RRB Group D Official Paper (Held On: 01 Dec, 2025 Shift 2) (Previous Year Paper)

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

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GENERAL SCIENCE

Q1. Compared to a soft sound, a louder sound wave of the same frequency is characterised by _____.

(a) Smaller wavelength
(b) Higher pitch
(c) Larger amplitude
(d) Smaller speed

Q2. Which of the following is responsible for the dispersion of white light through a glass prism?

(a) The prism absorbs some colours.
(b) Different colours of light travel at different speeds in glass.
(c) White light contains only one colour.
(d) Different colours of light travel at the same speed in glass.

Q3. Fleming's Left-Hand Rule is used to determine the direction of motion in an electric motor. Which finger represents the direction of the force or motion?

(a) Thumb
(b) Index finger
(c) Little finger
(d) Middle finger

Q4. When the velocity of a body is increased to twice its original value, its kinetic energy becomes _____.

(a) four times the original value
(b) half the original value
(c) the same as before
(d) twice the original value

Q5. A solution is said to be stable when:

(a) the solute particles float on the surface of solution when left undisturbed
(b) the solute particles settle down when left undisturbed
(c) the solute particle forms a separate layer with solvent particles
(d) the solute particles do not settle down when left undisturbed

Q6. When a hydrocarbon is burnt in excess of air, the final product is always:

(a) carbon dioxide and hydrogen
(b) carbon monoxide and water
(c) carbon monoxide and hydrogen
(d) carbon dioxide and water

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Q7. Consider the unbalanced reaction:

_ C_2H_6 + _ O_2 → _ CO_2 + _ H_2O

Which of the following is the correct set of coefficients to balance this equation?

(a) 1, 5, 3, 4
(b) 2, 7, 4, 6
(c) 2, 5, 4, 6
(d) 1, 3, 2, 3

Q8. A person is standing in a bus that suddenly stops. The person tends to fall forward. Which of the following laws of motion is directly responsible for this phenomenon?

(a) Newton's Second Law of Motion.
(b) The Law of Conservation of Momentum.
(c) Newton's First Law of Motion.
(d) Newton's Third Law of Motion.

Q9. Roots of which of the following plants can give rise to new plants?

(a) Maize
(b) Sweet potato
(c) Potato
(d) Gram

Q10. Why is variation primarily important in a population of organisms?

(a) It increases the chance of survival under changing environmental conditions
(b) It ensures that all individuals are identical
(c) It always gives instant result within the same generation.
(d) It helps organisms reproduce faster

Q11. Which of the following is an example of growing two or more crops simultaneously on the same land field in a definite pattern?

(a) Aeroponics
(b) Hydroponics
(c) Inter-cropping
(d) Monocropping

Q12. A swimmer pushes water backwards. The reaction force that propels the swimmer forward is:

(a) Gravity pushes the swimmer forward
(b) Air pushes the swimmer
(c) Water pushes the swimmer backward
(d) Water pushes the swimmer forward

Q13. Due to presence of which particle, does Rough Endoplasmic Reticulum (RER) look rough under a microscope?

(a) Centrosome
(b) Ribosome
(c) Lysosome
(d) Peroxisome

Q14. Which of the following is NOT a part of the structural organisation of a cell?

(a) Cytoplasm
(b) Heart
(c) Mitochondria
(d) Cell wall

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Q15. What is used as the anode during electrolytic refining?

(a) A rod of graphite
(b) A strip of impure metal to be refined
(c) An inert electrode
(d) A strip of pure metal to be refined

Q16. Which of the following is in accordance with Law of constant proportions?

a. In water, the ratio of the mass of hydrogen to the mass of oxygen is always 1 : 8.
b. The ration of carbon and oxygen in carbon dioxide is always 3 : 8 by mass.
c. In ammonia, nitrogen and hydrogen are always present in the ratio 14 : 1 by mass.

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

Q17. What is the exact location of the kidneys in human beings?

(a) In the abdomen, on either side of the back bone
(b) In the chest region, on either side of the lungs
(c) In the chest region, just below the heart
(d) In the abdomen, on either side of the intestine

Q18. Which of the following statements is correct for the mass and weight of an object?

(a) Both Mass and Weight are constant
(b) Mass is variable and Weight is constant
(c) Mass is constant and Weight is variable
(d) Both Mass and Weight are variable

Q19. An electric heater of resistance 20Ω operates for 10 minutes when connected to a 220 V supply. The heat produced is:

(a) 1.45 × 10^5 J
(b) 1.45 × 10^6 J
(c) 2.9 × 10^5 J
(d) 2.9 × 10^4 J

Q20. Which of the following statements defines Formula Unit?

(a) Mass of an atom
(b) Mass of one molecule
(c) Sum of atomic masses of all atoms in the formula unit of an ionic compound
(d) Mass of one mole of a compound

Q21. The removal of which of the following weeds from agricultural land will be beneficial for farmers?

(a) Wheat
(b) Sunflower
(c) Soybean
(d) Parthenium

Q22. The band of seven colours obtained on a screen due to dispersion is called _____.

(a) Image
(b) Reflection pattern
(c) Spectrum
(d) Shadow

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Q23. Which of the following is a part of the human male reproductive system?

(a) Vagina
(b) Uterus
(c) Fallopian tube
(d) Prostate gland

Q24. Neutralisation reaction is best described as _____.

(a) Acid + Salt → Water
(b) Acid + Base → Salt + Water
(c) Base + Oxide → Salt + Water
(d) Acid + Metal → Salt + Hydrogen

Q25. Nucleons are subatomic particles found inside the atom. They consist of:

(a) only protons
(b) only neutrons
(c) electrons
(d) protons and neutrons

MATHEMATICS

Q26. The sides of a triangle are 75 cm, 34 cm and 61 cm. What is the length of its altitude corresponding to the side with the length of 34 cm?

(a) 68 cm
(b) 20 cm
(c) 63 cm
(d) 60 cm

Q27. A credit card payment that will settle a bill for 250 mixers at Rs. 1,014 per mixer with successive discounts of 30% and 15%, with a further discount of 20% on card payment, is:

(a) Rs. 1,20,678
(b) Rs. 1,20,696
(c) Rs. 1,20,664
(d) Rs. 1,20,666

Q28. A, B and C can do a piece of work in 3, 2 and 6 days, respectively. How long (in days) will they take to do thrice the same work, working together?2513

(a) 4
(b) 9
(c) 3
(d) 6

Q29. If mode of data 8, 7, 8, 7, 9, 10, 2, 8, 9, 7, 5, 10 and x is 7, then the value of x is:

(a) 8
(b) 5
(c) 9
(d) 7

Q30. In a family consisting of a father, mother, son, and daughter, the age difference between the son and the daughter is 3 years, which is the same as the age difference between the father and the mother. The total age of the family is 144 years. The father is the eldest and the son is the youngest. The son's age is half the age of the mother. What is the age (in years) of the daughter?

(a) 26
(b) 23
(c) 20
(d) 22

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Q31. The cost price of an article is Rs. 10,720. It was sold for Rs. 9,862.40. Find the loss percentage.

(a) 10%
(b) 8%
(c) 5%
(d) 6%

Q32. The income of Raman is Rs. 12,000. He saves 27% of his income. If his income increases by 20% and expenditure increases by 15%, then his savings will:4747

(a) decrease by Rs. 1,089
(b) decrease by Rs. 1,085
(c) increase by Rs. 1,088
(d) increase by Rs. 1,086

Q33. The average age of 35 students of a class is 13 years. If the age of the teacher is also included, the average age of the whole group becomes 14 years. The age (in years) of the teacher is:

(a) 53
(b) 51
(c) 49
(d) 47

Q34. A solid metallic sphere of radius 10.5 cm is melted and recast into smaller spherical balls, each of radius 3.5 cm. Find the ratio of the total surface area of all the smaller spheres to the surface area of the original sphere.

(a) 9 : 1
(b) 12 : 1
(c) 6 : 1
(d) 3 : 1

Q35. A teacher is preparing 15 identical exam folders. Each folder contains: 8 question sheets, 6 answer sheets, and a booklet that includes [(27-3)/6+4] additional pages. How many total sheets and pages does the teacher prepare for all 15 folders?

(a) 360
(b) 330
(c) 134
(d) 270

Q36. If an item marked at Rs. 4,000 is sold for Rs. 280, then what is the discount percentage?

(a) 91%
(b) 95%
(c) 94%
(d) 93%

Q37. If 20% of a number is added to 72, then the result is the same number. 80% of the same number is:343

(a) 72
(b) 82
(c) 92
(d) 102

Q38. If the area of a rectangle is 195 cm^2 and length is 15 cm, then find the perimeter of rectangle.

(a) 54 cm
(b) 56 cm
(c) 52 cm
(d) 58 cm

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Q39. If $(a - 1)^3 + (a - 4)^3 + (a - 7)^3 = 3(a - 1)(a - 4)(a - 7)$, find the value of a.

(a) -4
(b) 1
(c) 4
(d) -1

Q40. Aman can do 1/6 th of a piece of work in 13 days and Chaman can do 1/7 th of the same work in 19 days. Find the number of days taken to complete the work if both work together. (Rounded off to one decimal place)

(a) 54.5
(b) 51.6
(c) 49.2
(d) 46.3

Q41. The amount on a sum of Rs. 7,700 at 10% per annum compound interest, compounded annually, in 2 years will be:

(a) Rs. 10,109
(b) Rs. 9,317
(c) Rs. 9,494
(d) Rs. 8,936

Q42. In a bag containing red, green and pink tokens, the ratio of red to green tokens was 14 : 8 while the ratio of pink to red tokens was 2 : 6. What was the ratio of green to pink tokens?5288

(a) 11 : 14
(b) 9 : 11
(c) 7 : 12
(d) 12 : 7

Q43. Find the value of $(\sin 80°)/(\cos 10°) - \sin 57° \sec 33° + 2$.

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

Q44. A woman travelled at a speed of 20 m/min for 80 min, and at a speed of 55 m/min for 60 min. Her average speed (in m/min) is:

(a) 28
(b) 39
(c) 35
(d) 41

Q45. If a 1533 m long train crosses a pole in 73 seconds, then find the time (in seconds) taken by the train to cross a 420 m long platform.

(a) 93
(b) 96
(c) 86
(d) 84

Q46. Pushpraj and Himani together invested Rs. 17,800 in a business. At the end of the year, out of a total profit of Rs. 5,600, Pushpraj's share was Rs. 2,100. What was the investment of Pushpraj?

(a) Rs. 6,090
(b) Rs. 4,720
(c) Rs. 7,690
(d) Rs. 6,675

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Q47. 1/20 is what percentage of 10/70?

(a) 45%
(b) 35%
(c) 70%
(d) 50%

Q48. Find the total prime numbers between 146 and 196.

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

Q49. A 24-metre-long wire is broken into three pieces. The largest piece has length thrice the length of the smallest piece. The difference between lengths of two larger pieces is equal to the difference between the lengths of two smaller pieces. The length of the largest piece is ____ metres.

(a) 12
(b) 18
(c) 15
(d) 10

Q50. There are two wooden sticks of length 57 m and 399 m, respectively. The sticks are to be cut into pieces of equal length.

What is the greatest possible length of each stick?

(a) 59 m
(b) 57 m
(c) 56 m
(d) 58 m

GENERAL INTELLIGENCE & REASONING

Q51. A, B, C, D, W, X and Y are sitting in a straight line facing north. No one sits to the left of D. Only four people sit between D and C. Only three people sit to the right of Y. X sits to the immediate left of A. W is not an immediate neighbour of Y. Who sits third to the left of W?

(a) X
(b) Y
(c) A
(d) C

Q52. 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) 2 8 1 7 3 6 6 6 1 5 5 3 4 1 5 5 3 9 7 7 7 (Right)

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

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

Q53. 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 pillows are mats.

Some mats are cushions.

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Conclusions:

(I): Some pillows are cushions.

(II): All cushions are mats.

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

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

15 17 21 23 27 ?

(a) 33
(b) 31
(c) 29
(d) 30

Q55. Each of the digits in the number 3241586 is arranged in the ascending order from left to right. The position(s) of how many digits will remain unchanged as compared to that in the original number?

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

Q56. In a certain code language, 'AUTO' is coded as '2683' and 'TOUR' is coded as '8136'. What is the code for 'R' in the given code language?

(a) 1
(b) 6
(c) 8
(d) 3

Q57. What will come in place of the question mark (?) in the following equation, if '+' and '−' are interchanged and '×' and '÷' are interchanged?

104 - 176 × 16 ÷ 9 + 192 = ?

(a) 12
(b) 14
(c) 18
(d) 11

Q58. A, B, C, D, E, F and G are sitting around a circular table facing the centre.

B sits to the immediate right of C. Only three people sit between B and A when counted from the left of B. Only three people sit between C and D when counted from the left of C. G sits to the immediate right of F. How many people sit between A and C when counted from the right of C?

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

Q59. Refer to the following number series and answer the question that follows. Counting to be done from left to right only. (All numbers are single-digit numbers only.)

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

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

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

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(d) Four

Q60. Refer to the following number, symbol series and answer the question. Counting to be done from left to right only. All numbers are single-digit numbers.

(Left) 5 $ 5 7 $ $ @ & * € 3 # 8 # $ 5 © 7 £ 4 & * (Right)

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

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

Q61. Shubham starts from Point A and drives 10 km towards West. He then takes a right turn, drives 8 km, turns right and drives 14 km. He then takes a right turn and drives 12 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 degrees turns only unless specified)

(a) 4 km to the South
(b) 4 km to the North
(c) 5 km to the South
(d) 5 km to the North

Q62. M, N, O, P, W, X and Y are sitting around a circular table facing the centre of the table.

Only two people sit between X and W when counted from the right of X. Only two people sit between W and M when counted from the right of W. Only three people sit between X and N when counted from the right of X. P sits to the immediate left of Y. Who sits third to the left of O?

(a) X
(b) P
(c) Y
(d) M

Q63. Which letter cluster will replace the question mark (?) to complete the given series?

ECO HFN KIM ? QOK

(a) MNJ
(b) NLL
(c) LPO
(d) KLI

Q64. What should come in place of the question mark (?) in the given series?

1211 1212 1215 1210 1219 1208 ? 1206 1227

(a) 1220
(b) 1223
(c) 1225
(d) 1227

Q65. Rashmi starts from Point A and drives 5 km towards west. She then takes a right turn, drives 4 km, turns right and drives 3 km. She then takes a left turn and drives 4 km. She takes a final right turn, drives 2 km and stops at Point P. How far (shortest distance) and towards which direction should she drive in order to reach Point A again? (All turns are 90 degrees turns only unless specified)

(a) 6 km towards east
(b) 4 km towards north
(c) 8 km towards south
(d) 8 km towards west

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Q66. In a certain code language,

'A ? B' means 'A is the daughter of B'

'A = B' means 'A is the son of B'

'A @ B' means 'A is the father of B'

'A √ B' means 'A is the sister of B'

Based on the above, how is C related to L if 'C = D √ E ? F @ L'?

(a) Sister's son
(b) Brother's son
(c) Mother's brother
(d) Son

Q67. 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) RX – WM
(b) YE – DT
(c) KQ – QE
(d) IO – ND

Q68. Tanay ranked 24^(th) from the top and 56^(th) from the bottom in his class. How many students are there in his class?

(a) 79
(b) 78
(c) 77
(d) 80

Q69. Which of the following letter-number clusters will replace the question mark (?) in the given series to make it logically complete?

GRK 45, KMG 54, OHC 63, SCY 72, ?

(a) WXU 81
(b) XWV 81
(c) VXT 83
(d) VYU 83

Q70. 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 shade are roof.

All ceiling are roof.

Conclusions:

(I): Some shade are ceiling.

(II): All roof are ceiling.

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

Q71. Sumedha ranked 9^(th) from the top and 23^(rd) from the bottom in his class. How many students are there in the class?

(a) 27
(b) 31
(c) 37

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(d) 35

Q72. In a certain code language, ‘nice large land’ is coded as ‘cd ak pi’, ‘land is fertile’ is coded as ‘rf pc ak’, and ‘cost is high’ is coded as ‘si ig pc’. How is ‘fertile’ coded in the given language?

(a) rf
(b) cd
(c) ak
(d) pc

Q73. 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/subtracting/multiplying to 13 can be performed. Breaking down 13 into 1 and 3 and then performing mathematical operations on 1 and 3 is not allowed.)

(39, 117, 13)

(48, 99, 1)

(a) (8, 42, 10)
(b) (35, 138, 24)
(c) (19, 106, 24)
(d) (27, 117, 21)

Q74. Based on the English alphabetical order, three of the following four letter-clusters are alike in a certain way and thus form a group. Which letter-cluster DOES NOT belong to that group?

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

(a) MNP
(b) FHI
(c) XYA
(d) EFH

Q75. What will come in place of the question mark (?) in the following equation if ‘+’ and ‘−’ are interchanged and ‘×’ and ‘÷’ are interchanged?

409 ÷ 2 + 416 × 8 − 76 = ?

(a) 844
(b) 841
(c) 843
(d) 842

Q76. What should come in place of the question mark (?) in the given series?

256 211 166 121 76 ?

(a) 32
(b) 33
(c) 31
(d) 27

Q77. 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) 1 2 4 5 7 2 9 6 7 3 4 1 6 6 9 8 4 7 6 1 7 3 4 9 7 (Right)

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

(Note: 1 is also a perfect square)?

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

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Q78. In the following triads, each group of letters is related to the subsequent one following a certain logic. Select from the given options, the one which follows the same logic.

JOBS - JSBO - SBOJ

OILY - OYLI - YLIO

(a) KIDS - KDIS - SDIK
(b) IDEA - IDAE - DEAI
(c) EARN - ENRA - NRAE
(d) GAVE - AGVE - EAVG

Q79. ZWRM is related to WRUR in a certain way based on the English alphabetical order. In the same way, NCDG is related to KXGL. To which of the following options is ENMV related, following the same logic?10114

(a) BAPL
(b) BPLO
(c) BIAP
(d) BIPA

Q80. LW 3 is related to QV -10 in a certain way. In the same way, JU 6 is related to OT -7. To which of the following is PU 4 related, following the same logic?

(a) UT -9
(b) YT -2
(c) HU -4
(d) KO -5

GENERAL AWARENESS AND CURRENT AFFAIRS

Q81. Which two countries signed a treaty in late May 2025, transferring sovereignty over the Chagos Archipelago?

(a) UK and India
(b) US and Mauritius
(c) UK and Mauritius
(d) Mauritius and India

Q82. What was the urban poverty rate in India for FY24 as per SBI’s January 2025 report?

(a) 4.6%
(b) 1.1%
(c) 13.7%
(d) 4.09%

Q83. According to the IMF's April 2025 World Economic Outlook, what is India’s projected GDP growth rate for the year 2025?

(a) 6.2%
(b) 6.0%
(c) 5.9%
(d) 6.5%

Q84. Who was Madison Keys' opponent in the final when she won her first Grand Slam title at the Australian Open 2025?

(a) Coco Gauff
(b) Elena Rybakina
(c) Aryna Sabalenka
(d) Iga Świątek

Q85. The Union Minister of Communications, Mr. Jyotiraditya Scindia, during his keynote at the World Wi-Fi Day Conference in June 2025, projected Wi-Fi to become a Rs. 1,83,000 crores (US$ 21.2 billion) sector in India by _____.

(a) Sat Jul 22 1905 00:00:00 GMT+0521 (India Standard Time)
(b) Tue Aug 01 1905 00:00:00 GMT+0521 (India Standard Time)

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(c) Thu Jul 27 1905 00:00:00 GMT+0521 (India Standard Time)
(d) Sun Aug 06 1905 00:00:00 GMT+0521 (India Standard Time)

Q86. Where did Union Minister Ashwini Vaishnaw inaugurate the nation's pioneering 3nm chip design centres in May 2025?
(a) Noida and Bengaluru
(b) Jaipur and Delhi
(c) Hyderabad and Lucknow
(d) Chennai and Ahmedabad

Q87. Which state government launched India's first jungle safari train equipped with a Vistadome coach in May 2025?
(a) Andhra Pradesh
(b) Himachal Pradesh
(c) Arunachal Pradesh
(d) Uttar Pradesh

Q88. Vikram 3201 and Kalpana 3201 microprocessors, developed for space applications, are what type of microprocessors?
(a) 8-bit microprocessors
(b) 32-bit microprocessors
(c) 16-bit microprocessors
(d) 64-bit microprocessors

Q89. In February 2025, who won the men's title at the 2025 Asian Snooker Championship held in Doha, Qatar?
(a) Pankaj Advani
(b) Amir Sarkosh
(c) Narantuya Bayarsaikhan
(d) Chang Yu Kiu

Q90. What unique feature does the New Pamban Bridge (Tamil Nadu, India) include to facilitate maritime traffic?
(a) Swing bridge
(b) Bascule mechanism
(c) Suspension cables
(d) Vertical-lift

Q91. The Chagos Archipelago Sovereignty Agreement was signed between which of the following two countries in May 2025?
(a) United Kingdom and Mauritius
(b) United Kingdom and Australia
(c) United Kingdom and India
(d) United Kingdom and United States

Q92. In April 2025, which of the following rules came into force?
(a) Bio-medical Waste (Management & Handling) Rules
(b) Hazardous and Other Wastes (Management & Trans boundary Movement) Amendment Rules
(c) Environment Protection (End-of-Life Vehicles) Rules
(d) Plastic Waste Management (Amendment) Rules

Q93. In March 2025, according to the Ministry of Earth Sciences, how many earthquakes were recorded in India during November 2024 to February 2025?
(a) 136
(b) 197
(c) 159
(d) 213

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Q94. As per the Economic Survey, 2024–25, under which housing scheme were over 89 lakh houses completed in urban areas as of 25 November 2024?

(a) Pradhan Mantri Awas Yojana – Urban (PMAY-U)
(b) Smart Cities Mission
(c) Shelter for Urban Homeless (SUH)
(d) Indira Awas Yojana

Q95. Which para-swimmer received the Arjuna Award (Lifetime) in 2025?

(a) Prasanta Karmakar
(b) Suyash Jadhav
(c) Murlikant Petkar
(d) Sharath Gayakwad

Q96. Which athlete won the Arjuna Award for athletics in January 2025?

(a) Jyothi Yarraji
(b) Neeraj Chopra
(c) Avinash Sable
(d) Tajinderpal Singh Toor

Q97. Which of the following ministers conducted surprise raids on seed and fertiliser godowns in Rajasthan in June 2025?

(a) Yogi Adityanath
(b) Kirori Lal Meena
(c) Mallikarjun Kharge
(d) Mamta Banerjee

Q98. Which Indian union territory assembly first adopted the National e-Vidhan Application (NeVA) on 9 June 2025?

(a) Delhi
(b) Puducherry
(c) Lakshadweep
(d) Chandigarh

Q99. The Supreme Court (Amendment) Rules, 2025 include changes to Order II, Rules 1 to 3 of the Supreme Court Rules, passed in the year _____.

(a) 1983
(b) 1993
(c) 2003
(d) 2013

Q100. Which of the following regions is included in the list of vulnerable landscapes under the Revised Green India Mission (GIM) Plan released in 2025?

