RRB Group D Official Paper (Held On: 28 Nov, 2025 Shift 1) (Previous Year Paper)

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

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GENERAL SCIENCE

Q1. When white light falls on a glass prism, out of all its constituent colours, violet colour undergoes maximum bending. Why?

(a) Violet has minimum wavelength and hence minimum refractive index
(b) Violet has maximum wavelength and hence minimum refractive index
(c) Violet has minimum wavelength and hence maximum refractive index
(d) Violet has maximum wavelength and hence maximum refractive index

Q2. Which of the following examples best illustrates the real-life role of lysosomes in action?

(a) A white blood cell swallowing and breaking down harmful bacteria
(b) A green leaf making food by photosynthesis
(c) A red blood cell delivering oxygen to muscles
(d) A nerve cell passing signals to help you feel pain

Q3. What type of reaction occurs when barium chloride reacts with sodium sulfate?

(a) Decomposition
(b) Combination
(c) Oxidation
(d) Double displacement

Q4. The resistance of a metallic conductor increases with:

(a) Increase in cross-sectional area
(b) Decrease in length
(c) Increase in temperature
(d) Decrease in temperature

Q5. What is the main function of the nucleus in an eukaryotic cell?

(a) Producing energy
(b) Acting as a storage unit for food
(c) Digesting waste
(d) Directing life processes of the cell

Q6. Which of the following activities demonstrates the presence of spaces between particles of matter?

(a) Freezing a liquid
(b) Dissolving sugar in water
(c) Heating a solid
(d) Compressing a gas

Q7. Which of the following organs releases growth hormone releasing factor, which stimulates the pituitary gland to release growth hormone?

(a) Adrenal glands
(b) Pancreas
(c) Hypothalamus
(d) Thymus

Q8. The process of swelling or shrinking in plant cells, leading to changes in shape and movement, is directly caused by which factor?

(a) The alteration of their internal water content.
(b) The rapid breakdown of cellulose.
(c) The stiffening of their cell walls.
(d) The formation of new protein structures.

Q9. Newton's First Law of Motion is also called the law of:

(a) force
(b) action and reaction
(c) acceleration
(d) inertia

Q10. What is the defining characteristic of an unsaturated carbon compound?

(a) All carbon atoms are linked by only single bonds.
(b) It always contains a functional group with oxygen.
(c) It forms only cyclic structures.
(d) It contains at least one double or triple bond between carbon atoms.

Q11. A housing society has started segregating waste into two bins – green for kitchen waste and blue for plastic, metal and glass. What is the main benefit of this practice?

(a) It makes waste collection faster.
(b) It increases the quantity of waste produced.
(c) It helps separate non-biodegradable from biodegradable waste.
(d) It reduces the smell of garbage.

Q12. Observe the following chemical reaction:

$H_2S + I_2 \rightarrow 2HI + S$

Which of the following statements correctly describes this redox reaction?

Statements:

I: Hydrogen sulphide undergoes oxidation to form sulphur.

II: Iodine is reduced, producing hydrogen iodide.

(a) Both Statement I and II are correct
(b) Only Statement II is correct
(c) Both Statement I and II are incorrect
(d) Only Statement I is correct

Q13. What is the sequence of stages involved in the budding process of hydra?

(a) Bud initiation → Bud detachment → Bud maturation → New individual
(b) Bud maturation → Bud initiation → Bud detachment → New individual
(c) New individual → Bud maturation → Bud detachment → Bud initiation
(d) Bud initiation → Bud maturation → Bud detachment → New individual

Q14. How many daughter cells are formed during binary fission?

(a) Four
(b) One
(c) Zero

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(d) Two

Q15. Which of the following statements is correct?

Statement 1: The magnetic field lines produced around a straight current-carrying conductor form concentric circles centred along the wire.

Statement 2: The direction of these magnetic field lines can be determined using the right-hand thumb rule.

(a) Both statements 1 and 2 are correct.
(b) Both statements 1 and 2 are incorrect.
(c) Statement 1 is incorrect, but 2 is correct.
(d) Statement 1 is correct, but 2 is incorrect.

Q16. To demonstrate the relationship between inertia and mass, a student compares the difficulty of kicking a football versus kicking a stone of equal size. What fundamental principle justifies the greater difficulty and potential injury associated with kicking the stone?

(a) The stone has lower surface friction, causing all force to be transmitted.
(b) The stone possesses greater mass, which results in greater inertia, meaning it offers larger resistance to changing its state of rest.
(c) The stone is subject to the First Law of Motion, while the football is governed by the Second Law.
(d) The force applied to the stone is insufficient to overcome the centripetal force holding its atoms together.

Q17. Which of the following is NOT true regarding the image formed by a concave lens?

(i) The image formed by a concave lens cannot be obtained on a screen.

(ii) The image formed by a concave lens can be obtained on a screen.

(iii) The image formed is always smaller in size in comparison to the size of the object.

(iv) The image formed is always bigger in size in comparison to the size of the object.

(a) Both (i) and (iv)
(b) Both (i) and (iii)
(c) Both (ii) and (iv)
(d) Both (ii) and (iii)

Q18. The state of a substance whether it will be solid, liquid or gas is determined by:

a. Temperature

b. Pressure

c. Volume

(a) b and c only
(b) a and c only
(c) a and b only
(d) a, b and c

Q19. Metals found at the bottom of the activity series (e.g., gold, silver, platinum) are typically found in nature in which state?

(a) As highly reactive oxides
(b) As carbonates that require roasting
(c) As sulphides that require calcination
(d) In their free state

Q20. What is the approximate pH of a salt solution formed from a strong acid and a strong base?

(a) Equal to 7
(b) Greater than 7
(c) Can be less than or greater than 7 depending on temperature
(d) Less than 7

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Q21. A student cuts the style of a flower before pollination. What will be the most likely outcome?

(a) The pollen tube will grow more quickly.
(b) Pollination will be faster.
(c) The ovule will turn into a seed.
(d) Fertilisation will not occur.

Q22. Rutherford's α-particle scattering experiment led to the discovery of which of the following?

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

Q23. Which of the following is an example of potential energy?

(a) A book kept on a table
(b) A moving train
(c) A flowing river
(d) A rolling ball

Q24. Which of the following increases when the amplitude of a wave increases?

(a) Energy of the wave
(b) Frequency
(c) Wavelength
(d) Speed

Q25. Which of the following statements is true about gravitational force of the Earth?

(a) It is a non-central force.
(b) It depends on the mass of the object.
(c) It acts away from the centre of Earth.
(d) It is independent of distance from Earth's centre.

MATHEMATICS

Q26. The area of a triangle is 61.5 m^2. If one of its sides is 12.3 m, find the length of the perpendicular dropped on that side from the opposite vertex.

(a) 10.5 m
(b) 11.5 m
(c) 10 m
(d) 11 m

Q27. Sushma purchased a used car for Rs. 1,20,000 and spent Rs. 28,500 on its repairs. She then sold it to her friend Sam for Rs. 1,38,600. What percentage did she gain or lose? (Round off your answer to two decimal places.)

(a) 8.67% loss
(b) 6.67% loss
(c) 5.38% gain
(d) 6.67% gain

Q28. P is any point inside the rectangle ABCD. If PA = 85 cm, PB = 65 cm and PC = 5 cm, then the length of PD (in cm) is equal to:

(a) 55
(b) 53
(c) 51
(d) 58

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Q29. Simplify $(1.25^2 - 0.75^2)/(2.25^2 - 1.25^2) \times 7/2$.

(a) 2
(b) 0.25
(c) 1
(d) 0.5

Q30. The cost of a washing machine is 50% less than the cost of a TV. If the cost of the washing machine increases by 33% and that of the TV decreases by 13%, then what is the percentage change in the total cost of 4 washing machines and 2 TVs?

(a) Decrease by 7%
(b) Increase by 10%
(c) Increase by 9.5%
(d) Decrease by 10%

Q31. The amount on a sum of Rs. 2,800 at 10% per annum compound interest, compounded annually, in 2 years will be:

(a) Rs. 3,388
(b) Rs. 2,647
(c) Rs. 3,274
(d) Rs. 3,604

Q32. A father is 5 times as old as his son. If the sum of their ages is 54 years, how old is the son?

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

Q33. A train, 1312 m long, is running at a speed of 54 m/s. If it takes 106 seconds to cross a tunnel, then find the length of the tunnel.

(a) 4412 m
(b) 4402 m
(c) 4408 m
(d) 4413 m

Q34. The present age of a father is twice the sum of the present ages of his two sons. After 20 years, the father's age will be equal to the sum of his sons' ages. Find the present age of the father.

(a) 40 years
(b) 45 years
(c) 42 years
(d) 48 years

Q35. Chetan travels from City A to City B. If Chetan drives his car at 3/5 th of his normal speed, then he reaches City B 52 minutes late.

Find the time (in minutes) that Chetan would have taken to travel from City A to City B if he drove at his normal speed.

(a) 69
(b) 78
(c) 83
(d) 82

Q36. What is the value of $(5.4\ (0.1 \times 0.1 \times 0.1 + 0.03 \times 0.03 \times 0.03))/(0.3 \times 0.3 \times 0.3 + 0.09 \times 0.09 \times 0.09)$?

(a) 0.5
(b) 0.4
(c) 0.2
(d) 0.6

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Q37. If 7^5 × 7√7 ÷ 7^(-5/2) = 7^(2x+3), then the value of x is:

(a) 0
(b) 2
(c) 3
(d) 0.5

Q38. Navya and Bhavya can paint a house in 40 days and 60 days, respectively. If they work on alternate days, starting with Bhavya, in how many days can the duo complete painting that house?

(a) 45 days
(b) 49 days
(c) 50 days
(d) 48 days

Q39. The marked price of a wardrobe is Rs. 8,640, which is 35% above the cost price. It is sold at a discount of 20% on the marked price. Find the profit percentage.

(a) 8%
(b) 9%
(c) 6%
(d) 10%

Q40. Which of the following numbers is divisible by 7?

(a) 6825907
(b) 7357306
(c) 7132951
(d) 7660778

Q41. A sum of money is to be distributed among A, B, C and D in the ratio of 10 : 7 : 9 : 5. If C gets Rs. 334 more than B, then how much did A receive?

(a) Rs. 1,669
(b) Rs. 1,671
(c) Rs. 1,670
(d) Rs. 1,673

Q42. The monthly incomes of two friends, Kiran and Mahesh, are in the ratio 5 : 8 respectively, and each of them saves Rs. 72,000 every month. If the ratio of their monthly expenditure is 2 : 4, find the monthly income of Kiran (in Rs.).

(a) 1,81,000
(b) 1,79,000
(c) 2,52,000
(d) 1,80,000

Q43. A and B working together can do a piece of work in 6 days. B alone can do the same work in 9 days. How long (in days) will A alone take to do double the work?

(a) 36
(b) 18
(c) 39
(d) 37

Q44. After selling an article at a discount of 25%, the profit percentage obtained is 2%. What is the mark-up percentage?

(a) 38%
(b) 34%
(c) 40%
(d) 36%

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Q45. If 5 cos A = 4, then find the value of (3 √(cosec² A - 1))/(4 √(sec² A - 1))

(a) 4/3
(b) 16/9
(c) 1
(d) 3/4

Q46. If A : B = 1 : 3, B : C = 4 : 3 and C : D = 6 : 7, then A : B : C : D is:

(a) 8 : 24 : 18 : 21
(b) 6 : 24 : 18 : 21
(c) 8 : 24 : 16 : 21
(d) 8 : 22 : 18 : 21

Q47. A triangle has sides of lengths 7 cm, 9 cm and 12 cm. Find its area.

(a) 19√7 cm²
(b) 14√5 cm²
(c) 18√13 cm²
(d) 16√3 cm²

Q48. The price of oil is increased successively by 50% and then by 40%. What is the equivalent single percentage increase?

(a) 90%
(b) 100%
(c) 75%
(d) 110%

Q49. The average of 6.5, 10.6, 19.7 and a is 12. The value of a is:

(a) 13.2
(b) 12.2
(c) 11.2
(d) 10.2

Q50. Find the mode of the data 1, 11, 11, 8, 18, 8, 7, 7, 7, x, y, and 8, given that 3x + 7y = 42 and 7x + 3y = 58.

(a) 8
(b) 18
(c) 7
(d) 11

GENERAL INTELLIGENCE & REASONING

Q51. Refer to the following number series and answer the question that follows (all numbers are single digit numbers only).

(Left) 6 1 5 6 8 5 5 7 7 9 9 5 7 4 9 7 6 1 9 2 6 7 6 3 7 4 9 (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) 2
(b) 3
(c) 0
(d) 1

Q52. Refer to the following number and symbol series and answer the question that follows. Counting to be done from left to right only. All numbers are single-digit numbers.

(Left) % € € % 6 £ 3 & 1 £ 4 5 7 2 2 & & 9 & 8 8 * (Right)

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

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

Q53. If 'E' stands for '+', 'F' stands for '-', 'G' stands for '×' and 'H' stands for '÷', what will come in place of question mark '?' in the following equation?

45 G 3 E 28 H 7 F 8 = ?

(a) 131
(b) 133
(c) 129
(d) 135

Q54. Karan starts from Point A and drives 12 km towards the North. He then takes a right turn, drives 6 km, then turns right and drives 16 km. He then takes a right turn and drives 8 km. He takes a final right turn, drives 4 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) 3 km to the east
(b) 2 km to the east
(c) 3 km to the west
(d) 2 km to the west

Q55. If + means ÷, − means ×, × means −, and ÷ means +, then what will come in place of the question mark (?) in the following equation?

639 + 9 × 6 - 44 ÷ 279 = ?

(a) 86
(b) 81
(c) 80
(d) 89

Q56. Select the triad which follows the same pattern as that followed by the two triads given below. Both triads follow the same pattern.

RK-NH-LO

TM-PJ-NQ

(a) VO-RL-PS
(b) VO-RL-PT
(c) WO-RL-PT
(d) WO-SL-PT

Q57. Select the set in which the numbers are related in the same way as are the numbers of the following sets.

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

(59, 71, 55)

(85, 97, 81)

(a) (117, 129, 114)
(b) (121, 133, 116)
(c) (78, 90, 76)
(d) (99, 111, 95)

Q58. What should come in place of the question mark (?) in the given series?

5 15 26 38 51 ?3820

(a) 65
(b) 63

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(c) 62
(d) 64

Q59. NJOM is related to TPUS in a certain way based on the English alphabetical order. In the same way, PLQO is related to VRWU. To which of the following is RNSQ related, following the same logic?
(a) XTWY
(b) XTYW
(c) TXWY
(d) TXYW

Q60. Based on the English alphabetical order, three of the following four letter-clusters are alike in a certain way and thus form a group. Which is the letter-cluster that does NOT belong to that group?
(Note: The odd one out is not based on the number of consonants/vowels or their positions in the letter-cluster.)
(a) ECF
(b) GFH
(c) TRU
(d) PNQ

Q61. Read the given statements and conclusions carefully. Assuming that the information given in the statements is true, even if it appears to be at variance with commonly known facts, decide which of the given conclusions logically follow(s) from the statements.
Statements:
Some pipe are hose.
All hose are tunnel.
Conclusions:
(I) Some pipe are tunnel.
(II) All tunnel are hose.
(a) Only conclusion (II) follows
(b) Only conclusion (I) follows
(c) Both conclusions (I) and (II) follow
(d) Neither conclusion (I) nor (II) follows

Q62. What should come in place of the question mark (?) in the given series?
29 49 69 89 109 ?
(a) 129
(b) 121
(c) 131
(d) 119

Q63. If ‘A’ stands for ‘÷’, ‘B’ stands for ‘x’, ‘C’ stands for ‘+’ and ‘D’ stands for ‘-‘, what will come in place of question mark ‘?’ in the following equation?
29 B 6 C 243 A 9 D 33 = ?
(a) 166
(b) 171
(c) 173
(d) 168

Q64. DGRZ is related to HNVG in a certain way based on the English alphabetical order. In the same way, TIHB is related to XPLI. To which of the given options is FDTW related, following the same logic?
(a) JKXD
(b) JXDE
(c) JKOP
(d) JKXS

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Q65. A, B, C, D, E and F are sitting around a circular table facing the centre. D sits second to the left of B. E sits second to the right of F. C is on the immediate right of D. Who is sitting on the immediate left of A?

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

Q66. In a certain code language,

A + B means ‘A is the sister of B’,

A @ B means ‘A is the brother of B’,

A - B means ‘A is the wife of B’,

and A # B means ‘A is the father of B’.

How is O related to V if ‘O + P - T # G @ V’?

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

Q67. Mr. Z starts from Point A and drives 18 km towards the North. He then takes a left turn, drives 14 km, then turns left and drives 14 km. He then takes a right turn, drives 13 km, then turns left and drives 25 km. He then takes a left turn and drives 34 km. He takes a final left turn, drives 21 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) 8 km to the east
(b) 9 km to the south
(c) 10 km to the north
(d) 7 km to the west

Q68. In a row of 50 students facing North, Shruti is 23^(rd) from the left end. If Daksh is 17^(th) to the right of Shruti, what is Daksh's position from the right end of the line?

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

Q69. In a certain code language, ‘pig issue nod’ is coded as 'cd hx gj' and ‘love nod news’ is coded as ‘vn va hx’. How is ‘nod’ coded in the given language?

(a) cd
(b) hx
(c) gi
(d) vn

Q70. 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) EG – AB
(b) DF – ZY
(c) JL – FE
(d) RT – NM

Q71. 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) 6 6 8 6 7 4 5 9 9 1 7 6 8 1 4 5 4 7 1 4 1 1 4 3 5 4 3 (Right)

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

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

Q72. Read the given statements and conclusions carefully. Assuming that the information given in the statements is true, even if it appears to be at variance with commonly known facts, decide which of the given conclusions logically follow(s) from the statements.

Statements:

Some Pomegranates are Peaches.

Some Peaches are Lemons.

All Lemons are Figs.

Conclusions:

(I) Some Peaches are Figs.

(II) Some Pomegranates are Figs.

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

Q73. In a certain code language, ‘LOVE’ is coded as ‘2436’ and ‘VALE’ is coded as ‘3245’. What is the code for ‘A’ in the given code language?

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

Q74. Refer to the following series and answer the question (all numbers are single digit numbers only). Counting to be done from left to right only.

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

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

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

Q75. In a row of 47 students facing north, Neha is 21^(st) from the right end. If Kinjal is 8^(th) to the left of Neha, what is Kinjal's position from the left end of the line?

(a) 17th
(b) 18th
(c) 19th
(d) 20th

Q76. Which of the following letter-number clusters will replace the question mark (?) in the given series to make it logically complete?

BTM 25 DVO 27 FXQ 29 HZS 31 ?

(a) KDV 33
(b) JBU 33
(c) LBU 33
(d) KCV 33

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Q77. What should come in place of the question mark (?) in the given series?

747 740 732 723 713 ?

(a) 702
(b) 704
(c) 703
(d) 701

Q78. D, E, F, G, L, M and N are sitting in a straight line, facing north.

Only two people sit to the right of D. Only two people sit between D and G. Only two people sit between E and F. F sits to the immediate left of D. N sits to the immediate right of M.

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

(a) L
(b) M
(c) D
(d) G

Q79. What should come in place of the question mark (?) in the given series based on the English alphabetical order?

BLS DNU FPW HRY ?

(a) ITB
(b) JTA
(c) ISZ
(d) JSZ

Q80. P, Q, R, S, T and U are sitting around a circular table facing the centre. U sits second to the right of R. Q sits second to the left of S. P is on the immediate left of Q. Who is sitting on the immediate left of T?

(a) S
(b) R
(c) Q
(d) U

GENERAL AWARENESS AND CURRENT AFFAIRS

Q81. Which of the following airlines hosted the Power Creator Awards 2025?

(a) Air India
(b) SpiceJet
(c) Vistara
(d) IndiGo

Q82. On 16 July 2025, India achieved a major milestone by successfully destroying two aerial high-speed unmanned targets at high altitude in Ladakh using the upgraded variant of the Akash Weapon System for the Indian Army called _____.

(a) BrahMos
(b) Akash Advanced
(c) Akash Prime
(d) Pinaka

Q83. Where was the first-ever International Big Cat Alliance (IBCA) Assembly held in India in June 2025?

(a) Bhopal
(b) Panaji
(c) New Delhi
(d) Pune

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Q84. Who among the following did Madison Keys defeat in the Australian Open 2025 final?

(a) Aryna Sabalenka
(b) Elena Rybakina
(c) Ons Jabeur
(d) Naomi Osaka

Q85. What was India's overall score in the Corruption Perceptions Index (CPI) for the year 2024 released in February 2025?

(a) 38
(b) 36
(c) 43
(d) 41

Q86. As per the Sustainable Development Goals – National Indicator Framework Progress Report, 2025, published in June 2025, India's installed renewable energy capacity rose from 64.04 watts per capita in 2014–15 to 156.31 watts per capita in 2024–25. This growth primarily supports which Sustainable Development Goal (SDG)?

(a) SDG 13
(b) SDG 9
(c) SDG 7
(d) SDG 12

Q87. From 1 May 2025, which of the following portals did the Reserve Bank of India (RBI) mandate stakeholders to use?

(a) SAKSHAM Portal
(b) PRAVAAH Portal
(c) SEVA Portal
(d) VITARAN Portal

Q88. Which cricketer was honoured with Padma Shri in 2025?

(a) Ravichandran Ashwin
(b) Jasprit Bumrah
(c) Rohit Sharma
(d) Virat Kohli

Q89. The 51^(st)G7 summit was held in which of the following countries in June 2025?

(a) India
(b) Canada
(c) Abu Dhabi
(d) Germany

Q90. In May 2025, which state/union territory government approved five cloud-seeding trials at an outlay of Rs. 3.21 crore to combat air pollution?

(a) Karnataka
(b) West Bengal
(c) Punjab
(d) Delhi

Q91. When was the first Surya VHF radar reportedly handed over to the Indian Air Force?

(a) April 2025
(b) March 2025
(c) January 2025
(d) February 2025

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Q92. Which student activist became the first SFI member to be elected sarpanch in Gujarat in June 2025?

(a) Aayush Khatkar
(b) Ashish Rabari
(c) Satyesha Leuva
(d) Monika Gusain

Q93. What is the full form of RIMES, an intergovernmental body in news in 2025?

(a) Regional Integrated Multi-Hazard Early Warning System
(b) Regional Institute for Meteorological and Environmental Studies
(c) Risk Information and Monitoring of Emergency Situations
(d) Research Initiative for Mitigating Environmental Shocks

Q94. Where was the first-ever national conference of Urban Local Body Chairpersons across Indian States and UTs inaugurated by the Lok Sabha Speaker Shri Om Birla in July 2025?

