RRB Group D Official Paper (Held On: 05 Dec, 2025 Shift 3) (Previous Year Paper)

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

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GENERAL SCIENCE

Q1. A 1000 kg car moving at 10 m/s is brought to rest by a constant braking force in 5 s. What is the magnitude of the force?

(a) 2000 N
(b) 1500 N
(c) 2500 N
(d) 3000N

Q2. A concave mirror forms an image at a distance of 20 cm when an object is placed 10 cm in front of it. What is the focal length of this mirror?

(a) 10 cm
(b) 20 cm
(c) 40 cm
(d) 30 cm

Q3. If the speed of a wave is 300 m/s and its wavelength is 0.75 m, the frequency of the wave is _____.

(a) 225 Hz
(b) 75 Hz
(c) 400 Hz
(d) 300 Hz

Q4. An electric bulb is rated 110 Watt – 220 Volt. The current drawn by the bulb is:

(a) 20 A
(b) 0.5 A
(c) 2 A
(d) 24,200 A

Q5. Which of the following statements are correct about molecular mass?

Statement 1: The molecular mass of a substance is the sum of the atomic masses of all the atoms in a molecule of the substance.

Statement 2: It is also known as the relative mass of a molecule.

Statement 3: It is expressed in atomic mass units (u).

(a) Only statements 2 and 3 are correct.
(b) Statements 1, 2 and 3 are correct.
(c) Only Statements 1 and 3 are correct.
(d) Only statements 1 and 2 are correct.

Q6. Suspensions are different from solutions because:

(a) They are transparent
(b) Their particles do not settle on standing
(c) They can be seen by naked eyes
(d) Their solute is fully dissolved

Q7. If an object moves from point A to point B (50 m east) and returns to point A in 10 seconds, its average velocity is:

(a) -10 m/s
(b) 0 m/s
(c) 5 m/s
(d) 10 m/s

Q8. What is the IUPAC name for an organic compound with two carbon atoms and a hydroxyl (-OH) functional group?

(a) Methanal
(b) Ethanol
(c) Propanone
(d) Ethanoic acid

Q9. Which of the following methods is an example of asexual reproduction in plants?

(a) Vegetative propagation
(b) Pollination
(c) Fertilisation
(d) Germination

Q10. The gas released on the reaction of metal carbonate with hydrochloric acid turns lime water milky. The released gas is:

(a) Hydrogen
(b) Carbon dioxide
(c) Chlorine
(d) Carbon monoxide

Q11. Read the given Assertion (A) and Reason (R) carefully and select the correct option.

(A): Mendel chose pea plants for his experiments because they were easy to grow and showed distinct contrasting traits.

(R): Pea plants reproduce asexually, allowing Mendel to control crosses easily.

(a) A is false, but R is true
(b) A is true, but R is false
(c) Both A and R are true, and R is the correct explanation of A
(d) Both A and R are true, but R is not the correct explanation of A

Q12. Which statement correctly represents the location of the meristematic tissue in a plant body?

(a) All over the plant body
(b) At some specific regions
(c) At the base of the stem
(d) At the tips of the leaves

Q13. Which of the following reproductive method will generate greater diversity in population?

(a) Fragmentation
(b) Budding
(c) Binary fission
(d) Sexual reproduction

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Q14. When dilute hydrochloric acid reacts with sodium hydrogencarbonate, which of the following observations is correct?

(a) Formation of a salt and water only
(b) Formation of hydrogen gas with a pop sound
(c) Rapid evolution of a colourless gas that turns lime water milky
(d) Formation of brown fumes of nitrogen dioxide

Q15. If the direction of current in a conductor is reversed, the direction of force on it will:

(a) become zero
(b) remain the same
(c) double
(d) reverse

Q16. A man lifts a stone of mass 22 kg through a vertical height of 4 m. Calculate the work done. (Take g = 10 m/s²)

(a) 55 J
(b) 400 J
(c) 220 J
(d) 880 J

Q17. Which of the following expressions is representing the correct lens formula?

(a) 1/v – 1/u = f
(b) 1/v + 1/u = 1/f
(c) 1/v + 1/u = f
(d) 1/v – 1/u = 1/f

Q18. When an empty plastic bottle with an airtight stopper is pushed deeper into a bucket of water, the increasing upward force that resists the downward push is known as _____.

(a) buoyant force (or upthrust)
(b) gravitational force
(c) surface tension
(d) atmospheric pressure

Q19. Which of the following observations could NOT be explained by Rutherford's model of the atom?

(a) The stability of the atom despite the presence of accelerating electrons
(b) The distribution of electrons around the nucleus
(c) The presence of a positively charged nucleus in the atom
(d) The deflection of alpha particles at large angles

Q20. Detergents can work in which of the following?

(a) Only distilled water
(b) Only hot water
(c) Only soft water
(d) Both hard and soft water

Q21. Why do we experience muscle cramps after heavy exercise?

(a) Due to accumulation of lactic acid
(b) Because muscles stop contracting
(c) Because blood flow completely stops during exercise
(d) Due to a decrease in body temperature

Q22. Why is the plasma membrane called selectively permeable?

(a) It allows only certain substances to pass in or out.
(b) It blocks all substances from entering.
(c) It dissolves unwanted materials.
(d) It allows all substances to pass freely.

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Q23. Which of the following is NOT a method of irrigation?

(a) Check dams
(b) River lift systems
(c) Canals
(d) Wells

Q24. Providing water to crops at optimal times during their growth cycle directly contributes to what outcome?

(a) Increased vulnerability to pests
(b) Delayed maturation
(c) Decreased nutrient uptake
(d) Higher expected yields

Q25. The nature of the bond formed in aliphatic carbon compounds is:

(a) coordinate
(b) hydrogen
(c) covalent
(d) ionic

MATHEMATICS

Q26. If 2^x = 8 and 3^y = 27, find the value of (2^(x+1) × 3^(y-2)).

(a) 144
(b) 48
(c) 121
(d) 81

Q27. If 20% of a number is added to 96, then the result is the same number. 70% of the same number is:

(a) 104
(b) 94
(c) 114
(d) 84

Q28. Bharat buys a gold ring for his mother. The ring is marked at Rs. 96,000 and is offered with two successive discounts of 25% and Q%, respectively. After receiving both discounts, he pays Rs. 18,000. Find the value of Q.

(a) 77
(b) 74
(c) 75
(d) 76

Q29. The sides of a triangle are 85 cm, 13 cm, and 84 cm. What is the length of its altitude corresponding to the side with a length of 13 cm?

(a) 55 cm
(b) 126 cm
(c) 101 cm
(d) 84 cm

Q30. The perimeter of a rectangle is 54 cm. Its length is 3 cm more than twice the breadth. Find the breadth.

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

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Q31. After selling an article at a discount of 44%, the profit percentage obtained is 12%. What is the markup percentage?

(a) 97%
(b) 102%
(c) 101%
(d) 100%

Q32. The present age of Mohan is three times the age of his son Rakesh. Four years ago from now, Mohan's age was four times his son's age at that time. What will be Rakesh's age (in years) after 7 years from now?

(a) 19
(b) 20
(c) 36
(d) 12

Q33. A 20-metre-tall building has an observer at the top looking at a point on the ground. If the line of sight to that point makes a downward-facing angle of 45°, what is the horizontal distance from the building's base to that point?

(a) 20 m
(b) 10 m
(c) $20\sqrt{2}$ m
(d) 40 m

Q34. A garrison of 1200 men has provisions for 12 days. How long (in days) will the provisions last if the garrison be increased by 600 men?

(a) 3
(b) 18
(c) 28
(d) 8

Q35. Two banks, A and B, offered loans at 3.5% and 7.5% per annum, respectively. Chetan borrowed an amount of Rs. 2,00,000 from each bank. Find the positive difference (in Rs.) between the amounts of simple interest paid to the two banks by Chetan after 3 years.

(a) 24,000
(b) 25,500
(c) 25,000
(d) 23,500

Q36. The arithmetic mean of the observations 53, 63, 79, 40, 34, 88, 34, 25 and 25 is:

(a) 49
(b) 50
(c) 42
(d) 44

Q37. If a 2622 m long train crosses a pole in 57 seconds, then find the time (in seconds) taken by the train to cross a 736 m long platform.

(a) 73
(b) 74
(c) 83
(d) 63

Q38. A can complete a piece of work in 90 days. B is 75% less efficient than A. C is 80% more efficient than B. If B and C work together for 30 days, A alone will complete the remaining work in:

(a) 73 days
(b) 68 days
(c) 69 days
(d) 71 days

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Q39. Akshat and Neha together invested Rs. 57,000 in a business. At the end of the year, out of a total profit of Rs. 8,000, Akshat's share was Rs. 2,200. How much was Akshat's investment?

(a) Rs. 15,355
(b) Rs. 17,445
(c) Rs. 15,675
(d) Rs. 16,645

Q40. A train overtakes two persons walking along a railway track. The first person walks at 10.8 km/hr, and the second person walks at 21.6 km/hr. The train takes 15 seconds and 20 seconds, respectively, to completely pass them. What is the speed of the train if both persons are walking in the same direction as the train?

(a) 45 km/hr
(b) 50 km/hr
(c) 64 km/hr
(d) 54 km/hr

Q41. Divide Rs. 8,118 between Ravina and Sarita in the ratio 3 : 15, then find the share of Sarita.

(a) Rs. 6,767
(b) Rs. 6,768
(c) Rs. 6,763
(d) Rs. 6,765

Q42. The volume of a right circular cylinder is 13,860 cm^3 and circumference of its base is 66 cm. The height of this cylinder is : (Use $\pi = 22/7$)

(a) 40 cm
(b) 39 cm
(c) 45 cm
(d) 53 cm

Q43. A solid metallic sphere of radius 9 cm is melted and recast into smaller spherical balls, each of radius 3 cm. Find the number of such small balls formed.

(a) 27
(b) 32
(c) 24
(d) 21

Q44. 1/20 is what percentage of 2/90 ?

(a) 235%
(b) 240%
(c) 450%
(d) 225%

Q45. One pipe can fill a tank in 9 minutes while another pipe can empty the completely filled tank in 36 minutes. If both the pipes are opened together when the tank is empty, how many minutes will it take to fill one-half of the tank?

(a) 7
(b) 12
(c) 6
(d) 13

Q46. The cost of a washing machine is 16% less than the cost of a TV. If the cost of the washing machine increases by 80% and that of the TV decreases by 44%, then what is the percentage change in the total cost of 5 washing machines and 2 TVs?

(a) Decrease by 38%
(b) Increase by 40%
(c) Increase by 43%
(d) Decrease by 37%

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Q47. By selling 20 pens for the cost price of 25 pens, what is the profit percentage?

(a) 28%
(b) 25%
(c) 20%
(d) 35%

Q48. If a – b = 6 and ab = 135, then find a possible value of (a + b).

(a) 23
(b) 26
(c) 24
(d) 27

Q49. A typist takes 40 minutes to type 2 pages. How long (in minutes) will he take to type 87 pages?2688

(a) 1745
(b) 1730
(c) 1750
(d) 1740

Q50. Find the median of the given data, if the cumulative frequency is 45.

Class	1-11	11-21	21-31	31-41
Frequency	10	11	X	11

(a) 222/13
(b) 224/13
(c) 223/13
(d) 221/13

GENERAL INTELLIGENCE & REASONING

Q51. What should come in place of the question mark (?) in the given series to make it logically complete?

11 14 19 26 ?

(a) 32
(b) 30
(c) 35
(d) 31

Q52. Mr. Akai starts from Point A and drives 2 km towards south. He then takes a right turn, drives 12 km, turns right and drives 21 km. He then takes a right turn and drives 23 km. He takes a final right turn, drives 19 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) 7 km to the west
(b) 11 km to the west
(c) 11 km to the north
(d) 7 km to the east

Q53. Refer to the following number series and answer the question that follows (all numbers are single-digit numbers only). Counting to be done from left to right only.

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

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

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

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Q54. GKNE is related to KHRB in a certain way based on the English alphabetical order. In the same way, OEVY is related to SBZV. To which of the given options is WYDS related, following the same logic?

(a) BVIO
(b) ZWIQ
(c) AVHP
(d) BUGQ

Q55. What will come in the place of '?' in the following equation, if '+' and ' ÷ ' are interchanged and ' - ' and ' x ' are interchanged?

168 + 42 × 14 - 9 ÷ 207 = ?

(a) 77
(b) 85
(c) 72
(d) 81

Q56. What should come in place of the question mark (?) in the given series?

4 6 12 14 28 ?

(a) 32
(b) 29
(c) 30
(d) 31

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

(Left) * + 9 \ / ? > @ 5 5 / ? / 9 * 1 ? # + 6 # (Right)

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

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

Q58. What should come in place of the question mark (?) in the given series based on the English alphabetical order?

GLO NSV UZC BGJ ?

(a) IQW
(b) INO
(c) IOP
(d) INQ

Q59. A, B, C, D, W, X and Y are sitting around a circular table facing the centre of the table.

A sits third to the left of X. Only one person sits between X and C when counted from the left of C. Only two people sit between B and W when counted from the right of W. D is an immediate neighbour of B. Who sits third to the right of Y?

(a) D
(b) C
(c) W
(d) A

Q60. In a certain code language,

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

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

'A * B' means 'A is the sister of B'

'A ÷ B' means 'A is the wife of B'

Based on the above, how is X related to Q if 'X ÷ Y + Z * P - Q'?

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

Q61. 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.)

(17, 34, 2)

(13, 39, 3)

(a) (14, 42, 4)
(b) (12, 60, 5)
(c) (11, 55, 3)
(d) (15, 25, 2)

Q62. 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) OK-PM
(b) IE-JG
(c) KG-LI
(d) MI-NL

Q63. Refer to the given number series and answer the question that follows. Counting to be done from left to right only. All numbers are single-digit numbers.

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

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

(a) Two
(b) One
(c) More than three
(d) Three

Q64. If 'E' stands for '+', 'F' stands for '−', 'G' stands for '×' and 'H' stands for '÷', what will come in place of the question mark (?) in the following equation?

72 H 8 G 2 E 10 F 5 = ?

(a) 25
(b) 21
(c) 23
(d) 27

Q65. Read the given statement(s) and conclusions carefully. Assuming that the information given in the statements is true, even if it appears to be at variance with commonly known facts, decide which of the given conclusions logically follow(s) from the statement(s).

Statements:

All cats are mammals.

No mammals are pets.

Conclusions:

(I) Some pets are cats.

(II) No cat is pet.

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

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(d) Only conclusion (I) follows.

Q66. NHRX is related to RFVV in a certain way based on the English alphabetical order. In the same way, VDZT is related to ZBDR. To which of the following is DZHP related, following the same logic?

(a) GYMO
(b) IYLO
(c) GWKM
(d) HXLN

Q67. In a certain code language, 'STAR' is coded as '3451' and 'RATE' is coded as '4375'. What is the code for 'E' in the given code language?

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

Q68. Seven boxes, D, E, F, U, V, W and X, are kept one over the other but not necessarily in the same order. No box is kept above X. Only two boxes are kept between W and V. Only U is kept below E. Only three boxes are kept between E and W. D is not kept immediately above V. How many boxes are kept between F and U?

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

Q69. Seven people, A, B, C, D, E, F and G, are sitting in a row, facing north.

No one sits to the right of C. Only three people sit between C and D. Only two people sit between D and G. A sits third to the left of F. B sits to the immediate right of F.

How many people sit to the right of B?

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

Q70. Sarita starts from Point A and drives 8 km towards the west. She then takes a left turn, drives 5 km, turns left and drives 5 km. She then takes a right turn and drives 6 km. She takes a final left turn, drives 3 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) 5 km towards the east
(b) 16 km towards the west
(c) 11 km towards the north
(d) 8 km towards the south

Q71. A, B, C, D, E, F and G are sitting around a circular table, facing the centre. Only two people sit between F and B when counted from the right of F. Only two people sit between B and A when counted from the right of B. Only three people sit between F and E when counted from the right of F. D sits to the immediate left of C. How many people sit between F and G when counted from the left of F?

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

Q72. What should come in place of the question mark (?) in the given series?

27 51 77 105 135 ?

(a) 163
(b) 170
(c) 162

(d) 167

Q73. YPMW is related to CLPT in a certain way based on the English alphabetical order. In the same way, GHSQ is related to KDVN. To which of the given options is OZYK related, following the same logic?

(a) SVBH
(b) UWCH
(c) RWAI
(d) TVAG

Q74. Which of the following letter-number clusters will replace the question mark (?) in the given series to make it logically complete?

CUM150, MEW136, WOG122, GYQ108, ?

(a) QIB94
(b) OIA94
(c) QIA94
(d) QCA94

Q75. Based on the English alphabetical order, three of the following four letter-clusters are alike in a certain way and thus form a group. Which is the letter-cluster that does NOT belong to that group?

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

(a) ILO
(b) XAD
(c) JMP
(d) CGI

Q76. Seven boxes A, B, C, D, E, F and G are kept one over the other but not necessarily in the same order.

No box is kept above D. Only three boxes are kept between D and F. Only one box is kept between G and E. E is kept immediately above F. Only four boxes are kept between G and A. C is kept at some place above B.

How many boxes are kept above C?

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

Q77. Read the given statements and conclusions carefully. Assuming that the information given in the statements is true, even if it appears to be at variance with commonly known facts, decide which of the given conclusions logically follow(s) from the statements.

Statements:

All kiwis are bananas.

All bananas are mangoes.

Conclusions:

(I): All kiwis are mangoes.

(II): Some mangoes are bananas.

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

Q78. If ‘A’ stands for ‘÷’, ‘B’ stands for ‘×’, ‘C’ stands for ‘+’ and ‘D’ stands for ‘−’, what will come in place of the question mark (?) in the following equation?

50 C 30 B 4 A 12 D 27 = ?

(a) 35
(b) 36
(c) 34

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(d) 33

Q79. 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 8 4 6 9 5 8 8 7 9 2 6 6 5 8 6 3 1 1 4 4 6 (Right)

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

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

Q80. In a certain code language, 'bring hot food' is coded as 'cf tk rg' and 'food is good' is coded as 'ml do cf'. How is 'food' coded in that language?

(a) cf
(b) ml
(c) do
(d) tk

GENERAL AWARENESS AND CURRENT AFFAIRS

Q81. In May 2025, which among the following institutions formally announced the creation of the Payments Regulatory Board (PRB), a six-member panel responsible for overseeing the country's payment systems?

(a) Securities and Exchange Board of India
(b) Small Industries Development Bank of India
(c) National Bank for Agriculture and Rural Development
(d) Reserve Bank of India

Q82. Which of the following states launched Surakshit Shanivar (Safe Saturday), a disaster preparedness initiative for students in June 2025?

(a) Assam
(b) Jharkhand
(c) Uttar Pradesh
(d) Bihar

Q83. Which of the following folk artists became the first dhaki to win a Padma Shri in 2025?

(a) Leander Paes
(b) Mary Kom
(c) Gokul Chandra Das
(d) Anant Nag

Q84. Where was the 2^(nd) Global Cervical Cancer Elimination Forum held?

(a) Cartagena, Colombia
(b) Jakarta, Indonesia
(c) Kigali, Rwanda
(d) Bali, Indonesia

Q85. Who is the author of the book 'Wild Fictions: Essays' published in January 2025?

(a) Aria Aber
(b) Amitav Ghosh
(c) Nandini Purandare
(d) Santanu Bhattacharya

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Q86. Where was the 7^(th) Khelo India Youth Games held in May 2025?

(a) Bihar
(b) New Delhi
(c) Uttar Pradesh
(d) Maharashtra

Q87. Where was the headquarters of the National Turmeric Board inaugurated by Union Home Minister Amit Shah in June 2025?

(a) Nizamabad, Telangana
(b) Kanpur, Uttar Pradesh
(c) Bhopal, Madhya Pradesh
(d) Mysuru, Karnataka

Q88. In April 2025, which of the following cities was hit by a sandstorm causing major flight disruptions?

(a) Dubai, UAE
(b) Beijing, China
(c) Basra, Iraq
(d) New Delhi, India

Q89. Where was the 58^(th) edition of the World Table Tennis Championships held in May 2025?

(a) Doha, Qatar
(b) Paris, France
(c) Berlin, Germany
(d) Tokyo, Japan

Q90. Who among the following was awarded the Women's Player of the Year at the AIFF Awards 2025?

(a) Panthoi Chanu
(b) Sujata Kar
(c) Soumya Guguloth
(d) Toijam Thoibisana Chanu

Q91. The 28^(th) National Conference on e-Governance (NCeG) was held in _____ during June 2025.

(a) Kolkata
(b) Chennai
(c) Visakhapatnam
(d) Bengaluru

Q92. In January 2025, who clinched the men’s singles title at the India Open 2025 badminton tournament in New Delhi?

(a) Lee Cheuk Yiu
(b) Kento Momota
(c) Viktor Axelsen
(d) Chen Long

Q93. With which country did India sign a major defence agreement worth Rs. 63,000 crore on 28 April 2025, for the acquisition of 26 Rafale-Marine fighter jets?

(a) Denmark
(b) Brazil
(c) Russia
(d) France

Q94. As of 2023, how many wildlife sanctuaries are there in India?

(a) 623
(b) 585
(c) 655
(d) 573

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Q95. In May 2025, Sudan's army appointed whom among the following as a new Prime Minister after two years of civil war?

(a) Osman Hussein
(b) Dafallah al-Haj Ali
(c) Kamil al-Taib Idris
(d) Abdalla Hamdok

Q96. In 2025, Shubhanshu Shukla conducted an International Space Station (ISS) experiment with moong and methi seeds to study:

(a) Seed germination under microgravity conditions
(b) Soil nutrient cycling under space conditions
(c) High-yield oilseed production on Earth
(d) Resistance of legumes to common pesticides

Q97. What is the main aim of the Youth Spiritual Summit held in Varanasi on the banks of River Ganga in July 2025?

(a) Promote awareness about river conservation
(b) Encourage use of digital tools for literacy
(c) Foster a national resolve against drug abuse
(d) Support local youth in rural entrepreneurship

Q98. In February 2025, the Technology Development Board signed an agreement with which company to produce purified pyrolysis oil to make circular plastics and sustainable chemicals?

(a) Tata Chemicals Ltd, Mumbai
(b) Jaypee Chemicals, Jaipur
(c) Adani Chemicals Ltd, Ahmedabad
(d) APChemi Pvt. Ltd, Navi Mumbai

Q99. In March 2025, the central bank of which country signed a Memorandum of Understanding (MoU) with the Reserve Bank of India (RBI) to enable cross-border transactions in local currencies?