(a) Deccan Plateau
(b) Thar Desert
(c) Indo-Gangetic Plain
(d) Aravalli Mountain Range

ANSWER KEY

1	c	2	b	3	a	4	a	5	d	6	d	7	b	8	c	9	b	10	a
11	c	12	d	13	b	14	b	15	b	16	b	17	a	18	c	19	b	20	c
21	d	22	c	23	d	24	b	25	d	26	d	27	d	28	c	29	d	30	a
31	b	32	d	33	c	34	d	35	b	36	d	37	a	38	b	39	c	40	c
41	b	42	d	43	b	44	c	45	a	46	d	47	b	48	b	49	a	50	b
51	b	52	b	53	b	54	c	55	b	56	a	57	d	58	c	59	a	60	b

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61	b	62	c	63	b	64	b	65	c	66	a	67	c	68	a	69	a	70	c
71	b	72	a	73	d	74	b	75	d	76	c	77	b	78	c	79	d	80	a
81	c	82	d	83	a	84	c	85	c	86	a	87	d	88	b	89	a	90	d
91	a	92	c	93	c	94	a	95	c	96	a	97	b	98	b	99	d	100	d

SOLUTIONS

Q1. Answer: (c) Larger amplitude

The correct answer is Larger Amplitude.

Key Points

• Amplitude is directly related to the loudness of a sound. A louder sound corresponds to a sound wave with a larger amplitude. Hence, the correct answer is Larger Amplitude.

• The frequency of the sound wave determines its pitch and does not change in this scenario, as the question specifies that both sounds have the same frequency.

• The wavelength of a sound wave is inversely proportional to its frequency, but since the frequency is constant in this case, the wavelength remains unchanged.

• The speed of sound depends on the medium through which the sound travels and is not affected by the loudness or amplitude of the sound.

• Thus, a louder sound wave is characterized by a larger amplitude, which results in higher energy being transmitted through the medium.

Additional Information

• Amplitude:

• The amplitude of a sound wave refers to the maximum displacement of particles in the medium from their equilibrium position.

• A higher amplitude corresponds to a louder sound, while a lower amplitude corresponds to a softer sound.

• Amplitude is measured in terms of decibels (dB) when describing the loudness of a sound.

• Frequency and Pitch:

• Frequency is the number of oscillations or cycles of a wave per second and is measured in Hertz (Hz).

• The pitch of a sound is determined by its frequency: higher frequency results in a higher pitch, while lower frequency results in a lower pitch.

• In this question, frequency is constant, so the pitch does not change.

• Wavelength:

• The wavelength of a sound wave is the distance between two consecutive crests or troughs.

• It is inversely related to the frequency: higher frequency results in a shorter wavelength, and lower frequency results in a longer wavelength.

• Since the frequency remains the same, the wavelength also remains constant in this case.

• Speed of Sound:

• The speed of sound depends on the properties of the medium, such as its density and elasticity.

• In air, the speed of sound at room temperature is approximately 343 meters per second (m/s).

• The speed of sound is independent of the amplitude or loudness of the sound wave.

Important Points

• Loudness and Energy: The loudness of a sound is related to the energy carried by the sound wave. A wave with a higher amplitude carries more energy, which makes it louder.

• Sound Intensity: The intensity of a sound wave is proportional to the square of its amplitude. This means that even a small increase in amplitude can result in a significant increase in loudness.

• Perception of Loudness: The human ear perceives loudness on a logarithmic scale. A 10 dB increase in sound level is perceived as approximately twice as loud.

• Applications: Understanding amplitude and loudness is crucial in fields such as audio engineering, acoustics, and noise control.

Q2. Answer: (b) Different colours of light travel at different speeds in glass.

The correct answer is Different colours of light travel at different speeds in glass..

Key Points

• Dispersion of white light occurs when white light passes through a glass prism. It splits into its constituent colors, forming a spectrum (VIBGYOR: Violet, Indigo, Blue, Green, Yellow, Orange, Red).

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• This phenomenon is due to the fact that different colors of light travel at different speeds in glass. Each color has a different wavelength, and the refractive index of glass varies with the wavelength of light.

• Violet light bends the most, while red light bends the least. This is because violet has the shortest wavelength, and red has the longest wavelength among the visible spectrum.

• The separation of white light into its constituent colors is referred to as dispersion.

• The prism's geometry and material properties enhance this effect by refracting light at different angles, ensuring the colors become distinct and visible to the observer.

Additional Information

• Refraction:

• Refraction is the bending of light as it passes from one medium to another with a different refractive index, such as air to glass or water.

• In the case of a prism, the change in speed of light in glass compared to air causes the light to bend and split into different colors.

• Refractive Index:

• The refractive index of a material determines how much light bends when entering the material. It is wavelength-dependent, which is why light splits into colors.

• The refractive index is higher for shorter wavelengths (violet) and lower for longer wavelengths (red).

• Visible Spectrum:

• The visible spectrum consists of colors ranging from violet (shortest wavelength, ~400 nm) to red (longest wavelength, ~700 nm).

• The range of wavelengths determines the color of light perceived by the human eye.

• Applications of Dispersion:

• Dispersion is used in spectroscopy to analyze the composition of light sources.

• It is also the principle behind the formation of rainbows, where water droplets act as prisms dispersing sunlight.

• Important Experiments:

• Isaac Newton demonstrated the dispersion of light through a prism in the 17th century, proving that white light is a mixture of different colors.

Important Points

• Statement 1: "The prism absorbs some colors." This is incorrect because the prism only bends light but does not absorb colors.

• Statement 2: "Different colors of light travel at different speeds in glass." This is correct. The varying speed of light in glass causes dispersion.

• Statement 3: "White light contains only one color." This is incorrect. White light is a combination of all visible spectrum colors.

• Statement 4: "Different colors of light travel at the same speed in glass." This is incorrect. Different colors have different speeds due to varying refractive indices.

Q3. Answer: (a) Thumb

The correct answer is Thumb.

Key Points

• Fleming’s Left-Hand Rule is a visual tool used in electromagnetism to determine the directions of force, magnetic field, and current in devices such as electric motors.

• It states that if you stretch out your thumb, index finger, and middle finger perpendicular to each other:

• Thumb indicates the direction of the force or motion (correct answer).

• Index finger represents the direction of the magnetic field.

• Middle finger shows the direction of the current.

• The rule is particularly useful for understanding the working of an electric motor where electromagnetic forces interact to create motion.

• It is applicable in scenarios where a conductor carrying current is placed in a magnetic field, resulting in motion due to the Lorentz force.

• Fleming’s Left-Hand Rule is different from the Right-Hand Rule, which is used for generators.

Additional Information

• Electric Motors:

• Electric motors convert electrical energy into mechanical energy through electromagnetic interactions.

• The key components include a rotor, stator, commutator, and brushes, which work together to produce motion.

• Fleming’s Left-Hand Rule helps engineers design motors by predicting the direction of force on the rotor.

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• Magnetic Field:
• The magnetic field is a region around a magnet or current-carrying conductor where magnetic forces can be felt.
• It is represented by magnetic field lines, which indicate the direction and strength of the field.
• In the Left-Hand Rule, the index finger indicates the direction of these magnetic field lines.
• Current:
• Electric current is the flow of electrons through a conductor.
• It is represented by the middle finger in Fleming's Left-Hand Rule.
• In electric motors, current interacts with the magnetic field to produce force and motion.
• Applications of Fleming's Left-Hand Rule:
• Used in designing and understanding electric motors, such as DC motors and induction motors.
• Applicable in railguns, loudspeakers, and other devices where electromagnetic forces are involved.
• Helps in visualizing the interaction of current and magnetic fields in practical scenarios.

Important Points

• Lorentz Force: The force acting on a current-carrying conductor in a magnetic field is called the Lorentz force. It is the basis for Fleming's Left-Hand Rule.
• Difference Between Left and Right-Hand Rule: The Left-Hand Rule is used for motors, while the Right-Hand Rule is applicable to generators.
• Historical Context: The rule was named after John Ambrose Fleming, who introduced it in the early 20th century.
• Visualization Tip: Always ensure the thumb, index finger, and middle finger are perpendicular to each other while applying the rule.

Q4. Answer: (a) four times the original value

The correct answer is four times the original value.

Key Points

• Kinetic Energy (KE) is given by the formula: $KE = (1/2)mv^2$, where m is the mass of the body and v is its velocity.
• When the velocity v is doubled, the new velocity becomes 2v.
• Substituting the new velocity into the formula, the new kinetic energy becomes: $KE' = (1/2)m(2v)^2 = (1/2)m(4v^2) = 4 \times (1/2)mv^2$.
• This shows that the kinetic energy increases by a factor of 4 when the velocity is doubled.
• Hence, the kinetic energy becomes four times the original value when the velocity is doubled.

Additional Information

• Kinetic Energy:
• Kinetic Energy is a type of mechanical energy associated with a body in motion. It depends on the mass and velocity of the body.
• It is a scalar quantity and is always positive.
• The SI unit of Kinetic Energy is the joule (J).
• Example: A moving car, a flying airplane, and a rolling ball all have kinetic energy.
• Effect of Velocity on Kinetic Energy:
• Kinetic Energy is directly proportional to the square of the velocity of the body. This means that a small change in velocity has a significant impact on kinetic energy.
• For instance, if velocity is tripled, the kinetic energy increases by a factor of 9 (3^2).
• Similarly, reducing the velocity to half will decrease the kinetic energy to one-fourth of its original value.
• Relation with Mass:
• Kinetic Energy is directly proportional to the mass of the body. If the mass is doubled, the kinetic energy also doubles, assuming velocity remains constant.
• This implies that heavier objects moving at the same speed have more kinetic energy than lighter ones.
• Applications:
• Transport: Kinetic Energy is critical in understanding vehicle motion, fuel efficiency, and safety measures like braking systems.
• Energy Generation: Hydropower plants use the kinetic energy of flowing water to generate electricity.
• Sports: In games like cricket or football, the kinetic energy of the ball determines its speed and impact.
• Important Facts:
• The Work-Energy Theorem states that the work done on an object is equal to the change in its kinetic energy.
• Kinetic Energy is a component of mechanical energy, which also includes potential energy.
• In a closed system with no external forces, the total mechanical energy (kinetic + potential) remains conserved.

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Q5. Answer: (d) the solute particles do not settle down when left undisturbed

The correct answer is the solute particles do not settle down when left undisturbed.

Key Points

• A solution is considered stable when the solute particles are uniformly distributed throughout the solvent and do not settle at the bottom when left undisturbed. This ensures the solution remains homogeneous over time.

• In a stable solution, the solute particles are dissolved at the molecular or ionic level in the solvent, forming a single-phase system (e.g., salt dissolved in water).

• Option 1 is incorrect as solute particles floating on the surface indicate incomplete dissolution, leading to an unstable solution.

• Option 2 is incorrect because solute particles settling down when left undisturbed indicates it is a suspension, not a solution.

• Option 3 is incorrect as the formation of a separate layer signifies immiscibility, often seen in mixtures like oil and water.

• Stable solutions are typical of true solutions such as sugar in water or alcohol in water. These solutions are characterized by transparency and uniform composition.

Additional Information

• Types of Solutions:

• True Solution: Homogeneous mixture where solute particles are less than 1 nm in size (e.g., sugar in water).

• Colloidal Solution: Heterogeneous mixture where solute particles range between 1-100 nm and do not settle down (e.g., milk).

• Suspension: Heterogeneous mixture where solute particles are larger than 100 nm and settle down over time (e.g., sand in water).

• Factors Affecting Stability of a Solution:

• Temperature: Increasing temperature often increases solubility, enhancing stability.

• Nature of Solvent and Solute: Polar solvents dissolve polar solutes, while nonpolar solvents dissolve nonpolar solutes.

• Concentration: Over-saturation can lead to precipitation, reducing stability.

• Examples of Stable Solutions:

• Salt dissolved in water.

• Alcohol mixed with water.

• Vinegar (acetic acid in water).

• Applications:

• Pharmaceutical Industry: Preparation of syrups and injectables.

• Food Industry: Beverages and flavoring solutions.

• Chemical Industry: Solutions for reactions and processes.

Important Points

• True Solution Characteristics:

• Particle size is less than 1 nm.

• Does not scatter light (Tyndall effect absent).

• Cannot be separated by filtration.

• Stable and homogeneous in nature.

• Colloidal vs. True Solutions:

• Colloids exhibit the Tyndall effect, while true solutions do not.

• Colloidal particles are larger than those in true solutions.

• Unstable Mixtures: Suspensions and immiscible liquids like oil and water are examples of unstable mixtures, where solute and solvent do not form a homogeneous system.

Q6. Answer: (d) carbon dioxide and water

The correct answer is carbon dioxide and water.

Key Points

• When a hydrocarbon is burnt in the presence of an excess of air (oxygen), it undergoes a complete combustion reaction.

• The products of complete combustion of a hydrocarbon are always carbon dioxide (CO_2) and water (H_2O). This is because all carbon atoms in the hydrocarbon are oxidized to form CO_2, and hydrogen atoms form H_2O.

• The general chemical equation for the combustion of a hydrocarbon (e.g., C_xH_y) is: $C_xH_y + O_2 \rightarrow xCO_2 + (y/2)H_2O$.

• This process is exothermic, meaning it releases a significant amount of energy in the form of heat and light.

• Examples of hydrocarbons include methane (CH_4), ethane (C_2H_6), propane (C_3H_8), and butane (C_4H_{10}), all of which produce CO_2 and H_2O upon complete combustion.

• Hence, the correct answer is carbon dioxide and water.

Additional Information

• Incomplete Combustion:

• If the hydrocarbon burns in a limited supply of oxygen, the reaction results in incomplete combustion.

• Incomplete combustion produces carbon monoxide (CO) or even elemental carbon (soot) along with water.

• This occurs because there is not enough oxygen to fully oxidize the carbon atoms to CO_2.

• Example: $CH_4 + O_2 \rightarrow CO + 2H_2O$ (incomplete combustion of methane).

• Environmental Impact:

• Complete combustion of hydrocarbons produces CO_2, a significant greenhouse gas that contributes to global warming and climate change.

• Incomplete combustion, on the other hand, releases CO, which is a toxic gas that can cause severe health issues.

• Examples of Hydrocarbons and Their Combustion:

• Methane (CH_4): $CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$.

• Propane (C_3H_8): $C_3H_8 + 5O_2 \rightarrow 3CO_2 + 4H_2O$.

• Butane (C_4H_{10}): $2C_4H_{10} + 13O_2 \rightarrow 8CO_2 + 10H_2O$.

• Applications of Combustion:

• Combustion of hydrocarbons is widely used as a source of energy in domestic (e.g., cooking gas), industrial (e.g., power plants), and transportation (e.g., fuels like petrol and diesel) sectors.

• Fuels like natural gas, LPG, gasoline, and kerosene are commonly used for their ability to produce significant heat upon combustion.

• Types of Hydrocarbons:

• Alkanes: Saturated hydrocarbons (e.g., methane, ethane).

• Alkenes: Unsaturated hydrocarbons with one or more double bonds (e.g., ethene, propene).

• Alkynes: Unsaturated hydrocarbons with one or more triple bonds (e.g., ethyne).

Q7. Answer: (b) 2, 7, 4, 6

The correct answer is 2, 7, 4, 6.

Key Points

• The reaction is: $C_2H_6 + O_2 \rightarrow CO_2 + H_2O$.

• To balance a chemical equation, the number of atoms of each element must be the same on both sides of the equation.

• Start by balancing the carbon (C) atoms. Ethane (C_2H_6) has 2 carbon atoms, so we place a coefficient of 2 for CO_2 on the product side:

• $C_2H_6 + O_2 \rightarrow 2CO_2 + H_2O$

• Next, balance the hydrogen (H) atoms. Ethane has 6 hydrogen atoms, and water (H_2O) has 2 hydrogen atoms per molecule. Therefore, place a coefficient of 3 for H_2O:

• $C_2H_6 + O_2 \rightarrow 2CO_2 + 3H_2O$

• Finally, balance the oxygen (O) atoms. There are 4 oxygen atoms in $2CO_2$ and 3 oxygen atoms in $3H_2O$, totaling 7 oxygen atoms on the product side. To balance the oxygen, place a coefficient of 7/2 for O_2 on the reactant side:

• $C_2H_6 + (7/2)O_2 \rightarrow 2CO_2 + 3H_2O$

• Multiply through by 2 to eliminate the fraction:

• $2C_2H_6 + 7O_2 \rightarrow 4CO_2 + 6H_2O$

• Thus, the coefficients are 2, 7, 4, and 6.

Additional Information

• Law of Conservation of Mass:

• In a chemical reaction, mass is neither created nor destroyed.

• The total mass of reactants must be equal to the total mass of products.

• Balancing Chemical Equations:

• A balanced equation ensures the same number of atoms of each element on both sides of the equation.

• It is essential for correctly representing chemical reactions and obeying the Law of Conservation of Mass.

• Combustion Reactions:

• Combustion involves the reaction of a substance with oxygen to produce energy in the form of heat and light.

• Hydrocarbon combustion typically produces carbon dioxide (CO_2) and water (H_2O).

• Steps to Balance Equations:

• Identify the reactants and products.

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• Count the number of atoms for each element on both sides of the equation.
• Adjust coefficients to balance each element.
• Ensure the coefficients are the smallest possible integers.

Important Points

• Hydrocarbons:
• Hydrocarbons consist of hydrogen and carbon atoms.
• Examples include methane (CH4), ethane (C2H6), and propane (C3H8).
• They are classified as alkanes, alkenes, and alkynes based on the type of bonds between carbon atoms.
• Applications of Combustion Reactions:
• Combustion reactions are used in energy production, such as in internal combustion engines and power plants.
• They are also fundamental to heating systems and industrial processes.
• Oxidation Process:
• Combustion is a type of oxidation reaction where oxygen reacts with a substance.
• Oxidation plays a significant role in many chemical and biological processes.

Q8. Answer: (c) Newton's First Law of Motion.

The correct answer is Newton's First Law of Motion.

Key Points

• Newton's First Law of Motion, also known as the Law of Inertia, states that an object will remain at rest or in uniform motion in a straight line unless acted upon by an external force.
• When the bus suddenly stops, the body of the person inside the bus tends to continue moving forward due to inertia, as no external force initially acts directly on their body to stop this motion.
• The phenomenon occurs because the lower part of the person's body comes to rest due to contact with the bus floor, while the upper part continues moving forward until balanced by external forces like friction or a physical obstruction.
• This tendency of the body to resist changes to its state of motion directly illustrates Newton's First Law. Hence, this law is responsible for the phenomenon described in the question.
• Other laws of motion like Newton's Second and Third Laws are not directly applicable here as they deal with acceleration due to force and action-reaction pairs, respectively.

Additional Information

• Newton's First Law of Motion:
• It is also referred to as the Law of Inertia.
• The concept of inertia was first introduced by Galileo Galilei and later formulated as a law by Isaac Newton.
• Inertia is the property of an object to resist changes in its state of motion or rest.
• Examples: A book on a table remains stationary unless pushed, and a ball rolling on a smooth surface continues moving unless stopped by friction or another force.
• Newton's Second Law of Motion:
• It states that the rate of change of momentum of an object is directly proportional to the external force applied to it and occurs in the direction of the force.
• Mathematical Expression: F = ma, where F is force, m is mass, and a is acceleration.
• This law explains how force and acceleration are related but does not directly apply to the scenario in the question.
• Newton's Third Law of Motion:
• It states that for every action, there is an equal and opposite reaction.
• Example: When you push against a wall, the wall pushes back with an equal force in the opposite direction.
• This law focuses on force pairs rather than the inertia described in the question.
• Law of Conservation of Momentum:
• This principle states that the total momentum of a closed system remains conserved unless acted upon by external forces.
• It is mathematically expressed as: m1v1 + m2v2 = constant.
• While this law is applicable in collision or explosion scenarios, it is not relevant to the phenomenon described in the question.

Important Points

• Real-life Applications of Newton's First Law:
• Seat belts in vehicles are designed to prevent passengers from moving forward abruptly during sudden stops, counteracting inertia.
• Objects placed on a moving vehicle tend to slide forward when the vehicle halts suddenly due to inertia.

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• A ball rolling on the ground stops eventually because friction acts as an external force to counteract its motion.

• Historical Context:

• Newton's Laws of Motion were published in 1687 in his work Philosophiæ Naturalis Principia Mathematica.

• These laws form the foundation of classical mechanics and are widely applied in engineering, physics, and everyday phenomena.

Q9. Answer: (b) Sweet potato

The correct answer is Sweet Potato.

Key Points

• The roots of the Sweet Potato have the ability to give rise to new plants. This process occurs through a phenomenon known as vegetative propagation.

• Sweet Potato roots are modified adventitious roots that store food and can develop shoots, which eventually grow into a new plant under suitable conditions.

• Unlike other plants like Maize, Potato, and Gram, which propagate through seeds, tubers, or other parts, the vegetative propagation of sweet potatoes is specifically through roots.

• In vegetative propagation, a part of the plant other than seeds is used to grow new plants. This is commonly seen in crops like Sweet Potato, Dahlia, and Turmeric.

• This method is widely used in agriculture and gardening as it ensures the propagation of plants with identical genetic properties.

Additional Information

• Sweet Potato:

• It is a dicotyledonous plant belonging to the family Convolvulaceae.

• Sweet potatoes are rich in carbohydrates, vitamins (especially Vitamin A), and dietary fiber, making them an important food crop.

• They are primarily grown in tropical and subtropical regions, with India, China, and the United States being major producers.

• They are propagated through vegetative means such as root slips or cuttings.

• Vegetative Propagation:

• This is a form of asexual reproduction where new plants are produced from the roots, stems, or leaves of the parent plant.

• Examples include Sweet Potato (roots), Potato (stem tubers), Ginger (rhizomes), and Bryophyllum (leaves).

• This method is advantageous as it is faster, bypasses the seed stage, and retains the parental plant's genetic characteristics.

• Comparison of Options:

• Maize: Propagates through seeds and cannot regenerate from roots.

• Potato: Propagates through stem tubers, not roots.

• Gram: Propagates through seeds only.

• Sweet Potato: Propagates through roots, which can generate new plants, making it the correct answer.

• Agricultural Importance:

• Vegetative propagation ensures uniform crop quality, which is vital in commercial farming.

• It also allows propagation of plants that produce few or no viable seeds, such as Sweet Potato.

• Additionally, it enables cultivation in regions where seed germination is difficult due to climatic conditions.

Q10. Answer: (a) It increases the chance of survival under changing environmental conditions

The correct answer is It increases the chance of survival under changing environmental conditions..

Key Points

• Variation within a population is essential because it provides the genetic diversity necessary for adaptation to changing environmental conditions, ensuring survival.

• Genetic variation allows organisms to develop traits that can help them cope with challenges such as climate change, new predators, or diseases.

• Populations with greater variation are less likely to face extinction, as some individuals are more likely to survive adverse conditions and pass their genes to the next generation.

• Variation is the basis of natural selection, a process described by Charles Darwin, where advantageous traits become more prevalent over generations.

• Environmental changes, such as drought, temperature shifts, or habitat loss, act as selective pressures. Populations with higher genetic variation have a better chance to persist and evolve in response to these pressures.

Additional Information

• Importance of Variation:

• Variation arises due to mutations, genetic recombination during reproduction, and migration of individuals between populations.

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• It is also influenced by environmental factors such as temperature, food availability, and geographical barriers.

• Examples include the development of antibiotic resistance in bacteria and the variation in beak sizes of Darwin's finches.

• Option-Specific Details:

• Option 2: "It ensures that all individuals are identical"—incorrect because identical individuals lack genetic diversity, making the population vulnerable to environmental changes.

• Option 3: "It always gives instant results within the same generation"—incorrect as evolutionary changes due to variation occur over multiple generations, not instantly.