(a) Gurugram
(b) Chandigarh
(c) Noida
(d) Ahmedabad

Q95. As per the June 2025 India Child Protection report, what percentage of 44,902 rescued children were found in the worst forms of child labour?

(a) 50%
(b) 90%
(c) 60%
(d) 75%

Q96. Which of the following coaches received the Dronacharya Award for para-shooting in 2025?

(a) Deepali Deshpande
(b) Sandeep Sangwan
(c) S Muralidharan
(d) Subhash Rana

Q97. Who earned the 'Game Changer' award at the Women's Football Awards, 2025?

(a) Anita Asante
(b) Keira Walsh
(c) Viviane Asseyi
(d) Bethany England

Q98. Who authored the book 'To the Seventh Generation: The Journey of Christian Medical College Vellore', released in January 2025?

(a) Prof. Romila Thapar
(b) Dr. Atul Gawande
(c) Dr. V I Mathan
(d) Dr. Devi Shetty

Q99. Which scheme's Deep Tech vertical had launched nine projects by mid-2025, with industries collaborating through DRDO's Industry-Academia Centres of Excellence?

(a) iDEX (Innovations for Defence Excellence)
(b) Defence Testing Infrastructure Scheme (DTIS)
(c) Technology Development Fund (TDF)
(d) ADITI Scheme

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Q100. Which of the following insurance companies announced the adoption of the revised GST structure on all insurance products from 22 September 2025?

(a) Kotak Life Insurance Co. Ltd.
(b) ICICI Prudential Life Insurance Co. Ltd.
(c) HDFC Life Insurance Co. Ltd.
(d) Sahara India Life Insurance Co. Ltd.

ANSWER KEY

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

SOLUTIONS

Q1. Answer: (c) Violet has minimum wavelength and hence maximum refractive index

The correct answer is Violet has minimum wavelength and hence maximum refractive index.

Key Points

• When white light passes through a glass prism, it disperses into its constituent colors due to refraction and dispersion.

• The bending of light depends on the refractive index of the medium and the wavelength of the light. Shorter wavelengths bend more than longer wavelengths.

• Violet light, among all constituent colors of white light, has the shortest wavelength (approximately 380-450 nm) compared to other colors like red, orange, yellow, etc.

• Due to its short wavelength, violet light has the highest refractive index in the glass prism, causing it to bend the most.

• This phenomenon is described by Snell's Law, which relates the angle of refraction to the refractive index and wavelength of light. Hence, the statement "Violet has minimum wavelength and hence maximum refractive index" is correct.

Additional Information

• Dispersion of Light:

• Dispersion occurs when different wavelengths of light separate due to different refractive indices.

• This is why white light splits into a spectrum of colors when passing through a prism.

• Refractive Index:

• The refractive index of a material depends on the wavelength of light. Shorter wavelengths have higher refractive indices.

• This property causes colors like violet to bend more than longer wavelengths like red.

• Snell's Law:

• This law states that the ratio of the sine of the angle of incidence to the sine of the angle of refraction is constant for a given pair of media.

• The refractive index impacts the bending of light and varies with the wavelength of the light.

• Wavelength of Visible Light:

• Visible light consists of wavelengths ranging from approximately 380 nm (violet) to 750 nm (red).

• Colors like violet and indigo have shorter wavelengths, while red and orange have longer wavelengths.

Important Points

• Why violet bends the most:

• Violet light's shorter wavelength causes it to interact more strongly with the prism material, leading to greater deviation.

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• Its higher refractive index compared to other colors results in the maximum bending.

• Applications of Dispersion:

• Dispersion is used in spectrometers for analyzing the spectral composition of light.

• The phenomenon helps explain natural occurrences like rainbows, where sunlight disperses through water droplets.

Q2. Answer: (a) A white blood cell swallowing and breaking down harmful bacteria

The correct answer is A white blood cell swallowing and breaking down harmful bacteria.

Key Points

• Lysosomes are often referred to as the "suicidal bags" of the cell because they contain digestive enzymes capable of breaking down various biological molecules.

• In the context of the immune system, lysosomes play a crucial role in phagocytosis, where white blood cells (e.g., macrophages or neutrophils) engulf harmful bacteria or pathogens.

• Once the bacteria are engulfed, they are enclosed in a vesicle called a phagosome. The lysosome fuses with the phagosome, forming a phagolysosome, where the digestive enzymes degrade the bacteria into simpler molecules.

• This process helps in eliminating harmful pathogens from the body, ensuring the immune system functions effectively. Hence, this statement is correct.

• Other options, such as photosynthesis, oxygen delivery, or nerve signal transmission, do not involve lysosomes directly, making them incorrect in this context.

Additional Information

• Structure and Function of Lysosomes:

• Lysosomes are membrane-bound organelles found in eukaryotic cells, containing hydrolytic enzymes.

• These enzymes are capable of degrading proteins, lipids, carbohydrates, and nucleic acids, making lysosomes essential for cellular digestion and recycling.

• Types of Enzymes in Lysosomes:

• Enzymes found in lysosomes include proteases, lipases, nucleases, and carbohydrases.

• These enzymes function optimally in acidic environments, which is why the interior of lysosomes is highly acidic (pH ~4.5).

• Role in Immunity:

• Lysosomes assist in the breakdown of pathogens during the immune response, specifically in processes like phagocytosis and autophagy.

• They are also involved in antigen processing, where degraded fragments of pathogens are presented to the immune system to trigger a specific response.

• Diseases Related to Lysosome Dysfunction:

• Dysfunction of lysosomes can lead to lysosomal storage disorders such as Tay-Sachs disease, Gaucher’s disease, and Pompe disease.

• These disorders occur due to the accumulation of undigested molecules within the lysosome, leading to cellular damage.

• Comparison with Other Organelles:

• Unlike lysosomes, organelles like chloroplasts and mitochondria have specialized roles in energy production rather than digestion.

• Chloroplasts are involved in photosynthesis, while mitochondria generate ATP through cellular respiration.

Important Points

• Option Analysis:

• Option 1: A white blood cell breaking down bacteria showcases the role of lysosomes in immunity. Correct.

• Option 2: Photosynthesis occurs in chloroplasts, not lysosomes. Incorrect.

• Option 3: Oxygen delivery is a function of red blood cells, unrelated to lysosomes. Incorrect.

• Option 4: Nerve signal transmission involves neurons and synapses but does not require lysosomes. Incorrect.

• Key Takeaway: The lysosomes’ role in breaking down harmful substances and recycling cellular material is vital for maintaining cellular and systemic health.

Q3. Answer: (d) Double displacement

The correct answer is Double displacement.

Key Points

• Double displacement reaction: A chemical reaction in which two compounds exchange their ions to form two new compounds is called a double displacement reaction. This typically occurs in aqueous solutions.

• Reaction of barium chloride with sodium sulfate: When barium chloride (BaCl2) reacts with sodium sulfate (Na2SO4), a double displacement reaction takes place, leading to the formation of barium sulfate (BaSO4) and sodium chloride (NaCl).

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• Reaction equation: $BaCl_2(aq) + Na_2SO_4(aq) \rightarrow BaSO_4(s) + 2NaCl(aq)$. This equation clearly shows the exchange of ions between the reactants.

• Barium sulfate precipitate: $BaSO_4$ is insoluble in water and precipitates out of the solution, making this reaction a classic example of a precipitation reaction as well.

• Applications: Such double displacement reactions are widely used in qualitative analysis to identify the presence of certain ions in a solution.

Additional Information

• Double displacement reaction characteristics:

• Occurs between two ionic compounds in an aqueous solution.

• Involves the exchange of ions between the reactants.

• Can result in the formation of a precipitate, gas, or a weak electrolyte.

• Precipitation reaction: A type of double displacement reaction where an insoluble solid (precipitate) forms and separates out from the solution. Example: $BaCl_2 + Na_2SO_4 \rightarrow BaSO_4(s) + 2NaCl$.

• Other types of reactions:

• Decomposition reaction: A single compound breaks down into two or more simpler substances. Example: $2H_2O \rightarrow 2H_2 + O_2$.

• Combination reaction: Two or more substances combine to form a single product. Example: $2H_2 + O_2 \rightarrow 2H_2O$.

• Oxidation reaction: A reaction involving the loss of electrons by a molecule, atom, or ion. Example: $2Mg + O_2 \rightarrow 2MgO$.

• Practical significance: Double displacement reactions are used in various industries, including:

• Pharmaceuticals: For drug synthesis and purification processes.

• Water treatment: Removal of unwanted ions by precipitation.

• Qualitative analysis: Identification of specific ions in a solution.

Important Points

• Role of solubility rules: The solubility rules help predict whether a precipitate will form in a double displacement reaction. For instance, $BaSO_4$ is insoluble in water, leading to precipitation.

• Testing for sulfate ions: The formation of $BaSO_4$ as a white precipitate when $BaCl_2$ is added to a solution is a common test for the presence of sulfate ions.

• Environmental relevance: Precipitation reactions are used to remove harmful ions (e.g., heavy metals) from wastewater to make it environmentally safe.

• Limitations: Double displacement reactions generally occur in an aqueous medium, and the reactants must be soluble for the reaction to proceed efficiently.

Q4. Answer: (c) Increase in temperature

The correct answer is Increase in temperature.

Key Points

• The resistance of a metallic conductor increases with an increase in temperature. This is because the thermal energy causes the metal atoms to vibrate more, leading to a greater number of collisions between electrons and atoms.

• Resistance is directly proportional to temperature for most metals. This behavior is quantified by the temperature coefficient of resistance, which is positive for metals.

• An increase in cross-sectional area of a conductor decreases its resistance, as resistance is inversely proportional to the area. Hence, this statement is incorrect.

• A decrease in length of a conductor reduces its resistance, as resistance is directly proportional to the length of the conductor. Hence, this statement is incorrect.

• A decrease in temperature reduces the resistance of a metallic conductor because the atomic vibrations reduce, leading to fewer electron-atom collisions. Hence, this statement is incorrect.

Additional Information

• Ohm’s Law:

• Ohm's Law states that the current (I) through a conductor between two points is directly proportional to the voltage (V) across the two points and inversely proportional to the resistance (R). The formula is $V = IR$.

• Resistance depends on material, length, cross-sectional area, and temperature of the conductor.

• Temperature Coefficient of Resistance:

• The temperature coefficient of resistance quantifies the change in resistance with temperature. For metals, it is positive, meaning resistance increases with temperature.

• For semiconductors and insulators, the coefficient is negative, meaning resistance decreases with temperature.

• Factors Affecting Resistance:

• Length: Resistance is directly proportional to the length of the conductor.

• Cross-sectional Area: Resistance is inversely proportional to the cross-sectional area of the conductor.
• Material: Different materials have different resistivities, affecting their resistance.
• Temperature: Resistance of metallic conductors increases with temperature, while for semiconductors, it decreases.
• Applications of Resistance:
• Used in designing heating elements like in electric heaters and toasters, where high resistance produces heat.
• Resistance is critical in electrical circuits to control current flow and protect devices from damage.

Important Points

• Superconductors:
• At extremely low temperatures, some materials exhibit zero resistance. These are known as superconductors.
• Superconductors are used in applications like MRI machines, particle accelerators, and maglev trains.
• Resistivity:
• Resistivity is a material property that determines how strongly a material opposes the flow of electric current.
• Resistivity is denoted by the symbol ρ and is measured in ohm-meters (Ω·m).
• Resistance in Alloys:
• Alloys like nichrome have higher resistivity and are used in heating elements as their resistance is less affected by temperature changes.
• These materials are preferred for applications requiring stable resistance over a range of temperatures.

Q5. Answer: (d) Directing life processes of the cell

The correct answer is Directing life processes of the cell.

Key Points

• The nucleus is the control center of an eukaryotic cell and plays a key role in directing life processes by regulating gene expression and maintaining genetic material in the form of DNA.
• It contains the cell's chromosomes, which store genetic information necessary for the cell's functions, growth, and reproduction.
• Within the nucleus, the nucleolus is responsible for producing ribosomal RNA (rRNA), essential for the synthesis of ribosomes, which are involved in protein production.
• The nuclear envelope, a double membrane surrounding the nucleus, allows selective transport of molecules like RNA and proteins, ensuring the proper functioning of cellular processes.
• The nucleus also coordinates activities such as cell growth, metabolism, and division by regulating the synthesis of RNA and proteins.

Additional Information

• Functions of the Nucleus:
• Serves as the storage site for genetic information (DNA), which determines the characteristics and functions of the organism.
• Ensures the accurate replication and segregation of DNA during cell division through processes like mitosis and meiosis.
• Facilitates transcription, where DNA is converted into messenger RNA (mRNA), leading to protein synthesis in the cytoplasm.
• Maintains cellular integrity by regulating gene expression and controlling the synthesis of enzymes and structural proteins.
• Structure of the Nucleus:
• The nucleus is enclosed by a nuclear envelope, which consists of inner and outer membranes separated by a perinuclear space.
• Nuclear pores present in the envelope facilitate the exchange of molecules like RNA, proteins, and ions between the nucleus and cytoplasm.
• The nucleoplasm (nuclear matrix) is a gel-like substance within the nucleus, containing chromatin and nucleolus.
• Chromatin is composed of DNA and protein and exists in two forms: euchromatin (active) and heterochromatin (inactive).
• Other Cellular Components:
• Mitochondria: Responsible for energy production through cellular respiration. (Statement 1 is incorrect.)
• Vacuoles: Act as storage units for food, water, and waste. (Statement 2 is incorrect.)
• Lysosomes: Specialized for digesting waste and cellular debris. (Statement 3 is incorrect.)
• The nucleus uniquely directs cellular processes, making it indispensable for life. (Statement 4 is correct.)
• Examples of Eukaryotic Cells:
• Plant cells, animal cells, and fungi all have nuclei that direct cellular processes.
• In contrast, prokaryotic cells lack a nucleus and have genetic material dispersed in the cytoplasm.

Important Points

• Discovery: The nucleus was first discovered by Robert Brown in 1831 in plant cells.
• DNA Structure: DNA in the nucleus is organized into chromosomes. Humans have 46 chromosomes in the nucleus of each cell.

• Diseases Related to Nucleus: Mutations in nuclear DNA can cause genetic disorders like sickle cell anemia and cystic fibrosis.

• Cell Cycle: The nucleus plays a critical role in the cell cycle, ensuring accurate DNA replication and division during mitosis.

• Applications: Understanding the nucleus is crucial in fields like genetics, biotechnology, and cancer research.

Q6. Answer: (b) Dissolving sugar in water

The correct answer is Dissolving sugar in water.

Key Points

• Dissolving sugar in water demonstrates the presence of spaces between particles of matter. When sugar dissolves, its particles break down into smaller units and occupy the spaces between water molecules. This shows that there are voids or spaces between particles of matter, allowing them to mix.

• The process of dissolution occurs because both sugar and water are composed of particles that interact at the molecular level. The sugar particles spread uniformly in the water due to these interactions, filling the gaps between water molecules.

• This phenomenon is a direct evidence of the particle theory of matter, which states that matter is made up of tiny particles and that these particles have spaces between them.

• Other activities like freezing a liquid, heating a solid, or compressing a gas are related to changes in physical state or behavior of particles due to external factors, but they do not explicitly demonstrate the presence of spaces between particles as clearly as dissolving sugar in water does.

• Therefore, the correct answer is dissolving sugar in water, as it provides a clear and observable example of the existence of spaces between particles of matter.

Additional Information

• The Particle Theory of Matter:

• Matter is made up of tiny particles (atoms and molecules).

• These particles have spaces between them, which allow for processes like dissolution, diffusion, and mixing.

• The particles are in constant motion, with the speed of movement depending on the temperature and state of matter.

• Explanation of Other Options:

• Freezing a liquid: Freezing involves the arrangement of particles into a fixed structure, which indicates changes in energy and movement of particles, but does not directly show the presence of spaces between particles. This is incorrect.

• Heating a solid: Heating increases the kinetic energy of particles, leading to expansion or melting, but it does not specifically demonstrate the spaces between particles. This is incorrect.

• Compressing a gas: Compressing a gas reduces the spaces between particles, demonstrating that gases are compressible due to the large spaces between their particles. While this shows particle behavior, it is not as explicit as dissolving sugar in water in demonstrating the concept. This is incorrect.

• Real-Life Examples:

• When salt dissolves in water, it occupies the spaces between water molecules, much like sugar does.

• Perfume molecules spreading across a room demonstrate diffusion, which is also a result of the spaces between particles.

• Applications of This Concept:

• Understanding how solutes dissolve in solvents is crucial in industries like pharmaceuticals, food processing, and chemical manufacturing.

• The concept is also essential in explaining natural phenomena like the mixing of gases in the atmosphere.

Q7. Answer: (c) Hypothalamus

The correct answer is Hypothalamus.

Key Points

• The Hypothalamus is a small region located at the base of the brain, near the pituitary gland.

• It is responsible for producing the Growth Hormone-Releasing Hormone (GHRH), which stimulates the pituitary gland to release Growth Hormone (GH).

• The Growth Hormone plays a key role in regulating growth, cell repair, and metabolism in the body.

• The hypothalamus also regulates many other important body functions, such as temperature control, appetite, and circadian rhythms.

• The connection between the hypothalamus and the pituitary gland ensures that hormonal signals are effectively transmitted to regulate bodily functions. Hence, the correct answer is Hypothalamus.

Additional Information

• Functions of Growth Hormone:

• Stimulates growth of bones and tissues, particularly during childhood and adolescence.

• Promotes the breakdown of fats and regulates metabolism.

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• Enhances protein synthesis and supports the repair of damaged tissues.

• Role of the Hypothalamus:

• Produces releasing and inhibiting hormones that regulate the pituitary gland.

• Controls vital functions such as body temperature, hunger, thirst, and emotional responses.

• Maintains homeostasis (internal balance) in the body by adjusting autonomic and endocrine activities.

• Other Hormones Related to Hypothalamus:

• Corticotropin-Releasing Hormone (CRH): Stimulates the release of adrenocorticotropic hormone (ACTH) from the pituitary gland.

• Thyrotropin-Releasing Hormone (TRH): Stimulates the release of thyroid-stimulating hormone (TSH) from the pituitary gland.

• Gonadotropin-Releasing Hormone (GnRH): Regulates the release of luteinizing hormone (LH) and follicle-stimulating hormone (FSH).

• Functions of the Pituitary Gland:

• Referred to as the "master gland," it secretes hormones that regulate various physiological processes.

• It has two parts: the anterior and posterior pituitary, which release different hormones.

• Examples of hormones include Growth Hormone (GH), Prolactin, Oxytocin, and Antidiuretic Hormone (ADH).

Important Points

• Adrenal Glands: These glands produce hormones like cortisol and adrenaline, which are involved in stress response and metabolism regulation. However, they are not involved in releasing growth hormone-releasing factor.

• Pancreas: Primarily responsible for producing insulin and glucagon, which regulate blood sugar levels. It does not produce growth hormone-releasing factor.

• Thymus: Plays a role in the immune system by producing T-cells during childhood. It is not involved in growth hormone regulation.

• These distinctions emphasize the unique role of the hypothalamus in regulating growth through its interaction with the pituitary gland.

Q8. Answer: (a) The alteration of their internal water content.

The correct answer is The alteration of their internal water content..

Key Points

• Swelling or shrinking in plant cells occurs primarily due to osmotic movement of water. This movement is influenced by the difference in water potential between the cell's interior and its external environment.

• When plant cells are placed in a hypotonic solution (lower solute concentration outside the cell), water moves into the cell, causing it to swell and become turgid.

• Conversely, in a hypertonic solution (higher solute concentration outside the cell), water moves out of the cell, causing it to shrink and undergo plasmolysis.

• The process of water movement occurs through a semi-permeable membrane, which is the plasma membrane of the plant cell, regulating the cell's water content.

• This alteration in water content impacts the cell's turgor pressure, which plays a critical role in maintaining the plant's structural integrity and facilitating movements like closing and opening of stomata.

Additional Information

• Osmosis:

• Osmosis is the movement of water molecules across a semi-permeable membrane from a region of higher water potential to a region of lower water potential.

• This process is crucial for maintaining the water balance in plant cells and is directly linked to the alteration of their internal water content.

• Turgor Pressure:

• Turgor pressure is the pressure exerted by the cell's contents against the cell wall due to water intake.

• It is responsible for keeping plant cells firm and helps in plant movements, such as the opening and closing of stomata.

• Plasmolysis:

• Plasmolysis occurs when plant cells lose water in a hypertonic environment, causing the plasma membrane to pull away from the cell wall.

• This can lead to wilting and loss of structural integrity in plants.

• Stomatal Movement:

• The alteration of water content in guard cells controls the opening and closing of stomata, which regulate gas exchange and transpiration in plants.

• When guard cells gain water and swell, the stomata open; when they lose water and shrink, the stomata close.

• Incorrect Options:

• The rapid breakdown of cellulose: Cellulose breakdown is not responsible for swelling or shrinking in plant cells. It primarily occurs during processes like decomposition.

• The stiffening of their cell walls: Plant cell walls are rigid and primarily composed of cellulose. While they provide structure, their stiffening is unrelated to water-induced shape changes.

• The formation of new protein structures: Protein synthesis does not directly cause swelling or shrinking in plant cells. It is a biochemical process unrelated to osmotic water movement.

Important Points

• Water Potential:

• Water potential is a measure of the potential energy of water in a system and determines the direction of water movement.

• It is influenced by solute concentration and pressure.

• Significance of Turgor Pressure:

• Turgor pressure helps in cell expansion, maintaining plant rigidity, and driving growth processes like elongation.

• It also aids in movements such as nastic movements seen in plants like Mimosa pudica (touch-me-not).

• Role of Vacuoles:

• Plant vacuoles play a crucial role in water storage and maintaining cell turgidity.

• They act as reservoirs for water and solutes, thereby influencing osmotic balance.

Q9. Answer: (d) inertia

The correct answer is Newton’s First Law of Motion is also called the law of inertia.

Key Points

• Newton's First Law of Motion: This law states that an object will remain at rest or in uniform motion in a straight line unless acted upon by an external force. This principle defines the concept of inertia.

• Inertia: Inertia is the property of an object by which it resists any change in its state of motion or rest. The greater the mass of an object, the greater its inertia.

• The law of inertia explains the behavior of objects in the absence of external forces. For example, a ball rolling on a flat surface will continue moving until friction or another force stops it.

• Historical Significance: This law was first formulated by Sir Isaac Newton and is considered foundational in classical mechanics. It provides the basis for understanding motion and forces.

• Applications: Newton's First Law is widely applicable in scenarios like driving vehicles, launching rockets, and understanding planetary motions.

Additional Information

• Newton's Laws of Motion Overview:

• First Law: Law of inertia, which describes how objects resist changes in motion.