(a) Sri Lanka
(b) United Arab Emirates
(c) Singapore
(d) Mauritius

Q100. With which country did India sign a significant defence Memorandum of Understanding (MoU) (through the JCBL Group) in April 2025 which is aimed at bolstering India's domestic defence manufacturing capabilities?

(a) Egypt
(b) Qatar
(c) Japan
(d) Slovakia

ANSWER KEY

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

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91 c	92 c	93 d	94 d	95 c	96 a	97 c	98 d	99 b	100 d

SOLUTIONS

Q1. Answer: (a) 2000 N

The correct answer is 2000 N.

Key Points

• The mass of the car is given as 1000 kg.

• The initial velocity of the car is 10 m/s, and the final velocity is 0 m/s (since it is brought to rest).

• The time taken to bring the car to rest is given as 5 seconds.

• Using the formula for acceleration: a = (v - u) / t, where v is the final velocity, u is the initial velocity, and t is the time:

a = (0 - 10) / 5 = -2 m/s² (negative sign indicates deceleration).

• The braking force can be calculated using Newton's second law of motion: F = m × a, where m is the mass and a is the acceleration:

F = 1000 × (-2) = -2000 N. The negative sign indicates the direction of the force is opposite to the motion, but the magnitude is 2000 N.

• Hence, the magnitude of the braking force is 2000 N.

Additional Information

• Newton's Second Law of Motion:

• It states that the force acting on an object is equal to the mass of the object multiplied by its acceleration: F = m × a.

• This law explains how the velocity of an object changes when it is subjected to an external force.

• Acceleration:

• It is the rate of change of velocity of an object with respect to time.

• It can be calculated using the formula: a = (v - u) / t, where v is the final velocity, u is the initial velocity, and t is the time.

• Braking Force:

• It is the force applied to bring a moving object to rest or reduce its velocity.

• In this case, the braking force is calculated using Newton's second law, considering the deceleration of the car.

• Practical Applications:

• Understanding braking force is crucial in designing braking systems for vehicles to ensure safety and efficiency.

• It is also used in calculating stopping distances and improving road safety features.

Important Points

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

• Unit of Force: The SI unit of force is the Newton (N), where 1 N = 1 kg·m/s².

• Deceleration: A negative acceleration value indicates a reduction in velocity or slowing down.

• Stopping Distance: The distance required to bring a moving vehicle to rest depends on the initial velocity, braking force, and road conditions.

Q2. Answer: (b) 20 cm

The correct answer is 20 cm.

Key Points

• To solve this question, we use the mirror formula:

1/f = 1/v + 1/u, where:

• f is the focal length of the mirror.

• v is the distance of the image from the mirror.

• u is the distance of the object from the mirror.

• Given:

• v = 20 cm (image distance).

• u = -10 cm (object distance; negative because the object is placed on the same side as the reflecting surface).

• Using the formula:

• 1/f = 1/v + 1/u

• Substitute the values: 1/f = 1/20 + 1/(-10)

• 1/f = 1/20 - 1/10

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• Find the LCM: 1/f = (1 - 2)/20 = -1/20
• Thus, f = -20 cm.
• The negative sign indicates that the focal length is on the same side as the object, confirming it is a concave mirror.
• Therefore, the focal length of the mirror is 20 cm.

Additional Information

• Mirror Formula:
• The formula 1/f = 1/v + 1/u is universally applicable for all mirrors (concave, convex, or plane).
• It relates the focal length (f), object distance (u), and image distance (v).
• Sign convention is crucial:
• Distances measured in the direction of the incident light are positive.
• Distances measured against the direction of the incident light are negative.
• Concave Mirror:
• A concave mirror has a reflecting surface that curves inward, resembling the interior of a sphere.
• It forms real, inverted images when the object is beyond the focal point and virtual, upright images when the object is inside the focal point.
• Applications: Used in headlights, shaving mirrors, and astronomical telescopes.
• Image Formation by Concave Mirrors:
• If the object is placed:
• Beyond the center of curvature: Image is real, inverted, and smaller.
• At the center of curvature: Image is real, inverted, and of the same size.
• Between the center of curvature and focus: Image is real, inverted, and magnified.
• At the focus: Image is highly magnified and formed at infinity.
• Between the focus and the pole: Image is virtual, upright, and magnified.
• Sign Conventions in Mirrors:
• Object distance (u): Always negative for real objects.
• Image distance (v): Positive for real images and negative for virtual images.
• Focal length (f): Negative for concave mirrors and positive for convex mirrors.

Q3. Answer: (c) 400 Hz

The correct answer is Option 3: 400 Hz.

Key Points

• The speed of a wave is related to its frequency and wavelength by the formula: v = f × λ, where:
• v is the speed of the wave (in meters per second, m/s).
• f is the frequency of the wave (in Hertz, Hz).
• λ (lambda) is the wavelength of the wave (in meters, m).
• In the given problem:
• Speed of the wave (v) = 300 m/s
• Wavelength (λ) = 0.75 m
• To find the frequency (f), rearrange the formula: f = v / λ.
• Substitute the given values:
• f = 300 / 0.75
• f = 400 Hz
• Hence, the correct frequency of the wave is 400 Hz, which corresponds to Option 3.

Additional Information

• Wave Parameters:
• Wavelength (λ): The distance between two consecutive crests or troughs of a wave. Measured in meters (m).
• Frequency (f): The number of wave cycles that pass a given point per second. Measured in Hertz (Hz).
• Wave Speed (v): The distance a wave travels per unit of time. Measured in meters per second (m/s).
• Types of Waves:
• Mechanical Waves: Require a medium to travel through (e.g., sound waves, water waves).
• Electromagnetic Waves: Do not require a medium and can travel through a vacuum (e.g., light, radio waves).
• Key Characteristics of Frequency:

• The frequency of a wave determines its energy. Higher frequencies correspond to higher energy.
• The unit of frequency, Hertz (Hz), is named after the physicist Heinrich Hertz.
• For electromagnetic waves (like light), frequency is inversely proportional to wavelength (shorter wavelengths have higher frequencies).
• Applications of Frequency and Wavelength:
• Communication: Radio and television signals use specific frequencies for transmission.
• Medical Imaging: Ultrasound operates at frequencies beyond human hearing (above 20 kHz).
• Navigation: Sonar systems use sound wave frequencies to detect underwater objects.

Important Points

• Relation Between Wave Speed, Frequency, and Wavelength: The formula $v = f \times \lambda$ applies universally to all types of waves, including sound, light, and water waves.
• SI Units:
• Wave Speed (v): Measured in meters per second (m/s).
• Wavelength (λ): Measured in meters (m).
• Frequency (f): Measured in Hertz (Hz).
• Real-Life Example:
• For sound waves traveling in air, the speed is approximately 343 m/s at room temperature. A sound wave with a wavelength of 1 meter would have a frequency of approximately 343 Hz.
• Visible light has wavelengths in the range of 400-700 nm, corresponding to frequencies in the range of 430-750 THz.

Q4. Answer: (b) 0.5 A

The correct answer is 0.5 A.

Key Points

• The power rating of the electric bulb is given as 110 Watt, and the voltage rating is 220 Volt.
• The formula for current is derived from the basic formula of power: $P = V \times I$, where:
• P = Power (in Watts)
• V = Voltage (in Volts)
• I = Current (in Amperes)
• Rearranging the formula to find the current gives: $I = P / V$.
• Substituting the given values:
• P = 110 W
• V = 220 V

$I = 110 / 220 = 0.5$ A.

• Hence, the current drawn by the bulb is 0.5 A.

Additional Information

• Electric Power:
• Power is the rate at which electrical energy is transferred by an electric circuit.
• It is measured in Watts (W), where 1 Watt = 1 Joule/second.
• The formula for power in an electrical circuit is: $P = V \times I$, where P is power, V is voltage, and I is current.
• Voltage:
• Voltage is the electrical potential difference between two points in a circuit.
• It is measured in Volts (V), and it represents the energy per unit charge.
• Current:
• Current is the flow of electric charge in a circuit.
• It is measured in Amperes (A), where 1 Ampere = 1 Coulomb/second.
• Ohm's Law:
• According to Ohm's Law, $V = I \times R$, where V is voltage, I is current, and R is resistance.
• This relationship helps in determining the behavior of electrical circuits.
• Applications:
• The calculation of current is essential for determining the efficiency and safety of electrical appliances.
• It helps in designing circuits and selecting appropriate fuses or circuit breakers.

Important Points

• Practical Example:

• If a bulb with the same rating (110 W, 220 V) is connected to a lower voltage source, the current drawn will decrease proportionally.

• For example, if the voltage is halved to 110 V, the current will also reduce to 0.25 A.

• Safety Measures:

• Always ensure that the voltage supply matches the rated voltage of the appliance to avoid damage or inefficiency.

• Using appliances at incorrect voltage can lead to overheating, reduced lifespan, or even short circuits.

Q5. Answer: (b) Statements 1, 2 and 3 are correct.

The correct answer is Statements 1, 2, and 3.

Key Points

• Statement 1: The molecular mass of a substance is the sum of the atomic masses of all the atoms in a molecule of the substance.

• This statement is correct. Molecular mass is calculated by adding up the atomic masses of all the constituent atoms in a molecule. For example, the molecular mass of water (H2O) is calculated as:

• Atomic mass of hydrogen = 1 u (2 atoms of H contribute 2 u)

• Atomic mass of oxygen = 16 u

• Total molecular mass = 2 + 16 = 18 u

• Statement 2: It is also known as the relative mass of a molecule.

• This statement is correct. The molecular mass is often referred to as the relative molecular mass because it compares the mass of a molecule to 1/12th the mass of a carbon-12 atom. This concept is widely used in chemistry.

• Statement 3: It is expressed in atomic mass units (u).

• This statement is correct. The molecular mass is expressed in atomic mass units (u), where 1 u is defined as 1/12th the mass of a carbon-12 atom. For example, the molecular mass of CO2 (carbon dioxide) is 44 u.

Additional Information

• Atomic Mass:

• The atomic mass of an element is the mass of a single atom of that element, expressed in atomic mass units (u).

• For example, the atomic mass of hydrogen is approximately 1 u, while that of oxygen is approximately 16 u.

• Molecular Mass Calculation:

• To calculate the molecular mass, sum up the atomic masses of all the constituent atoms in the molecule. For example:

• For CH4 (methane): Molecular mass = (1 × 12) + (4 × 1) = 16 u

• For H2SO4 (sulfuric acid): Molecular mass = (2 × 1) + (1 × 32) + (4 × 16) = 98 u

• Relative Molecular Mass:

• The term "relative molecular mass" is interchangeable with molecular mass and compares the mass of a molecule to 1/12th the mass of a carbon-12 atom.

• It is a dimensionless quantity and is numerically equal to the molecular mass expressed in atomic mass units (u).

• Importance of Molecular Mass:

• Molecular mass is essential in stoichiometric calculations, chemical reactions, and understanding molecular structures.

• It helps in determining the proportions of elements in a compound and predicting the quantities of reactants and products in a reaction.

• Units of Measurement:

• Molecular mass is measured in atomic mass units (u), where 1 u = 1.66053906660 × 10^(-27) kg.

• Mass spectrometry is often used to measure molecular mass precisely in laboratories.

Important Points

• Atomic Mass Unit (u):

• The atomic mass unit is a standard unit of mass used to express atomic and molecular masses.

• It is defined as 1/12th the mass of a single atom of carbon-12 (C-12).

• Avogadro's Number:

• Avogadro's number (6.022×10^{23}) relates the atomic or molecular mass of a substance to the number of atoms or molecules in a mole.

• This concept is crucial in understanding the relationship between macroscopic and microscopic properties of matter.

• Applications:

• Molecular mass is widely used in chemistry for determining molar masses, stoichiometric ratios, and solution concentrations.

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• It is also essential in biochemistry for understanding the structure and function of biomolecules like proteins, DNA, and enzymes.

Q6. Answer: (c) They can be seen by naked eyes

The correct answer is They can be seen by naked eyes.

Key Points

• Suspensions are a type of heterogeneous mixture where the solute particles do not dissolve but remain dispersed throughout the medium. The particles in suspensions are large enough to be seen by the naked eye, which is one of their defining characteristics. Hence, this statement is correct.

• Suspensions are not transparent; instead, they appear cloudy or opaque because the large particles scatter light. Hence, statement 1 is incorrect.

• The particles in a suspension tend to settle at the bottom of the container if left undisturbed for some time due to gravity. This property distinguishes suspensions from true solutions, where the solute remains dissolved. Hence, statement 2 is incorrect.

• Unlike solutions, where the solute is uniformly dissolved at the molecular level, suspensions have a solute that is not fully dissolved. Instead, the particles remain suspended in the medium. Hence, statement 4 is incorrect.

• The correct distinguishing feature of suspensions is that the particles can be observed without any special equipment, unlike solutions or colloids where particles are too small to be seen. Hence, statement 3 is correct.

Additional Information

• Key Characteristics of Suspensions:

• They are heterogeneous mixtures, meaning the composition is not uniform throughout the mixture.

• The particle size in suspensions is typically larger than 1 micrometer, which is why they can be seen without magnification.

• Suspensions are unstable; the particles will settle over time if the mixture is left undisturbed.

• They can be separated by physical methods such as filtration, unlike solutions.

• Examples include muddy water, flour in water, and chalk powder in water.

• Comparison with Solutions and Colloids:

• In solutions, the solute is completely dissolved, resulting in a homogeneous mixture. The particle size is less than 1 nanometer, and they are transparent.

• Colloids are intermediate between solutions and suspensions. The particle size is between 1 nanometer and 1 micrometer, making them appear homogeneous to the naked eye but heterogeneous under a microscope.

• Suspensions, on the other hand, have large particles that are visible and tend to settle upon standing.

• Applications of Suspensions:

• Used in pharmaceuticals for drug delivery where the active ingredient is suspended in a liquid medium (e.g., antacids).

• Common in paints, where pigments are suspended in a liquid base.

• Found in food products like fruit juices that contain pulp.

• Other Important Facts:

• The Tyndall effect is not observed in suspensions because the particles are large enough to scatter light in all directions.

• The stability of suspensions can be improved using stabilizing agents to prevent particles from settling.

Important Points

• Examples of Suspensions:

• Muddy water: Soil particles suspended in water.

• Flour in water: A common suspension used in cooking and experiments.

• Chalk powder in water: Demonstrates the settling property of suspensions.

• Differences from Colloids:

• Colloids are stable and do not settle, unlike suspensions.

• Colloids exhibit the Tyndall effect, while suspensions do not.

Q7. Answer: (b) 0 m/s

The correct answer is 0 m/s.

Key Points

• Average velocity is defined as the total displacement divided by the total time taken. Displacement refers to the shortest straight-line distance between the initial and final positions of the object.

• In this scenario, the object moves from point A to point B (50 m east) and then returns to point A. The total displacement is zero because the object returns to its starting point.

• The formula for average velocity is: Average velocity = Total displacement / Total time

• Since the displacement is zero, the average velocity becomes: 0 m/s.

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• This calculation is irrespective of the path taken or the speed of movement. Average velocity focuses solely on the starting and ending positions. Hence, the correct answer is 0 m/s.

Additional Information

• Difference Between Velocity and Speed:

• Velocity is a vector quantity that includes both magnitude and direction. It is calculated using displacement.

• Speed is a scalar quantity that only considers the magnitude and is calculated using the distance traveled.

• For example, if an object returns to its starting point, its displacement is zero, resulting in zero velocity, but the speed would still be the total distance traveled divided by the time.

• Displacement vs Distance:

• Displacement is the straight-line distance between the initial and final positions of an object, considering direction.

• Distance is the total length of the path traveled by the object, irrespective of direction.

• In this case, the distance traveled is 100 m (50 m east + 50 m back), but the displacement is zero.

• Time Taken:

• The total time taken for the journey is 10 seconds.

• While time is a crucial factor in calculating average speed and velocity, it does not affect the displacement directly.

• Applications in Physics:

• Understanding average velocity is crucial in motion analysis, especially in determining net movement.

• It is commonly used in problems related to circular motion, oscillatory motion, and return journeys.

Important Points

• Instantaneous Velocity: This refers to the velocity of an object at a particular instant or point during its motion. It differs from average velocity, which considers the overall displacement over a time interval.

• Uniform Motion: If an object travels equal distances in equal intervals of time, its velocity remains constant. For non-uniform motion, velocity varies.

• Zero Displacement Scenarios: When an object returns to its starting position, its displacement becomes zero, regardless of the path taken or the distance covered.

• Practical Examples: A runner completing a lap on a circular track, or a pendulum swinging back to its initial position, are cases where displacement could be zero, leading to zero average velocity.

Q8. Answer: (b) Ethanol

The correct answer is Ethanol.

Key Points

• Ethanol (C_2H_5OH) is the IUPAC name for an organic compound with two carbon atoms and a hydroxyl (-OH) functional group.

• The eth- prefix in IUPAC nomenclature indicates the presence of two carbon atoms in the compound.

• The suffix -ol is used for compounds that contain a hydroxyl (-OH) functional group, signifying that the compound is an alcohol.

• Ethanol is also commonly referred to as "ethyl alcohol" and is widely used as a solvent, in alcoholic beverages, and as a biofuel.

• This compound does not fall under aldehydes (like methanal), ketones (like propanone), or carboxylic acids (like ethanoic acid), as it belongs to the alcohol group. Hence, option 2 is correct.

Additional Information

• Other Functional Groups and Their IUPAC Naming:

• Methanal: It is an aldehyde with the formula CH_2O. The suffix -al signifies the presence of an aldehyde group.

• Propanone: It is a ketone with the formula C_3H_6O. The suffix -one indicates the ketone functional group.

• Ethanoic acid: It is a carboxylic acid with the formula CH_3COOH. The suffix -oic acid designates the carboxylic acid group.

• Uses of Ethanol:

• Ethanol is extensively used in the beverage industry for alcoholic drinks.

• It is employed as a solvent in industries due to its ability to dissolve both polar and non-polar compounds.

• Ethanol serves as a biofuel (E10 or E20 blends) to reduce carbon emissions.

• It is used in medical applications, such as antiseptics and sanitizers.

• Physical Properties of Ethanol:

• Ethanol is a colorless liquid with a characteristic odor.

• It has a boiling point of 78.37°C (173.07°F) and is miscible with water in all proportions.

• Its density at room temperature is approximately 0.789 g/cm^3.

• Industrial Production Methods:

• Fermentation: Ethanol is produced by fermenting sugars using yeast in an anaerobic environment.

• Hydration of Ethylene: Ethanol can also be synthesized industrially by adding water to ethylene in the presence of an acid catalyst.

Important Points

• Environmental Impact: Ethanol is considered a cleaner fuel alternative compared to fossil fuels, as it reduces greenhouse gas emissions.

• Safety Concerns: Ethanol is highly flammable and can pose risks if not handled properly, especially in industrial settings.

• Regulations: Ethanol use in food, beverages, and fuel is subject to strict regulations by government bodies to ensure safety and quality.

Q9. Answer: (a) Vegetative propagation

The correct answer is Vegetative Propagation.

Key Points

• Vegetative propagation is a form of asexual reproduction in plants, where new plants grow from vegetative parts such as roots, stems, or leaves rather than seeds.

• This method does not involve the fusion of gametes, which is a characteristic of sexual reproduction.

• Examples of vegetative propagation include the growth of plants like potatoes from tubers, onions from bulbs, and strawberries from runners.

• It allows plants to reproduce quickly and maintain genetic uniformity, as the offspring are identical to the parent plant.

• Some common artificial methods of vegetative propagation include grafting, layering, and tissue culture, which are widely used in agriculture and horticulture to propagate desirable plant varieties.

Additional Information

• Pollination:

• Pollination is the process of transferring pollen grains from the male anther to the female stigma of a flower, leading to fertilization.

• It is a part of sexual reproduction in plants and involves the formation of seeds.

• Pollination can occur through various agents such as wind, water, insects, birds, or animals.

• Hence, this option is incorrect as it is not a method of asexual reproduction.

• Fertilization:

• Fertilization is the fusion of male and female gametes to form a zygote, which then develops into a seed.

• It is a key process in sexual reproduction in plants.

• Therefore, this option is incorrect for asexual reproduction.

• Germination:

• Germination is the process by which a seed develops into a new plant under favorable conditions.

• It is a subsequent stage of sexual reproduction, dependent on seed formation.

• Thus, this option is not related to asexual reproduction.

• Examples of Vegetative Propagation:

• Natural methods: Runners in strawberries, tubers in potatoes, bulbs in onions, and rhizomes in ginger.

• Artificial methods: Grafting (e.g., mango), cutting (e.g., rose), layering (e.g., jasmine), and tissue culture (e.g., orchids).

Important Points

• Advantages of Vegetative Propagation:

• Preserves genetic uniformity, as offspring are clones of the parent plant.

• Allows for the propagation of plants that do not produce viable seeds or have long seed dormancy periods.

• Speeds up plant reproduction compared to seed-based methods.

• Disadvantages of Vegetative Propagation:

• Does not promote genetic diversity, making plants vulnerable to diseases and environmental changes.

• May require specialized skills or equipment, especially in artificial propagation methods like tissue culture.

Q10. Answer: (b) Carbon dioxide

The correct answer is Carbon Dioxide.

Key Points

• The reaction between a metal carbonate (e.g., calcium carbonate) and hydrochloric acid (HCl) produces carbon dioxide (CO_2), water (H_2O), and a salt. The general reaction is as follows:

Metal Carbonate + HCl → Salt + CO_2 + H_2O.

• When the released carbon dioxide gas is passed through lime water (a solution of calcium hydroxide, $Ca(OH)_2$), it reacts to form

calcium carbonate ($CaCO_3$), which makes the lime water turn milky.

$Ca(OH)_2 + CO_2 \rightarrow CaCO_3$ (milky) + H_2O.

• This reaction is a qualitative test for the presence of carbon dioxide gas.

• Hydrogen gas (Option 1) and carbon monoxide (Option 4) do not turn lime water milky, while chlorine gas (Option 3) has entirely different chemical properties and reactions.

• Hence, the gas released in this reaction is Carbon Dioxide.

Additional Information

• Metal Carbonates:

• Metal carbonates like calcium carbonate ($CaCO_3$), sodium carbonate (Na_2CO_3), and potassium carbonate (K_2CO_3) react with acids to release carbon dioxide gas.

• These compounds decompose upon heating to produce carbon dioxide as well.

• Lime Water Test:

• Lime water ($Ca(OH)_2$) is commonly used to test for the presence of CO_2. The formation of a milky precipitate ($CaCO_3$) confirms the gas.