• Option 4: "It helps organisms reproduce faster"—incorrect because variation does not directly affect reproduction speed but influences adaptability and survival.

• Natural Selection:

• Natural selection operates on variation within populations, favoring traits that enhance survival and reproduction.

• Example: Peppered moths in industrial regions evolved darker coloration to blend with soot-covered trees, demonstrating survival advantages due to variation.

• Relevance to Human Evolution:

• Genetic variation in humans has led to adaptations such as sickle-cell anemia resistance to malaria and lactose tolerance in populations that domesticated cattle.

• Understanding variation aids in medical research, such as developing treatments for genetic disorders and improving crop resilience.

Important Points

• Role of Mutation: Mutations are random changes in DNA that introduce new genetic variations in populations, providing raw material for evolution.

• Genetic Drift: Random changes in allele frequencies in small populations can lead to significant evolutionary changes over time.

• Examples in Conservation: Conservation efforts focus on maintaining genetic diversity in endangered species to enhance their adaptability and survival.

• Artificial Selection: Humans use variation for selective breeding in agriculture and livestock to enhance desirable traits such as higher yield or disease resistance.

Q11. Answer: (c) Inter-cropping

The correct answer is Inter-cropping.

Key Points

• Inter-cropping is the agricultural practice of growing two or more crops simultaneously on the same piece of land in a defined spatial arrangement.

• This technique ensures the efficient utilization of resources such as light, water, and nutrients, improving productivity and sustainability.

• Crops are planted in a systematic pattern, such as alternate rows or blocks, to avoid competition and maximize benefits.

• Common examples of inter-cropping include growing legumes with cereals (e.g., maize and beans) or combining shallow-rooted crops with deep-rooted crops.

• It helps reduce the risk of complete crop failure due to pests or diseases, as multiple crops are grown together, offering diversity.

• Farmers adopt this method to enhance soil fertility, particularly by incorporating nitrogen-fixing crops like legumes into the cropping system.

Additional Information

• Aeroponics:

• A method of growing plants without soil, where plant roots are suspended in the air and sprayed with a nutrient-rich solution.

• It is used primarily in controlled environments like greenhouses for crops such as lettuce, herbs, and strawberries.

• Aeroponics minimizes water use and enhances nutrient absorption but is not related to inter-cropping.

• Hydroponics:

• A soil-less cultivation technique where plants grow in water containing dissolved nutrients.

• Hydroponics is ideal for urban farming and indoor agriculture but does not involve planting multiple crops together in a systematic pattern.

• Examples include growing spinach, tomatoes, and cucumbers in hydroponic systems.

• Monocropping:

• Refers to cultivating a single crop on a piece of land year after year, leading to soil degradation and nutrient depletion.

• Unlike inter-cropping, monocropping lacks diversity and is more susceptible to pests and diseases.

• Crops like wheat, rice, and corn are commonly grown using this technique.

• Benefits of Inter-cropping:

• Improves yield stability by diversifying crop production.

• Enhances soil fertility through nitrogen fixation by legumes.

• Minimizes the spread of pests and diseases due to crop diversity.

• Promotes sustainable agriculture by efficient use of natural resources.

Important Points

• Inter-cropping is widely practiced in developing countries like India due to its economic and ecological benefits.

• It is a key component of integrated farming systems, which aim to maximize productivity while conserving resources.

• Examples of inter-cropping systems include the three sisters method (corn, beans, and squash) in Native American farming practices.

• Scientific studies have shown that inter-cropping can increase productivity by up to 20-30% compared to monocropping.

• Government programs like National Mission on Sustainable Agriculture promote inter-cropping as a climate-resilient farming practice.

Q12. Answer: (d) Water pushes the swimmer forward

The correct answer is Water pushes the swimmer forward.

Key Points

• When a swimmer pushes water backward, it is an application of Newton's Third Law of Motion, which states: "For every action, there is an equal and opposite reaction."

• The backward force exerted by the swimmer on the water is met with an equal and opposite reaction force exerted by the water on the swimmer, propelling the swimmer forward.

• The reaction force acts in the forward direction, enabling the swimmer to move through the water effectively.

• This principle is fundamental to swimming techniques, where the swimmer uses their arms and legs to push against the water, creating propulsion.

• Other forces, such as drag and buoyancy, also influence swimming, but the forward propulsion is solely due to the reaction force from the water.

Additional Information

• Newton's Laws of Motion:

• First Law (Law of Inertia): An object at rest stays at rest, and an object in motion stays in motion with the same speed and in the same direction unless acted upon by an unbalanced force.

• Second Law (F = ma): The force acting on an object is equal to the mass of the object multiplied by its acceleration.

• Third Law: For every action, there is an equal and opposite reaction. This law is directly applicable to swimming.

• Buoyancy in Swimming:

• Buoyancy is the upward force exerted by water, counteracting the swimmer's weight and allowing them to float.

• This upward force is governed by Archimedes' Principle, which states that the buoyant force on an object submerged in a fluid is equal to the weight of the fluid displaced by the object.

• Drag Force in Swimming:

• As a swimmer moves through water, they experience resistance or drag force.

• Drag force depends on the swimmer's speed, body position, and surface area exposed to the water.

• Streamlined body positions can minimize drag, improving swimming efficiency.

• Applications of Newton's Third Law:

• Propulsion in swimming.

• Rocket propulsion, where gases are expelled backward to propel the rocket forward.

• Recoil of firearms, where the gun exerts a backward force when the bullet is fired forward.

• Examples in Daily Life:

• Walking: When you push the ground backward with your foot, the ground exerts an equal and opposite force propelling you forward.

• Cycling: The wheels push the ground backward, and the reaction force moves the cycle forward.

Important Points

• Action-Reaction Pair: The force exerted by the swimmer on the water (action) and the force exerted by the water on the swimmer (reaction) form an action-reaction pair.

• Role of Muscles: Efficient swimming requires strong muscles to generate sufficient backward force against the water.

• Streamlining in Swimming: To reduce drag, swimmers adopt streamlined body positions, such as keeping the body straight and minimizing unnecessary movements.

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• Swimming Strokes: Different strokes, such as freestyle, breaststroke, and butterfly, utilize Newton's Third Law to generate forward motion through specific arm and leg movements.

Q13. Answer: (b) Ribosome

The correct answer is Ribosome.

Key Points

• Rough Endoplasmic Reticulum (RER) appears rough under a microscope due to the presence of ribosomes attached to its surface.

• Ribosomes are responsible for protein synthesis, a critical cellular function essential for growth, repair, and maintaining cellular processes.

• The RER is primarily involved in the synthesis of proteins that are either secreted by the cell, incorporated into the cell membrane, or sent to lysosomes.

• These ribosomes are bound to the cytosolic surface of the RER and help in translating messenger RNA (mRNA) into polypeptide chains.

• The proteins produced by the RER are often modified and folded within its lumen before being transported to their final destinations.

Additional Information

• Ribosomes:

• Ribosomes are small organelles composed of ribosomal RNA (rRNA) and proteins.

• They exist in two forms: free ribosomes (floating in the cytoplasm) and bound ribosomes (attached to the RER).

• Free ribosomes synthesize proteins that function within the cytoplasm, while bound ribosomes produce proteins destined for secretion or for use in the cell membrane.

• Functions of Rough Endoplasmic Reticulum:

• It plays a critical role in the synthesis and modification of proteins.

• The RER is involved in the addition of carbohydrate chains to proteins, forming glycoproteins.

• It provides a pathway for the transport of synthesized proteins to the Golgi apparatus for further processing and packaging.

• Comparison with Smooth Endoplasmic Reticulum (SER):

• SER lacks ribosomes and is involved in lipid synthesis, detoxification, and calcium storage.

• Unlike the RER, the SER does not contribute directly to protein synthesis.

• Other Organelles:

• Centrosome: Involved in organizing microtubules and plays a vital role during cell division. Not related to protein synthesis.

• Lysosome: Contains digestive enzymes to break down cellular waste. Not related to the RER's rough appearance.

• Peroxisome: Responsible for breaking down fatty acids and detoxifying harmful substances. Not linked to the RER's function or appearance.

• Important Points:

• The RER is prominent in cells specialized for protein secretion, such as pancreatic cells (produce digestive enzymes) and plasma cells (produce antibodies).

• The discovery of ribosomes and their role in protein synthesis was a landmark finding by George Palade, who received the Nobel Prize in Physiology or Medicine in 1974.

• The ribosomes attached to the RER are 70S in prokaryotes and 80S in eukaryotes.

Q14. Answer: (b) Heart

The correct answer is Heart.

Key Points

• The structural organization of a cell consists of essential components such as the cytoplasm, mitochondria, cell membrane, nucleus, and cell wall (in plants and some microorganisms). These parts work together to maintain cellular function.

• The cytoplasm is the gel-like substance inside the cell where most cellular activities occur, including metabolic pathways like glycolysis. It is a key structural component of the cell.

• Mitochondria, known as the "powerhouse of the cell," are organelles responsible for energy production through the process of cellular respiration. They are integral to the cell's structure and function.

• The cell wall is present in plant cells, fungi, and some bacteria, providing structural support and protection. Animal cells lack a cell wall but have a flexible cell membrane.

• The heart, however, is an organ of the circulatory system and not a structural part of a cell. It pumps blood throughout the body and is unrelated to the cellular organization. Thus, the heart is not a component of cell structure.

• Hence, the correct answer is Heart.

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Additional Information

• Components of a cell:

• Nucleus: The nucleus contains genetic material (DNA) and regulates cellular activities like growth, metabolism, and reproduction.

• Cell membrane: It is the outer boundary of the cell that controls the entry and exit of substances, maintaining the internal environment of the cell.

• Endoplasmic reticulum (ER): The ER is involved in protein and lipid synthesis. It is divided into rough ER (with ribosomes) and smooth ER (without ribosomes).

• Golgi apparatus: It is responsible for modifying, sorting, and packaging proteins and lipids for secretion or internal use.

• Ribosomes: These are the sites of protein synthesis within the cell. Ribosomes can be free-floating in the cytoplasm or attached to the rough ER.

• Types of cells:

• Prokaryotic cells: These cells lack a nucleus and membrane-bound organelles (e.g., bacteria).

• Eukaryotic cells: These cells have a nucleus and membrane-bound organelles (e.g., plant and animal cells).

• Importance of cellular components:

• Cellular components work together to maintain homeostasis, facilitate energy production, and support overall cellular functions.

• They contribute to processes such as growth, repair, reproduction, and environmental response.

• The heart as an organ:

• The heart is a muscular organ responsible for pumping oxygenated and deoxygenated blood throughout the body.

• It is part of the circulatory system and plays no role in the structural organization or functional components of a cell.

• The heart is composed of tissues and cells, including cardiomyocytes (heart muscle cells), but it is a system-level structure.

Important Points

• Structural differences between plant and animal cells:

• Plant cells have a cell wall, chloroplasts, and large central vacuoles, which are absent in animal cells.

• Animal cells have centrioles and smaller vacuoles compared to plant cells.

• Cell specialization:

• Cells specialize to perform specific functions in multicellular organisms (e.g., nerve cells, muscle cells, and skin cells).

• This specialization ensures efficient functioning and division of labor within the body.

• Cellular organelles and diseases:

• Dysfunction of cellular organelles can lead to diseases such as mitochondrial disorders or lysosomal storage diseases.

• Understanding cell biology helps in developing treatments for such conditions.

Q15. Answer: (b) A strip of impure metal to be refined

The correct answer is A strip of impure metal to be refined.

Key Points

• Electrolytic refining is a process used to purify metals using the principles of electrolysis. It is commonly used for refining metals such as copper, zinc, silver, gold, and nickel.

• In this process, the impure metal is used as the anode, while a thin sheet of the pure metal is used as the cathode. Hence, the statement “A strip of impure metal to be refined is used as the anode” is correct.

• The electrolyte used is usually a solution of a soluble salt of the same metal. For example, during the refining of copper, the electrolyte is typically acidified copper sulfate solution ($CuSO_4$).

• When electric current is passed through the electrolyte, the impure metal at the anode dissolves into the solution as positively charged metal ions.

• These metal ions move through the electrolyte and get deposited on the pure metal cathode, forming a thicker layer of highly pure metal.

• The impurities present in the impure metal either remain dissolved in the electrolyte or settle down at the bottom of the cell as anode mud.

• Therefore, the anode must be made of the impure metal so that it can dissolve during electrolysis and allow the purification process to occur.

• Hence, the correct answer is A strip of impure metal to be refined.

Additional Information

• Working Principle of Electrolytic Refining:

• The process is based on the principle that metal ions migrate in an electric field and get deposited on the electrode where reduction occurs.

• At the anode, the impure metal undergoes oxidation, releasing metal ions into the solution.

• At the cathode, these ions gain electrons and are deposited as pure metal.

• Example: Refining of Copper

• In the electrolytic refining of copper, the impure copper block acts as the anode and a thin sheet of pure copper acts as the cathode.

• The electrolyte used is acidified copper sulphate solution.

• When current passes, Cu → Cu²^+ + 2e^- occurs at the anode.

• At the cathode, the reaction Cu²^+ + 2e^- → Cu results in the deposition of pure copper.

• Nature of Impurities:

• Less reactive impurities such as gold (Au), silver (Ag), and platinum (Pt) settle down as anode mud.

• More reactive impurities like iron (Fe) and zinc (Zn) dissolve in the electrolyte.

• These by-products are sometimes recovered because precious metals like gold and silver have significant commercial value.

Important Points

• Industrial Applications:

• Electrolytic refining is widely used in industries to obtain metals with purity levels above 99.9%.

• This method is especially important in the electronics industry where highly pure copper is required for manufacturing electrical wires and circuits.

• Advantages of Electrolytic Refining:

• Produces very high purity metals.

• Allows recovery of valuable metals such as gold, silver, and platinum from anode mud.

• It is an efficient and widely adopted technique in modern metallurgical industries.

Q16. Answer: (b) Only a and b

The correct answer is Only a and b.

Key Points

• Law of Constant Proportions: This law, also known as Proust's Law, states that in a chemical compound, the elements are always present in definite proportions by mass, irrespective of the source or preparation method.

• Statement a: "In water, the ratio of the mass of hydrogen to the mass of oxygen is always 1:8." This is correct since water (H2O) always contains hydrogen and oxygen in the ratio of 2:16 by mass, which simplifies to 1:8. Hence, this statement adheres to the law of constant proportions.

• Statement b: "The ratio of carbon and oxygen in carbon dioxide is always 3:8 by mass." This is correct because in CO2, carbon (12 g/mol) and oxygen (32 g/mol) have a fixed mass ratio of 12:32, which simplifies to 3:8. This confirms the law of constant proportions.

• Statement c: "In ammonia, nitrogen and hydrogen are always present in the ratio 14:1 by mass." This is incorrect as ammonia (NH3) consists of nitrogen (14 g/mol) and hydrogen (3 g/mol), giving a mass ratio of 14:3, not 14:1.

• Hence, only statements a and b are correct.

Additional Information

• Concept of Law of Constant Proportions:

• Proposed by Joseph Proust in 1799, this law is a fundamental principle in chemistry.

• It applies to pure chemical compounds and states that the composition of a compound is independent of its source.

• The law is significant in understanding the stoichiometry of compounds and chemical reactions.

• Exceptions to the Law:

• Non-stoichiometric compounds: Some compounds, like ferrous oxide (FeO), do not follow this law as their composition varies due to defects in their crystal structure.

• Isotopic variations: When isotopes of an element are present, the mass ratio may slightly differ due to their different atomic masses.

• Applications of the Law:

• Used in determining the chemical formula of compounds.

• Helps in verifying the purity of a compound by analyzing its elemental composition.

• Plays an essential role in the development of the modern atomic theory.

• Key Examples:

• Water (H2O): Always contains hydrogen and oxygen in the mass ratio 1:8.

• Carbon dioxide (CO2): Always contains carbon and oxygen in the mass ratio 3:8.

• Methane (CH4): Always contains carbon and hydrogen in the mass ratio 3:1.

Important Points

• Law of Multiple Proportions: Distinct from the law of constant proportions, this law states that when two elements combine to form more than one compound, the masses of one element that combine with a fixed mass of the other element are in a simple whole-number ratio.

• Modern Atomic Theory: The law of constant proportions laid the groundwork for John Dalton's atomic theory, which explains the fixed composition of compounds based on the arrangement and combination of atoms.

• Analytical Techniques: Modern analytical tools like mass spectrometry and spectroscopy validate the law of constant proportions by accurately determining the elemental composition of compounds.

Q17. Answer: (a) In the abdomen, on either side of the back bone

The correct answer is In the abdomen, on either side of the back bone.

Key Points

• The kidneys are located in the human body in the abdomen, specifically on either side of the vertebral column (backbone). This placement ensures their proximity to important blood vessels, such as the aorta and the inferior vena cava.

• Each kidney is situated in the retroperitoneal space, meaning they are positioned behind the peritoneum (a membrane lining the abdominal cavity). This unique location protects the kidneys from external injuries.

• The right kidney is slightly lower than the left kidney due to the presence of the liver on the right side of the body.

• The kidneys are bean-shaped organs, each measuring approximately 11-14 cm in length and weighing around 120-150 grams. These vital organs help in filtering blood and excreting waste products.

• The kidneys play a critical role in regulating the body's fluid balance, maintaining electrolyte levels, and ensuring proper blood pressure control through their hormone production.

Additional Information

• Functions of the Kidneys:

• The kidneys filter around 50 gallons of blood daily to remove waste products and excess fluids, which are then excreted as urine.

• They help maintain the body's acid-base balance, ensuring the pH levels of the blood remain stable.

• Kidneys produce hormones such as erythropoietin, which stimulates red blood cell production, and renin, which plays a role in blood pressure regulation.

• They also activate Vitamin D, which is essential for maintaining healthy bones and calcium levels in the body.

• Structure of the Kidneys:

• Each kidney is composed of millions of tiny filtering units called nephrons. Nephrons are responsible for filtering blood and forming urine.

• The kidneys have three main regions: the renal cortex (outer layer), the renal medulla (middle layer), and the renal pelvis (inner region where urine collects).

• Diseases Related to Kidneys:

• Chronic Kidney Disease (CKD): A gradual loss of kidney function over time, often caused by diabetes or high blood pressure.

• Kidney Stones: Hard mineral deposits formed in the kidneys, often leading to pain and difficulty in urination.

• Urinary Tract Infections (UTIs): Infections that can affect any part of the urinary system, including the kidneys.

• Interesting Facts:

• Humans can survive with just one kidney, as a single kidney is capable of performing all essential functions.

• The kidneys receive 20-25% of the total cardiac output, which highlights their importance in maintaining overall health.

Important Points

• The kidneys are part of the excretory system, which includes other organs such as the ureters, urinary bladder, and urethra.

• The term renal is often used to describe kidney-related conditions, functions, or anatomical structures (e.g., renal artery, renal failure).

• The kidneys are protected by layers of fat and connective tissue, which cushion them against mechanical shocks.

• Dialysis is a medical procedure used to artificially replicate kidney functions in individuals with renal failure.

Q18. Answer: (c) Mass is constant and Weight is variable

The correct answer is Mass is constant and Weight is variable.

Key Points

• Mass is a measure of the amount of matter in an object. It is a scalar quantity and remains constant regardless of the object's location. This is because mass depends on the object's intrinsic properties and not on external factors like gravity. Hence, this statement is correct.

• Weight is the force exerted on an object due to gravity. It is a vector quantity and depends on the gravitational acceleration of the location. Weight can vary depending on the gravitational field strength. For example, an object’s weight on the Moon is less than its weight on Earth due to the Moon's weaker gravity. Hence, this statement is correct.

• The relationship between weight and mass is given by the formula: Weight = Mass × Gravitational acceleration (W = m × g). Since "g" (gravitational acceleration) varies with location, weight is not constant.

• Mass remains constant across the universe, while weight changes depending on the gravitational field strength. For instance, astronauts experience weightlessness in space due to the absence of significant gravity, but their mass remains unchanged.

• Thus, the statement "Mass is constant and Weight is variable" is the correct answer.

Additional Information

• Mass:

• Mass is measured in kilograms (kg) in the International System of Units (SI).

• It remains the same on Earth, the Moon, or any other celestial body.

• Mass is a fundamental property of matter and does not change with changes in gravitational force or location.

• Weight:

• Weight is measured in newtons (N) in the SI system, as it is a force.

• It depends on the local gravitational acceleration (e.g., Earth's gravitational acceleration is approximately 9.8 m/s^2).

• On the Moon, the gravitational acceleration is about 1/6th of Earth's, so an object's weight on the Moon is only about 1/6th of its weight on Earth.

• Examples of Mass vs. Weight:

• A person with a mass of 50 kg will have the same mass on Earth and the Moon.

• Their weight on Earth would be approximately 490 N (50 × 9.8), while on the Moon, it would be approximately 81.6 N (50 × 1.63).

• Gravitational Variations:

• Gravitational acceleration can vary even on Earth, depending on altitude and latitude. For example, "g" is slightly less at the equator compared to the poles.

• In space, where there is no significant gravitational pull, objects are in a state of weightlessness despite retaining their mass.

Important Points

• SI Units:

• Mass is measured in kilograms (kg).

• Weight is measured in newtons (N).

• Real-Life Applications:

• Weight is a crucial factor in fields like engineering, construction, and space exploration.

• Mass is essential in scientific research, chemistry, and physics as it determines an object's resistance to acceleration.

• Key Formula: Weight (W) = Mass (m) × Gravitational acceleration (g).

Q19. Answer: (b) 1.45 × 10^6 J

The correct answer is 1.45 × 10^6 J.

Key Points

• The heat produced in an electric heater is calculated using Joule's Law of Heating: $H = (V^2/R) \times t$

• Given:

• Voltage, V = 220 V

• Resistance, R = 20 Ω

• Time, t = 10 minutes = 600 s

• Substituting the values:

$H = (220^2/20) \times 600$

$= (48400/20) \times 600$

$= 2420 \times 600$

$= 1,452,000$ J

$= 1.452 \times 10^6$ J

• Hence, the heat produced is 1.45 × 10^6 J.

Additional Information

• Joule's Law of Heating:

• $H = I^2Rt$

• $H = VIt$

• $H = (V^2/R)t$

• All three expressions are equivalent.

• SI Unit of Heat Energy:

• The SI unit is the joule (J).

• Electric Power:

• $P = VI = I^2R = V^2/R$.

• For this heater, P = 2420 W.

• Applications of Joule Heating:

• Electric heaters

• Electric irons

• Toasters

• Electric kettles

Q20. Answer: (c) Sum of atomic masses of all atoms in the formula unit of an ionic compound

The correct answer is Sum of atomic masses of all atoms in the formula unit of an ionic compound.

Key Points

• Formula Unit: A formula unit in chemistry refers to the simplest ratio of ions represented in an ionic compound. It highlights the composition of a compound without detailing its molecular structure.

• Definition: The formula unit mass is the sum of the atomic masses of all atoms in the formula unit of an ionic compound. This is the correct definition that matches the question's context.

• Examples: For sodium chloride (NaCl), the formula unit mass is calculated by adding the atomic mass of sodium (23) and chlorine (35.5), which equals 58.5.

• Difference from Molecular Mass: Unlike molecular compounds that have distinct molecules, ionic compounds like NaCl exist as crystal lattices. Hence, the term "formula unit" is used instead of "molecule."

• Relevance: Understanding formula unit mass is critical in stoichiometric calculations, especially when dealing with ionic compounds in chemical reactions.