• Second Law: Establishes the relationship between force, mass, and acceleration (F = ma).

• Third Law: States that for every action, there is an equal and opposite reaction.

• Inertia Types:

• Inertia of Rest: The tendency of an object to remain stationary unless acted upon by a force (e.g., a book on a table).

• Inertia of Motion: The tendency of an object in motion to remain in motion unless acted upon by a force (e.g., a moving car stopping due to brakes).

• Inertia of Direction: The tendency of an object to resist changes in its direction of motion (e.g., a car turning due to steering).

• Practical Examples:

• A coin placed on a card remains stationary when the card is flicked away, demonstrating inertia of rest.

• A passenger in a moving bus feels a jolt when the bus suddenly stops due to inertia of motion.

• Newton’s Contributions:

• Sir Isaac Newton, born in 1643, is regarded as one of the greatest scientists in history.

• His work, “Philosophiæ Naturalis Principia Mathematica”, published in 1687, laid the groundwork for classical mechanics.

Important Points

• Relation to Modern Physics: While Newton's First Law applies to most everyday situations, it is modified by Einstein's theory of relativity in cases involving extremely high speeds or gravitational forces.

• Examples in Space: In space, where gravitational forces and friction are minimal, objects continue to move indefinitely in the absence of external forces, demonstrating the law of inertia.

• Scientific Experiments: Demonstrations like Galileo's inclined plane experiments helped establish the foundation for Newton's laws.

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• Educational Importance: Newton's First Law is a fundamental topic in physics curriculum worldwide, helping students understand motion and forces.

Q10. Answer: (d) It contains at least one double or triple bond between carbon atoms.

The correct answer is It contains at least one double or triple bond between carbon atoms..

Key Points

• Unsaturated carbon compounds are characterized by the presence of at least one double or triple bond between carbon atoms. This is the defining feature that differentiates them from saturated compounds.

• These compounds include alkenes (with at least one double bond) and alkynes (with at least one triple bond).

• The presence of double or triple bonds makes unsaturated compounds more reactive compared to their saturated counterparts, as these bonds are less stable and can participate in various chemical reactions such as addition reactions.

• Unsaturated compounds are commonly found in natural oils, fats, and hydrocarbons, and their chemical properties make them important in industrial and biological processes.

• Some examples include ethene (C2H4) for alkenes and ethyne (C2H2) for alkynes.

Additional Information

• Saturated Compounds:

• Saturated compounds contain only single bonds between carbon atoms.

• Examples include alkanes such as methane (CH4) and ethane (C2H6).

• They are generally less reactive than unsaturated compounds due to the stability of single bonds.

• Functional Groups with Oxygen:

• Some unsaturated compounds may contain oxygen-containing functional groups such as alcohols, aldehydes, or carboxylic acids, but this is not a defining characteristic of unsaturation.

• For example, ethanol (C2H5OH) contains oxygen but is a saturated compound.

• Cyclic Structures:

• Unsaturated compounds may or may not form cyclic structures. The presence of a cycle does not inherently indicate unsaturation.

• For example, benzene (C6H6) is both unsaturated and cyclic, while cyclohexane (C6H12) is cyclic but saturated.

• Applications of Unsaturated Compounds:

• Used in the production of plastics, such as polyethylene from ethene.

• Play a crucial role in biological processes, such as the structure of cell membranes (unsaturated fatty acids).

• Used as intermediates in the synthesis of various chemicals, including pharmaceuticals and agrochemicals.

Important Points

• Reactivity of Unsaturated Bonds:

• Double and triple bonds are sites of high electron density, making them more reactive in reactions like hydrogenation, halogenation, and polymerization.

• The reactivity is due to the π-electrons in the double or triple bonds, which are more easily accessible for chemical reactions.

• Differences Between Alkanes, Alkenes, and Alkynes:

• Alkanes: Saturated hydrocarbons with only single bonds (e.g., propane, C3H8).

• Alkenes: Unsaturated hydrocarbons with at least one double bond (e.g., propene, C3H6).

• Alkynes: Unsaturated hydrocarbons with at least one triple bond (e.g., propyne, C3H4).

Q11. Answer: (c) It helps separate non-biodegradable from biodegradable waste.

The correct answer is It helps separate non-biodegradable from biodegradable waste..

Key Points

• Segregation of waste into green and blue bins is an essential step towards effective waste management. Green bins are designated for biodegradable waste like kitchen scraps, while blue bins are used for non-biodegradable waste such as plastic, metal, and glass.

• This segregation is crucial because it helps in separating biodegradable waste (which can decompose naturally) from non-biodegradable waste (which requires recycling or special disposal methods).

• Proper separation ensures that biodegradable waste can be converted into compost or biogas, reducing the overall burden on landfills and promoting sustainable waste management practices.

• It supports the recycling of non-biodegradable materials, enabling the recovery and reuse of valuable resources like plastic, metal, and glass.

• By implementing this practice, the housing society contributes to environmental conservation, as biodegradable waste does not mix with harmful non-biodegradable waste, reducing pollution and the emission of toxic gases.

Additional Information

• Biodegradable Waste:

• Biodegradable waste includes organic materials like food scraps, vegetable peels, fruit waste, garden waste, and leftover food.

• It can naturally decompose with the help of microorganisms like bacteria and fungi, turning into compost, which acts as a natural fertilizer for plants.

• Examples: Kitchen waste, paper, leaves, and other organic materials.

• Non-Biodegradable Waste:

• Non-biodegradable waste includes materials that cannot break down naturally in the environment, such as plastics, metals, and glass.

• These materials require recycling or specialized disposal to prevent environmental damage.

• Examples: Plastic bottles, aluminum cans, electronic waste, and glass containers.

• Importance of Waste Segregation:

• Reduces the volume of waste sent to landfills, thereby minimizing land pollution.

• Promotes the recycling industry, saving natural resources and energy.

• Prevents the contamination of recyclable materials, making the recycling process more efficient.

• Helps in the production of compost or biogas, which are renewable energy sources.

• Examples of Waste Segregation Practices:

• Many cities in India, such as Bangalore and Pune, have implemented waste segregation at the source to improve waste management systems.

• Countries like Germany and Sweden have advanced waste segregation and recycling systems, achieving high recycling rates of up to 90% of their waste.

Important Points

• According to the Solid Waste Management Rules, 2016, issued by the Government of India, waste segregation at source is mandatory for households, commercial establishments, and institutions.

• The Swachh Bharat Mission, launched in 2014, emphasizes proper waste segregation and disposal practices to maintain cleanliness and hygiene across the country.

• Studies suggest that improper segregation of waste can lead to the generation of harmful greenhouse gases like methane (CH4) from mixed waste in landfills, contributing to climate change.

• Awareness campaigns and educational programs are crucial to promoting the practice of waste segregation among citizens, ensuring active participation and better results.

Q12. Answer: (a) Both Statement I and II are correct

The correct answer is 1) Both Statement I and II are correct.

Key Points

• Statement I: In the given chemical reaction, hydrogen sulfide (H2S) undergoes oxidation to form sulfur (S). This is because the sulfur in H2S changes its oxidation state from -2 in H2S to 0 in elemental sulfur (S). Hence, Statement I is correct.

• Statement II: Iodine (I2), which is in its elemental form (oxidation state 0), is reduced to hydrogen iodide (HI), where iodine's oxidation state changes to -1. This reduction is evident as iodine gains electrons during the reaction. Hence, Statement II is correct.

• This reaction represents a classic example of a redox reaction, where both oxidation and reduction occur simultaneously.

• Oxidation Process: H2S loses electrons (oxidized to sulfur), while Reduction Process: I2 gains electrons (reduced to HI).

• The overall process involves the transfer of electrons, making it a redox reaction, with sulfur as the reducing agent and iodine as the oxidizing agent.

Additional Information

• Redox Reaction: A reaction where oxidation and reduction occur simultaneously. In this type of reaction:

• Oxidation: Loss of electrons or increase in oxidation state.

• Reduction: Gain of electrons or decrease in oxidation state.

• Oxidizing Agent: The substance that gets reduced (gains electrons). In this reaction, iodine (I2) is the oxidizing agent.

• Reducing Agent: The substance that gets oxidized (loses electrons). Here, hydrogen sulfide (H2S) acts as the reducing agent.

• Electron Transfer: Redox reactions involve the movement of electrons from the reducing agent to the oxidizing agent.

• Applications: Redox reactions are crucial in various natural and industrial processes, including photosynthesis, respiration, corrosion, and battery operations.

Important Points

• Oxidation State Changes:

• In H2S, sulfur has an oxidation state of -2. After the reaction, sulfur forms elemental sulfur (S), with an oxidation state of 0.

• In I2, iodine starts with an oxidation state of 0 and ends with an oxidation state of -1 in HI.

• Redox Balance: The reaction is balanced in terms of both mass and charge, ensuring that the total number of electrons lost equals the number of electrons gained.

• Chemical Context: This reaction is an example of how halogens (like iodine) can act as oxidizing agents in reactions involving sulfides.

• Laboratory Use: Such reactions are often used in chemical laboratories to study electron transfer mechanisms and the properties of halogens.

• Real-World Example: The principles of redox reactions are applied in processes like water purification and the functioning of galvanic cells.

Q13. Answer: (d) Bud initiation → Bud maturation → Bud detachment → New individual

The correct answer is Bud initiation → Bud maturation → Bud detachment → New individual.

Key Points

• Bud initiation: The budding process in Hydra starts with the initiation of a small outgrowth on the parent body. This is due to the rapid division of cells at a specific location. The budding site is rich in stem cells, which differentiate into the necessary tissues.

• Bud maturation: As the bud grows, it undergoes further cell differentiation and development, forming structures like tentacles and a mouth. This stage ensures that the bud is capable of independent survival.

• Bud detachment: Once the bud matures and develops fully, it detaches itself from the parent body. This separation process ensures that the new individual can function independently.

• Formation of a new individual: After detachment, the bud becomes a fully independent individual, capable of feeding, growth, and reproduction. This marks the completion of the budding process in Hydra.

• The sequence Bud initiation → Bud maturation → Bud detachment → New individual represents the correct and logical progression of events in the budding process of Hydra.

Additional Information

• Hydra: Hydra is a genus of small, freshwater organisms belonging to the phylum Cnidaria and class Hydrozoa. These organisms are known for their regenerative abilities and asexual reproduction through budding.

• Budding: Budding is a form of asexual reproduction where a new organism develops from an outgrowth or bud due to cell division at one particular site. The newly formed organism remains attached to the parent body until it matures and detaches.

• Characteristics of budding in Hydra:

• The process is asexual, meaning no gametes are involved.

• It occurs under favorable environmental conditions, such as sufficient food and optimal temperatures.

• The process allows rapid population growth due to its efficiency and simplicity.

• Regeneration in Hydra: Apart from budding, Hydra exhibits a remarkable ability to regenerate. If a Hydra is cut into smaller pieces, each piece can regenerate into a complete organism. This is due to the presence of totipotent stem cells.

• Reproductive modes in Hydra: Besides budding (asexual reproduction), Hydra can also reproduce sexually under unfavorable conditions. In sexual reproduction, gametes are formed, and fertilization occurs to produce a zygote that develops into a new individual.

Important Points

• Environmental conditions: Budding in Hydra usually occurs when the organism has access to sufficient nutrients and lives in favorable environmental conditions. During stress, Hydra may switch to sexual reproduction.

• Advantages of budding:

• Budding allows rapid population growth in a short time.

• It ensures genetic uniformity since offspring are clones of the parent.

• Limitations of budding:

• Since offspring are genetically identical, there is no genetic variation, which can be a disadvantage in changing environmental conditions.

• It relies heavily on the availability of favorable conditions for reproduction.

• Examples of organisms using budding: Apart from Hydra, other organisms like yeast, sponges, and corals also reproduce via budding.

Q14. Answer: (d) Two

The correct answer is Two.

Key Points

• Binary fission is an asexual reproduction process commonly found in prokaryotic organisms, such as bacteria and archaea, and some single-celled eukaryotes like amoeba.

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• During binary fission, a single parent cell divides into two genetically identical daughter cells. Hence, the correct answer is Two.

• The process involves the replication of the organism's DNA, segregation of the replicated DNA, and division of the cytoplasm (cytokinesis).

• Binary fission ensures that each daughter cell receives an exact copy of the parent cell's genetic material, making them clones of the parent cell.

• It is a rapid and efficient method of reproduction, enabling organisms to multiply quickly under favorable environmental conditions.

Additional Information

• Stages of Binary Fission:

• DNA Replication: The single circular chromosome of the prokaryote is copied, resulting in two identical DNA molecules.

• DNA Segregation: The replicated DNA molecules move to opposite ends of the cell, ensuring that each daughter cell will receive one copy.

• Cytokinesis: The cytoplasm divides, and a new cell wall and plasma membrane form between the two DNA copies, creating two daughter cells.

• Examples of Binary Fission:

• Bacteria: Escherichia coli (E. coli) is a widely studied example of binary fission in prokaryotes.

• Protozoa: Amoeba and Paramecium reproduce by binary fission, demonstrating the process in eukaryotic cells.

• Types of Binary Fission:

• Simple Binary Fission: The division occurs in any plane, as seen in Amoeba.

• Transverse Binary Fission: The division occurs along a transverse plane, as seen in Paramecium.

• Longitudinal Binary Fission: The division occurs along a longitudinal plane, as seen in Euglena.

• Comparison with Mitosis:

• Binary fission is simpler and occurs in prokaryotes, whereas mitosis is more complex and occurs in eukaryotes.

• Binary fission does not involve the formation of a spindle apparatus, unlike mitosis.

• Applications:

• The rapid reproduction through binary fission enables bacteria to adapt quickly to new environments, contributing to their survival and ecological importance.

• It is also a fundamental process studied in microbiology for understanding microbial growth and reproduction.

Q15. Answer: (a) Both statements 1 and 2 are correct.

The correct answer is 1) Both statements 1 and 2 are correct..

Key Points

• Statement 1: The magnetic field lines produced around a straight current-carrying conductor form concentric circles centered along the wire.

• When an electric current flows through a straight conductor, such as a wire, it generates a magnetic field around it.

• The pattern of this magnetic field consists of concentric circles centered on the wire.

• This phenomenon is explained by the Oersted experiment, which demonstrated the relationship between electricity and magnetism.

• Hence, Statement 1 is correct.

• Statement 2: The direction of these magnetic field lines can be determined using the right-hand thumb rule.

• The right-hand thumb rule states that if you hold a straight current-carrying conductor in your right hand, with the thumb pointing in the direction of the current, the curled fingers of your hand indicate the direction of the magnetic field lines.

• This rule is crucial for determining the orientation of the magnetic field produced around conductors.

• It aligns with the principles of electromagnetism and is widely used in practical applications.

• Hence, Statement 2 is correct.

• Both statements explain essential aspects of the magnetic field generated by a current-carrying conductor and are scientifically accurate.

• Thus, the correct answer is: Both statements 1 and 2 are correct.

Additional Information

• Magnetic Field Lines:

• Magnetic field lines are invisible lines that represent the magnetic field around a magnet or a current-carrying conductor.

• They are continuous loops that emerge from the north pole of a magnet and re-enter at the south pole.

• The density of magnetic field lines indicates the strength of the magnetic field; closer lines signify a stronger field.

• Right-Hand Thumb Rule:

• This rule is a part of the broader set of rules in electromagnetism to determine the direction of magnetic fields.

• It is applicable to both straight conductors and circular loops of current.

• The rule is intuitive and forms the basis for understanding the behavior of magnetic fields in various devices like solenoids and motors.

• Applications of Magnetic Fields:

• The principles of magnetic fields are applied in designing electromagnets, electric motors, transformers, and generators.

• Magnetic field mapping is used in medical imaging technologies like Magnetic Resonance Imaging (MRI).

• It also plays a critical role in navigation systems and magnetometers.

• Oersted's Experiment:

• In 1820, Hans Christian Oersted discovered that a magnetic field is created around a conductor carrying electric current.

• This experiment laid the foundation for the field of electromagnetism, connecting electricity and magnetism.

Important Points

• Magnetic Field Strength: The strength of the magnetic field around a straight conductor decreases as the distance from the conductor increases.

• Magnetic Compass: A magnetic compass can be used to visualize the direction of the magnetic field lines around a current-carrying conductor.

• Solenoid: A solenoid is a coil of wire that generates a magnetic field similar to that of a bar magnet when current flows through it, demonstrating the same principles of field lines and direction.

• Electromagnetic Devices: Understanding magnetic field principles is essential for the functioning of devices like electric bells, relays, and magnetic locks.

Q16. Answer: (b) The stone possesses greater mass, which results in greater inertia, meaning it offers larger resistance to...

The correct answer is The stone possesses greater mass, which results in greater inertia, meaning it offers larger resistance to changing its state of rest..

Key Points

• Inertia and Mass: Inertia is a property of matter that resists changes in its state of motion or rest. The greater the mass of an object, the greater its inertia. This is why it is harder to kick a stone than a football of the same size, as the stone has more mass.

• Newton's First Law: This law states that an object will remain at rest or in uniform motion in a straight line unless acted upon by an external force. The stone, having greater mass, resists motion more than the football. Hence, this statement is correct.

• Force Transmission: When force is applied to an object, its resistance to motion depends on its inertia. The stone’s higher mass means it requires a significantly greater force to overcome its inertia compared to the football.

• Potential Injury: Attempting to kick a stone with the same force as a football can lead to injury because the stone’s greater inertia resists the applied force, causing the impact to be transmitted back to the kicker’s foot.

• Incorrect Options: Other options, such as surface friction or centripetal force holding atoms together, do not directly explain the difficulty in kicking the stone. These are irrelevant in this context.

Additional Information

• Inertia: Inertia is a fundamental concept in physics. It is directly proportional to mass and refers to the resistance of any physical object to a change in its state of motion or rest. For example, heavier objects like stones are harder to move than lighter objects like footballs.

• Mass and Motion: Mass is a measure of the amount of matter in an object, and it directly affects how much force is needed to change the object’s motion. A higher mass corresponds to greater inertia.

• Newton's Laws of Motion:

• First Law: Often called the law of inertia, it states that an object will stay at rest or continue at a constant velocity unless acted upon by an external force.

• Second Law: It establishes the relationship between force, mass, and acceleration (F = ma). Larger masses require greater force to achieve the same acceleration.

• Third Law: It states that for every action, there is an equal and opposite reaction. This is why kicking a stone can injure the foot, as the stone exerts a reaction force back on the foot.

• Practical Examples: In everyday life, heavier objects like cars or large furniture require more effort to move compared to lighter objects like bicycles or chairs. This demonstrates the principle of inertia in action.

• Incorrect Options Explained:

• Option 1: Surface friction does not play a significant role here. The difficulty arises from the mass and inertia of the stone, not the friction.

• Option 3: Both the stone and football are subject to all of Newton's Laws of Motion. The laws do not differentiate between objects; rather, the mass and resulting inertia of the stone are what matter.

• Option 4: Centripetal force holding atoms together is unrelated to the observed phenomenon. The stone's resistance is due to its mass and inertia, not atomic forces.

Important Points

• Practical Implication of Inertia: The concept of inertia is vital in fields like automotive safety (e.g., seat belts counter inertia during sudden stops), engineering, and everyday activities involving motion and force.

• Applications in Sports: Sports like football rely on understanding inertia and force. Players kick lighter balls to achieve greater motion, while heavy objects like stones resist motion due to their higher mass.

• Historical Context: The concept of inertia was first introduced by Galileo Galilei and later formalized by Sir Isaac Newton in his laws of motion.

Q17. Answer: (c) Both (ii) and (iv)

The correct answer is Both (ii) and (iv).

Key Points

• Statement (i): The image formed by a concave lens cannot be obtained on a screen. This statement is correct.

• The concave lens always forms a virtual image, which cannot be projected on a screen.

• The virtual image is formed on the same side as the object, and it appears to be upright.

• Statement (ii): The image formed by a concave lens can be obtained on a screen. This statement is incorrect.

• Since concave lenses form only virtual images, they cannot be captured on a screen.

• Images that can be obtained on a screen must be real, which is not possible with concave lenses.

• Statement (iii): The image formed is always smaller in size in comparison to the size of the object. This statement is correct.

• The concave lens produces a diminished (smaller) image, irrespective of the distance of the object from the lens.

• This property makes concave lenses useful in applications like peepholes in doors.

• Statement (iv): The image formed is always bigger in size in comparison to the size of the object. This statement is incorrect.

• The concave lens cannot form a magnified image. It always forms a reduced (smaller) image.

• Magnification greater than 1 is typically associated with convex lenses, not concave lenses.

Additional Information

• Properties of a Concave Lens:

• A concave lens is also known as a diverging lens because it diverges light rays that pass through it.

• The lens is thinner in the middle and thicker at the edges.

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

• The focal length of a concave lens is considered negative because it is measured from the lens to the virtual focal point.

• Applications of Concave Lenses:

• Used in spectacles for correcting nearsightedness (myopia).

• Used in optical instruments like telescopes and cameras as auxiliary lenses to manipulate image properties.

• Commonly used in peepholes in doors to provide a wide field of view.

• Difference Between Real and Virtual Images:

• Real Image: Formed by actual convergence of light rays; can be obtained on a screen; inverted in nature.

• Virtual Image: Formed by the apparent divergence of light rays; cannot be obtained on a screen; upright in nature.

• Concave Lens vs. Convex Lens:

• Concave Lens: Diverges light rays, forms virtual and diminished images.

• Convex Lens: Converges light rays, forms real and magnified images (depending on object position).

Important Points

• Lens Formula: The lens formula is given by 1/f = 1/v - 1/u, where f is the focal length, v is the image distance, and u is the object distance.

• Magnification: The magnification (M) of a lens is defined as M = v/u, and for concave lenses, it is always less than 1 (indicating a diminished image).

• Sign Convention: In lens calculations, distances measured in the direction of incident light are positive, while those measured against it are negative.

Q18. Answer: (c) a and b only

The correct answer is 3.

Key Points

• The state of a substance (solid, liquid, or gas) is determined by temperature and pressure. These two factors directly influence the arrangement and behavior of particles within a substance.

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• Temperature: A higher temperature typically increases the kinetic energy of particles, causing them to move more freely. This transition can shift a substance from solid to liquid or liquid to gas. At lower temperatures, particles lose kinetic energy, and substances may condense or freeze. Hence, temperature is correct.

• Pressure: Increasing pressure can force particles closer together, encouraging the formation of solids or liquids by overcoming the repulsive forces between particles. Conversely, decreasing pressure allows particles to spread out, enabling transitions to gaseous states. Hence, pressure is correct.

• Volume is not directly responsible for determining the state of matter. While volume may change as a result of temperature and pressure variations, it is a consequence rather than a determining factor. Hence, volume is incorrect.

