along with the car due to friction.

• However, the upper part of the body is not in rigid contact with the car and tries to maintain its state of motion due to inertia. Hence, the body jerks forward as it continues to move while the base has stopped.

Additional Information

• Definition of Inertia: Inertia is the inherent property of a body by virtue of which it resists any change in its state of rest or uniform motion. It is not a force but a fundamental characteristic of matter.

• Types of Inertia:

• Inertia of Rest: The tendency of an object to stay at rest. For example, when a bus starts suddenly, passengers jerk backwards because the lower body moves forward with the bus while the upper body tries to remain at rest.

• Inertia of Motion: The tendency of an object to stay in motion. This is observed when a moving car stops abruptly, as mentioned in the question.

• Inertia of Direction: The tendency of an object to maintain its direction of travel. For example, when a car takes a sharp curve, passengers are thrown to one side because their bodies try to continue moving in the original straight line.

• Relationship with Mass: The inertia of an object is measured by its mass. A body with a larger mass (like a truck) has more inertia and requires a greater force to change its state compared to an object with a smaller mass (like a bicycle).

• Historical Context: These principles were first mathematically detailed by Sir Isaac Newton in his work 'Philosophiæ Naturalis Principia Mathematica', published in the year 1687.

Important Points

• Safety Applications: The concept of Inertia of Motion is the primary reason why seatbelts are mandatory in vehicles. Seatbelts provide the necessary counter-force to stop the upper body from crashing into the dashboard or windshield during sudden braking or a collision.

• Friction's Role: While inertia causes the forward movement, it is the frictional force between the person and the seat (and the floor) that eventually helps bring the passenger to a stop relative to the car.

• Galileo’s Contribution: Before Newton, Galileo Galilei was the first to suggest the concept of inertia through his experiments with inclined planes and falling objects in the early 17th century.

Q8. Answer: (b) 10.0 m/s²

The correct answer is 10.0 m/s2.

Key Points

• To find the acceleration due to gravity (g), we use the second equation of motion for a body falling under gravity: s = ut + 1/2 gt2.

• In this problem, the stone falls freely, which implies that its initial velocity (u) is 0 m/s.

• The distance (s) covered by the stone is given as 20 m, and the time (t) taken is 2.0 s.

• By substituting the known values into the equation: 20 = (0 * 2.0) + 1/2 * g * (2.0 * 2.0).

• This simplifies to 20 = 1/2 * g * 4, which further reduces to 20 = 2g.

• Solving for g, we get g = 20 / 2 = 10.0 m/s2. Hence, the calculated value for acceleration due to gravity is 10.0 m/s2.

Additional Information

• Acceleration due to Gravity (g):

• It is the acceleration gained by an object due to the gravitational force of a massive body like Earth.

• On the surface of the Earth, the standard value of g is approximately 9.8 m/s2, though in many competitive exams and physics

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problems, it is rounded to 10.0 m/s2 for ease of calculation.

• The value of g varies depending on the altitude (decreases as we go up) and depth (decreases as we go towards the center of the Earth).

• Free Fall:

• An object is said to be in free fall when it moves solely under the influence of gravity, with no other forces like air resistance acting upon it.

• During free fall, all objects, regardless of their mass, accelerate toward the center of the Earth at the same rate (g), as famously demonstrated by Galileo Galilei.

• Equations of Motion under Gravity:

• For an object falling downwards: v = u + gt; s = ut + 1/2 gt2; and v2 = u2 + 2gs.

• If an object is thrown upwards, the acceleration is taken as -g because it acts against the direction of motion.

• The SI unit of acceleration due to gravity is meters per second squared (m/s2).

Important Points

• The value of g is maximum at the poles and minimum at the equator due to the Earth's ellipsoidal shape and rotation.

• Weight is the product of mass and acceleration due to gravity (W = m * g). Since g changes based on location (like moving from Earth to the Moon), the weight of an object changes while its mass remains constant.

• On the Moon, the value of g is approximately 1/6th of that on Earth, roughly 1.62 m/s2.

Q9. Answer: (c) The graph is a straight line because velocity changes by equal amounts in equal intervals of time.

The correct answer is The graph is a straight line because velocity changes by equal amounts in equal intervals of time.

Key Points

• Uniformly accelerated motion is defined as a type of motion in which the velocity of an object changes by equal amounts in equal intervals of time.

• In this type of motion, the acceleration remains constant throughout the duration of the movement.

• The velocity-time graph (v-t graph) for an object moving with uniform acceleration is always a straight line. This is because the relationship between velocity and time is linear, following the first equation of motion: v = u + at. Hence, statement 3 is correct.

• The slope of the velocity-time graph represents the acceleration of the object. Since the slope of a straight line is constant, it signifies that the acceleration is uniform.

• A horizontal graph would imply that velocity is not changing, which means the acceleration is zero. Hence, statement 1 is incorrect.

• A curved graph indicates that the velocity is changing at a non-uniform rate, meaning the acceleration is not constant. Hence, statement 2 is incorrect.

Additional Information

• Uniform Motion:

• In uniform motion, an object travels equal distances in equal intervals of time, meaning the velocity is constant.

• The acceleration in uniform motion is zero.

• The v-t graph for uniform motion is a straight line parallel to the time axis (horizontal line).

• Area under the Graph:

• The area enclosed by the velocity-time graph and the time axis represents the displacement of the object over a specific time interval.

• For a straight-line graph starting from the origin, this area forms a triangle, whereas for motion with an initial velocity, it forms a trapezium.

• Equations of Motion:

• There are three fundamental equations for uniformly accelerated motion:

1. v = u + at (Velocity-time relation)

2. s = ut + 1/2 at^2 (Position-time relation)

3. v^2 = u^2 + 2as (Position-velocity relation)

• Here, u is initial velocity, v is final velocity, a is acceleration, t is time, and s is displacement.

Important Points

• Slope Interpretation:

• A positive slope on a v-t graph indicates positive acceleration (the object is speeding up).

• A negative slope (downward line) indicates retardation or deceleration (the object is slowing down).

• Position-Time Graph:

• For uniformly accelerated motion, the position-time (s-t) graph is not a straight line but a parabola.

• This is because displacement is proportional to the square of time (t^2).

• Real-world Example:

• A classic example of uniformly accelerated motion is an object in free fall near the Earth's surface.

• In the absence of air resistance, the object accelerates downward at a constant acceleration due to gravity (g), which is approximately 9.8 m/s^2.

Q10. Answer: (a) They carry materials to and from the Golgi apparatus

The correct answer is They carry materials to and from the Golgi apparatus.

Key Points

• The Golgi apparatus functions as the central sorting and dispatching station for the cell's chemical products. Its primary role involves modifying, sorting, and packaging proteins and lipids that are synthesized in the cell.

• Vesicles are essential components of this system because they act as transport vehicles. They fuse with the cis face (receiving side) of the Golgi to deliver raw materials from the Endoplasmic Reticulum (ER).

• Once the materials undergo biochemical modifications within the cisternae (the flattened sacs of the Golgi), they are pinched off into new secretory vesicles from the trans face (shipping side).

• These vesicles then carry the processed materials to their final destinations, such as the plasma membrane for secretion outside the cell or to other internal organelles. Hence, statement 1 is correct.

• Unlike vesicles, mitochondria are responsible for generating energy (ATP), and lysosomes are the organelles that digest waste materials. Vesicles do not play a primary role in forming the nucleus.

Additional Information

• Discovery: The Golgi apparatus was discovered by the Italian biologist Camillo Golgi in 1898. He used a unique staining technique called the black reaction to visualize it under a microscope.

• Structure: It consists of a series of flattened, membrane-bound sacs known as cisternae. A typical Golgi stack may contain anywhere from three to twenty cisternae, depending on the cell type.

• Protein Modification: One of the most important functions of the Golgi is glycosylation, where carbohydrate chains are added to proteins to form glycoproteins. This process is vital for cell signaling and recognition.

• Formation of Lysosomes: The Golgi apparatus is directly involved in the synthesis of lysosomes. It packages hydrolytic enzymes into specialized vesicles that become the cell's primary digestive system.

• Cell Secretion: In glandular cells, the Golgi apparatus is highly developed because these cells are specialized in secreting substances like hormones and enzymes, which require extensive packaging into secretory vesicles.

• Plant Cells: In plant cells, the Golgi apparatus is often referred to as dictyosomes. They play a crucial role in synthesizing polysaccharides like pectin and hemicellulose used in the construction of the cell wall.

Q11. Answer: (c) Carbon dioxide and water

The correct answer is Carbon dioxide and water.

Key Points

• Complete combustion of carbon compounds occurs when there is a sufficient and unlimited supply of oxygen or air available for the chemical reaction.

• The primary chemical products of this process are always carbon dioxide (CO_2) and water (H_2O) vapor. Hence, the statement regarding the production of carbon dioxide and water is correct.

• During complete combustion, the carbon and hydrogen atoms in the fuel react fully with oxygen, ensuring that no unburnt carbon or carbon monoxide remains as a byproduct.

• This reaction is highly exothermic, meaning it releases a significant amount of energy in the form of heat and light, making it the ideal process for heating and power generation.

• Carbon compounds, particularly saturated hydrocarbons like methane, ethane, and propane, undergo complete combustion to produce a clean, blue flame without any soot or smoke.

Additional Information

• Incomplete Combustion: This happens when the oxygen supply is limited. Instead of carbon dioxide, it produces carbon monoxide (CO)—a highly toxic, colorless, and odorless gas—or soot (fine carbon particles). The flame produced is usually yellow and sooty.

• Hydrocarbons: These are organic compounds consisting entirely of hydrogen and carbon. They are the primary components of fossil fuels like natural gas, petrol, and diesel.

• Oxidation Reaction: Combustion is a specific type of oxidation reaction where a substance reacts rapidly with oxygen. All combustion reactions are oxidation reactions, but not all oxidation reactions (like rusting) are combustion.

• Ignition Temperature: For combustion to begin, the carbon compound must be heated to its ignition temperature, which is the lowest temperature at which a substance catches fire.

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• Environmental Impact: While complete combustion is efficient, the release of carbon dioxide is a major contributor to the greenhouse effect and global warming.

Important Points

• Saturated vs. Unsaturated Hydrocarbons: Saturated hydrocarbons (alkanes) generally give a clean flame, while unsaturated hydrocarbons (alkenes and alkynes) often give a yellow flame with black smoke because the carbon percentage is higher, leading to incomplete oxidation in normal air.

• LPG Combustion: The Liquefied Petroleum Gas (LPG) used in kitchens contains butane. The burners have air holes to ensure a sufficient oxygen supply, resulting in a blue flame. If the holes are blocked, the flame turns yellow, indicating incomplete combustion.

• Chemical Equation: A general example is the combustion of methane: $CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$ + Heat/Light. This demonstrates the transformation into carbon dioxide and water.

Q12. Answer: (a) Cisternae

The correct answer is Cisternae.

Key Points

• The Golgi apparatus is composed of a series of flattened, membrane-bound sacs known as Cisternae. These structures are typically stacked together in a parallel fashion, resembling a stack of pancakes. Hence, option 1 is correct.

• A typical Golgi stack contains anywhere from 4 to 8 cisternae, although in some protists, the number can reach up to 60. Each cisterna creates a separate enclosed environment, allowing for different chemical reactions to occur at different stages of processing.

• The cisternae are functionally distinct and exhibit polarity. The cis face is the receiving side located near the Endoplasmic Reticulum (ER), while the trans face is the shipping side that faces the plasma membrane.

• Within these cisternae, the cell performs essential modifications to proteins and lipids, such as glycosylation (adding sugar chains) and phosphorylation.

• The Golgi apparatus plays a vital role in the secretory pathway, acting as the primary center for sorting and packaging molecules into vesicles for delivery to specific intracellular or extracellular destinations.

Additional Information

• Cristae:

• These are the internal infoldings or finger-like projections of the inner mitochondrial membrane.

• The primary function of cristae is to increase the surface area of the mitochondria, which facilitates higher rates of ATP (Adenosine Triphosphate) production through cellular respiration.

• They house the Electron Transport Chain and the enzyme ATP synthase, which are crucial for energy metabolism.

• Vesicles:

• These are small, spherical, membrane-bound compartments that transport or store substances within the cytoplasm.

• In the context of the Golgi complex, transport vesicles bring materials from the ER to the cis-Golgi, while secretory vesicles bud off from the trans-Golgi to carry finished products to the cell membrane.

• Thylakoids:

• These are disc-like, membrane-bound structures found inside chloroplasts of plant cells and cyanobacteria.

• They are arranged in stacks called grana and contain chlorophyll, the pigment responsible for capturing light energy.

• Thylakoids are the primary site for the light-dependent reactions of photosynthesis, where solar energy is converted into chemical energy.

Important Points

• Discovery: The Golgi apparatus was first identified in 1898 by the Italian physician and biologist Camillo Golgi using a silver nitrate staining technique.

• Cellular Location: It is found in almost all eukaryotic cells, including plants, animals, and fungi, but is absent in prokaryotic cells like bacteria.

• Analogy: Because of its role in sorting, tagging, and distributing cellular products, it is frequently referred to as the "Post Office" or "Shipping Center" of the cell.

• Dictyosomes: In plant cells, the Golgi stacks are often referred to as dictyosomes and are usually more scattered throughout the cytoplasm compared to the centralized Golgi in animal cells.

Q13. Answer: (c) forms concentric circles around the conductor

The correct answer is forms concentric circles around the conductor.

Key Points

• The magnetic field produced by a straight current-carrying conductor forms a pattern of concentric circles centered at every point on the conductor. These circles lie in a plane perpendicular to the direction of the current.

• The discovery of the relationship between electricity and magnetism was made by Hans Christian Oersted in 1820, when he noticed a compass needle deflect near a metallic wire carrying electric current.

• The direction of these magnetic field lines can be easily determined using the Right-Hand Thumb Rule (also known as Maxwell's Corkscrew Rule). According to this rule, if the thumb of the right hand points in the direction of the current, the curled fingers will indicate the direction of the magnetic field lines.

• The strength or magnitude of the magnetic field (B) at any given point is directly proportional to the current (I) passing through the conductor. If the current increases, the magnetic field becomes stronger.

• The magnitude of the magnetic field is inversely proportional to the distance (r) from the conductor. As the distance from the wire increases, the concentric circles representing the field lines are drawn further apart, indicating a decrease in field strength.

Additional Information

• Right-Hand Thumb Rule Details:

• If the current flows vertically upwards, the magnetic field lines appear to move in an anti-clockwise direction when viewed from above.

• If the current flows vertically downwards, the magnetic field lines appear to move in a clockwise direction.

• SI Unit: The SI unit of magnetic field induction or magnetic flux density is the Tesla (T), named after the inventor Nikola Tesla. Another smaller unit used is the Gauss (G), where 1 Tesla = 10,000 Gauss.

• Visualization: The pattern of concentric circles can be visualized by passing a straight wire through a horizontal cardboard and sprinkling iron filings on it. When current is passed, the filings arrange themselves in circular patterns around the wire.

• Mathematical Expression: For an infinitely long straight conductor, the magnetic field B at a distance r is given by the formula B = (μ0I) / (2πr), where μ0 is the permeability of free space (approximately 4π × 10^-^7 T·m/A).

Important Points

• The magnetic field lines are closed continuous loops; however, for a straight wire, they simply loop around the wire itself without a defined "North" or "South" pole in the traditional bar-magnet sense.

• The field lines never intersect each other. If they did, it would mean that at the point of intersection, the magnetic field has two different directions, which is physically impossible.

• The density of the magnetic field lines indicates the strength of the field; closer lines near the conductor signify a stronger magnetic field compared to the regions further away.

• The magnetic effect of current is the fundamental principle behind the working of devices like electromagnets, electric motors, and galvanometers.

Q14. Answer: (d) Existence of double or triple bonds between carbon atoms

The correct answer is Existence of double or triple bonds between carbon atoms.

Key Points

• Unsaturated organic compounds are defined by the presence of double bonds or triple bonds between carbon atoms within their molecular structure.

• The high reactivity of these compounds is primarily due to the presence of pi (π) bonds. Unlike sigma (σ) bonds, which are formed by the head-on overlap of atomic orbitals, pi bonds result from the lateral overlap of p-orbitals.

• These pi bonds are characterized by a high electron density located above and below the plane of the bonded carbon atoms, making the electrons easily accessible to electrophilic reagents.

• Because these bonds are relatively weaker than single bonds, they can be easily broken to form new single bonds with other atoms. This allows unsaturated compounds to undergo addition reactions readily. Hence, option 4 is the correct statement.

• In contrast, saturated compounds (alkanes) contain only single C-C bonds and are much less reactive because they require substitution reactions, which involve breaking stronger sigma bonds.

Additional Information

• Alkenes: These are hydrocarbons containing at least one carbon-carbon double bond (C=C). Their general formula is CnH2n. An example is Ethene (C2H4), used extensively in the production of plastics.

• Alkynes: These hydrocarbons contain at least one carbon-carbon triple bond (C≡C). Their general formula is CnH2n-2. Ethyne (C2H2), also known as acetylene, is a common example used in welding torches.

• Hybridization: In unsaturated compounds, the carbon atoms involved in double bonds are sp2 hybridized, while those in triple bonds are sp hybridized. This geometric arrangement contributes to the spatial availability of electrons for reactions.

• Functional Groups: While the presence of halogen atoms (Option 1) can increase the reactivity of a molecule, it characterizes haloalkanes rather than the inherent nature of unsaturation.

• Hydrogen Content: The absence of hydrogen (Option 2) does not define unsaturation; for instance, Carbon Tetrachloride (CCl4) has no hydrogen but is a saturated molecule because it only contains single bonds.