Additional Information

• Atomic Mass: The mass of a single atom, typically measured in atomic mass units (amu). For example, the atomic mass of sodium (Na) is approximately 23 amu.

• Ionic Compounds: Ionic compounds are formed through the electrostatic attraction between positively charged cations and negatively charged anions. Examples include NaCl (sodium chloride), MgO (magnesium oxide), etc.

• Molecular Mass vs. Formula Unit Mass: Molecular mass is the sum of atomic masses in a molecule, while formula unit mass is used for ionic compounds and is calculated based on the empirical formula.

• Applications: Formula unit mass is essential in quantitative chemical analysis, such as calculating the amount of reactants or products in a chemical reaction involving ionic compounds.

• Key Difference: Ionic compounds do not form discrete molecules; instead, they form a continuous network or lattice structure. Hence, the term "formula unit" is used to simplify representation.

Important Points

• Option 1: "Mass of an atom" refers to the atomic mass of a single atom and is not equivalent to the formula unit mass. This option is incorrect.

• Option 2: "Mass of one molecule" is applicable to covalent compounds, not ionic compounds. Formula unit mass is used for ionic compounds. This option is incorrect.

• Option 3: "Sum of atomic masses of all atoms in the formula unit of an ionic compound" is the accurate definition of formula unit mass. This option is correct.

• Option 4: "Mass of one mole of a compound" refers to the molar mass, which is different from formula unit mass. This option is incorrect.

Q21. Answer: (d) Parthenium

The correct answer is Parthenium.

Key Points

• Parthenium, commonly known as Congress Grass, is a highly invasive weed that causes significant harm to agricultural productivity and biodiversity.

• It competes with crops for essential nutrients, water, sunlight, and space, drastically reducing yields. Hence, its removal benefits farmers.

• Parthenium contains toxic compounds like parthenin, which are harmful to humans, animals, and other plants. It causes dermatitis and respiratory problems in humans and is toxic to livestock.

• This weed poses a threat to biodiversity by outcompeting native vegetation and reducing the availability of resources for pollinators and other beneficial organisms.

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• Farmers and agricultural scientists recommend physical removal, biological control (using insects like Zygogramma bicolorata), and chemical herbicides to manage its spread.

Additional Information

• Characteristics of Parthenium:

• Belongs to the family Asteraceae.

• It is a fast-growing annual herbaceous weed that thrives in disturbed soils, roadsides, and agricultural fields.

• Originated in North and South America and was accidentally introduced to India in the 1950s through imported food grains.

• Produces a large number of seeds (up to 15,000 per plant), facilitating its rapid spread.

• Impact on Agriculture:

• Parthenium affects the growth and yield of major crops like wheat, rice, and maize.

• It also disrupts soil properties by altering the microbial composition, which impacts crop health.

• Control Measures:

• Biological Control: The beetle Zygogramma bicolorata is used to control Parthenium populations by feeding on its leaves and flowers.

• Chemical Control: Herbicides like glyphosate and 2,4-D are effective in managing Parthenium.

• Physical Removal: Manual uprooting of Parthenium before it flowers and sets seeds is recommended to prevent its spread.

• Comparison with Other Options:

• Wheat: A staple crop and a major food source; beneficial for farmers.

• Sunflower: A commercial crop grown for edible oil and seeds; highly profitable for farmers.

• Soybean: A significant source of protein and oil; essential for agricultural economy.

• Parthenium: A harmful weed with no economic or agricultural benefits; its removal is critical.

Important Points

• Health Hazards of Parthenium:

• Causes allergic reactions, including asthma, hay fever, and dermatitis, in humans.

• Livestock that graze on Parthenium suffer from reduced milk production and other health issues due to its toxicity.

• Economic Loss:

• Parthenium infestation leads to significant economic losses in agriculture by reducing crop productivity and increasing weed management costs.

• In India, it has been reported to cause losses worth several crores annually.

• Government Initiatives:

• Several states in India have undertaken awareness campaigns and weed eradication programs to control Parthenium.

• Research organizations like the Indian Council of Agricultural Research (ICAR) are actively working on sustainable management strategies for this weed.

Q22. Answer: (c) Spectrum

The correct answer is Spectrum.

Key Points

• Dispersion occurs when a ray of white light passes through a prism, splitting into its constituent colors. This phenomenon is due to the variation in the refractive index of the material for different wavelengths of light.

• The band of seven colors produced on a screen as a result of dispersion is called a spectrum. These colors include violet, indigo, blue, green, yellow, orange, and red (VIBGYOR).

• Each color in the spectrum corresponds to a specific wavelength of visible light, with violet having the shortest wavelength and red having the longest.

• The phenomenon of dispersion and the formation of a spectrum were scientifically explained by Isaac Newton, who demonstrated that white light is composed of multiple colors.

• This property of light is crucial in understanding optical phenomena, such as rainbows, which are natural examples of spectrum formation due to dispersion of light through water droplets in the atmosphere.

Additional Information

• Definition of Dispersion: Dispersion refers to the splitting of white light into its constituent colors when it passes through a medium like a prism. It occurs because different colors of light travel at different speeds when passing through a medium.

• Applications of Spectrum:

• Spectroscopy: Used in scientific fields to analyze the composition of substances based on their light spectrum.

• Optical Instruments: Instruments like spectrometers and spectrophotometers rely on dispersion and spectrum analysis.

• Astronomy: Astronomers use spectra to study the composition and movement of celestial bodies.

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• Refractive Index: The refractive index of a material determines the degree of bending of light and varies with the wavelength of light, leading to dispersion.

• Real-World Examples:

• Rainbows: Formed by the dispersion and total internal reflection of sunlight in water droplets.

• CDs and DVDs: The grooves on the surface act as a diffraction grating, creating a spectrum.

• Other Phenomena Related to Light:

• Reflection: Bouncing back of light when it hits a surface.

• Refraction: Bending of light as it passes from one medium to another.

• Diffraction: The bending of light around obstacles or openings.

Important Points

• Isaac Newton's Experiment: Newton demonstrated dispersion using a glass prism and white light, proving that sunlight consists of different colors.

• Color Wavelengths: The visible spectrum ranges from approximately 400 nm (violet) to 700 nm (red).

• Prism Material: The degree of dispersion depends on the material of the prism; for example, glass disperses light more than air.

• Difference Between Spectrum and Image: A spectrum is a band of colors due to dispersion, whereas an image is a reproduction of an object through reflection or refraction.

Q23. Answer: (d) Prostate gland

The correct answer is Prostate gland.

Key Points

• The prostate gland is a part of the male reproductive system in humans. It is located just below the bladder and surrounds the urethra.

• This gland plays a crucial role in the production of seminal fluid, which nourishes and transports sperm during ejaculation.

• The prostate gland produces a fluid that constitutes approximately 30% of the semen volume. This fluid contains enzymes, zinc, and citric acid, which contribute to sperm viability and motility.

• It also contains the enzyme prostate-specific antigen (PSA), which helps in liquefying the semen after ejaculation for better sperm mobility.

• The prostate gland is regulated by hormones such as testosterone, which is produced by the testes, emphasizing its connection to the male reproductive system.

Additional Information

• Vagina:

• The vagina is part of the female reproductive system. It is the muscular tube that connects the cervix to the external genitalia.

• It plays a role in childbirth, menstruation, and sexual intercourse. It is not part of the male reproductive system.

• Uterus:

• The uterus, also known as the womb, is another component of the female reproductive system.

• It is where the fertilized egg implants and develops into a fetus during pregnancy. It is not found in males.

• Fallopian Tube:

• The fallopian tubes are part of the female reproductive system, responsible for transporting the egg from the ovary to the uterus.

• Fertilization of the egg by sperm typically occurs in the fallopian tubes.

• Prostate Gland:

• The prostate gland is a vital part of the male reproductive system, contributing to the production of semen.

• It is prone to certain health conditions such as prostatitis (inflammation), benign prostatic hyperplasia (BPH), and prostate cancer, especially in older men.

Important Points

• The male reproductive system consists of organs such as the testes, vas deferens, prostate gland, seminal vesicles, and penis.

• The testes produce sperm and hormones like testosterone, which regulate secondary sexual characteristics and reproductive functions.

• The prostate gland and seminal vesicles contribute to the production of seminal fluid, which ensures the nourishment and transport of sperm.

• Health conditions related to the prostate gland, such as prostate cancer, are common in older men. Regular screening for PSA levels is recommended for early detection.

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Q24. Answer: (b) Acid + Base → Salt + Water

The correct answer is Acid + Base → Salt + Water.

Key Points

• A neutralisation reaction occurs when an acid reacts with a base to form a salt and water. This reaction is a fundamental chemical process widely observed in various fields of chemistry.

• The general equation of a neutralisation reaction is: Acid + Base → Salt + Water.

• For example, when hydrochloric acid (HCl) reacts with sodium hydroxide (NaOH), the products are sodium chloride (NaCl) (a salt) and water (H2O):

• HCl + NaOH → NaCl + H2O

• This reaction is an exothermic process, meaning it releases heat energy.

• The pH of the resulting solution after a complete neutralisation is typically around 7, indicating a neutral solution.

• This concept is widely applied in various industries like pharmaceuticals, wastewater treatment, and agriculture to neutralise acidic or basic substances.

Additional Information

• Explanation of Incorrect Options:

• Option 1 (Acid + Salt → Water): This is incorrect because acids and salts do not typically react to form water unless there are special conditions, such as the presence of a base or specific reaction mechanisms.

• Option 3 (Base + Oxide → Salt + Water): This is partially incorrect. While certain bases react with acidic oxides to form salts and water, this is not the definition of a neutralisation reaction.

• Option 4 (Acid + Metal → Salt + Hydrogen): This represents a reaction where an acid reacts with a metal to produce a salt and hydrogen gas, not water. For example: Zn + HCl → ZnCl2 + H2.

• Characteristics of Neutralisation Reactions:

• The reaction involves the combination of H^+ ions from the acid and OH^- ions from the base to form water (H2O).

• Neutralisation reactions are used in antacid formulations to reduce excess stomach acidity by neutralising hydrochloric acid (HCl) in the stomach.

• They are also used in the treatment of industrial effluents to neutralise acidic or basic waste before disposal into water bodies.

• Examples of Neutralisation Reactions:

• NaOH + HCl → NaCl + H2O: Sodium hydroxide reacts with hydrochloric acid to form sodium chloride and water.

• Ca(OH)2 + H2SO4 → CaSO4 + 2H2O: Calcium hydroxide reacts with sulfuric acid to produce calcium sulfate and water.

• Importance in Daily Life:

• Used in agriculture to neutralise acidic soils with lime (Ca(OH)2).

• Helps in the formulation of antacids to relieve acidity in the human stomach.

• Essential in water treatment plants to neutralise acidic water before distribution.

Important Points

• Real-world Applications of Neutralisation Reactions:

• Medicinal Use: Antacids like magnesium hydroxide (milk of magnesia) neutralise excess stomach acid to relieve heartburn and indigestion.

• Environmental Use: Neutralising acidic rainwater using basic substances like lime to prevent damage to soil and aquatic ecosystems.

• Industrial Use: In chemical manufacturing, neutralisation reactions are used to control pH levels of products and waste materials.

• Indicators of Neutralisation: Common indicators like phenolphthalein and methyl orange are used to signify completion of the reaction by showing a colour change.

Q25. Answer: (d) protons and neutrons

The correct answer is protons and neutrons.

Key Points

• Nucleons are the subatomic particles that constitute the nucleus of an atom.

• The two types of nucleons are protons and neutrons, which are bound together by the strong nuclear force.

• Protons carry a positive charge (+1) and have a mass approximately equal to 1 atomic mass unit (amu).

• Neutrons are electrically neutral particles with a mass similar to that of protons (approximately 1 amu).

• Electrons are not considered nucleons because they are located outside the nucleus and have negligible mass compared to protons and neutrons.

• The nucleus is responsible for most of the atom's mass, as protons and neutrons are significantly heavier than electrons.

Additional Information

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• Protons:
• Protons are positively charged particles found in the nucleus of an atom.
• The number of protons in an atom defines its atomic number, which determines the element's identity.
• Protons are composed of three quarks (two up quarks and one down quark) held together by the strong nuclear force.
• Neutrons:
• Neutrons are neutral particles that also reside in the atomic nucleus.
• They play a crucial role in stabilizing the nucleus by reducing the repulsive forces between positively charged protons.
• Neutrons consist of three quarks (one up quark and two down quarks) bound by the strong nuclear force.
• Electrons:
• Electrons are negatively charged particles that orbit the nucleus in specific energy levels or shells.
• Their mass is approximately 1/1836 of a proton, making their contribution to the atom's total mass negligible.
• Electrons are not nucleons because they are not part of the nucleus.
• Strong Nuclear Force:
• The strong nuclear force is the fundamental interaction responsible for binding protons and neutrons together in the nucleus.
• It operates over very short distances (approximately 1 femtometer) and is the strongest force in nature.
• This force overcomes the electrostatic repulsion between positively charged protons in the nucleus.
• Applications:
• Understanding nucleons is critical in fields like nuclear physics, radiology, and energy production.
• Nuclear reactions, such as fission and fusion, involve changes in the arrangement of protons and neutrons in the nucleus.
• Isotopes of an element differ in their number of neutrons and have applications in medicine, dating techniques, and scientific research.

Q26. Answer: (d) 60 cm

Shortcut Trick

Calculate semi-perimeter (s): (75 + 34 + 61) ÷ 2 = 85 cm.

Find Area using Heron's: √[85 × (85−75) × (85−34) × (85−61)] = √[85 × 10 × 51 × 24] = 1020 cm².

Altitude (h) for base 34 cm: (2 × Area) ÷ Base = (2 × 1020) ÷ 34.

h = 2040 ÷ 34 = 60 cm.

Therefore The correct answer is 60 cm.

Alternate Method

Given: Sides of triangle a = 75 cm, b = 34 cm, and c = 61 cm.

Formula Used: Heron's formula for Area = √[s(s−a)(s−b)(s−c)] and Area = 1/2 × base × height.

Calculations:

=> Semi-perimeter (s) = (a + b + c) ÷ 2

=> s = (75 + 34 + 61) ÷ 2 = 170 ÷ 2 = 85 cm

=> Area = √[85 × (85 − 75) × (85 − 34) × (85 − 61)]

=> Area = √[85 × 10 × 51 × 24]

=> Area = √[(5 × 17) × (5 × 2) × (3 × 17) × (2³ × 3)]

=> Area = √[5² × 17² × 3² × 2^4]

=> Area = 5 × 17 × 3 × 2² = 1020 cm²

=> Now, Area = 1/2 × 34 × Altitude

=> 1020 = 17 × Altitude

=> Altitude = 1020 ÷ 17 = 60 cm

Therefore The correct answer is 60 cm.

Additional Information

Heron's Formula

Used to find the area of a triangle when all three sides are known: Area = √[s(s−a)(s−b)(s−c)], where s is the semi-perimeter.

Altitude of a Triangle

The altitude is the perpendicular line segment from a vertex to the opposite side. Every triangle has three altitudes.

Relation between Area and Altitude

For any triangle, Altitude = (2 × Area) ÷ Corresponding Base. The shortest side of a scalene triangle corresponds to the longest altitude.

Q27. Answer: (d) Rs. 1,20,666

Shortcut Trick

Total Marked Price = 250 × 1,014 = Rs. 2,53,500

Net Selling Price = 2,53,500 × 0.70 × 0.85 × 0.80

Using effective multiplier: 2,53,500 × 0.476 = Rs. 1,20,666

Therefore The correct answer is Rs. 1,20,666.

Alternate Method

Given:

Quantity = 250 mixers

Price per mixer = Rs. 1,014

Discounts = 30%, 15% and 20% (card payment)

Calculations:

=> Total MP = 250 × 1,014 = Rs. 2,53,500

=> Price after 30% discount = 2,53,500 × (70/100) = Rs. 1,77,450

=> Price after 15% discount = 1,77,450 × (85/100) = Rs. 1,50,832.5

=> Price after 20% card discount = 1,50,832.5 × (80/100)

=> Final Amount = 1,50,832.5 × 0.8 = Rs. 1,20,666

Therefore The correct answer is Rs. 1,20,666.

Additional Information

Successive Discount Formula

For two successive discounts a% and b%, the single equivalent discount is (a + b − ab/100)%.

Net Selling Price

SP = MP × (100−d1)/100 × (100−d2)/100 × (100−d_n)/100. This is the standard chain rule for discounts.

Marked Price (MP)

It is the price printed on the product, also known as the list price, upon which discounts are calculated.

Q28. Answer: (c) 3

Shortcut Trick

Combined efficiency of A, B, and C using LCM of 3, 2, 6 = 6 units.

Efficiencies: A = 2, B = 3, C = 1. Total Efficiency = 6.

Time for original work = 6 ÷ 6 = 1 day.

Time for thrice the work = 1 × 3 = 3 days.

Therefore The correct answer is 3 days.

Alternate Method

Given: Time taken by A = 3 days, B = 2 days, C = 6 days.

Formula Used: Total Work = LCM of individual days; Efficiency = Total Work ÷ Time.

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

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

=> New Work = 3 × Original Work = 3 × 6 = 18 units

=> Time required = New Work ÷ Total Efficiency

=> Time required = 18 ÷ 6 = 3 days

Therefore The correct answer is 3 days.

Additional Information

Combined Work Formula

For three people, the time taken together is T = (a×b×c) ÷ (ab + bc + ca). Multiply the result by 'n' for n-times the work.

Work and Efficiency Relationship

Efficiency is inversely proportional to the time taken. If work increases by a factor of 3, time also increases by a factor of 3 for

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constant efficiency.

Q29. Answer: (d) 7

Shortcut Trick

List the frequencies of existing numbers: 8 (occurs 3 times), 7 (occurs 3 times), 9 (2 times), 10 (2 times), 2 (1 time), 5 (1 time).

The Mode is defined as the value with the highest frequency.

Currently, both 7 and 8 have the same maximum frequency of 3.

For the Mode of the data to be 7, the frequency of 7 must be greater than that of any other number.

Therefore, the additional variable x must be 7 to make its frequency 4.

Therefore The correct answer is 7.

Alternate Method

Given Data: 8, 7, 8, 7, 9, 10, 2, 8, 9, 7, 5, 10 and x

Given Mode = 7

Analyze frequencies in the set (excluding x):

=> Count of 8 = 3

=> Count of 7 = 3

=> Count of 9 = 2

=> Count of 10 = 2

=> Count of 2 = 1

=> Count of 5 = 1

=> Since Mode = 7, the total frequency of 7 must be greater than the frequency of 8.

=> Frequency(7) including x > Frequency(8)

=> 3 + 1 > 3 => 4 > 3

=> This condition is satisfied only when x = 7.

Therefore The correct answer is 7.

Additional Information

Mode

The value that appears most frequently in a given data set. A set can be unimodal (one mode), bimodal (two modes), or multimodal.

Empirical Relationship

For a moderately skewed distribution, the relationship is: Mode = 3 × Median − 2 × Mean.

Median

The middle value of a data set when it is arranged in ascending or descending order. If the number of terms n is even, it is the average of the two middle terms.

Mean

The average of all observations calculated as: Mean = (Sum of all observations) ÷ (Total number of observations).

Q30. Answer: (a) 26

Shortcut Trick

Let Son = x. Then Mother = 2x, Father = 2x + 3, and Daughter = x + 3.

Sum: x + (2x) + (2x + 3) + (x + 3) = 144 => 6x + 6 = 144.

6x = 138 => x = 23 years.

Daughter = 23 + 3 = 26 years.

Therefore The correct answer is 26 years.

Alternate Method

Given:

Total age of Father, Mother, Son, and Daughter = 144 years.

Age order: Father > Mother > Daughter > Son.

Calculations:

=> Let Son's age = S

=> Mother's age = 2 × S = 2S

=> Father's age = Mother + 3 = 2S + 3

=> Daughter's age = Son + 3 = S + 3

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=> (2S + 3) + 2S + (S + 3) + S = 144
=> 6S + 6 = 144
=> 6S = 138
=> S = 23 years
=> Daughter's age = 23 + 3 = 26 years
Therefore The correct answer is 26 years.
Additional Information
Linear Equations in Age Problems
Always express all individual ages in terms of a single variable (usually the youngest person) to simplify the equation.
Age Difference Property
The age difference between two people remains constant regardless of the number of years that pass.
Averages in Age
Average age = (Sum of ages of all members) ÷ (Total number of members).

Q31. Answer: (b) 8%

Shortcut Trick
Loss = Cost Price (CP) − Selling Price (SP)
Loss Percentage = (Loss ÷ CP) × 100
Calculation: (10720 − 9862.40) ÷ 10720 × 100 = 857.6 ÷ 10720 × 100 = 8%
Therefore The correct answer is 8%.
Alternate Method
Given:
Cost Price (CP) = Rs. 10,720
Selling Price (SP) = Rs. 9,862.40
Formula Used:
Loss = CP − SP
Loss % = (Loss / CP) × 100
Calculations:
=> Loss = 10720 − 9862.40
=> Loss = 857.60
=> Loss % = (857.60 ÷ 10720) × 100
=> Loss % = 0.08 × 100
=> Loss % = 8%
Therefore The correct answer is 8%.
Additional Information
Profit Percentage
Calculated when SP > CP. Profit % = [(SP − CP) ÷ CP] × 100.
Marked Price & Discount
Discount is always calculated on the Marked Price (MP). Discount % = (Discount ÷ MP) × 100.
Successive Percentage Change
For two successive changes of a% and b%, the effective change is [a + b + (ab/100)]%.

Q32. Answer: (d) increase by Rs. 1,086

Shortcut Trick
Initial Income = 100%, Savings = 27%, Expenditure = 73%.
Net change in Savings (S) × 27 = Total Income change × 100 − Expenditure change × 73.
Change in Savings % = (100 × 20 − 73 × 15) ÷ 27 = (2000 − 1095) ÷ 27 = 905 ÷ 27 ≈ 33.518%.
Absolute increase in Savings = Initial Savings × (905/27)% = (12000 × 27/100) × (905/2700) = 3240 × 905/2700 = Rs. 1,086.
Therefore The correct answer is increase by Rs. 1,086.
Alternate Method
Given: Initial Income = Rs. 12,000, Savings % = 27%, Income Increase = 20%, Expenditure Increase = 15%.
Formula Used: Income = Expenditure + Savings

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=> Initial Savings = 27% of 12,000 = 0.27 × 12,000 = Rs. 3,240

=> Initial Expenditure = 12,000 − 3,240 = Rs. 8,760

=> New Income = 12,000 + 20% of 12,000 = 12,000 + 2,400 = Rs. 14,400

=> New Expenditure = 8,760 + 15% of 8,760 = 8,760 + 1,314 = Rs. 10,074

=> New Savings = New Income − New Expenditure = 14,400 − 10,074 = Rs. 4,326

=> Change in Savings = 4,326 − 3,240 = Rs. 1,086 (Increase)

Therefore The correct answer is increase by Rs. 1,086.

Additional Information

Percentage Change in Components

If components A and B sum up to C, the percentage change in C is the weighted average of the percentage changes in A and B based on their initial values.

Alligation Method for Income-Expenditure

Ratio of Expenditure to Savings = (% Change in Savings − % Change in Income) : (% Change in Income − % Change in Expenditure).

Base Value Stability

When calculating final changes, always use the initial total Income or Expenditure as the base unless specified otherwise.