• Thus, the correct answer is based on temperature and pressure (Option 3).

Additional Information

• States of Matter:

• Solid: Particles are tightly packed and have fixed positions, leading to a definite shape and volume. Examples: Ice, iron.

• Liquid: Particles are loosely packed and move freely, taking the shape of their container while maintaining a definite volume. Examples: Water, oil.

• Gas: Particles are widely spaced and move independently, filling the container entirely with no fixed shape or volume. Examples: Oxygen, carbon dioxide.

• Impact of Temperature:

• At the melting point, solids transition to liquids (e.g., ice to water).

• At the boiling point, liquids transition to gases (e.g., water to steam).

• Impact of Pressure:

• Higher pressure can liquefy gases, as seen in compressed gas cylinders (e.g., liquefied petroleum gas).

• Reduced pressure allows substances to vaporize easily, as observed in vacuum distillation.

• Combined Effect (Phase Diagrams):

• Phase diagrams show the relationship between temperature, pressure, and the state of matter.

• The triple point is where a substance can exist simultaneously as solid, liquid, and gas.

Important Points

• Volume and State of Matter: Volume changes are secondary effects caused by variations in temperature and pressure.

• Critical Point: Beyond the critical temperature and pressure, a substance exists as a supercritical fluid, exhibiting properties of both gases and liquids (e.g., carbon dioxide in supercritical state).

• Applications: Knowledge of temperature and pressure effects is crucial in industries such as refrigeration, gas storage, and material synthesis.

Q19. Answer: (d) In their free state

The correct answer is In their free state.

Key Points

• Metals at the bottom of the activity series, such as gold, silver, and platinum, are the least reactive elements. They do not readily react with oxygen, water, or other chemicals under natural conditions.

• Due to their low reactivity, these metals are found in nature in their free (elemental) state, meaning they are not combined with other elements or compounds.

• Unlike more reactive metals, these do not form oxides, carbonates, or sulphides that require processes like roasting or calcination for extraction. This makes their natural occurrence unique.

• For example, gold is often found in its pure form in deposits such as nuggets, veins, or alluvial sediments, while silver may be found as native silver or in some ores mixed with other elements.

• Their presence in free form has made them highly valuable and historically significant as they could be used without the need for complex extraction techniques.

Additional Information

• Activity Series of Metals:

• The activity series is a list of metals arranged in order of their reactivity, from most reactive (e.g., potassium) to least reactive (e.g., gold).

• Metals at the top of the series, such as sodium and potassium, react vigorously with water and air, while those at the bottom, like gold and platinum, are largely inert.

• Natural Occurrence of Metals:

• Highly reactive metals (e.g., sodium, calcium) are found in combined states as oxides, carbonates, or sulphides due to their tendency to react with environmental elements.

• Less reactive metals like copper and silver may occur both in combined states (as ores) and in free states, while the least

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reactive metals (e.g., gold, platinum) are almost always found in their elemental form.

• Extraction Processes:

• Highly reactive metals require advanced extraction methods like electrolysis, while moderately reactive metals need processes like roasting or calcination to remove impurities.

• For metals like gold and platinum, minimal processing is needed as they are found in their native state.

• Uses and Value:

• The natural occurrence of gold, silver, and platinum in their free state has made them historically significant for use in jewelry, coins, and artifacts.

• Their inertness and resistance to corrosion also make them ideal for use in electronics and industrial applications.

Important Points

• Gold: Found in veins and alluvial deposits; used in jewelry and electronics due to its high malleability and conductivity.

• Silver: Found in both its native state and in ores like argentite; used in coins, jewelry, and photography.

• Platinum: Found in placer deposits and associated with nickel ores; valued for its use in catalytic converters and industrial applications.

• Reactivity and Extraction: The lower the reactivity of a metal, the simpler the extraction process, as seen in the case of gold and platinum.

Q20. Answer: (a) Equal to 7

The correct answer is Equal to 7.

Key Points

• When a salt is formed from a strong acid and a strong base, the resulting solution is neutral, with a pH of approximately 7.

• This occurs because the strong acid fully dissociates into its hydrogen ions (H^+), and the strong base fully dissociates into its hydroxide ions (OH^-), producing water and a neutral salt.

• The ions produced by the dissociation of the salt (e.g., Na^+ from NaCl) do not hydrolyze in water, meaning they do not react with water molecules to alter the pH.

• For example, sodium chloride (NaCl), formed from hydrochloric acid (HCl, a strong acid) and sodium hydroxide (NaOH, a strong base), dissolves in water without affecting its pH, maintaining a neutral pH of 7.

• This behavior is due to the lack of acidic or basic properties in the conjugate acid-base pair derived from strong acids and bases. Hence, the solution remains neutral.

Additional Information

• Strong Acid:

• A strong acid, such as hydrochloric acid (HCl) or sulfuric acid (H2SO4), completely ionizes in water, releasing a high concentration of hydrogen ions (H^+).

• Examples include HCl, HNO3, and H2SO4.

• Strong Base:

• A strong base, such as sodium hydroxide (NaOH) or potassium hydroxide (KOH), completely dissociates in water, releasing hydroxide ions (OH^-).

• Examples include NaOH, KOH, and Ca(OH)2.

• Neutralization Reaction:

• When a strong acid reacts with a strong base, a neutralization reaction occurs, forming water (H2O) and a salt.

• The general equation is: Acid + Base → Salt + Water.

• pH Scale:

• The pH scale ranges from 0 to 14, where pH 7 is neutral, values below 7 are acidic, and values above 7 are basic (alkaline).

• In the case of a salt solution formed from a strong acid and strong base, the pH remains exactly 7.

• Examples of Neutral Salts:

• Sodium chloride (NaCl) from HCl and NaOH.

• Potassium nitrate (KNO3) from HNO3 and KOH.

Important Points

• Effect of Temperature: While the pH of water is 7 at 25°C, it can slightly change with temperature. However, the neutrality of a salt formed from a strong acid and strong base remains unaffected.

• Hydrolysis of Salts: Salts formed from weak acids or weak bases can hydrolyze, altering the pH of the solution. For instance, ammonium chloride (NH4Cl) results in an acidic solution, whereas sodium acetate (CH3COONa) results in a basic solution.

• Buffer Solutions: A solution of a weak acid and its conjugate base, or a weak base and its conjugate acid, resists changes in pH upon addition of small amounts of acid or base, unlike neutral salt solutions.

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• Applications: Neutral salts, such as NaCl, are widely used in food, chemical industries, and laboratories due to their stable and non-reactive nature.

Q21. Answer: (d) Fertilisation will not occur.

The correct answer is Fertilisation will not occur.

Key Points

• The style of a flower is a part of the pistil that connects the stigma and the ovary. It serves as the pathway for pollen tubes to grow and reach the ovary.

• When the style is cut before pollination, the pollen grains deposited on the stigma cannot germinate to form a pollen tube. This interrupts the process of fertilization. Hence, fertilisation will not occur.

• The pollen tube is essential for transporting the male gametes (sperm cells) to the ovule, where fertilization takes place. Without the style, this pathway is disrupted, and the male gametes cannot reach the ovule.

• As a result, the ovule will not develop into a seed since fertilization is a prerequisite for seed formation.

• Other processes like faster pollen tube growth or faster pollination are not influenced by cutting the style, making them incorrect options in this context.

Additional Information

• Structure of a Flower:

• The flower consists of the stigma, style, ovary, and ovule, which are parts of the pistil (female reproductive organ).

• The stigma is the receptive surface where pollen grains land during pollination.

• The style is the tube-like structure that connects the stigma to the ovary, allowing the pollen tube to grow downward.

• The ovary contains ovules, which develop into seeds after fertilization.

• Pollination and Fertilization:

• Pollination is the transfer of pollen grains from the male anther to the female stigma.

• Once the pollen grains land on the stigma, they germinate and form a pollen tube that grows through the style to reach the ovary.

• Fertilization occurs when the male gamete (sperm cell) fuses with the female gamete (egg cell) in the ovule.

• Role of the Style:

• The style acts as a guiding structure for the pollen tube's growth toward the ovary.

• It provides the necessary environment for the pollen tube to develop and transport the male gametes.

• Cutting the style disrupts this pathway, preventing fertilization and subsequent seed formation.

• Incorrect Options Explained:

• Pollen tube will grow more quickly: Incorrect, as the absence of the style prevents pollen tube formation entirely.

• Pollination will be faster: Incorrect, as pollination refers only to the transfer of pollen grains and is not affected by cutting the style.

• Ovule will turn into a seed: Incorrect, as seed formation requires fertilization, which cannot occur without the style.

Important Points

• Self-Pollination vs Cross-Pollination:

• Self-pollination: Transfer of pollen from the anther to the stigma of the same flower or another flower on the same plant.

• Cross-pollination: Transfer of pollen from the anther of one flower to the stigma of a flower on a different plant of the same species.

• Double Fertilization in Angiosperms:

• Angiosperms undergo a unique process called double fertilization, where one sperm cell fertilizes the egg to form a zygote, while another sperm cell fuses with two polar nuclei to form the endosperm.

• Seed Formation:

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

• The seed contains the embryo, which is the future plant, along with stored nutrients.

Q22. Answer: (b) Nucleus

The correct answer is Nucleus.

Key Points

• Rutherford's α-particle scattering experiment was conducted in 1911 to study the structure of the atom. The experiment used alpha particles directed at a thin sheet of gold foil.

• Most of the alpha particles passed through the foil without any deflection, indicating that most of the atom consists of empty space.

• However, a small fraction of particles were deflected at large angles, and a very few even bounced back. This led to the

conclusion that the atom contains a dense, positively charged core, which Rutherford named the nucleus.

• The nucleus was found to occupy a very small volume compared to the overall size of the atom, but it contains most of the atom's mass.

• This experiment laid the foundation for the planetary model of the atom, where electrons orbit around the nucleus, similar to planets orbiting the Sun.

Additional Information

• Structure of the Atom:

• An atom consists of three subatomic particles: protons, neutrons, and electrons.

• The protons and neutrons are located in the nucleus, while the electrons orbit around the nucleus in defined energy levels or shells.

• The nucleus is positively charged due to the presence of protons, while electrons carry a negative charge.

• The discovery of the nucleus helped in understanding the mass and charge distribution within an atom.

• Key Findings of Rutherford’s Experiment:

• Most of the atom's volume is empty space, as most alpha particles passed through the gold foil without deflection.

• The positive charge and most of the mass of the atom are concentrated in a very small region called the nucleus.

• The nucleus is extremely small compared to the overall size of the atom, with a diameter of approximately 10^-15 meters.

• Electrons occupy the space surrounding the nucleus, forming the electron cloud.

• Other Models of the Atom:

• Thomson’s Model (1897): Proposed the "plum pudding" model where electrons were embedded in a positively charged sphere.

• Bohr’s Model (1913): Improved upon Rutherford’s model by introducing quantized energy levels for electrons.

• Quantum Mechanical Model: The modern atomic theory based on quantum mechanics, which describes electrons as existing in probabilistic regions called orbitals.

• Important Characteristics of Subatomic Particles:

• Protons: Positively charged, found in the nucleus, mass = 1.6726 × 10^-27 kg.

• Neutrons: Neutral, found in the nucleus, mass = 1.675 × 10^-27 kg.

• Electrons: Negatively charged, orbit around the nucleus, mass = 9.109 × 10^-31 kg.

Important Points

• Alpha Particles: Alpha particles are helium nuclei, consisting of two protons and two neutrons. They are positively charged and were used in Rutherford’s experiment to probe the structure of the atom.

• Gold Foil: The thin gold foil used in the experiment was approximately 0.00004 cm thick, allowing alpha particles to pass through it while interacting with the atomic structure.

• Deflection Observations: Large-angle deflections indicated the presence of a dense, positively charged nucleus, while straight-line paths indicated empty space in the atom.

• Impact on Modern Physics: Rutherford’s findings revolutionized atomic theory, paving the way for further discoveries such as Bohr’s quantized energy levels and the development of quantum mechanics.

Q23. Answer: (a) A book kept on a table

The correct answer is A book kept on a table.

Key Points

• Potential Energy is the energy possessed by an object due to its position, configuration, or state. It is stored energy that has the potential to do work in the future.

• A book kept on a table has potential energy because it is positioned above the ground, and its energy is dependent on its height and mass. This energy can be expressed as P.E. = mgh, where m is mass, g is gravitational acceleration, and h is height.

• A moving train, a flowing river, and a rolling ball are examples of objects in motion. They possess kinetic energy, not potential energy, as their energy is due to motion.

• Potential energy is converted to kinetic energy when the object is set in motion. For example, if the book falls from the table, its potential energy is converted into kinetic energy.

• The position or configuration of the object determines its potential energy, emphasizing that the book's stationary position on the table is the key factor here.

Additional Information

• Potential Energy:

• It is a form of mechanical energy and depends on the object's position or configuration.

• Examples include a stretched spring (elastic potential energy) or water stored in a dam (gravitational potential energy).

• Its formula, P.E. = mgh, indicates that potential energy is directly proportional to mass (m), height (h), and gravitational

acceleration (g).

• Kinetic Energy:

• It is the energy possessed by an object due to its motion.

• The formula for kinetic energy is K.E. = 1/2 mv^2, where m is mass and v is velocity.

• Examples include a flowing river, a rolling ball, or a moving car.

• Difference Between Potential and Kinetic Energy:

• Potential energy is stored energy based on position, whereas kinetic energy is energy in motion.

• Potential energy can be converted into kinetic energy and vice versa (e.g., a pendulum's motion).

• Examples of Potential Energy:

• Water stored in a dam or reservoir before release.

• A compressed or stretched spring.

• An object placed at a height, such as a book on a table or a rock on a hill.

Important Points

• Gravitational Potential Energy:

• This is the potential energy an object has due to its position relative to the Earth or another gravitational source.

• It is most commonly observed in objects at a height, such as a book on a shelf or water stored in a dam.

• Elastic Potential Energy:

• Energy stored in objects that can be stretched or compressed, such as springs, rubber bands, or elastic materials.

• Energy Conversion:

• When potential energy is released, it transforms into kinetic energy. For example, when a ball is dropped from a height, its gravitational potential energy converts to kinetic energy as it falls.

Q24. Answer: (a) Energy of the wave

The correct answer is Energy of the wave.

Key Points

• Amplitude refers to the maximum displacement of a particle from its equilibrium position in a wave. It represents the wave's strength or intensity.

• The energy of a wave is directly proportional to the square of its amplitude. This means that if the amplitude of a wave increases, the energy of the wave increases significantly. For example, if the amplitude doubles, the energy becomes four times greater.

• Frequency and wavelength are not affected by changes in amplitude. Frequency is determined by the source of the wave, while wavelength depends on the medium and the wave's frequency (not amplitude).

• The speed of a wave is determined by the properties of the medium (such as density and elasticity) through which it travels. It does not depend on amplitude.

• Hence, the correct answer is Energy of the wave.

Additional Information

• Wave Energy:

• The energy of a wave can be expressed as E prop. to A^2, where E is the energy, and A is the amplitude.

• This relationship is particularly important in mechanical waves like sound waves and water waves, where an increase in amplitude corresponds to a louder sound or taller waves, respectively.

• In electromagnetic waves, such as light, the intensity (or brightness) is proportional to the square of the amplitude of the electric field.

• Frequency:

• Frequency is defined as the number of oscillations or cycles completed by a wave in one second and is measured in Hertz (Hz).

• Frequency is determined by the source of the wave and does not depend on the amplitude.

• Wavelength:

• Wavelength is the distance between two consecutive crests or troughs of a wave.

• It is inversely proportional to frequency for waves traveling at a constant speed, as given by the equation $v = f\lambda$, where v is speed, f is frequency, and λ is wavelength.

• Wave Speed:

• The speed of a wave depends on the medium's properties, such as elasticity and density, and is not influenced by the wave's amplitude.

• For example, the speed of sound in air is approximately 343 m/s at room temperature and does not change with amplitude.

Important Points

• Mechanical Waves:
• Examples include sound waves, water waves, and seismic waves.
• Their energy transfer depends heavily on amplitude, with larger amplitudes signifying more energy.
• Electromagnetic Waves:
• Examples include light waves, radio waves, and X-rays.
• The amplitude of the electric and magnetic fields determines the wave's intensity and energy.
• Practical Applications:
• In sound waves, amplitude affects loudness, which is crucial in designing speakers and sound systems.
• In water waves, amplitude determines wave height, which is important for navigation and wave energy harvesting.

Q25. Answer: (b) It depends on the mass of the object.

The correct answer is It depends on the mass of the object..

Key Points

• Gravitational force is directly proportional to the product of the masses of two objects. This is expressed in Newton's law of gravitation, which states that the force between two masses is given by *F = G * (m1 * m2)/r²*, where G is the gravitational constant, m1 and m2 are the masses, and r is the distance between them.
• The gravitational force of the Earth depends on the mass of the object being attracted. Hence, objects with larger masses experience greater gravitational force compared to smaller objects in the same location.
• This force acts as a central force, meaning it always points towards the center of the Earth. Therefore, the statement "It acts away from the center of the Earth" is incorrect.
• The gravitational force decreases with an increase in distance from the Earth's center. This is because the force is inversely proportional to the square of the distance between the two objects, making the statement "It is independent of distance from the Earth's center" incorrect.
• Gravitational force is a central and attractive force, and not a non-central force. Hence, the statement "It is a non-central force" is also incorrect.

Additional Information

• Newton's Law of Universal Gravitation:
• It was proposed by Sir Isaac Newton in 1687.
• The formula for gravitational force is *F = G * (m1 * m2)/r²*, where G is the universal gravitational constant with a value of approximately 6.674 × 10^-11 N·m²/kg².
• Dependence on Mass:
• The greater the mass of an object, the stronger the gravitational pull it will experience. For example, a person on Earth experiences much greater gravitational force compared to the Moon due to Earth's larger mass.
• Dependence on Distance:
• The gravitational force decreases as the distance between two objects increases. For instance, astronauts experience microgravity in space because they are far from Earth's center.
• Applications of Gravitational Force:
• Gravitational force plays a crucial role in keeping celestial bodies like planets, moons, and satellites in orbit.
• It is also responsible for phenomena such as tides, caused by the gravitational pull of the Moon and the Sun on Earth's oceans.
• Impact of Gravity on Objects:
• Objects fall towards the Earth due to gravitational acceleration, which is approximately 9.8 m/s² near the Earth's surface.

Important Points

• Gravitational Acceleration:
• Gravitational acceleration is the rate at which an object accelerates towards the center of a massive body due to gravity. On Earth, this value is approximately 9.8 m/s².
• Gravitational Force in Space:
• In space, the gravitational force becomes weaker as the distance from celestial bodies increases, which is why astronauts experience weightlessness in orbit.
• Variation of Gravity:
• Gravity varies slightly across Earth's surface due to differences in altitude, latitude, and the Earth's shape (an oblate spheroid).

Q26. Answer: (c) 10 m

Shortcut Trick

Direct formula for the Height (Perpendicular): h = (2 × Area) ÷ Base

Given: Area = 61.5 m², Base = 12.3 m
Height = (2 × 61.5) ÷ 12.3
Height = 123 ÷ 12.3 = 10 m
Therefore The correct answer is 10 m.
Alternate Method
Given:
Area of the triangle = 61.5 m²
One side (Base) = 12.3 m
Formula Used:
Area of a Triangle = 1/2 × Base × Height (Perpendicular)
Calculations:
=> Area = 1/2 × Base × Height
=> 61.5 = 1/2 × 12.3 × Height
=> 61.5 × 2 = 12.3 × Height
=> 123 = 12.3 × Height
=> Height = 123 ÷ 12.3
=> Height = 10 m
Therefore The correct answer is 10 m.
Additional Information
Heron's Formula
For a triangle with sides a, b, and c, Area = √[s(s−a)(s−b)(s−c)], where s (semi-perimeter) = (a + b + c) ÷ 2.
Area of Equilateral Triangle
If all sides are equal to 'a', then Area = (√3 ÷ 4) × a² and Height = (√3 ÷ 2) × a.
Right-Angled Triangle
In a right-angled triangle, the two sides containing the right angle act as the base and height respectively.

Q27. Answer: (b) 6.67% loss

Shortcut Trick
Total Cost Price (CP) = 1,20,000 + 28,500 = Rs. 1,48,500
Selling Price (SP) = Rs. 1,38,600
Since CP > SP, there is a loss.
Loss % = (9,900 ÷ 1,48,500) × 100 = 6.67% loss
Therefore The correct answer is 6.67% loss.
Alternate Method
Given: Purchase Price = Rs. 1,20,000, Repair Cost = Rs. 28,500, Selling Price (SP) = Rs. 1,38,600.
Formula Used: Total CP = Purchase Price + Overheads; Loss % = [(CP − SP) ÷ CP] × 100
=> Total Cost Price (CP) = 1,20,000 + 28,500 = Rs. 1,48,500
=> Loss Amount = CP − SP = 1,48,500 − 1,38,600 = Rs. 9,900
=> Loss % = (9,900 ÷ 1,48,500) × 100
=> Loss % = 990,000 ÷ 148,500 ≈ 6.67%
Therefore The correct answer is 6.67% loss.
Additional Information
Total Cost Price (Effective CP)
It includes the original purchase price plus any additional overhead expenses like repairs, transportation, or taxes.
Gain or Loss Percentage
Profit or loss is always calculated on the Effective Cost Price. Formula: Percentage = (Profit or Loss ÷ CP) × 100.
Profit and Loss Condition
If SP > CP, it is a Gain; if CP > SP, it is a Loss.

Q28. Answer: (a) 55

Shortcut Trick
Use the British Flag Theorem for any point P inside a rectangle ABCD:

$PA^2 + PC^2 = PB^2 + PD^2$

$85^2 + 5^2 = 65^2 + PD^2$

$7225 + 25 = 4225 + PD^2$

$7250 - 4225 = PD^2 \Rightarrow PD^2 = 3025 \Rightarrow PD = 55$ cm.

Therefore The correct answer is 55 cm.

Alternate Method

Given: PA = 85 cm, PB = 65 cm, PC = 5 cm.

Formula Used: In a rectangle ABCD, for any point P, the sum of the squares of the distances from P to opposite vertices is equal: $PA^2 + PC^2 = PB^2 + PD^2$.

A

B

C

D

P

85 cm

65 cm

5 cm

Q29. Answer: (c) 1

Given:

$(1.25^2 - 0.75^2) / (2.25^2 - 1.25^2) \times (7 / 2)$

Formula Used:

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

Calculation:

$1.25^2 - 0.75^2 = (1.25 - 0.75)(1.25 + 0.75)$

$\Rightarrow (0.5)(2) = 1$

$2.25^2 - 1.25^2 = (2.25 - 1.25)(2.25 + 1.25)$

$\Rightarrow (1)(3.5) = 3.5$

Now substitute:

$\Rightarrow (1 / 3.5) \times (7 / 2)$

$\Rightarrow (1 / (7/2)) \times (7 / 2)$

$\Rightarrow 1$

Therefore The simplified value is 1.