Important Points

• Bromine Water Test: This is a classic qualitative test used to identify unsaturation. When unsaturated compounds are added to

reddish-brown bromine water, the color disappears (decolorization) as an addition reaction occurs, forming a colorless dibromoalkane.

• Hydrogenation: This is a major industrial application where unsaturated vegetable oils are converted into saturated fats (like vanaspati ghee) by adding hydrogen gas in the presence of Nickel (Ni) or Palladium (Pd) catalysts at a temperature of about 473 K.

• Polymerization: The reactivity of the double bond allows unsaturated monomers like Vinyl Chloride to link together to form long-chain polymers like PVC (Polyvinyl Chloride), which is used in pipes and insulation.

• Stability: Although reactive, the bond energy of a C=C double bond (approx 614 kJ/mol) is higher than a C-C single bond (approx 347 kJ/mol), but because the pi component is easier to disrupt, the molecule is chemically more active.

Q15. Answer: (a) Mixtures

The correct answer is Mixtures.

Key Points

• The Law of Constant Proportion, also known as the Law of Definite Proportions, was proposed by the French chemist Joseph Proust in 1799. It states that a chemical compound always contains its component elements in a fixed ratio by mass, regardless of its source or method of preparation.

• Mixtures: A mixture consists of two or more substances physically combined in any proportion. Because the components of a mixture do not react chemically to form a new substance with a fixed composition, the Law of Constant Proportion is not applicable to them. For example, a salt-water solution can have varying amounts of salt. Hence, statement 1 is correct.

• Ionic Compounds: These are substances formed by the chemical combination of elements through ionic bonds. They follow the Law of Constant Proportion strictly. For instance, Sodium Chloride (NaCl) always contains Sodium and Chlorine in a fixed mass ratio of approximately 23:35.5. Hence, statement 2 is incorrect.

• Compounds: By definition, a compound is a substance formed when two or more elements are chemically bonded together. Every pure sample of a specific compound will always have the same elements in the same mass proportion. Water (H2O), for example, always contains Hydrogen and Oxygen in a 1:8 ratio by mass. Hence, statement 3 is incorrect.

• Elements: Elements are pure substances consisting of only one type of atom. While the law governs how elements combine to form compounds, it is technically "applicable" in the sense that elements are the constituents that define the proportions in chemical reactions. However, compared to mixtures, they represent the fundamental units that obey chemical laws. Hence, statement 4 is incorrect.

Additional Information

• Nature of Mixtures:

• Mixtures are classified into Homogeneous (uniform composition, like air or alloys) and Heterogeneous (non-uniform composition, like sand and iron filings).

• Unlike compounds, the components of a mixture retain their original physical properties and can be separated by physical methods such as filtration, distillation, or magnetization.

• The variable composition is the defining feature that exempts them from the Law of Definite Proportions.

• Chemical Laws of Combination:

• Law of Conservation of Mass: Formulated by Antoine Lavoisier in 1789, stating that mass is neither created nor destroyed in a chemical reaction.

• Law of Multiple Proportions: Proposed by John Dalton in 1803, stating that if two elements form more than one compound, the masses of one element that combine with a fixed mass of the other are in a ratio of small whole numbers.

• Dalton’s Atomic Theory:

• In 1808, John Dalton provided the theoretical explanation for these laws. He stated that atoms of different elements combine in simple whole-number ratios to form compounds.

• This theory explains why the relative number and kinds of atoms are constant in a given compound, directly supporting Proust's findings.

Important Points

• Exceptions to the Law: While generally true for most inorganic compounds, Non-stoichiometric compounds (also called Berthollides) do not follow this law. Their elemental composition can vary within certain limits, often found in solid-state chemistry and mineralogy (e.g., Ferrous Oxide often appearing as Fe0.95O).

• Isotopes: The law can also be slightly affected by the presence of isotopes. Since isotopes of an element have different atomic masses, a compound made with different isotopic ratios will have different mass proportions, even though it is chemically the "same" compound.

Q16. Answer: (d) Esters

The correct answer is Esters.

Key Points

• Ethanoic acid reacts with absolute alcohols (such as ethanol) in the presence of an acid catalyst to produce a compound known as an Ester.

• This specific chemical reaction between a carboxylic acid and an alcohol is widely known as Esterification. Hence, the correct answer is Esters.

• In this reaction, the hydroxyl group (-OH) of the carboxylic acid is replaced by an alkoxy group (-OR) from the alcohol, resulting in the formation of the ester functional group (-COOR) and water as a byproduct.

• Generally, Concentrated Sulfuric Acid (H_2SO_4) is used as a catalyst in this process to accelerate the reaction and act as a dehydrating agent to remove water, shifting the equilibrium toward the product side.

• The most common example of this reaction is the combination of Ethanoic acid and Ethanol, which yields Ethyl Ethanoate, a colorless liquid with a characteristic fruity smell.

Additional Information

• Ethanoic Acid:

• Commonly known as Acetic Acid, it belongs to a group of organic acids called Carboxylic Acids.

• A 5-8% solution of acetic acid in water is known as Vinegar and is used extensively as a preservative in pickles.

• The melting point of pure ethanoic acid is 290 K, and because it often freezes during winter in cold climates, it is also referred to as Glacial Acetic Acid.

• Properties and Uses of Esters:

• Esters are sweet-smelling substances that occur naturally in many fruits and flowers.

• Due to their pleasant fragrance, they are primarily used in the manufacture of perfumes, cosmetics, and as artificial flavoring agents in the food industry.

• They also serve as excellent organic solvents for lacquers, resins, and nitrocellulose.

• Saponification Reaction:

• When an ester is treated with an alkali (a base like Sodium Hydroxide), it is converted back into alcohol and the sodium salt of the carboxylic acid.

• This reaction is known as Saponification because it is the fundamental process used in the preparation of soaps.

• Soaps are essentially sodium or potassium salts of long-chain fatty acids (carboxylic acids).

Important Points

• Chemical Equation: The reaction of Ethanoic acid (CH_3COOH) and Ethanol (CH_3CH_2OH) can be represented as: $CH_3COOH + CH_3CH_2OH$ (in presence of Acid) $\rightarrow CH_3COOCH_2CH_3 + H_2O$.

• Aldehydes and Ketones: These are different functional groups. Aldehydes have the -CHO group, while Ketones have the -C=O group within the carbon chain. They are not the direct products of the reaction between a carboxylic acid and an alcohol.

• Catalytic Role: Without the acid catalyst, the reaction between ethanoic acid and alcohol is extremely slow. The catalyst provides protons that increase the electrophilicity of the carbonyl carbon in the acid.

• Reversibility: Esterification is a reversible reaction. To obtain a high yield of ester, water is often removed as it forms to prevent the reverse reaction (hydrolysis).

Q17. Answer: (c) The uterine lining breaks down and is expelled as blood and mucous.

The correct answer is The uterine lining breaks down and is expelled as blood and mucous.

Key Points

• The process in which the female body sheds the lining of the uterus when pregnancy does not occur is known as menstruation.

• If the egg released during ovulation is not fertilized by a sperm, it lives for about 24 hours and then begins to degenerate.

• Without fertilization, the corpus luteum (a temporary endocrine structure in the ovary) degenerates, leading to a sharp decline in the levels of hormones like progesterone and estrogen.

• The endometrium (thick uterine lining), which was prepared to nourish a fertilized egg, is no longer needed. Consequently, this lining breaks down and is discharged through the vagina as a mixture of blood, mucous, and tissue. Hence, statement 3 is correct.

• The thick uterine lining is not retained permanently; instead, it is rebuilt during every cycle to prepare for a potential pregnancy. Hence, statement 1 is incorrect.

• An egg only turns into an embryo if it is successfully fertilized by a male gamete (sperm). If fertilization does not happen, the egg simply disintegrates. Hence, statement 2 is incorrect.

• The ovary does not stop releasing eggs permanently after a single unfertilized cycle. This process continues monthly until a woman reaches menopause, typically between the ages of 45 and 55. Hence, statement 4 is incorrect.

Additional Information

• The Menstrual Cycle: It is the reproductive cycle in female primates (e.g., monkeys, apes, and human beings). The first menstruation begins at puberty and is called menarche. It usually repeats at an interval of about 28 to 29 days.

• Phases of the Cycle:

• Menstrual Phase: Lasts for 3 to 5 days, involving the shedding of the endometrial lining.

• Follicular Phase: Primary follicles in the ovary grow to become a fully mature Graafian follicle, and the endometrium regenerates through proliferation.

• Ovulatory Phase: Occurs around the 14th day of a 28-day cycle, where a surge in Luteinizing Hormone (LH) induces the rupture of the Graafian follicle and the release of the egg.

• Luteal Phase: The remaining parts of the Graafian follicle transform into the corpus luteum, which secretes large amounts of progesterone.

• Hormonal Regulation: The cycle is regulated by hormones from the pituitary gland (FSH and LH) and the ovaries (estrogen and progesterone). FSH (Follicle Stimulating Hormone) stimulates follicular development, while LH triggers ovulation.

• Menopause: In human beings, menstrual cycles cease around 50 years of age; that is termed menopause. Cyclic menstruation is an indicator of normal reproductive life and extends between menarche and menopause.

Important Points

• Fertilization: If fertilization occurs, the corpus luteum is maintained and continues to produce progesterone, which is essential for maintaining the endometrium during pregnancy. In this case, the menstrual flow does not occur.

• Lack of Menstruation: While the absence of a period is often an early sign of pregnancy, it can also be caused by other factors such as stress, poor health, hormonal imbalances, or extreme physical exercise.

• Zygote Formation: If the egg is fertilized in the fallopian tube (specifically the ampulla), it forms a zygote, which then undergoes cleavage to become an embryo before implanting in the uterine wall.

Q18. Answer: (b) 20 m/s

The correct answer is 20 m/s.

Key Points

• The motion of the block is a case of free fall under gravity. When an object is dropped, its initial velocity (u) is 0 m/s.

• To find the velocity of the block as it hits the ground, we use the third equation of motion: v^2 = u^2 + 2as.

• In this scenario:

• Initial velocity (u) = 0 m/s (since it is dropped).

• Distance or Height (s) = 20 m.

• Acceleration (a) = acceleration due to gravity (g) = 10 m/s^2.

• Substituting these values into the formula:

• v^2 = 0^2 + 2 * 10 * 20

• v^2 = 400

• v = 20 m/s.

• Therefore, the final velocity (v) with which the 1 kg block hits the ground is 20 m/s. Hence, the correct option is 20 m/s.

Additional Information

• Acceleration due to Gravity (g): This is the acceleration gained by an object due to the gravitational force of the Earth. Its standard value is approximately 9.8 m/s^2, but for simpler calculations, it is often taken as 10 m/s^2.

• Independence of Mass: In the absence of air resistance, the final velocity and the time of flight of a falling body are independent of its mass. Whether the block is 1 kg or 100 kg, it will hit the ground with the same velocity if dropped from the same height.

• Conservation of Energy: This problem can also be solved using the principle of conservation of energy. The Potential Energy (PE) at the top of the building (mgh) is converted entirely into Kinetic Energy (KE) at the bottom (1/2 mv^2). Equating mgh = 1/2 mv^2 allows the mass (m) to be canceled from both sides, leading to the formula v = sqrt(2gh).

• Equations of Motion: There are three primary equations for uniformly accelerated motion:

• v = u + at (First equation)

• s = ut + 1/2 at^2 (Second equation)

• v^2 = u^2 + 2as (Third equation)

Important Points

• Sign Convention: In kinematics, the direction of motion is crucial. When an object falls downward, both displacement and acceleration are usually taken as positive if the downward direction is chosen as the positive axis.

• Impact of Height: The velocity is directly proportional to the square root of the height. If the height is quadrupled, the velocity at impact doubles.

• Time of Fall: The time it takes for the block to reach the ground can be calculated using v = u + at. For this case, 20 = 0 + 10 * t, which gives t = 2 seconds.

• Air Resistance: In real-world scenarios, air resistance acts in the opposite direction of motion, reducing the net acceleration and resulting in a terminal velocity if the fall is high enough. However, in standard physics problems, air resistance is typically neglected unless specified.

Q19. Answer: (b) • 87.5 cm

The correct answer is - 87.5 cm.

Key Points

• The relationship between the object distance (u), image distance (v), and focal length (f) of a spherical mirror is given by the Mirror Formula: 1/f = 1/v + 1/u.

• According to the New Cartesian Sign Convention, the object distance (u) is always taken as negative because the object is placed in front of the mirror. In this case, u = -35.0 cm.

• For a concave mirror, the focus lies in front of the reflecting surface; therefore, the focal length (f) is always negative. Here, f = -25.0 cm.

• Substituting the values into the Mirror Formula: 1/v = 1/f - 1/u. This leads to 1/v = 1/(-25.0) - 1/(-35.0), which simplifies to 1/v = -1/25 + 1/35.

• Finding the common denominator (175), we get 1/v = (-7 + 5) / 175, resulting in 1/v = -2 / 175.

• Solving for v, the image distance is v = -175 / 2, which equals - 87.5 cm. This indicates the image is formed on the same side as the object.

Additional Information

• Nature of Image: Since the image distance (v) is negative, it signifies that a real and inverted image is formed in front of the concave mirror.

• Magnification (m): The linear magnification is calculated using the formula m = -v/u. Substituting the values, m = -(-87.5) / (-35.0) = -2.5. A magnification greater than 1 (in absolute terms) indicates the image is enlarged, and the negative sign confirms it is inverted.

• Positioning: In this scenario, the object is placed at 35.0 cm, which is between the focal length (25.0 cm) and the center of curvature (50.0 cm). When an object is between F and C, the image is always formed beyond C.

• Concave Mirror: Also known as a converging mirror, it has the ability to produce both real and virtual images depending on the distance of the object from the pole.

• Uses: These mirrors are widely used in torches, search-lights, and vehicle headlights to get powerful parallel beams of light, as well as in shaving mirrors to see a larger image of the face.

Important Points

• Sign Convention Rules: All distances are measured from the pole of the mirror. Distances measured in the direction of the incident light are positive, while those measured against it are negative.

• Focal Length Comparison: Unlike a concave mirror, a convex mirror always has a positive focal length because its principal focus is behind the mirror.

• Center of Curvature (C): For this mirror, C = 2f, meaning the radius of curvature is 50.0 cm. Since the calculated v = 87.5 cm, the image is indeed beyond C.

• Real vs Virtual: A negative v value always corresponds to a real image for mirrors, whereas a positive v would imply a virtual image formed behind the mirror.

Q20. Answer: (a) Both statements A and B are correct.

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

Key Points

• Statement A: Plants require a specific soil pH range for healthy development because the availability of essential nutrients is directly influenced by the acidity or alkalinity of the soil. Most common crops and garden plants prefer a slightly acidic to neutral range, typically between pH 6.0 and 7.0. If the pH deviates significantly from this range, nutrients like Nitrogen, Phosphorus, and Potassium may become chemically "locked" and unavailable to the plant roots. Hence, statement A is correct.

• Statement B: Farmers and gardeners perform soil testing to determine the pH value before planting. This information is crucial for deciding the type of fertiliser or soil conditioner required; for instance, if the soil is too acidic, farmers add lime (calcium carbonate) to raise the pH, whereas if it is too alkaline, they may add sulfur or acidifying fertilisers like ammonium sulfate to lower the pH. Hence, statement B is correct.

• The interaction between soil pH and fertilisers ensures that the chemical environment of the rhizosphere is optimized for ion exchange, allowing plants to absorb minerals effectively.

• Proper pH management prevents nutrient toxicity (such as Aluminum toxicity in very acidic soils) and nutrient deficiency (such as Iron chlorosis in alkaline soils).

• Hence, the correct answer is both statements A and B are correct.

Additional Information

• Definition of Soil pH: It is a measure of the hydrogen ion (H+) concentration in the soil solution. The scale ranges from 0 to 14, where 7.0 is neutral, values below 7.0 are acidic, and values above 7.0 are alkaline.

• Factors Affecting pH: Several factors influence soil pH, including parent material (the type of rock the soil formed from), climate

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(rainfall causes leaching of basic cations like Calcium and Magnesium, leading to acidity), and the decomposition of organic matter.

• Impact on Microorganisms: The biological activity of soil is also pH-dependent; for example, Rhizobium bacteria, which are responsible for Nitrogen fixation in leguminous plants, thrive best in neutral or slightly alkaline soils and their activity decreases in acidic environments.

• Nutrient Availability Trends: In acidic soils (pH below 5.5), the solubility of Aluminum, Iron, and Manganese increases, which can be toxic to plants. Conversely, in alkaline soils (pH above 8.0), Phosphorus often reacts with Calcium to form insoluble compounds, making it unavailable to plants.

Important Points

• Soil Amendments: To correct soil pH, farmers use specific materials. Agricultural lime (calcite or dolomite) is the most common amendment for acidic soils. For alkaline soils, besides elemental sulfur, materials like Gypsum (Calcium Sulfate) are used to improve soil structure and manage sodium levels.

• Logarithmic Scale: It is important to note that the pH scale is logarithmic; a change of 1 unit on the scale represents a 10-fold change in acidity or alkalinity. For example, a soil with pH 5.0 is 10 times more acidic than a soil with pH 6.0.

• Cation Exchange Capacity (CEC): The ability of soil to hold and exchange nutrients is often linked to pH. As pH increases, the CEC of many soils also increases, allowing the soil to retain more nutrient cations like Potassium (K^+) and Magnesium (Mg^{2+}).

• Fertiliser Choice: The use of Urea and Ammonium-based fertilisers can gradually increase soil acidity over time due to the process of nitrification, which releases hydrogen ions into the soil.

Q21. Answer: (a) Fertilisation is not occurring

The correct answer is Fertilisation is not occurring.

Key Points

• The process of menstruation is directly linked to the absence of fertilisation. When an ovum (egg) is released during ovulation and does not meet a sperm, the hormonal signals required to maintain the pregnancy environment are not produced. Hence, statement 1 is correct.