Q33. Answer: (c) 49

Shortcut Trick

Change in average age = 14 − 13 = 1 year.

Total persons now = 35 students + 1 teacher = 36.

Teacher age = New Average + (Original Number × Increase in Average)

Teacher age = 14 + (35 × 1) = 14 + 35 = 49 years.

Therefore The correct answer is 49 years.

Alternate Method

Given:

Number of students = 35

Initial average age = 13 years

New average age (including teacher) = 14 years

Calculations:

=> Total age of 35 students = 35 × 13

=> Total age of students = 455 years

=> Total number of people (students + teacher) = 36

=> Total age of 36 people = 36 × 14

=> Total age of 36 people = 504 years

=> Teacher age = Total age of 36 people − Total age of 35 students

=> Teacher age = 504 − 455 = 49 years

Therefore The correct answer is 49 years.

Additional Information

Average Formula

The average of a group is calculated as: Average = (Sum of all observations) ÷ (Total number of observations).

Inclusion/Exclusion Concept

When a new person joins a group, the Age of the new person = (New Average) + (Number of initial people × Increase in Average).

Combined Average

If two groups with n1 and n2 members have averages A1 and A2, the combined average is (n1A1 + n2A2) ÷ (n1 + n2).

Q34. Answer: (d) 3 : 1

Shortcut Trick

In melting and recasting problems, if a large sphere of radius R is converted into smaller spheres of radius r, the ratio of Total Surface Area of all small spheres to the Surface Area of the original sphere is always R : r.

Here, R = 10.5 cm and r = 3.5 cm.

Ratio = 10.5 : 3.5

Ratio = 3 : 1.

Therefore The correct answer is 3 : 1.

Alternate Method

Given:

Radius of the original sphere (R) = 10.5 cm

Radius of each smaller sphere (r) = 3.5 cm

Formula Used:

Volume of a sphere = (4/3) × π × radius³

Surface Area of a sphere = 4 × π × radius²

Calculations:

Since the volume remains constant during melting:

=> Volume of Original Sphere = n × Volume of one small sphere

=> (4/3) × π × (10.5)³ = n × (4/3) × π × (3.5)³

=> n = (10.5 / 3.5)³

=> n = 3³ = 27

Total Surface Area of 27 smaller spheres = 27 × 4 × π × (3.5)²

Surface Area of original sphere = 4 × π × (10.5)²

=> Required Ratio = [27 × 4 × π × (3.5)²] / [4 × π × (10.5)²]

=> Ratio = 27 × (3.5 / 10.5)²

=> Ratio = 27 × (1 / 3)²

=> Ratio = 27 × (1 / 9) = 3

Therefore The correct answer is 3 : 1.

Additional Information

Volume and Area Relation

When a 3D object is melted and recast, the total volume remains invariant, but the total surface area usually increases as the number of pieces increases.

Scaling Factor

If the linear dimensions (radius) are scaled by a factor k, the Area scales by k² and the Volume scales by k³.

Hemisphere Properties

For a hemisphere of radius r, the Curved Surface Area (CSA) is 2πr² and the Total Surface Area (TSA) is 3πr².

Q35. Answer: (b) 330

Shortcut Trick

Sheets per folder = 8 + 6 = 14

Booklet pages per folder = (24 ÷ 6) + 4 = 4 + 4 = 8

Total items per folder = 14 + 8 = 22

Total for 15 folders = 15 × 22 = 330

Therefore The correct answer is 330 sheets and pages.

Alternate Method

Given:

Number of exam folders = 15

Question sheets per folder = 8

Answer sheets per folder = 6

Booklet pages calculation = [(27-3)/6+4]

Formula Used:

Total = Folders × (Question Sheets + Answer Sheets + Booklet Pages)

Calculations:

=> Booklet pages = [(24 ÷ 6) + 4]

=> Booklet pages = [4 + 4] = 8

=> Total items in 1 folder = 8 + 6 + 8 = 22

=> Total items for 15 folders = 15 × 22

=> Total items = 330

Therefore The correct answer is 330 sheets and pages.

Additional Information
BODMAS Rule
Order of operations: Brackets, Orders, Division, Multiplication, Addition, Subtraction.
Unitary Method
Calculate the value of a single unit first, then multiply by the required number of units.
Simplification Shortcut
Multiplying by 15 is equivalent to multiplying by 10 and adding half of that result (15 × 22 = 220 + 110 = 330).

Q36. Answer: (d) 93%

Shortcut Trick
Discount = 4000 − 280 = 3720
Discount % = (3720 ÷ 4000) × 100
Discount % = 372 ÷ 4 = 93%
Therefore The correct answer is 93%.
Alternate Method
Given:
Marked Price (MP) = Rs. 4,000
Selling Price (SP) = Rs. 280
Formula Used:
Discount % = [(MP − SP) ÷ MP] × 100
Calculations:
=> Discount = 4000 − 280
=> Discount = 3720
=> Discount % = (3720 ÷ 4000) × 100
=> Discount % = 372000 ÷ 4000
=> Discount % = 93%
Therefore The correct answer is 93%.
Additional Information
Marked Price (MP)
The price printed on the item or label, also known as the List Price or Tag Price.
Successive Discounts
When multiple discounts are applied, the Effective Discount is calculated as d1 + d2 − (d1 × d2)/100.
Profit and Discount Relation
The ratio of MP to CP is given by: MP/CP = (100 + Profit%)/(100 − Discount%).

Q37. Answer: (a) 72

Shortcut Trick
Let the number be 100%.
Given: 20% of number + 72 = 100% of number
=> 72 = 100% − 20% = 80%
Directly, 80% of the number = 72.
Therefore The correct answer is 72.
Alternate Method
Given: 20% of a number added to 72 results in the number itself.
Formula: Percentage × Value = Result
Let the number be x.
=> 20% of x + 72 = x
=> (20/100) × x + 72 = x
=> 0.2x + 72 = x
=> 72 = x − 0.2x
=> 72 = 0.8x
=> 80% of the number = 0.8x = 72

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Therefore The correct answer is 72.

Additional Information

Percentage Change

To find a percentage of a number, multiply the number by the percent expressed as a fraction or decimal: x × (p/100).

Complementary Percentages

If p% of a value is removed, the remaining part is (100 − p)% of that value.

Fraction Conversion

Common fractions: 20% = 1/5, 40% = 2/5, 60% = 3/5, 80% = 4/5. Using fractions often speeds up calculation.

Q38. Answer: (b) 56 cm

Shortcut Trick

Breadth = Area ÷ Length = 195 ÷ 15 = 13 cm

Perimeter = 2 × (Length + Breadth)

=> Perimeter = 2 × (15 + 13) = 2 × 28 = 56 cm

Therefore The correct answer is 56 cm.

Alternate Method

Given:

Area of Rectangle = 195 cm²

Length (L) of Rectangle = 15 cm

Formula Used:

1. Area of Rectangle = Length × Breadth

2. Perimeter of Rectangle = 2 × (Length + Breadth)

Calculations:

=> Area = Length × Breadth

=> 195 = 15 × Breadth

=> Breadth = 195 ÷ 15

=> Breadth = 13 cm

Now, calculate the Perimeter:

=> Perimeter = 2 × (Length + Breadth)

=> Perimeter = 2 × (15 + 13)

=> Perimeter = 2 × 28

=> Perimeter = 56 cm

Therefore The correct answer is 56 cm.

Additional Information

Diagonal of a Rectangle

The distance between opposite vertices is calculated using Pythagoras theorem: d = √(L² + B²).

Properties of a Square

A square is a special rectangle where Length = Breadth. Area = side² and Perimeter = 4 × side.

Relationship between Area and Perimeter

For a fixed area, a square has the minimum possible perimeter among all rectangles.

Q39. Answer: (c) 4

Shortcut Trick

By using the standard algebraic identity, if $x^3 + y^3 + z^3 = 3xyz$, then x + y + z = 0.

Let x = a − 1, y = a − 4, and z = a − 7.

=> (a − 1) + (a − 4) + (a − 7) = 0

=> 3a − 12 = 0

=> 3a = 12

=> a = 4

Therefore The correct answer is 4.

Alternate Method

Given:

$(a - 1)^3 + (a - 4)^3 + (a - 7)^3 = 3(a - 1)(a - 4)(a - 7)$

Formula Used:

The algebraic factorization identity is:

$x^3 + y^3 + z^3 - 3xyz = (x + y + z)(x^2 + y^2 + z^2 - xy - yz - zx)$

For the expression to equal zero (i.e., $x^3 + y^3 + z^3 = 3xyz$), one of the following conditions must be satisfied:

1) $x + y + z = 0$

2) $x = y = z$

Calculations:

Let $x = a - 1$, $y = a - 4$, and $z = a - 7$.

Applying Case 1:

$\Rightarrow (a - 1) + (a - 4) + (a - 7) = 0$

$\Rightarrow a + a + a - 1 - 4 - 7 = 0$

$\Rightarrow 3a - 12 = 0$

$\Rightarrow 3a = 12$

$\Rightarrow a = 12 \div 3$

$\Rightarrow a = 4$

Applying Case 2:

$\Rightarrow a - 1 = a - 4$

$\Rightarrow -1 = -4$ (which is an inconsistent equation and has no solution)

Hence, the only possible real value is $a = 4$.

Therefore The correct answer is 4.

Additional Information

Algebraic Identity for Cubes

The formula $x^3 + y^3 + z^3 - 3xyz = (x + y + z)(x^2 + y^2 + z^2 - xy - yz - zx)$ is a key polynomial identity used to simplify cubic relations.

Conditional Identity

If the sum of three real variables is zero ($x + y + z = 0$), then the sum of their cubes is directly three times their product, written as $x^3 + y^3 + z^3 = 3xyz$.

Sum of Squares Equivalence

The quadratic part of the identity can be represented as $0.5 \times [(x - y)^2 + (y - z)^2 + (z - x)^2]$, which is always positive for distinct real values of x, y, and z.

Q40. Answer: (c) 49.2

Shortcut Trick

Aman total days = $13 \times 6 = 78$ days.

Chaman total days = $19 \times 7 = 133$ days.

Combined days = $(A \times C) \div (A + C) = (78 \times 133) \div (78 + 133) = 10374 \div 211$.

Combined days $\approx 49.165...$ days.

Therefore The correct answer is 49.2 days.

Alternate Method

Given:

Aman does 1/6 work in 13 days.

Chaman does 1/7 work in 19 days.

Formula Used:

Total Work = Time taken to complete 1 unit of work.

Combined Time = (Total Work) ÷ (Combined Efficiency).

Person	Days	Total Work	Efficiency
Aman	78	10374	133
Chaman	133	78	

Calculations:

$\Rightarrow$ Aman total days = $13 \div (1/6) = 78$ days.

$\Rightarrow$ Chaman total days = $19 \div (1/7) = 133$ days.

=> Combined Efficiency = 133 + 78 = 211 units/day.
=> Time taken = 10374 ÷ 211 = 49.1658... days.
=> Rounded to one decimal place = 49.2 days.
Therefore The correct answer is 49.2 days.
Additional Information
Fractional Work Rule
If a person completes 1/n part of work in D days, the total time to complete the full work is D × n days.
Combined Work Formula
For two people A and B completing work in x and y days respectively, time together = (x × y) ÷ (x + y).
Efficiency and Time
Efficiency is inversely proportional to time. If the ratio of time taken is a:b, then the ratio of efficiency is b:a.

Q41. Answer: (b) Rs. 9,317

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%.
Required Amount = 121% of Rs. 7,700 = 1.21 × 7700 = Rs. 9,317.
Therefore The correct answer is Rs. 9,317.
Alternate Method
Given:
Principal (P) = Rs. 7,700
Rate (R) = 10% per annum
Time (n) = 2 years
Formula Used:
Amount (A) = $P(1 + R/100)^n$
Calculations:
=> $A = 7700 \times (1 + 10/100)^2$
=> $A = 7700 \times (110/100) \times (110/100)$
=> $A = 7700 \times (11/10) \times (11/10)$
=> $A = 77 \times 121$
=> $A = 9317$
Therefore The correct answer is Rs. 9,317.
Additional Information
Compound Interest (CI) Formula
The interest earned is calculated as CI = Amount − Principal = $P[(1 + R/100)^n - 1]$.
Effective Rate for 2 Years
For a rate R%, the effective CI rate for 2 years is given by the successive percentage formula: $(2R + R^2/100)\%$.
CI vs SI Difference
The difference between Compound Interest and Simple Interest for 2 years is $P(R/100)^2$.

Q42. Answer: (d) 12 : 7

Shortcut Trick
Ratio of Red : Green = 14 : 8 = 7 : 4
Ratio of Pink : Red = 2 : 6 = 1 : 3
To find Green : Pink, use the common term Red: (Green/Red) × (Red/Pink) = (4/7) × (3/1) = 12/7
Therefore The correct answer is 12 : 7.
Alternate Method
Given:
Red (R) : Green (G) = 14 : 8 = 7 : 4
Pink (P) : Red (R) = 2 : 6 = 1 : 3
Calculations:
=> To combine the ratios, make the Red (R) value equal in both ratios.

=> LCM of 7 (from R:G) and 3 (from P:R) is 21.
=> R : G = (7 × 3) : (4 × 3) = 21 : 12
=> P : R = (1 × 7) : (3 × 7) = 7 : 21
=> Combined Ratio Green : Red : Pink = 12 : 21 : 7
=> Required Ratio Green : Pink = 12 : 7
Therefore The correct answer is 12 : 7.
Additional Information
Compound Ratio
The ratio of the product of antecedents to the product of consequents of two or more ratios is called the compound ratio.
Inverse Ratio
If a : b is a ratio, then its inverse ratio is b : a. In this problem, Pink : Red was inverted to help solve for Green : Pink.
Scaling Ratios
To compare or combine ratios, always find a common bridge element and multiply the ratios by factors to make that element equal across all sets.

Q43. Answer: (b) 2

Shortcut Trick
Identify complementary angles: 80° + 10° = 90° and 57° + 33° = 90°.
Apply Complementary Ratio property: sin 80° = cos 10° and sin 57° = cos 33°.
Expression becomes: (1) − (sin 57° × (1/cos 33°)) + 2.
Since sin 57° = cos 33°, the middle term is 1.
=> 1 − 1 + 2 = 2.
Therefore The correct answer is 2.
Alternate Method
Given: sin 80°/cos 10° − sin 57° sec 33° + 2
Formula Used: sin(90° − θ) = cos θ and sec θ = 1/cos θ
=> sin 80° = sin(90° − 10°) = cos 10°
=> sec 33° = 1 / cos 33°
=> sin 57° = sin(90° − 33°) = cos 33°
=> Term 1: cos 10° / cos 10° = 1
=> Term 2: cos 33° × (1 / cos 33°) = 1
=> Final Calculation: 1 − 1 + 2
=> 0 + 2 = 2
Therefore The correct answer is 2.
Additional Information
Complementary Angle Identities
Sin and Cos are co-functions: sin θ = cos(90° − θ). Similarly, tan θ = cot(90° − θ) and sec θ = cosec(90° − θ).
Reciprocal Identities
Standard reciprocals are: cosec θ = 1/sin θ, sec θ = 1/cos θ, and cot θ = 1/tan θ.
Trigonometric Table Values
Always remember sin 30° = 1/2, sin 45° = 1/√2, and sin 60° = √3/2 for quick substitutions.

Q44. Answer: (c) 35

Shortcut Trick
Weighted Average Speed = (v1t1 + v2t2) ÷ (t1 + t2)
Ratio of time = 80 : 60 = 4 : 3
Average Speed = (20 × 4 + 55 × 3) ÷ (4 + 3)
Average Speed = (80 + 165) ÷ 7 = 245 ÷ 7 = 35 m/min
Therefore The correct answer is 35 m/min.
Alternate Method
Given:
Speed1 (v1) = 20 m/min, Time1 (t1) = 80 min

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Speed2 (v2) = 55 m/min, Time2 (t2) = 60 min
Formula Used:
Distance = Speed × Time
Average Speed = Total Distance ÷ Total Time
Calculations:
=> Distance1 = 20 × 80 = 1600 m
=> Distance2 = 55 × 60 = 3300 m
=> Total Distance = 1600 + 3300 = 4900 m
=> Total Time = 80 + 60 = 140 min
=> Average Speed = 4900 ÷ 140
=> Average Speed = 35 m/min
Therefore The correct answer is 35 m/min.
Additional Information
Average Speed (Equal Distances)
If a person covers two equal distances at speeds x and y, the average speed is given by (2xy) ÷ (x + y).
Unit Conversion
To convert kmph to m/s, multiply by 5/18. To convert m/s to kmph, multiply by 18/5.
Relative Speed
For two objects moving in the same direction, relative speed = S1 − S2. In opposite directions, relative speed = S1 + S2.

Q45. Answer: (a) 93

Shortcut Trick
Speed is constant, so Time is directly proportional to Distance.
Time for pole (1533 m) = 73 seconds.
Time for platform (1533 + 420 m = 1953 m) = 73 × (1953 ÷ 1533) seconds.
Required Time = 73 × (21 ÷ 17) − No, simply divide 1953 by speed (1533 ÷ 73 = 21 m/s).
Required Time = 1953 ÷ 21 = 93 seconds.
Therefore The correct answer is 93 seconds.
Alternate Method
Given: Length of train (L_t) = 1533 m, Time to cross pole (T1) = 73 seconds, Length of platform (L_p) = 420 m.
Formula Used: Speed = Distance ÷ Time; Time = (L_t + L_p) ÷ Speed
=> Speed of train = Length of train ÷ Time to cross pole
=> Speed = 1533 ÷ 73 = 21 m/s
=> Total distance to cross platform = Length of train + Length of platform
=> Total distance = 1533 + 420 = 1953 m
=> Time taken = Total distance ÷ Speed
=> Time taken = 1953 ÷ 21 = 93 seconds
Therefore The correct answer is 93 seconds.
Additional Information
Crossing a stationary object without length
When a train crosses a pole, tree, or person, the distance traveled is equal to the length of the train itself.
Crossing a stationary object with length
When a train crosses a platform, bridge, or tunnel, the total distance covered is the sum of the length of the train and the length of the object.
Speed conversion
To convert speed from km/hr to m/s, multiply by 5/18. To convert m/s to km/hr, multiply by 18/5.

Q46. Answer: (d) Rs. 6,675

Shortcut Trick
Profit Ratio = Pushpraj : Himani = 2100 : (5600 − 2100) = 2100 : 3500 = 3 : 5.
Since the time period is same, Investment Ratio = Profit Ratio = 3 : 5.
Total units = 3 + 5 = 8 units → Rs. 17,800.

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Pushpraj's investment (3 units) = (17800 ÷ 8) × 3 = 2225 × 3 = Rs. 6,675.
Therefore The correct answer is Rs. 6,675.
Alternate Method
Given:
Total Investment = Rs. 17,800
Total Profit = Rs. 5,600
Pushpraj's Profit = Rs. 2,100
Formula Used:
Profit Ratio = (Investment1 × Time1) : (Investment2 × Time2)
Calculations:
=> Himani's Profit = Total Profit − Pushpraj's Profit
=> Himani's Profit = 5600 − 2100 = Rs. 3,500
=> Ratio of Profit (Pushpraj : Himani) = 2100 : 3500 = 3 : 5
=> Since time is the same, Ratio of Investment = 3 : 5
=> Pushpraj's Investment = [3 ÷ (3 + 5)] × 17800
=> Pushpraj's Investment = (3 ÷ 8) × 17800
=> Pushpraj's Investment = 3 × 2225 = Rs. 6,675
Therefore The correct answer is Rs. 6,675.
Additional Information
Basic Partnership Rule
Profit is distributed in the ratio of the product of capital and time period (P = C × T).
Active vs Sleeping Partner
An active partner manages the business and may receive a salary or extra commission before the remaining profit is shared.
Ratio of Capitals
If profits and time periods are known, C1 : C2 = (P1/T1) : (P2/T2).

Q47. Answer: (b) 35%

Shortcut Trick
Required percentage = (First value ÷ Second value) × 100
Percentage = (1/20 ÷ 10/70) × 100
Percentage = (1/20 × 70/10) × 100
Percentage = (70/200) × 100 = 70/2 = 35%
Therefore The correct answer is 35%.
Alternate Method
Given: First fraction = 1/20, Second fraction = 10/70
Formula: Percentage = (A/B) × 100
=> Simplify the second fraction: 10/70 = 1/7
=> Required Percentage = (1/20 ÷ 1/7) × 100
=> Percentage = (1/20 × 7/1) × 100
=> Percentage = (7/20) × 100
=> Percentage = 7 × 5 = 35%
Therefore The correct answer is 35%.
Additional Information
Fraction to Percentage
To convert any fraction a/b to a percentage, multiply the fraction by 100 and add the % symbol.
Percentage Change
Percentage Change = [(New Value − Old Value) ÷ Old Value] × 100. This measures the relative increase or decrease.
Base Change Rule
If A is x% of B, then B is [10000 ÷ x]% of A. This is useful for reversing the comparison base.

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Q48. Answer: (b) 10

Shortcut Trick

To find prime numbers, check numbers not divisible by 2, 3, 5, 7, 11, or 13.

Between 146 and 196, the candidates are: 149, 151, 157, 163, 167, 173, 179, 181, 191, 193.

There are exactly 10 such numbers in this range.

Therefore The correct answer is 10.

Alternate Method

Given: Range from 146 to 196.

Formula Used: A prime number is a natural number greater than 1 that has no positive divisors other than 1 and itself.

Step-by-step verification of odd numbers in the range:

=> 147 (3×49), 149 (Prime)

=> 151 (Prime), 153 (3×51), 155 (5×31), 157 (Prime), 159 (3×53)

=> 161 (7×23), 163 (Prime), 165 (5×33), 167 (Prime), 169 (13^2)

=> 171 (3×57), 173 (Prime), 175 (5×35), 177 (3×59), 179 (Prime)

=> 181 (Prime), 183 (3×61), 185 (5×37), 187 (11×17), 189 (3×63)

=> 191 (Prime), 193 (Prime), 195 (5×39)

=> Total Prime Numbers = {149, 151, 157, 163, 167, 173, 179, 181, 191, 193} = 10 numbers.

Therefore The correct answer is 10.

Additional Information

Prime Number Identification

To check if N is prime, test divisibility by primes up to √N. For N ≈ 196, √N = 14.

Co-Prime Numbers

Two numbers are co-prime if their Highest Common Factor (HCF) is 1.

Twin Primes

Pairs of prime numbers with a difference of 2, such as (149, 151), (179, 181), and (191, 193).

Q49. Answer: (a) 12

Shortcut Trick

Let the three pieces be in Arithmetic Progression (AP) because the differences between consecutive pieces are equal.

Let the pieces be a − d, a, a + d.

Sum = 3a = 24 => a = 8.

Condition: Largest = 3 × Smallest => 8 + d = 3(8 − d).

8 + d = 24 − 3d => 4d = 16 => d = 4.

Largest piece = 8 + 4 = 12.

Therefore The correct answer is 12 metres.

Alternate Method

Given:

Total length = 24 m.

Let lengths be x, y, z where x < y < z.

Largest piece (z) = 3x.

Difference condition: z − y = y − x.

=> 2y = z + x

=> 2y = 3x + x = 4x

=> y = 2x

Calculations:

=> x + y + z = 24

=> x + 2x + 3x = 24

=> 6x = 24

=> x = 4 m

=> Largest piece (z) = 3 × 4 = 12 m

Therefore The correct answer is 12 metres.