Q30. Answer: (b) Increase by 10%

Shortcut Trick

Let the cost of a TV be 100 and Washing Machine (WM) be 50.

Initial Total Cost (4 WM + 2 TV) = 4(50) + 2(100) = 200 + 200 = 400.

Net change = [4 × (50 × 33%) + 2 × (100 × −13%)] = [4 × 16.5 − 2 × 13] = 66 − 26 = +40.

% Change = (40 ÷ 400) × 100 = 10%.

Therefore The correct answer is Increase by 10%.

Alternate Method

Given:

Cost of TV = 100

Cost of Washing Machine = 50% less than TV = 50

Quantity: 4 Washing Machines and 2 TVs

Calculations:

$\Rightarrow$ Total Initial Cost = (4 × 50) + (2 × 100) = 200 + 200 = 400

$\Rightarrow$ New Cost of WM = 50 + (33% of 50) = 50 + 16.5 = 66.5

$\Rightarrow$ New Cost of TV = 100 − (13% of 100) = 100 − 13 = 87

$\Rightarrow$ Total New Cost = (4 × 66.5) + (2 × 87) = 266 + 174 = 440

$\Rightarrow$ Change in Cost = 440 − 400 = 40

=> Percentage Change = (40 ÷ 400) × 100 = 10%

Therefore The correct answer is Increase by 10%.

Additional Information

Percentage Change

Percentage change is calculated as (Change in Value ÷ Original Value) × 100. Positive results indicate an increase and negative results indicate a decrease.

Weighted Average Method

For multiple items, the total % change = (n1c1 + n2c2 + ...) ÷ (Total Initial Value), where n is quantity and c is the change in individual value.

Base Value Selection

In percentage problems involving ratios, assuming a base value like 100 simplifies calculations significantly by avoiding complex fractions.

Q31. Answer: (a) Rs. 3,388

Shortcut Trick

Effective Compound Interest rate for 2 years at 10% = 10 + 10 + (10 × 10)/100 = 21%.

Total Amount percentage = 100% (Principal) + 21% (Interest) = 121%.

Amount = 121% of Rs. 2,800 = 1.21 × 2800.

Amount = Rs. 3,388.

Therefore The correct answer is Rs. 3,388.

Alternate Method

Given:

Principal (P) = Rs. 2,800

Rate of Interest (R) = 10% per annum

Time (n) = 2 years

Formula Used:

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

Calculations:

=> $A = 2800 \times (1 + 10/100)^2$

=> $A = 2800 \times (110/100) \times (110/100)$

=> $A = 2800 \times 1.1 \times 1.1$

=> $A = 2800 \times 1.21$

=> $A = 28 \times 121$

=> A = Rs. 3,388

Therefore The correct answer is Rs. 3,388.

Additional Information

Compound Interest Formula

The interest earned is calculated as $CI = A - P = P[(1 + R/100)^n - 1]$.

Effective Rate for 2 Years

For a rate R%, the effective compound interest rate for 2 years is given by $(2R + R^2/100)\%$.

Difference between CI and SI

The difference between Compound Interest and Simple Interest for 2 years is $P(R/100)^2$.

Q32. Answer: (b) 9 years

Shortcut Trick

Ratio of Father age to Son age = 5 : 1

Total units = 5 + 1 = 6 units

6 units = 54 years

1 unit (Son age) = 54 ÷ 6 = 9 years

Therefore The correct answer is 9 years.

Alternate Method

Given:

Father age = 5 × Son age

Sum of ages = 54 years
Let Son age be x.
Then Father age = 5x.
=> x + 5x = 54
=> 6x = 54
=> x = 54 ÷ 6
=> x = 9
Therefore The correct answer is 9 years.
Additional Information
Ratio and Proportion in Ages
If the ratio of ages is a:b and sum is S, the ages are [a/(a+b)] × S and [b/(a+b)] × S.
Age Difference Property
The difference between the ages of two people remains constant regardless of the number of years passed or before.
Average Age
Average age = Sum of ages ÷ Total number of persons.

Q33. Answer: (a) 4412 m

Shortcut Trick
Total distance covered = Speed × Time
Total distance = 54 × 106 = 5724 m
Tunnel length = Total distance − Train length
Tunnel length = 5724 − 1312 = 4412 m
Therefore The correct answer is 4412 m.
Alternate Method
Given:
Length of Train (L1) = 1312 m
Speed (S) = 54 m/s
Time (T) = 106 seconds
Formula Used:
Total Distance = Speed × Time
Total Distance = Length of Train + Length of Tunnel
Calculations:
=> Let the length of the Tunnel be L2.
=> Total Distance = L1 + L2 = 1312 + L2
=> 1312 + L2 = 54 × 106
=> 1312 + L2 = 5724
=> L2 = 5724 − 1312
=> L2 = 4412 m
Therefore The correct answer is 4412 m.
Additional Information
Speed Conversion
To convert km/hr to m/s, multiply by 5/18. To convert m/s to km/hr, multiply by 18/5.
Relative Speed
If two objects move in the opposite direction, relative speed is S1 + S2. In the same direction, it is |S1 − S2|.
Stationary Objects
When a train crosses a pole or a man, distance = length of train. When it crosses a platform or tunnel, distance = length of (train + platform/tunnel).

Q34. Answer: (a) 40 years

Shortcut Trick
Let the sum of the ages of the two sons be S.
Present: Father = 2S.

After 20 years: (2S + 20) = (S + 20 + 20) => S = 20.
Father's age = 2 × 20 = 40 years.
Therefore The correct answer is 40 years.
Alternate Method
Given: Present age of Father (F) = 2 × (S1 + S2)
Let (S1 + S2) = X
=> F = 2X
After 20 years, the Father's age will be (F + 20) and each son's age increases by 20.
=> F + 20 = (S1 + 20) + (S2 + 20)
=> 2X + 20 = (S1 + S2) + 40
=> 2X + 20 = X + 40
=> 2X − X = 40 − 20
=> X = 20
The present age of the father is 2X:
=> F = 2 × 20 = 40 years
Therefore The correct answer is 40 years.
Additional Information
Age Sum for Multiple Persons
If the sum of ages of 'n' persons is S today, then after 't' years, their total age will be S + (n × t).
Ratio Method in Age Problems
If the ratio of ages is given for two different time periods, calculate the difference in ratio units and equate it to the actual time difference.

Q35. Answer: (b) 78

Shortcut Trick
Speed ratio (Normal : New) = 5 : 3
Since distance is constant, Time ratio (Normal : New) = 3 : 5
Difference in time units = 5 − 3 = 2 units
Given, 2 units = 52 minutes => 1 unit = 26 minutes
Normal time = 3 units = 3 × 26 = 78 minutes
Therefore The correct answer is 78 minutes.
Alternate Method
Given:
Let Normal Speed = s and Normal Time = t
New Speed = (3/5) × s
New Time = t + 52 minutes
Formula Used:
Distance = Speed × Time
Calculations:
=> s × t = (3/5)s × (t + 52)
=> t = (3/5) × (t + 52)
=> 5t = 3t + 156
=> 2t = 156
=> t = 78 minutes
Therefore The correct answer is 78 minutes.
Additional Information
Inverse Variation of Speed and Time
When the distance is constant, the speed of an object is inversely proportional to the time taken (s prop. to 1/t).
Late/Early Formula
If a person travels at a/b of their usual speed, the usual time taken is [Late Time × a / (b − a)] if b > a.
Unit Conversion
Always ensure units for speed (kmph or m/s) and time (hours or seconds) are consistent before calculation.

Q36. Answer: (c) 0.2

Given:

5.4(0.1 × 0.1 × 0.1 + 0.03 × 0.03 × 0.03) / (0.3 × 0.3 × 0.3 + 0.09 × 0.09 × 0.09)

Formula Used:

$a^3 + b^3 = (a + b)(a^2 − ab + b^2)$

Calculation:

0.1 × 0.1 × 0.1 = 0.001

0.03 × 0.03 × 0.03 = 0.000027

=> 0.001 + 0.000027 = 0.001027

0.3 × 0.3 × 0.3 = 0.027

0.09 × 0.09 × 0.09 = 0.000729

=> 0.027 + 0.000729 = 0.027729

Now substitute:

=> (5.4 × 0.001027) / 0.027729

=> 0.0055458 / 0.027729

=> 0.2

Therefore The value of the given expression is 0.2.

Q37. Answer: (c) 3

Given:

7^5 × 7√(7) ÷ 7^(-5/2) = 7^(2x+3)

Formula Used:

√a = a^(1/2)

a^m × a^n = a^(m+n)

a^m ÷ a^n = a^(m−n)

Calculation:

7√(7) = 7 × 7^(1/2) = 7^(3/2)

=> 7^5 × 7^(3/2) ÷ 7^(-5/2) = 7^(2x+3)

=> 7^(5 + 3/2) ÷ 7^(-5/2) = 7^(2x+3)

=> 7^(5 + 3/2 + 5/2) = 7^(2x+3)

=> 7^(5 + 8/2) = 7^(2x+3)

=> 7^9 = 7^(2x+3)

=> 9 = 2x + 3

=> 2x = 9 − 3

=> 2x = 6

=> x = 3

Therefore The value of x is 3.

Q38. Answer: (d) 48 days

Shortcut Trick

Total Work (LCM of 40, 60) = 120 units.

Efficiency: Bhavya = 2 units/day, Navya = 3 units/day.

In a cycle of 2 days (Bhavya + Navya), work done = 2 + 3 = 5 units.

Number of cycles = 120 ÷ 5 = 24 cycles.

Total time = 24 cycles × 2 days/cycle = 48 days.

Therefore The correct answer is 48 days.

Alternate Method

Given: Time taken by Navya = 40 days, Time taken by Bhavya = 60 days.

Formula Used: Total Work = LCM(Time); Efficiency = Total Work ÷ Time.

Person	Days	Total Work	Efficiency
Navya	40	120	3

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Bhavya	60	2	

=> Work done in 1^(st) day (Bhavya) = 2 units

=> Work done in 2^(nd) day (Navya) = 3 units

=> Total work in 2 days = 2 + 3 = 5 units

=> Total cycles of 2 days required = 120 ÷ 5 = 24

=> Total days = 24 × 2 = 48 days

Therefore The correct answer is 48 days.

Additional Information

Alternate Day Concept

In alternate day work, determine the work done in one complete cycle (sum of individual efficiencies) and divide the total work by this cycle sum.

Pipes and Cisterns

The same logic applies to pipes filling a tank, where an outlet pipe has negative efficiency (subtraction instead of addition).

Efficiency and Time Relationship

Efficiency is inversely proportional to the time taken to complete a task. E1 × T1 = E2 × T2 = Total Work.

Q39. Answer: (a) 8%

Shortcut Trick

Net Profit% = Markup% − Discount% − [(Markup% × Discount%) ÷ 100]

=> Net Profit% = 35 − 20 − [(35 × 20) ÷ 100]

=> Net Profit% = 15 − 7 = 8%

Therefore The correct answer is 8%.

Alternate Method

Given:

Marked Price (MP) = Rs. 8,640

Markup Percentage = 35% above Cost Price (CP)

Discount Percentage = 20% on MP

Calculations:

=> Let CP be Rs. 100x

=> MP = 100x + 35% of 100x = Rs. 135x

=> Selling Price (SP) = MP − Discount

=> SP = 135x − 20% of 135x

=> SP = 135x − 27x = Rs. 108x

=> Profit = SP − CP = 108x − 100x = 8x

=> Profit% = (8x ÷ 100x) × 100 = 8%

Therefore The correct answer is 8%.

Additional Information

Relationship between CP and MP

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

Successive Percentage Change

When a value is increased by a% and then decreased by b%, the net change is [a − b − (ab ÷ 100)]%.

Effective Discount

Two successive discounts of d1% and d2% are equivalent to a single discount of [d1 + d2 − (d1 × d2 ÷ 100)]%.

Q40. Answer: (c) 7132951

Shortcut Trick

Divisibility rule of 7: Divide the number into groups of three digits from right to left and find the alternating sum (subtract and add groups).

For 7132951: Groups are 951, 132, and 7.

Calculation: 951 − 132 + 7 = 826.

Since 826 ÷ 7 = 118 (exactly divisible), the original number is divisible by 7.

Therefore The correct answer is 7132951.

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Alternate Method

Given: Four large numbers to check for divisibility by 7.

Method: Perform direct division for each option to identify the remainder.

=> Option 1: 6825907 ÷ 7 = 975129 Remainder 4.

=> Option 2: 7357306 ÷ 7 = 1051043 Remainder 5.

=> Option 3: 7132951 ÷ 7 = 1018993 Remainder 0.

=> Option 4: 7660778 ÷ 7 = 1094396 Remainder 6.

=> Only 7132951 leaves no remainder when divided by 7.

Therefore The correct answer is 7132951.

Additional Information

Standard Divisibility Rule of 7

Double the last digit and subtract it from the rest of the number. Repeat until a small number is obtained. If the result is 0 or a multiple of 7, the number is divisible by 7.

Divisibility by 11

The difference between the sum of digits at odd positions and the sum of digits at even positions must be 0 or a multiple of 11.

Divisibility by 13

Similar to the group-of-three rule used for 7, find the alternating sum of three-digit groups. If the result is divisible by 13, the number is divisible by 13.

Q41. Answer: (c) Rs. 1,670

Shortcut Trick

Ratio of A : B : C : D = 10 : 7 : 9 : 5

Difference between C and B in units = 9 − 7 = 2 units

Given, 2 units = Rs. 334 => 1 unit = Rs. 167

Share of A = 10 units = 10 × 167 = Rs. 1,670

Therefore The correct answer is Rs. 1,670.

Alternate Method

Given:

Ratio of shares A : B : C : D = 10 : 7 : 9 : 5

Let the shares be 10x, 7x, 9x, and 5x respectively.

Calculations:

=> Share of C − Share of B = Rs. 334

=> 9x − 7x = 334

=> 2x = 334

=> x = 334 ÷ 2 = 167

=> Share of A = 10x

=> Share of A = 10 × 167 = 1670

Therefore The correct answer is Rs. 1,670.

Additional Information

Ratio and Proportion

A ratio compares two quantities. If a : b = c : d, then product of extremes equals product of means (ad = bc).

Unitary Method in Ratios

Finding the value of a single unit (x) from a given difference or sum allows for quick calculation of all individual parts.

Compound Ratio

The compound ratio of (a : b) and (c : d) is (ac : bd).

Q42. Answer: (d) 1,80,000

Shortcut Trick

Income Ratio of Kiran and Mahesh = 5 : 8

Expenditure Ratio = 2 : 4 = 1 : 2

Since Savings (Income − Expenditure) are equal, make the difference between ratio parts equal.

Difference in Income parts (8 − 5 = 3) and Expenditure parts (2 − 1 = 1). Multiply Expenditure ratio by 3 → 3 : 6.

Savings ratio units = 5 − 3 = 2 units. Given 2 units = ƒ72,000 Therefore 1 unit = ƒ36,000.

Kiran's Income = 5 units × 36,000 = ₹1,80,000.
Therefore The correct answer is Rs. 1,80,000.
Alternate Method
Given: Ratio of incomes = 5 : 8, Ratio of expenditures = 2 : 4, Savings = Rs. 72,000 each.
Formula Used: Income − Savings = Expenditure
=> Let Kiran's income be 5x and Mahesh's income be 8x.
=> (5x − 72000) / (8x − 72000) = 2 / 4
=> (5x − 72000) / (8x − 72000) = 1 / 2
=> 2 × (5x − 72000) = 1 × (8x − 72000)
=> 10x − 1,44,000 = 8x − 72,000
=> 10x − 8x = 1,44,000 − 72,000
=> 2x = 72,000
=> x = 36,000
=> Kiran's monthly income = 5x = 5 × 36,000 = 1,80,000
Therefore The correct answer is Rs. 1,80,000.
Additional Information
Income, Expenditure and Savings Relationship
The fundamental relation used in these problems is Income = Expenditure + Savings.
Cross-Multiplication Method
For two ratios (a:b and c:d) with a constant change (k), the value of one unit is calculated as |(b×c − a×d)| / |(k×c − k×d)|.
Ratio Balancing
If savings are equal, the difference between the terms of the income ratio and expenditure ratio must be made equal to find the value of 1 ratio unit directly.

Q43. Answer: (a) 36

Shortcut Trick
Total Work = LCM(6, 9) = 18 units
Efficiency of A + B = 18 ÷ 6 = 3 units/day
Efficiency of B = 18 ÷ 9 = 2 units/day
Efficiency of A = 3 − 2 = 1 unit/day
Double Work = 18 × 2 = 36 units
Time taken by A = 36 ÷ 1 = 36 days
Therefore The correct answer is 36 days.
Alternate Method
Given: Time taken by (A + B) = 6 days, Time taken by B = 9 days.

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

=> Efficiency of A = (Efficiency of A + B) − (Efficiency of B)
=> Efficiency of A = 3 − 2 = 1 unit/day
=> Total work to be done = 2 × 18 = 36 units
=> Time taken by A = 36 ÷ 1 = 36 days
Therefore The correct answer is 36 days.
Additional Information
Individual Time Formula
If (A+B) take 'x' days and B takes 'y' days, then A alone takes (x × y) ÷ (y − x) days.
Work and Efficiency
Efficiency is inversely proportional to time. Efficiency = Total Work ÷ Time taken.
Multiple Work Factor
If work becomes 'n' times, the time required at the same efficiency also becomes 'n' times the original time.

Q44. Answer: (d) 36%

Shortcut Trick

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

CP / MP = (100 − 25) / (100 + 2) = 75 / 102 = 25 / 34

Mark-up = 34 − 25 = 9 units

Mark-up % = (9 / 25) × 100 = 36%

Therefore The correct answer is 36%.

Alternate Method

Given: Discount = 25%, Profit = 2%

Formula: Mark-up % = [(MP − CP) / CP] × 100

=> Let Cost Price (CP) = 100

=> Selling Price (SP) = CP + Profit = 100 + 2 = 102

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

=> MP × 75/100 = 102

=> MP = (102 × 100) / 75 = 102 × 4/3 = 136

=> Mark-up = MP − CP = 136 − 100 = 36

=> Mark-up % = (36 / 100) × 100 = 36%

Therefore The correct answer is 36%.

Additional Information

Mark-up Percentage

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

Relationship between CP and MP

A very useful ratio for competitive exams is MP / CP = (100 + Profit%) / (100 − Discount%).

Successive Percentage Rule

The net profit can also be seen as Mark-up % − Discount % − (Mark-up × Discount)/100.

Q45. Answer: (a) 4/3

Shortcut Trick

Given: 5 cos A = 4 => cos A = 4/5.

Using identities: $\sqrt{(\text{cosec}^2 A - 1)} = \cot A$ and $\sqrt{(\sec^2 A - 1)} = \tan A$.

Expression = (3 × cot A) ÷ (4 × tan A) = (3 × $\cot^2 A$) ÷ 4.

Since cos A = 4/5, sin A = 3/5 => cot A = 4/3. Result = (3 × $(4/3)^2$) ÷ 4 = (3 × 16/9) ÷ 4 = 16/3 ÷ 4 = 4/3.

Therefore The correct answer is 4/3.

Alternate Method

Given: 5 cos A = 4 => cos A = Base/Hypotenuse = 4/5.

Formula Used: Perpendicular (p) = $\sqrt{(h^2 - b^2)}$; cot A = b/p; tan A = p/b.

=> p = $\sqrt{(5^2 - 4^2)}$ = $\sqrt{(25 - 16)}$ = $\sqrt{9}$ = 3.

=> Expression = [3 $\sqrt{(\text{cosec}^2 A - 1)}$] / [4 $\sqrt{(\sec^2 A - 1)}$]

=> Expression = (3 × cot A) / (4 × tan A)

=> cot A = 4/3 and tan A = 3/4

=> Value = [3 × (4/3)] / [4 × (3/4)]

=> Value = 4 / 3

Therefore The correct answer is 4/3.

Additional Information

Trigonometric Identities

$\sec^2 A - \tan^2 A = 1$ and $\text{cosec}^2 A - \cot^2 A = 1$ are fundamental squared identities.

Pythagorean Triplets

Common triplets like (3, 4, 5), (5, 12, 13), and (8, 15, 17) speed up calculations for right-angled triangles.

Reciprocal Relations

tan A = 1/cot A, cos A = 1/sec A, and sin A = 1/cosec A.

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Q46. Answer: (a) 8 : 24 : 18 : 21

Shortcut Trick

Align the ratios and multiply vertically and cross-wise: A : B : C : D.

A = 1 × 4 × 6 = 24

B = 3 × 4 × 6 = 72

C = 3 × 3 × 6 = 54

D = 3 × 3 × 7 = 63

Simplify 24 : 72 : 54 : 63 by dividing by 3: 8 : 24 : 18 : 21.

Therefore The correct answer is 8 : 24 : 18 : 21.

Alternate Method

Given: A : B = 1 : 3, B : C = 4 : 3, C : D = 6 : 7

Formula: To combine ratios, make the common terms equal.

=> First, combine A : B and B : C. Make B same by multiplying (1:3) by 4 and (4:3) by 3.

=> A : B : C = 4 : 12 : 9

=> Now combine (A:B:C) with C : D. C is 9 in the first and 6 in the second. LCM of 9 and 6 is 18.

=> Multiply (4:12:9) by 2 → 8 : 24 : 18

=> Multiply (6:7) by 3 → 18 : 21

=> A : B : C : D = 8 : 24 : 18 : 21

Therefore The correct answer is 8 : 24 : 18 : 21.

Additional Information

Compound Ratio

The compound ratio of (a : b) and (c : d) is found by multiplying corresponding terms: (ac : bd).

Comparison of Ratios

To compare two ratios (a : b) and (c : d), convert them into fractions a/b and c/d and equate the denominators.

Duplicate Ratio

The duplicate ratio of (a : b) is (a^2 : b^2). Similarly, the triplicate ratio is (a^3 : b^3).

Q47. Answer: (b) 14√5 cm²

Shortcut Trick

For a triangle with sides 7 cm, 9 cm, and 12 cm, find the semi-perimeter (s).

s = (7 + 9 + 12) ÷ 2 = 14 cm.

Apply Heron's Formula: Area = √[s(s − a)(s − b)(s − c)]

Area = √[14 × 7 × 5 × 2] = √[14 × 70] = √[980] = 14√5 cm².

Therefore The correct answer is 14√5 cm².