• The uterus lining, known as the endometrium, thickens every month to prepare for the possible implantation of a fertilised embryo. If no embryo is formed, the corpus luteum in the ovary stops producing progesterone.

• The statement "The uterus is rejecting the embryo" is incorrect because, in a normal menstrual cycle where fertilisation does not happen, there is no embryo created to be rejected. Hence, statement 2 is incorrect.

• If fertilisation were occurring each time, the zygote would implant in the uterine wall, and the hormonal feedback loop (specifically hCG) would prevent the lining from shedding, thus stopping menstruation. Hence, statement 3 is incorrect.

• The prompt explicitly states that "ovulation occurs regularly," which means the ovaries are successfully releasing mature eggs into the fallopian tubes. Hence, statement 4 is incorrect.

• The shedding of the endometrium along with blood and the unfertilised egg constitutes the menstrual flow, which typically lasts for 3 to 5 days.

Additional Information

• The Menstrual Cycle:

• The cycle is a series of natural changes in the female reproductive system that makes pregnancy possible. It usually repeats every 28 days, though it can vary from 21 to 35 days in healthy adults.

• It is regulated by hormones such as Luteinizing Hormone (LH), Follicle Stimulating Hormone (FSH), Estrogen, and Progesterone.

• Phases of the Cycle:

• Follicular Phase: Starts on the first day of menstruation and ends with ovulation. FSH stimulates the ovaries to produce follicles.

• Ovulation: Occurs around day 14 of a 28-day cycle. A surge in LH causes the most mature follicle to release an egg.

• Luteal Phase: After ovulation, the ruptured follicle transforms into the corpus luteum, which secretes progesterone to keep the endometrium thick.

• Fertilisation and Implantation:

• Fertilisation typically occurs in the ampulla of the fallopian tube.

• If the sperm fertilises the egg, the resulting zygote travels to the uterus and implants in the lining within 6 to 12 days.

• Once implantation occurs, the body begins producing Human Chorionic Gonadotropin (hCG), which is the hormone detected by pregnancy tests.

Important Points

• Menarche: This refers to the first menstrual period in a female's life, usually occurring between the ages of 10 and 15.

• Menopause: The permanent cessation of the menstrual cycle, typically occurring between the ages of 45 and 55, signifying the end of the reproductive phase.

• Endometrium: This is the mucous membrane lining the uterus, which thickens under the influence of estrogen during the

proliferative phase of the cycle.

• Unfertilised Egg Lifespan: An ovum remains viable for only about 12 to 24 hours after ovulation. If it is not fertilised within this window, it begins to degenerate.

Q22. Answer: (d) Gas < Liquid < Solid

The correct answer is Gas < Liquid < Solid.

Key Points

• All matter is composed of tiny particles that are constantly in motion. The strength of the intermolecular force of attraction between these particles determines the physical state of the substance at a given temperature and pressure.

• In Solids, the particles are closely packed in a regular arrangement. The force of attraction between the particles is maximum, which holds them in fixed positions. This is why solids have a definite shape and volume. Hence, solids have the strongest attraction.

• In Liquids, the intermolecular forces are strong enough to keep the particles close together but not strong enough to keep them in fixed positions. Particles can slide past one another, allowing liquids to flow and take the shape of their container. Hence, the attraction in liquids is intermediate.

• In Gases, the particles are very far apart compared to solids and liquids. The force of attraction between gas particles is negligible or very weak, allowing them to move randomly at high speeds in all directions. Hence, gases have the weakest attraction.

• Therefore, when arranged in increasing order of the strength of attraction, the correct sequence is Gas < Liquid < Solid. Hence, the selected option is correct.

Additional Information

• Kinetic Energy and States of Matter:

• Particles in a gas possess the maximum kinetic energy, which overcomes the attractive forces and allows them to occupy any available space.

• Particles in a solid possess the minimum kinetic energy, manifesting only as vibrations about their fixed mean positions.

• Compressibility:

• Due to the weak attractive forces and large inter-particle spaces, gases are highly compressible.

• In contrast, solids and liquids are nearly incompressible because their particles are already very close due to stronger attraction.

• Density:

• Typically, the density of a substance is highest in its solid state because the strong attraction pulls particles into the smallest possible volume. Ice (water) is a notable exception to this general rule due to its unique hydrogen bonding.

• Diffusion:

• The rate of diffusion is highest in gases because of the weak forces of attraction and high speeds of particles. It is lowest in solids.

Important Points

• Thermal Energy vs. Intermolecular Forces: The state of matter is a result of the competition between intermolecular forces (which try to keep particles together) and thermal energy (which tries to keep particles apart by increasing their motion).

• Melting and Boiling Points: A substance with very strong intermolecular attraction will generally have a high melting point and boiling point because more energy is required to overcome the forces holding the particles together.

• Nature of Forces: These attractive forces can include London dispersion forces, dipole-dipole interactions, and hydrogen bonding, collectively referred to as Van der Waals forces in many contexts.

Q23. Answer: (d) Opposite to the flow of electrons

The correct answer is Opposite to the flow of electrons.

Key Points

• The direction of electric current is conventionally taken as the direction of the flow of positive charges.

• When electricity was first discovered in the 18th century, the existence of subatomic particles like electrons and protons was unknown. Scientists like Benjamin Franklin assumed that electricity was a fluid that flowed from a "surplus" (positive) to a "deficit" (negative).

• In metallic conductors, electric current is actually caused by the movement of electrons, which are negatively charged particles.

• Electrons flow from the negative terminal to the positive terminal of a battery because they are repelled by the negative charge and attracted to the positive charge.

• Since conventional current was established as flowing from positive to negative before the electron was discovered by J.J. Thomson in 1897, we still use the convention that current direction is opposite to the flow of electrons. Hence, the correct answer is Opposite to the flow of electrons.

Additional Information

• Definition of Electric Current:

• Electric current is the rate at which electric charge flows through a specific area, usually represented by the symbol I.

• The formula is I = Q / t, where Q is the net charge in Coulombs (C) and t is the time in seconds (s).

• SI Unit:

• The standard SI unit of electric current is the Ampere (A).

• One Ampere is defined as the flow of one Coulomb of charge per one second.

• Drift Velocity:

• In a conductor, although electrons move at high thermal speeds, their net flow in a specific direction when a potential difference is applied is called drift velocity.

• The drift velocity is surprisingly slow, often around 0.1 mm/s to 1 mm/s, even though the electric signal travels at nearly the speed of light.

• Charge Carriers in Different Media:

• In solids (metals), the charge carriers are exclusively free electrons.

• In electrolytes (liquids), the current is carried by both positive ions (cations) and negative ions (anions).

• In gases (ionized plasma), current is carried by both electrons and positive ions.

• Ammeter:

• An Ammeter is a device used to measure the magnitude of electric current in a circuit. It is always connected in series with the circuit component through which the current is to be measured.

Q24. Answer: (c) Menstruation

The correct answer is Menstruation.

Key Points

• Menstruation is the natural, cyclic process in human females involving the shedding of the endometrium (the inner lining of the uterus).

• This process occurs specifically when the ovum (egg) released during the ovulation phase is not fertilised by a sperm.

• In the absence of fertilisation, the corpus luteum degenerates, leading to a sharp decline in the levels of progesterone and estrogen hormones.

• The lack of these hormones causes the uterine lining to break down, resulting in bleeding that exits the body through the vagina.

• A typical menstrual flow lasts for approximately 3 to 7 days, and the entire menstrual cycle repeats roughly every 28 days, although variations between 21 to 35 days are considered normal.

Additional Information

• The Menstrual Cycle Phases:

• Menstrual Phase: The first stage where the uterine lining is shed.

• Follicular Phase: Starts on the first day of the period and ends with ovulation. The pituitary gland releases Follicle Stimulating Hormone (FSH) to stimulate the ovaries to produce follicles.

• Ovulation Phase: Occurs around day 14 of the cycle when a mature egg is released from the ovary into the Fallopian tube.

• Luteal Phase: The phase following ovulation where the uterus prepares for a potential pregnancy by thickening its lining.

• Important Milestones:

• Menarche: The very first occurrence of menstruation in a female, typically happening during puberty between the ages of 10 and 15.

• Menopause: The biological stage marking the end of menstrual cycles, usually diagnosed after a woman has gone 12 months without a period, typically occurring between the ages of 45 and 55.

• Clarification of Other Options:

• Maturation: This refers to the biological process of development. In the reproductive context, it often refers to oocyte maturation, where an immature egg develops into a mature one within the follicle.

• Fertilisation: The process where a sperm cell fuses with an egg cell to form a zygote. This usually takes place in the ampulla of the Fallopian tube.

• Maintenance: In reproductive biology, this refers to the maintenance of the endometrium during pregnancy. If the egg is fertilised, the hormone progesterone prevents the lining from shedding to support the growing embryo.

Important Points

• The cycle is regulated by a complex interplay of hormones from the hypothalamus, pituitary gland, and the ovaries.

• The Endometrium is highly vascularized (rich in blood vessels) to provide nutrients to a potential fetus; its shedding is what causes the menstrual blood.

• If pregnancy occurs, the menstrual cycle stops temporarily as the placenta begins producing Human Chorionic Gonadotropin

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(hCG) to maintain the uterine lining.

Q25. Answer: (b) It is used to overcome the forces of attraction between the particles.

p data-end="57" data-start="0">The correct answer is It is used to overcome the forces of attraction between the particles.

Key Points

• When a solid reaches its melting point, it begins to transition into a liquid state. During this process, even if heat is continuously supplied, the temperature of the substance remains constant until the entire solid has melted.

• This phenomenon occurs because the heat energy supplied is being utilized to change the state of matter rather than increasing the kinetic energy of the particles.

• Specifically, the energy is consumed to break the intermolecular forces of attraction that hold the particles in a fixed, rigid position in the solid lattice. Hence, the statement that it is used to overcome the forces of attraction is correct.

• Since the average kinetic energy of the particles does not increase during this phase change, the thermometer does not show a rise in temperature.

• This "hidden" heat that is absorbed by the substance without a change in temperature is known as Latent Heat.

Additional Information

• Latent Heat of Fusion:

• The Latent Heat of Fusion is defined as the amount of heat energy required to change 1 kg of a solid into a liquid at its melting point at atmospheric pressure.

• For example, the latent heat of fusion for ice is approximately 3.34 x 10^5 Joules per kilogram (J/kg). This means 3.34 x 10^5 J of energy is needed to convert 1 kg of ice at 0 degree Celsius to water at 0 degree Celsius.

• Melting Point and Pressure:

• The melting point is the specific temperature at which a solid becomes a liquid at 1 atmospheric pressure. For ice, this is 273.15 K or 0 degree Celsius.

• Different substances have different melting points based on the strength of their chemical bonds or intermolecular forces. Substances with stronger forces of attraction require more energy (higher temperature) to melt.

• Comparison of Energy Levels:

• Particles in water at 0 degree Celsius (273 K) have more energy as compared to particles in ice at the same temperature.

• This extra energy is the latent heat absorbed during the melting process, which allows the water particles to move more freely than the restricted particles in the ice structure.

Important Points

• The Role of Energy in Phase Change:

• In Thermodynamics, during a phase transition like melting (fusion) or boiling (vaporization), the energy supplied goes into increasing the potential energy of the system rather than the kinetic energy.

• Because temperature is a measure of the average kinetic energy, the temperature remains stagnant during the entire duration of the state change.

• Distinction between Forces:

• The options mentioning forces of repulsion are scientifically inaccurate in this context. Melting is strictly about overcoming the attractive forces (like Hydrogen bonding in ice or Ionic bonds in salts) that keep the solid intact.

• Energy is not "lost" to the surroundings during the melting process in an ideal scenario; rather, it is absorbed by the substance to perform work against the molecular bonds.

Q26. Answer: (d) 5

Shortcut Trick

Convert terms to the same prime base: $125 = 5^3$ and $0.25 = 1/4$

=> 5^(1/4) × (5³)^(1/4)

=> 5^(1/4) × 5^(3/4) = 5^((1/4 + 3/4))

=> $5^1 = 5$

Therefore The correct answer is 5.

Alternate Method

Given:

Expression = 5^(1/4) × 125^(0.25)

Formula Used:

a^m × b^m = (a × b)^m

Calculation:

=> Since 1/4 = 0.25, the expression can be written as:

=> 5^(0.25) × 125^(0.25)
=> Applying the formula a^m × b^m = (a × b)^m:
=> (5 × 125)^(0.25)
=> 625^(0.25)
=> Converting the decimal power back to a fraction (0.25 = 1/4):
=> 625^(1/4)
=> We know that 625 = 5 × 5 × 5 × 5 = 5^4
=> (5^4)^(1/4)
=> 5^(4 × (1/4))
=> $5^1 = 5$
Therefore The correct answer is 5.
Additional Information
Product Rule of Indices
When multiplying terms with the same base, add their exponents: a^m × a^n = a^(m+n)
Power of a Power Rule
When raising a power to another power, multiply the exponents: $(a^m)^n$ = a^(mn)
Power of a Product Rule
When multiplying terms with the same exponent, multiply their bases: a^m × b^m = (a × b)^m

Q27. Answer: (d) 1,31,200

Shortcut Trick
Winner votes = Total Votes × Valid % × Winner %
Winner votes = 2,00,000 × (100 − 18)% × 80%
Winner votes = 2,00,000 × 0.82 × 0.80 = 1,31,200
Therefore The correct answer is 1,31,200 votes.
Alternate Method
Given:
Total Votes = 2,00,000
Invalid Votes = 18%
Winner Shares = 80% of Valid Votes
Calculations:
=> Total Valid Votes = Total Votes × (100% − 18%)
=> Total Valid Votes = 2,00,000 × 82/100 = 1,64,000
=> Votes for Winner = 80% of 1,64,000
=> Votes for Winner = (80/100) × 1,64,000
=> Votes for Winner = 0.8 × 1,64,000 = 1,31,200
Therefore The correct answer is 1,31,200 votes.
Additional Information
Election Base Value
Always identify if percentages are of Total Votes or Valid Votes. Winner % + Loser % = 100% of Valid Votes.
Victory Margin
Victory Margin = (Winner % − Loser %) × Valid Votes. This is the difference in votes between the two candidates.
Successive Percentage
When multiple deductions occur (Invalid then Winner), the final value is A × (1 − r1/100) × (r2/100).

Q28. Answer: (a) 2

Shortcut Trick
Combined efficiency of A, B, and C with Total Work = 6 units:
Efficiency of A = 2, B = 1, C = 3 => Total Efficiency = 6
Twice the work = 2 × 6 = 12 units
Time taken = 12 ÷ 6 = 2 days
Therefore The correct answer is 2 days.

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Alternate Method

Given:

Time taken by A = 3 days

Time taken by B = 6 days

Time taken by C = 2 days

Formula Used:

Total Work = LCM of individual times

Efficiency = Total Work ÷ Time Taken

Time Taken = Total Work ÷ Combined Efficiency

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

Calculations:

=> Total Efficiency of (A + B + C) = 2 + 1 + 3 = 6 units/day

=> New Total Work = 2 × 6 = 12 units

=> Required Time = 12 ÷ 6 = 2 days

Therefore The correct answer is 2 days.

Additional Information

LCM Method for Time & Work

Using the LCM of individual days as the total work unit simplifies complex calculations into basic integer addition and division.

Work and Efficiency Relation

Work is directly proportional to efficiency when time is constant, and inversely proportional to time when work is constant (Work = Efficiency × Time).

Q29. Answer: (c) 90 minutes

Shortcut Trick

When distance is constant, speed is inversely proportional to time.

Ratio of Normal Speed to New Speed = 4 : 3

Ratio of Normal Time to New Time = 3 : 4

Difference in time units = 4 − 3 = 1 unit → 30 minutes

Usual Time = 3 units = 3 × 30 = 90 minutes.

Therefore The correct answer is 90 min.

Alternate Method

Given: New Speed = 3/4 of Normal Speed, Time Delay = 30 minutes.

Formula Used: Speed × Time = Distance | Time = Distance ÷ Speed

=> Let normal speed be S and normal time be T.

=> Distance (D) = S × T

=> New Speed = 0.75S, New Time = T + 30

=> S × T = 0.75S × (T + 30)

=> T = 0.75T + 22.5

=> 0.25T = 22.5

=> T = 22.5 ÷ 0.25 = 90

Therefore The correct answer is 90 min.

Additional Information

Inverse Variation Rule

When distance is constant, if speed becomes a/b of its original value, time becomes b/a of its original value.

Time Delay Formula

Usual Time = (Late Time × Numerator) ÷ (Denominator − Numerator) = (30 × 3) ÷ (4 − 3) = 90 minutes.

Average Speed

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Average Speed for same distance covered at different speeds S1 and S2 is 2S1S2 ÷ (S1 + S2).

Q30. Answer: (d) 19

Shortcut Trick

Increase in Average = (New score − Old average) ÷ Total innings

=> Increase = (194 − 80) ÷ 6

=> Increase = 114 ÷ 6 = 19

Therefore The correct answer is 19.

Alternate Method

Given: Average of 5 innings = 80 runs, 6^(th) inning score = 194 runs.

Formula: New Average = Total Runs ÷ Total Innings

=> Total runs in 5 innings = 5 × 80 = 400

=> Total runs in 6 innings = 400 + 194 = 594

=> New average = 594 ÷ 6 = 99

=> Increase in average = New average − Old average

=> Increase = 99 − 80 = 19

Therefore The correct answer is 19.

Additional Information

Net Deviation Method

The sum of deviations of all observations from their average is always zero. The extra runs in the new inning are distributed equally among all innings to find the average increase.

Combined Average Formula

Combined Average = (n1x1 + n2x2) ÷ (n1 + n2), where n is the number of items and x is the average of those items.