• Prolonged exposure of carbon dioxide to lime water can convert calcium carbonate into calcium bicarbonate, which is soluble in water and clears the milky appearance:

$CaCO_3 + CO_2 + H_2O \rightarrow Ca(HCO_3)_2$.

• Properties of Carbon Dioxide:

• Carbon dioxide is a colorless, odorless gas that is denser than air.

• It does not support combustion and is commonly used in fire extinguishers.

• It is a significant component of the Earth's atmosphere, contributing to the greenhouse effect.

• Other Gases Mentioned:

• Hydrogen (H_2): A highly flammable gas that burns with a pale blue flame and produces water as a byproduct. It does not turn lime water milky.

• Chlorine (Cl_2): A greenish-yellow gas with a pungent smell. It is widely used as a disinfectant but does not react with lime water to form a milky precipitate.

• Carbon Monoxide (CO): A colorless, odorless, and poisonous gas that does not turn lime water milky.

Important Points

• The milky appearance caused by lime water is due to the formation of insoluble calcium carbonate, a characteristic feature of carbon dioxide.

• To differentiate between carbon dioxide and other gases, observing their reaction with lime water is a reliable and simple chemical test.

• Carbon dioxide plays a crucial role in biological processes like photosynthesis and is a key component in carbonated beverages.

Q11. Answer: (b) A is true, but R is false

The correct answer is 2) A is true, but R is false.

Key Points

• Assertion (A): Mendel chose pea plants for his experiments because they were easy to grow and showed distinct contrasting traits.

This statement is correct because pea plants (Pisum sativum) have several advantages for genetic studies: they grow quickly, have a short life cycle, produce many seeds, and exhibit easily identifiable contrasting traits like flower color, seed shape, and plant height.

• Reason (R): Pea plants reproduce asexually, allowing Mendel to control crosses easily.

This statement is false. Pea plants reproduce sexually through pollination. Mendel was able to control pollination manually by performing artificial cross-pollination (transferring pollen from one plant to another) or self-pollination. This allowed him to control the inheritance of traits.

• The Reason does not correctly explain the Assertion, as Mendel's success was due to his ability to control sexual reproduction in pea plants, not because the plants reproduced asexually.

• Mendel's experiments with pea plants laid the foundation for modern genetics and introduced concepts like the laws of segregation and independent assortment.

• Hence, the correct answer is 2) A is true, but R is false.

Additional Information

• Mendel's Choice of Pea Plants:

• Mendel chose Pisum sativum (pea plants) because they had seven pairs of contrasting traits, such as flower color (purple/white), seed shape (round/wrinkled), and plant height (tall/dwarf).

• They are self-pollinating but can be cross-pollinated manually, which allowed Mendel to control the inheritance of traits.

• Pea plants have a short generation time and produce a large number of offspring, making it easier to observe statistical patterns.

• Mendel's Experiment:

• Mendel performed cross-pollination by removing the stamens from flowers to prevent self-pollination and dusting pollen from another plant onto the stigma.

• He tracked the inheritance of traits across generations, leading to the discovery of dominant and recessive traits.

• He introduced the concept of pure lines (plants that consistently produce offspring with the same traits) for his genetic studies.

• Key Discoveries:

• Law of Segregation: Each organism has two alleles for each trait, and these alleles segregate during gamete formation, with each gamete receiving one allele.

• Law of Independent Assortment: Alleles for different traits are inherited independently of each other, provided the genes are not linked.

• Why Reproduction Type Matters:

• Pea plants reproduce sexually, not asexually. Asexual reproduction involves producing offspring genetically identical to the parent, which is not applicable to Mendel's experiments.

• Mendel's ability to control sexual reproduction (pollination) allowed him to manipulate and study the inheritance of specific traits.

Important Points

• Gregor Mendel is known as the "Father of Genetics" for his pioneering work with pea plants.

• He conducted experiments between 1856 and 1863 and published his findings in 1866, though they were recognized much later.

• His work introduced fundamental concepts in genetics, such as alleles, dominant and recessive traits, and the mathematical patterns of inheritance.

• The rediscovery of Mendel's work in the early 20th century (1900) by scientists like Hugo de Vries, Carl Correns, and Erich von Tschermak laid the foundation for modern genetics.

Q12. Answer: (b) At some specific regions

The correct answer is At some specific regions.

Key Points

• Meristematic tissue in plants is found only at specific regions of growth. These regions are responsible for the active division of cells.

• The main locations of meristematic tissues include the apical meristems (found at the tips of roots and shoots), intercalary meristems (at the base of leaves or internodes), and lateral meristems (responsible for secondary growth, like the vascular cambium and cork cambium).

• These tissues are undifferentiated, meaning that the cells are capable of continuous division and can differentiate into specialized tissues as needed by the plant.

• Their specific locations ensure that growth occurs in a controlled and organized manner, such as elongation of shoots and roots or increase in girth of stems and trunks.

• The statement "At some specific regions" is correct because meristematic tissues are not distributed all over the plant body but are restricted to particular zones.

Additional Information

• Types of Meristematic Tissue:

• Apical Meristem: Found at the tips of roots and shoots; responsible for primary growth such as elongation of the plant.

• Lateral Meristem: Includes vascular cambium and cork cambium; responsible for secondary growth and increase in thickness or girth of the plant.

• Intercalary Meristem: Located at the base of leaves or internodes; helps in regrowth and elongation of certain plants like grasses.

• Functions of Meristematic Tissue:

• Facilitates growth in plants, both in height (primary growth) and in girth (secondary growth).

• Helps in the repair of plant tissues and wound healing.

• Contributes to the formation of new organs such as leaves, flowers, and roots.

• Characteristics of Meristematic Cells:

• Small in size with thin cell walls and dense cytoplasm.

• Contain large nuclei and lack vacuoles.

• Actively divide to produce new cells.

• Examples of Growth Regions:

• Root Tips: Apical meristem aids in root penetration into the soil.

• Shoot Tips: Apical meristem facilitates upward growth towards sunlight.

• Stem Girth: Lateral meristem helps in thickening of stems and trunks in woody plants.

Important Points

• Why other options are incorrect:

• All over the plant body: Incorrect, as meristematic tissues are localized to specific regions and not distributed throughout the plant body.

• At the base of the stem: Partially correct but does not encompass all meristematic tissues (e.g., apical and lateral meristems are not located at the base).

• At the tips of the leaves: Incorrect, as meristematic tissues are not located at leaf tips but rather at their base (intercalary meristem in some plants).

• Applications of Meristematic Tissue Study:

• Used in tissue culture to produce clones of plants through micropropagation.

• Helps in understanding plant growth patterns and developmental processes.

• Contributes to advancements in agricultural practices and genetic engineering.

Q13. Answer: (d) Sexual reproduction

The correct answer is Sexual Reproduction.

Key Points

• Sexual reproduction involves the fusion of male and female gametes (sperm and egg), resulting in the formation of offspring with genetic material from both parents.

• This process leads to genetic recombination, which creates new combinations of genes, thereby increasing genetic diversity in the population.

• It enables populations to adapt better to changing environments, as greater genetic variation increases the likelihood of individuals possessing traits that enhance survival and reproduction.

• Unlike asexual reproduction methods like fragmentation, budding, or binary fission, sexual reproduction does not produce clones, thus avoiding the risk of accumulating harmful mutations over generations.

• Examples of organisms reproducing sexually include humans, animals, flowering plants, and some fungi.

Additional Information

• Fragmentation:

• Fragmentation is a form of asexual reproduction where an organism splits into fragments, and each fragment grows into a new, genetically identical organism.

• Examples: Spirogyra (a type of algae) and some flatworms.

• While it is a quick way to reproduce, it results in no genetic variation, as offspring are clones of the parent.

• Budding:

• Budding is another asexual method where a new organism develops from an outgrowth or bud on the parent organism.

• Examples: Yeast, hydra, and some species of coral.

• Like fragmentation, it produces genetically identical offspring, limiting genetic diversity.

• Binary Fission:

• Binary fission is an asexual reproductive process where a single organism divides into two identical daughter cells.

• It is common in prokaryotic organisms like bacteria and some protozoa.

• This method is efficient but does not contribute to genetic diversity.

• Sexual Reproduction:

• Sexual reproduction is the process where genetic material from two parents combines to produce genetically distinct offspring.

• It involves processes such as meiosis (formation of haploid gametes) and fertilization (fusion of gametes).

• This method is common in animals, plants, and fungi and is essential for evolution and adaptation.

Important Points

• Advantages of sexual reproduction:

• Promotes genetic diversity, which is crucial for adaptation and survival in changing environments.

• Allows for the elimination of harmful mutations over generations.

• Facilitates species evolution by introducing new gene combinations.

• Limitations of asexual reproduction:

• Lack of genetic diversity can make populations vulnerable to environmental changes, diseases, and other challenges.

• Organisms are exact clones, so any genetic defect in the parent is passed on to the offspring.

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• Adaptation and Evolution:

• Sexual reproduction is a driving force behind the process of evolution, as it facilitates natural selection by producing varied traits in offspring.

• Populations with greater genetic diversity are better equipped to adapt to new environmental pressures, such as climate change or emerging diseases.

Q14. Answer: (c) Rapid evolution of a colourless gas that turns lime water milky

The correct answer is Rapid evolution of a colourless gas that turns lime water milky.

Key Points

• When dilute hydrochloric acid (HCl) reacts with sodium hydrogencarbonate (NaHCO3), a chemical reaction occurs, producing carbon dioxide gas (CO2), water (H2O), and sodium chloride (NaCl).

• The reaction is represented as:

$NaHCO_3 + HCl \rightarrow NaCl + H_2O + CO_2$.

• The evolution of CO2 gas is rapid and observable as bubbles or effervescence during the reaction.

• Carbon dioxide gas, when passed through lime water (Ca(OH)2), reacts to form calcium carbonate (CaCO3), which turns the lime water milky:

$CO_2 + Ca(OH)_2 \rightarrow CaCO_3 + H_2O$.

• This observable change is a key characteristic of the reaction between an acid and a carbonate or bicarbonate compound.

Additional Information

• Explanation of the incorrect options:

• Formation of a salt and water only: This is incorrect because the reaction also produces carbon dioxide gas in addition to salt and water.

• Formation of hydrogen gas with a pop sound: This is incorrect because hydrogen gas is not produced in this reaction. The gas evolved is carbon dioxide.

• Formation of brown fumes of nitrogen dioxide: This is incorrect because nitrogen dioxide (NO2) is not involved in this reaction.

• Characteristics of carbon dioxide:

• Carbon dioxide is a colourless, odourless gas.

• It is slightly soluble in water, forming carbonic acid (H2CO3).

• Its presence can be identified using the lime water test, which turns milky due to the formation of calcium carbonate.

• Applications of bicarbonates:

• Sodium bicarbonate (baking soda) is widely used in cooking as a leavening agent.

• It is also used in antacids to neutralize excess stomach acid.

• In laboratories, bicarbonates are used to study reactions with acids for educational purposes.

• Acid-carbonate reactions:

• Acid-carbonate or acid-bicarbonate reactions are commonly used to test for the presence of carbonates in substances.

• These reactions are exothermic and produce effervescence due to the evolution of carbon dioxide gas.

Important Points

• Carbon dioxide detection:

• Carbon dioxide can be detected using the lime water test, which is a simple yet effective method to confirm its presence.

• This test is often used in school laboratories to demonstrate the reaction between acids and carbonates.

• Environmental significance:

• Carbon dioxide is a greenhouse gas and plays a significant role in global warming and climate change.

• Its concentration in the atmosphere is monitored carefully by scientists to understand and mitigate environmental impacts.

• Safety precautions:

• While performing the reaction in a laboratory, ensure proper ventilation as the rapid evolution of carbon dioxide can displace oxygen momentarily.

• Avoid skin contact with hydrochloric acid as it is corrosive and can cause burns.

Q15. Answer: (d) reverse

The correct answer is reverse.

Key Points

• When the direction of the current in a conductor is reversed, the direction of the magnetic field created around the conductor also changes. This is governed by Ampere's circuital law and the Right-Hand Thumb Rule.

• The force experienced by a current-carrying conductor in a magnetic field is determined by Fleming's Left-Hand Rule, which

states that the direction of force is perpendicular to both the current and the magnetic field.

• Since the current direction reverses, the interaction between the magnetic field and the current results in the reversal of the direction of the force acting on the conductor.

• The force does not become zero, nor does it double or remain the same. It reverses direction due to the inverse relationship between current and force direction as per the laws of electromagnetism.

• This phenomenon is crucial in applications like electric motors, where the reversal of current is used to control the direction of rotation.

Additional Information

• Right-Hand Thumb Rule:

• This rule states that if you hold a conductor with your right hand and your thumb points in the direction of the current, then the curled fingers will represent the direction of the magnetic field around the conductor.

• Reversing the current direction will cause the magnetic field direction to reverse.

• Fleming's Left-Hand Rule:

• It is used to determine the direction of force acting on a current-carrying conductor placed in a magnetic field.

• According to this rule, if the thumb, forefinger, and middle finger of the left hand are held perpendicular to each other:

• The forefinger points in the direction of the magnetic field.

• The middle finger represents the direction of current.

• The thumb shows the direction of the force.

• Reversing the current in the conductor will change the direction indicated by the thumb, which corresponds to the force direction.

• Applications in Electric Motors:

• In electric motors, the reversal of current in the armature coils leads to a change in the direction of the force acting on the coils, ensuring continuous rotation.

• This principle is utilized in devices like DC motors and generators.

• Magnetic Field and Force Relationship:

• The force on a current-carrying conductor in a magnetic field is given by the formula $F = BIL \sin(\theta)$, where:

• B is the magnetic field strength.

• I is the current.

• L is the length of the conductor.

• θ is the angle between the conductor and the magnetic field.

• Reversing the current changes the interaction, causing the force to reverse direction.

Important Points

• Electromagnetic Laws: The reversal of current and its effects on force are explained through fundamental laws like Ampere's Law and Lorentz Force Law.

• Practical Examples: Devices such as loudspeakers, electric motors, and solenoids rely on the reversal of current to function efficiently.

• Magnetic Field Direction: The direction of the magnetic field around a current-carrying conductor can be visualized using iron filings or magnetic compass needles.

• Force Measurement: Experimental setups such as the magnetic force on a wire experiment can demonstrate the reversal of force direction with current change.

Q16. Answer: (d) 880 J

The correct answer is 880 J.

Key Points

• Work Done Formula: The formula to calculate the work done is Work (W) = Force (F) × Displacement (d) × cos(θ). Here, θ is the angle between the force and displacement. Since the stone is lifted vertically, θ = 0°, and cos(0°) = 1.

• Force Calculation: The force required to lift the stone is equal to its weight, which is given by F = m × g, where m = 22 kg (mass of the stone) and g = 10 m/s² (acceleration due to gravity). Thus, F = 22 × 10 = 220 N.

• Displacement: The vertical displacement of the stone is given as d = 4 m.

• Work Done Calculation: Substituting the values into the formula for work, we get W = 220 × 4 × 1 = 880 J.

• Correct Option: Hence, the work done to lift the stone is 880 J, which corresponds to Option 4.

Additional Information

• Work in Physics: Work is a measure of energy transfer when an object is moved over a distance by an external force. It is a scalar quantity and is expressed in joules (J) in the SI system.

• Units of Work: The SI unit of work is the joule (J), where 1 joule = 1 newton × 1 meter (N·m). In the CGS system, work is

measured in ergs, where 1 joule = 10^7 ergs.

• Gravitational Force: The weight of an object is the force due to gravity acting on its mass. It is calculated as Weight = mass × acceleration due to gravity (g), where g is approximately 9.8 m/s² on Earth.

• Key Applications of Work: Understanding work is essential in various fields, such as engineering, mechanics, and energy systems. It helps in calculating energy transfer, power, and efficiency in machines and everyday processes.

• Examples: Common examples of work include lifting an object, moving a car uphill, or compressing a spring. In all these cases, energy is transferred to perform the task.

Important Points

• Positive Work: When the force and displacement are in the same direction, the work done is positive. Example: Lifting an object upward.

• Negative Work: When the force and displacement are in opposite directions, the work done is negative. Example: Friction acting on a sliding object.

• Zero Work: If there is no displacement or the force is perpendicular to the direction of displacement, the work done is zero. Example: Carrying an object horizontally without lifting or lowering it.

• Conservation of Energy: The work-energy principle states that the work done on an object is equal to the change in its kinetic energy, highlighting the conservation of energy in a system.

Q17. Answer: (d) 1/v – 1/u = 1/f

The correct answer is 1/v - 1/u = 1/f.

Key Points

• The lens formula is an important mathematical expression in optics that relates the focal length (f), the distance of the object (u), and the distance of the image (v).

• The correct lens formula is 1/v - 1/u = 1/f, where:

• v is the image distance from the lens.

• u is the object distance from the lens.

• f is the focal length of the lens.

• This formula applies to both convex (converging) and concave (diverging) lenses, with proper sign conventions.

• Sign convention: Distances are measured from the optical center of the lens:

• Distances measured in the direction of the incident light are considered positive.

• Distances measured against the direction of the incident light are considered negative.

• Option 1 (1/v - 1/u = f), Option 2 (1/v + 1/u = 1/f), and Option 3 (1/v + 1/u = f) are incorrect as they do not follow the proper derivation or conventions of the lens formula.

Additional Information

• Convex Lens:

• A convex lens is thicker in the middle and converges light rays to a point known as the principal focus.

• If an object is placed beyond the focal length, the lens forms a real and inverted image.

• Applications: Used in magnifying glasses, cameras, and optical instruments.

• Concave Lens:

• A concave lens is thinner in the middle and diverges light rays, forming a virtual, upright, and diminished image.

• Applications: Used in eyeglasses for correcting myopia (nearsightedness).

• Derivation of Lens Formula:

• The lens formula is derived using the geometry of light rays passing through the lens and the principle of refraction.

• It is based on the relationship between the object distance, image distance, and focal length, ensuring that light rays converge or diverge correctly.

• Magnification (M):

• Magnification is given by the formula: M = v/u.

• It represents the ratio of the height of the image to the height of the object.

• Applications of Lens Formula:

• Used in designing optical instruments like telescopes, microscopes, and cameras.

• Helps in predicting the position and size of images formed by lenses.

Important Points

• Sign Convention: Positive and negative signs are crucial for accurate calculations in optics.

• Real Image: Formed when light rays converge; can be projected onto a screen.

• Virtual Image: Formed when light rays appear to diverge; cannot be projected onto a screen.

• Principal Axis: The straight line passing through the optical center and the focus of the lens.

• Focal Length: The distance between the optical center and the principal focus.

Q18. Answer: (a) buoyant force (or upthrust)

The correct answer is buoyant force (or upthrust).

Key Points

• Buoyant force, also known as upthrust, is the upward force exerted by a fluid on an object immersed in it. This force opposes the downward gravitational pull.

• When an empty plastic bottle with an airtight stopper is pushed deeper into water, the volume of displaced water increases, leading to a stronger buoyant force.

• The buoyant force increases with depth due to the greater pressure exerted by the surrounding water. This is governed by the principle of fluid pressure increasing with depth.

• Archimedes' Principle states that the buoyant force acting on an object is equal to the weight of the fluid displaced by the object. This principle explains the resistance felt when pushing the bottle deeper.

• This phenomenon is applicable to all fluids, including liquids and gases, and is crucial in understanding the behavior of objects in water or air.

Additional Information

• Characteristics of Buoyant Force:

• It acts vertically upward, counteracting the weight of the object.

• The magnitude of the buoyant force depends on the density of the fluid and the volume of the object submerged.

• Objects with densities less than the fluid will float, while denser objects sink.

• Gravitational Force:

• Gravitational force is the downward pull exerted by the Earth on any object.

• It is proportional to the mass of the object and acts opposite to the buoyant force.

• In this case, gravitational force is not the correct explanation for the resistance experienced while pushing the bottle deeper.

• Surface Tension:

• Surface tension is the property of liquid surfaces that causes them to behave like an elastic sheet.

• It is responsible for phenomena such as water droplets forming spherical shapes but does not directly explain the upward force resisting the downward push of the bottle.

• Atmospheric Pressure:

• Atmospheric pressure is the force exerted by the weight of the air above a surface.

• It does not significantly affect the buoyant force experienced by the bottle underwater.

Important Points

• Archimedes' Principle: This principle is fundamental in understanding buoyancy and explains why objects float or sink in fluids.

• Applications: Buoyant force is utilized in designing ships, submarines, hot air balloons, and hydrometers.

• Example: A steel ship floats because its overall density (including air inside) is less than water, whereas a steel block sinks due to higher density.

• Scientific Fact: Water has a density of approximately 1 g/cm^3, making it a common reference fluid for buoyancy experiments.

• Practical Insight: Divers experience increasing buoyant force as they go deeper, requiring adjustments in weights to maintain stability underwater.

Q19. Answer: (a) The stability of the atom despite the presence of accelerating electrons

The correct answer is 1) The stability of the atom despite the presence of accelerating electrons.

Key Points

• Rutherford’s atomic model was based on the gold foil experiment, which demonstrated the existence of a dense, positively charged nucleus at the center of the atom surrounded by electrons.

• According to this model, electrons move around the nucleus in circular paths. However, accelerating electrons should theoretically emit electromagnetic radiation and lose energy over time.

• The stability of the atom cannot be explained by Rutherford’s model because, as electrons lose energy, they would spiral inward and collapse into the nucleus. This is inconsistent with the observation that atoms are stable. Hence, statement 1 is incorrect.

• Statement 2: Rutherford’s model did not provide details about how electrons are distributed or arranged around the nucleus. It only suggested that electrons revolve around the nucleus in circular paths. Hence, statement 2 is correct.

• Statement 3: Rutherford’s experiment clearly demonstrated the presence of a positively charged nucleus within the atom, which deflected alpha particles. Hence, statement 3 is correct.

• Statement 4: The large-angle deflection of alpha particles was explained by Rutherford, as it occurred due to the collision of

alpha particles with the dense nucleus. Hence, statement 4 is correct.

Additional Information

• Limitations of Rutherford's Model:

• It could not explain the stability of the atom. Accelerating electrons should lose energy and collapse into the nucleus, but this does not happen.

• The model did not describe the arrangement or distribution of electrons around the nucleus.

• It failed to explain the atomic spectra observed for different elements.

• Key Features of Rutherford's Model:

• The atom consists of a small, dense, positively charged nucleus where most of the mass of the atom is concentrated.

• Electrons revolve around the nucleus in circular paths called orbits.

• Most of the atom's volume is empty space.

• Gold Foil Experiment:

• Rutherford bombarded thin gold foil with alpha particles.