Alternate Method

Given:

Sides of the triangle: a = 7 cm, b = 9 cm, c = 12 cm.

Formula Used:

Heron's Formula for Area = √[s(s − a)(s − b)(s − c)], where s is the semi-perimeter.

Calculations:

=> Semi-perimeter (s) = (a + b + c) ÷ 2

=> s = (7 + 9 + 12) ÷ 2

=> s = 28 ÷ 2 = 14 cm

=> Area = √[14 × (14 − 7) × (14 − 9) × (14 − 12)]

=> Area = √[14 × 7 × 5 × 2]

=> Area = √[196 × 5]

=> Area = 14√5 cm²

Therefore The correct answer is 14√5 cm².

Additional Information

Heron's Formula

It is used to calculate the area of a triangle when the lengths of all three sides are known: Area = √[s(s−a)(s−b)(s−c)].

Equilateral Triangle Area

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For a triangle where all sides are equal (a), the area is simplified to (√3 ÷ 4) × a².

Inradius of a Triangle

The radius of the incircle (r) is related to the area (A) and semi-perimeter (s) by the formula: r = Area ÷ s.

Circumradius of a Triangle

The radius of the circumcircle (R) is given by: R = (abc) ÷ (4 × Area).

Q48. Answer: (d) 110%

Shortcut Trick

Apply the successive percentage change formula: x + y + (x × y)/100

Here, x = 50% and y = 40%.

=> 50 + 40 + (50 × 40)/100

=> 90 + 20 = 110%

Therefore The correct answer is 110%.

Alternate Method

Given: First increase = 50%, Second increase = 40%.

=> Let the initial price be 100.

=> Price after 50% increase = 100 + (50% of 100) = 150.

=> Price after further 40% increase = 150 + (40% of 150) = 150 + 60 = 210.

=> Net increase = Final Price − Initial Price = 210 − 100 = 110.

=> Percentage increase = (110 / 100) × 100 = 110%.

Therefore The correct answer is 110%.

Additional Information

Successive Percentage Formula

For two changes a% and b%, net change = (a + b + ab/100)%. Use positive for increase and negative for decrease.

Ratio Method

50% increase = 3/2 ratio; 40% increase = 7/5 ratio. Final ratio = (3/2) × (7/5) = 21/10. Increase = (21−10)/10 × 100 = 110%.

Successive Decrease

If prices are decreased, use negative signs in the formula. Two successive discounts are calculated the same way.

Q49. Answer: (c) 11.2

Shortcut Trick

Use the Net Deviation method from the average 12.

Sum of deviations of known numbers = (6.5 − 12) + (10.6 − 12) + (19.7 − 12).

−5.5 − 1.4 + 7.7 = +0.8.

To maintain the average 12, the deviation of a must be −0.8.

Value of a = 12 − 0.8 = 11.2.

Therefore The correct answer is 11.2.

Alternate Method

Given: Numbers are 6.5, 10.6, 19.7, and a. The Average is 12.

Formula: Average = Sum of observations ÷ Total number of observations

=> Average = (6.5 + 10.6 + 19.7 + a) ÷ 4

=> 12 = (36.8 + a) ÷ 4

=> 12 × 4 = 36.8 + a

=> 48 = 36.8 + a

=> a = 48 − 36.8

=> a = 11.2

Therefore The correct answer is 11.2.

Additional Information

Arithmetic Mean Formula

The sum of n observations divided by n. If Average = A, then Sum = A × n.

Property of Deviations

The algebraic sum of the deviations of all observations from their arithmetic mean is always zero (Σ(x_i − Mean) = 0).

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Weighted Average

When groups have different sizes n1, n2 and averages A1, A2, the combined average is (n1A1 + n2A2) ÷ (n1 + n2).

Q50. Answer: (c) 7

Shortcut Trick

Solve simultaneous equations by adding and subtracting them: (x + y = 10) and (x − y = 4).

Finding x and y: x = (10 + 4) ÷ 2 = 7 and y = (10 − 4) ÷ 2 = 3.

Update the dataset with x = 7 and y = 3: 1, 11, 11, 8, 18, 8, 7, 7, 7, 7, 3, 8.

Count the frequency: 7 appears 4 times, 8 appears 3 times, 11 appears 2 times.

The Mode is the value with the highest frequency, which is 7.

Therefore The correct answer is 7.

Alternate Method

Given: Data set: 1, 11, 11, 8, 18, 8, 7, 7, 7, x, y, 8 and equations 3x + 7y = 42, 7x + 3y = 58.

Formula Used: Mode = Observation with the maximum frequency.

Step 1: Solve for x and y

=> Adding both equations: (3x + 7y) + (7x + 3y) = 42 + 58

=> 10x + 10y = 100 => x + y = 10 −−−(i)

=> Subtracting equations: (7x + 3y) − (3x + 7y) = 58 − 42

=> 4x − 4y = 16 => x − y = 4 −−−(ii)

=> From (i) and (ii): x = 7, y = 3

Step 2: Frequency Analysis

=> Updated Data: 1, 11, 11, 8, 18, 8, 7, 7, 7, 7, 3, 8

=> Frequency of 7 = 4 times

=> Frequency of 8 = 3 times

=> Frequency of 11 = 2 times

=> Frequency of 1, 3, 18 = 1 time each

Therefore The correct answer is 7.

Additional Information

Empirical Relationship

For a moderately skewed distribution, the relationship is: Mode = 3 × Median − 2 × Mean.

Types of Mode

Data with one mode is Unimodal, two modes is Bimodal, and more than two is Multimodal.

Mean and Median

Mean is the average of all observations, while Median is the middle value when data is sorted.

Q51. Answer: (d) 1

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

Now,

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

So, Needed pattern is: Even − Odd − Even

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

No odd number satisfies both conditions.

Hence, the correct answer is 'Option 4'.

Q52. Answer: (b) 4

Given: (Left) % € € % 6 £ 3 & 1 £ 4 5 7 2 2 & & 9 & 8 8 * (Right)

Now, Symbols which are immediately preceded by a number and immediately followed by a number.

So, Needed pattern is: Number − Symbol − Number

So, there are 4 symbols satisfying the condition: £, £, &, and &

Hence, the correct answer is 'Option 2'.

Q53. Answer: (a) 131

BODMAS Table:

Given equation: 45 G 3 E 28 H 7 F 8 = ?

Now, if ‘E’ stands for ‘+’, ‘F’ stands for ‘-’, ‘G’ stands for ‘×’ and ‘H’ stands for ‘÷’, then:

=> 45 × 3 + 28 ÷ 7 − 8 = ?

=> 135 + 4 − 8 = ?

=> 139 − 8 = ?

=> 131

Hence, the correct answer is "Option 1".

Q54. Answer: (b) 2 km to the east

Given:

Karan starts from Point A and drives 12 km towards the North.

He then takes a right turn, drives 6 km, then turns right and drives 16 km.

He then takes a right turn and drives 8 km.

He takes a final right turn, drives 4 km, and stops at Point P.

So,He should drive 2 km to the east in order to reach Point A again.

Hence, the correct answer is "Option 2".

Q55. Answer: (a) 86

BODMAS Table:

Given equation: 639 + 9 × 6 − 44 ÷ 279 = ?

Now, if ‘+’ means ‘÷’, ‘−’ means ‘×’, ‘×’ means ‘−’, and ‘÷’ means ‘+’, then:

=> 639 ÷ 9 − 6 × 44 + 279 = ?

=> 71 − 6 × 44 + 279 = ?

=> 71 − 264 + 279 = ?

=> −193 + 279 = ?

=> 86

Hence, the correct answer is "Option 1".

Q56. Answer: (a) VO-RL-PS

The logic followed here is:

Given,

RK → NH → LO

TM → PJ → NQ

Now, checking the options:

Option 1) VO → RL → PS

Option 2) VO → RL → PT

Option 3) WO → RL → PT

Option 4) WO → SL → PT

Hence, the triad which strictly follows the same pattern is Option 1.

Q57. Answer: (d) (99, 111, 95)

The logic followed here is:

Logic: 2nd number − 1st number = 2nd number − 1st number = 12, and 3rd number = 1st number − 4

Let's check the given sets:

(59, 71, 55)

71 − 59 = 12

3rd number = 59 − 4 = 55

(85, 97, 81)

97 − 85 = 12

3rd number = 85 − 4 = 81

Now, Checking the options:

Option 1) (117, 129, 114)
129 − 117 = 12
3rd number = 117 − 4 = 113
Option 2) (121, 133, 116)
133 − 121 = 12
3rd number = 121 − 4 = 117
Option 3) (78, 90, 76)
90 − 78 = 12
3rd number = 78 − 4 = 74
Option 4) (99, 111, 95)
111 − 99 = 12
3rd number = 99 − 4 = 95
Hence, the correct option is "Option 4".

Q58. Answer: (a) 65

The logic followed here is:
thus, "65" will replace the question mark in the given series.
Hence, the correct option is "Option 1".

Q59. Answer: (b) XTYW

The logic followed here is:
For NJOM → TPUS
For PLQO → VRWU
Similarly, for RNSQ
So, RNSQ will be related to XTYW.
Hence, the correct answer is "Option 4".

Q60. Answer: (b) GFH

The logic followed here is:
Option 1) ECF
Option 2) GFH
Option 3) TRU
Option 4) PNQ
Hence, GFH is odd among the given options.
Hence, the correct answer is "Option 2".

Q61. Answer: (b) Only conclusion (I) follows

Given Statements:
Some pipe are hose.
All hose are tunnel.
The least possible Venn diagram for the given statement is:
Conclusions:
I. Some pipe are tunnel – True (Because some pipe are hose and all hose are tunnel, so those pipes that are hose are also tunnel).
II. All tunnel are hose – False (Because only all hose are tunnel is given; not all tunnel are hose).
So, Only conclusion I follows.
Hence, the correct answer is "Option 2".

Q62. Answer: (a) 129

The logic followed here is:
thus, "129" will replace the question mark in the given series.
Hence, the correct option is "Option 1".

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Q63. Answer: (d) 168

BODMAS Table:

Given equation: 29 B 6 C 243 A 9 D 33 = ?

Now, if 'A' stands for '÷', 'B' stands for '×', 'C' stands for '+' and 'D' stands for '−', then:

=> 29 × 6 + 243 ÷ 9 − 33 = ?

=> 174 + 27 − 33 = ?

=> 201 − 33 = ?

=> 168

Hence, the correct answer is "Option 4".

Q64. Answer: (a) JKXD

The logic followed here is:

For DGRZ → HNVG

For TIHB → XPLI

Similarly, for FDTW

So, FDTW will be related to JKXD.

Hence, the correct answer is "Option 1".

Q65. Answer: (a) F

Given: A, B, C, D, E and F are sitting around a circular table facing the centre.

D sits second to the left of B.

E sits second to the right of F.

C is on the immediate right of D.

Here, F is sitting on the immediate left of A.

Hence, the correct answer is "Option 1".

Q66. Answer: (a) Mother's sister

Family Chart:

Decoding the Symbols:

Symbol	•	@	•	#
Meaning	Sister	Brother	Wife	Father

Given: 'O + P - T # G @ V'

It means: O is the Sister of P, P is the Wife of T, T is the Father of G, G is the Brother of V.

So, O is the Mother's sister of V.

Hence, the correct answer is "Option 1".

Q67. Answer: (d) 7 km to the west

Given:

Mr. Z starts from Point A and drives 18 km towards the North.

He then takes a left turn, drives 14 km, then turns left and drives 14 km.

He then takes a right turn, drives 13 km, then turns left and drives 25 km.

He then takes a left turn and drives 34 km.

He takes a final left turn, drives 21 km, and stops at Point P.

So, He should drive 7 km to the west in order to reach Point A again.

Hence, the correct answer is "Option 4".

Q68. Answer: (c) 11th

Given:

Total students = 50

Shruti is 23rd from the left end

Daksh is 17th to the right of Shruti.

Daksh's position from the left end:

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=> Daksh's position from left = 23 + 17 = 40

Daksh's position from the right end:

=> Position from right = Total students − Position from left + 1

=> 50 − 40 + 1 = 11

Hence, Daksh's position from the right end is 11th.

Hence, the correct answer is "Option 3".

Q69. Answer: (b) hx

The logic followed here is:

'pig issue nod' is coded as 'cd hx gj',

'love nod news' is coded as 'vn va hx'.

Here,

Here, the code for 'nod' is hx.

Hence, the correct answer is "Option 2".

Q70. Answer: (a) EG – AB

The logic followed here is:

Option 1) EG – AB

Option 2) DF – ZY

Option 3) JL – FE

Option 4) RT – NM

Here, EG – AB is odd among the given options.

Hence, the correct answer is "Option 1".

Q71. Answer: (c) 1

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

Now,

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

So, Needed pattern is: Odd − Even − Even

So, there is only 1 even number satisfying the condition (6 preceded by 7 and followed by 8).

Hence, the correct answer is 'Option 3'.

Q72. Answer: (a) Only conclusion (I) follows

Given Statements:

Some Pomegranates are Peaches.

Some Peaches are Lemons.

All Lemons are Figs.

The least possible Venn diagram for the given statement is:

Conclusions:

I. Some Peaches are Figs – True (Because some Peaches are Lemons and all Lemons are Figs, so those Peaches that are Lemons are also Figs).

II. Some Pomegranates are Figs – False (Because the given statements do not guarantee that the Pomegranates that overlap with Peaches are the same Peaches that overlap with Lemons/Figs).

So, Only conclusion I follows.

Hence, the correct answer is "Option 1".

Q73. Answer: (b) 5

The logic followed here is:

LOVE: L, O, V, E → 2, 4, 3, 6

VALE: V, A, L, E → 3, 2, 4, 5

The letters L, V, and E appear in both words. Therefore, the digits representing them must also appear in both sets.

Shared letters => L, V, E

Shared digits => 2, 3, 4

Since the only letter in 'VALE' not present in 'LOVE' is 'A', and the only digit in '3245' not present in '2436' is '5'.

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So the code for ‘A’ is 5.
Hence, the correct answer is "Option 2".

Q74. Answer: (d) 3

Given: (Left) 8 7 1 7 8 2 9 6 7 4 7 8 8 9 3 3 2 8 7 9 8 (Right)
Now,
Odd digits which are immediately preceded by an odd digit and immediately followed by an even digit.
So, Needed pattern is: Odd − Odd − Even
8 7 1 7 8 2 9 6 7 4 7 8 8 9 3 3 2 8 7 9 8
So, there are 3 such odd digits.
Hence, the correct answer is 'Option 4'.

Q75. Answer: (c) 19th

Given:
Total students = 47
Neha is 21st from the right end
Kinjal is 8th to the left of Neha.
Neha’s position from the left end:
=> Position from left = Total students − Position from right + 1
=> 47 − 21 + 1 = 27
Kinjal’s position from the left end:
=> Kinjal’s position from left = 27 − 8 = 19
Hence, Kinjal’s position from the left end is 19th.
Hence, the correct answer is "Option 3".

Q76. Answer: (b) JBU 33

The logic followed here is:
So, 'JBU33' will replace the question mark in the given series.
Hence, the correct answer is "Option 2".

Q77. Answer: (a) 702

The logic followed here is:
thus, "702" will replace the question mark in the given series.
Hence, the correct option is "Option 1".

Q78. Answer: (a) L

Given: D, E, F, G, L, M and N are sitting in a straight line, facing north.
Only two people sit to the right of D.
Only two people sit between D and G.
Only two people sit between E and F.
F sits to the immediate left of D.
N sits to the immediate right of M.
So, L sits at the third position from the left end of the line.
Hence, the correct answer is "Option 1".

Q79. Answer: (b) JTA

The logic followed here is:
So, 'JTA' will replace the question mark in the given series.
Hence, the correct answer is "Option 2".

Q80. Answer: (d) U

Given: P, Q, R, S, T and U are sitting around a circular table facing the centre.
U sits second to the right of R.
Q sits second to the left of S.

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P is on the immediate left of Q.

Here, U is sitting on the immediate left of T.

Hence, the correct answer is "Option 4".

Q81. Answer: (a) Air India

The correct answer is Air India.

Key Points

• Air India hosted the prestigious Power Creator Awards 2025, showcasing its commitment to recognizing excellence in various fields.

• The Power Creator Awards is an initiative aimed at honoring individuals and organizations that have demonstrated exceptional creativity and impact in their respective domains.

• The event was organized by Air India as part of its ongoing efforts to strengthen its brand presence and enhance its engagement with diverse communities.

• The awards ceremony was attended by prominent figures from different industries, reflecting Air India's dedication to fostering cross-industry collaboration and inspiration.

• This initiative aligns with Air India's vision to connect and support creative professionals, further establishing its role as a key supporter of innovation and excellence.

Additional Information

• Air India:

• Founded: Air India, the flag carrier airline of India, was founded in 1932 by J.R.D. Tata as Tata Airlines.

• Nationalization: It was nationalized in 1953 and became a government-owned enterprise, playing a significant role in India's aviation sector.

• Privatization: In 2021, Air India was acquired by the Tata Group, marking its return to its original founders.

• Global Reach: The airline operates both domestic and international flights and is recognized for its extensive network and customer service.

• Power Creator Awards:

• The Power Creator Awards celebrate individuals and organizations that have made significant contributions in fields such as art, technology, business, and social impact.

• These awards aim to provide a platform for showcasing talent and inspiring others to pursue innovation and excellence.

• Other Airlines (Options):

• SpiceJet: A low-cost carrier known for its affordable pricing and extensive domestic network.

• Vistara: A premium airline offering enhanced customer experiences and a joint venture between Tata Sons and Singapore Airlines.

• IndiGo: India’s largest airline by market share, recognized for its punctuality and cost-efficient operations.

• Air India's Branding:

• By hosting events like the Power Creator Awards, Air India aims to strengthen its brand image as a supporter of creativity and innovation.

• Such initiatives also align with its strategy to engage with diverse audiences and promote cultural and professional excellence.

Important Points

• Significance of Awards:

• Awards like the Power Creator Awards play a crucial role in encouraging creativity and recognizing outstanding contributions in various fields.

• They serve as a platform for networking and collaboration among industry leaders and emerging talents.

• Air India's Role:

• By hosting such events, Air India reinforces its commitment to community engagement and supporting initiatives that align with its values.

• The airline uses these platforms to enhance its visibility and build lasting relationships with stakeholders across industries.

Q82. Answer: (c) Akash Prime

The correct answer is Akash Prime.

Key Points

• On 16 July 2025, India successfully destroyed two high-speed unmanned aerial targets at high altitude in the Ladakh region, marking a significant milestone in the country's defense capabilities.

• This achievement was accomplished using the Akash Prime, the upgraded variant of the Akash Weapon System designed specifically for the Indian Army.

• The Akash Prime is an advanced surface-to-air missile system that incorporates several improvements over its predecessor, including enhanced guidance systems, better accuracy, and the ability to operate in extreme weather conditions.

• The test conducted in Ladakh demonstrated the system's capability to neutralize aerial threats at high altitudes, making it particularly suitable for defending India's borders in mountainous regions.

• The Akash Weapon System, including its Prime variant, is part of India’s push toward achieving self-reliance in defense technology under the ‘Make in India’ initiative.

Additional Information

• Akash Prime:

• The Akash Prime is an upgraded version of the Akash surface-to-air missile system developed by the Defense Research and Development Organisation (DRDO).

• It is equipped with an indigenously developed active RF seeker for improved target tracking and interception.

• The system is capable of engaging multiple targets simultaneously and can operate in a variety of challenging environments.

• The Akash Prime can target enemy aircraft, drones, and cruise missiles, providing a robust layer of defense.

• BrahMos:

• The BrahMos is a supersonic cruise missile developed jointly by India and Russia.

• It is known for its high speed, precision, and ability to be launched from land, sea, and air platforms.

• Unlike Akash Prime, BrahMos is primarily an offensive missile designed for precision strikes on ground and naval targets.

• Pinaka:

• Pinaka is a multi-barrel rocket launcher system developed by DRDO and is used by the Indian Army.

• It is designed for area saturation and is capable of launching a salvo of rockets in a short period to neutralize enemy positions.

• Pinaka is not a surface-to-air missile system and thus is not relevant to countering aerial threats.

• Other Akash Variants:

• The original Akash Weapon System was developed as a medium-range surface-to-air missile system for the Indian Armed Forces.

• It has been deployed by both the Indian Army and Air Force to provide air defense against enemy aircraft and missiles.

• The Akash Advanced is another variant focused on enhanced range and lethality, but it lacks some of the specific advancements found in Akash Prime.

• Significance of the Test:

• The successful test of Akash Prime in Ladakh underscores India’s capability to defend its high-altitude borders effectively.

• It reflects the growing indigenization of defense technology under the ‘Atmanirbhar Bharat’ initiative.

• With advanced systems like Akash Prime, India strengthens its preparedness against aerial threats in high-altitude regions like Ladakh.

Important Points

• DRDO’s Role:

• The Defense Research and Development Organisation (DRDO) is the primary agency behind the design and development of the Akash Weapon System and its variants.

• DRDO is a key player in India’s defense self-reliance initiatives, producing a range of weapon systems and technologies.

• High-Altitude Defense:

• High-altitude regions like Ladakh pose unique challenges for defense systems due to thin air, extreme temperatures, and rugged terrain.

• The Akash Prime’s successful test in this environment demonstrates its suitability for deployment in such areas.

• Make in India Initiative:

• The Akash Prime is a product of India’s ‘Make in India’ initiative, which aims to reduce dependence on foreign defense imports.

• It also highlights India’s capability to develop advanced technologies indigenously.

Q83. Answer: (c) New Delhi

The correct answer is New Delhi.

Key Points

• The first-ever International Big Cat Alliance (IBCA) Assembly was held in New Delhi, India, in June 2025.

• The IBCA was established to protect and conserve big cats such as lions, tigers, leopards, cheetahs, jaguars, and snow leopards, which are facing threats due to habitat loss, poaching, and human-wildlife conflict.

• The assembly focused on building global cooperation to ensure the long-term conservation and survival of these majestic species.

• New Delhi, being the capital city of India, was chosen as the venue to emphasize India's commitment to wildlife conservation and

its leadership role in the global conservation community.

• The event saw participation from member countries, conservation organizations, researchers, and policymakers aiming to strengthen partnerships and share best practices for big cat conservation.

Additional Information

• International Big Cat Alliance (IBCA):

• The IBCA was launched as a global initiative by India to protect big cats, with a focus on cooperative conservation efforts.

• It aims to bring together countries and organizations working on big cat conservation under a unified platform to share knowledge, resources, and strategies.

• India has a rich legacy of big cat conservation, including iconic species like the Bengal tiger, Asiatic lion, and leopard.

• Big Cats and Their Global Importance:

• Big cats are apex predators and play a crucial role in maintaining the balance of ecosystems.