Excluded Value Effect

When a value is removed, if the average decreases, the excluded value was greater than the old average; if the average increases, the excluded value was smaller.

Q31. Answer: (d) Rs. 8,833

Shortcut Trick

For a 10% rate compounded annually for 2 years, the effective interest rate is calculated as: 10 + 10 + (10 × 10 / 100) = 21%.

The total Amount represents 100% (Principal) + 21% (Interest) = 121% of the Principal.

Amount = 7,300 × 121/100 = 73 × 121 = 8,833.

Therefore The correct answer is Rs. 8,833.

Alternate Method

Given:

Principal (P) = Rs. 7,300

Rate (R) = 10% per annum

Time (T) = 2 years

Formula Used:

Amount (A) = P(1 + R/100)^T

Calculations:

=> A = 7300 × (1 + 10/100)²

=> A = 7300 × (1 + 1/10)²

=> A = 7300 × (11/10) × (11/10)

=> A = 7300 × 121 / 100

=> A = 73 × 121

=> A = 8833

Therefore The correct answer is Rs. 8,833.

Additional Information

Effective Rate for Compound Interest

For a rate R% for 2 years, the effective interest rate is R + R + (R×R)/100.

Difference between CI and SI

For 2 years, the difference between Compound Interest and Simple Interest is P(R/100)².

Amount vs Interest

Interest is only the extra money earned, whereas Amount is the sum of the initial Principal and the interest earned.

Q32. Answer: (d) Decreases by 65.47%

Shortcut Trick

Initial Price = 100

Final Price = 100 × 0.90 × 0.55 × 0.45 × 1.55

Final Price = 34.52925

Net Change = 100 − 34.52925 = 65.47075%

Therefore The correct answer is Decreases by 65.47%.

Alternate Method

Given: Successive changes of −10%, −45%, −55%, and +55%.

Formula: Final Price = Initial Price × (1 ± r1/100) × (1 ± r2/100) ...

=> Let original price be 100.

=> Price after 1st month = 100 × (1 − 10/100) = 90

=> Price after 2nd month = 90 × (1 − 45/100) = 90 × 0.55 = 49.5

=> Price after 3rd month = 49.5 × (1 − 55/100) = 49.5 × 0.45 = 22.275

=> Price after 4th month = 22.275 × (1 + 55/100) = 22.275 × 1.55 = 34.52625

=> Percentage change = ((34.52625 − 100) ÷ 100) × 100 = −65.47375%

=> Rounding to two decimal places, we get 65.47% decrease.

Therefore The correct answer is Decreases by 65.47%.

Additional Information

Successive Percentage Change

For two successive changes a% and b%, the net effective change is given by (a + b + ab/100)%.

Multiplying Factor Method

To find the final value after multiple changes, multiply the initial value by (1 + r/100) for increase and (1 − r/100) for decrease.

Percentage Increase/Decrease

Percentage change = [(Final Value − Initial Value) ÷ Initial Value] × 100. Positive result denotes increase, negative denotes decrease.

Q33. Answer: (d) 20

Shortcut Trick

Identify the minimum difference between any two numbers: 5440 − 4220 = 1220 and 6880 − 5440 = 1440.

The HCF must be a factor of the difference 1220.

Check the options: 1220 is not divisible by 80, 60, or 40.

1220 ÷ 20 = 61. Since 20 divides all three numbers, it is the HCF.

Therefore The correct answer is 20.

Alternate Method

Given: Numbers are 4220, 5440, and 6880.

Formula Used: HCF (Highest Common Factor) is the greatest number that divides each of the numbers without a remainder.

Using Long Division Method for 4220 and 5440:

=> 5440 = 4220 × 1 + 1220

=> 4220 = 1220 × 3 + 560

=> 1220 = 560 × 2 + 100

=> 560 = 100 × 5 + 60

=> 100 = 60 × 1 + 40

=> 60 = 40 × 1 + 20

=> 40 = 20 × 2 + 0

=> HCF of 4220 and 5440 is 20.

Now, check if 6880 is divisible by 20:

=> 6880 ÷ 20 = 344 (Exactly divisible)

Therefore The correct answer is 20.

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Additional Information

Properties of HCF

The HCF of two or more numbers is the greatest divisor that divides them exactly. HCF is always less than or equal to the smallest number.

Relation between HCF and LCM

For two numbers a and b: HCF × LCM = a × b. This property is widely used to find one value if the others are known.

HCF of Fractions

HCF of Fractions = (HCF of Numerators) ÷ (LCM of Denominators).

Q34. Answer: (d) 13

Shortcut Trick

Assume all 15 coins are Rs. 10 coins: Total value = 15 × 10 = Rs. 150.

Difference from actual value = 150 − 85 = Rs. 65.

Difference between coin denominations = 10 − 5 = Rs. 5.

Number of Rs. 5 coins = Total Difference ÷ Denomination Difference = 65 ÷ 5 = 13.

Therefore The correct answer is 13 coins.

Alternate Method

Given:

Total coins = 15

Total value = Rs. 85

Let the number of Rs. 5 coins be x.

Then the number of Rs. 10 coins = (15 − x).

Calculation:

=> 10 × (15 − x) + 5 × x = 85

=> 150 − 10x + 5x = 85

=> 150 − 5x = 85

=> 5x = 150 − 85

=> 5x = 65

=> x = 65 ÷ 5

=> x = 13

Therefore The correct answer is 13 coins.

Additional Information

Linear Equation in One Variable

An equation which can be written in the form ax + b = 0, where a and b are real numbers and a ≠ 0.

Alligation Method

Average value per coin = 85 ÷ 15 = Rs. 17/3. Ratio of (Rs. 10 coins) to (Rs. 5 coins) = (17/3 − 5) : (10 − 17/3) = 2/3 : 13/3 = 2 : 13.

Q35. Answer: (b) 22.15

Shortcut Trick

Apply the inverse proportion formula: M1 × D1 = M2 × D2

Here, 46 × 13 = 27 × Time

=> Time = 598 ÷ 27

=> Time ≈ 22.15 minutes

Therefore The correct answer is 22.15 minutes.

Alternate Method

Given:

Number of initial pipes (n1) = 46

Time taken initially (t1) = 13 minutes

Number of final pipes (n2) = 27

Formula Used:

Since the capacity of the tank is constant, the time taken is inversely proportional to the number of pipes used.

Total Work = Pipes × Time

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Calculations:
=> Total Work = 46 × 13 = 598 units
=> Time required for 27 pipes = Total Work ÷ n2
=> Time = 598 ÷ 27
=> Time = 22.148148...
=> Time ≈ 22.15 minutes (rounded to two decimal places)
Therefore The correct answer is 22.15 minutes.
Additional Information
Inverse Proportion
When one quantity increases while the other decreases proportionally, they are in inverse proportion. Formula: x1y1 = x2y2.
Pipes and Cisterns Logic
Efficiency of multiple identical pipes is additive. Total volume = (Number of pipes) × (Efficiency of one pipe) × (Time taken).

Q36. Answer: (d) Rs. 11,880

Shortcut Trick
Radius (r) = 5 cm and Height (h) = 35 cm.
Curved Surface Area (CSA) = 2 × (22/7) × 5 × 35 = 1100 cm².
Total Cost = 1100 × 12 = Rs. 13,200.
Net Paid Amount (after 10% discount) = 13,200 × 0.9 = Rs. 11,880.
Therefore The correct answer is Rs. 11,880.
Alternate Method
Given:
Diameter of the cylindrical pillar = 10 cm => Radius (r) = 10/2 = 5 cm.
Height (h) = 35 cm.
Painting Rate = Rs. 12/cm².
Discount = 10%.
Formula Used:
Curved Surface Area (CSA) = 2πrh
Net Amount = Total Cost − Discount
Calculations:
=> Curved Surface Area = 2 × (22/7) × 5 × 35
=> Curved Surface Area = 2 × 22 × 5 × 5
=> Curved Surface Area = 1100 cm²
=> Total Painting Cost = 1100 × 12 = Rs. 13,200
=> Discount Amount = 10% of 13,200 = (10/100) × 13200 = Rs. 1,320
=> Final Amount Paid = 13,200 − 1,320 = Rs. 11,880
Therefore The correct answer is Rs. 11,880.
Additional Information
Total Surface Area of a Cylinder
The Total Surface Area (TSA) includes both the curved surface and the two circular bases: TSA = 2πrh + 2πr² = 2πr(h + r).
Volume of a Cylinder
The Volume represents the capacity of the cylinder: Volume = πr²h.
Successive Discount Formula
If two successive discounts x% and y% are given, the single equivalent discount is [x + y − (xy/100)]%.

Q37. Answer: (c) 33,000

Shortcut Trick
New Income = 50,000 × 1.1 = Rs. 55,000
Saving % = 100% − 40% = 60%
New Saving = 60% of 55,000 = 0.60 × 55,000
New Saving = Rs. 33,000
Therefore The correct answer is Rs. 33,000.

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Alternate Method
Given:
Initial Income = Rs. 50,000
Expenditure Rate = 40%
Income Increment = 10%
Calculations:
=> New Income = 50,000 + (10/100 × 50,000)
=> New Income = 50,000 + 5,000 = Rs. 55,000
=> New Expenditure = 40% of 55,000
=> New Expenditure = 0.40 × 55,000 = Rs. 22,000
=> New Savings = New Income − New Expenditure
=> New Savings = 55,000 − 22,000 = Rs. 33,000
Therefore The correct answer is Rs. 33,000.
Additional Information
Percentage Change in Savings
If both income and expenditure increase by the same percentage (k%), then savings also increase by exactly k%.
Income-Expenditure Formula
Income = Expenditure + Savings. This base identity is used to solve all budget and personal finance aptitude problems.
Successive Percentage
When a value is increased by x% and then y%, the net effective change is (x + y + xy/100)%.

Q38. Answer: (b) Rs. 40

Shortcut Trick
Total Cost Price (CP) of 20 pens = Rs. 200.
Selling Price (SP) of 1 pen = Rs. 12.
Total Selling Price (SP) = 20 × 12 = Rs. 240.
Total Profit = Total SP − Total CP = 240 − 200 = Rs. 40.
Therefore The correct answer is Rs. 40.
Alternate Method
Given: Total CP = Rs. 200, Number of pens = 20, SP per pen = Rs. 12.
Formulas: Profit = SP − CP | CP per unit = Total CP ÷ Quantity.
=> Cost Price of one pen = 200 ÷ 20 = Rs. 10.
=> Profit per pen = SP per pen − CP per pen = 12 − 10 = Rs. 2.
=> Total Profit = Profit per pen × Total pens = 2 × 20 = Rs. 40.
Therefore The correct answer is Rs. 40.
Additional Information
Profit and Loss Percentage
Profit% is always calculated on the Cost Price (CP). Formula: Profit% = (Profit ÷ CP) × 100.
Selling Price Calculation
If profit percentage is given: SP = CP × (100 + Profit%) ÷ 100.

Q39. Answer: (a) 920

Shortcut Trick
Combine ratios A : B = 20 : 2 (or 10 : 1) and B : C = 1 : 4.
Combined ratio A : B : C = 10 : 1 : 4.
Total units = 10 + 1 + 4 = 15 units.
Share of B = (1 ÷ 15) × 13,800 = 920.
Therefore The correct answer is Rs. 920.
Alternate Method
Given:
Total Profit = Rs. 13,800
Ratio A : B = 20 : 2 = 10 : 1

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Ratio B : C = 1 : 4
Calculations:
=> Common ratio A : B : C = 10 : 1 : 4
=> Let shares be 10x, 1x, and 4x
=> 10x + 1x + 4x = 13,800
=> 15x = 13,800
=> x = 13,800 ÷ 15
=> x = 920
=> Share of B = 1x = Rs. 920
Therefore The correct answer is Rs. 920.
Additional Information
Compound Ratio
To combine A : B and B : C, make the value of B common in both ratios by multiplying with suitable factors.
Partnership Profit Distribution
Profit is distributed in the ratio of (Capital × Time). If time is same, profit ratio equals the investment ratio.
Ratio to Value Conversion
Individual share = (Individual ratio part ÷ Total ratio parts) × Total value.

Q40. Answer: (c) 65

Shortcut Trick
Age of new person = New Average + (Initial number of members × Increase in average)
Given: New Average = 42 years, Initial members = 23 students, Increase = 1 year (42 − 41)
=> Teacher's Age = 42 + (23 × 1)
=> Teacher's Age = 42 + 23 = 65 years.
Therefore The correct answer is 65 years.
Alternate Method
Given:
Initial number of students = 23
Initial average age = 41 years
New number of members (including teacher) = 24
New average age = 42 years
Formula Used:
Total Age = Average × Number of persons
Age of added person = (New Total Age) − (Initial Total Age)
Calculations:
=> Total age of 23 students = 23 × 41
=> Total age of 23 students = 943 years
=> Total age of 24 persons (students + teacher) = 24 × 42
=> Total age of 24 persons = 1008 years
=> Age of the teacher = 1008 − 943
=> Age of the teacher = 65 years
Therefore The correct answer is 65 years.
Additional Information
Average Concept
Average = (Sum of all observations) ÷ (Total number of observations). It represents the central value of a data set.
Excluded Observation
If a person leaves the group, the age of the person = (Old Average × Old Count) − (New Average × New Count).
Effect of Replacement
If one person is replaced by another: Age of New Person = Age of Old Person + (Total count × Change in average).

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Q41. Answer: (a) 4

Shortcut Trick

Apply the inverse proportion logic: M1D1 = M2D2.

20 × 13 = 65 × D2

D2 = (20 × 13) ÷ 65 = 260 ÷ 65 = 4.

Therefore The correct answer is 4 days.

Alternate Method

Given:

Initial number of pupils (M1) = 20

Initial days (D1) = 13 days

Increased pupils (M2) = 65

Formula Used:

In Time and Work (Provisions), Total Work = Number of People × Days.

Calculations:

=> Total provision = 20 × 13 = 260 units

=> Let the number of days for 65 pupils be x.

=> 65 × x = 260

=> x = 260 ÷ 65

=> x = 4

Therefore The correct answer is 4 days.

Additional Information

Chain Rule (Inverse Proportion)

When the number of people increases, the number of days for which the food lasts decreases. This follows the formula M1D1H1/W1 = M2D2H2/W2.

Total Work Constant

If work or total provisions remain constant, then Man-Days (M × D) always remains a constant value.

Q42. Answer: (d) 18 years

Shortcut Trick

Age difference between Reena and Meena is always 5 years.

8 years ago, Reena was twice as old as Meena (Ratio 2 : 1).

Difference in ratio parts (2 − 1 = 1 unit) represents 5 years.

Therefore 8 years ago, Reena age = 2 units × 5 = 10 years.

Present age of Reena = 10 + 8 = 18 years.

Therefore The correct answer is 18 years.

Alternate Method

Given:

Age difference = 5 years

Condition: 8 years ago, Reena was twice as old as Meena.

Let Meena's present age be x years.

Then Reena's present age = (x + 5) years.

8 years ago:

=> Meena age = x − 8

=> Reena age = (x + 5) − 8 = x − 3

According to the question:

=> (x − 3) = 2 × (x − 8)

=> x − 3 = 2x − 16

=> 2x − x = 16 − 3

=> x = 13

Reena's present age = x + 5 = 13 + 5 = 18 years.

Therefore The correct answer is 18 years.

Additional Information

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Constant Age Difference

The difference between the ages of two persons remains constant at any point in time (past, present, or future).

Ratio Method for Ages

If the ratio of ages is given for two different time periods, equate the difference between the ratio parts to the constant age difference to find the value of 1 unit.

Future and Past Ages

To find age 'n' years ago, subtract 'n' from present age. To find age after 'n' years, add 'n' to present age.

Q43. Answer: (c) Only C

Shortcut Trick

Scheme A: Buy 42 Get 47 means 5 items are free on 47. Discount% = 5 ÷ 47 × 100 ≈ 10.64%.

Scheme B: Successive 16% and 36%. Equivalent discount = 16 + 36 − (16 × 36 ÷ 100) = 52 − 5.76 = 46.24%.

Scheme C: Successive 46% and 46%. Equivalent discount = 46 + 46 − (46 × 46 ÷ 100) = 92 − 21.16 = 70.84%.

Comparing the three: 70.84% > 46.24% > 10.64%.

Therefore, Scheme C is the most beneficial to the customer.

Therefore The correct answer is Only C.

Alternate Method

Given → Scheme A (Free items), Scheme B (16% & 36%), Scheme C (46% & 46%). Formulas: Discount% = (Free Items ÷ Total Items) × 100 | Successive Discount = a + b − ab ÷ 100.

=> For Scheme A: Discount = (47 − 42) ÷ 47 × 100 = 500 ÷ 47 = 10.638%

=> For Scheme B: Discount = 16 + 36 − (16 × 36) ÷ 100 = 52 − 5.76 = 46.24%

=> For Scheme C: Discount = 46 + 46 − (46 × 46) ÷ 100 = 92 − 21.16 = 70.84%

=> Higher discount percentage means more beneficial to the customer.

=> Scheme C provides the highest discount of 70.84%.

Therefore The correct answer is Only C.

Additional Information

Buy X Get Y Free

In a 'Buy X get Y' scheme, the discount percentage is calculated as [Y ÷ (X + Y)] × 100. In this problem, 'get 47' implies 47 is the total items, so free = 5.

Successive Discount Formula

For two successive discounts of a% and b%, the effective discount is (a + b − ab/100)%. A higher effective discount is always better for the buyer.

Q44. Answer: (b) 3√61 cm

Shortcut Trick

In a triangle with an angle of 120°, the side opposite to it is calculated as: $XZ^2 = XY^2 + YZ^2 + (XY \times YZ)$.