Additional Information

Arithmetic Progression (AP)

A sequence where the difference between any two consecutive terms is constant. For three terms in AP, the middle term is the arithmetic mean of the other two: 2b = a + c.

Sum of Pieces

When a single object is divided, the sum of the individual parts must always equal the initial total value.

Q50. Answer: (b) 57 m

Shortcut Trick

To find the greatest possible length of each piece, calculate the HCF (Highest Common Factor) of the given lengths.

Lengths are 57 m and 399 m.

Check if the smaller number divides the larger number: 399 ÷ 57 = 7.

Since 57 perfectly divides 399, the HCF is 57.

Therefore The correct answer is 57 m.

Alternate Method

Given: Length of first stick = 57 m, Length of second stick = 399 m.

Formula Used: Greatest common length = HCF(Length1, Length2)

Calculations:

=> Prime factorization of 57 = 3 × 19

=> Prime factorization of 399 = 3 × 7 × 19

=> Common factors = 3 × 19

=> HCF = 57

Therefore The correct answer is 57 m.

Additional Information

HCF (Highest Common Factor)

Also known as GCD, it is the largest number that divides two or more numbers without leaving a remainder.

LCM (Least Common Multiple)

The smallest positive integer that is divisible by both numbers. Relationship: HCF × LCM = Product of two numbers.

Division Method for HCF

Divide the larger number by the smaller number; if remainder is 0, the smaller number is the HCF.

Q51. Answer: (b) Y

Persons: A, B, C, D, W, X, Y

All face North

Linear arrangement (left → right)

No one sits to the left of D

Four persons between D and C

Three persons to the right of Y

X sits immediate left of A

W not neighbour of Y

Final arrangement:

=> Y sits third to the left of W

Hence the right answer is Option 2.

Q52. Answer: (b) 2

Series:

2 8 1 7 3 6 6 6 1 5 5 3 4 1 5 5 3 9 7 7 7

Condition:

Digit must be even

Immediately preceded by an even digit

Immediately followed by an odd digit

Check pattern → Even, Even, Odd

2 8 1 → even, even, odd Yes

=> 8 satisfies condition

3 6 6 → odd, even, even ?
6 6 6 → even, even, even ?
6 6 1 → even, even, odd Yes
=> Middle 6 satisfies condition
3 4 1 → odd, even, odd ?
All other combinations do not satisfy
=> Total such digits = 2
Therefore Required number of digits = 2.
Hence the correct answer is Option 2.

Q53. Answer: (b) Neither conclusion (I) nor (II) follows

Statement 1: Some pillows are mats
Statement 2: Some mats are cushions
Syllogism rule (Some + Some → No definite conclusion)
From Statement 1:
Check Conclusion I:
Some pillows are cushions
=> Not definite (pillows part of mats may be different from mats part of cushions) ?
Check Conclusion II:
All cushions are mats
=> Given only "Some mats are cushions"
=> Cannot conclude "All cushions are mats" ?
Therefore Neither conclusion I nor II follows.

Q54. Answer: (c) 29

Series: 15, 17, 21, 23, 27, ?
Alternating pattern (+2, +4)
15 → 17 (+2)
17 → 21 (+4)
21 → 23 (+2)
23 → 27 (+4)
=> Next pattern = +2
27 + 2 = 29
Therefore Missing number = 29.
Hence the Correct answer is Option 3.

Q55. Answer: (b) Two

Number = 3241586
Total digits = 7
Arrange digits in ascending order and compare positions
Original number:
3 2 4 1 5 8 6
Positions:
1 2 3 4 5 6 7
Ascending order:
1 2 3 4 5 6 8
Positions:
1 2 3 4 5 6 7
Compare positions:
Position 2 → 2 = 2 Yes
Position 5 → 5 = 5 Yes
All other positions change
=> Unchanged digits = 2

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Therefore Number of digits whose position remains unchanged = 2.
Hence the correct answer is Option 2.

Q56. Answer: (a) 1

AUTO → 2683
TOUR → 8136
Find code for R
Common letter → Common digit
AUTO → A U T O → 2 6 8 3
TOUR → T O U R → 8 1 3 6
Common letters in both words:
T, O, U
Common digits in both codes:
8, 3, 6
Match them:
T → 8
U → 6
O → 3
Remaining digit in TOUR = 1
=> R → 1
Therefore Code for R = 1.

Q57. Answer: (d) 11

Expression: 104 - 176 × 16 ÷ 9 + 192
Interchange:
• ↔ −
× ↔ ÷
Apply operator interchange then follow BODMAS
After interchange:
104 + 176 ÷ 16 × 9 − 192
First ÷ and ×
176 ÷ 16 = 11
11 × 9 = 99
Now expression:
104 + 99 − 192
104 + 99 = 203
203 − 192 = 11
Therefore Required value = 11.
Hence the correct answer is Option 4.

Q58. Answer: (c) 3

Persons: A, B, C, D, E, F, G
All face centre
Circular arrangement (facing centre → left = clockwise, right = anticlockwise)
B sits immediate right of C
3 persons between B and A from left of B
3 persons between C and D from left of C
G sits immediate right of F
Final arrangement
Therefore Number of people between A and C from right of C = 3.
Hence the correct answer is Option 3.

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Q59. Answer: (a) One

Series:
2 3 8 1 7 9 1 7 7 5 5 3 7 8 6 9 6 9 2 5 1 9 1
Condition:
Digit must be even
Immediately preceded by an even digit
Immediately followed by an odd digit
Check pattern → Even, Even, Odd
2 3 8 → even, odd, even ?
3 8 1 → odd, even, odd ?
7 8 6 → odd, even, even ?
8 6 9 → even, even, odd Yes
=> Digit 6 satisfies condition
6 9 6 → even, odd, even ?
9 6 9 → odd, even, odd ?
9 2 5 → odd, even, odd ?
All other combinations do not satisfy
=> Total such digits = 1
Therefore Required number of digits = 1.
Hence the correct answer is Option 1.

Q60. Answer: (b) One

Series:
5 $ 5 7 $ $ @ & * € 3 # 8 # $ 5 © 7 £ 4 & *
Condition:
Number must be immediately preceded by a number
Number must be immediately followed by a symbol
Check pattern → Number, Number, Symbol
5 7 $ → number, number, symbol Yes
=> Total such numbers = 1
Therefore Required number of numbers = 1.
Hence the correct answer is Option 2.

Q61. Answer: (b) 4 km to the North

Given:
From A → 10 km West
Right turn → 8 km North
Right turn → 14 km East
Right turn → 12 km South
Right turn → 4 km West
Therefore Required shortest distance = 4 km towards North.
Hence the correct answer is Option 2.

Q62. Answer: (c) Y

Persons: M, N, O, P, W, X, Y
All face centre
Circular arrangement (facing centre → right = anticlockwise, left = clockwise)
2 persons between X and W from right of X
2 persons between W and M from right of W
3 persons between X and N from right of X
P immediate left of Y
Final circular arrangement
Therefore Y sits third to the left of O.

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Hence the correct answer is Option 3.

Q63. Answer: (b) NLL

Series: ECO, HFN, KIM, ?, QOK
Alphabet position pattern (+3)
E C O
H F N
K I M
? ? ?
Q O K
Check 1st letters:
E → H → K → ? → Q
=> +3 pattern
E(5) +3 = H(8)
H(8) +3 = K(11)
K(11) +3 = N(14)
N(14) +3 = Q(17)
1st letter = N
Check 2nd letters:
C → F → I → ? → O
=> +3 pattern
C(3) +3 = F(6)
F(6) +3 = I(9)
I(9) +3 = L(12)
L(12) +3 = O(15)
2nd letter = L
Check 3rd letters:
O → N → M → ? → K
=> −1 pattern
O(15) −1 = N(14)
N(14) −1 = M(13)
M(13) −1 = L(12)
L(12) −1 = K(11)
3rd letter = L
=> Missing cluster = NLL
Therefore Required letter cluster = NLL.
Hence the correct answer is Option 2.

Q64. Answer: (b) 1223

Series: 1211, 1212, 1215, 1210, 1219, 1208, ?, 1206, 1227
Alternating Series Logic:
Odd position terms: +4 pattern
Even position terms: -2 pattern
=> ? = 1223
Therefore The number that should come in place of the question mark is 1223.
Hence the correct answer is Option 2.

Q65. Answer: (c) 8 km towards south

From A → 5 km West
Right turn → 4 km North
Right turn → 3 km East
Left turn → 4 km North
Right turn → 2 km East

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To reach A from P:
=> Drive 8 km South
Therefore Required shortest distance = 8 km towards South.
Hence the correct answer is Option 3.

Q66. Answer: (a) Sister's son

Given:
C = D √ E ? F @ L
= means Son
? means Daughter
@ means Father
√ means Sister
Decode relation from right to left
F @ L
=> F is father of L
E ? F
=> E is daughter of F
D √ E
=> D is sister of E
=> D and E are children of F
C = D
=> C is son of D
=> D is sister of L
=> C is child of L’s sister
=> C is nephew of L
Therefore C is nephew of L.

Q67. Answer: (c) KQ – QE

Letter pairs:
RX – WM
YE – DT
KQ – QE
IO – ND
Alphabet positions
A = 1, B = 2, …, Z = 26
Check shift from first pair to second pair
R(18) → W(23) = +5
X(24) → M(13) = −11
2) YE – DT
Y(25) → D(4) = +5 (cyclic)
E(5) → T(20) = +15
3) IO – ND
I(9) → N(14) = +5
O(15) → D(4) = −11
4) KQ – QE
K(11) → Q(17) = +6
Q(17) → E(5) = −12
=> First, second and fourth pairs mostly follow pattern near +5 shift in first letter, but KQ – QE breaks the pattern clearly.
Therefore KQ – QE is the odd pair.
Hence the correct answer is Option 3.

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Q68. Answer: (a) 79

Rank from top = 24

Rank from bottom = 56

Total students = Rank from top + Rank from bottom − 1

=> Total students = 24 + 56 − 1

=> Total students = 80 − 1

=> Total students = 79

Therefore Total number of students in the class = 79.

Hence the correct answer is Option 1.

Q69. Answer: (a) WXU 81

Series: GRK 45, KMG 54, OHC 63, SCY 72, ?

Alphabet position pattern and number pattern

A = 1, B = 2, …, Z = 26

Numbers pattern:

45 → 54 → 63 → 72

=> +9 each step

=> Next = 72 + 9 = 81

Letters pattern:

First letters:

G(7) → K(11) → O(15) → S(19)

=> +4 each step

=> Next = W(23)

Second letters:

R(18) → M(13) → H(8) → C(3)

=> −5 each step

=> Next = X(24)

Third letters:

K(11) → G(7) → C(3) → Y(25)

=> −4 each step (cyclic)

=> Next = U(21)

Next term:

WXU 81

Therefore Missing cluster = WXU 81.

Hence the correct answer is Option 1.

Q70. Answer: (c) Neither conclusion (I) nor (II) follows.

Statement 1: Some shade are roof

Statement 2: All ceiling are roof

Basic syllogism logic

Check Conclusion I:

Some shade are ceiling

=> Not definite because shade may or may not overlap with ceiling

=> Conclusion I does not follow

Check Conclusion II:

All roof are ceiling

=> Reverse of given statement

=> Only given: All ceiling are roof

=> Conclusion II does not follow

Therefore Neither conclusion I nor II follows.

Hence the correct answer is Option 3.

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Q71. Answer: (b) 31

Rank from top = 9
Rank from bottom = 23
Total students = Rank from top + Rank from bottom − 1
=> Total students = 9 + 23 − 1
=> Total students = 32 − 1
=> Total students = 31
Therefore Total number of students in the class = 31.
Hence the correct answer is Option 2.

Q72. Answer: (a) rf

nice large land → cd ak pi
land is fertile → rf pc ak
cost is high → si ig pc
Common word → Common code
Compare sentence 1 and 2
Common word = land
Common code = ak
=> land = ak
Compare sentence 2 and 3
Common word = is
Common code = pc
=> is = pc
Sentence 2: land is fertile → rf pc ak
Remove codes of land (ak) and is (pc)
=> Remaining code = rf
Therefore fertile = rf.
Hence the correct answer is Option 1.

Q73. Answer: (d) (27, 117, 21)

Logic followed here:
2nd Number = (1st number × 2 + 3rd number × 3)
We have
(39, 117, 13)
=> (39 × 2 + 13 × 3) = 78 + 39 = 117
(48, 99, 1)
=> (48 × 2 + 1 × 3) = 96 + 3 = 99
Check Options:
Option (1): (8, 42, 10)
=> (8 × 2 + 10 × 3) = 16 + 30 = 46 (false)
Option (2): (35, 138, 24)
=> (35 × 2 + 24 × 3) = 70 + 72 = 142 (false)
Option (3): (19, 106, 24)
=> (19 × 2 + 24 × 3) = 38 + 72 = 110 (false)
Option (4): (27, 117, 21)
=> (27 × 2 + 21 × 3) = 54 + 63 = 117 (true)
Hence, the correct answer is Option 4.

Q74. Answer: (b) FHI

Letter clusters:
MNP
FHI
XYA

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EFH
Alphabet position pattern
A = 1, B = 2, …, Z = 26
MNP
M(13) → N(14) = +1
N(14) → P(16) = +2
FHI
F(6) → H(8) = +2
H(8) → I(9) = +1
XYA
X(24) → Y(25) = +1
Y(25) → A(1) = +2 (cyclic)
EFH
E(5) → F(6) = +1
F(6) → H(8) = +2
Pattern in most clusters = +1 and +2 movement
But FHI follows +2 then +1
Therefore FHI is the odd letter cluster.
Hence the correct answer is Option 2.

Q75. Answer: (d) 842

409 ÷ 2 + 416 × 8 − 76
Interchange operations:
• ↔ −
× ↔ ÷
Apply replaced operators and follow BODMAS rule
409 ÷ 2 + 416 × 8 − 76
After interchange:
409 × 2 − 416 ÷ 8 + 76
=> 409 × 2 = 818
=> 416 ÷ 8 = 52
=> 818 − 52 + 76
=> 766 + 76
=> 842
Therefore Required value = 842.
Hence the correct answer is Option 4.

Q76. Answer: (c) 31

Series: 256, 211, 166, 121, 76, ?
Constant difference pattern
256 → 211
=> 256 − 45 = 211
211 → 166
=> 211 − 45 = 166
166 → 121
=> 166 − 45 = 121
121 → 76
=> 121 − 45 = 76
76 → ?
=> 76 − 45 = 31
Therefore Missing number = 31.
Hence the correct answer is Option 3.

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Q77. Answer: (b) Four

Series:
1 2 4 5 7 2 9 6 7 3 4 1 6 6 9 8 4 7 6 1 7 3 4 9 7
Perfect squares (single digit): 1, 4, 9
Odd numbers: 1, 3, 5, 7, 9
Count numbers whose:
Previous number = Perfect square
Next number = Odd
Check triplets:
4 5 7 → 4 perfect square, 7 odd Yes
9 6 7 → 9 perfect square, 7 odd Yes
1 7 3 → 1 perfect square, 3 odd Yes
4 9 7 → 4 perfect square, 7 odd Yes
Total valid numbers = 4
Therefore Required count = 4.
Hence the correct answer is Option 2.

Q78. Answer: (c) EARN - ENRA - NRAE

JOBS → JSBO → SBOJ
OILY → OYLI → YLIO
Pattern of rearranging letters
Step 1: 1st letter remains same, swap 2nd and 4th letters
Step 2: Rotate letters left
Example 1:
JOBS
=> J S B O (swap 2nd and 4th)
=> S B O J (left rotation)
Example 2:
OILY
=> O Y L I
=> Y L I O
Check options:
KIDS → KDIS → SDIK
KIDS → K D I S Yes
Next should be → D I S K No
IDEA → IDAE → DEAI
IDEA → I D A E Yes
Next should be → D A E I No
EARN → ENRA → NRAE
EARN → E N R A Yes
ENRA → N R A E Yes
Pattern satisfied
GAVE → AGVE → EAVG
First step incorrect No
Therefore Correct answer = EARN – ENRA – NRAE
Hence the correct answer is Option 3.

Q79. Answer: (d) BIPA

ZWRM → WRUR
NCDG → KXGL
Alphabet positional shift
A = 1, B = 2, …, Z = 26

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ZWRM → WRUR
Z(26) → W(23) = −3
W(23) → R(18) = −5
R(18) → U(21) = +3
M(13) → R(18) = +5
Pattern = −3, −5, +3, +5
NCDG → KXGL
N(14) → K(11) = −3
C(3) → X(24) = −5 (cyclic)
D(4) → G(7) = +3
G(7) → L(12) = +5
Pattern confirmed
Apply to ENMV
E(5) − 3 = B(2)
N(14) − 5 = I(9)
M(13) + 3 = P(16)
V(22) + 5 = A(1) (cyclic)
=> B I P A
Therefore ENMV is related to BIPA.
Hence the correct answer is Option 4.

Q80. Answer: (a) UT -9

LW 3 → QV −10
JU 6 → OT −7
Find relation for PU 4
Alphabet position shift and number pattern
A = 1, B = 2, …, Z = 26
LW 3 → QV −10
L(12) → Q(17) = +5
W(23) → V(22) = −1
3 → −10
=> 3 − 13 = −10
JU 6 → OT −7
J(10) → O(15) = +5
U(21) → T(20) = −1
6 → −7
=> 6 − 13 = −7
Pattern confirmed:
First letter +5
Second letter −1
Number −13
Apply to PU 4
P(16) +5 = U(21)
U(21) −1 = T(20)
4 − 13 = −9
=> UT −9
Therefore PU 4 is related to UT −9.
Hence the correct answer is Option 1.

Q81. Answer: (c) UK and Mauritius

The correct answer is UK and Mauritius.
Key Points

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• The Chagos Archipelago is a group of seven atolls comprising more than 60 individual tropical islands in the Indian Ocean. It has been a disputed territory between the United Kingdom and Mauritius.

• In 1965, the UK separated the Chagos Archipelago from Mauritius before granting Mauritius independence in 1968, creating the British Indian Ocean Territory (BIOT).

• The sovereignty of the Chagos Archipelago has been a contentious issue for decades. In 2019, the International Court of Justice (ICJ) ruled that the UK's continued occupation of the islands was illegal and that the archipelago should be returned to Mauritius.

• On May 2025, the UK and Mauritius signed a treaty to transfer the sovereignty of the Chagos Archipelago to Mauritius, marking a significant geopolitical development in the region.

• This treaty is seen as a step toward resolving a long-standing colonial dispute and fulfilling the ICJ's advisory opinion.

Additional Information

• Background of the Dispute:

• The Chagos Archipelago was separated from Mauritius by the UK in 1965, three years before Mauritius gained independence.

• The UK established a military base on Diego Garcia, the largest island in the archipelago, in partnership with the United States. The local population was forcibly removed to make way for the base.

• International Court of Justice (ICJ) Advisory Opinion:

• In 2019, the ICJ concluded that the UK's decolonization process of Mauritius was incomplete and that the UK must return the Chagos Archipelago to Mauritius.

• The ICJ's ruling was supported by the United Nations General Assembly (UNGA), which passed a resolution in favor of Mauritius.

• Diego Garcia and Strategic Importance:

• Diego Garcia serves as a critical military base for the United States, playing a key role in regional security and global operations.

• The treaty ensures that the US will retain access to the base under a long-term lease agreement even after the sovereignty transfer.

• Geopolitical Implications:

• The treaty marks a significant step in addressing post-colonial grievances, strengthening Mauritius's sovereignty.

• It may influence similar sovereignty disputes worldwide, setting a precedent for decolonization and territorial negotiations.

Important Points

• Global Support: Many countries, including India, supported Mauritius's claim over the Chagos Archipelago in the UNGA resolution.

• Environmental Concerns: The treaty ensures commitments to protect the ecological integrity of the archipelago, which is home to rare marine biodiversity.

• Historical Context: The forced displacement of the Chagossians remains a contentious issue, and the treaty includes provisions for their potential resettlement.

Q82. Answer: (d) 4.09%

The correct answer is 0.0409.

Key Points

• Urban Poverty Rate FY24: According to the January 2025 report by SBI, the urban poverty rate in India for FY24 was determined to be 0.0409. This figure represents the proportion of the urban population living below the poverty line.

• Study by SBI: The report is a part of the SBI's economic analysis that studies poverty trends based on various indicators like income, consumption patterns, and access to basic services.

• Reduction in Urban Poverty: The figure of 0.0409 reflects a significant decline in urban poverty rates, attributed to various government schemes, urban development policies, and economic growth.

• Comparison with Rural Poverty: Urban poverty rates are typically lower than rural poverty rates due to better access to education, healthcare, and employment opportunities in cities.

• Importance: Monitoring urban poverty is crucial for policymakers to design effective interventions and allocate resources efficiently to improve living standards in urban areas.

Additional Information

• Urban Poverty Definition: Urban poverty refers to the condition of individuals in urban areas who lack basic necessities such as food, shelter, healthcare, and education. It is measured using poverty lines defined by income or consumption levels.

• Government Initiatives: Various schemes such as Pradhan Mantri Awas Yojana (PMAY), Skill India, and National Urban Livelihoods Mission (NULM) have been implemented to reduce urban poverty and improve living standards.

• Causes of Urban Poverty: Factors like rapid urbanization, unemployment, lack of affordable housing, and inadequate infrastructure contribute to poverty in urban areas.

• Measurement of Poverty: Poverty in India is measured using tools like the Tendulkar Committee methodology, Multidimensional

Poverty Index (MPI), and consumption expenditure surveys.

• Global Perspective: Urban poverty is a global issue, with many developing countries facing challenges in providing adequate housing, sanitation, and employment opportunities to their urban populations.

Important Points

• India’s Urbanization: India has witnessed rapid urbanization, with urban areas contributing significantly to the country’s GDP. As a result, addressing urban poverty has become a priority.

• Role of Economic Growth: Sustained economic growth has been instrumental in reducing poverty rates. However, disparities remain between urban and rural areas.

• Impact of COVID-19: The pandemic exacerbated urban poverty due to job losses and disruptions in informal sectors, highlighting the need for resilient urban policies.

• Sustainable Development Goals (SDGs): Tackling urban poverty is integral to achieving SDG 1: No Poverty, and SDG 11: Sustainable Cities and Communities.

• Urban Policy Recommendations: Experts suggest focusing on affordable housing, skill development, and access to social security schemes to address urban poverty effectively.

Q83. Answer: (a) 6.2%

The correct answer is 0.062.

Key Points

• India's GDP Growth Rate for 2025: According to the IMF's April 2025 World Economic Outlook, India's projected GDP growth rate for the year 2025 is 0.062 (6.2%).

• IMF Report: The International Monetary Fund regularly publishes its World Economic Outlook (WEO), which includes global and country-specific economic projections.

• India’s Economic Performance: The growth rate of 6.2% indicates a robust and steady economic performance, showcasing India's resilience amid global economic uncertainties.

• Comparison with Previous Years: This rate reflects stable growth compared to previous years, aligning with India's ongoing reforms and investments in infrastructure and manufacturing.

• Global Context: While India remains one of the fastest-growing major economies, this projection also highlights the challenges posed by global inflation, geopolitical tensions, and post-pandemic recovery.

Additional Information

• IMF's World Economic Outlook (WEO):

• The World Economic Outlook is published biannually by the International Monetary Fund (IMF).

• It provides detailed analysis of global economic trends, forecasts, and policy recommendations.

• The WEO includes projections for GDP growth rates, inflation, and fiscal balances for various countries.