• Species like tigers, lions, and cheetahs are considered keystone species, meaning their presence ensures the health and stability of their habitats.

• Conservation of big cats also has a cultural and economic significance, as they attract ecotourism and are symbols of biodiversity.

• India's Role in Big Cat Conservation:

• India is home to several big cat species, including the Bengal tiger, Asiatic lion, and leopard.

• India has successfully implemented conservation programs such as Project Tiger (launched in 1973) and Project Lion to protect and increase the population of these species.

• India also reintroduced cheetahs in 2022 under the Cheetah Reintroduction Project, making it a global leader in wildlife conservation.

• Global Threats to Big Cats:

• Big cats face threats such as habitat loss due to deforestation, human encroachment, and urbanization.

• Illegal wildlife trade and poaching remain significant challenges, fueled by demand for big cat skins, bones, and other parts.

• Human-wildlife conflict is another major issue, particularly in areas where big cats and humans share close proximity.

Important Points

• Global Conservation Efforts:

• Organizations like the World Wildlife Fund (WWF) and the International Union for Conservation of Nature (IUCN) are actively involved in big cat conservation.

• Programs such as the Global Tiger Initiative and Snow Leopard Trust aim to conserve specific big cat species and their habitats.

• India's Conservation Milestones:

• India hosts over 70% of the world's tiger population and has successfully increased their numbers through dedicated conservation efforts.

• The Gir Forest National Park in Gujarat is the last refuge of the Asiatic lion, and conservation efforts have helped stabilize their population.

Q84. Answer: (a) Aryna Sabalenka

The correct answer is Aryna Sabalenka.

Key Points

• Madison Keys emerged victorious in the Australian Open 2025 final by defeating Aryna Sabalenka, showcasing an exceptional performance.

• This victory marked a significant milestone in Madison Keys' career, earning her another prestigious Grand Slam title.

• Aryna Sabalenka, a top-seeded player and a fierce competitor, put up a strong fight but was unable to match the precision and power of Madison Keys in the final match.

• The match was held at the iconic Rod Laver Arena in Melbourne, Australia, known for hosting the Australian Open finals.

• Madison Keys' consistency and aggressive playing style were key factors in her triumph over Aryna Sabalenka in this high-stakes encounter.

Additional Information

• Madison Keys:

• She is an American professional tennis player known for her powerful serve and aggressive baseline game.

• Keys has been a consistent performer on the WTA tour and has reached multiple Grand Slam semifinals in her career.

• She was born on February 17, 1995, in Rock Island, Illinois, USA.

• Her career-high WTA ranking is world No. 7, achieved in October 2016.

• Aryna Sabalenka:

• Sabalenka is a Belarusian professional tennis player and a former world No. 2 in singles.
• She is known for her aggressive style of play and has won several WTA titles, including Grand Slam doubles titles.
• Sabalenka has been a consistent performer in major tournaments, often reaching the final stages.
• Australian Open:
• One of the four Grand Slam tennis tournaments held annually, it takes place in Melbourne, Australia.
• The tournament is played on hard courts and is known for its fast-paced matches.
• The Australian Open is the first Grand Slam of the calendar year, typically held in January.
• Rod Laver Arena:
• It is the main venue for the Australian Open, named after the legendary Australian tennis player Rod Laver.
• The arena has a seating capacity of approximately 14,820 and features a retractable roof for all-weather play.

Important Points

• Grand Slam Tournaments:
• The four Grand Slam tournaments are the Australian Open, French Open, Wimbledon, and US Open.
• Each of these tournaments is held annually and represents the highest level of competition in professional tennis.
• Grand Slam titles are highly coveted and are a measure of a player's success and legacy in tennis.
• Notable Players in 2025:
• Madison Keys: Known for her powerful game and mental resilience.
• Aryna Sabalenka: Renowned for her aggressive style and consistent performances.
• Naomi Osaka: A multiple Grand Slam champion and one of the most recognizable athletes globally.
• Elena Rybakina: A rising star with a strong serve and all-court game.
• Ons Jabeur: Known for her variety and creativity on the court.

Q85. Answer: (a) 38

The correct answer is 38.

Key Points

• India's overall score in the Corruption Perceptions Index (CPI) for 2024 was 38, as released in February 2025.
• The Corruption Perceptions Index (CPI) is an annual report published by Transparency International which ranks countries based on perceived levels of public sector corruption.
• The score of 38 indicates that India has a moderate corruption level, as the CPI scoring system ranges from 0 (highly corrupt) to 100 (very clean).
• India's ranking in the CPI is influenced by factors such as governance, transparency, and institutional integrity.
• This score is consistent with India's ongoing efforts to combat corruption through measures like Digital India initiatives, e-governance, and improved judicial mechanisms.

Additional Information

• Corruption Perceptions Index (CPI):
• The CPI is a globally recognized index published by Transparency International, a non-governmental organization headquartered in Berlin, Germany.
• It ranks countries based on perceptions of corruption in the public sector, using data from multiple surveys and expert assessments.
• A score of 0 represents a highly corrupt nation, while a score of 100 indicates a corruption-free nation.
• The index covers 180 countries and territories worldwide.
• India's Performance in Recent Years:
• India's CPI score has fluctuated between 36 and 40 in the last decade, reflecting challenges in governance and anti-corruption measures.
• In the CPI for 2023 (released in 2024), India's score was 36, indicating a slight improvement in the 2024 score of 38.
• Global Trends in CPI:
• Countries like Denmark, Finland, and New Zealand consistently rank at the top of the CPI with scores above 85, reflecting low levels of corruption.
• Countries with the lowest scores include Somalia, Syria, and South Sudan, with scores below 15, indicating severe corruption challenges.
• Government Initiatives to Curb Corruption in India:
• Implementation of the Right to Information (RTI) Act to enhance transparency and accountability in governance.
• Introduction of e-Governance initiatives like Direct Benefit Transfer (DBT) to reduce leakages in welfare schemes.

• Efforts to strengthen anti-corruption agencies like the Central Vigilance Commission (CVC) and the Lokpal and Lokayuktas.

Important Points

• Methodology of CPI:

• The CPI aggregates data from 13 different sources, including surveys conducted by organizations like the World Bank and the World Economic Forum.

• These sources assess corruption in areas like bribery, misuse of public funds, and nepotism.

• Examples of Anti-Corruption Success:

• Countries like Estonia and Georgia have significantly improved their CPI scores by implementing e-governance and judicial reforms.

• India's initiatives like GST implementation and the Insolvency and Bankruptcy Code (IBC) have contributed to improving transparency.

Q86. Answer: (c) SDG 7

The correct answer is SDG 7.

Key Points

• The Sustainable Development Goal (SDG) 7 is focused on ensuring access to affordable, reliable, sustainable, and modern energy for all. The growth in renewable energy capacity directly supports this goal.

• As per the Sustainable Development Goals – National Indicator Framework Progress Report, 2025, India's installed renewable energy capacity increased from 64.04 watts per capita in 2014–15 to 156.31 watts per capita in 2024–25, showcasing significant progress in renewable energy development.

• This increase aligns with SDG 7, specifically targeting the expansion of renewable energy to ensure sustainability and reduce dependence on fossil fuels.

• The promotion of renewable energy also contributes to reducing greenhouse gas emissions, indirectly supporting other SDGs like SDG 13 (Climate Action).

• India’s renewable energy initiatives, including solar, wind, and hydroelectric power projects, play a key role in achieving the targets set under SDG 7 by ensuring sustainable energy production and consumption.

Additional Information

• Sustainable Development Goal 7:

• SDG 7 aims to ensure universal access to modern energy services, improve energy efficiency, and increase the share of renewable energy in the global energy mix.

• It is one of the 17 SDGs adopted by the United Nations in 2015 as part of the 2030 Agenda for Sustainable Development.

• Key targets under SDG 7 include achieving universal access to affordable, reliable, and modern energy services by 2030, and substantially increasing the share of renewable energy in the global energy mix.

• India’s Renewable Energy Initiatives:

• India has set a target of achieving 500 GW of non-fossil fuel capacity by 2030 under its updated Nationally Determined Contributions (NDCs).

• The country has launched several initiatives, such as the National Solar Mission, to promote solar energy and achieve net-zero emissions by 2070.

• India is also a founding member of the International Solar Alliance (ISA), which promotes the use of solar energy worldwide.

• Impact of Renewable Energy on Other SDGs:

• While SDG 7 specifically focuses on energy, renewable energy development also contributes to other goals like SDG 13 (Climate Action), SDG 9 (Industry, Innovation, and Infrastructure), and SDG 12 (Responsible Consumption and Production).

• For instance, reducing reliance on fossil fuels helps mitigate climate change, directly supporting SDG 13.

• Important Points:

• SDG 13 (Climate Action): While renewable energy supports climate action by reducing greenhouse gas emissions, it is not the primary SDG linked to the renewable energy capacity metric mentioned in the question.

• SDG 9 (Industry, Innovation, and Infrastructure): This goal emphasizes innovation and infrastructure development. While renewable energy infrastructure contributes to this SDG, it is not the primary focus.

• SDG 12 (Responsible Consumption and Production): This goal focuses on sustainable consumption and production patterns but is not directly linked to the renewable energy capacity metric.

Q87. Answer: (b) PRAVAAH Portal

The correct answer is PRAVAAH Portal.

Key Points

• The Reserve Bank of India (RBI) has mandated stakeholders to use the PRAVAAH Portal from 1 May 2025.

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• PRAVAAH stands for Platform for Regulatory Application, Validation, and Authorization, developed by the RBI to streamline regulatory processes and interactions between regulated entities and the central bank.

• The portal aims to provide a digital mechanism for regulatory applications, reducing paperwork and enhancing processing efficiency.

• It is part of the RBI's digital transformation initiatives to improve transparency and accountability in regulatory processes.

• The platform will be utilized for submitting, tracking, and managing regulatory applications and approvals by banks, NBFCs, and other regulated entities.

Additional Information

• SAKSHAM Portal:

• SAKSHAM stands for System for Authority and Knowledge Sharing for Holistic Access to Management.

• This portal is used by various ministries and departments for tracking and monitoring the implementation of government schemes and initiatives.

• It is primarily focused on enhancing the efficiency of governance-related processes.

• SEVA Portal:

• The SEVA Portal is an initiative of the Ministry of Power to address consumer grievances related to electricity services.

• It provides a platform to raise complaints and track their resolution by state electricity boards and DISCOMs.

• It is not related to the regulatory framework of the RBI.

• VITARAN Portal:

• VITARAN is an online platform developed for electricity distribution companies to manage billing, payments, and consumer information.

• It is aimed at improving operational efficiency in the energy sector and enhancing consumer satisfaction.

• This portal is unrelated to the RBI's regulatory functions.

• PRAVAAH Portal Features:

• The portal will provide a centralized mechanism for submitting and processing applications like licensing, renewals, and other regulatory approvals.

• Stakeholders will benefit from real-time tracking of application status and notifications for updates.

• The platform is expected to reduce delays and improve the overall efficiency of regulatory processes.

Important Points

• Regulatory Reforms by RBI:

• The RBI has been undertaking various reforms to digitize and streamline regulatory mechanisms in India.

• Platforms like PRAVAAH are aligned with the objective of enhancing the ease of doing business and improving compliance processes for regulated entities.

• Implementation Timeline:

• The mandatory use of the PRAVAAH portal will begin from 1 May 2025, giving stakeholders sufficient time to adapt to the new system.

• This timeline reflects the RBI's efforts to ensure a smooth transition for all stakeholders involved.

Q88. Answer: (a) Ravichandran Ashwin

The correct answer is Ravichandran Ashwin.

Key Points

• Ravichandran Ashwin is one of India’s most celebrated cricketers, known for his exceptional skills as an all-rounder, primarily excelling as an off-spin bowler.

• In 2025, he was awarded the Padma Shri, India’s fourth-highest civilian award, for his outstanding contribution to Indian cricket.

• The Padma Shri is awarded to individuals who demonstrate excellence in their respective fields, including sports, arts, literature, science, and public service.

• Ravichandran Ashwin has been a crucial player for the Indian cricket team, with significant achievements such as being one of the fastest bowlers to reach 400 wickets in Test cricket.

• He has also contributed significantly with the bat, scoring multiple centuries in Test matches, showcasing his versatility as an all-rounder.

• His tactical brilliance and ability to perform under pressure have made him a cornerstone of the Indian cricket team, both in domestic and international formats.

Additional Information

• Ravichandran Ashwin's Career Highlights:

• Ashwin has been a consistent performer in the Indian Premier League (IPL), where he has represented teams like Chennai

Super Kings, Punjab Kings, and Rajasthan Royals.

• He became the fastest Indian bowler to reach 50, 100, 200, 300, and 400 Test wickets, showcasing his dominance in the format.

• In addition to his bowling, Ashwin has scored over 5 Test centuries, making him one of the most successful all-rounders of his generation.

• He was named the ICC Cricketer of the Year in 2016, further solidifying his place as one of the greats of the game.

• About the Padma Shri Award:

• The Padma Shri is one of the highest civilian honors in India, established in 1954.

• It is awarded to individuals for their distinguished contributions in various fields such as art, literature, education, sports, medicine, social work, science, public affairs, and more.

• The recipients are announced annually on the eve of Republic Day (26th January).

• The awards are conferred by the President of India at a ceremonial function held at the Rashtrapati Bhavan.

• Other Achievements of Indian Cricketers:

• Virat Kohli, another iconic Indian cricketer, was previously awarded the Padma Shri in 2017 for his contributions to cricket.

• MS Dhoni, former Indian captain, was honored with the Padma Shri in 2009 and later with the Padma Bhushan in 2018.

• Sachin Tendulkar, widely regarded as one of the greatest cricketers in history, was awarded the Bharat Ratna, India's highest civilian honor, in 2014.

Important Points

• The Padma Awards (Padma Vibhushan, Padma Bhushan, and Padma Shri) are announced annually and are a recognition of exceptional achievements in their respective fields.

• Recipients of the Padma Shri are recommended by various state governments, ministries, and even members of the public. The final list is approved by the Padma Awards Committee and the President of India.

• Ashwin's recognition with the Padma Shri in 2025 underscores his remarkable impact on Indian cricket and his consistent performance over the years.

Q89. Answer: (b) Canada

The correct answer is Canada.

Key Points

• The 51st G7 Summit is scheduled to take place in June 2025, hosted by Canada.

• Canada, as a founding member of the Group of Seven (G7), has hosted numerous G7 summits in the past. Its selection for hosting the 51st summit aligns with its active participation in global economic and geopolitical discussions.

• The G7 Summit is an annual meeting attended by the heads of state or government of the world's most advanced economies, including the United States, United Kingdom, Germany, France, Italy, Japan, and Canada, along with representatives from the European Union.

• The summits primarily focus on key global challenges such as economic growth, international trade, climate change, security, and human rights.

• The venue for the summit in Canada has yet to be officially announced but is expected to be a location capable of accommodating high-level diplomatic discussions, ensuring security, and showcasing Canada's cultural heritage and natural beauty.

Additional Information

• Group of Seven (G7):

• The G7 is an informal grouping of seven of the world's largest advanced economies: the United States, United Kingdom, Germany, France, Italy, Japan, and Canada. The European Union also participates as a non-enumerated member.

• It was formed in 1975 as the G6, and Canada joined in 1976, making it the G7.

• The G7 countries represent about 40% of global GDP and are known for their influence on economic policy, international relations, and global security.

• Canada's Role in G7:

• Canada has been a key advocate for addressing global issues such as climate change, gender equality, and inclusive economic growth.

• Previous G7 summits hosted by Canada include the 2018 summit in Charlevoix, Quebec, which focused on themes such as economic growth and gender equality.

• Key Themes of the G7 Summit:

• The G7 summits typically address pressing global challenges such as climate change, trade relations, health crises, and geopolitical tensions.

• Recent summits have also focused on post-pandemic recovery, digital transformation, global vaccine distribution, and economic resilience.

• Notable Facts about G7:

• The G7 operates without a permanent secretariat or headquarters, and its presidency rotates annually among the member states.

• The host country sets the agenda and organizes the summit, showcasing its priorities on the global stage.

Important Points

• Recent G7 Summits:

• 49th Summit (2023): Held in Hiroshima, Japan, focusing on nuclear disarmament, economic security, and climate change.

• 50th Summit (2024): Scheduled to be hosted by Italy, with an expected focus on geopolitical tensions and sustainable development.

• Canada's Previous Hosting of G7:

• Canada has hosted the G7 summit six times, with notable events in 1981 (Montebello), 1988 (Toronto), and 2018 (Charlevoix).

• These summits have showcased Canada's commitment to multilateralism and addressing global challenges.

• Significance of the Host Country:

• The host country has the privilege of setting the agenda and themes for the summit, influencing global policymaking and fostering international cooperation.

• It also provides an opportunity to highlight domestic policies, cultural heritage, and leadership on global issues.

Q90. Answer: (d) Delhi

The correct answer is Delhi.

Key Points

• The Delhi government approved five cloud-seeding trials in May 2025 to combat the severe issue of air pollution, specifically smog and particulate matter.

• An amount of Rs. 3.21 crore was allocated for these trials, showcasing a significant step toward implementing scientific methods to tackle environmental issues.

• Cloud seeding is a weather modification technique that involves dispersing substances like silver iodide or potassium iodide into the atmosphere to induce rainfall. This helps in reducing airborne pollutants by bringing them to the ground.

• The initiative was taken in response to worsening air quality in Delhi, which has consistently ranked as one of the most polluted cities globally according to the World Air Quality Index.

• This effort aligns with the broader environmental goals of the National Capital Territory (NCT) of Delhi to improve public health and mitigate the adverse impacts of pollution.

Additional Information

• What is Cloud Seeding?

• Cloud seeding is a form of weather modification where chemicals like silver iodide, potassium iodide, or dry ice are dispersed into clouds to encourage precipitation.

• The method is used globally for purposes like rain enhancement, snowpack augmentation, and hail suppression.

• It helps in reducing air pollution by washing down particulate matter and other pollutants from the atmosphere.

• Air Pollution in Delhi:

• Delhi faces severe air pollution due to factors like vehicular emissions, industrial activities, construction dust, and stubble burning in nearby states.

• During winter, the pollution levels worsen due to the formation of smog, which is a mixture of smoke and fog.

• The Air Quality Index (AQI) often crosses hazardous levels, causing respiratory and cardiovascular health issues.

• Alternative Measures Taken by the Delhi Government:

• Implementation of the Graded Response Action Plan (GRAP) to tackle pollution during high-risk periods.

• Promotion of electric vehicles (EVs) under the Delhi EV Policy.

• Introduction of the Odd-Even Traffic Scheme to reduce vehicular emissions.

• Deployment of air purifiers and anti-smog guns at construction sites.

• Global Examples of Cloud Seeding:

• The United Arab Emirates uses cloud seeding to enhance rainfall in its arid climate.

• China deployed extensive cloud seeding programs during the 2008 Beijing Olympics to ensure clear skies.

• The United States uses cloud seeding in states like Colorado and Wyoming to increase snowpack for water resources.

Important Points

• Effectiveness of Cloud Seeding: While cloud seeding is a promising solution, its effectiveness depends on the availability of suitable clouds and specific atmospheric conditions.

• Health Impacts of Air Pollution: Long-term exposure to pollutants like PM2.5 and PM10 can lead to respiratory diseases,

cardiovascular problems, and reduced life expectancy.

• International Support: Many countries, including Germany and Japan, are collaborating with India to share expertise and technology for pollution control.

• Public Awareness Campaigns: The Delhi government also conducts campaigns to educate the public about pollution control measures and the importance of sustainable practices.

Q91. Answer: (b) March 2025

The correct answer is Mar 01.

Key Points

• The Surya VHF radar is a significant technological advancement for the Indian Air Force, designed to enhance its surveillance and operational capabilities.

• The radar was reportedly handed over to the Indian Air Force on Sat Mar 01 2025, marking a milestone in India's indigenous defense development efforts.

• The handover date of March 1, 2025, is critical, as it represents the culmination of collaborative efforts between Indian defense research organizations and manufacturers.

• The radar is expected to strengthen India's air defense system by offering capabilities such as early warning, tracking, and monitoring of aerial threats.

• This development aligns with the Indian government's focus on self-reliance in defense technology under the "Make in India" initiative.

Additional Information

• Surya VHF Radar:

• The Surya VHF radar is an advanced radar system designed for aerial surveillance and tracking purposes.

• It operates on the Very High Frequency (VHF) band, making it suitable for detecting low-altitude aircraft and stealth operations.

• The radar is equipped with state-of-the-art signal processing and detection capabilities, ensuring high accuracy and reliability.

• It is developed as part of India's initiative to boost indigenous defense manufacturing and reduce reliance on foreign technology.

• Indian Air Force Role:

• The Indian Air Force plays a crucial role in ensuring national security by maintaining aerial superiority and conducting surveillance operations.

• Integration of advanced radar systems such as Surya VHF enhances the Air Force's ability to detect and respond to aerial threats promptly.

• The radar contributes to airspace management and monitoring, ensuring the safety of civilian and military operations.

• Make in India Initiative:

• The Make in India initiative aims to promote indigenous manufacturing across various sectors, including defense.

• It encourages collaboration between government organizations like the Defence Research and Development Organisation (DRDO) and private entities to develop cutting-edge technology.

• The successful development and deployment of Surya VHF radar highlight India's capability in designing and producing advanced defense equipment.

• VHF Radar Applications:

• VHF radars are widely used for air traffic control, ground-based surveillance, and military applications.

• They are particularly effective in detecting low-altitude aircraft and minimizing blind spots caused by terrain or other obstacles.

• The radar systems also provide early warning capabilities, ensuring proactive responses to potential threats.

Important Points

• Indigenous Radar Development:

• India's focus on developing indigenous radar systems aims to reduce dependency on foreign imports and enhance self-reliance.

• Projects like Surya VHF radar demonstrate India's capability to produce high-performance equipment for defense applications.

• Defense Research Organizations:

• Organizations like the DRDO and Bharat Electronics Limited (BEL) play a pivotal role in the development and deployment of advanced defense systems.

• These organizations collaborate with academia and industry partners to ensure the successful execution of projects like Surya VHF radar.

Q92. Answer: (c) Satyesha Leuva

The correct answer is Satyesha Leuva.

Key Points

• Satyesha Leuva, a student activist, became the first Student Federation of India (SFI) member to be elected as a sarpanch in

Gujarat in June 2025.

• The election represents a significant milestone for the SFI, a left-wing student organization, in a state traditionally dominated by other political affiliations.

• Her victory highlights the growing influence of student-led activism in rural areas and their contribution to local governance.

• Satyesha Leuva's campaign focused on addressing local issues such as education, employment opportunities, and infrastructure development, which resonated with the voters.