=> $XZ^2 = 12^2 + 15^2 + (12 \times 15)$

=> $XZ^2 = 144 + 225 + 180 = 549$

=> $XZ = \sqrt{549} = 3\sqrt{61}$ cm

Therefore The correct answer is $3\sqrt{61}$ cm.

Alternate Method

Given: Side XY = 12 cm, Side YZ = 15 cm, and Angle angle Y = 120°.

Formula Used: Cosine Rule: $b^2 = a^2 + c^2 − 2ac \cos(B)$

=> Applying Cosine Rule for side XZ:

=> $XZ^2 = XY^2 + YZ^2 − 2(XY)(YZ) \cos(\text{angle Y})$

=> $XZ^2 = (12)^2 + (15)^2 − 2 \times 12 \times 15 \times \cos(120°)$

=> $XZ^2 = 144 + 225 − 360 \times (−0.5)$ [Since $\cos 120° = −1/2$]

=> $XZ^2 = 369 + 180$

=> $XZ^2 = 549$

=> $XZ = \sqrt{549} = \sqrt{(9 \times 61)}$

=> $XZ = 3\sqrt{61}$ cm

Therefore The correct answer is $3\sqrt{61}$ cm.

Additional Information

Cosine Rule

It relates the lengths of the sides of a triangle to the cosine of one of its angles: $c^2 = a^2 + b^2 - 2ab\cos(C)$.

Special Case: 120 Degrees

When the angle is 120°, the term $-2ab\cos(120°)$ becomes $+ab$ because $\cos(120°) = -1/2$.

Sine Rule

In any triangle, the ratio of a side to the sine of its opposite angle is constant: $a/\sin A = b/\sin B = c/\sin C$.

Q45. Answer: (a) 72

Shortcut Trick

For four numbers a, b, c, and d in proportion, the product of extremes equals the product of means: $a \times d = b \times c$.

Given a = 8, b = X, c = 15, and d = 135.

$8 \times 135 = X \times 15$

$X = (8 \times 135) \div 15 \Rightarrow X = 8 \times 9 = 72$.

Therefore The correct answer is 72.

Alternate Method

Given: First term (a) = 8, Second term (b) = X, Third term (c) = 15, Fourth term (d) = 135.

Formula Used: $a/b = c/d$

$\Rightarrow 8 / X = 15 / 135$

$\Rightarrow 8 / X = 1 / 9$

$\Rightarrow X = 8 \times 9$

$\Rightarrow X = 72$

Therefore The correct answer is 72.

Additional Information

Fourth Proportional

If a, b, c, d are in proportion, then d is the fourth proportional to a, b, and c, calculated as $d = (b \times c) \div a$.

Third Proportional

If a, b, c are in continued proportion (a:b = b:c), then c is the third proportional, where $c = b^2 \div a$.

Mean Proportional

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

Q46. Answer: (c) 58.21 m^3

Shortcut Trick

Ratio CSA : TSA = 2 : 3 $\Rightarrow 2\pi rh : 2\pi r(h + r) = 2 : 3 \Rightarrow h : (h + r) = 2 : 3 \Rightarrow h = 2r$.

CSA = $2 \times (22/7) \times r \times (2r) = 55.44 \Rightarrow r^2 = (55.44 \times 7) / 88 = 4.41 \Rightarrow r = 2.1$ m.

Height $h = 2 \times 2.1 = 4.2$ m.

Volume = $\pi r^2 h = (22/7) \times 2.1 \times 2.1 \times 4.2 = 13.86 \times 4.2 = 58.212\ m^3$.

Therefore The correct answer is 58.21 m^3.

Alternate Method

Given:

Curved Surface Area (CSA) = 55.44 m^2

CSA = (2/3) × Total Surface Area (TSA)

Formula Used:

CSA of cylinder = $2\pi rh$

TSA of cylinder = $2\pi r(h + r)$

Volume of cylinder = $\pi r^2 h$

Calculations:

$\Rightarrow 2\pi rh = (2/3) \times 2\pi r(h + r)$

$\Rightarrow h = (2/3)(h + r)$

$\Rightarrow 3h = 2h + 2r$

$\Rightarrow h = 2r$

$\Rightarrow$ Now, $2 \times (22/7) \times r \times h = 55.44$

$\Rightarrow 2 \times (22/7) \times r \times 2r = 55.44$

=> (88/7) × r² = 55.44

=> r² = (55.44 × 7) / 88

=> r² = 0.63 × 7 = 4.41

=> r = 2.1 m

=> h = 2 × 2.1 = 4.2 m

=> Volume = (22/7) × (2.1)² × 4.2

=> Volume = (22/7) × 4.41 × 4.2

=> Volume = 22 × 0.63 × 4.2 = 58.212 m³

Therefore The correct answer is 58.21 m³.

Additional Information

Surface Area of Cylinder

The Curved Surface Area (CSA) excludes the top and bottom circles, while the Total Surface Area (TSA) includes them: TSA = 2πrh + 2πr².

Volume Calculation

The volume of any right circular cylinder is the product of the base area and its height: Volume = πr²h.

Hollow Cylinder

For a hollow cylinder with outer radius R and inner radius r, the Volume of material = π(R² − r²)h.

Q47. Answer: (a) 15 m²

Shortcut Trick

Substitute the given values x = 2 and y = 1 directly into the length and breadth expressions.

Length = 2(2) + 1² = 4 + 1 = 5 m

Breadth = 2(2) − 1² = 4 − 1 = 3 m

Area = Length × Breadth = 5 × 3 = 15 m²

Therefore The correct answer is 15 m².

Alternate Method

Given:

Length (L) = (2x + y²) m

Breadth (B) = (2x − y²) m

Values: x = 2, y = 1

Formula Used:

Area of a Rectangle = Length × Breadth

Algebraic Identity: (a + b)(a − b) = a² − b²

Calculations:

=> Area = (2x + y²) × (2x − y²) => Area = (2x)² − (y²)² => Area = 4x² − y^4 => Substituting x = 2 and y = 1: => Area = 4(2)² − (1)^4 => Area = 4 × 4 − 1 => Area = 16 − 1 = 15 m²

Therefore The correct answer is 15 m².

Additional Information

Area of Rectangle

The total space occupied by a rectangle in a 2D plane is calculated as the product of its length and breadth.

Perimeter of Rectangle

The total distance around the boundary of a rectangle, given by 2 × (Length + Breadth).

Algebraic Identity

The identity (a + b)(a − b) = a² − b² is frequently used to simplify products of binomials in geometry problems.

Q48. Answer: (a) 28,200

Shortcut Trick

Convert Speed from km/hr to m/min: 84.6 × (1000 ÷ 60) = 1,410 m/min.

Distance = Speed × Time = 1,410 × 20 = 28,200 m.

Therefore The correct answer is 28,200 m.

Alternate Method

Given:

Speed (S) = 84.6 km/hr

Time (T) = 20 minutes
Formula Used:
Distance = Speed × Time
1 km = 1000 m | 1 hour = 60 minutes
Calculations:
=> Speed in m/s = 84.6 × (5/18) = 4.7 × 5 = 23.5 m/s
=> Time in seconds = 20 × 60 = 1200 seconds
=> Distance = 23.5 × 1200
=> Distance = 28,200 m
Therefore The correct answer is 28,200 m.
Additional Information
Unit Conversion
To convert km/hr to m/s, multiply by 5/18. To convert m/s to km/hr, multiply by 18/5.
Speed-Time Relationship
Distance is directly proportional to time when speed is constant (D = S × T).
Average Speed
Average Speed = Total Distance traveled ÷ Total Time taken.

Q49. Answer: (c) 20°

Shortcut Trick
The angle formed by the bisectors of two adjacent angles in a quadrilateral is equal to half the sum of the other two angles.
=> angle STR = (angle P + angle Q) ÷ 2
=> 18° = (angle P + angle Q) ÷ 2 => angle P + angle Q = 36°
Given ratio angle P : angle Q = 2 : 7. Total parts = 2 + 7 = 9 units.
=> 9 units = 36° => 1 unit = 4°
Difference = (7 − 2) units = 5 units = 5 × 4° = 20°.
Therefore The correct answer is 20°.
Alternate Method
Given: angle STR = 18°, angle P : angle Q = 2 : 7, ST and RT are angle bisectors of angle S and angle R.
Formula Used: Sum of interior angles of a quadrilateral = 360°; Sum of angles in a triangle = 180°.
In ΔSTR:
=> angle TSR + angle TRS + angle STR = 180°
=> (angle S ÷ 2) + (angle R ÷

Q50. Answer: (d) 77 : 144

Shortcut Trick
The relationship between Cost Price (CP) and Marked Price (MP) is given by the ratio:
CP : MP = (100 − Discount%) : (100 + Profit%)
CP : MP = (100 − 23) : (100 + 44)
CP : MP = 77 : 144
Therefore The correct answer is 77 : 144.
Alternate Method
Given: Discount = 23%, Profit = 44%
Formulas: SP = MP × (100 − D%) ÷ 100 | SP = CP × (100 + P%) ÷ 100
=> Let Marked Price (MP) be 100.
=> Selling Price (SP) = 100 − 23% of 100 = 77.
=> Since Profit is 44%, SP = CP × 144 ÷ 100.
=> 77 = CP × 144 ÷ 100 => CP = (77 × 100) ÷ 144.
=> Ratio CP : MP = [(77 × 100) ÷ 144] : 100.
=> CP : MP = 77 : 144.
Therefore The correct answer is 77 : 144.
Additional Information

Marked Price & Discount

The Marked Price (Listed Price) is the price printed on the label. Discount is always calculated on the MP to arrive at the Selling Price.

Markup Percentage

Markup% = (MP − CP) ÷ CP × 100. It represents how much higher the marked price is compared to the cost price.

Q51. Answer: (b) Wife's father

Family Chart:

Decoding the Symbols:

Symbol	x	−	•	÷
Meaning	Father	Mother	Brother	Son

Given: K x M − N + P ÷ Q

It means: K is the father of M, M is the mother of N, N is the brother of P, and P is the son of Q.

Now, K is the father of Q's wife.

Hence, the correct answer is "Option 1".

Q52. Answer: (c) One

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

A sits second from one of the extreme ends of the line.

Only two people sit between A and B.

C sits second to the right of B.

Only three people sit between C and D.

F sits second to the left of D.

E sits at one of the positions to the right of G.

Now, 1 people people sit between A and G.

Hence, the correct answer is "Option 3".

Q53. Answer: (d) BG – EL

The logic followed here is based on the alphabetical position pattern:

Option 1: KF – MK

Option 2: OP – QU

Option 3: SZ – UE

Option 4: BG – EL

Thus, BG – EL does not follow the same pattern.

Hence, the odd one out is Option 4.

Q54. Answer: (c) 20 metres towards the west

Given:

Sachin starts from A and runs 15 metres East.

He turns left → 25 metres North.

He turns right → 5 metres East.

He turns right → 25 metres South and reaches B.

So, To reach A from B → move 20 metres West.

Hence, the correct answer is Option 3.

Q55. Answer: (b) NRSR

The logic followed here is:

For, EIJI is related to JNON

Now, for PTUT is related to UYZY

Now, applying the same logic for IMNM

So, IMNM → NRSR

Hence, the correct answer is "Option 2".

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Q56. Answer: (a) 2

Given: Q, U, V, P, T, R, W and S are sitting around a circular table facing the centre.
Q sits to the immediate right of U.
There are exactly three people between U and V.
P is an immediate neighbour of both T and Q.
R sits second to the right of T.
W is an immediate neighbour of both R and S.
So, there are 2 people between W and Q from the right of W.
Hence, the correct answer is "Option 1".

Q57. Answer: (c) 3

Given: (Left) 7, #, 5, %, 5, 1, €, 8 (Right)
Now,
Symbols, which are immediately preceded by a number and also immediately followed by a number.
So, Needed pattern is: Number - Symbol - Number
(Left) 7, #, 5, %, 5, 1, €, 8 (Right)
So, total valid symbols = 3
Hence, the correct answer is Option 3.

Q58. Answer: (d) 22 km to the west

Given:
Prayansh starts from A and drives 34 km North.
He turns left → 41 km West.
He turns left → 56 km South.
He turns left → 63 km East.
He takes a final left turn → 22 km North and reaches P.
So, To reach A from P → move 22 km West.
Hence, the correct answer is Option 4.

Q59. Answer: (b) Four

Given: A, B, C, D, E and F are sitting around a circular table facing the centre.
D sits third to the right of C.
A sits second to the left of C.
E sits second to the right of F.
B sits to the immediate right of E.
So, there are 4 people between A and F from the left of A.
Hence, the correct answer is "Option 2".

Q60. Answer: (c) JKN12

The logic followed here is:
So, the next term = JKN12
Hence, the correct answer is Option 3.

Q61. Answer: (b) 3

Given: (Left) 3, 4, 4, 9, 8, 8, 6, 8, 4, 2, 1, 1, 8, 5, 9, 8, 5, 7, 1, 8, 6, 2, 7, 2, 9, 2, 6 (Right)
Now,
Odd numbers, which are immediately preceded by an even number and also immediately followed by an even number.
So, Needed pattern is: Even Number - Odd Number - Even Number
(Left) 3, 4, 4, 9, 8, 8, 6, 8, 4, 2, 1, 1, 8, 5, 9, 8, 5, 7, 1, 8, 6, 2, 7, 2, 9, 2, 6 (Right)
So, total valid odd numbers = 3
Hence, the correct answer is Option 2.

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Q62. Answer: (d) EQR48

The logic followed here is:

So, the next term = EQR48

Hence, the correct answer is Option 4.

Q63. Answer: (b) 103

The logic followed here is:

thus, "103" will replace the question mark in the given series.

Hence, the correct option is "Option 2".

Q64. Answer: (d) 3

Given number: 63157842

Logic:

Add 1 to each odd digit

Subtract 2 from each even digit

Original number: 6 3 1 5 7 8 4 2

Digit	Type	Operation	New Digit
6	Even	6 − 2	4
3	Odd	3 + 1	4
1	Odd	1 + 1	2
5	Odd	5 + 1	6
7	Odd	7 + 1	8
8	Even	8 − 2	6
4	Even	4 − 2	2
2	Even	2 − 2	0

New number: 4 4 2 6 8 6 2 0

Repeated digits are: 4, 2, 6

Total repeated digits = 3

Hence, the correct answer is Option 4.

Q65. Answer: (b) Both conclusions (I) and (II) follow

Given Statements:

All mangoes are artists.

All kiwis are mangoes.

The least possible Venn diagram for the given statement is:

Conclusions:

I. All kiwis are artists - Follows (Since all kiwis are mangoes and all mangoes are artists, all kiwis are artists).

II. Some artists are kiwis - Follows (Kiwis are completely inside artists, therefore some artists are kiwis).

So, both conclusions I and II follow.

Hence, the correct answer is Option 2.

Q66. Answer: (a) AD-HB

The logic followed here is based on the alphabetical position pattern:

Option 1: AD – HB

Option 2: EH – LG

Option 3: CF – JE

Option 4: GJ – NI

Thus, AD – HB does not follow the given rule.

Hence, the odd one out is Option 1.

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Q67. Answer: (c) 1126

The logic followed here is:

thus, "1126" will replace the question mark in the given series.

Hence, the correct option is "Option 3".

Q68. Answer: (d) FBCA

The logic followed here is:

For, LHIG is related to DZAY

For, XTUS is related to PLMK

Now, applying the same logic for NJKI

So, NJKI → FBCA

Hence, the correct answer is "Option 4".

Q69. Answer: (d) TL-QI-NP

The logic followed here is:

For, NF-KC-HJ

For, LD-IA-FH

Now, applying the same logic for TL-QI-NP

So, TL-QI-NP follows the same pattern correctly.

Hence, the correct answer is "Option 4".

Q70. Answer: (c) 3

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

Now,

Even numbers, which are immediately preceded by an odd number and also immediately followed by an odd number.

So, Needed pattern is: Odd Number - Even Number - Odd Number

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

So, total valid even numbers = 3

Hence, the correct answer is Option 3.

Q71. Answer: (a) 31

The logic followed here is:

Logic: Find the reverse positional values of the letters, add them together, and then subtract 12 from the total.

For, DTWG → 42

=> D = 23, T = 7, W = 4, G = 20

=> 23 + 7 + 4 + 20 = 54

=> 54 − 12 = 42

For, RAYI → 43

=> R = 9, A = 26, Y = 2, I = 18

=> 9 + 26 + 2 + 18 = 55

=> 55 − 12 = 43

Now, applying the same pattern to OZES:

=> O = 12, Z = 1, E = 22, S = 8

=> 12 + 1 + 22 + 8 = 43

=> 43 − 12 = 31

Hence, the correct answer is Option 1.

Q72. Answer: (d) 14

Given: Total persons = 50, Amit is 17th from the left, Vilas has 18 people to his right.

Vilas's position from right = 18 + 1 = 19th from the right.

Vilas's position from left = 50 − 19 + 1 = 32nd.

Now, Amit = 17th from left and Vilas = 32nd from left.

Number of persons between them = 32 − 17 − 1 = 14

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Hence, the correct answer is Option 4.

Q73. Answer: (d) -8

The logic followed here is:

thus, "-8" will replace the question mark in the given series.

Hence, the correct option is "Option 4".

Q74. Answer: (b) 3

Given number: 4593867

Logic:

Add 1 to each even digit

Subtract 2 from each odd digit

Original number: 4 5 9 3 8 6 7

Digit	Type	Operation	New Digit
4	Even	4 + 1	5
5	Odd	5 − 2	3
9	Odd	9 − 2	7
3	Odd	3 − 2	1
8	Even	8 + 1	9
6	Even	6 + 1	7
7	Odd	7 − 2	5

New number: 5 3 7 1 9 7 5

Now, Second from the left = 3

Hence, the correct answer is Option 2.