• Most alpha particles passed through the foil, but some were deflected at small angles, and a few at large angles.

• This led to the conclusion that atoms have a dense nucleus surrounded by electrons.

• Bohr's Model:

• To address the limitations of Rutherford's model, Niels Bohr proposed the Bohr model in 1913.

• Bohr explained that electrons occupy discrete energy levels or shells around the nucleus and do not spiral inward.

• The model introduced the concept of quantized energy levels, explaining atomic stability and spectra.

Important Points

• Rutherford's Gold Foil Experiment:

• Year: 1909

• Conducted by: Ernest Rutherford, assisted by Hans Geiger and Ernest Marsden.

• Observation: Most alpha particles passed through, some deflected, and a few bounced back.

• Conclusion: Discovery of the nucleus as the dense center of the atom.

• Bohr's Contributions:

• Introduced quantized energy levels in 1913.

• Explained atomic spectra using the concept of energy transitions.

• Provided a stable model for atoms, addressing the shortcomings of Rutherford's model.

Q20. Answer: (d) Both hard and soft water

The correct answer is Both hard and soft water.

Key Points

• Detergents are chemical substances designed to remove dirt, grease, and stains from various surfaces, including clothes, dishes, and floors.

• Unlike soaps, detergents can function effectively in both hard water and soft water due to their synthetic surfactants.

• Hard water contains dissolved minerals like calcium and magnesium that can interfere with the cleaning action of soaps. Detergents, however, are formulated with ingredients that prevent these minerals from forming insoluble precipitates.

• Soft water, which has minimal mineral content, allows detergents to work efficiently without interference from minerals, ensuring better cleaning performance.

• Detergents are widely used in areas with hard water because they do not form scum and maintain their effectiveness regardless of water quality.

Additional Information

• Composition of Detergents:

• Detergents typically contain surfactants, builders, bleaching agents, enzymes, and fragrances.

• Surfactants lower the surface tension of water, allowing the detergent to spread and penetrate dirt and grease.

• Builders, such as phosphates, soften hard water by binding to calcium and magnesium ions.

• Difference Between Soap and Detergent:

• Soap: Made from natural fatty acids and alkali, soaps are biodegradable but can form scum in hard water.

• Detergent: Synthetic cleaning agents, detergents are effective in both hard and soft water and do not form insoluble precipitates.

• Environmental Concerns:

• Some detergents contain phosphates that can lead to water pollution by causing eutrophication in aquatic ecosystems.

• Biodegradable detergents and eco-friendly formulations are increasingly being developed to reduce environmental impact.

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• Applications of Detergents:

• Used in household cleaning for laundry, dishwashing, and floor cleaning.

• Industrial applications include cleaning machinery, oil spills, and medical instruments.

Important Points

• Hard Water Regions:

• Hard water is commonly found in areas with high concentrations of limestone, gypsum, or chalk in the soil.

• Regions such as Rajasthan in India and Texas in the United States are known for hard water.

• Health Effects:

• Hard water is safe for drinking but can lead to scaling in plumbing and appliances, reducing their efficiency.

• Soft water is preferred for cleaning and washing as it prevents mineral buildup on surfaces.

• Technological Advancements:

• Modern detergents include enzymes that target specific stains like protein, grease, and starch.

• Liquid detergents and pods have gained popularity for their convenience and effectiveness.

Q21. Answer: (a) Due to accumulation of lactic acid

The correct answer is Due to accumulation of lactic acid.

Key Points

• Muscle cramps after heavy exercise occur primarily due to the accumulation of lactic acid in the muscles. Lactic acid is a by-product of anaerobic respiration, which happens when the oxygen supply to the muscles is insufficient during intense physical activities.

• When muscles perform strenuous exercise, they may switch to anaerobic metabolism, leading to the buildup of lactic acid. This causes a drop in pH levels in the muscle tissue, resulting in a burning sensation and cramps.

• Insufficient oxygen supply: During vigorous physical activities, muscles require more oxygen. If the supply is inadequate, the muscles rely on anaerobic respiration, which produces lactic acid.

• The accumulation of lactic acid affects the nerve endings in the muscles, causing discomfort and cramping sensations. This phenomenon is temporary and typically resolves once the lactic acid is flushed out of the system.

• Proper hydration and stretching before and after exercise can help reduce the risk of muscle cramps caused by lactic acid buildup.

Additional Information

• Anaerobic respiration:

• Occurs when oxygen levels are insufficient for aerobic respiration.

• Produces energy for muscle contraction but generates lactic acid as a by-product.

• Lactic acid buildup leads to temporary muscle fatigue and cramps.

• Role of lactic acid:

• Lactic acid is cleared from the muscles and metabolized into glucose by the liver through a process called the Cori cycle.

• The buildup of lactic acid can lead to a temporary decrease in muscle efficiency.

• Preventing muscle cramps:

• Maintain proper hydration during and after exercise to reduce the risk of cramps.

• Include electrolytes in your diet to ensure muscle function and avoid electrolyte imbalance.

• Perform warm-up and cool-down exercises to improve blood circulation and reduce lactic acid buildup.

• Misconceptions:

• Muscle cramps are not caused by the complete cessation of blood flow (Statement 3 is incorrect). Blood flow increases during exercise to supply oxygen to the muscles.

• Muscle cramps are not due to a decrease in body temperature (Statement 4 is incorrect). Body temperature typically rises during exercise.

• Muscles do not stop contracting during cramps (Statement 2 is incorrect). On the contrary, cramps are due to involuntary contractions.

Important Points

• Lactic acid threshold: This refers to the exercise intensity at which lactic acid starts accumulating significantly in the muscles. Training at or below this threshold can improve endurance.

• Electrolyte imbalance: Lack of electrolytes like sodium, potassium, and magnesium can exacerbate muscle cramps. Proper nutrition is essential for maintaining muscle function.

• Stretching and massage: Post-exercise stretching and massage can help in dissipating lactic acid and relieving cramps.

• Scientific studies: Research has shown that lactic acid is rapidly cleared from the muscles after exercise, and cramps are

generally resolved within a short duration.

Q22. Answer: (a) It allows only certain substances to pass in or out.

The correct answer is It allows only certain substances to pass in or out..

Key Points

• The plasma membrane, also known as the cell membrane, is referred to as selectively permeable because it allows only specific substances to enter or leave the cell, while blocking others. This selective permeability ensures the maintenance of the cell's internal environment.

• This selective nature is attributed to the phospholipid bilayer structure of the membrane, which is embedded with proteins. Small and non-polar molecules, like oxygen and carbon dioxide, can pass through easily, while larger or charged molecules require specific transport mechanisms.

• Transport across the membrane occurs in two forms: passive transport (e.g., diffusion and osmosis, which do not require energy) and active transport (which uses energy to move substances against their concentration gradient).

• The plasma membrane also contains protein channels and carriers that facilitate the transport of larger or charged molecules, such as glucose and ions, ensuring that only the necessary substances enter or exit the cell.

• This selective permeability plays a critical role in processes like homeostasis, allowing the cell to maintain a stable internal environment despite changes in the external surroundings.

Additional Information

• Components of the Plasma Membrane:

• The plasma membrane is composed of a phospholipid bilayer, where the hydrophilic (water-attracting) heads face outward and the hydrophobic (water-repelling) tails face inward.

• Embedded proteins: These include integral and peripheral proteins, which assist in transport, signal transduction, and cell recognition.

• Cholesterol: Cholesterol molecules are interspersed within the bilayer, providing stability and fluidity to the membrane.

• Carbohydrates: Found attached to proteins or lipids on the extracellular side of the membrane, they play a role in cell-cell recognition and signaling.

• Mechanisms of Transport:

• Passive Transport: Includes diffusion (movement of molecules from high to low concentration), osmosis (diffusion of water), and facilitated diffusion (movement of molecules via specific protein channels).

• Active Transport: Requires energy in the form of ATP to transport substances against their concentration gradient. Examples include the sodium-potassium pump.

• Importance of Selective Permeability:

• Helps maintain a stable internal environment (homeostasis) by regulating ion concentrations, pH levels, and nutrient intake.

• Facilitates communication between cells through the exchange of signaling molecules.

• Protects the cell from harmful substances and toxins by restricting their entry.

• Examples of Substances and Their Transport:

• Small, non-polar molecules: Oxygen (O2) and carbon dioxide (CO2) diffuse freely across the membrane.

• Large molecules: Glucose and amino acids require protein carriers or channels for transport.

• Ions: Sodium (Na^+), potassium (K^+), and calcium (Ca^(2+)) move through specific ion channels.

Important Points

• Fluid Mosaic Model: Proposed by Singer and Nicolson in 1972, this model describes the plasma membrane as a fluid structure with various proteins floating in or on the lipid bilayer.

• Endocytosis and Exocytosis: These processes allow the cell to engulf large particles (endocytosis) or release substances (exocytosis) by forming vesicles.

• Diseases Related to Membrane Dysfunction: Disorders like Cystic Fibrosis occur due to faulty ion channels in the plasma membrane.

• Role in Cell Communication: Membrane proteins act as receptors for hormones, neurotransmitters, and other signaling molecules, enabling intercellular communication.

Q23. Answer: (a) Check dams

The correct answer is Check dams.

Key Points

• Check dams are primarily constructed to conserve water by slowing down the flow of small streams or rivers. They help in water harvesting and groundwater recharge but are not classified as a formal method of irrigation. Hence, check dams are not a method of irrigation.

• River lift systems are a recognized irrigation method. They involve lifting water from rivers using pumps or other mechanisms to

supply water to agricultural fields. This statement is correct.

• Canals are an integral part of irrigation systems. They are constructed to divert water from rivers or reservoirs to agricultural lands. This statement is correct.

• Wells are one of the oldest and most common irrigation methods. Farmers draw water from underground sources using wells for irrigation purposes. This statement is correct.

• Check dams, unlike canals, wells, and river lift systems, do not directly supply water to agricultural fields for irrigation. They are used for water conservation and storage but not for direct irrigation.

Additional Information

• Check Dams:

• These are small, low structures built across streams or rivers to reduce water flow and promote groundwater recharge.

• They are commonly used for soil conservation and preventing erosion in hilly or semi-arid areas.

• Check dams are not designed to directly supply water for irrigation but support water availability in nearby areas.

• River Lift Irrigation:

• This method involves pumping water from rivers to higher elevation areas for agricultural purposes.

• It is particularly useful in regions where gravitational water flow is not possible.

• Examples of river lift irrigation projects can be found in India, such as the Godavari Lift Irrigation Scheme in Telangana.

• Canals:

• Canals are man-made channels designed to carry water from rivers or reservoirs to agricultural lands.

• They are a major source of irrigation in India, especially in states like Punjab, Haryana, and Uttar Pradesh.

• The Indira Gandhi Canal in Rajasthan is one of the largest canal irrigation projects in the world.

• Wells:

• Wells are excavations in the ground to access underground water for irrigation and other purposes.

• Tube wells and dug wells are common types of wells used for irrigation.

• India has a significant dependency on well irrigation, especially in regions like Gujarat, Maharashtra, and Tamil Nadu.

Important Points

• Classification of Irrigation Methods:

• Surface Irrigation: Includes canals, tanks, and river lift systems.

• Subsurface Irrigation: Relies on underground water sources accessed through wells.

• Micro-Irrigation: Includes drip and sprinkler irrigation, promoting water efficiency.

• Role of Water Conservation:

• Structures like check dams and percolation tanks play a vital role in replenishing groundwater but do not directly irrigate fields.

• These measures are essential in drought-prone and water-scarce regions to ensure sustainable water availability.

• Government Initiatives:

• Programs like the Pradhan Mantri Krishi Sinchayee Yojana (PMKSY) promote efficient water management and irrigation practices in India.

• PMKSY focuses on ‘Har Khet Ko Pani’ and improving on-farm water use efficiency.

Q24. Answer: (d) Higher expected yields

The correct answer is Higher expected yields.

Key Points

• Providing water to crops at optimal times ensures that plants receive adequate moisture during critical growth stages like germination, flowering, and fruiting, leading to higher productivity and better crop health.

• Proper irrigation prevents water stress, which can cause stunted growth, reduced photosynthesis, and lower yields. This ensures plants can reach their full potential.

• Maintaining optimal soil moisture levels enhances the absorption of nutrients by the roots, promoting robust growth and development of crops.

• Efficient irrigation practices help in reducing crop failures due to droughts or water shortages, directly contributing to higher expected yields.

• When crops are watered at the correct intervals, it minimizes the risk of waterlogging, which can otherwise lead to root rot and nutrient leaching, thereby ensuring healthier plants.

Additional Information

• Effects of improper irrigation:

• Over-irrigation: Leads to waterlogging, soil salinity, and reduced oxygen availability for roots, which can inhibit plant growth and lower yields.

• Under-irrigation: Causes water stress, reduced nutrient uptake, and ultimately lower productivity as plants cannot complete their growth cycles effectively.
• Methods of efficient irrigation:
• Drip irrigation: Supplies water directly to the root zone, reducing water wastage and ensuring even distribution.
• Sprinkler irrigation: Simulates natural rainfall and is effective for crops requiring uniform moisture.
• Flood irrigation: Though traditional, it is less efficient and can lead to water wastage and soil degradation if not managed properly.
• Importance of irrigation scheduling:
• Scheduling irrigation based on crop type, soil type, and growth stage ensures optimal water usage and avoids wastage.
• Using tools like soil moisture sensors or weather forecasts can help in determining the correct irrigation timing.
• Role of irrigation in sustainable agriculture:
• Efficient irrigation practices conserve water resources while maximizing crop output, ensuring environmental sustainability.
• It reduces dependency on rainfall, making agriculture more resilient to climate change.

Important Points
• Factors affecting crop yields:
• Water availability: Sufficient water at critical stages like flowering and grain filling is crucial for high yields.
• Soil fertility: Proper irrigation complements nutrient uptake, ensuring balanced plant nutrition.
• Climate: Temperature and rainfall patterns also influence irrigation needs and crop productivity.
• Examples of high-yield crops:
• Wheat: Requires adequate water during germination and grain formation stages for high yields.
• Rice: Prefers flooded conditions but benefits from controlled irrigation practices like alternate wetting and drying.
• Maize: Needs consistent water supply during tasseling and silking stages for optimal kernel development.

Q25. Answer: (c) covalent

The correct answer is covalent.

Key Points
• The nature of the bond in aliphatic carbon compounds is primarily covalent. Covalent bonds are formed due to the sharing of electron pairs between atoms.
• In aliphatic compounds, carbon atoms form bonds with hydrogen or other carbon atoms through single (sigma), double (pi), or triple bonds, which are all covalent in nature.
• Covalent bonding allows carbon to achieve a stable electron configuration by completing its octet (8 electrons in the outer shell).
• Aliphatic compounds include structures like alkanes, alkenes, and alkynes, all of which are based on covalent bonding within their molecular framework.
• This type of bonding is responsible for the stability, reactivity, and various physical and chemical properties of aliphatic carbon compounds.

Additional Information
• Covalent Bond:
• It is a type of chemical bond where electron pairs are shared between atoms.
• This bond occurs between non-metallic elements like carbon, hydrogen, oxygen, etc.
• Covalent bonds can be classified as single, double, or triple bonds, depending on the number of shared electron pairs.
• Examples of covalently bonded aliphatic compounds include methane (CH4), ethene (C2H4), and ethyne (C2H2).
• Types of Bonds in Aliphatic Compounds:
• Single Bond: Found in alkanes (e.g., methane), where carbon atoms share a single pair of electrons.
• Double Bond: Found in alkenes (e.g., ethene), where two pairs of electrons are shared between carbon atoms.
• Triple Bond: Found in alkynes (e.g., ethyne), where three pairs of electrons are shared between carbon atoms.
• Other Types of Bonds:
• Coordinate Bond: Not typically found in aliphatic carbon compounds. It involves one atom donating both electrons for sharing.
• Hydrogen Bond: A weak bond observed in polar molecules like water, not relevant to aliphatic compounds.
• Ionic Bond: Observed in compounds formed between metals and non-metals, not in aliphatic hydrocarbons.
• Applications of Aliphatic Compounds:
• Used as fuels (e.g., methane, propane, butane).
• Serve as raw materials in the chemical and pharmaceutical industries.
• Act as solvents in various organic reactions.

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Important Points

• Aliphatic Compounds: These are organic compounds that consist of carbon and hydrogen atoms arranged in straight chains, branched chains, or non-aromatic rings.

• Examples: Methane (CH4), Ethane (C2H6), Propane (C3H8).

• Bond Angle: The bond angle in methane, a typical aliphatic compound, is approximately 109.5°, characteristic of tetrahedral geometry.

• Versatility of Carbon: Carbon's ability to form covalent bonds with other elements and itself allows the creation of a vast array of organic compounds.

Q26. Answer: (b) 48

Given:

2^x = 8

3^y = 27

Formula Used:

a^m × a^n = a^(m+n)

Calculation:

=> 2^x = 2^3 => x = 3

=> 3^y = 3^3 => y = 3

=> 2^(x+1) = 2^(3+1) = 2^4 = 16

=> 3^(y-2) = 3^(3-2) = 3^1 = 3

=> 2^(x+1) × 3^(y-2) = 16 × 3

=> 48

Therefore The correct answer is 48

Q27. Answer: (d) 84

Given:

20% of number + 96 = number

Formula Used:

Percentage = value ÷ 100

Calculation:

=> Let number = x

=> (20 ÷ 100)x + 96 = x

=> 0.2x + 96 = x

=> x − 0.2x = 96

=> 0.8x = 96

=> x = 96 ÷ 0.8

=> x = 120

=> 70% of number = (70 ÷ 100) × 120

=> 70% = 84

Therefore The correct answer is 84.

Q28. Answer: (c) 75

Shortcut Trick

Marked Price = Rs. 96,000

After 1^(st) discount of 25%: 96,000 × 3/4 = Rs. 72,000

Remaining discount amount = 72,000 − 18,000 = Rs. 54,000

Q% = (54,000 ÷ 72,000) × 100 = 75%

Therefore The correct answer is 75%.

Alternate Method

Given:

Marked Price (MP) = Rs. 96,000

Selling Price (SP) = Rs. 18,000

Discount 1 (d1) = 25%

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Discount 2 (d2) = Q%
Formula Used:
SP = MP × (100 − d1)/100 × (100 − d2)/100
Calculations:
=> 18,000 = 96,000 × (100 − 25)/100 × (100 − Q)/100
=> 18,000 = 96,000 × 75/100 × (100 − Q)/100
=> 18,000 = 96,000 × 3/4 × (100 − Q)/100
=> 18,000 = 72,000 × (100 − Q)/100
=> 18,000 / 72,000 = (100 − Q)/100
=> 1/4 = (100 − Q)/100
=> 100/4 = 100 − Q
=> 25 = 100 − Q
=> Q = 100 − 25 = 75
Therefore The correct answer is 75.
Additional Information
Successive Discount Formula
For two successive discounts a% and b%, the single equivalent discount is (a + b − ab/100)%.
Marked Price and Selling Price Relation
Selling Price = Marked Price − Discount. Discount is always calculated on the Marked Price.
Discount Percentage
Discount % = (Discount Amount ÷ Marked Price) × 100.

Q29. Answer: (d) 84 cm

Shortcut Trick
Check for Pythagorean Triplet: $13^2 + 84^2 = 169 + 7056 = 7225 = 85^2$.
This is a right-angled triangle with legs 13 cm and 84 cm.
For a right triangle, the altitude to one leg is simply the length of the other leg.
For side 13 cm (base), the corresponding altitude is 84 cm.
Therefore The correct answer is 84 cm.
Alternate Method
Given: Sides of the triangle are a = 85 cm, b = 13 cm, and c = 84 cm.
Formula Used: Area of Triangle = 1/2 × base × height
First, verify if the triangle is right-angled using Pythagoras Theorem:
=> $13^2 + 84^2 = 169 + 7056 = 7225$
=> $85^2 = 7225$
=> $13^2 + 84^2 = 85^2$ (Condition Satisfied)
Since it is a right-angled triangle, the legs are 13 cm and 84 cm.
=> Area = 1/2 × 13 × 84 = 546 cm^2
To find the altitude (h) corresponding to the side of 13 cm:
=> Area = 1/2 × 13 × h
=> 546 = 1/2 × 13 × h
=> h = (546 × 2) ÷ 13
=> h = 1092 ÷ 13
=> h = 84 cm
Therefore The correct answer is 84 cm.
Additional Information
Heron's Formula
For any triangle with sides a, b, c, Area = √[s(s−a)(s−b)(s−c)], where semi-perimeter s = (a + b + c) ÷ 2.
Pythagorean Triplets
Common triplets include (3, 4, 5), (5, 12, 13), (7, 24, 25), (8, 15, 17), and (13, 84, 85). These always form a right-angled triangle.
Altitude in Right Triangles
In a triangle with legs x and y, the altitude to side x is y, and the altitude to side y is x. The altitude to the hypotenuse is (x × y) ÷

hypotenuse.

Q30. Answer: (b) 8 cm

Shortcut Trick

Semi-perimeter of the Rectangle = 54 ÷ 2 = 27 cm.

Let Breadth be b. Then Length is 2b + 3.

Sum of sides (L + b) = (2b + 3) + b = 27.

3b = 24 => b = 8 cm.

Therefore The correct answer is 8 cm.

Alternate Method

Given: Perimeter = 54 cm, Length = 2 × Breadth + 3.

Formula Used: Perimeter = 2 × (Length + Breadth)

Let the Breadth be 'b' cm.

According to the question, Length (L) = 2b + 3.

=> 2 × (Length + Breadth) = 54

=> 2 × [(2b + 3) + b] = 54

=> 2 × (3b + 3) = 54

=> 3b + 3 = 54 ÷ 2

=> 3b + 3 = 27

=> 3b = 27 − 3

=> 3b = 24

=> b = 8 cm

Therefore The correct answer is 8 cm.

Additional Information

Area of Rectangle

The surface area covered by a rectangle is calculated as Area = Length × Breadth.

Diagonal of Rectangle

The diagonal 'd' connects opposite corners and is found using Pythagoras theorem: $d = \sqrt{(Length^2 + Breadth^2)}$.

Rectangle Properties

A rectangle is a quadrilateral where all interior angles are 90° and opposite sides are equal and parallel.

Q31. Answer: (d) 100%

Shortcut Trick

Use the direct relation between Cost Price (CP) and Marked Price (MP):

CP ÷ MP = (100 − Discount%) ÷ (100 + Profit%)

CP ÷ MP = (100 − 44) ÷ (100 + 12) = 56 ÷ 112 = 1 ÷ 2

Markup% = [(2 − 1) ÷ 1] × 100 = 100%

Therefore The correct answer is 100%.