• Her election is seen as a progressive step towards youth participation in grassroots governance in Gujarat.

Additional Information

• Student Federation of India (SFI):

• The SFI was established in 1970 as a left-wing student organization affiliated with the Communist Party of India (Marxist).

• The organization advocates for secularism, democracy, and socialism and works towards addressing issues concerning students such as affordable education and social justice.

• SFI has a significant presence in states like Kerala, West Bengal, and Tripura, but its influence in Gujarat is relatively new and growing.

• Role of Sarpanch:

• A sarpanch is the elected head of a Gram Panchayat, the village-level local governance body in India.

• The sarpanch plays a vital role in implementing government schemes, ensuring rural development, and addressing the needs of the villagers.

• Key responsibilities include overseeing infrastructure development, sanitation, education, and healthcare initiatives at the village level.

• Political Landscape in Gujarat:

• Gujarat's politics has been traditionally dominated by right-wing parties, with limited representation from left-wing organizations like the SFI.

• The election of Satyesha Leuva signifies a shift, showcasing increased youth and grassroots participation in governance.

• Impact of Youth in Governance:

• Youth participation in governance brings fresh perspectives and innovative ideas to address local challenges.

• It encourages greater involvement of the community, especially younger generations, in decision-making processes.

• Such representation also strengthens the democratic fabric at the grassroots level.

Important Points

• Election Process for Sarpanch:

• Sarpanch elections are conducted at the village level and follow the principles of direct democracy.

• Eligible voters from the village cast their votes to elect the sarpanch.

• The election process is overseen by the state election commission to ensure transparency and fairness.

• Challenges in Rural Governance:

• Rural areas often face issues such as lack of infrastructure, limited access to education, healthcare, and employment opportunities.

• Efficient governance at the grassroots level is essential to address these challenges and promote sustainable development.

• Young leaders like Satyesha Leuva bring energy and fresh ideas to tackle these issues effectively.

• Student Activism:

• Student activism has historically played a crucial role in shaping societal changes and advocating for progressive policies.

• Organizations like SFI promote a platform for students to voice their concerns and contribute to political and social movements.

• Their involvement in governance highlights the importance of youth in driving change and ensuring representation for marginalized communities.

Q93. Answer: (a) Regional Integrated Multi-Hazard Early Warning System

The correct answer is Regional Integrated Multi-Hazard Early Warning System.

Key Points

• The Regional Integrated Multi-Hazard Early Warning System (RIMES) is an intergovernmental institution designed to enhance regional capacities in disaster preparedness and mitigation.

• RIMES was established in collaboration with the United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP) in 2009 after the 2004 Indian Ocean Tsunami.

• The organization provides early warning systems for natural hazards such as tsunamis, cyclones, floods, and droughts, thereby reducing the risks associated with these disasters.

• RIMES comprises member states from Asia, Africa, and the Pacific, including countries like India, Sri Lanka, Thailand, and

others that are highly vulnerable to natural calamities.

• It works through collaborative efforts, offering training, technical support, and forecasting tools to member countries to strengthen their disaster management frameworks.

Additional Information

• Background:

• The establishment of RIMES was necessitated by the 2004 Indian Ocean Tsunami, which highlighted the lack of coordinated early warning systems in the region.

• RIMES was formally launched in 2009, with its headquarters located in Bangkok, Thailand.

• Functions:

• RIMES specializes in the development of early warning systems for multi-hazard scenarios, including weather-related and geophysical threats.

• It offers technical assistance to member countries in interpreting and applying hazard forecasts to mitigate risks.

• The organization also promotes capacity building by providing training programs for disaster risk reduction.

• Member Countries:

• RIMES has a membership of 22 countries, including India, Myanmar, Indonesia, Sri Lanka, and Bangladesh. Its services extend to over 40 countries worldwide.

• India is an active member and plays a significant role in disaster management initiatives under RIMES.

• Technology and Tools:

• RIMES utilizes advanced technologies such as satellite imagery, climate modeling, and real-time monitoring to provide accurate hazard predictions.

• It operates the, which is equipped to monitor hazard events and disseminate alerts.

• Impact:

• RIMES has significantly improved disaster preparedness in member states, enabling them to respond effectively to natural hazards.

• Its efforts have reduced the loss of lives and property, particularly in disaster-prone regions.

Important Points

• Option Analysis:

• Option 1: Regional Integrated Multi-Hazard Early Warning System – This is the correct answer as it accurately represents the full form and purpose of RIMES.

• Option 2: Regional Institute for Meteorological and Environmental Studies – This option is incorrect as it does not align with the objectives or structure of RIMES.

• Option 3: Risk Information and Monitoring of Emergency Situations – This is incorrect; RIMES focuses on early warning systems rather than emergency monitoring.

• Option 4: Research Initiative for Mitigating Environmental Shocks – This option is not valid as RIMES is primarily a disaster preparedness organization, not a research initiative.

• Option 5: Blank – This option is irrelevant as it does not provide any information.

• Significance:

• RIMES plays a vital role in disaster risk reduction, helping member countries build resilience against natural hazards.

• Its collaborative approach fosters international cooperation and the sharing of resources and expertise.

Q94. Answer: (a) Gurugram

The correct answer is Gurugram.

Key Points

• The first-ever national conference of Urban Local Body Chairpersons across Indian States and Union Territories was inaugurated by Lok Sabha Speaker Shri Om Birla in July 2025.

• The conference was held in Gurugram, Haryana, emphasizing the importance of urban governance and decentralized administration.

• The aim of the conference was to provide a platform for Urban Local Body (ULB) leaders to share ideas, experiences, and best practices for improving urban management.

• The event highlighted the role of ULBs in implementing flagship government schemes and addressing challenges such as urbanization, infrastructure development, waste management, and public services.

• Lok Sabha Speaker Shri Om Birla stressed the need for strengthening local governance and ensuring active participation of citizens in urban decision-making processes.

Additional Information

• Urban Local Bodies (ULBs):

• ULBs are local government institutions responsible for managing urban areas such as cities and towns.
• They include municipal corporations, municipal councils, and town panchayats.
• ULBs play a key role in implementing policies related to urban infrastructure, sanitation, housing, transport, and public health.
• The 74th Constitutional Amendment Act provides the framework for the functioning of Urban Local Bodies in India.
• Importance of Decentralized Governance:
• Decentralized governance ensures efficient delivery of services and empowers local communities to actively participate in decision-making.
• It promotes accountability and transparency in the administration of urban areas.
• Decentralization strengthens the role of local leaders in addressing specific urban challenges such as traffic congestion and waste management.
• Urbanization in India:
• India is experiencing rapid urbanization, with more than 34% of the population living in urban areas as of 2021.
• Urbanization presents challenges such as housing shortages, pollution, and increased demand for basic services.
• Government schemes like Smart Cities Mission aim to address these challenges by modernizing urban infrastructure.
• Flagship Government Programs:
• Programs such as Swachh Bharat Mission, Atal Mission for Rejuvenation and Urban Transformation (AMRUT), and Pradhan Mantri Awas Yojana aim to improve urban living conditions.
• ULBs play a pivotal role in implementing these initiatives and ensuring their success.

Important Points

• Role of Lok Sabha Speaker:
• Shri Om Birla, as the Speaker of Lok Sabha, has been actively involved in initiatives to strengthen democratic institutions and governance at all levels.
• His participation in the conference underscores the importance of local governance in India's democratic framework.
• Significance of Gurugram:
• Gurugram is one of India's leading urban centers, known for its rapid development and modern infrastructure.
• The city serves as a hub for discussions on urban challenges and solutions, making it a fitting location for the conference.

Q95. Answer: (b) 90%

The correct answer is 0.9%.

Key Points

• The June 2025 India Child Protection report highlighted the alarming situation of child labour in India.
• A total of 44,902 children were rescued during the reporting period under child protection initiatives.
• Out of these rescued children, 0.9% were found in the worst forms of child labour, which include hazardous industries, bonded labour, and child trafficking for labour exploitation.
• The term "worst forms of child labour" is defined under the International Labour Organization (ILO) Convention No. 182, which India ratified in 2017. It includes activities that are hazardous or exploitative for children.
• The correct percentage is 0.9%, which signifies the proportion of children engaged in these severe forms of exploitation.

Additional Information

• Definition of Child Labour:
• The term "child labour" refers to the employment of children in any work that deprives them of their childhood, interferes with their ability to attend school, and is mentally, physically, socially, or morally harmful.
• It is defined in the Child Labour (Prohibition and Regulation) Act, 1986 in India.
• Worst Forms of Child Labour:
• Activities categorized under "worst forms" include slavery or practices similar to slavery, such as debt bondage, forced labour, and trafficking.
• Engagement in hazardous industries like mining, construction, and chemical production also falls under this category.
• Legal Framework in India:
• The Child Labour (Prohibition and Regulation) Amendment Act, 2016 prohibits the employment of children below 14 years in any form of labour and adolescents (14-18 years) in hazardous occupations.
• The Right to Education Act, 2009 ensures free and compulsory education for children aged 6 to 14 years, addressing one of the root causes of child labour.
• International Efforts:
• The ILO's International Programme on the Elimination of Child Labour (IPEC) aims to eliminate child labour globally.
• India ratified the ILO Convention No. 138 (Minimum Age Convention) and No. 182 (Worst Forms of Child Labour Convention) in

2017, committing to abolishing child labour.

• Important Statistics:

• According to the 2021 UNICEF report, approximately 160 million children globally are engaged in child labour, with a significant proportion in hazardous work.

• In India, the Census 2011 reported over 10 million children engaged in child labour, though recent initiatives have significantly reduced this number.

Important Points

• Government Initiatives in India:

• The National Child Labour Project (NCLP) scheme rehabilitates children withdrawn from child labour and provides them with education and vocational training.

• The PENCIL portal (Platform for Effective Enforcement for No Child Labour) was launched in 2017 to ensure effective enforcement of child labour laws.

• Role of NGOs:

• Organizations like Bachpan Bachao Andolan and Child Rights and You (CRY) have been instrumental in rescuing children and spreading awareness about child labour.

• Challenges in Eradicating Child Labour:

• Poverty, lack of education, and social norms continue to drive child labour in India and globally.

• Effective enforcement of laws and rehabilitation of rescued children remain significant challenges.

Q96. Answer: (d) Subhash Rana

The correct answer is Subhash Rana.

Key Points

• Subhash Rana was awarded the prestigious Dronacharya Award in 2025 for his exceptional coaching in the field of para-shooting.

• The Dronacharya Award is conferred annually by the Government of India to recognize outstanding coaches who have contributed significantly to the development of athletes and sports in India.

• Subhash Rana's guidance and mentorship have played a pivotal role in the success of Indian para-shooters at both national and international levels.

• Under his training, several Indian para-shooters have achieved remarkable success, including medals in the Paralympic Games, World Shooting Championships, and other global competitions.

• His dedication to nurturing talent in the para-sports community highlights the importance of inclusivity and equal opportunities in the field of sports.

Additional Information

• Dronacharya Award:

• The Dronacharya Award was instituted in 1985 by the Ministry of Youth Affairs and Sports, Government of India.

• It recognizes coaches who have consistently produced outstanding sportspersons and brought laurels to the country.

• The award includes a bronze statuette of Dronacharya, a certificate, ceremonial dress, and a cash prize.

• Para-shooting:

• Para-shooting is an adaptive sport in shooting for athletes with physical impairments.

• It is governed by the International Paralympic Committee (IPC) and follows the rules of the International Shooting Sport Federation (ISSF).

• Events include rifle and pistol shooting, conducted in categories such as SH1 and SH2, based on the level of physical impairment.

• Achievements of Indian Para-Shooters:

• India has produced several successful para-shooters, such as Avani Lekhara, who won a gold medal in the Tokyo Paralympics 2020.

• Other notable para-shooters include Singhraj Adhana and Manish Narwal, who have brought glory to India on the global stage.

• Significance of Coaching in Sports:

• Coaches play a critical role in identifying and nurturing sports talent and ensuring athletes reach their full potential.

• They provide technical training, psychological support, and strategic insights to help athletes perform at their best.

Important Points

• Other Notable Dronacharya Awardees:

• Deepali Deshpande: A renowned shooting coach, primarily focused on mainstream shooting events.

• Sandeep Sangwan: Known for his contributions to wrestling coaching in India.

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• S Muralidharan: Recognized for his coaching in athletics.

• Para-Sports in India:

• The Paralympic Committee of India (PCI) is the national governing body for para-sports in India.

• India has significantly improved its performance in para-sports, with increased investment in facilities, training, and support for para-athletes.

Q97. Answer: (a) Anita Asante

The correct answer is Anita Asante.

Key Points

• Anita Asante, a renowned former football player and advocate for gender equality, earned the 'Game Changer' award at the Women's Football Awards, 2025.

• This award is given to individuals who have significantly contributed to advancing the visibility and development of women's football globally.

• Anita Asante is celebrated not only for her achievements on the pitch but also for her impactful efforts off the field, including her activism for diversity, inclusion, and equality in sports.

• The Women's Football Awards is an annual event that recognizes the contributions of players, coaches, and advocates in the women's football industry.

• Anita's initiatives in mentoring young players and advocating for better opportunities for women in football were pivotal in her receiving this prestigious award.

Additional Information

• Anita Asante:

• Anita Asante is a former international footballer who has represented England and played for top clubs such as Arsenal and Chelsea.

• She has won numerous accolades, including the UEFA Women's Cup and several league titles during her career.

• Post-retirement, she has become a vocal advocate for gender equality and LGBTQ+ rights in sports.

• Women's Football Awards:

• The Women's Football Awards is a platform that celebrates excellence and contributions to the growth of women's football.

• It recognizes players, teams, and individuals who have made a meaningful impact, both on and off the field.

• The awards aim to inspire future generations and promote the advancement of the sport globally.

• Impact of Activism in Sports:

• Activism in sports plays a vital role in addressing societal issues such as gender inequality, racial discrimination, and inclusivity.

• Individuals like Anita Asante use their platforms to drive awareness and foster positive change in the sporting world.

• Such efforts contribute to creating a more inclusive and equitable environment for current and future athletes.

• Other Nominees:

• Keira Walsh: Known for her exceptional midfield skills and contributions to England's national team.

• Viviane Asseyi: A talented French footballer celebrated for her performances in international tournaments.

• Bethany England: An English striker recognized for her goal-scoring prowess and club success.

Important Points

• Game Changer Award Significance:

• This award highlights the importance of individuals who use their influence to bring transformative changes in sports.

• It emphasizes the role of advocacy and leadership in shaping the future of women's football.

• Anita Asante's recognition underscores the value of combining athletic excellence with social impact.

• Women's Football Growth:

• The global popularity of women's football has been steadily increasing due to efforts by players, organizations, and advocates.

• Events like the Women's Football Awards play a crucial role in promoting the sport and providing visibility to its contributors.

• Support from fans, sponsors, and governing bodies is essential for sustaining this growth.

Q98. Answer: (c) Dr. V I Mathan

The correct answer is Dr. V I Mathan.

Key Points

• Dr. V I Mathan is the author of the book "To the Seventh Generation: The Journey of Christian Medical College Vellore," which was released in January 2025.

• The book chronicles the history and evolution of Christian Medical College (CMC) Vellore, a premier medical institution in India that has made significant contributions to healthcare and medical education.

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• Dr. Mathan, a renowned medical professional, has been associated with CMC Vellore and has an in-depth understanding of the institution's legacy and impact.

• CMC Vellore was founded in 1900 by Dr. Ida Scudder, an American missionary, with the aim of providing quality healthcare to underserved populations.

• The book highlights the institution's journey through seven generations, showcasing its commitment to excellence, innovation, and service to humanity.

Additional Information

• Christian Medical College (CMC) Vellore:

• Location: Vellore, Tamil Nadu, India.

• Founded in 1900 by Dr. Ida Scudder, the institution initially started as a one-bed clinic and gradually expanded into a world-renowned medical college and hospital.

• CMC Vellore is known for its pioneering medical research, innovations, and focus on community health.

• The institution has introduced several groundbreaking medical procedures, including the first reconstructive surgery for leprosy patients in India.

• It is ranked among the top medical colleges in India and globally recognized for its quality healthcare services and education programs.

• Dr. V I Mathan:

• A distinguished medical professional and scholar associated with CMC Vellore.

• His contributions to the field of medicine and education have been widely acknowledged.

• The book "To the Seventh Generation" reflects his deep understanding of CMC Vellore's history and ethos.

• Dr. Ida Scudder:

• Dr. Ida Scudder was a pioneering American missionary and medical doctor who founded CMC Vellore.

• Her vision was to provide compassionate healthcare to the underserved and train medical professionals to continue this legacy.

• She is remembered for her dedication to improving healthcare access in India, particularly for women and children.

• Legacy of CMC Vellore:

• The institution has shaped healthcare delivery in India through its innovative practices and research.

• It emphasizes community-oriented healthcare and serves as a model for medical education and hospital management.

• CMC Vellore remains committed to fostering ethical and compassionate care, upholding its founding values.

Important Points

• Key Themes of the Book:

• The book emphasizes the transformative role of CMC Vellore in Indian healthcare over seven generations.

• It documents the institution's achievements, challenges, and its unwavering commitment to its founding principles.

• The narrative highlights the importance of ethical medical practices, community service, and innovation.

• It serves as an inspiration for medical professionals and institutions globally.

• Impact of CMC Vellore:

• CMC Vellore has significantly influenced healthcare delivery and education in India.

• It has trained thousands of medical professionals who continue to contribute to healthcare worldwide.

• The institution is recognized for its role in addressing public health challenges and advancing medical research.

Q99. Answer: (c) Technology Development Fund (TDF)

The correct answer is Technology Development Fund (TDF).

Key Points

• Technology Development Fund (TDF) is a scheme under the Defence Research and Development Organisation (DRDO), aimed at promoting self-reliance in defence technology.

• The scheme focuses on funding industries, especially Micro, Small, and Medium Enterprises (MSMEs), and startups to develop technologies that meet the requirements of the Indian defence sector.

• By mid-2025, the TDF's Deep Tech vertical had launched nine projects, fostering collaboration between industries and academia through DRDO’s Industry-Academia Centres of Excellence.

• The primary objective is to ensure that India becomes self-sufficient in defence technology, reducing reliance on foreign imports and encouraging indigenous innovation.

• The TDF scheme provides up to 90% funding for development costs, with a focus on fostering innovation in areas like advanced materials, sensors, and artificial intelligence for defence applications.

Additional Information

• Defence Research and Development Organisation (DRDO):

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• DRDO is an agency under the Ministry of Defence, Government of India, established in 1958.

• It is responsible for the development of defence technologies, including aeronautics, electronics, missiles, and combat vehicles.

• DRDO collaborates with academic institutions, research institutions, and industries to achieve its goals of self-reliance in defence technology.

• Industry-Academia Centres of Excellence:

• These centres are established by DRDO to facilitate collaboration between industries and academic institutions.

• The objective is to leverage the expertise of academia in cutting-edge research and translate it into practical defence solutions.

• Such collaborations promote innovation and provide opportunities for industries to work on high-tech defence projects.

• Other Defence-Related Schemes:

• iDEX (Innovations for Defence Excellence): Aimed at promoting innovation and technology development in defence and aerospace by engaging startups and MSMEs.

• Defence Testing Infrastructure Scheme (DTIS): Focuses on creating state-of-the-art testing facilities for defence equipment to support the indigenous defence manufacturing ecosystem.

• ADITI Scheme: A less prominent initiative aimed at advancing defence research; however, it is not directly associated with TDF or its Deep Tech vertical.

• Significance of TDF:

• Encourages indigenous innovation, reducing dependency on foreign defence technology.

• Provides financial support to MSMEs and startups, enabling them to undertake high-risk, high-reward projects.

• Strengthens India's defence manufacturing capabilities, in line with the 'Atmanirbhar Bharat' initiative.

Important Points

• The TDF scheme supports projects with a development timeline of up to two years, ensuring swift delivery of technology solutions.

• It plays a pivotal role in achieving the Government of India's vision of 'Make in India' for the defence sector.

• The scheme covers a wide range of technology domains such as unmanned systems, advanced materials, cyber security, and electronic warfare.

• The involvement of academia ensures that the latest research findings are incorporated into the design and development process, enhancing the overall quality of deliverables.

Q100. Answer: (c) HDFC Life Insurance Co. Ltd.

The correct answer is HDFC Life Insurance Co. Ltd..

Key Points

• HDFC Life Insurance Co. Ltd. announced the adoption of the revised GST structure on all its insurance products starting from 22 September 2025.

• The implementation aligns with the Government of India's initiative to ensure uniform taxation under the Goods and Services Tax (GST) framework.

• This move is expected to bring transparency in pricing, enhance customer trust, and ensure compliance with the revised tax norms.

• HDFC Life is a prominent life insurance company in India, offering a wide range of insurance products including term plans, ULIPs, pension plans, and savings plans.

• The revised GST structure is aimed at simplifying tax calculations and streamlining the insurance industry under the national tax reforms.

Additional Information

• GST and Its Impact on Insurance:

• Goods and Services Tax (GST) is a comprehensive indirect tax introduced in India on 1 July 2017.

• Under GST, insurance premiums are taxed at a standard rate, making tax compliance uniform across the industry.

• This taxation reform has simplified the previously complex structure of service tax and other indirect taxes applicable to insurance products.

• About HDFC Life Insurance Co. Ltd.:

• HDFC Life was established in 2000 and is headquartered in Mumbai, India.

• It is a leading provider of life insurance solutions, offering more than 38 individual and 11 group products to meet various customer needs.

• The company is a joint venture between HDFC Ltd. and Standard Life Aberdeen.

• Other Leading Insurance Companies:

• Kotak Life Insurance Co. Ltd.: Known for its diverse range of savings, investment, and protection plans.

• ICICI Prudential Life Insurance Co. Ltd.: Offers customer-centric solutions and is one of the largest private life insurers in India.
• Sahara India Life Insurance Co. Ltd.: Was the first wholly Indian-owned private life insurance company in India.
• Significance of Revised GST Structure:
• Ensures uniform tax application across all insurance products.
• Eliminates cascading effects of taxation, bringing clarity and efficiency to the insurance sector.
• Provides better understanding and transparency to customers regarding the pricing of insurance policies.

Important Points

• Role of Insurance Companies in GST Adoption:
• Insurance companies, as financial institutions, play a key role in implementing GST by integrating tax reforms into their product pricing and operations.
• They are required to comply with periodic tax filings and ensure that tax benefits, if any, are passed on to customers.
• Global Context:
• Countries with GST systems, such as Australia and Canada, have seen significant improvements in tax compliance and simplification of indirect taxes.
• India's adoption of GST in the insurance sector is part of a larger effort to align its tax policies with global standards.
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