Q75. Answer: (d) 4

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

Now,

Odd numbers, which are immediately preceded by an even number and also immediately followed by an even number.

So, Needed pattern is: Even Number - Odd Number - Even Number

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

So, total valid odd numbers = 4

Hence, the correct answer is Option 4.

Q76. Answer: (a) 74th

The logic followed here is:

Logic: To find a person's position from the opposite end of a row, first determine the position from the given end and then use the formula:

Position from Left = Total Students − Position from Right + 1

Now,

Mr. Hepa = 9th from the Right

Mr. Annu is 13 places to the left of Mr. Hepa

=> Position of Mr. Annu from the Right = 9 + 13

=> Position of Mr. Annu from the Right = 22

So, Total Students = 95

=> Position of Mr. Annu from the Left = 95 − 22 + 1

=> Position of Mr. Annu from the Left = 74

Hence, the correct answer is Option 1.

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Q77. Answer: (b) (13, 21, 51)

The logic followed here is:

Logic: (1st number + 2nd number) + 17 = 3rd number

For, (17, 25, 59)

=> 17 + 25 = 42

=> 42 + 17 = 59

For, (5, 13, 35)

=> 5 + 13 = 18

=> 18 + 17 = 35

Now, checking the options using the same pattern:

Option 1) (9, 17, 25)

=> 9 + 17 = 26

=> 26 + 17 = 43 ≠ 25

Option 2) (13, 21, 51)

=> 13 + 21 = 34

=> 34 + 17 = 51

Option 3) (11, 19, 48)

=> 11 + 19 = 30

=> 30 + 17 = 47 ≠ 48

Option 4) (15, 7, 23)

=> 15 + 7 = 22

=> 22 + 17 = 39 ≠ 23

Hence, the correct answer is Option 2.

Q78. Answer: (b) 4

The logic followed here is:

Given:

HAVE → 4579

VOLT → 2438

So, V → 4

Hence, the correct answer is Option 2.

Q79. Answer: (d) 0

BODMAS Table:

Given equation: 16 × 4 + 3 − 4 ÷ 8 = ?

Now, replacing the symbols as:

Symbol	•	−	×	÷
Replaced by	÷	×	−	•

=> 16 ÷ 4 − 3 × 4 + 8 = ?

=> 4 − 3 × 4 + 8 = ?

=> 4 − 12 + 8 = ?

=> −8 + 8 = ?

=> 0

Hence, the correct answer is Option 4.

Q80. Answer: (a) Only conclusion (I) follows

Given Statements:

All helmets are mats.

All helmets are bottles.

The least possible Venn diagram for the given statement is:

Conclusions:

I. Some mats are bottles - Follows (Since all helmets are both mats and bottles, there is a common overlap between mats and

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bottles).

II. All bottles are helmets - Does not follow (The statements only say that all helmets are bottles, not that all bottles are helmets).

So, only conclusion I follows.

Hence, the correct answer is Option 1.

Q81. Answer: (c) Southern Command

p>The correct answer is Southern Command.

Key Points

• In December 2025, the Indian Army successfully conducted a combat launch of the BrahMos Supersonic Cruise Missile from a test range located in the Bay of Bengal.

• The successful launch was executed by the Southern Command of the Indian Army, demonstrating the high state of operational readiness and the precision strike capabilities of the missile system.

• The missile followed a pre-defined trajectory and successfully hit its designated target ship with pinpoint accuracy, validating the tactical procedures for long-range engagement.

• This test was part of a series of training exercises aimed at ensuring that the Indian Army remains prepared for multi-domain warfare and maritime security challenges.

• The Southern Command, which oversees a vast geographical area, plays a critical role in integrating such advanced missile systems into its combat strategy to safeguard India's interests. Hence, the correct answer is Southern Command.

Additional Information

• BrahMos Missile Overview:

• The BrahMos is a supersonic cruise missile developed by BrahMos Aerospace, a joint venture between India’s DRDO (Defence Research and Development Organisation) and Russia’s NPO Mashinostroyeniya (NPOM).

• It is named after the rivers Brahmaputra of India and Moskva of Russia.

• The missile operates on a "Fire and Forget" principle and is capable of reaching speeds of up to Mach 2.8 to Mach 3.0, making it one of the fastest cruise missiles in the world.

• Propulsion and Launch Platforms:

• It utilizes a two-stage propulsion system: a solid propellant booster for the initial phase and a liquid ramjet for the sustained supersonic cruise phase.

• BrahMos is highly versatile and can be launched from land-based mobile launchers, ships, submarines, and Su-30 MKI fighter aircraft.

• Southern Command of Indian Army:

• The Southern Command is the largest command of the Indian Army in terms of territory, with its headquarters located in Pune, Maharashtra.

• It was formed in 1895 and covers several states including Maharashtra, Gujarat, Rajasthan, Karnataka, Kerala, Tamil Nadu, and Telangana.

Important Points

• Range and Enhancements: While the initial versions had a range limited to 290 km (due to MTCR guidelines), newer variants with extended ranges exceeding 450 km to 800 km are being developed and tested.

• Strategic Significance: The integration of the BrahMos system into the Indian Army (since 2007), Indian Navy (since 2005), and Indian Air Force (since 2020) provides India with a credible "stand-off" range capability.

• Export Potential: In January 2022, India signed its first major export deal for the BrahMos missile with the Philippines, marking a significant milestone in India's defense exports and the "Make in India" initiative.

Q82. Answer: (d) Valueattics Reinsurance

The correct answer is Valueattics Reinsurance.

Key Points

• In March 2025, Valueattics Reinsurance officially entered the Indian market after receiving the final R3 license from the regulator.

• The Insurance Regulatory and Development Authority of India (IRDAI) granted the registration, making it one of the few private domestic reinsurers to operate in the country.

• The entry of Valueattics Reinsurance is seen as a strategic move to boost the reinsurance capacity within India and provide local insurers with more options for risk transfer.

• This development marks a significant shift in the Indian insurance landscape, which has traditionally been dominated by the state-owned GIC Re and various Foreign Reinsurance Branches (FRBs).

• The company aims to leverage advanced technology and data analytics to offer specialized reinsurance products tailored for the Indian market.

Additional Information

• Reinsurance Fundamentals:

• Reinsurance is essentially "insurance for insurance companies." It allows primary insurers to protect themselves against catastrophic losses by passing a portion of the risk to a reinsurer.

• It helps in capital management, as it reduces the amount of capital an insurance company must hold to cover potential claims.

• IRDAI (Insurance Regulatory and Development Authority of India):

• It is the statutory body established under the IRDAI Act, 1999, tasked with regulating and developing the insurance industry in India.

• Headquartered in Hyderabad, it ensures the financial soundness of companies and protects the interests of policyholders.

• Market Structure in India:

• GIC Re (General Insurance Corporation of India) is the National Reinsurer and remains the largest player in the Indian market.

• Apart from domestic players, several global giants like Munich Re, Swiss Re, and Hannover Re operate in India through their Foreign Reinsurance Branches (FRBs).

• Licensing Stages:

• Any entity wanting to start a reinsurance business in India must go through three levels of approval: R1 (requisition for registration), R2 (detailed scrutiny), and R3 (final certificate of registration).

Important Points

• Economic Impact: The entry of private reinsurers like Valueattics Reinsurance helps in retaining more premium income within India, thereby preventing the outflow of foreign exchange.

• Capital Requirements: Under Indian law, a reinsurer is typically required to have a minimum paid-up equity capital of Rs. 200 Crore to commence operations.

• Vision 2047: The IRDAI has set a goal of "Insurance for All by 2047," and increasing the number of reinsurers is a vital component of achieving the necessary underwriting capacity for the nation.

• Role of Technology: New-age reinsurers are increasingly using Artificial Intelligence (AI) and Machine Learning to better predict risk patterns related to climate change and health indices in India.

Q83. Answer: (a) Rekha Gupta

The correct answer is Rekha Gupta.

Key Points

• Following the Delhi Legislative Assembly Elections held in February 2025, Rekha Gupta was sworn in as the Chief Minister of the National Capital Territory (NCT) of Delhi.

• She represents the Bharatiya Janata Party (BJP), which secured a majority in the 70-member assembly by winning more than the required 36 seats.

• The oath of office and secrecy was administered to her by the Lieutenant Governor of Delhi at a ceremony held at Raj Niwas (or potentially a public venue like Ramlila Maidan).

• Her appointment followed the conclusion of the term of the previous assembly, where the transition of power occurred from the Aam Aadmi Party (AAP) to the BJP. Hence, the statement regarding her swearing-in is correct.

• Rekha Gupta is a seasoned politician who has previously served as a Corporator and held significant positions within the Delhi University Students' Union (DUSU) in the mid-1990s.

Additional Information

• Delhi's Governance Framework:

• The governance of Delhi is unique as it is a Union Territory with its own legislature, established under the 69th Constitutional Amendment Act, 1991.

• Article 239AA of the Constitution of India grants special status to Delhi, allowing it to have an elected Legislative Assembly and a Council of Ministers.

• The Chief Minister of Delhi is appointed by the President of India (not the Governor/LG directly), and other ministers are appointed by the President on the advice of the Chief Minister.

• The Role of the Lieutenant Governor (LG):

• The Lieutenant Governor acts as the Administrator of Delhi and represents the Union Government.

• While the elected government has the power to legislate on matters in the State List and Concurrent List, three subjects—Police, Public Order, and Land—remain under the exclusive jurisdiction of the Central Government via the LG.

• Other Political Figures Mentioned:

• Atishi Marlena: A prominent leader of the Aam Aadmi Party who served as the Chief Minister briefly in 2024-2025 and held multiple portfolios including Education and Finance. Hence, statement 2 is incorrect in the context of the 2025 swearing-in winner.

• Manish Sisodia: The former Deputy Chief Minister of Delhi, known for his role in the Delhi Education Revolution. Hence, statement 3 is incorrect.

• Arvind Kejriwal: The founder of AAP and a three-time Chief Minister of Delhi, who resigned in late 2024. Hence, statement 4 is incorrect.

Important Points

• Eligibility for Chief Minister: To become the Chief Minister of Delhi, a person must be a citizen of India, have attained the age of 25 years, and must be a member of the Delhi Legislative Assembly.

• Cabinet Strength: According to Article 239AA, the size of the Council of Ministers in Delhi is limited to 10% of the total number of members in the Legislative Assembly, which means Delhi can have a maximum of 7 ministers including the Chief Minister.

• Legislative Term: The Delhi Legislative Assembly has a normal tenure of 5 years from the date appointed for its first meeting, unless dissolved earlier by the President.

• Historical Context: The first Chief Minister of Delhi was Chaudhary Brahm Brahm Prakash in 1952, and after a long hiatus where the post was abolished, it was reinstated in 1993 with Madan Lal Khurana.

Q84. Answer: (a) World Test Championship

The correct answer is World Test Championship.

Key Points

• South Africa secured a historic victory in the World Test Championship, effectively ending a 27-year wait for a major International Cricket Council (ICC) trophy.

• The last time the South African national team, known as the Proteas, won a premier global cricket tournament was the ICC KnockOut Trophy (now known as the Champions Trophy) held in 1998.

• The World Test Championship is a league competition for Test cricket run by the ICC, which began its first cycle in 2019 to determine the ultimate world champion in the longest format of the game.

• Winning this title is a significant milestone for South African cricket, as the team had previously reached multiple semi-finals in various formats but failed to cross the final hurdle until this WTC triumph.

• The victory signifies South Africa's dominance in the red-ball format over a two-year cycle, involving rigorous series against other top-ranked nations like Australia, India, and England.

Additional Information

• ICC Champions Trophy 1998:

• The inaugural edition of the ICC KnockOut Trophy was held in Bangladesh in October 1998.

• South Africa emerged as the champions after defeating the West Indies in the final match in Dhaka, with Hansie Cronje leading the side.

• World Test Championship (WTC) Format:

• The WTC was introduced to bring more relevance to Test cricket. The competition features the top nine Test-playing nations.

• Points are awarded for each match, and the two teams with the highest percentage of points at the end of the cycle compete in a one-off final at a neutral venue, often in England at Lord's or The Oval.

• South Africa's Cricket Legacy:

• The country was banned from international cricket between 1970 and 1991 due to the apartheid policy.

• Since their return in 1991, they have produced legendary players such as Jacques Kallis, AB de Villiers, Dale Steyn, and Hashim Amla.

• Despite their individual brilliance, the "chokers" tag haunted them for decades due to heartbreaking losses in the 1992, 1999, and 2015 World Cup knockouts.

• Other ICC Tournaments:

• The ICC Cricket World Cup (50-over format) and the ICC T20 World Cup are the other major trophies that South Africa has competed for over the years.

• Winning the World Test Championship is often considered the most prestigious achievement in modern cricket due to the endurance and skill required over five-day matches.

Q85. Answer: (d) World Anti-Doping Agency (WADA)

The correct answer is World Anti-Doping Agency (WADA).

Key Points

• The World Anti-Doping Agency (WADA) is the primary international body responsible for regulating and monitoring the fight against drugs in sports. In July 2025, India introduced critical amendments to its National Anti-Doping Act following concerns raised by WADA regarding compliance with the World Anti-Doping Code.

• The amendments aimed to ensure that India's legal framework for sports remains consistent with international standards, specifically addressing the independence of the National Anti-Doping Agency (NADA) and the National Anti-Doping Laboratory (NDTL).

• The World Anti-Doping Code is a document that harmonizes anti-doping policies, rules, and regulations within sport

organizations and among public authorities around the world. Failure to comply with this code can lead to sanctions, including the suspension of a country's ability to host international sporting events. Hence, the statement regarding WADA raising concerns is correct.

• In the context of the 2025 legislative update, the focus was on enhancing data protection for athletes and streamlining the results management process to prevent delays in adjudicating doping cases.

• The National Anti-Doping Agency (NADA) of India, established in 2005, is mandated to implement anti-doping programs in the country in accordance with WADA guidelines.

Additional Information

• World Anti-Doping Agency (WADA):

• WADA was established on November 10, 1999, in Lausanne, Switzerland, following the Declaration of Lausanne. Its current headquarters are located in Montreal, Canada.

• It is a foundation initiated by the International Olympic Committee (IOC) to promote, coordinate, and monitor the fight against doping in sports in all its forms.

• UNESCO’s Role:

• The United Nations Educational, Scientific and Cultural Organization (UNESCO) adopted the International Convention against Doping in Sport in 2005.

• This convention is the legal instrument through which governments formally commit to the WADA Code, as WADA is a private non-governmental organization.

• International Olympic Committee (IOC):

• While the IOC works closely with WADA, its primary function is the organization and governance of the Olympic Games and the promotion of Olympism worldwide.

• The IOC provides significant funding to WADA, but the agency operates as an independent international body.

• National Anti-Doping Bill, 2022:

• Before the 2025 amendments, India passed the National Anti-Doping Bill in 2022, which provided statutory backing to NADA and established the National Board for Anti-Doping in Sports.

• This legislative framework is essential for maintaining the National Anti-Doping Laboratory (NDTL)’s WADA accreditation, which is necessary for the international validity of test results.

Important Points

• Banned Substances: WADA maintains an annual Prohibited List, which identifies substances and methods prohibited at all times, in-competition only, and in specific sports (e.g., anabolic agents, peptide hormones, and masking agents).

• Whereabouts Requirements: Athletes in a Registered Testing Pool (RTP) must provide accurate information about their daily location to facilitate out-of-competition testing without prior notice.

• Therapeutic Use Exemptions (TUE): Athletes may have illnesses or conditions that require them to take particular medications. If the medication falls under the Prohibited List, a TUE may give the athlete the authorization to take the needed medicine.

• Sanctions: Violations of anti-doping rules can lead to disqualification of results, forfeiture of medals, and period of ineligibility (bans) ranging from a few months to a lifetime.

Q86. Answer: (c) India

The correct answer is India.

Key Points

• According to the IMF World Economic Outlook (WEO) projections for 2025, India is expected to remain the fastest-growing major economy in the world.

• The International Monetary Fund (IMF) has projected India’s GDP growth to be 6.5% for the year 2025, driven by strong domestic demand and a burgeoning working-age population. Hence, the correct option is India.

• In comparison, China's economic growth is projected to slow down to approximately 4.1% in 2025, primarily due to the ongoing property sector crisis and subdued consumer confidence.

• The United States of America is projected to experience a growth rate of 1.9%, reflecting a cooling labor market and the delayed effects of monetary policy tightening.

• Japan is expected to see a growth rate of about 1.1%, as the economy continues to grapple with demographic challenges and modest private consumption.

Additional Information

• International Monetary Fund (IMF):

• It is a major financial agency of the United Nations, headquartered in Washington, D.C., and was established in 1944 during the Bretton Woods Conference.

• Currently, it consists of 190 member countries working to foster global monetary cooperation and secure financial stability.

• The World Economic Outlook (WEO) is a comprehensive report published twice a year (April and October) that provides analysis

and forecasts for the global economy.

• GDP (Gross Domestic Product):

• It is the total market value of all finished goods and services produced within a country's borders in a specific time period, serving as a scorecard of a country's economic health.

• India’s GDP surpassed the $3.5 trillion mark recently, making it the fifth-largest economy in the world by nominal GDP.

• Global Growth Projections:

• The IMF projects steady but slow global growth at approximately 3.2% for 2025, as central banks worldwide navigate inflation targets.

• Growth in Emerging Market and Developing Economies (EMDEs) continues to outpace Advanced Economies, with Asia remaining the main engine of global expansion.

Important Points

• Growth Drivers for India: Significant public investment in infrastructure, the Production Linked Incentive (PLI) scheme, and the Digital India initiative have been pivotal in maintaining high growth trajectories.

• Monetary Policy: The Reserve Bank of India (RBI) maintains an inflation target of 4% (with a margin of +/- 2%), which helps in stabilizing the macroeconomic environment for sustained growth.