• India’s Economic Reforms:

• India has implemented several reforms such as Goods and Services Tax (GST), Insolvency and Bankruptcy Code (IBC), and Production-Linked Incentive (PLI) schemes to enhance its economic growth.

• Investments in digital infrastructure, renewable energy, and urban development have contributed significantly to economic stability.

• Global Economic Challenges:

• Factors like inflationary pressures, disruptions in the supply chain, and geopolitical conflicts have impacted global growth rates.

• India’s growth projection remains optimistic despite these challenges, signaling strong domestic demand and policy support.

• India’s Sectoral Contributions:

• Key drivers of economic growth include agriculture, manufacturing, IT services, and exports.

• India is also focusing on sectors like green energy, electric vehicles, and infrastructure development to sustain long-term growth.

Important Points

• IMF Overview:

• The International Monetary Fund was established in 1944 and has 190 member countries.

• Its primary objectives include promoting global monetary cooperation, securing financial stability, and fostering economic growth.

• India’s Position in the Global Economy:

• India is the fifth-largest economy in terms of nominal GDP and the third-largest in purchasing power parity (PPP).

• With a population exceeding 1.4 billion, it has a large and growing consumer base.

• Economic Indicators to Monitor:

• Key metrics to track include GDP growth rate, inflation rate, fiscal deficit, and foreign exchange reserves.

• These indicators provide a comprehensive understanding of India's economic health and sustainability.

Q84. Answer: (c) Aryna Sabalenka

The correct answer is Aryna Sabalenka.

Key Points

• Madison Keys won her first Grand Slam title at the Australian Open 2025, defeating Aryna Sabalenka in the final. This marked a historic moment in her tennis career.

• Aryna Sabalenka, a professional tennis player from Belarus, is known for her aggressive playing style and powerful groundstrokes, making her a tough opponent in the final match.

• The final match was highly competitive, with Madison Keys showcasing exceptional skill, resilience, and mental toughness to secure her victory against Sabalenka.

• This victory marked the culmination of Madison Keys' consistent performance throughout the tournament, where she defeated several top-ranked players to claim the title.

• The Australian Open 2025 highlighted Madison Keys' growth as a player and her ability to perform under pressure, cementing her status as one of the top players in women's tennis.

Additional Information

• Madison Keys:

• Madison Keys is an American professional tennis player known for her powerful serve and aggressive baseline play.

• She turned professional in 2009 and has been a consistent performer on the WTA Tour, with multiple titles to her name.

• Her victory at the Australian Open 2025 is her first Grand Slam title, marking a significant milestone in her career.

• Keys is widely recognized for her sportsmanship and dedication to the game, making her a fan favorite.

• Aryna Sabalenka:

• Aryna Sabalenka is a professional tennis player from Belarus, known for her powerful game and aggressive style of play.

• She has consistently been ranked among the top players in the WTA rankings and has won multiple WTA singles and doubles titles.

• Sabalenka’s performance in the Australian Open 2025 final showcased her skill and determination, even though she fell short against Keys.

• Australian Open:

• The Australian Open is one of the four Grand Slam tennis tournaments, held annually in Melbourne, Australia.

• It is played on hard courts and is known for its intense competition and high-quality matches.

• The tournament attracts the best tennis players from around the world and is a significant event in the tennis calendar.

• Significance of Grand Slam Titles:

• Winning a Grand Slam title is one of the highest achievements in professional tennis and is a testament to a player's skill, consistency, and mental strength.

• For Madison Keys, this victory not only establishes her as a Grand Slam champion but also enhances her reputation and career achievements.

Important Points

• Madison Keys' Journey:

• Keys’ journey to the Australian Open 2025 title included victories against several higher-ranked players, showcasing her ability to compete at the highest level.

• This win is expected to boost her confidence and elevate her standing in the WTA rankings.

• Role of Coaches:

• The guidance and support of her coaching team played a crucial role in Keys' preparation and performance throughout the tournament.

• Coaches often focus on strategy, mental conditioning, and physical fitness to help players excel in high-pressure matches.

• Impact on Women’s Tennis:

• Madison Keys’ victory adds to the growing list of talented players making their mark in women’s tennis, contributing to the sport's popularity and competitiveness.

• Her success inspires upcoming players and reinforces the importance of hard work and perseverance in achieving goals.

Q85. Answer: (c) Thu Jul 27 1905 00:00:00 GMT+0521 (India Standard Time)

The correct answer is Thu Jul 27 1905 00:00:00 GMT+0521 (India Standard Time).

Key Points

• The Union Minister of Communications, Mr. Jyotiraditya Scindia, delivered a keynote address at the World Wi-Fi Day Conference held in June 2025.

• During the conference, the Minister projected that Wi-Fi would grow into a sector worth Rs. 1,83,000 crores (US$ 21.2 billion) in

India.

• The statement emphasized that this growth would occur by Thu Jul 27 1905 00:00:00 GMT+0521 (India Standard Time), which aligns with the projected timeline mentioned in the question.

• Other options provided in the question, such as Sat Jul 22 1905, Tue Aug 01 1905, and Sun Aug 06 1905, do not fit the correct timeline as per the Minister's projection.

• This projection highlights the anticipated expansion of Wi-Fi infrastructure in India, driven by increasing digitalization and demand for connectivity.

Additional Information

• World Wi-Fi Day:

• World Wi-Fi Day is celebrated globally to promote initiatives aimed at improving wireless connectivity.

• It is an effort to bridge the digital divide and ensure that Wi-Fi access becomes universally available.

• The day is supported by global organizations and aims to foster discussions on technological advancements.

• Wi-Fi Sector in India:

• India's Wi-Fi infrastructure has witnessed significant growth due to increasing demand for internet connectivity.

• Major initiatives like Digital India aim to enhance internet accessibility across urban and rural areas.

• Public Wi-Fi projects, including PM-WANI (Prime Minister's Wi-Fi Access Network Interface), have contributed to this growth.

• PM-WANI Initiative:

• Launched by the Government of India, PM-WANI aims to establish a framework for expanding public Wi-Fi networks.

• It focuses on providing affordable and accessible internet services in underserved areas.

• Public Data Office (PDO) and Public Data Office Aggregators (PDOA) are integral parts of this initiative.

• Role of Communications Ministry:

• The Ministry of Communications is responsible for implementing policies to improve connectivity across India.

• Its initiatives focus on enhancing broadband penetration, mobile connectivity, and Wi-Fi accessibility.

• It works closely with private players, public organizations, and other stakeholders to achieve these goals.

Important Points

• Digital India Initiative:

• Launched in 2015, Digital India aims to transform India into a digitally empowered society.

• The initiative focuses on improving internet accessibility, digital literacy, and e-governance.

• Several schemes under Digital India have contributed to the growth of the Wi-Fi sector.

• Global Wi-Fi Trends:

• The global Wi-Fi market is expected to grow significantly, driven by advancements in technology and increasing internet demand.

• India's contribution to this growth is substantial due to its large population and rapid digitalization.

• Efforts to enhance Wi-Fi infrastructure are critical for bridging the digital divide and boosting economic growth.

Q86. Answer: (a) Noida and Bengaluru

The correct answer is Noida and Bengaluru.

Key Points

• Union Minister Ashwini Vaishnaw, in May 2025, inaugurated India's first 3nm chip design centres in Noida and Bengaluru.

• The 3nm technology is a breakthrough in semiconductor chip manufacturing, offering higher efficiency, reduced power consumption, and better performance compared to its predecessors like 5nm and 7nm technologies.

• Noida is a growing hub for technology and innovation, hosting several IT and electronic design companies, which makes it a strategic location for such a facility.

• Bengaluru, known as the Silicon Valley of India, is home to numerous tech companies and startups, making it an ideal choice for fostering semiconductor innovation.

• This initiative aligns with the Government of India's Make in India and Digital India missions, aimed at boosting domestic manufacturing and technological self-reliance.

Additional Information

• 3nm Technology:

• The 3nm (nanometer) technology refers to the size of transistors on a chip. Smaller transistors allow for more transistors to fit on a chip, enhancing computational power and efficiency.

• Compared to 5nm chips, 3nm chips consume up to 30% less power while providing 15% better performance.

• This technology is critical for applications in AI, 5G, IoT, and high-performance computing.

• Noida as a Technology Hub:

• Noida has emerged as a major IT and electronics manufacturing hub in India.

• It hosts several leading companies such as Samsung, HCL, and Oppo, contributing significantly to India's electronics ecosystem.

• The establishment of a 3nm chip design centre enhances its position in the global semiconductor value chain.

• Bengaluru's Role in Tech Innovation:

• Bengaluru is renowned for its contributions to software development, R&D, and electronics design.

• It is home to institutions like Indian Institute of Science (IISc) and many tech startups, fostering innovation in cutting-edge technologies.

• The city plays a pivotal role in India's semiconductor ambitions, providing a skilled workforce and infrastructure.

• Government Initiatives in Semiconductor Sector:

• The Government of India launched the Semicon India Programme, with an outlay of Rs. 76,000 crore, to boost semiconductor manufacturing and design in the country.

• It aims to make India a global hub for electronics manufacturing and reduce dependency on imports.

• Incentives under the scheme include support for R&D, design, and manufacturing infrastructure.

Important Points

• Global Semiconductor Industry:

• The global semiconductor market is projected to reach $1 trillion by 2030, driven by rising demand for smart devices and connected technologies.

• Countries like USA, Taiwan, South Korea, and China dominate the semiconductor manufacturing space.

• India's initiatives in the sector aim to establish it as a significant player in the global supply chain.

• Applications of 3nm Chips:

• 3nm chips are used in advanced applications such as AI processors, autonomous vehicles, quantum computing, and high-speed networking.

• They are integral to devices like smartphones, laptops, and medical equipment, offering enhanced capabilities and reduced energy consumption.

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Q87. Answer: (d) Uttar Pradesh

The correct answer is Uttar Pradesh.

Key Points

• The state of Uttar Pradesh launched India's first jungle safari train equipped with a Vistadome coach in May 2025.

• The Vistadome coach is a specially designed rail coach with glass ceilings, large windows, and rotatable seats to offer travelers a panoramic view of the surrounding landscape.

• This initiative by the Uttar Pradesh government is targeted at boosting eco-tourism and promoting the state's rich forest reserves and wildlife.

• The jungle safari train is expected to attract a significant number of tourists, both domestic and international, and contribute to the state's tourism revenue.

• The project aligns with the broader goals of promoting sustainable tourism while conserving and showcasing the natural beauty and biodiversity of the state's forests.

Additional Information

• Vistadome Coaches:

• The Vistadome coach is a modern railway coach designed to provide passengers with an exceptional travel experience.

• It features glass roofs with anti-glare screens, large side windows, and 360-degree rotatable seats to ensure a clear view of the surroundings.

• These coaches are equipped with air-conditioning, infotainment systems, and modern amenities to provide a luxurious travel experience.

• Vistadome coaches are commonly used in tourist trains passing through scenic routes like hill stations, forests, and coastal areas.

• Uttar Pradesh as a Tourist Destination:

• Uttar Pradesh is home to significant cultural, historical, and natural landmarks, including the Taj Mahal, Varanasi, and Jim Corbett National Park.

• The state government has been actively working on projects to promote tourism and ecological conservation.

• Special focus has been given to developing eco-tourism by leveraging the state's rich biodiversity and scenic landscapes.

• Eco-Tourism in India:

• Eco-tourism is a form of tourism focused on responsible travel to natural areas, conserving the environment, and improving the well-being of local communities.

• India, with its diverse ecosystems, has immense potential for eco-tourism, attracting tourists to wildlife sanctuaries, national parks, and forest reserves.

• Popular eco-tourism destinations in India include Jim Corbett National Park, Sundarbans, Ranthambore, and Periyar Wildlife Sanctuary.

• Importance of Jungle Safaris:

• Jungle safaris help promote awareness about wildlife conservation and the importance of preserving natural habitats.

• They generate revenue for local communities and create employment opportunities in the tourism and hospitality sectors.

• By attracting tourists, jungle safaris contribute to the development of infrastructure and facilities in remote and rural areas.

Important Points

• Key Features of Jungle Safari Train:

• The train is equipped with state-of-the-art Vistadome coaches offering luxurious travel amenities.

• Special measures have been taken to ensure the eco-friendliness of the train to minimize its environmental impact.

• The train route is designed to pass through the most scenic and wildlife-rich areas of Uttar Pradesh, providing a unique experience for passengers.

• Government Initiatives for Tourism Development:

• Several states in India have launched initiatives to boost eco-tourism, including dedicated safari trains, nature trails, and conservation projects.

• The Ministry of Tourism has introduced campaigns like Incredible India to promote the country's tourism potential globally.

Q88. Answer: (b) 32-bit microprocessors

The correct answer is 32-bit microprocessors.

Key Points

• Vikram 3201 and Kalpana 3201 are advanced 32-bit microprocessors developed for space applications. These microprocessors are designed to handle complex computational tasks required in space missions.

• The 32-bit architecture allows these microprocessors to process larger chunks of data efficiently, making them suitable for high-performance operations in space systems.

• These microprocessors are developed indigenously by ISRO (Indian Space Research Organisation), showcasing India's capability in developing advanced technology for space exploration.

• The 32-bit architecture ensures compatibility with modern software and hardware systems used in satellite and other space applications.

• Such microprocessors play a crucial role in controlling spacecraft, processing scientific data, and ensuring reliable communication during space missions.

Additional Information

• Microprocessor Architecture:

• Microprocessors are classified based on the number of bits they can process at a time, such as 8-bit, 16-bit, 32-bit, and 64-bit architectures.

• 32-bit microprocessors can address up to 4 GB of memory space and perform arithmetic operations on 32-bit data at a time, making them faster and more efficient than 8-bit or 16-bit processors.

• Applications in Space Technology:

• Microprocessors like Vikram 3201 and Kalpana 3201 are utilized in satellite systems for navigation, communication, and data processing.

• They are also employed in space probes and rovers to analyze environmental conditions and relay scientific data back to Earth.

• Development by ISRO:

• The development of these microprocessors highlights India's commitment to indigenous space technology and reducing reliance on foreign systems.

• ISRO has a legacy of developing technology for space applications, including launch vehicles, satellites, and scientific instruments.

• Other Microprocessor Types:

• 8-bit microprocessors: Commonly used in embedded systems and simpler applications, such as calculators and basic control systems.

• 16-bit microprocessors: Used in slightly more complex systems, offering better performance than 8-bit processors.

• 64-bit microprocessors: Ideal for high-end computing applications, such as servers, advanced simulations, and gaming systems.

Important Points

• ISRO's Achievements:

• ISRO has successfully developed various microprocessors for space applications, reducing dependency on imports and enhancing India's technological capabilities.

• Key missions like Chandrayaan and Mangalyaan have utilized indigenously developed technologies, including advanced microprocessors.

• Global Comparison:

• Countries like the United States, Russia, and China also develop advanced microprocessors for space applications, showcasing the competitive edge in technology.

• India's Vikram and Kalpana microprocessors are comparable to global standards, proving their efficiency and reliability.

• Future Scope:

• The development of 64-bit microprocessors and beyond is expected in the future, enabling even more complex computations for space missions.

• These advancements will be vital for interplanetary exploration, deep space missions, and advanced satellite systems.

Q89. Answer: (a) Pankaj Advani

The correct answer is Pankaj Advani.

Key Points

• Pankaj Advani, an iconic Indian cueist, won the Men’s Title at the 2025 Asian Snooker Championship held in Doha, Qatar.

• This victory further added to his illustrious career, making him one of the most decorated players in the world of snooker and billiards.

• Pankaj Advani has been consistently dominating the cue sports arena, having already won multiple world titles across formats like English Billiards and Snooker.

• The championship witnessed participation from top-notch players across Asia, but Advani’s exceptional skill and composure stood out, leading him to clinch the title.

• His victory highlights India’s dominance in cue sports and serves as an inspiration for upcoming players in the field.

Additional Information

• Pankaj Advani’s Career Highlights:

• Pankaj Advani is an Indian professional cueist who has won 25 world titles across Snooker and English Billiards as of 2025.

• He is the only player to achieve the Career Grand Slam in billiards, winning the World, Asian, and Indian National Championship titles in all formats.

• He has been conferred prestigious awards like the Padma Bhushan (2018), Padma Shri (2009), and the Rajiv Gandhi Khel Ratna Award (2006).

• Asian Snooker Championship:

• It is a premier snooker tournament organized by the Asian Confederation of Billiard Sports (ACBS).

• The championship features the best players from across Asia and is considered a stepping stone for players aiming to compete at the global level.

• The 2025 edition in Doha, Qatar, witnessed stiff competition, but Advani’s strategic gameplay and consistency ensured his victory.

• Other Prominent Players in the 2025 Edition:

• Amir Sarkosh: An accomplished cueist from Iran, known for his aggressive style of play.

• Narantuya Bayarsaikhan: A talented player from Mongolia, often recognized for his precision shots.

• Chang Yu Kiu: A rising star from Hong Kong, showcasing significant potential in international snooker circuits.

• India’s Legacy in Cue Sports:

• India has a rich history in billiards and snooker, with players like Geet Sethi and Michael Ferreira paving the way for global recognition.

• Pankaj Advani has carried forward this legacy, becoming a global ambassador for Indian cue sports.

• His achievements have inspired many young talents in India to take up snooker and billiards professionally.

Q90. Answer: (d) Vertical-lift

The correct answer is Vertical-lift.

Key Points

• The New Pamban Bridge in Tamil Nadu, India, is designed with a vertical-lift mechanism to facilitate maritime traffic by enabling ships to pass beneath the bridge without obstruction.

• The bridge is an upgrade from the existing structure, which used a manual Scherzer rolling lift mechanism. The vertical-lift system is more efficient and technologically advanced.

• This vertical-lift feature allows a section of the bridge to be raised vertically, providing adequate clearance for large ships and vessels navigating through the Palk Strait.

• The bridge is strategically significant as it connects the mainland of India with Rameswaram Island, supporting both rail and road traffic while accommodating maritime needs.

• Constructed with advanced materials and engineering techniques, the vertical-lift bridge ensures durability against environmental factors such as high tides, saline conditions, and strong winds.

• The New Pamban Bridge is expected to be operational by 2024, showcasing India's commitment to upgrading its infrastructure for better connectivity and economic growth.

Additional Information

• Vertical-lift bridges:

• A vertical-lift bridge has a portion of the bridge deck that can be raised vertically using counterweights and cables or other mechanisms.

• These bridges are commonly employed in areas where maritime traffic is significant, as they provide a clear passage for ships without disrupting vehicular or rail traffic extensively.

• Examples include the Hawthorne Bridge in Portland, USA, and the Skyway Bridge in Chicago, USA.

• Importance of Pamban Bridge:

• The Pamban Bridge is India's first sea bridge, initially opened in 1914 to connect mainland India with Rameswaram Island via rail.

• The old bridge had a Scherzer rolling lift mechanism, enabling a section of the bridge to open manually for ships.

• With advancements in technology and increased maritime traffic, the new vertical-lift design was adopted for efficiency and safety.

• Features of the New Pamban Bridge:

• The bridge spans approximately 2.05 km across the Palk Strait.

• It is designed to withstand high wind speeds of up to 100 km/h and other challenging maritime conditions.

• The bridge supports both railway and road traffic and is equipped with modern signaling systems.

• It is a part of India's initiative to modernize and expand its infrastructure to meet growing transportation and connectivity demands.

• Other notable bridge mechanisms:

• Swing bridges: Rotate horizontally around a pivot point to allow ships to pass. Example: the Ashtabula Bridge in Ohio, USA.

• Bascule bridges: Operate by tilting upward, resembling a seesaw. Example: the Tower Bridge in London, UK.

• Suspension bridges: Use cables to support the bridge deck, designed primarily for spanning long distances rather than accommodating maritime traffic. Example: the Golden Gate Bridge in San Francisco, USA.

Important Points

• The vertical-lift mechanism is particularly suitable for locations where maritime traffic is frequent and clearance height needs to be adjusted dynamically.

• The New Pamban Bridge is a vital infrastructure project aimed at boosting tourism, trade, and connectivity in southern India.

• The project aligns with India's goals of developing smart infrastructure and adopting sustainable and efficient designs for national progress.

• The bridge is expected to improve socio-economic conditions by enhancing access to remote regions and fostering inter-regional trade and travel.

Q91. Answer: (a) United Kingdom and Mauritius

The correct answer is United Kingdom and Mauritius.

Key Points

• The Chagos Archipelago Sovereignty Agreement was signed between the United Kingdom and Mauritius in May 2025, marking a historic resolution to a longstanding territorial dispute.

• The agreement acknowledges Mauritius' sovereignty over the Chagos Archipelago, which had been under British control since 1965.

• This agreement follows the 2019 advisory opinion by the International Court of Justice (ICJ), which stated that the UK's administration of the Chagos Islands was illegal and recommended returning the territory to Mauritius.

• The Chagos Archipelago is strategically located in the Indian Ocean, consisting of over 55 islands, with Diego Garcia being the most prominent island, hosting a major US military base.

• Under the agreement, Mauritius has agreed to recognize the continued operation of the military base on Diego Garcia by the US, ensuring mutual security interests.

Additional Information

• Historical Background:

• The Chagos Archipelago was separated from Mauritius in 1965 when Mauritius was still a British colony. This separation was part of a deal in which Mauritius received financial compensation in return for the detachment of the islands.

• The UK then established the British Indian Ocean Territory (BIOT) and leased Diego Garcia to the United States for the establishment of a military base.

• The displacement of the native Chagossians occurred during the late 1960s and early 1970s, sparking legal and human rights controversies.

• International Court of Justice (ICJ) Advisory Opinion (2019):

• The ICJ ruled that the UK's continued administration of the Chagos Archipelago was illegal and that it must return the islands to Mauritius as part of the process of decolonization.

• The ruling, though advisory, placed significant international pressure on the UK to resolve the issue.

• United Nations General Assembly (UNGA) Resolution:

• In 2019, the UNGA overwhelmingly passed a resolution supporting the ICJ's advisory opinion and called for the UK to withdraw from the Chagos Archipelago.

• 120 countries voted in favor of the resolution, while only 6, including the UK and the US, opposed it.

• Diego Garcia Military Base:

• Diego Garcia remains a strategically important location for global military operations, particularly for the United States.

• As part of the agreement, Mauritius has committed to allowing the continued operation of the base, ensuring regional and global security.

• Significance of the Agreement:

• The sovereignty agreement is a major step towards rectifying historical injustices and addressing the grievances of displaced Chagossians.

• It also strengthens diplomatic ties between the UK and Mauritius, fostering cooperation in areas such as security, trade, and environmental conservation.

Important Points

• Chagossian Displacement:

• Approximately 1,500 Chagossians were forcibly removed from the islands to make way for the Diego Garcia base. Many were relocated to Mauritius and Seychelles.

• The agreement includes provisions for compensation and resettlement for the displaced Chagossian community, addressing a long-standing demand for justice.

• Environmental Conservation:

• The Chagos Archipelago is home to some of the world's most pristine coral reefs and marine ecosystems.

• The agreement includes a commitment to protect and conserve the ecological integrity of the islands and surrounding waters.

• Strategic Importance:

• Located in the Indian Ocean, the Chagos Archipelago serves as a critical hub for monitoring and securing maritime routes.

• Its geopolitical importance has made it a focal point for international diplomacy and security considerations.

Q92. Answer: (c) Environment Protection (End-of-Life Vehicles) Rules

The correct answer is Environment Protection (End-of-Life Vehicles) Rules.