Alternate Method

Given: Discount = 44%, Profit = 12%

Formula Used: MP = CP × (100 + P%) ÷ (100 − D%)

=> Let Cost Price (CP) = 100 units

=> Selling Price (SP) = 100 + 12% of 100 = 112 units

=> Marked Price (MP) × (100 − 44)/100 = 112

=> MP × 56/100 = 112

=> MP = (112 × 100) ÷ 56 = 200 units

=> Markup Value = MP − CP = 200 − 100 = 100 units

=> Markup% = (100 ÷ 100) × 100 = 100%

Therefore The correct answer is 100%.

Additional Information

Marked Price Relation

The ratio of CP to MP is always given by (100 − D%) : (100 + P%) or (100 − L%) in case of loss.

Successive Percentage Method

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

Markup Definition

Markup percentage is always calculated on the Cost Price: [(MP − CP) ÷ CP] × 100.

Q32. Answer: (a) 19

Shortcut Trick

Ratio of Mohan to Rakesh (Present) = 3 : 1 (Difference = 2)

Ratio of Mohan to Rakesh (4 years ago) = 4 : 1 (Difference = 3)

Equalize difference: Present (3:1)×3 = 9:3 | 4 yrs ago (4:1)×2 = 8:2

Ratio gap (9−8 or 3−2) = 1 unit → 4 years

Rakesh present age = 3 units = 12 years

Rakesh age after 7 years = 12 + 7 = 19 years

Therefore The correct answer is 19 years.

Alternate Method

Given: Present age ratio Mohan:Rakesh = 3:1. Time interval = 4 years. Age after 7 years required.

=> Let Rakesh's present age be x years.

=> Mohan's present age = 3x years.

=> 4 years ago, Mohan's age = 3x − 4 and Rakesh's age = x − 4.

=> According to question: 3x − 4 = 4 × (x − 4)

=> 3x − 4 = 4x − 16

=> 4x − 3x = 16 − 4

=> x = 12 (Rakesh's present age)

=> Age after 7 years = 12 + 7 = 19 years.

Therefore The correct answer is 19 years.

Additional Information

Ratio Difference Equality

When the age of two people changes over time, the absolute difference between their ages always remains constant.

Age after 'n' years

If present age is P, then age after n years is P + n and age n years ago was P − n.

Cross-Multiplication Method

For two ratios a:b and c:d with a change 'k', the value of 1 unit = |(b×c − a×d)| / |k×(c − d)|.

Q33. Answer: (a) 20 m

Shortcut Trick

In a right-angled triangle, if the angle of elevation or depression is 45°, the triangle is isosceles.

For a 45°−45°−90° triangle, the ratio of Height : Base is 1 : 1.

Since the height of the building is 20 m, the horizontal distance must also be 20 m.

Therefore The correct answer is 20 m.

Alternate Method

Given:

Height of the building (AB) = 20 m

Angle of depression = 45° => Angle of elevation (θ) = 45°

Formula Used:

tan θ = Perpendicular / Base

Calculations:

=> tan 45° = AB / BC

=> 1 = 20 / BC

=> BC = 20 m

Therefore The correct answer is 20 m.

Additional Information

Angle of Depression and Elevation

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The angle of depression from an observer to a point is numerically equal to the angle of elevation from that point to the observer due to alternate interior angles.

Specific Trigonometric Ratios

Common values include tan 30° = 1/√3, tan 45° = 1, and tan 60° = √3. These are vital for solving height and distance problems.

Q34. Answer: (d) 8

Shortcut Trick

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

Initial: 1200 men × 12 days = 14400 total man-days of food.

New strength: 1200 + 600 = 1800 men.

New days = 14400 ÷ 1800 = 8 days.

Therefore The correct answer is 8 days.

Alternate Method

Given: Initial men (M1) = 1200, Initial days (D1) = 12, Increase in men = 600.

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

=> Total Provisions = 1200 × 12 = 14400 units

=> Total Men (M2) = 1200 + 600 = 1800

=> Number of days (D2) = Total Provisions ÷ M2

=> D2 = 14400 ÷ 1800

=> D2 = 8 days

Therefore The correct answer is 8 days.

Additional Information

Inverse Variation

When the number of men increases, the days the food lasts decreases proportionally, following the rule M1D1 = M2D2.

Chain Rule Formula

The general formula is (M1 × D1 × H1) / W1 = (M2 × D2 × H2) / W2, where M is men, D is days, H is hours, and W is work.

Food Consumption

In provision problems, the total quantity of food remains constant unless specified otherwise.

Q35. Answer: (a) 24,000

Shortcut Trick

Calculate the difference in interest rates per annum: 7.5% − 3.5% = 4%.

Total interest percentage difference for 3 years = 4% × 3 = 12%.

Required positive difference = 12% of Principal = (12 ÷ 100) × 2,00,000.

Interest Difference = 12 × 2,000 = 24,000.

Therefore The correct answer is Rs. 24,000.

Alternate Method

Given:

Principal (P) = Rs. 2,00,000

Rate of interest for Bank A (R1) = 3.5% p.a.

Rate of interest for Bank B (R2) = 7.5% p.a.

Time (T) = 3 years

Formula Used:

Simple Interest (SI) = (P × R × T) ÷ 100

Calculations:

=> Interest from Bank A (SI1) = (2,00,000 × 3.5 × 3) ÷ 100

=> SI1 = 2,000 × 10.5 = Rs. 21,000

=> Interest from Bank B (SI2) = (2,00,000 × 7.5 × 3) ÷ 100

=> SI2 = 2,000 × 22.5 = Rs. 45,000

=> Positive Difference = SI2 − SI1

=> Difference = 45,000 − 21,000 = Rs. 24,000

Therefore The correct answer is Rs. 24,000.

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Additional Information

Simple Interest Formula

SI = (P × R × T) ÷ 100, where P is Principal, R is Rate, and T is Time in years.

Direct Difference Method

When Principal and Time are constant, the difference in interest is directly proportional to the difference in rates: ΔSI = (P × ΔR × T) ÷ 100.

Amount Calculation

Total Amount (A) = Principal + Simple Interest. The difference in final amounts will be equal to the difference in interests if principals are equal.

Q36. Answer: (a) 49

Shortcut Trick

Assume a Base Value (Assumed Mean) = 50.

Find deviations from 50: +3, +13, +29, −10, −16, +38, −16, −25, −25.

Net Deviation = (+3+13+29+38) + (−10−16−16−25−25) = 83 − 92 = −9.

Correction = Total Deviation ÷ Number of items = −9 ÷ 9 = −1.

Actual Average = Assumed Mean + Correction = 50 − 1 = 49.

Therefore The correct answer is 49.

Alternate Method

Given:

Observations = 53, 63, 79, 40, 34, 88, 34, 25, 25

Formula Used:

Arithmetic Mean = (Sum of all observations) ÷ (Total number of observations)

Calculations:

=> Total sum = 53 + 63 + 79 + 40 + 34 + 88 + 34 + 25 + 25

=> Total sum = 441

=> Total number of observations (n) = 9

=> Arithmetic Mean = 441 ÷ 9

=> Arithmetic Mean = 49

Therefore The correct answer is 49.

Additional Information

Properties of Arithmetic Mean

The sum of the deviations of a set of observations from their arithmetic mean is always zero (Σ(x_i − mean) = 0).

Effect of Arithmetic Operations

If every observation is increased, decreased, multiplied, or divided by a constant k, the mean also changes by that same factor k.

Weighted Arithmetic Mean

When observations have different levels of importance, it is calculated as Σw_ix_i ÷ Σw_i, where w represents the weight of each value.

Q37. Answer: (a) 73

Shortcut Trick

Speed remains constant => Distance is directly proportional to Time.

Ratio of Distances = 2622 : (2622 + 736) = 2622 : 3358.

Time taken = 57 × (3358 ÷ 2622) = 57 × (1.2807...) = 73 seconds.

Therefore The correct answer is 73 seconds.

Alternate Method

Given: Length of train (L_T) = 2622 m, Time to cross pole (t1) = 57 s, Length of platform (L_P) = 736 m.

Formula: Speed = Total Distance ÷ Total Time

=> Speed of train = L_T ÷ t1

=> Speed = 2622 ÷ 57 = 46 m/s

=> Total distance to cross platform = L_T + L_P

=> Total Distance = 2622 + 736 = 3358 m

=> Time required (t2) = Total Distance ÷ Speed

=> t2 = 3358 ÷ 46

=> t2 = 73 seconds

Therefore The correct answer is 73 seconds.

Additional Information

Relative Speed

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

Unit Conversion

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

Crossing Objects

When a train crosses a pole or man, distance = train length. When it crosses a bridge or platform, distance = train length + object length.

Q38. Answer: (c) 69 days

Shortcut Trick

Efficiency Ratio A : B : C

B is 75% less efficient than A → B = 0.25 × A

C is 80% more efficient than B → C = 1.8 × B = 1.8 × 0.25A = 0.45A

Total Work = Efficiency of A × 90 = 1 × 90 = 90 units

Work by B and C (30 days) = (0.25 + 0.45) × 30 = 0.7 × 30 = 21 units

Remaining Work = 90 − 21 = 69 units. Time for A = 69 ÷ 1 = 69 days

Therefore The correct answer is 69 days.

Alternate Method

Given: A's time = 90 days. B's efficiency = 25% of A. C's efficiency = 180% of B.

Person	Efficiency Calculation	Efficiency (Units/Day)
A	Assumed base efficiency	100
B	100 − 75%	25
C	25 + 80% of 25	45

=> Total Work = Efficiency of A × Days = 100 × 90 = 9000 units

=> Efficiency of (B + C) = 25 + 45 = 70 units/day

=> Work done by B and C in 30 days = 70 × 30 = 2100 units

=> Remaining work = 9000 − 2100 = 6900 units

=> Time taken by A alone = Remaining Work ÷ Efficiency of A = 6900 ÷ 100 = 69 days

Therefore The correct answer is 69 days.

Additional Information

Efficiency and Time Relationship

Efficiency is inversely proportional to the time taken to complete a work. If efficiency ratio is x : y, the time ratio is y : x.

Total Work Formula

Total Work = Efficiency × Time. This is the fundamental equation for all Time and Work problems.

Combined Efficiency

When multiple people work together, their individual efficiencies are added to find the combined rate of work per day.

Q39. Answer: (c) Rs. 15,675

Shortcut Trick

Profit Ratio = Investment Ratio (since time is the same).

Akshat profit : Total profit = 2200 : 8000 = 11 : 40.

Akshat investment = (11 ÷ 40) × 57000.

Akshat investment = 11 × 1425 = Rs. 15,675.

Therefore The correct answer is Rs. 15,675.

Alternate Method

Given: Total Investment = Rs. 57,000 | Total Profit = Rs. 8,000 | Akshat profit = Rs. 2,200.

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Formula Used: Profit Ratio = Investment × Time

=> Let Akshat investment be x and Neha investment be (57000 − x).

=> Ratio of Profits = Akshat Profit : Neha Profit

=> Neha Profit = 8000 − 2200 = Rs. 5,800.

=> Ratio = 2200 : 5800 = 11 : 29.

=> Ratio of Investments = 11 : 29.

=> Sum of ratios = 11 + 29 = 40 units.

=> 40 units = 57,000.

=> 1 unit = 57000 ÷ 40 = 1,425.

=> Akshat investment (11 units) = 11 × 1425 = Rs. 15,675.

Therefore The correct answer is Rs. 15,675.

Additional Information

Partnership Basic Law

Profit is divided in the ratio of the product of Capital and Time: P1:P2 = C1×T1 : C2×T2.

Equal Time Investment

If the time period for all partners is the same, the Profit ratio is directly proportional to the Investment ratio.

Active vs Sleeping Partner

An Active partner may receive a salary or management fee from the total profit before the remaining profit is distributed based on investment ratios.

Q40. Answer: (d) 54 km/hr

Shortcut Trick

Relative Speed concept: Length of train is constant.

Let V be the speed of the train in km/hr.

(V − 10.8) × 15 = (V − 21.6) × 20

3 × (V − 10.8) = 4 × (V − 21.6)

3V − 32.4 = 4V − 86.4 => V = 54 km/hr.

Therefore The correct answer is 54 km/hr.

Alternate Method

Given:

Speed of Person 1 (S1) = 10.8 km/hr

Speed of Person 2 (S2) = 21.6 km/hr

Time taken for P1 (T1) = 15 sec; Time for P2 (T2) = 20 sec

Formula Used:

Distance (Length of train) = Relative Speed × Time

Calculations:

=> Let train speed be V km/hr.

=> L = (V − 10.8) × (5/18) × 15 --- (i)

=> L = (V − 21.6) × (5/18) × 20 --- (ii)

=> (V − 10.8) × 15 = (V − 21.6) × 20

=> 15V − 162 = 20V − 432

=> 5V = 270

=> V = 54 km/hr

Therefore The correct answer is 54 km/hr.

Additional Information

Relative Speed

When two objects move in the same direction, relative speed = S1 − S2. In opposite directions, relative speed = S1 + S2.

Unit Conversion

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

Train Crossing Objects

When a train crosses a pole or person, distance covered = length of train. When crossing a platform, distance = length of train + length of platform.

Q41. Answer: (d) Rs. 6,765

Shortcut Trick

Total ratio parts = 3 + 15 = 18 parts.

Total amount Rs. 8,118 represents 18 parts.

Sarita share (15 parts) = (8,118 ÷ 18) × 15.

Sarita share = 451 × 15 = Rs. 6,765.

Therefore The correct answer is Rs. 6,765.

Alternate Method

Given:

Total amount = Rs. 8,118

Ratio of Ravina : Sarita = 3 : 15

Formula Used:

Share of a person = (Individual ratio / Sum of ratios) × Total Amount

Calculations:

=> Let the shares be 3x and 15x.

=> 3x + 15x = 8,118

=> 18x = 8,118

=> x = 8,118 ÷ 18

=> x = 451

=> Sarita share = 15x = 15 × 451

=> Sarita share = Rs. 6,765

Therefore The correct answer is Rs. 6,765.

Additional Information

Ratio Simplification

A ratio can be simplified by dividing both terms by their HCF. Here, 3 : 15 can be simplified to 1 : 5.

Proportional Division

To divide a quantity S in ratio a : b, the parts are [a/(a+b)] × S and [b/(a+b)] × S.

Verification Rule

The sum of all individual shares must always equal the total initial amount.

Q42. Answer: (a) 40 cm

Shortcut Trick

Base Area of the cylinder = (Circumference)² ÷ (4 × π)

Base Area = (66 × 66 × 7) ÷ (4 × 22) = (3 × 66 × 7) ÷ 4 = 346.5 cm²

Height (h) = Volume ÷ Base Area

h = 13,860 ÷ 346.5 = 40 cm

Therefore The correct answer is 40 cm.

Alternate Method

Given:

Volume (V) = 13,860 cm³

Circumference (C) = 66 cm

π = 22/7

Formula Used:

Circumference of base = 2 × π × r

Volume of cylinder = π × r² × h

Calculations:

=> 2 × (22/7) × r = 66

=> r = (66 × 7) ÷ (2 × 22)

=> r = (3 × 7) ÷ 2 = 10.5 cm

=> Volume = π × r² × h = 13,860

=> (22/7) × 10.5 × 10.5 × h = 13,860

=> 22 × 1.5 × 10.5 × h = 13,860

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=> 346.5 × h = 13,860
=> h = 13,860 ÷ 346.5
=> h = 40 cm
Therefore The correct answer is 40 cm.
Additional Information
Curved Surface Area (CSA) of Cylinder
The area of the curved surface only is given by CSA = 2 × π × r × h.
Total Surface Area (TSA) of Cylinder
The total area including the two circular bases is TSA = 2 × π × r(r + h).
Base Area of Cylinder
The area of the circular base is given by A = π × r².

Q43. Answer: (a) 27

Shortcut Trick
When a solid metallic sphere is melted and recast into smaller spheres, the total volume remains constant.
Number of small balls (n) = (Radius of larger sphere / Radius of smaller sphere)³
n = (9 / 3)³ = 3³ = 27
Therefore The correct answer is 27 balls.
Alternate Method
Given:
Radius of the larger metallic sphere (R) = 9 cm
Radius of each smaller spherical ball (r) = 3 cm
Formula Used:
Volume of a sphere = (4/3) × π × r³
Calculations:
=> Let n be the number of small balls formed.
=> Volume of large sphere = n × Volume of one small ball
=> (4/3) × π × R³ = n × (4/3) × π × r³
=> R³ = n × r³
=> 9³ = n × 3³
=> 729 = n × 27
=> n = 729 ÷ 27
=> n = 27
Therefore The correct answer is 27 balls.
Additional Information
Volume and Surface Area of Sphere
The Volume is (4/3)πr³ and the Total Surface Area is 4πr².
Volume of Hemisphere
A hemisphere is half of a sphere; its Volume is (2/3)πr³.
Surface Area of Hemisphere
The Curved Surface Area (CSA) is 2πr² and the Total Surface Area (TSA) is 3πr².
Recasting Principle
During melting and recasting, the Volume of the initial object always equals the Total Volume of the new objects.

Q44. Answer: (d) 225%

Given:
Value 1 = 1/20
Value 2 = 2/90
Formula Used:
Percentage = Value 1 ÷ Value 2 × 100
Calculation:
=> (1/20) ÷ (2/90) × 100

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=> = 1/20 × 90/2 × 100
=> = 90 ÷ 40 × 100
=> = 9/4 × 100
=> = 225
Therefore The correct answer is 225%.

Q45. Answer: (c) 6

Shortcut Trick
Net efficiency = Filling pipe − Emptying pipe
LCM of 9 and 36 is 36 (Total Capacity).
Net efficiency = (36 ÷ 9) − (36 ÷ 36) = 4 − 1 = 3 units/min.
Time to fill half tank = (36 ÷ 2) ÷ 3 = 18 ÷ 3 = 6 minutes.
Therefore The correct answer is 6 minutes.
Alternate Method
Given: Filling time = 9 min, Emptying time = 36 min.

Pipe	Time (min)	Total Capacity (LCM)	Efficiency
Pipe A (Fill)	9	36 units	+4
Pipe B (Empty)	36	−1	

Calculations:
=> Combined Efficiency of (A + B) = 4 − 1 = 3 units/min.
=> One-half capacity of tank = 36 ÷ 2 = 18 units.
=> Time taken to fill 18 units = 18 ÷ 3 = 6 minutes.
Therefore The correct answer is 6 minutes.
Additional Information
Pipes & Cisterns Rule
Efficiency of an emptying pipe is always taken as negative while calculating net work done.
Net Rate Formula
If pipe A fills in 'x' and pipe B empties in 'y', time to fill is (xy) ÷ (y − x).
Work & Time Relationship
Total Capacity = Time × Efficiency. To fill half the tank, divide total capacity by 2 before calculating time.

Q46. Answer: (b) Increase by 40%

Shortcut Trick
Let TV cost = 100. Then Washing Machine (WM) cost = 84.
Initial total cost (5 WM + 2 TV) = 5 × 84 + 2 × 100 = 420 + 200 = 620.
New cost (5 WM + 2 TV) = 5 × (84 × 1.8) + 2 × (100 × 0.56) = 5 × 151.2 + 2 × 56 = 756 + 112 = 868.
Change = 868 − 620 = 248. Percentage change = (248 ÷ 620) × 100 = 40%.
Therefore The correct answer is Increase by 40%.
Alternate Method
Given:
Cost of TV = T | Cost of Washing Machine = W
=> W = T − 16% of T = 0.84T
Let T = 100, then W = 84.
Initial Total Cost (C1):
=> C1 = (5 × W) + (2 × T) = (5 × 84) + (2 × 100)
=> C1 = 420 + 200 = 620
New Costs:
=> New W = 84 + 80% of 84 = 84 × 1.8 = 151.2
=> New T = 100 − 44% of 100 = 56
Final Total Cost (C2):
=> C2 = (5 × 151.2) + (2 × 56)

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=> C2 = 756 + 112 = 868
Percentage Change:
=> Increase = 868 − 620 = 248
=> % Increase = (248 ÷ 620) × 100
=> % Increase = 0.4 × 100 = 40%
Therefore The correct answer is Increase by 40%.
Additional Information
Percentage Change
The formula for percentage change is [(Final Value − Initial Value) ÷ Initial Value] × 100.
Successive Percentage Change
If a value changes by a% and then by b%, the effective change is (a + b + ab/100)%.
Weighted Average
Total change can also be viewed as a weighted average where weights are the initial total costs of each item category.

Q47. Answer: (b) 25%

Shortcut Trick
Profit % = [(Items Left) ÷ (Items Sold)] × 100
Profit items = 25 − 20 = 5 pens.
Profit % = (5 ÷ 20) × 100 = 1/4 × 100 = 25%.
Therefore The correct answer is 25%.
Alternate Method
Given:
Selling Price (SP) of 20 pens = Cost Price (CP) of 25 pens.
Calculation:
=> Let CP of 1 pen = Rs. 1
=> CP of 25 pens = Rs. 25
=> Therefore, SP of 20 pens = Rs. 25
=> CP of 20 pens = Rs. 20
=> Profit = SP − CP = 25 − 20 = Rs. 5
=> Profit % = (Profit ÷ CP) × 100
=> Profit % = (5 ÷ 20) × 100 = 25%
Therefore The correct answer is 25%.
Additional Information
Article Swap Ratio
If CP of x articles = SP of y articles, then Profit/Loss % = (x − y)/y × 100. Positive result denotes Profit, negative denotes Loss.
Marked Price & Discount
Profit % can also be calculated if Marked Price and Discount are known using the relation: CP × (100 + P%) = MP × (100 − D%).
Successive Profit/Loss
When two successive changes a% and b% occur, the net change is [a + b + (ab/100)]%.

Q48. Answer: (c) 24

Shortcut Trick
Directly apply the algebraic identity relating the sum and difference: $(a + b) = \sqrt{((a - b)^2 + 4ab)}$.
Substitute the values: $(a + b) = \sqrt{(6^2 + 4 \times 135)}$.
Calculation: $(a + b) = \sqrt{(36 + 540)} = \sqrt{576} = 24$.
Therefore The correct answer is 24.
Alternate Method
Given:
Difference of numbers (a − b) = 6
Product of numbers (ab) = 135
Formula used:
The standard algebraic relationship is: $(a + b)^2 = (a - b)^2 + 4ab$

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Calculations:

=> $(a + b)^2 = (6)^2 + 4 \times 135$

=> $(a + b)^2 = 36 + 540$

=> $(a + b)^2 = 576$

=> $a + b = \sqrt{576}$

=> $a + b = 24$

Therefore The correct answer is 24.