• Key Figures: Kristalina Georgieva serves as the Managing Director of the IMF, while Pierre-Olivier Gourinchas is the Chief Economist responsible for the WEO reports.

• Fiscal Consolidation: The Indian government aims to reduce the fiscal deficit to below 4.5% of GDP by 2025-26, which is a key factor monitored by global rating agencies.

Q87. Answer: (b) Pakistan

The correct answer is Pakistan.

Key Points

• The International Monetary Fund (IMF) sanctioned a significant financial package of $2.3 billion to Pakistan in May 2025 to help the country navigate its ongoing economic challenges.

• This funding was approved under the Extended Fund Facility (EFF), aiming to provide Pakistan with the necessary liquidity to stabilize its balance of payments and bolster its foreign exchange reserves.

• The approval came after Pakistan demonstrated a commitment to stringent structural reforms, including measures to increase tax revenue, adjust energy tariffs, and maintain a market-determined exchange rate.

• The $2.3 billion disbursement is part of a larger multi-year program designed to bring macroeconomic stability and promote sustainable growth in the South Asian nation.

• The IMF Executive Board emphasized the importance of fiscal discipline and social safety nets to protect the most vulnerable segments of the Pakistani population during the reform process.

Additional Information

• International Monetary Fund (IMF):

• The IMF is a global organization headquartered in Washington, D.C., consisting of 190 member countries.

• It was established in 1944 at the Bretton Woods Conference and began formal operations in 1945.

• Its primary mission is to ensure the stability of the international monetary system, facilitate international trade, and provide loans to countries facing financial crises.

• Extended Fund Facility (EFF):

• The EFF is a service provided by the IMF that offers assistance to countries facing serious medium-term balance of payments problems because of structural weaknesses.

• These programs are typically longer than standard Stand-By Arrangements, usually lasting 3 to 4 years, to allow for deep-seated economic reforms.

• Pakistan's Economic Context:

• Pakistan has a long history with the IMF, having entered into more than 20 programs since joining the organization in 1950.

• The country has frequently struggled with high inflation, fiscal deficits, and circular debt in the energy sector, necessitating periodic international bailouts.

Important Points

• Special Drawing Rights (SDRs): The IMF uses SDRs as an international reserve asset. The value of the SDR is based on a basket of five major currencies: the US Dollar, Euro, Chinese Renminbi, Japanese Yen, and British Pound Sterling.

• Conditionality: IMF loans are often "conditional," meaning the borrowing country must implement specific policies—such as austerity measures or privatization—to receive the funds.

• Managing Director: The IMF is traditionally headed by a European, while the World Bank is headed by an American. As of the current period, the leadership focuses on climate-resilient financing and debt restructuring for developing nations.

• Impact of Sanction: A $2.3 billion influx is critical for Pakistan to avoid sovereign default and to restore confidence among international investors and bilateral lenders like China, Saudi Arabia, and the UAE.

Q88. Answer: (c) Cloud-seeding to induce artificial rain

The correct answer is Cloud-seeding to induce artificial rain.

Key Points

• In October 2025, the Delhi government collaborated with researchers from IIT Kanpur to implement cloud-seeding as an emergency measure to mitigate the hazardous smog and air pollution levels in the city.

• The project aimed to induce artificial rain to facilitate the washout effect, which effectively removes suspended particulate matter like PM2.5 and PM10 from the atmosphere.

• The attempt eventually proved unsuccessful because the implementation of cloud-seeding requires specific meteorological conditions, including a minimum of 40% to 50% atmospheric moisture and the presence of rain-bearing clouds.

• During the specified period in October 2025, the humidity levels were too low and the sky lacked the necessary cumulus cloud formations, rendering the chemical dispersal from aircraft ineffective. Hence, the correct answer is Cloud-seeding to induce artificial rain.

Additional Information

• Cloud Seeding Technology:

• It is a weather modification technique where substances such as silver iodide, potassium iodide, or dry ice are dispersed into the air to serve as cloud condensation nuclei.

• In India, IIT Kanpur has developed a specialized flaring attachment for aircraft to carry out this process, which was previously tested in 2023.

• Delhi's Pollution Dynamics:

• The National Capital Region (NCR) experiences a seasonal spike in AQI (Air Quality Index) during October and November due to stubble burning in Punjab and Haryana, combined with firecracker emissions and calm wind conditions.

• A phenomenon known as temperature inversion traps pollutants close to the ground, creating a thick layer of smog that poses severe health risks to the 30 million residents of the region.

• Other Mitigation Measures:

• The Graded Response Action Plan (GRAP) is the primary regulatory framework used in Delhi, which involves restricting construction, banning diesel generators, and implementing the odd-even vehicle scheme.

• The government has also installed smog towers at Connaught Place and Anand Vihar, though their effectiveness is limited to a very small radius of 1 km.

Important Points

• Environmental Constraints: Artificial rain is not a permanent solution for air pollution; it is a temporary relief mechanism that is highly dependent on unpredictable weather patterns and wind direction.

• Technical Collaboration: The Delhi government offered to fund the entire cost of the IIT Kanpur project, estimated at several crores of rupees, provided the Directorate General of Civil Aviation (DGCA) and Ministry of Defence provided the necessary airspace clearances.

• Health Impact: Persistent smog in 2025 led to a 20% increase in respiratory ailments among children and the elderly, necessitating the exploration of high-tech solutions like cloud-seeding.

Q89. Answer: (d) Bharat Electronics Limited (BEL) & Safran Electronics and Defence (SED)

The correct answer is Bharat Electronics Limited (BEL) & Safran Electronics and Defence (SED).

Key Points

• In November 2025, Bharat Electronics Limited (BEL) and Safran Electronics and Defence (SED) signed a Joint Venture Cooperation Agreement (JVCA) aimed at the production of HAMMER smart precision-guided Air-to-Ground weapons in India.

• The partnership focuses on the indigenous manufacturing of the AASM HAMMER (Highly Agile Modular Munition Extended Range) to support the Aatmanirbhar Bharat initiative in the defence sector.

• The JVCA outlines the transfer of technology and the establishment of a domestic supply chain for these advanced munitions, ensuring long-term sustenance and maintenance, repair, and overhaul (MRO) services within the country.

• This collaboration significantly strengthens the strategic partnership between India and France, focusing on high-end aerospace technology and local production capabilities.

• The HAMMER system is designed to be integrated into various fighter aircraft, providing the Indian Air Force (IAF) with a versatile and highly accurate strike capability against a variety of land-based targets.

Additional Information

• Bharat Electronics Limited (BEL):

• BEL is a Navratna Public Sector Undertaking (PSU) under the Ministry of Defence, Government of India.

• Founded in 1954 and headquartered in Bengaluru, it specializes in advanced electronic products for the Army, Navy, and Air Force.

• The company plays a vital role in the indigenization of radar systems, missile systems, and communication equipment.

• Safran Electronics and Defence (SED):

• Safran is a French multinational company that operates globally in the aviation, defence, and space markets.

• It is a world leader in optronics, avionics, and navigation systems, providing critical technology for modern warfare.

• AASM HAMMER Weapon System:

• The HAMMER is a modular Air-to-Ground weapon that consists of a guidance kit and a range extension kit fitted to standard bombs.

• It features multiple guidance options, including Satellite/Inertial, Infrared, and Laser seekers, allowing for high precision in all weather conditions.

• It has been successfully integrated into the Rafale fighter jets and is planned for integration with the LCA Tejas to enhance the IAF's combat edge.

Important Points

• The HAMMER munitions were initially procured by the IAF through emergency procurement routes following the 2020 border stand-offs.

• The production in India under the JVCA will reduce import dependency and lower the life-cycle costs of the weapon system for the Indian military.

• The agreement aligns with the Defence Acquisition Procedure (DAP) 2020, which prioritizes Buy (Indian-IDDM) and Make in India categories for defence hardware.

• This joint venture is expected to create high-tech employment opportunities and boost the defence industrial ecosystem in India.

Q90. Answer: (c) Leh

The correct answer is Leh.

Key Points

• In November 2024, the Indian Space Research Organisation (ISRO) launched India’s inaugural analog space mission in Leh, Ladakh.

• The mission is a collaborative effort involving ISRO’s Human Space Flight Centre (HSFC), Aakaar Space, the University of Ladakh, IIT Bombay, and the Ladakh Autonomous Hill Development Council (LAHDC).

• The primary objective of this mission is to simulate interplanetary habitat conditions, providing a controlled environment to study the challenges of living on the Moon or Mars.

• The mission aims to explore the feasibility of establishing a sustainable base station beyond Earth by testing life support systems, resource management, and communication protocols.

• Leh was selected as the site for this mission because its geographical and climatic features—including high altitude, low oxygen levels, extreme cold, and barren landscape—closely mimic the lunar and martian environments.

Additional Information

• Analog Space Missions:

• These are field tests conducted in locations on Earth that have physical similarities to extreme space environments.

• They are used to test robotics, habitats, spacesuits, and human psychology in isolation before actual spaceflight.

• International agencies like NASA and ESA conduct similar missions in locations like Antarctica and the Atacama Desert.

• Significance of Ladakh for Space Research:

• Known as a cold desert, Ladakh offers unique geological analogs for Mars, specifically its volcanic rocks and permafrost.

• The low atmospheric pressure and low humidity in Leh provide an ideal setting to test the durability of spacecraft materials.

• ISRO (Indian Space Research Organisation):

• Founded on August 15, 1969, and headquartered in Bengaluru.

• ISRO is currently working on the Gaganyaan mission, which is India’s first human spaceflight program.

• The organisation has also planned the Bharatiya Antariksh Station (Indian Space Station), targeted for completion by 2035.

Important Points

• In-Situ Resource Utilization (ISRU): One of the mission's focuses is ISRU, which involves learning how to use local materials (like lunar regolith) to construct structures or produce oxygen and water.

• Human Factors: The mission tracks the circadian rhythms, mental health, and physical health of participants living in a confined analog habitat.

• Future Prospects: Successful data from the Leh analog mission will contribute to the design of the habitat modules for India's future missions to the Moon under the Chandrayaan program.

Q91. Answer: (d) Kerala

The correct answer is Kerala.

Key Points

• A state-of-the-art Skill Development Centre was inaugurated in the state of Kerala in July 2025 to enhance the employability of the local youth under the Pradhan Mantri Jan Vikas Karyakram (PMJVK).

• The Pradhan Mantri Jan Vikas Karyakram is a Centrally Sponsored Scheme implemented by the Ministry of Minority Affairs across India to provide better socio-economic infrastructure.

• The inauguration in Kerala specifically targets the creation of specialized infrastructure for vocational training, ensuring that students and workers from minority communities have access to modern industrial skills. Hence, the correct answer is Kerala.

• This initiative is designed to address the development deficits in identified areas by providing facilities for education, skill development, and healthcare.

• The Skill Development Centre is expected to offer courses aligned with the National Skills Qualifications Framework (NSQF), focusing on sectors like Information Technology, Electronics, and Healthcare.

Additional Information

• Pradhan Mantri Jan Vikas Karyakram (PMJVK):

• The scheme was restructured and renamed from the Multi-sectoral Development Programme (MsDP) in May 2018 to provide a sharper focus on the development of Minority Concentration Areas (MCAs).

• It aims to improve the quality of life of people and reduce imbalances in Minority Concentration Areas through the creation of community assets.

• The Ministry of Minority Affairs is the nodal agency responsible for the planning and execution of projects under this Centrally Sponsored Scheme.

• Projects are approved based on the proposals submitted by State Governments and Union Territory administrations, ensuring a bottom-up approach to development.

• Funding and Coverage:

• The funding pattern for PMJVK generally follows a 60:40 ratio between the Centre and the State, while for North-Eastern and Himalayan States, it is 90:10.

• The scheme covers all districts of the country, focusing on blocks, towns, and clusters of villages where the minority population is 25% or more, along with backwardness in socio-economic parameters.

• Identified minority communities include Muslims, Sikhs, Christians, Buddhists, Jains, and Zoroastrians (Parsis) as notified under the National Commission for Minorities Act, 1992.

Important Points

• Strategic Objectives:

• One of the primary objectives is to ensure inclusive growth by providing Skill Development hubs that reduce the unemployment rate among marginalized sections.

• The scheme supports the Atmanirbhar Bharat (Self-Reliant India) mission by fostering entrepreneurship and providing technical training at the grassroots level.

• In Kerala, the focus of such centers often includes nursing, paramedical sciences, and digital literacy, reflecting the state's high demand for skilled professionals in these sectors.

• July 2025 marks a significant timeline for the completion of several PMJVK projects sanctioned during the previous fiscal years to ensure last-mile delivery of government services.

Q92. Answer: (a) Bandhavgarh Tiger Reserve

The correct answer is Bandhavgarh Tiger Reserve.

Key Points

• The annual elephant rejuvenation camp, often referred to as the Hathi Mahotsav, was successfully organized in September 2025 at the Bandhavgarh Tiger Reserve located in Madhya Pradesh.

• This 7-day long event is a traditional ritual designed to provide a much-needed break and health boost to the captive elephants that serve the Forest Department throughout the year.

• During this period, the elephants are exempted from their regular duties, such as wildlife monitoring, rescue operations, and anti-poaching patrolling in the dense terrains of the reserve.

• The rejuvenation process involves a specialized nutritious diet prepared for each elephant, which includes a mix of jaggery, coconuts, sugarcane, bananas, apples, and bajra khichdi mixed with vitamins and minerals.

• Expert veterinarians conduct comprehensive health check-ups, while the mahouts (elephant handlers) perform daily oil massages and give the animals luxurious baths in the local water bodies to ensure their physical and mental well-being.

Additional Information

• Bandhavgarh Tiger Reserve:

• Located in the Umaria district of Madhya Pradesh, it was declared a National Park in 1968 and became a Tiger Reserve in 1993.

• It is famous for having one of the highest densities of Royal Bengal Tigers in the world and is historically significant as the home of the first White Tiger discovered in the wild, named Mohan.

• Madhya Pradesh - The Tiger State:

• Madhya Pradesh retained its status as the Tiger State of India according to the All India Tiger Estimation 2022 report, which recorded a population of 785 tigers in the state.

• Apart from Bandhavgarh, the state is home to other prominent reserves including Kanha Tiger Reserve, Pench Tiger Reserve, Satpura Tiger Reserve, Panna Tiger Reserve, and Sanjay-Dubri Tiger Reserve.

• Significance of Captive Elephants:

• Captive elephants are vital for tiger conservation because they allow forest guards to navigate areas where motor vehicles cannot reach.

• They are also used in tranquilizing and relocating tigers or other animals during human-wildlife conflict situations.

• Other Tiger Reserves mentioned:

• Kanha Tiger Reserve is the largest in the state and the first in India to introduce an official mascot, Bhoorsingh the Barasingha.

• Satpura Tiger Reserve, located in the Narmadapuram district, is known for its unique biodiversity and was part of the UNESCO World Heritage tentative list.

• Sanjay Tiger Reserve is situated in the Sidhi district and forms a critical corridor for wildlife movement between Madhya Pradesh and Chhattisgarh.

Important Points

• The rejuvenation camp is usually held during the monsoon season or immediately after, as the forest tracks are often inaccessible for routine patrolling, allowing the Forest Department to focus on the health of their animal workforce.

• Project Tiger, launched in 1973, remains the overarching framework under which these reserves are managed to ensure the survival of the Bengal Tiger in its natural habitat.

• The National Tiger Conservation Authority (NTCA) is the statutory body under the Ministry of Environment, Forest and Climate Change that oversees the management of these camps and reserves across India.

Q93. Answer: (d) New Delhi

The correct answer is New Delhi.

Key Points

• The historic first-ever Kho Kho World Cup was hosted in New Delhi, India, from 13 to 19 January 2025.

• The tournament took place at the iconic Indira Gandhi Arena (Indira Gandhi Indoor Stadium), which is known for hosting major international sporting events.

• The event was jointly organized by the Kho Kho Federation of India (KKFI) and the International Kho Kho Federation to elevate the traditional Indian sport to a global platform.

• A total of 24 countries from six continents participated in the competition, featuring 16 men's teams and 16 women's teams in their respective categories.

• The tournament aimed to promote the indigenous sport of India internationally, showcasing the speed, agility, and strategy inherent in Kho Kho.

Additional Information

• Origin of Kho Kho:

• Kho Kho is one of the oldest traditional tag sports in India, with its modern origins traced back to the state of Maharashtra.

• Historically, it was played on 'raths' or chariots and was known as Rathera.

• Kho Kho Federation of India (KKFI):

• The KKFI was established in the year 1955 to standardize the rules and promote the sport across the country.

• The current President of the Kho Kho Federation of India is Sudhanshu Mittal, who has been instrumental in organizing the inaugural World Cup.

• International Kho Kho Federation:

• This body oversees the global development of the sport and works towards its inclusion in multi-sport events like the Asian Games and eventually the Olympics.

• Tournament Theme:

• The slogan for the 2025 World Cup was "Lakhon Dil, Ek Dhadkan" (Millions of hearts, one heartbeat), emphasizing the emotional connection of the Indian populace with this native sport.

Important Points

• Government Support: The Union Ministry of Youth Affairs and Sports, under the Government of India, provided extensive support for the event as part of the initiative to promote indigenous games.

• Technical Evolution: The transition from playing on mud surfaces to synthetic mats has been a significant factor in making the sport more professional and visually appealing for international broadcasting.

• Ultimate Kho Kho (UKK): The success of the professional league, Ultimate Kho Kho, which launched its first season in 2022, played a pivotal role in building the momentum and viewership required to host a World Cup in 2025.

• Global Reach: Apart from India, nations like England, South Africa, Nepal, Bhutan, and Malaysia have emerged as strong contenders, indicating the growing popularity of the sport outside South Asia.