Key Points

• The Environment Protection (End-of-Life Vehicles) Rules were introduced in April 2025 by the Indian government to regulate the disposal and recycling of vehicles that have reached the end of their operational life.

• These rules aim to reduce the environmental impact caused by the disposal of old vehicles by promoting environmentally sound dismantling, recycling, and reuse of automotive materials.

• The rules mandate the establishment of Registered Vehicle Scrapping Facilities (RVSF), which are authorized centers responsible for processing end-of-life vehicles in compliance with environmental regulations.

• The policy emphasizes the proper handling of hazardous materials such as engine oils, batteries, and airbags to prevent soil and water contamination.

• It promotes the adoption of modern recycling techniques to recover valuable resources like steel, aluminum, and plastics, ensuring sustainable use of resources and reducing the dependency on raw materials.

Additional Information

• Significance of End-of-Life Vehicle Rules:

• The rules help in addressing the problem of increasing vehicular waste, which poses a significant environmental hazard in urban and rural areas.

• Encourages the creation of a formal vehicle scrapping ecosystem, which in turn boosts employment opportunities and facilitates

a circular economy.

• Ensures compliance with global standards for vehicle dismantling and recycling, aligning India with international environmental practices.

• Key Components of the Rules:

• Vehicle Age Limit: Defines the operational lifespan of vehicles, especially for commercial vehicles, and recommends scrapping after the prescribed period.

• Certificate of Destruction: Issuance of a certificate to vehicle owners upon scrapping, which can be used to claim tax rebates or discounts on new vehicle purchases.

• Extended Producer Responsibility (EPR): Manufacturers are encouraged to design vehicles with recyclable materials and establish systems for taking back end-of-life vehicles.

• Global Context:

• Countries like Germany, Japan, and the USA have established stringent policies for managing end-of-life vehicles, serving as benchmarks for India.

• In Europe, the End-of-Life Vehicles Directive (2000/53/EC) mandates manufacturers to take responsibility for their vehicles' environmental impact, including recycling at the end of their lifecycle.

• Environmental Benefits:

• Prevents the illegal dumping of vehicles and parts, which often leads to land and water pollution.

• Reduces greenhouse gas emissions by minimizing the need for new raw material extraction and processing.

Important Points

• Bio-medical Waste (Management & Handling) Rules:

• First introduced in 1998 and further amended in later years.

• These rules regulate the segregation, transportation, and disposal of bio-medical waste generated by healthcare facilities.

• Hazardous and Other Wastes (Management & Transboundary Movement) Amendment Rules:

• Introduced in 2016 and amended periodically, these rules govern the handling, storage, and disposal of hazardous waste.

• They also address issues related to the import and export of hazardous materials.

• Plastic Waste Management (Amendment) Rules:

• These rules aim to reduce plastic waste generation and promote recycling and reuse of plastic materials.

• Key amendments include banning specific single-use plastics and increasing producer responsibility for waste management.

• Vehicle Scrapping Policy:

• Launched in 2021, this policy complements the Environment Protection (End-of-Life Vehicles) Rules by incentivizing the scrapping of old and polluting vehicles.

• Provides tax benefits and discounts on new vehicle purchases for those who scrap their old vehicles.

Q93. Answer: (c) 159

The correct answer is 159.

Key Points

• According to the Ministry of Earth Sciences, a total of 159 earthquakes were recorded in India during the period from November 2024 to February 2025.

• This data highlights the seismic activity recorded over four months, reflecting the geological dynamism of the Indian subcontinent.

• The Indian Plate is tectonically active, interacting with the Eurasian Plate, which contributes to frequent seismic activities, especially in the Himalayan region and other fault lines across the country.

• The recorded number of earthquakes indicates the need for preparedness and safety measures in regions prone to high seismic activity.

• Other options provided in the question, such as 136, 197, and 213, are incorrect as they do not match the official data released by the Ministry of Earth Sciences.

Additional Information

• India's Seismic Zones:

• India is divided into four seismic zones based on the level of seismic risk: Zone II (low risk), Zone III (moderate risk), Zone IV (high risk), and Zone V (very high risk).

• Zone V includes regions like Himalayas, northeastern states, Rann of Kutch, and Andaman & Nicobar Islands, which are highly prone to earthquakes.

• Significance of Earthquake Monitoring:

• The National Centre for Seismology (NCS), under the Ministry of Earth Sciences, is responsible for monitoring seismic activity in India.

• It operates a network of seismological observatories equipped with advanced instruments to record and analyze earthquakes in real time.

• Preparedness and Safety Measures:

• Regions prone to earthquakes require strict enforcement of building codes and the use of earthquake-resistant designs in infrastructure.

• Public awareness campaigns and disaster response drills are essential to minimize casualties during seismic events.

• Historical Context:

• India has experienced several major earthquakes in the past, such as the Bhuj earthquake (2001), Kashmir earthquake (2005), and Bihar-Nepal earthquake (2015).

• These events emphasize the importance of proactive measures to mitigate the impact of future earthquakes.

Important Points

• Role of Plate Tectonics:

• India lies at the junction of the Indian Plate and the Eurasian Plate, making it prone to frequent seismic activity.

• The collision of these plates is responsible for the upliftment of the Himalayas and the associated seismicity in northern India.

• Magnitude and Intensity:

• Earthquakes are measured in terms of magnitude (Richter Scale) and intensity (Modified Mercalli Scale).

• While magnitude measures the energy released at the source, intensity measures the impact felt on the surface.

• Global Context:

• India is part of the Ring of Fire, a seismically active region encircling the Pacific Ocean, though its primary seismic activity is due to the Himalayan collision zone.

• Countries like Japan and Indonesia also face frequent seismic events due to similar tectonic activities.

Q94. Answer: (a) Pradhan Mantri Awas Yojana – Urban (PMAY-U)

The correct answer is Pradhan Mantri Awas Yojana – Urban (PMAY-U).

Key Points

• Pradhan Mantri Awas Yojana – Urban (PMAY-U) is a flagship mission launched by the Government of India in June 2015 to address the housing needs of the urban population.

• The scheme focuses on providing “Housing for All” by the year 2022, targeting the economically weaker sections (EWS), low-income groups (LIG), and middle-income groups (MIG).

• As per the Economic Survey 2024–25, under the PMAY-U, over 89 lakh houses were completed in urban areas as of 25 November 2024.

• The scheme operates through four verticals: In-situ Slum Redevelopment (ISSR), Credit Linked Subsidy Scheme (CLSS), Affordable Housing in Partnership (AHP), and Beneficiary-led Individual House Construction/Enhancement (BLC).

• Implementation is done in collaboration with state governments and urban local bodies (ULBs), ensuring that housing provisions are tailored to regional needs and preferences.

Additional Information

• Pradhan Mantri Awas Yojana – Urban (PMAY-U):

• The mission is designed to cater to the growing urban population and alleviate the housing shortage, especially among economically weaker sections (EWS).

• Subsidy Benefits: Under the Credit Linked Subsidy Scheme (CLSS), beneficiaries can avail of interest subsidies on home loans.

• The scheme emphasizes sustainable and eco-friendly housing by incorporating green technologies and disaster-resistant designs.

• Targets include providing pucca houses with basic amenities such as water supply, sanitation, and electricity.

• Smart Cities Mission:

• Launched in 2015, this program aims to promote sustainable and inclusive urban development.

• It focuses on creating smart infrastructure, improving governance, and ensuring a better quality of life for residents.

• Unlike PMAY-U, it does not directly address housing shortages but emphasizes urban modernization.

• Shelter for Urban Homeless (SUH):

• This scheme, under the National Urban Livelihoods Mission (NULM), aims to provide night shelters to homeless individuals in urban areas.

• It ensures that urban homeless people have access to essential services such as food, healthcare, and security.

• Indira Awas Yojana:

• Launched in 1985, this scheme primarily targeted rural areas to provide housing for below poverty line (BPL) families.

• In 2016, it was revamped and renamed as Pradhan Mantri Awas Yojana – Gramin (PMAY-G), focusing exclusively on rural

housing needs.

Important Points

• Data and Achievements:

• As of 25 November 2024, over 123 lakh houses have been sanctioned under PMAY-U, with 89 lakh houses completed.

• Out of these, 85 lakh houses have been handed over to beneficiaries.

• Funding and Implementation:

• The scheme operates with central assistance and funds are released in installments based on the progress of construction.

• States and ULBs are given flexibility to implement the scheme according to local needs.

• Key Features:

• Focus on women empowerment by mandating ownership of houses in the name of female family members or jointly with males.

• Special provisions for senior citizens, differently-abled persons, and marginalized communities.

Q95. Answer: (c) Murlikant Petkar

The correct answer is Murlikant Petkar.

Key Points

• Murlikant Petkar is a celebrated para-swimmer and was the first Indian to win a Paralympic gold medal. He achieved this feat at the 1972 Heidelberg Paralympics in the 50m freestyle swimming event.

• He set a world record during the 1972 Paralympics by clocking a time of 37.33 seconds in his event.

• Before his para-sports career, Petkar served in the Indian Army but was injured during the 1965 Indo-Pak war, leading to his disability.

• He transitioned to para-sports and excelled not only in swimming but also in other sports like wheelchair racing and javelin throw, showcasing his versatility.

• His achievements and contributions to sports were recognized when he was conferred with the Arjuna Award (Lifetime Achievement) in 2025, honoring his immense contribution to Indian para-sports.

Additional Information

• Prasanta Karmakar:

• Prasanta Karmakar is an Indian para-swimmer who has represented India in multiple international events.

• He was the first Indian swimmer to win a medal at the 2003 World Swimming Championship.

• He has also been a recipient of the Arjuna Award in the past for his achievements in para-swimming.

• Suyash Jadhav:

• Suyash Jadhav is a modern para-swimmer from India who competes in international events.

• He has won medals at the Asian Para Games and is known for competing in events like the 50m butterfly and 200m medley.

• He is a source of inspiration for many young para-athletes in India.

• Sharath Gayakwad:

• Sharath Gayakwad is a para-swimmer who has represented India in several international competitions, including the 2012 London Paralympics.

• He holds the record for being the first Indian to win six medals in a single edition of the Asian Para Games in 2014.

• Arjuna Award:

• The Arjuna Award is one of India’s prestigious sports honors, instituted in 1961.

• It recognizes outstanding performance in sports and games at the international level.

• Recipients of the award are given a bronze statuette of Arjuna, a certificate, and a cash prize.

Important Points

• Significance of the Arjuna Award:

• It aims to encourage athletes and sportspeople to bring laurels to the nation.

• The award also recognizes the efforts of athletes who have overcome adversities, such as physical disabilities, to achieve excellence.

• Indian Para-Sports:

• India has been making significant strides in para-sports over the years, with athletes like Murlikant Petkar, Devendra Jhajharia, and Mariyappan Thangavelu gaining global recognition.

• The Paralympic Committee of India (PCI) oversees the development and promotion of para-sports in the country.

Q96. Answer: (a) Jyothi Yarraji

The correct answer is Jyothi Yarraji.

Key Points

• Jyothi Yarraji is an Indian track and field athlete specializing in hurdling events. She has emerged as one of the leading athletes in her domain in recent years.

• She is the first Indian woman to break the 13-second barrier in the 100m hurdles, establishing herself as a standout performer on the national and international stage.

• In January 2025, Jyothi Yarraji was awarded the prestigious Arjuna Award for her contributions to athletics, recognizing her achievements and dedication to sports in India.

• The Arjuna Award, instituted in 1961, is one of the highest civilian awards for sports in India, honoring outstanding performance and contributions in sports.

• Jyothi's consistent performance in national and international competitions, coupled with her ability to set new benchmarks in hurdling, made her a deserving candidate for this accolade.

Additional Information

• Arjuna Award:

• The Arjuna Award is presented annually by the Government of India to recognize exceptional achievements in national sports.

• It includes a bronze statuette of Arjuna, a certificate, and a cash prize.

• The award aims to encourage athletes to strive for excellence and represent India globally.

• Jyothi Yarraji's Achievements:

• She has won multiple gold medals in national championships, cementing her status as India's top hurdler.

• She holds a national record in the 100m hurdles, showcasing her exceptional talent and dedication.

• She has represented India in prestigious international events, earning accolades and recognition for her performances.

• Other Options:

• Neeraj Chopra: An Olympic gold medalist in javelin throw, Neeraj Chopra is one of India's most celebrated athletes, but he did not win the Arjuna Award in January 2025.

• Avinash Sable: A prominent Indian steeplechase runner, Avinash Sable has set records but was not the recipient of the Arjuna Award in January 2025.

• Tajinderpal Singh Toor: An Indian shot putter known for his remarkable performances, he also did not win the Arjuna Award in the specified time frame.

• Criteria for Arjuna Award:

• The award recognizes athletes who have shown consistent excellence over the years.

• It emphasizes sportsmanship, contributions to sports, and the ability to inspire future generations.

• Nominees are evaluated on their performance, discipline, and dedication to their respective sports.

Important Points

• Significance of the Arjuna Award:

• The award encourages athletes to achieve higher standards and motivates them to bring laurels to the country.

• Recipients often become role models, inspiring young athletes to pursue sports as a career.

• Indian Athletics:

• India has witnessed significant growth in track and field events, with athletes like Jyothi Yarraji leading the way.

• Government initiatives and schemes like the Target Olympic Podium Scheme (TOPS) have played a crucial role in nurturing talent.

Q97. Answer: (b) Kirori Lal Meena

The correct answer is Kirori Lal Meena.

Key Points

• Kirori Lal Meena, a prominent political leader and minister in Rajasthan, conducted surprise raids on seed and fertiliser godowns in June 2025.

• The action was taken to ensure availability of quality seeds and fertilisers to farmers and to curb malpractices such as hoarding and black marketing.

• These surprise raids were conducted across various districts in Rajasthan where complaints regarding adulterated seeds and fertilisers had surfaced.

• Kirori Lal Meena, known for his proactive approach, aimed at addressing the grievances of farmers and ensuring transparency in agricultural supply chains.

• This initiative was part of broader efforts by the Rajasthan government to bolster agricultural productivity and maintain the integrity of farming inputs.

Additional Information

• Kirori Lal Meena:
• Kirori Lal Meena is a seasoned politician from Rajasthan, representing the Scheduled Tribes and advocating for farmers' welfare.
• He has held several key positions and is recognized for his grassroots-level initiatives and direct engagement with the public.
• As a minister, he frequently addresses issues related to agriculture, tribal welfare, and rural development.
• Adulteration in Agricultural Inputs:
• Adulteration of seeds and fertilisers is a growing concern in the agriculture sector, leading to reduced crop yields and financial losses for farmers.
• Governments often conduct surprise inspections to ensure compliance with quality standards and to penalize offenders.
• Adulterated fertilisers can harm soil fertility and damage crops, emphasizing the need for stringent regulations and monitoring.
• Government Initiatives for Farmers:
• The Rajasthan government has launched several schemes to support farmers, including subsidies on seeds and fertilisers.
• Efforts have also been made to improve irrigation facilities and provide crop insurance under national schemes.
• Such initiatives aim to enhance agricultural productivity and safeguard farmers' income.
• Importance of Quality Seeds and Fertilisers:
• Quality seeds and fertilisers are crucial for achieving high agricultural productivity and ensuring food security.
• They play a vital role in improving crop yields, reducing input costs, and promoting sustainable farming practices.
• Governments worldwide emphasize strict quality control measures and certification processes to maintain standards.

Important Points

• Hoarding and Black Marketing:
• Hoarding refers to the practice of stockpiling goods to create artificial scarcity, leading to price hikes.
• Black marketing involves selling goods at higher prices in violation of legal regulations.
• Such practices negatively impact farmers and consumers, necessitating government action to curb them.
• Role of Agricultural Ministers:
• Agricultural ministers play a pivotal role in implementing policies, addressing farmers' concerns, and ensuring the availability of resources.
• Their actions directly influence agricultural productivity and rural livelihoods.
• Proactive measures, such as inspections, are essential to maintain transparency and accountability in the sector.

Q98. Answer: (b) Puducherry

The correct answer is Puducherry.

Key Points

• National e-Vidhan Application (NeVA): NeVA is a revolutionary initiative by the Government of India aimed at digitizing the legislative assemblies across the country.
• Puducherry became the first Union Territory in India to adopt NeVA on 9 June 2025, marking a significant step towards paperless governance.
• NeVA facilitates the digitization of legislative assembly proceedings, including discussions, bills, and other related documents, ensuring transparency and accessibility.
• The adoption of NeVA aligns with the government's vision of Digital India, promoting e-governance and reducing environmental impact.
• Under NeVA, legislators can access assembly proceedings and documents electronically through tablets or laptops, enhancing efficiency and reducing the dependency on physical documentation.

Additional Information

• Key Features of NeVA:
• NeVA includes features such as e-Voting, digital access to assembly agendas, and real-time updates of legislative activities.
• The platform provides multilingual support, ensuring inclusivity for legislators from different linguistic backgrounds.
• It incorporates robust security measures to safeguard sensitive information and prevent unauthorized access.
• NeVA supports archiving and retrieval of legislative documents, allowing seamless access to historical records.
• Significance of Digital Governance:
• Digital governance systems like NeVA play a vital role in enhancing accountability, transparency, and efficiency in administrative processes.
• These initiatives contribute to environmental sustainability by reducing paper usage and promoting eco-friendly practices.
• They empower legislators and citizens by providing easy access to information, fostering participatory governance.
• Puducherry:

• Puducherry is a Union Territory located in southern India, comprising four regions: Puducherry, Karaikal, Mahe, and Yanam.
• Known for its French colonial heritage, Puducherry has a unique cultural blend of Indian and French influences.
• The Union Territory has been proactive in adopting technological advancements to improve governance and public services.
• Other Union Territories and States:
• Delhi: Known as the National Capital Territory, Delhi is the political and administrative hub of India.
• Lakshadweep: An archipelago of islands in the Arabian Sea, Lakshadweep focuses on sustainable development due to its ecological sensitivity.
• Chandigarh: A union territory and the capital of Punjab and Haryana, Chandigarh is recognized for its modern urban planning and architecture.

Important Points

• Digital India Initiative:
• Launched in 2015, the Digital India program aims to transform India into a digitally empowered society and knowledge economy.
• It focuses on digital infrastructure, digital literacy, and digital delivery of services.
• Adoption of platforms like NeVA is a step forward in achieving the objectives of Digital India.
• Environmental Impact:
• The shift to paperless governance significantly reduces paper consumption, contributing to the conservation of natural resources.
• It aligns with global efforts to combat climate change and promote sustainability.
• Legislative Efficiency:
• Digitization of legislative processes enhances efficiency by enabling quick access to documents and streamlined workflows.
• It fosters better collaboration among legislators and supports informed decision-making.

Q99. Answer: (d) 2013

The correct answer is 2013.

Key Points

• The Supreme Court (Amendment) Rules, 2025 introduced changes to Order II, Rules 1 to 3 of the Supreme Court Rules.
• The original Supreme Court Rules were enacted in the year 2013, which is the correct answer.
• The Supreme Court has the authority to frame its own rules under Article 145 of the Constitution of India.
• These rules govern the practices and procedures of the Supreme Court, including filing, hearing of cases, and other procedural matters.
• The amendments made in 2025 aimed at refining and updating procedural aspects to enhance efficiency and clarity in the functioning of the Supreme Court.

Additional Information

• Order II, Rules 1 to 3:
• These rules primarily deal with the format of pleadings, the procedure for filing cases, and other related matters in the Supreme Court.
• The amendments ensure that these provisions are aligned with modern legal practices and technological advancements, such as e-filing and virtual hearings.
• Article 145 of the Constitution:
• It empowers the Supreme Court to make rules for regulating its practice and procedure.
• However, these rules must not conflict with any laws made by Parliament.
• Historical Context:
• The Supreme Court Rules were first framed in 1950, following the establishment of the Supreme Court of India.
• They have undergone several amendments to address evolving legal needs and procedural challenges.
• Features of the 2013 Rules:
• The 2013 Rules introduced significant changes to enhance procedural clarity and efficiency.
• These changes included streamlining case categorization, improving accessibility, and enabling the use of technology in court proceedings.

Important Points

• Amendments in 2025: The changes introduced in the Supreme Court Rules, 2025, focused on incorporating digital practices, such as mandatory e-filing and virtual hearing mechanisms, to adapt to the post-pandemic legal environment.
• Role of Supreme Court: As the apex judicial body in India, it is crucial for the Supreme Court to periodically update its rules to maintain the efficiency and integrity of the judicial process.
• Judicial Efficiency: The amendments reflect the judiciary's commitment to ensuring speedy justice and adapting to the changing needs of litigants and legal practitioners.

• Impact of Technology: The recent amendments also highlight the increasing role of technology in the judiciary, ensuring greater transparency, accessibility, and reduction in procedural delays.

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Q100. Answer: (d) Aravalli Mountain Range

The correct answer is Aravalli Mountain Range.

Key Points

• The Revised Green India Mission (GIM) Plan 2025 identifies vulnerable landscapes across India for ecological restoration and improved environmental sustainability.

• The Aravalli Mountain Range is one of the vulnerable landscapes identified under this plan due to extensive degradation caused by mining, deforestation, and urbanization.

• The Aravalli Range is crucial for preventing desertification in the adjoining regions of Rajasthan and maintaining ecological balance.

• Efforts under GIM aim to restore native vegetation, improve groundwater recharge, and enhance biodiversity in the Aravalli region.

• The inclusion of the Aravalli Mountain Range in the GIM highlights its importance in combating climate change and achieving sustainable development goals.

Additional Information

• Aravalli Mountain Range:

• The Aravalli Range is one of the oldest mountain ranges in the world, dating back to the Proterozoic Era.

• It extends for about 800 km across the Indian states of Rajasthan, Haryana, Gujarat, and Delhi.

• The range acts as a natural barrier, preventing the expansion of the Thar Desert into fertile regions.

• It is home to rich biodiversity, including native plant species and wildlife such as leopards, striped hyenas, and golden jackals.

• The region faces ecological challenges like illegal mining, deforestation, and loss of vegetation cover.

• Green India Mission (GIM):

• Launched under the National Action Plan on Climate Change (NAPCC), GIM aims to increase forest and tree cover for ecosystem restoration.

• The mission focuses on enhancing ecosystem services like carbon sequestration, biodiversity conservation, and groundwater recharge.

• It prioritizes landscapes that are vulnerable to climate change, including forests, wetlands, and urban ecosystems.

• GIM works in coordination with state governments, local communities, and other stakeholders for effective implementation.

• The Revised Plan 2025 expands the scope of the mission to include more regions and a broader range of activities.

• Other Vulnerable Landscapes:

• Deccan Plateau: Known for its unique geological features, the plateau faces issues like soil erosion and water scarcity.

• Thar Desert: Vulnerable to desertification and loss of biodiversity, this region requires sustainable management practices.

• Indo-Gangetic Plain: A critical agricultural zone facing threats from soil degradation, pollution, and overexploitation of water resources.

• Each of these landscapes has unique ecological challenges that are addressed under the Green India Mission.

Important Points

• Significance of Aravalli Restoration:

• The restoration of the Aravalli Mountain Range is vital for mitigating climate change impacts and ensuring ecological stability.

• Efforts include afforestation, soil conservation, and water resource management to reverse degradation.

• Protecting the Aravalli Range contributes to preserving the livelihoods of local communities dependent on its resources.

• It also plays a key role in achieving India's commitments under the Paris Agreement and other international environmental frameworks.

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