Additional Information

Algebraic Sum-Difference Relation

The relationship between the square of the sum and the square of the difference is given by $(a + b)^2 - (a - b)^2 = 4ab$.

Sum of Squares Identity

To find the sum of squares, use $a^2 + b^2 = (a - b)^2 + 2ab$ or $a^2 + b^2 = (a + b)^2 - 2ab$.

Difference of Squares

The identity for the product of the sum and difference is $(a + b)(a - b) = a^2 - b^2$.

Q49. Answer: (d) 1740

Shortcut Trick

Time taken per page = 40 minutes ÷ 2 pages = 20 minutes/page.

Total time for 87 pages = 87 × 20 minutes.

Total time = 1740 minutes.

Therefore The correct answer is 1740 minutes.

Alternate Method

Given:

Pages (W1) = 2, Time (T1) = 40 minutes

Pages (W2) = 87, Time (T2) = ?

Formula Used:

Work is directly proportional to time: (T1 / W1) = (T2 / W2)

Calculations:

=> 40 / 2 = T2 / 87

=> 20 = T2 / 87

=> T2 = 20 × 87

=> T2 = 1740 minutes

Therefore The correct answer is 1740 minutes.

Additional Information

Direct Proportion

When one quantity increases, the other increases in the same ratio. Formula: x1/y1 = x2/y2.

MDH Formula

For Time & Work problems involving men, days, and hours: (M1×D1×H1)/W1 = (M2×D2×H2)/W2.

Rate of Work

Rate = Total Work ÷ Total Time. In this case, 2 pages / 40 min = 0.05 pages per minute.

Q50. Answer: (a) 222/13

Shortcut Trick

Total cumulative frequency (N) = 45. Sum of frequencies: 10 + 11 + X + 11 = 45 => X = 13.

Median point (N/2) = 45 ÷ 2 = 22.5. Cumulative frequencies are 10, 21, 34, 45.

Since 22.5 falls between 21 and 34, the median class is 21−31.

Median = Lower limit + [((N/2) − cf_(prev)) ÷ f_m] × h = 21 + [(22.5 − 21) ÷ 13] × 10 = 21 + 15/13 = 22 2/13.

Therefore The correct answer is 22 2/13.

Alternate Method

Given: Total frequency N = 45. Classes: 1−11, 11−21, 21−31, 31−41. Frequencies: 10, 11, X, 11.

Formula: Median = l + [((N/2) − cf) / f] × h

Calculations:

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=> Total N = 10 + 11 + X + 11 = 45

=> 32 + X = 45 => X = 13

=> N/2 = 45 / 2 = 22.5

=> Cumulative Frequency (cf) table: 10, 21, 34, 45

=> Since 22.5 is greater than 21, the Median Class is 21−31.

=> l = 21, cf (preceding) = 21, f (median class) = 13, h (width) = 10

=> Median = 21 + [(22.5 − 21) / 13] × 10

=> Median = 21 + [1.5 / 13] × 10 = 21 + 15 / 13

=> Median = 21 + 1 2/13 = 22 2/13

Therefore The correct answer is 22 2/13.

Additional Information

Median for Grouped Data

It is the value of the middle observation. Calculated using l + [((N/2) − cf) / f] × h, where l is lower limit, cf is preceding cumulative frequency, and h is class size.

Empirical Relationship

The relationship between the three measures of central tendency is: 3 Median = Mode + 2 Mean.

Median Class

The class whose cumulative frequency is just greater than or equal to N/2 is called the Median Class.

Q51. Answer: (c) 35

Given: 11 14 19 26 ?

The logic followed here is:

Thus, 35 should come in place of the question mark (?) in the given series to make it logically complete.

Hence, the correct answer is "Option 3".

Q52. Answer: (b) 11 km to the west

Given: Mr. Akai starts from Point A and drives 2 km towards south. He then takes a right turn, drives 12 km, turns right and drives 21 km. He then takes a right turn and drives 23 km. He takes a final right turn, drives 19 km and stops at Point P.

Thus, he should drive 11 km to the west in order to reach Point A again.

Hence, the correct answer is "Option 2".

Q53. Answer: (d) One

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

Now,

Even numbers, each of which is immediately preceded by an odd number and also immediately followed by an odd number.

So, the needed pattern is: Odd — Even — Odd

Thus, there is one even number, which is immediately preceded by an odd number and also immediately followed by an odd number.

Hence, the correct answer is "Option 4".

Q54. Answer: (c) AVHP

The position and positional values or English Alphabets are:

Given: GKNE is related to KHRB in a certain way based on the English alphabetical order. In the same way, OEVY is related to SBZV.

The logic followed here is:

Similarly,

Thus, WYDS is related to AVHP.

Hence, the correct answer is "Option 3".

Q55. Answer: (b) 85

BODMAS Rule:

Given equation: 168 + 42 × 14 − 9 ÷ 207 = ?

Now, if '+' and ' ÷ ' are interchanged and ' - ' and ' x ' are interchanged, then:

=> 168 ÷ 42 − 14 × 9 + 207 = ?

=> 4 − 14 × 9 + 207 = ?
=> 4 + 207 − 126 = ?
=> 211 − 126 = ?
=> 86 = ?
Hence, the correct answer is "Option 2".

Q56. Answer: (c) 30

Given: 4 6 12 14 28 ?
The logic followed here is:
Thus, 30 should come in place of the question mark (?) in the given series.
Hence, the correct answer is "Option 3".

Q57. Answer: (d) One

Given: (Left) * + 9 \ / ? > @ 5 5 / ? / 9 * 1 ? # + 6 # (Right)
Now,
Symbols, each of which is immediately preceded by a number and also immediately followed by a number.
So, the needed pattern is: Number — Symbol — Number
Thus, there is one symbol, which is immediately preceded by a number and also immediately followed by a number.
Hence, the correct answer is "Option 4".

Q58. Answer: (d) INQ

The position and positional values or English Alphabets are:
Given: GLO NSV UZC BGJ ?
The logic followed here is:
Thus, INQ should come in place of the question mark (?) in the given series based on the English alphabetical order.
Hence, the correct answer is "Option 4".

Q59. Answer: (d) A

Given: A, B, C, D, W, X and Y are sitting around a circular table facing the centre of the table.
1. A sits third to the left of X.
2. Only one person sits between X and C when counted from the left of C.
3. Only two people sit between B and W when counted from the right of W.
4. D is an immediate neighbour of B.
The above statement cannot be satisfied in case II, so it is eliminated.
Y, the only person left will occupy the vacant position.
Thus, A sits third to the right of Y.
Hence, the correct answer is "Option 4".

Q60. Answer: (b) Mother’s mother

Family Chart:
Decoding the Symbols:

A is				
Symbol	•	•	•	÷
Meaning	father	mother	sister	wife
to B				

Given: X ÷ Y + Z * P - Q
It means: X is the wife of Y, Y is the father of Z, Z is the sister of P, P is the mother of Q.
Thus, X is Q's Mother’s mother.
Hence, the correct answer is "Option 2".

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Q61. Answer: (b) (12, 60, 5)

The logic followed here is:

Logic: (a, b, c) → b = a × c

(17, 34, 2) → 17 × 2 = 34

(13, 39, 3) → 13 × 3 = 39

Let's check each option:

1. (14, 42, 4) → 14 × 4 = 56 ≠ 42

2. (12, 60, 5) → 12 × 5 = 60

3. (11, 55, 3) → 11 × 3 = 33 ≠ 55

4. (15, 25, 2) → 15 × 2 = 30 ≠ 25

Thus, (12, 60, 5) is the set in which the numbers are related in the same way as the given sets.

Hence, the correct answer is "Option 2".

Q62. Answer: (d) MI-NL

The position and positional values or English Alphabets are:

The pattern followed here is:

Each letter-cluster pair follows the pattern +1, +2.

1. OK–PM

This letter-cluster pair follows the pattern +1, +2.

2. IE–JG

This letter-cluster pair follows the pattern +1, +2.

3. KG–LI

This letter-cluster pair follows the pattern +1, +2.

4. MI–NL

This letter-cluster pair does not follow the pattern +1, +2.

Hence, the correct answer is "Option 4".

Q63. Answer: (d) Three

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

Now,

Odd numbers, each of which is immediately preceded by an odd number and also immediately followed by an even number.

So, the needed pattern is: Odd — Odd — Even

Thus, there are three odd numbers, each of which is immediately preceded by an odd number and also immediately followed by an even number.

Hence, the correct answer is "Option 4".

Q64. Answer: (c) 23

BODMAS Rule:

Decoding the given information:

Letter	E	F	G	H
Meaning	•	•	×	÷

Given equation: 72 H 8 G 2 E 10 F 5 = ?

Now replacing the sign from left to right using BODMAS Rule, we get:

=> 72 ÷ 8 × 2 + 10 − 5 = ?

=> 9 × 2 + 10 − 5 = ?

=> 18 + 10 − 5 = ?

=> 28 − 5 = ?

=> 23 = ?

Hence, the correct answer is "Option 3".

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Q65. Answer: (b) Only conclusion (II) follows.

Statements:

All cats are mammals.

No mammals are pets.

The least possible Venn diagram for the given statement is:

Conclusions:

(I) Some pets are cats. - False (Because, All cats are mammals and No mammals are pets, which means all cats being mammals are not pets.)

(II) No cat is pet. - True (Because, All cats are mammals and No mammals are pets, which means all cats being mammals are not pets. Hence, no cat is pet.)

Thus, Only conclusion (II) follows.

Hence, the correct answer is "Option 2".

Q66. Answer: (d) HXLN

The position and positional values or English Alphabets are:

Given: NHRX is related to RFVV in a certain way based on the English alphabetical order. In the same way, VDZT is related to ZBDR.

The logic followed here is:

Similarly,

Thus, DZHP is related to HXLN.

Hence, the correct answer is "Option 4".

Q67. Answer: (b) 7

Given: In a certain code language, ‘STAR’ is coded as ‘3451’ and ‘RATE’ is coded as ‘4375’.

Thus, 7 is the code for ‘E’ in the given code language.

Hence, the correct answer is "Option 2".

Q68. Answer: (a) Two

Given: Seven boxes, D, E, F, U, V, W and X, are kept one over the other but not necessarily in the same order.

1. No box is kept above X.
2. Only U is kept below E.
3. Only three boxes are kept between E and W.
4. Only two boxes are kept between W and V.
5. D is not kept immediately above V.

X
W
D
V
E
U

F, the only box left will occupy the vacant position.

X
W
D
F
V
E

U

Thus, two boxes are kept between F and U.

Hence, the correct answer is "Option 1".

Q69. Answer: (b) 2

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

1. No one sits to the right of C.
2. Only three people sit between C and D.
3. Only two people sit between D and G.
4. A sits third to the left of F.
5. B sits to the immediate right of F.

E, the only person left will occupy the vacant position.

Thus, 2 people sit to the right of B.

Hence, the correct answer is "Option 2".

Q70. Answer: (c) 11 km towards the north

Given: Sarita starts from Point A and drives 8 km towards the west. She then takes a left turn, drives 5 km, turns left and drives 5 km. She then takes a right turn and drives 6 km. She takes a final left turn, drives 3 km and stops at Point P.

Thus, she should drive 11 km towards the north in order to reach Point A again.

Hence, the correct answer is "Option 3".

Q71. Answer: (c) 1

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

1. Only two people sit between F and B when counted from the right of F.
2. Only two people sit between B and A when counted from the right of B.
3. Only three people sit between F and E when counted from the right of F.
4. D sits to the immediate left of C.

G, the only person left will occupy the vacant position.

Thus, 1 people sit between F and G when counted from the left of F.

Hence, the correct answer is "Option 3".

Q72. Answer: (d) 167

Given: 27 51 77 105 135 ?

The logic followed here is:

Thus, 167 should come in place of the question mark (?) in the given series.

Hence, the correct answer is "Option 4".

Q73. Answer: (a) SVBH

The position and positional values or English Alphabets are:

Given: YPMW is related to CLPT in a certain way based on the English alphabetical order. In the same way, GHSQ is related to KDVN.

The logic followed here is:

Similarly,

Thus, OZYK is related to SVBH.

Hence, the correct answer is "Option 1".

Q74. Answer: (c) QIA94

The position and positional values or English Alphabets are:

Given: CUM150, MEW136, WOG122, GYQ108, ?

The logic followed here is:

Thus, QIA94 will replace the question mark (?) in the given series to make it logically complete.

Hence, the correct answer is "Option 3".

Q75. Answer: (d) CGI

The position and positional values or English Alphabets are:

The pattern followed here is:

Each letter-cluster follows the pattern +3, +3.

1. ILO

This letter-cluster follows the pattern +3, +3.

2. XAD

This letter-cluster follows the pattern +3, +3.

3. JMP

This letter-cluster follows the pattern +3, +3.

4. CGI

This letter-cluster does not follows the pattern +3, +3.

Thus, CGI is the odd one out.

Hence, the correct answer is "Option 4".

Q76. Answer: (c) 2

Given: Seven boxes A, B, C, D, E, F and G are kept one over the other but not necessarily in the same order.

1. No box is kept above D.
2. Only three boxes are kept between D and F.
3. Only one box is kept between G and E.
4. E is kept immediately above F.
5. Only four boxes are kept between G and A.
6. C is kept at some place above B.

D
G
C
E
F
B
A

Thus, 2 boxes are kept above C.

Hence, the correct answer is "Option 3".

Q77. Answer: (c) Both conclusions (I) and (II) follow

Statements:

All kiwis are bananas.

All bananas are mangoes.

The least possible Venn diagram for the given statement is:

Conclusions:

(I): All kiwis are mangoes. - True (Because, All kiwis are bananas and All bananas are mangoes, which means all kiwis are mangoes.)

(II): Some mangoes are bananas. - True (Because, All bananas are mangoes, which means Some mangoes are bananas.)

Thus, Both conclusions (I) and (II) follow.

Hence, the correct answer is "Option 3".

Q78. Answer: (d) 33

BODMAS Rule:

Decoding the given information:

Letter	A	B	C	D

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Meaning	÷	×	•	•

Given equation: 50 C 30 B 4 A 12 D 27 = ?

Now replacing the sign from left to right using BODMAS Rule, we get:

=> 50 + 30 × 4 ÷ 12 − 27 = ?

=> 50 + 30 × 0.33 − 27 = ?

=> 50 + 10 − 27 = ?

=> 60 − 27 = ?

=> 33 = ?

Hence, the correct answer is "Option 4".

Q79. Answer: (d) Four

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

Now,

Even numbers, each of which is immediately preceded by an even number and also immediately followed by an even number.

So, the needed pattern is: Even — Even — Even

Thus, there are four even numbers, each of which is immediately preceded by an even number and also immediately followed by an even number.

Hence, the correct answer is "Option 4".

Q80. Answer: (a) cf

Given: In a certain code language, ‘bring hot food’ is coded as ‘cf tk rg’ and ‘food is good’ is coded as ‘ml do cf’.

Thus, ‘food’ is coded as 'cf' in that language.

Hence, the correct answer is "Option 1".

Q81. Answer: (d) Reserve Bank of India

The correct answer is Reserve Bank of India.

Key Points

• The Reserve Bank of India (RBI) announced the formation of the Payments Regulatory Board (PRB) in May 2025. The PRB is a six-member panel entrusted with the responsibility of overseeing and regulating the country's payment systems.

• The Payments Regulatory Board was established as per the recommendations of the Committee on Digital Payments, headed by Ratan Watal. This committee emphasized the need for a separate regulatory body for payment systems in India.

• The PRB's objectives include ensuring the development of secure, efficient, and accessible payment systems while promoting innovation and competition in the payment ecosystem.

• The six-member PRB comprises the Governor of the RBI as the Chairperson, a Deputy Governor of the RBI as a member, and nominees from the Central Government, along with independent experts in the field of payment systems.

• The establishment of the PRB aligns with the RBI's role in fostering a robust and secure digital payment infrastructure, which is critical for the country's digital economy.

Additional Information

• Reserve Bank of India (RBI):

• The Reserve Bank of India is India's central bank, established on April 1, 1935, under the Reserve Bank of India Act, 1934.

• It is headquartered in Mumbai, Maharashtra, and primarily functions to regulate the issue of currency and manage the country's monetary policy.

• The RBI plays a crucial role in supervising and regulating banks, fostering financial stability, and promoting the development of financial markets.

• Committee on Digital Payments:

• The Ratan Watal Committee was constituted by the Government of India in 2016 to suggest measures to increase the use of digital payments.

• It recommended the establishment of a dedicated regulatory body for payment systems to ensure better governance and oversight.

• Functions of the Payments Regulatory Board:

• Regulating payment systems in India to ensure their security, efficiency, and accessibility.

• Promoting competition and innovation in the payment ecosystem.

• Ensuring the protection of consumer interests in the digital payment space.

• Monitoring the compliance of payment service providers with regulatory norms and guidelines.

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• Importance of Payment Systems Regulation:

• A robust payment system infrastructure ensures secure and efficient transactions, fostering trust in the digital economy.

• Regulation helps in mitigating risks such as frauds, cyberattacks, and operational failures in payment systems.

• It promotes financial inclusion by enabling easier access to digital payment methods for underserved populations.

Important Points

• The RBI is responsible for overseeing the country's payment systems under the Payment and Settlement Systems Act, 2007.

• The establishment of the PRB was a significant step to ensure the growth of a secure, seamless, and innovative payment ecosystem in India.

• The PRB's formation reflects India's commitment to strengthening its digital payment infrastructure, which is pivotal to achieving a cashless economy.

• Global examples, such as the Payment Systems Regulator (PSR) in the UK, have demonstrated the benefits of having a separate regulatory body for payment systems.

Q82. Answer: (d) Bihar

The correct answer is Bihar.

Key Points

• Surakshit Shanivar (Safe Saturday) is a disaster preparedness initiative launched by the state of Bihar to educate students about disaster management and response strategies.

• This initiative was introduced in June 2025 to address the state's vulnerability to natural disasters such as floods, earthquakes, and cyclones.

• The program aims to enhance the disaster resilience of students by providing them with practical training, mock drills, and awareness sessions.

• By focusing on school children, the initiative seeks to build a culture of preparedness and safety among the younger generation.

• The program aligns with the state's efforts to reduce disaster risks and ensure sustainable development by incorporating disaster education into the academic curriculum.

Additional Information

• Natural Disasters in Bihar:

• Bihar is highly prone to natural disasters such as floods, which occur annually due to overflowing rivers like the Ganga, Kosi, and Gandak.

• The state also experiences earthquakes as it lies in the seismic zone V and IV, making it highly vulnerable to seismic activities.

• Cyclones and droughts are other significant challenges faced by the region, affecting agriculture and livelihoods.

• Disaster Preparedness in India:

• The National Disaster Management Authority (NDMA) was established in 2005 under the Disaster Management Act to coordinate disaster preparedness and response.

• India has implemented various programs like the National Cyclone Risk Mitigation Project (NCRMP) and the Earthquake Risk Mitigation Project to reduce vulnerabilities.

• Role of Schools in Disaster Preparedness:

• Schools play a critical role in disaster preparedness by educating children about risk reduction and emergency response.

• Programs like mock drills, evacuation exercises, and first-aid training empower students to act effectively during emergencies.

• Key Initiatives by Bihar:

• Bihar has implemented several disaster preparedness programs, including flood forecasting systems and community-based disaster management training.

• The state government actively collaborates with organizations like the UNICEF and the National Institute of Disaster Management (NIDM) to enhance disaster resilience.

Important Points

• Disaster Management Act, 2005:

• This act provides the framework for disaster risk reduction, preparedness, and response in India.

• It mandates the establishment of the NDMA at the national level and the State Disaster Management Authorities (SDMAs) at the state level.

• UN Sendai Framework (2015-2030):

• The Sendai Framework emphasizes the importance of disaster risk reduction through education, capacity building, and community participation.

• India is a signatory to this framework and incorporates its principles into national disaster management policies.

Q83. Answer: (c) Gokul Chandra Das

The correct answer is Gokul Chandra Das.

Key Points

• Gokul Chandra Das, a renowned dhaki artist, became the first dhaki to receive the prestigious Padma Shri award in 2025. This recognition highlights the contribution of traditional folk art to India's cultural heritage.

• A dhaki is a traditional drummer who plays the dhol, especially during the festival of Durga Puja in West Bengal and other parts of eastern India. Their rhythmic beats are an integral part of the festive celebrations.

• Gokul Chandra Das was honored for his exceptional dedication to preserving and promoting the art of dhaki drumming, which has been a part of India's intangible cultural heritage for centuries.

• The Padma Shri award, India's fourth-highest civilian honor, is given for distinguished contributions in various fields, including art, literature, sports, and social work.

• This award has brought attention to folk artists who often remain underrepresented despite their significant contributions to India's cultural fabric.

Additional Information

• Padma Awards:

• The Padma Awards are one of the highest civilian honors in India, instituted in 1954. They include Padma Vibhushan, Padma Bhushan, and Padma Shri.

• The awards are conferred by the President of India and recognize excellence in various fields such as art, literature, social work, public affairs, science, and sports.

• Padma Shri is awarded for distinguished contributions, and recipients are selected through nominations vetted by committees.

• Dhaki Tradition:

• Dhakis are traditional drummers, primarily found in West Bengal, Odisha, and Assam. They play the dhol, a large drum, during various celebrations, especially Durga Puja.

• The beats of dhakis serve as a call to devotees during religious ceremonies and create a festive ambiance.

• Dhakis often wear traditional attire and perform synchronized movements while drumming, adding to the visual appeal of their performance.

• Durga Puja:

• Durga Puja is a major Hindu festival celebrated across India, especially in West Bengal. It marks the victory of Goddess Durga over the demon Mahishasura.

• The festival is characterized by grand decorations, idol worship, cultural performances, and the rhythmic beats of dhakis.

• Dhaki drummers play a pivotal role in enhancing the spiritual experience of the festival through their vibrant and energetic beats.

• Recognition of Folk Artists:

• Folk artists contribute significantly to preserving India's intangible cultural heritage. Their recognition through awards like Padma Shri helps in promoting and safeguarding these traditions.

• Such honors bring attention to marginalized communities and encourage younger generations to continue practicing traditional art forms.

• Artists like Gokul Chandra Das serve as ambassadors of cultural heritage, inspiring others to appreciate and sustain India's rich traditions.

Important Points

• Leander Paes: An Indian tennis legend known for his numerous Grand Slam victories and contributions to Indian sports. However, he is not associated with dhaki drumming or Padma Shri for folk art.