Q94. Answer: (b) Sandhya Shantaram

The correct answer is Sandhya Shantaram.

Key Points

• The veteran Indian actress and dancer Sandhya Shantaram, widely recognized for her prolific work in Marathi and Hindi cinema, passed away in October 2025.

• She was particularly celebrated for her lead roles in cinematic masterpieces directed by the legendary filmmaker V. Shantaram, such as the musical Navrang (1959) and the tragic drama Pinjra (1972).

• Born as Vijaya Deshmukh, she was discovered by V. Shantaram and cast in the film Amar Bhoopali in 1951, marking the beginning of a legendary career spanning several decades.

• She was known for her exceptional classical dance abilities, which were showcased extensively in films like Jhalak and Do Aankhen Barah Haath (1957).

• Her performance in Pinjra is considered a milestone in Marathi cinema, where she played the role of a Tamasha dancer who challenges the moral fiber of a village teacher. Hence, the correct answer is Sandhya Shantaram.

Additional Information

• Significant Films:

• Navrang (1959): This film is famous for its vibrant Holi sequences and the iconic song "Tu Chhupi Hai Kahan". Sandhya played a dual role (real-life wife and the protagonist's muse), showcasing her versatility as an actor and kathak dancer.

• Pinjra (1972): It was the first Marathi film to be produced in color. The film explored themes of morality, social fall, and the Lavani folk dance culture of Maharashtra.

• Do Aankhen Barah Haath (1957): In this socially relevant film about prison reform, she played the role of a toy seller, contributing to a project that won the Silver Bear at the Berlin International Film Festival.

• Association with Rajkamal Kalamandir:

• Most of her work was produced under the banner of Rajkamal Kalamandir, one of India's most prestigious film studios located in Mumbai.

• She married V. Shantaram in the 1950s and remained a core part of his creative vision until his death in 1990.

• Legacy in Dance:

• Unlike many actors of her era, Sandhya performed high-intensity classical and folk dance sequences without the use of body doubles, often undergoing rigorous training for months to perfect her movements for the big screen.

Important Points

• V. Shantaram: A pioneer of Indian Cinema, he was a recipient of the Dadasaheb Phalke Award in 1985. His films often focused on social reform and humanism.

• Other Options:

• Jyoti Chandekar: A well-known Marathi stage and film actress, known for her powerful character roles, but she is not the lead associated with Navrang.

• Sulakshana Pandit: An actress and playback singer prominent in the 1970s and 1980s, known for her roles in Bollywood but not primarily for Shantaram's early classics.

• Madhumati: A famous dancer and actress in Hindi cinema known for her item numbers and character roles during the Golden Era of the 1960s.

Q95. Answer: (d) Telecom Regulatory Authority of India (TRAI)

The correct answer is Telecom Regulatory Authority of India (TRAI).

Key Points

• In June 2025, the Reserve Bank of India (RBI) and the Telecom Regulatory Authority of India (TRAI) entered into a strategic collaboration to tackle the growing menace of spam calls and SMS related to unsolicited loan offers and credit card services.

• The primary objective of this partnership is to safeguard consumers from financial fraud and harassment caused by unregistered telemarketers who bypass standard regulatory protocols.

• As part of the initiative, the RBI issued directives to all Scheduled Commercial Banks and NBFCs to ensure that their third-party agents strictly adhere to TRAI’s guidelines regarding Unsolicited Commercial Communications (UCC).

• The collaboration involves the implementation of AI-driven filters and blockchain-based Distributed Ledger Technology (DLT) to

monitor and block headers and templates used by scammers to impersonate legitimate financial institutions.

• This move follows a significant rise in complaints regarding digital lending apps and spam calls that often lead to phishing attacks and unauthorized data harvesting.

Additional Information

• Telecom Regulatory Authority of India (TRAI):

• Established on February 20, 1997, under the Telecom Regulatory Authority of India Act, 1997, to regulate telecom services in India.

• It is headquartered in New Delhi and functions as a statutory body to ensure transparency and healthy competition in the telecom sector.

• TRAI introduced the Telecom Commercial Communications Customer Preference Regulations (TCCCPR) in 2018 to provide a framework for controlling spam and protecting subscriber privacy.

• Reserve Bank of India (RBI):

• The RBI was established on April 1, 1935, in accordance with the provisions of the Reserve Bank of India Act, 1934.

• As the Central Bank of the country, it regulates the monetary policy and oversees the banking system to maintain financial stability.

• In recent years, the RBI has introduced Digital Lending Guidelines (2022) to protect borrowers from predatory lending practices and illegal loan apps.

• Unsolicited Commercial Communication (UCC):

• This refers to any commercial communication that a subscriber receives without their explicit consent.

• The DND (Do Not Disturb) registry, managed by TRAI, allows users to opt-out of receiving such communications.

Important Points

• The Joint Working Group formed by RBI and TRAI focuses on technical solutions like Calling Name Presentation (CNAP), which helps users identify the caller's identity before answering.

• The Sanchar Saathi portal, launched by the Department of Telecommunications (DoT), also plays a crucial role in reporting fraudulent mobile connections and spam.

• Financial institutions found violating these norms face heavy penalties under the Banking Regulation Act, 1949, and TRAI regulations.

• This initiative is a critical step toward the Digital India vision, ensuring a secure digital ecosystem for online banking and financial transactions.

Q96. Answer: (b) Nitin Gadkari

The correct answer is Nitin Gadkari.

Key Points

• The book titled 'Sanghatil Manavi Vyavasthapan' is authored by the senior Bharatiya Janata Party (BJP) leader and Union Minister for Road Transport and Highways, Nitin Gadkari.

• The publication, released in May 2025, provides unique insights into the organizational culture and human resource management strategies of the Rashtriya Swayamsevak Sangh (RSS).

• The title 'Sanghatil Manavi Vyavasthapan' translates to "Human Management in Organization," highlighting Nitin Gadkari's perspective on how the RSS builds and maintains its vast network of volunteers through interpersonal relationships and disciplined management.

• In this book, the author explores the methodology of the Sangh in nurturing leadership and fostering a sense of national service among its members. Hence, the correct answer is Nitin Gadkari.

• The work is considered significant as it bridges the gap between traditional RSS values and modern management principles, written by a person who has been an active member of the organization for decades.

Additional Information

• Nitin Jairam Gadkari:

• He was born on May 27, 1957, in Nagpur, Maharashtra. Nagpur is also the global headquarters of the RSS.

• He served as the National President of the BJP from 2009 to 2013 and is known for his administrative efficiency and infrastructure development projects in India.

• Nitin Gadkari has a long-standing association with the RSS, which has deeply influenced his political and social philosophy.

• Rashtriya Swayamsevak Sangh (RSS):

• The RSS was founded on September 27, 1925, by Keshav Baliram Hedgewar in Nagpur.

• It is a right-wing, Hindu nationalist volunteer organization that focuses on character building and nation-building through a network of local branches known as Shakhas.

• The management style of the RSS is often studied for its decentralized structure and the ability to mobilize millions of volunteers

without a conventional corporate hierarchy.

• Other Options Context:

• Amit Shah is the Union Home Minister and has been a key strategist for the BJP, but he is not the author of this specific management-focused book on the RSS.

• Yogi Adityanath is the Chief Minister of Uttar Pradesh and the head of the Gorakhnath Math, primarily known for his administrative reforms in the state.

• Shashi Tharoor is an Indian National Congress politician and a prolific author known for books like ‘The Paradoxical Prime Minister’ and ‘Why I Am a Hindu’, but his writings usually offer a different ideological perspective compared to the Sangh's management insights.

Important Points

• The book ‘Sanghatil Manavi Vyavasthapan’ emphasizes the concept of "Antyodaya" (uplifting the last person), which is a core philosophy of both the RSS and the BJP.

• It discusses the evolution of the RSS from a small group in 1925 to one of the world's largest non-governmental organizations by the year 2025.

• The publication serves as a guide for young leaders to understand how organizational discipline and human empathy can coexist in large-scale social movements.

• Nitin Gadkari's writings often reflect his practical approach to economic development and social welfare, integrated with the cultural values he imbibed from the Sangh.

Q97. Answer: (d) Jiang Yuyan

The correct answer is Jiang Yuyan.

Key Points

• Jiang Yuyan, a phenomenal para-swimmer from China, was officially named the Sportsperson of the Year with a Disability at the 2025 Laureus World Sports Awards.

• The award recognizes her historic and dominant performance during the Paris 2024 Paralympic Games, where she emerged as the most successful athlete of the entire event.

• During the Paris 2024 games, she won an incredible seven gold medals, competing in various individual and relay events within the S6 and S7 classifications.

• Her gold medal tally included victories in the 50m freestyle S6, 100m freestyle S7, 400m freestyle S6, and 50m butterfly S6, alongside multiple relay successes.

• At only 19 years old at the time of the games, she became a symbol of excellence and resilience, breaking several world records and Paralympic records in the process.

Additional Information

• Background of Jiang Yuyan:

• Born in 2004 in Shaoxing, Zhejiang province, China, she faced significant adversity early in life after losing her right arm and right leg in a car accident at the age of four.

• She is widely known by the nickname "Flying Fish" due to her extraordinary speed and technique in the swimming pool.

• She began her international career with a breakthrough at the 2019 World Para Swimming Championships in London, where she won three gold medals at the age of 14.

• The Laureus World Sports Awards:

• Established in 1999, these awards are often considered the "Oscars of Sport," honoring the greatest sporting achievements of the previous calendar year.

• The Sportsperson of the Year with a Disability category is one of the most prestigious honors in the Paralympic movement, highlighting athletes who overcome physical challenges to reach the pinnacle of sport.

• The winners are selected through a two-step process: a nominations panel of world media followed by a final vote by the Laureus World Sports Academy.

Important Points

• Paralympic Dominance: Jiang Yuyan’s seven gold medals in a single Paralympic Games is a rare feat that places her among the all-time greats, comparable to legendary swimmers like Michael Phelps in the Olympic context.

• Classification System: In para-swimming, S6 and S7 refer to physical impairment classifications. The lower the number, the more severe the activity limitation. Jiang's ability to break records across multiple classes showcases her versatility.

• Laureus Academy: The final voting body for these awards, the Laureus World Sports Academy, consists of 71 of the greatest living sporting legends, ensuring that the winners are recognized by their peers.

• China's Performance: Jiang's contributions were pivotal in helping China top the medal table at the Paris 2024 Paralympics with a total of 94 gold medals and 220 medals overall.

Q98. Answer: (b) Himachal Pradesh

The correct answer is Himachal Pradesh.

Key Points

• The government of Himachal Pradesh, during the presentation of its administrative goals in March 2025, announced a significant environmental target to bring 5,000 hectares of land under afforestation during the financial year 2025-2026.

• This initiative is part of the state's broader vision to enhance its green cover and mitigate the impacts of climate change in the fragile Himalayan ecosystem. Hence, the statement regarding the 5,000-hectare target is correct for Himachal Pradesh.

• The afforestation drive will focus on the plantation of broad-leaved trees and species that are resilient to forest fires, which is a major concern for the state during the summer months.

• The Himachal Pradesh Forest Department has been designated as the nodal agency to identify degraded forest lands and community lands for this massive plantation exercise.

• The project also aims to involve local communities and Panchayati Raj Institutions to ensure the survival rate of the saplings and to promote community-led conservation.

Additional Information

• Geographical and Forest Profile:

• Himachal Pradesh has a total geographical area of 55,673 sq km, out of which a significant portion is classified under recorded forest area.

• According to the India State of Forest Report (ISFR), the state has been consistently working to increase its forest cover from the current levels to reach the national goal of 33%.

• The state is home to diverse flora, including Deodar (Cedrus deodara), Oak, Kail, and Chir Pine.

• Green State Vision:

• The Government of Himachal Pradesh has set an ambitious target to transform the state into a "Green Energy State" by March 31, 2026.

• The afforestation target of 5,000 hectares for 2025-2026 complements this vision by creating carbon sinks to offset emissions.

• Economic and Ecological Importance:

• Forests in Himachal Pradesh play a crucial role in watershed management, providing water to several downstream states in North India through rivers like the Beas, Ravi, and Sutlej.

• Eco-tourism is a major source of revenue for the state, which is directly dependent on the preservation of its natural landscapes and wildlife habitats.

Important Points

• Major Schemes:

• The state implements various schemes like "Ek Buta Beti Ke Naam," where saplings are planted to celebrate the birth of a girl child, linking social forestry with gender empowerment.

• The "Mukhyamantri Van Vistaar Yojana" is another key initiative focused on expanding greenery in barren and rocky terrains.

• Climate Resilience:

• The 2025-2026 plan emphasizes soil moisture conservation through the construction of check dams and ponds alongside afforestation to prevent soil erosion and landslides.

• The state has also been exploring carbon credit mechanisms to incentivize sustainable forest management.

Q99. Answer: (b) Wahiajer Multi Sports Complex Stadium

The correct answer is Wahiajer Multi Sports Complex Stadium.

Key Points

• The 6th edition of the Meghalaya Games was officially inaugurated by the Chief Minister of Meghalaya, Conrad K Sangma, in January 2025.

• The prestigious multi-sporting event was hosted at the Wahiajer Multi Sports Complex Stadium, which is located in Jowai within the West Jaintia Hills district.

• This event marks a significant step in the state government's policy to decentralize sports and host major tournaments in different districts to promote local talent and improve sports infrastructure.

• The 6th Meghalaya Games involved the participation of approximately 3,000 athletes representing all the districts of the state, competing in various disciplines such as Athletics, Archery, Football, and Boxing.

• The inauguration ceremony was attended by several dignitaries, including the Sports and Youth Affairs Minister, highlighting the state's commitment to the "Sports Youth Policy".

Additional Information

• Meghalaya State Olympic Association (MSOA):

• The MSOA, in collaboration with the Department of Sports and Youth Affairs, is the primary body responsible for organizing the

Meghalaya Games.

• The association aims to prepare state athletes for national-level competitions, including the National Games of India.

• Previous Editions:

• The 5th edition of the Meghalaya Games was held in January 2024 in Tura, West Garo Hills, and was inaugurated by the President of India, Droupadi Murmu.

• Before 2022, the games were largely centered in the state capital, Shillong, but have since moved to different regions like Garo Hills and Jaintia Hills to ensure inclusive growth.

• Infrastructure Development:

• The Wahiajer Multi Sports Complex is a state-of-the-art facility featuring modern amenities for indoor and outdoor sports, funded as part of the state's massive investment in sports facilities totaling over Rs. 500 crore in recent years.

• The government is focusing on creating synthetic tracks and astroturf football grounds across various blocks in Meghalaya.

Important Points

• STAR Talent Identification Program:

• During the games, the government utilizes the STAR program to scientifically test and identify young athletes with high potential for elite training.

• Meghalaya has successfully tested over 15,000 children under this initiative to build a robust sporting ecosystem.

• Significance of the Venue:

• The choice of Wahiajer in Jowai emphasizes the government's effort to reach the rural youth and provide them with a platform similar to that available in urban centers.

• The Meghalaya Games serves as a selection trial for athletes to represent the state in the North East Games and other national forums.

• Cultural Integration:

• The games are not just about sports but also showcase the rich cultural heritage of the Khasi, Garo, and Jaintia communities through various cultural performances during the opening and closing ceremonies.

Q100. Answer: (b) Agricultural Science

The correct answer is Agricultural Science.

Key Points

• Dr. C Anandharamakrishnan has been conferred with the prestigious Rashtriya Vigyan Puraskar 2024 in the Vigyan Shri category for his pioneering work in Agricultural Science.

• He currently serves as the Director of the CSIR-National Institute for Interdisciplinary Science and Technology (NIIST), located in Thiruvananthapuram, Kerala.

• The Vigyan Shri award specifically recognizes individuals who have made distinguished contributions to any field of science and technology.

• His research expertise spans several critical areas, including food engineering, 3D food printing, nanotechnology for food packaging, and engineered digestive systems.

• The 2024 awards ceremony was held on August 23, 2024, which coincided with the first-ever National Space Day in India.

Additional Information

• Rashtriya Vigyan Puraskar (RVP):

• This national award was instituted in 2023 by the Government of India to simplify and unify the diverse science awards previously given by various ministries.

• It is categorized into four levels: Vigyan Ratna (Lifetime Achievement), Vigyan Shri (Distinguished Contribution), Vigyan Yuva-SSB (Young Scientists), and Vigyan Team.

• The awards are open to persons of Indian origin (PIO) and non-resident Indians (NRI), in addition to citizens of India.

• Dr. C Anandharamakrishnan's Career:

• Before his tenure at CSIR-NIIST, he served as the Director of the National Institute of Food Technology, Entrepreneurship and Management (NIFTEM), Thanjavur.

• He holds a Doctoral degree from Loughborough University, United Kingdom, and has been instrumental in developing spray drying and electrospraying techniques for nutrient delivery.

• He is a Fellow of the National Academy of Sciences (NASI) and the Royal Society of Chemistry.

• Significance of the 2024 Awards:

• The 2024 edition marked the inaugural distribution of these unified national science awards.

• A total of 33 awards were announced across various disciplines like Physics, Chemistry, Biological Sciences, and Mathematics.

Important Points

• Award Selection: The final recipients are selected by a high-level committee chaired by the Principal Scientific Adviser to the

Government of India.

• Date of Announcement: The names of the awardees are officially announced on May 11 every year, which is celebrated as National Technology Day.

• National Space Day: The President of India, Droupadi Murmu, presented the awards at Rashtrapati Bhavan on August 23, celebrating the anniversary of the Chandrayaan-3 mission's success.

• Scientific Impact: In the field of Agricultural Science, Dr. Anandharamakrishnan’s work helps in addressing food security and improving the shelf-life of agricultural produce through advanced bioprocessing.

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