• Mary Kom: A celebrated Indian boxer and Olympic medalist, known for her achievements in sports. She is unrelated to the folk art of dhaki drumming.

• Anant Nag: A veteran Indian actor known for his work in Kannada cinema, but he has no association with the traditional art of dhaki drumming.

Q84. Answer: (d) Bali, Indonesia

The correct answer is Bali, Indonesia.

Key Points

• The 2nd Global Cervical Cancer Elimination Forum was held in Bali, Indonesia, emphasizing the importance of eliminating cervical cancer as a public health issue globally.

• The forum focused on strategies to achieve the World Health Organization's (WHO) global strategy for eliminating cervical cancer through vaccination, screening, and treatment.

• It brought together global health experts, policymakers, researchers, and organizations to discuss advancements and challenges in combating cervical cancer.

• The event highlighted the importance of HPV vaccination programs and accessible cervical cancer screening methods, particularly in low- and middle-income countries.

• The forum also stressed the need for equitable healthcare access and international collaboration to eradicate cervical cancer by 2030.

Additional Information

• Human Papillomavirus (HPV) and Cervical Cancer:

• HPV is the main cause of cervical cancer, with types 16 and 18 responsible for nearly 70% of cases globally.

• Vaccination against HPV is a key preventive measure, with vaccines like Gardasil and Cervarix widely used.

• Regular screening methods, such as Pap smears and HPV DNA testing, help in the early detection and treatment of precancerous lesions.

• WHO Global Strategy for Cervical Cancer Elimination:

• Launched in November 2020, the strategy aims to reduce cervical cancer cases and deaths by promoting vaccination, screening, and treatment.

• The goal is to achieve 90% HPV vaccination coverage, 70% screening coverage, and 90% access to treatment for cervical cancer globally.

• The strategy also emphasizes public awareness campaigns and strengthening healthcare systems.

• Bali, Indonesia:

• Bali is a popular global destination known for its cultural heritage, natural beauty, and as a center for international conferences and forums.

• The selection of Bali for the forum highlights Indonesia's commitment to advancing global health initiatives and fostering international collaboration.

• Global Impact:

• Cervical cancer is the fourth most common cancer among women worldwide, with over 600,000 new cases and 340,000 deaths annually.

• Forums like this are critical in addressing disparities in healthcare access, especially in low-income and developing countries.

Important Points

• Global Statistics:

• Cervical cancer accounts for about 7.5% of all female cancer deaths globally.

• It is highly preventable through vaccination and early detection.

• HPV Vaccination Programs:

• Several countries have implemented national HPV vaccination programs targeting adolescents to prevent cervical cancer.

• Vaccination coverage is improving, but challenges remain in ensuring equitable access.

• Role of International Collaboration:

• Forums like the Global Cervical Cancer Elimination Forum play a crucial role in fostering partnerships and sharing best practices.

• Global organizations like WHO and UNICEF are key stakeholders in these initiatives.

• Indonesia's Healthcare Initiatives:

• Indonesia has been actively working to improve healthcare access and outcomes through programs focusing on vaccination, maternal health, and cancer prevention.

• The forum in Bali underscores the country's dedication to global health priorities.

Q85. Answer: (b) Amitav Ghosh

The correct answer is Amitav Ghosh.

Key Points

• Amitav Ghosh is a renowned Indian author known for his significant contributions to literature, particularly in the fields of fiction and essays.

• The book "Wild Fictions: Essays" published in January 2025 is attributed to Amitav Ghosh, showcasing his expertise in blending environmental and cultural themes.

• Amitav Ghosh's works often focus on issues such as climate change, colonialism, and historical narratives, making him a prominent voice in contemporary literature.

• His previous works include critically acclaimed books such as "The Great Derangement" and "The Glass Palace", which explore themes of human interactions with nature and history.

• Ghosh has been the recipient of several prestigious awards including the Jnanpith Award, India’s highest literary honor, for his contribution to literature.

Additional Information

• About Amitav Ghosh:

• Born on July 11, 1956, in Kolkata, India, Amitav Ghosh has established himself as a global literary figure.

• He holds academic qualifications from St. Stephen's College, Delhi University, and a doctorate from Oxford University.

• His writing style often intertwines historical fiction with modern-day concerns, particularly focusing on global environmental issues.

• Key Themes in “Wild Fictions: Essays”:

• The book explores the concept of wildness in nature and its intricate connection with human civilization.

• It delves into topics such as climate change, ecological degradation, and the human role in altering natural landscapes.

• Ghosh’s essays provide a unique perspective on literature’s role in addressing global environmental challenges.

• Other Works by Amitav Ghosh:

• The Great Derangement: A non-fiction work focusing on the impact of climate change and its representation in literature.

• Sea of Poppies: A historical novel exploring the lives of characters impacted by the opium trade during the British colonial era.

• Gun Island: A novel with themes of migration and environmental crises.

• Global Recognition:

• Amitav Ghosh has received international accolades such as the Prix Médicis étranger and has been shortlisted for the Booker Prize.

• His works have been translated into several languages, enabling his ideas to reach a global audience.

Important Points

• Environmental Literature: Amitav Ghosh is regarded as a pioneer in addressing climate change and ecological themes in fiction, a genre that has gained prominence in recent years.

• Contributions to Indian Literature: His works have significantly contributed to the global recognition of Indian authors in the literary community.

• Legacy: Ghosh’s influence extends beyond literature, inspiring discussions on the intersection of culture, history, and environmental sustainability.

• Book Release: The publication of "Wild Fictions: Essays" in January 2025 is expected to attract readers interested in ecological narratives and literary essays.

Q86. Answer: (a) Bihar

The correct answer is Bihar.

Key Points

• The 7th Khelo India Youth Games were hosted by the state of Bihar in May 2025. This event marked a significant milestone in India's effort to promote sports culture across states.

• The Khelo India Youth Games is a flagship initiative of the Ministry of Youth Affairs and Sports, Government of India, aimed at fostering young athletic talent and improving sports infrastructure in the country.

• Bihar was chosen as the host due to its growing commitment to developing sports facilities and nurturing budding sports talent in the region.

• The games featured participation from thousands of young athletes across various disciplines, showcasing the diversity and potential of Indian sports at the grassroots level.

• In preparation for the event, Bihar upgraded its existing sports infrastructure and introduced new facilities, aligning with the Khelo India mission to enhance sports facilities in underserved regions.

Additional Information

• About Khelo India Youth Games:

• The Khelo India Youth Games (KIYG) were launched in 2018 as a part of the Khelo India Program, which seeks to revive India's sports culture at the grassroots level.

• The event encourages young athletes to showcase their talent in different sports disciplines, providing a platform for future national and international competitions.

• The program also focuses on the development of sports infrastructure and the identification of talent through systematic scouting.

• Significance of Bihar as Host:

• Bihar is an emerging state in sports development, with increasing investment in sports infrastructure and athlete training programs.

• Hosting the event provided Bihar with the opportunity to boost tourism, economy, and overall development through sports.

• The games also aimed to inspire the youth of Bihar to take up sports as a career and participate in national and international events.

• Noteworthy Features of Khelo India Program:

• The program includes initiatives like Talent Identification, Sports Scholarships, and promotion of Fit India Movement.
• It provides scholarships to 1,000 talented athletes every year, covering training expenses, equipment, and coaching.
• The initiative also promotes the establishment of sports academies and upgrading of existing sports facilities.
• Previous Hosts of Khelo India Youth Games:
• 2018: New Delhi
• 2019: Pune, Maharashtra
• 2020: Guwahati, Assam
• 2021: Haryana (held in 2022 due to COVID-19 pandemic)
• 2023: Madhya Pradesh
Important Points
• Khelo India Scheme:
• Launched in 2018, the scheme focuses on building a strong sports ecosystem in India by identifying and nurturing young talent.
• It aims to cover school-level, college-level, and university-level sports, promoting a culture of fitness and sportsmanship.
• The scheme's budget allocation has seen significant increases over the years, reflecting the government's commitment to the initiative.
• Impact of Hosting Khelo India Youth Games:
• It boosts the host state's sports infrastructure, creating long-term benefits for athletes and sports culture.
• Encourages states to adopt sports-friendly policies and promote fitness programs among the youth.
• Generates awareness about less popular sports disciplines and provides a platform for budding athletes from diverse backgrounds.

Q87. Answer: (a) Nizamabad, Telangana

The correct answer is Nizamabad, Telangana.
Key Points
• The headquarters of the National Turmeric Board was inaugurated in June 2025 by Union Home Minister Amit Shah.
• The headquarters is located in Nizamabad, Telangana, a region known for its rich turmeric production and trade.
• Nizamabad is a prominent hub for turmeric cultivation in India, contributing significantly to India's position as one of the largest producers of turmeric globally.
• The establishment of the board aims to promote turmeric cultivation, improve its marketing strategies, and address the concerns of turmeric farmers.
• The board will also focus on research and development, enhancing the quality of turmeric products, and exploring export opportunities for Indian turmeric in international markets.
Additional Information
• Turmeric in India:
• India is the largest producer, consumer, and exporter of turmeric globally.
• Turmeric is widely grown in states like Telangana, Tamil Nadu, Andhra Pradesh, Maharashtra, and Karnataka.
• It is known for its various applications in cooking, medicine, cosmetics, and dyeing.
• Indian turmeric is highly sought after in international markets for its superior quality and high curcumin content.
• Nizamabad Region:
• Nizamabad is often referred to as the "Turmeric City" due to its extensive turmeric production.
• The region has a climate and soil type that are conducive to turmeric cultivation.
• The Nizamabad Agricultural Market is one of the largest turmeric markets in Asia.
• National Turmeric Board:
• The National Turmeric Board was established to address the challenges faced by turmeric farmers, such as market fluctuations and lack of proper infrastructure.
• It aims to create a centralized system for managing turmeric production, quality control, and export logistics.
• It will also facilitate scientific research to improve the yield and quality of turmeric crops.
• Turmeric's Importance:
• Turmeric has significant medicinal properties, including anti-inflammatory and antioxidant effects.
• It is a key ingredient in traditional Indian medicine systems like Ayurveda and Siddha.
• The global demand for turmeric has increased due to its use in health supplements and natural remedies.
Important Points
• Turmeric Export:

• India exported turmeric worth USD 236 million in 2023, with major importers including the USA, UAE, and Bangladesh.

• The establishment of the National Turmeric Board will help streamline the export process and improve the global competitiveness of Indian turmeric.

• Government Initiatives:

• The Indian government has launched various schemes to support spice farmers, such as Mission for Integrated Development of Horticulture (MIDH).

• These initiatives aim to enhance the productivity and profitability of spice cultivation, including turmeric.

Q88. Answer: (c) Basra, Iraq

The correct answer is Basra, Iraq.

Key Points

• Sandstorm in Basra, Iraq: In April 2025, the city of Basra, Iraq, experienced a severe sandstorm, leading to major disruptions in daily activities, including flight operations.

• Impact on Flights: The sandstorm caused low visibility conditions, making it unsafe for aircraft to operate. As a result, numerous flights were delayed or canceled.

• Environmental Conditions: Basra is located in a region prone to sandstorms due to its arid climate and proximity to desert landscapes, which contribute to the formation of such weather events.

• Health Concerns: Sandstorms often lead to respiratory issues among residents due to the inhalation of fine particles, prompting authorities to issue health advisories.

• Emergency Measures: Authorities in Basra implemented measures to mitigate the impact, including grounding flights, issuing warnings, and advising citizens to stay indoors.

Additional Information

• Sandstorms:

• A sandstorm is a meteorological phenomenon caused by strong winds lifting loose sand and dust from arid regions into the atmosphere.

• They are most common in desert regions, especially in the Middle East, North Africa, and parts of Asia.

• Sandstorms can travel hundreds of kilometers and cause disruptions in transportation, health, and infrastructure.

• Basra's Geographic Context:

• Basra is located in southern Iraq, near the Persian Gulf, and is Iraq's main port city.

• The region's desert climate makes it vulnerable to frequent sandstorms, especially during seasonal transitions.

• Flight Disruptions Due to Weather:

• Severe weather conditions like sandstorms, heavy rains, or snowstorms can cause low visibility, making it hazardous for aircraft to take off or land.

• Airports often implement measures such as grounding flights and rerouting air traffic to ensure passenger safety.

• Health Impacts:

• Sandstorms can lead to respiratory problems, skin irritation, and eye infections due to the presence of fine dust particles.

• Authorities often recommend wearing masks, staying indoors, and using air purifiers during sandstorms.

Important Points

• Sandstorm Frequency:

• Regions like Basra experience sandstorms frequently due to their proximity to deserts and exposure to strong winds.

• Seasonal changes, especially during spring and autumn, increase the likelihood of such events.

• Global Examples:

• Beijing, China: Known for experiencing seasonal dust storms originating from the Gobi Desert.

• Dubai, UAE: Occasionally faces sandstorms due to its desert terrain.

• New Delhi, India: Experiences dust storms during pre-monsoon months, though less intense compared to desert regions.

• Preventive Measures:

• Governments and local authorities should implement early warning systems to alert citizens about impending sandstorms.

• Infrastructure like airports and roads should be equipped to handle disruptions caused by extreme weather events.

Q89. Answer: (a) Doha, Qatar

The correct answer is Doha, Qatar.

Key Points

• The 58th edition of the World Table Tennis Championships was held in May 2025, marking a significant event in the global table tennis calendar.

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• The venue for the championships was Doha, Qatar, a city known for hosting major international sporting events.

• Doha has previously hosted several prestigious events, including the 2022 FIFA World Cup and the Asian Games, making it a hub for international sports.

• The tournament saw participation from table tennis players across the globe, competing for titles in men's singles, women's singles, men's doubles, women's doubles, and mixed doubles.

• This event further strengthened Qatar's reputation as a key player in hosting international sports and fostering global sportsmanship.

Additional Information

• World Table Tennis Championships:

• The World Table Tennis Championships is one of the most prestigious events organized by the International Table Tennis Federation (ITTF).

• It has been held annually since 1926, except for certain interruptions caused by global events like World War II.

• Competitions are held in various categories, including singles, doubles, and team events.

• The championships serve as an opportunity for players to demonstrate their skills and for nations to compete at the highest level of table tennis.

• Doha, Qatar:

• Doha is the capital city of Qatar, located on the eastern coast of the Arabian Peninsula.

• Known for its modern infrastructure, Doha has emerged as a prominent destination for hosting global sports events.

• It hosted the 2022 FIFA World Cup, the first World Cup held in the Middle East.

• Doha's advanced facilities and commitment to sports have made it a preferred choice for international championships.

• Importance of the Championships:

• The World Table Tennis Championships provide a platform for athletes to showcase their talent and for countries to display their organizational capabilities.

• It plays a significant role in promoting table tennis worldwide and fostering international cooperation through sports.

• The event also contributes to the local economy and tourism of the host city by attracting fans and participants from around the world.

• Other Host Cities:

• Paris, France: A renowned city for art, culture, and sports, Paris has hosted several international events, including the Olympics.

• Berlin, Germany: A historical city known for its contributions to sports and cultural events.

• Tokyo, Japan: A global sports hub, Tokyo recently hosted the 2020 Summer Olympics.

Important Points

• International Table Tennis Federation (ITTF):

• The ITTF is the governing body for table tennis worldwide, established in 1926.

• It organizes major international tournaments, including the World Table Tennis Championships.

• Headquartered in Lausanne, Switzerland, the ITTF aims to promote table tennis globally.

• Qatar's Sports Vision:

• Qatar has invested heavily in sports infrastructure, aiming to become a global sports hub.

• The nation has hosted events like the IAAF World Athletics Championships and the Asian Cup.

• Its commitment to sports is part of the Qatar National Vision 2030, focusing on sustainable development and international cooperation.

• Impact of Hosting:

• Hosting international championships enhances the host city's global image.

• It boosts the economy through tourism, sponsorships, and local business opportunities.

• Such events also encourage sports participation and inspire future athletes.

Q90. Answer: (c) Soumya Guguloth

The correct answer is Soumya Guguloth.

Key Points

• Soumya Guguloth was awarded the Women's Player of the Year at the All India Football Federation (AIFF) Awards 2025.

• She has been recognized for her exceptional performance and contributions in the field of women's football in India during the year 2025.

• The AIFF Awards are conducted annually to honor players, coaches, and contributors to Indian football, and Soumya Guguloth's achievements stood out among her peers.

• Soumya Guguloth is celebrated for her impactful gameplay, leadership qualities, and consistency in national and international

tournaments.

• This recognition not only highlights her individual talent but also serves as an inspiration for aspiring women footballers across the nation.

Additional Information

• AIFF Awards:

• The AIFF Awards are prestigious honors given annually by the All India Football Federation to recognize excellence in Indian football.

• Awards are given in various categories, including Men's and Women's Player of the Year, Emerging Player of the Year, and Coaching accolades.

• The recognition aims to encourage and motivate players to excel and contribute to the growth of football in India.

• Soumya Guguloth:

• Soumya Guguloth is a prominent figure in Indian women's football and has been instrumental in several key victories for the national team.

• She has represented India in international tournaments and continues to be a vital player in the national squad.

• Her skills include tactical gameplay, precision passing, and goal-scoring abilities.

• Other Nominees:

• Panthoi Chanu: Known for her goalkeeping prowess, she has been a strong contender in women's football.

• Sujata Kar: A midfielder with significant contributions to her team but did not win the award this year.

• Toijam Thoibisana Chanu: Another talented footballer who was among the nominees but did not secure the title.

• Indian Women’s Football:

• India has been making strides in women's football, with increasing participation and improved infrastructure.

• Initiatives like the Indian Women's League (IWL) aim to promote and develop women's football across the country.

• Support from AIFF and recognition through awards help in boosting the morale of players and encouraging them to perform at their best.

Important Points

• Significance of AIFF Awards:

• The AIFF Awards play a critical role in recognizing and rewarding talent in Indian football, thereby encouraging players to excel further.

• These awards act as a benchmark for performance and inspire young athletes to pursue football professionally.

• Impact of Recognition:

• Winning such awards boosts the confidence of players and provides them with a platform to gain national and international recognition.

• It also brings attention to the development of women's football in India, contributing to its growth and popularity.

Q91. Answer: (c) Visakhapatnam

The correct answer is Visakhapatnam.

Key Points

• The 28th National Conference on e-Governance (NCeG) was held in Visakhapatnam, Andhra Pradesh, in June 2025.

• The conference was jointly organized by the Department of Administrative Reforms and Public Grievances (DARPG), the Ministry of Electronics and Information Technology (MeitY), and the Government of Andhra Pradesh.

• Theme: The theme of the conference was centered on “e-Governance: A Decade of Digital Transformation”, focusing on leveraging technology for enhancing governance and citizen-centric service delivery.

• The conference provided a platform for policymakers, industry leaders, and IT experts to discuss innovative practices in e-Governance, emerging technologies, and their applications in public service delivery.

• Several best practices in e-Governance initiatives from different states were showcased during the event, emphasizing digital inclusion and innovation.

Additional Information

• About the National Conference on e-Governance (NCeG):

• The National Conference on e-Governance is an annual event aimed at promoting excellence in e-Governance initiatives across India.

• The conference is jointly organized by the Department of Administrative Reforms and Public Grievances (DARPG) and the Ministry of Electronics and IT (MeitY).

• It serves as a platform to exchange knowledge, showcase best practices, and discuss emerging trends in e-Governance.

• e-Governance in India:

• e-Governance involves the use of Information and Communication Technology (ICT) to deliver government services efficiently and transparently to citizens.

• Major e-Governance initiatives in India include DigiLocker, UMANG App, e-Way Bill, and GeM (Government e-Marketplace).

• It aims to promote transparency, accountability, and citizen empowerment.

• Visakhapatnam:

• Visakhapatnam, also known as Vizag, is a major port city in Andhra Pradesh, renowned for its natural harbor and industrial significance.

• It is a hub for technology-driven initiatives and has been actively participating in digital transformation projects.

• The city is also famous for hosting events of national and international importance, including conferences on IT and governance.

• Digital Transformation in Governance:

• Digital transformation in governance encompasses the adoption of modern technologies like AI, blockchain, cloud computing, and data analytics to improve public administration and service delivery.

• Initiatives like Aadhaar, Digital India, and Smart Cities Mission are examples of India's progress in digital governance.

Q92. Answer: (c) Viktor Axelsen

The correct answer is Viktor Axelsen.

Key Points

• Viktor Axelsen is a world-renowned badminton player from Denmark, known for his exceptional skills and dominance in men’s singles events.

• He clinched the men’s singles title at the India Open 2025, held in New Delhi, continuing his streak of remarkable performances on the international stage.

• The India Open is part of the Badminton World Federation (BWF) World Tour Super 500 series, attracting top players from around the globe.

• Viktor Axelsen, a former Olympic gold medalist (Tokyo 2020), has consistently ranked among the top players in the BWF world rankings.

• His victory in January 2025 further solidifies his position as one of the greatest badminton players of his generation.

Additional Information

• Viktor Axelsen:

• Born on January 4, 1994, in Odense, Denmark.

• He became the first European men’s singles player to win the Olympic gold medal in badminton at the Tokyo 2020 Olympics.

• Axelsen is celebrated for his powerful smashes, exceptional footwork, and strategic gameplay, which have made him a formidable opponent.

• He won the BWF World Championships in 2017 and 2022 and has multiple titles on the BWF World Tour.

• As of 2025, Axelsen is regarded as a global ambassador for badminton, inspiring young players worldwide.

• India Open:

• The India Open is an annual badminton tournament organized by the Badminton Association of India (BAI).

• It is a part of the BWF World Tour Super 500 series, featuring top-ranked players from around the world.

• The tournament is held in New Delhi, India, and is known for its competitive matches and enthusiastic crowd support.

• The event has been instrumental in promoting badminton in India and showcasing Indian players on the global stage.

• Other Players Mentioned:

• Lee Cheuk Yiu: A talented player from Hong Kong known for his agility and skill.

• Kento Momota: A former world champion from Japan, admired for his defensive gameplay and precision.

• Chen Long: An Olympic gold medalist (Rio 2016) from China, renowned for his tactical expertise.

Important Points

• BWF World Tour:

• The BWF World Tour is a series of elite badminton tournaments sanctioned by the Badminton World Federation.

• It includes tournaments classified into different levels, such as Super 1000, Super 750, Super 500, and Super 300.

• Players earn points based on their performance in these tournaments, contributing to their BWF world rankings.

• Olympic Achievements in Badminton:

• Badminton was introduced as an Olympic sport in 1992 at the Barcelona Games.

• Viktor Axelsen’s gold medal at Tokyo 2020 marked a historic achievement for European badminton.

• Other notable Olympic champions include Lin Dan (China) and Chen Long (China).

Q93. Answer: (d) France

The correct answer is France.

Key Points

• India signed a major defence agreement worth Rs. 63,000 crore with France on 28 April 2025 for the acquisition of 26 Rafale-Marine fighter jets.

• The Rafale-Marine jets are specifically designed for operations from aircraft carriers and are an adaptation of the land-based Rafale jets, which are already in service with the Indian Air Force.

• This deal strengthens India's defence ties with France, a longstanding strategic partner, and enhances India's naval combat capabilities.

• The agreement is part of India's broader efforts to modernize its armed forces and improve its maritime security in the Indian Ocean Region (IOR).

• The Rafale-Marine jets will be deployed on India's indigenous aircraft carrier, INS Vikrant, which was commissioned in 2022.

Additional Information

• Rafale-Marine Fighter Jets:

• The Rafale-Marine is the naval variant of the Rafale fighter jet manufactured by Dassault Aviation, France.

• It is capable of operating from aircraft carriers and is equipped with advanced technologies such as active electronically scanned array (AESA) radar, advanced weaponry, and electronic warfare systems.

• The jet has a combat radius of approximately 1,850 km and can carry a wide range of air-to-air and air-to-ground missiles.

• Its advanced features include reduced radar cross-section, superior agility, and multi-role capabilities, making it highly versatile in modern warfare.

• India-France Defence Relations:

• India and France have a robust strategic partnership, especially in the areas of defence and aerospace.

• In 2016, India signed a deal with France for the procurement of 36 Rafale fighter jets for the Indian Air Force.

• The two countries also collaborate in areas such as nuclear energy, space technology, and maritime security.

• France supports India’s efforts to become self-reliant in defence manufacturing through initiatives like Make in India.

• INS Vikrant:

• INS Vikrant is India’s first indigenous aircraft carrier, commissioned in 2022.

• It is designed to carry both fixed-wing aircraft like the Rafale-Marine and rotary-wing aircraft for various operational roles.

• Equipped with modern sensors and weapons, it enhances India’s capability to project power in the Indian Ocean Region.

• The addition of Rafale-Marine jets will significantly bolster INS Vikrant’s operational efficiency.

• Significance of the Deal:

• The deal strengthens India’s maritime defence capabilities amidst growing challenges in the Indian Ocean Region.

• It signals India's focus on enhancing its blue-water navy and achieving strategic autonomy in defence.

• It aligns with India’s broader goals under initiatives like Atmanirbhar Bharat (self-reliant India).

• It also reflects the deepening bilateral ties between India and France in strategic and defence sectors.

Important Points

• Indian Ocean Region (IOR):

• The IOR is a region of high strategic importance due to the presence of critical sea lanes and abundant natural resources.

• India has been strengthening its naval capabilities to secure its interests in the region amidst increasing activities by other powers such as China.

• The deployment of Rafale-Marine jets on INS Vikrant will enhance India’s ability to monitor and dominate the region.

• Maritime Security:

• Maritime security is critical for protecting trade routes, combating piracy, and ensuring regional stability.

• The Rafale-Marine jets, with their advanced capabilities, will play a key role in safeguarding India’s maritime interests.

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Q94. Answer: (d) 573

The correct answer is 573.

Key Points

• India is home to a vast array of wildlife sanctuaries, which play a crucial role in conserving biodiversity and protecting endangered species.

• As of 2023, there are a total of 573 wildlife sanctuaries in India, as per the National Wildlife Database maintained by the Wildlife Institute of India.

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• These wildlife sanctuaries cover approximately 119,776 square kilometers, accounting for 3.64% of India's total geographical area.

• The sanctuaries are governed under the provisions of the Wildlife Protection Act, 1972, which aims to safeguard wildlife habitats and species.

• Some prominent wildlife sanctuaries in India include the Periyar Wildlife Sanctuary (Kerala), Sariska Wildlife Sanctuary (Rajasthan), and Sundarbans Wildlife Sanctuary (West Bengal).

• The sanctuaries serve as protected areas for various species, including tigers, elephants, leopards, rhinoceroses, and numerous bird species.

Additional Information

• Wildlife Protection Act, 1972:

• This Act provides the legal framework for the conservation of wildlife in India.

• It defines various categories of protected areas, including national parks, wildlife sanctuaries, conservation reserves, and community reserves.

• It prohibits hunting, poaching, and destruction of wildlife habitats and imposes penalties for violations.

• Under this Act, State Governments have the power to notify sanctuaries and national parks.

• Wildlife Sanctuaries vs National Parks:

• Wildlife Sanctuaries are established primarily for the protection of wildlife species and their habitats, allowing regulated human activities.

• National Parks are more strictly protected areas, where human activities such as grazing or forestry are completely prohibited.

• India has 106 national parks as of 2023.

• Eco-tourism and Wildlife Sanctuaries:

• Wildlife sanctuaries in India are popular destinations for eco-tourism, contributing to environmental awareness and local economies.

• Activities like safari tours, bird watching, and nature trails are organized to engage tourists without harming the environment.

• Examples include Jim Corbett National Park and Ranthambore Wildlife Sanctuary.

• Important Wildlife Sanctuaries in India:

• Sundarbans Wildlife Sanctuary (West Bengal): Known for the Bengal tiger and mangrove ecosystem.

• Periyar Wildlife Sanctuary (Kerala): Famous for its elephants and biodiversity-rich Western Ghats.

• Sariska Wildlife Sanctuary (Rajasthan): A key habitat for Indian tigers.

• Kaziranga Wildlife Sanctuary (Assam): Known for the Indian one-horned rhinoceros.

Important Points

• India’s Biodiversity: India is one of the world’s megadiverse countries, harboring 8% of the world's species, including endemic flora and fauna.

• Government Initiatives: Several programs like Project Tiger (1973) and Project Elephant (1992) have been launched for species-specific conservation.

• International Commitments: India is a signatory to global conventions like the Convention on Biological Diversity (CBD) and the Convention on International Trade in Endangered Species (CITES).

• Role of Protected Areas: Wildlife sanctuaries help mitigate human-wildlife conflict, conserve ecosystems, and support climate resilience.

Q95. Answer: (c) Kamil al-Taib Idris

The correct answer is Kamil al-Taib Idris.

Key Points

• In May 2025, after two years of civil war, Sudan's army appointed Kamil al-Taib Idris as the new Prime Minister.

• Kamil al-Taib Idris is a Sudanese diplomat and former Director-General of the World Intellectual Property Organization (WIPO).

• The appointment marked a significant step towards restoring governance and stability in Sudan after a prolonged period of civil unrest.

• During his tenure at WIPO, Idris gained a reputation as a skilled negotiator and a proponent of intellectual property rights, which could be pivotal in rebuilding Sudan's war-torn economy.

• This decision was part of broader efforts to establish a transitional government aimed at achieving peace and facilitating democratic elections in the future.

Additional Information

• Civil War in Sudan:

• The civil war in Sudan, which started in 2023, was primarily triggered by tensions between the military and paramilitary groups over power-sharing agreements.

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• The war caused widespread humanitarian crises, including displacement of millions and economic collapse.
• Kamil al-Taib Idris:
• Born in Sudan in 1954, Idris is an accomplished diplomat with extensive experience in international law and development.
• He served as Director-General of WIPO from 1997 to 2008, advocating for intellectual property as a tool for economic growth.
• World Intellectual Property Organization (WIPO):
• An agency of the United Nations, WIPO aims to promote the protection of intellectual property worldwide.
• It plays a crucial role in fostering innovation and creativity, especially in developing nations.
• Sudan's Political Transition:
• Sudan has been undergoing a challenging political transition since the ousting of former President Omar al-Bashir in 2019.
• The appointment of a Prime Minister is a critical step towards forming a civilian-led government.

Important Points

• Sudan's Economic Challenges:
• The prolonged conflict severely impacted Sudan's economy, leading to hyperinflation and food scarcity.
• Efforts are underway to stabilize the economy through international aid and reforms.
• Role of International Community:
• The United Nations, African Union, and neighboring countries have been mediating peace talks in Sudan.
• Economic sanctions and humanitarian aid have been key tools in influencing the conflict resolution process.
• Focus on Elections:
• The transitional government is expected to hold free and fair democratic elections by 2026.
• This marks a pivotal moment in Sudan's journey towards democracy and stability.

Q96. Answer: (a) Seed germination under microgravity conditions

The correct answer is Seed germination under microgravity conditions.

Key Points

• Seed germination under microgravity conditions was the focus of Shubhanshu Shukla's experiment in 2025 on the International Space Station (ISS).
• The study aimed to understand how seeds like moong (green gram) and methi (fenugreek) germinate in the absence of Earth's gravity.
• Microgravity poses unique challenges for biological processes such as seed germination, including issues like water distribution, nutrient absorption, and root growth orientation.
• Understanding seed behavior in space is critical for the development of space farming, a necessary step for long-term human space exploration and colonization.
• This experiment contributes to the field of astrobiology and sheds light on the viability of growing food in extraterrestrial environments.

Additional Information

• Microgravity and Its Effects:
• Microgravity is a condition where objects appear to be weightless and experience minimal gravitational force. It is common in space.
• Under microgravity, water tends to form spherical droplets, and nutrient distribution becomes uneven, which can complicate plant growth.
• Space Farming:
• Space farming involves growing crops in extraterrestrial environments, such as the ISS or other planets like Mars.
• It is essential for providing a sustainable source of food for astronauts on long-duration missions.
• Plants also contribute to life support systems by producing oxygen and removing carbon dioxide.
• Moong and Methi Seeds:
• Moong (green gram) is a protein-rich legume widely used in Indian cuisine.
• Methi (fenugreek) is known for its nutritional and medicinal properties, including its ability to reduce blood sugar levels.
• Both are fast-growing plants, making them ideal for short-term experiments like those conducted on the ISS.
• Significance of Seed Germination Studies in Space:
• Understanding seed germination in space helps scientists design systems for growing crops in extraterrestrial environments.
• It also contributes to our understanding of how plants adapt to extreme conditions, which can have applications on Earth, such as in arid or nutrient-poor soils.

Important Points

• Challenges in Space Farming:
• Watering plants in microgravity is difficult as water does not flow naturally but instead forms floating droplets.
• Lack of soil in space requires innovative techniques like hydroponics or aeroponics for plant growth.
• Light exposure in spacecraft is artificial, requiring the use of LED systems to simulate sunlight.
• Previous Experiments:
• NASA has conducted experiments on growing crops like lettuce, radishes, and wheat aboard the ISS.
• The European Space Agency (ESA) has also studied plant growth under simulated Martian and lunar conditions.
• Future Implications:
• Successful space farming can reduce the dependency on Earth for food supplies during space missions.
• It can also pave the way for establishing self-sustaining human colonies on planets like Mars.
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Q97. Answer: (c) Foster a national resolve against drug abuse

The correct answer is Foster a national resolve against drug abuse.

Key Points

• The Youth Spiritual Summit held in Varanasi on the banks of the River Ganga in July 2025 aimed to address a critical social issue of drug abuse, fostering awareness and collective resolve among the youth.
• The summit emphasized the importance of spiritual and moral education as a tool to combat the growing menace of drug addiction, particularly among young individuals in India.
• It was organized with the collaboration of various governmental, non-governmental, and spiritual organizations, bringing together youth leaders, educators, and policymakers to discuss strategies for tackling substance abuse.
• Participants were encouraged to adopt a lifestyle rooted in values, discipline, and mindfulness to resist the temptation of drugs and promote overall well-being.
• The initiative aligns with the Indian Government's broader mission to achieve a drug-free society and support youth in becoming responsible citizens contributing positively to national development.

Additional Information

• Drug Abuse in India:
• Drug abuse is a major issue in India, with a significant portion of the youth population being affected. According to the National Drug Dependence Treatment Centre (NDDTC) survey of 2019, approximately 2.8% of the population is engaged in opioid use.
• Drugs like heroin, cannabis, and prescription drugs are among the most abused substances in the country.
• The issue is exacerbated by factors such as peer pressure, unemployment, stress, and lack of awareness.
• Government Initiatives to Combat Drug Abuse:
• The Indian Government has launched programs like the National Action Plan for Drug Demand Reduction (NAPDDR) 2018-2025 to prevent drug abuse and ensure the rehabilitation of affected individuals.
• Anti-drug campaigns such as Nasha Mukt Bharat Abhiyan focus on creating awareness and providing support at the grassroots level.
• Collaboration with international organizations like the United Nations Office on Drugs and Crime (UNODC) is also in place to address the issue globally.
• Spiritual and Moral Education:
• Spiritual practices like yoga, meditation, and mindfulness play a vital role in helping individuals overcome addiction by promoting mental clarity and emotional stability.
• Many rehabilitation centers in India incorporate spiritual teachings to aid in the recovery process.
• Spiritual summits provide a platform for the youth to engage with thought leaders and adopt healthier lifestyles.
• Role of Youth in Tackling Drug Abuse:
• Youth represent the future of the nation and play a critical role in spreading awareness and advocating for a drug-free society.
• Peer-led initiatives and community programs organized by youth groups have proven effective in reducing drug abuse in local communities.
• Participation in summits like the Youth Spiritual Summit empowers young individuals to lead by example and inspire others to avoid substance abuse.

Important Points

• Significance of Varanasi:
• Varanasi, located on the banks of the River Ganga, is one of the most sacred cities in India and serves as an ideal location for hosting spiritual events.
• The city's historical and cultural heritage aligns with the themes of spirituality and moral upliftment promoted during the summit.

• Global Perspective on Drug Abuse:

• The World Drug Report 2023 by the United Nations states that around 284 million people aged 15-64 used drugs globally in 2020.

• Efforts to combat drug abuse often require international cooperation and the implementation of evidence-based policies.

• Key Challenges:

• Lack of awareness about the harmful effects of drugs and inadequate access to rehabilitation services are major barriers to tackling drug abuse.

• Social stigma associated with addiction often prevents individuals from seeking help.

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Q98. Answer: (d) APChemi Pvt. Ltd, Navi Mumbai

The correct answer is APChemi Pvt. Ltd, Navi Mumbai.

Key Points

• Technology Development Board (TDB) signed an agreement with APChemi Pvt. Ltd., Navi Mumbai, in February 2025 to produce purified pyrolysis oil for making circular plastics and sustainable chemicals.

• APChemi Pvt. Ltd. specializes in converting waste plastics into high-value pyrolysis oil, which can be further refined into sustainable chemicals and circular plastics.

• The collaboration aims to bolster the circular economy by promoting the reuse of plastic waste, reducing environmental pollution, and supporting sustainable industrial practices.

• Purified pyrolysis oil is a critical feedstock for creating low-carbon plastics and sustainable chemical solutions, aligning with India's green and environmental goals.

• Through this agreement, the initiative aims to reduce the dependency on fossil fuel-based feedstocks in the production of plastics and chemicals, promoting the use of recycled materials.

Additional Information

• APChemi Pvt. Ltd.:

• Headquartered in Navi Mumbai, this company is a leading technology provider in the field of waste plastic pyrolysis.

• It operates advanced pyrolysis facilities that transform non-recyclable plastic waste into purified pyrolysis oil, which can be used in various industrial applications.

• APChemi has gained recognition for its cutting-edge technology and its commitment to sustainability and reducing plastic waste.

• Technology Development Board (TDB):

• The Technology Development Board is a statutory body under the Department of Science and Technology, Government of India.

• Its primary mission is to promote the development and commercialization of indigenous technology solutions in India.

• It provides financial assistance to industries and enterprises for innovative and environmentally sustainable projects.

• Pyrolysis Technology:

• Pyrolysis is a thermal decomposition process that converts organic materials, such as plastic waste, into useful by-products like pyrolysis oil, char, and syngas.

• The process operates at high temperatures in the absence of oxygen, ensuring that the materials break down into smaller molecules.

• Purified pyrolysis oil is increasingly being used as a feedstock for producing sustainable chemicals and circular plastics.

• Significance of Circular Plastics:

• Circular plastics are produced from recycled materials or sustainable feedstocks, reducing reliance on virgin plastics derived from fossil fuels.

• This approach helps in mitigating plastic pollution and contributes to achieving climate goals by lowering greenhouse gas emissions.

• The use of circular plastics supports the United Nations Sustainable Development Goals (SDGs), particularly those related to responsible consumption and production.

Important Points

• Other Options Explained:

• Tata Chemicals Ltd., Mumbai: Known for its chemical and specialty products, it focuses on industrial chemicals, agricultural solutions, and consumer products but is not directly involved in pyrolysis oil production.

• Jaypee Chemicals, Jaipur: Primarily engaged in the manufacture of basic chemicals but does not specialize in sustainable plastics or pyrolysis technologies.

• Adani Chemicals Ltd., Ahmedabad: Part of the Adani Group, focusing on fertilizers and industrial chemicals, but not directly linked to purified pyrolysis oil production.

• Environmental Impact: The collaboration between TDB and APChemi addresses one of the most pressing environmental

challenges—plastic waste management—by promoting recycling and sustainable practices.

• Global Context: The agreement reflects India's commitment to the global shift towards a circular economy and aligns with international efforts to combat plastic pollution and climate change.

Q99. Answer: (b) United Arab Emirates

The correct answer is United Arab Emirates.

Key Points

• In March 2025, the Central Bank of the United Arab Emirates (CBUAE) signed a Memorandum of Understanding (MoU) with the Reserve Bank of India (RBI).

• The MoU was aimed at enabling cross-border transactions using local currencies, fostering economic cooperation between India and the UAE.

• This initiative is part of the broader strategy to reduce dependency on the US Dollar in international trade and promote the use of national currencies.

• The collaboration between India and the UAE will enhance trade efficiency and reduce transaction costs, benefiting businesses in both countries.

• The agreement also signifies strengthening of bilateral relations between India and the UAE, which have been key trading partners for decades.

Additional Information

• India-UAE Trade Relations:

• The UAE is India's third-largest trading partner, with trade valued at over $70 billion annually.

• India exports products like precious stones, machinery, and textiles to the UAE, while importing petroleum products and gold.

• Both nations are committed to enhancing economic cooperation through various agreements and initiatives like CEPA (Comprehensive Economic Partnership Agreement).

• Local Currency Trade:

• Trading in local currencies helps reduce dependency on foreign currencies like the US Dollar, ensuring more stable and predictable trade dynamics.

• This mechanism also protects against global currency fluctuations and supports national economies.

• Role of Central Banks:

• The Reserve Bank of India (RBI) and the Central Bank of UAE play a pivotal role in regulating monetary policies and ensuring smooth implementation of agreements like the MoU.

• Such partnerships contribute to the development of efficient banking systems and financial infrastructure for international trade.

• Global Trend:

• Several countries, including India and UAE, are exploring alternatives to traditional trade currencies, promoting the use of national currencies for bilateral trade.

• This trend aligns with efforts to create a more multipolar financial system and reduce reliance on dominant currencies like the US Dollar.

Important Points

• Cross-Border Transactions:

• Such transactions facilitate trade and investment by allowing businesses to operate in their local currencies, reducing risks related to currency conversions.

• They are particularly beneficial for emerging economies, which often face challenges due to currency volatility.

• India's Economic Strategy:

• India's focus on expanding trade in local currencies is part of its broader economic strategy to strengthen its global trade position.

• Initiatives like MoUs with partner countries reflect India's commitment to fostering economic partnerships and reducing external dependencies.

• Bilateral Agreements:

• Such agreements often include frameworks for banking cooperation, trade facilitation, and resolution mechanisms for financial disputes.

• The MoU between India and UAE is a step toward deeper economic integration and collaboration.

Q100. Answer: (d) Slovakia

The correct answer is Slovakia.

Key Points

• In April 2025, India signed a significant defence Memorandum of Understanding (MoU) with Slovakia, facilitated through the

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JCBL Group.

• The agreement aims to bolster India’s domestic defence manufacturing capabilities, aligning with the "Make in India" initiative, which focuses on reducing dependency on imports and enhancing indigenous production.

• Slovakia, a prominent player in the defence manufacturing sector, is known for its advanced technologies in military equipment, including armoured vehicles, artillery systems, and missile technologies.

• This collaboration is expected to lead to the transfer of technology (ToT), joint ventures, and skill enhancement for Indian defence manufacturers, further boosting India’s self-reliance in defence production.

• The partnership highlights the growing importance of international collaborations in enhancing India’s strategic defence capabilities and fulfilling its vision of becoming a global defence export hub.

Additional Information

• India’s Defence Manufacturing Sector:

• The Indian government has introduced several reforms to promote indigenous defence production, such as increasing the FDI limit to 74% through the automatic route.

• Key initiatives like ‘Atmanirbhar Bharat’ and the Defence Production and Export Promotion Policy (DPEPP) 2020 aim to enhance the domestic defence manufacturing ecosystem.

• India’s defence exports have witnessed a significant rise, with the government targeting Rs. 35,000 crores in exports by 2025.

• Slovakia’s Defence Industry:

• Slovakia is renowned for its expertise in manufacturing land-based defence systems, including infantry fighting vehicles, mortars, and radar systems.

• The country is a member of NATO and the European Union, which ensures that its defence manufacturing standards align with global benchmarks.

• Slovakia’s defence exports are primarily focused on Europe, the Middle East, and now, emerging markets like India.

• Significance of India-Slovakia Defence MoU:

• The agreement is expected to enhance India’s technological capabilities in the defence sector by accessing Slovakia’s advanced military technologies.

• It provides a platform for joint development and production, ensuring that India can cater to its defence needs while also contributing to global markets.

• The partnership signifies India’s growing focus on establishing strategic collaborations with European nations to diversify its defence partnerships.

• JCBL Group:

• The JCBL Group, a leading Indian company, specializes in automotive and defence manufacturing, including armoured vehicles and other military hardware.

• The group has been instrumental in facilitating international collaborations to bring advanced technologies to India.

• Its role in this MoU underscores the importance of public-private partnerships in achieving India’s defence production goals.

Important Points

• ‘Make in India’ Initiative:

• Launched in 2014, this initiative aims to transform India into a global manufacturing hub by encouraging both foreign and domestic companies to manufacture in India.

• In the defence sector, it emphasizes self-reliance, with policies designed to reduce imports and promote indigenous development.

• As part of this initiative, the government has identified 101 defence items for indigenization.

• Defence Collaboration with Other Nations:

• India has signed similar defence agreements with countries like Israel (for UAVs and radar systems) and Russia (for BrahMos missile systems).

• These partnerships have significantly contributed to India’s defence capabilities and export potential.

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