RRB Group D Official Paper (Held On: 04 Dec, 2025 Shift 2) (Previous Year Paper)

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

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GENERAL SCIENCE

Q1. Which of the following best explains the term 'formula unit mass'?

(a) The mass of one mole of a substance
(b) The mass of a single atom of an element
(c) The mass of a single molecule of an element
(d) The total mass of all atoms in one formula unit of a compound

Q2. A convex lens has a focal length of 25 cm. What is the power of this convex lens?

(a) +4.0 D
(b) -4.0 D
(c) -2.0 D
(d) +3.0 D

Q3. Which type of meristematic tissue is responsible for increase in the height of plants?

(a) Apical meristem
(b) Secondary meristem
(c) Cambium
(d) Lateral meristem

Q4. Through which part of the female reproductive system does the egg travel from the ovary to the uterus?

(a) Vagina
(b) Cervix
(c) Ureter
(d) Fallopian tube

Q5. A farmer wants to improve both the quantity and quality of honey produced on their farm. What practice should they adopt?

(a) Reduce the number of flowering plants
(b) Remove all wildflowers from the area
(c) Ensure nectar-rich flowers bloom throughout the season
(d) Keep the bees in shaded areas away from plants

Q6. Which of the following statements is NOT true about average speed?

(a) Average speed only needs the magnitude, not direction
(b) Its SI unit is metres per second m/s
(c) To find speed, we need both the magnitude and direction of the object
(d) Speed is calculated as distance divided by time

Q7. Which of the following shows acidic behaviour in aqueous solution?

(a) Ca(OH)2
(b) HCl
(c) NaOH
(d) KOH

Q8. Which of the following movements is brought about by voluntary muscles?

(a) Movement in intestines
(b) Movement of tongue
(c) Movement in the stomach walls
(d) Movement of heart

Q9. Which of the following is true regarding loudness of sound?

(a) Loudness depends on the amplitude.
(b) Loudness depends on the frequency.
(c) Loudness depends on the speed of wave.
(d) Loudness depends on the wavelength.

Q10. Work done by a constant force is zero if:

(a) displacement is small
(b) force is large
(c) force is variable
(d) displacement is zero or perpendicular to force

Q11. If a current-carrying conductor is placed in a magnetic field and the direction of current is reversed, the force on the conductor _____.

(a) remains the same
(b) doubles
(c) reverses direction
(d) becomes zero

Q12. The most common electrolyte to be used for electrolytic refining of copper would be the solution of acidified:

(a) copper carbonate
(b) copper oxide
(c) copper chloride
(d) copper sulphate

Q13. Which of the following statements is correct about the 'Attraction of particles of matter'?

(a) The force of attraction is same for different particles.
(b) The force of attraction is less in liquids as compared to gases.
(c) The force of attraction is more in liquids as compared to solids.
(d) The force of attraction is different for different particles.

Q14. Which of the following statement(s) is/are true about the pressure exerted by fluids?

(i) Fluids exert pressure on the base and walls of the container in which they are enclosed.
(ii) Pressure exerted in any confined mass of fluid is transmitted unequally in different directions.

(a) Only (ii)
(b) Only (i)
(c) Both (i) and (ii)
(d) Neither (i) nor (ii)

Q15. Which of the following cells has dendrite on one end?

(a) Monocyte
(b) Platelet
(c) Neuron

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(d) Red blood cell

Q16. Which among the following is NOT a physical characteristic of ionic compounds?

(a) Insoluble in water
(b) High boiling point
(c) High melting point
(d) Conducts electricity in molten state

Q17. The defect in which a person cannot see distant objects clearly but can see nearby objects is called _____.

(a) astigmatism
(b) presbyopia
(c) myopia
(d) hypermetropia

Q18. Which of the chemical formulae represents bleaching powder?

(a) Ca(ClO)
(b) Ca(ClO2) 2
(c) Ca2(ClO)2
(d) Ca(ClO)2

Q19. Select the group of organisms in which asexual reproduction occurs by fission.

(a) All seed plants
(b) Blue-green algae
(c) Flowering plants
(d) All plants

Q20. What are the two main properties of carbon that contribute to its 'versatile nature' and its ability to form a large number of compounds?

(a) High melting point and ductility
(b) Good conductivity and sonorous nature
(c) Isomerism and allotropy
(d) Catenation and tetravalency

Q21. What is the role of the pollen tube in plant fertilisation?

(a) To form the zygote
(b) To produce the male germ cell
(c) To transport pollen grains to the stigma
(d) To transport the male germ cell to the female germ cell

Q22. Which of the following situations involves an unbalanced force?

(a) A ball rolling on the ground and eventually stopping
(b) A person standing still on the ground
(c) A car moving with uniform speed on a straight road
(d) A book kept on a table

Q23. Which incident was responsible for the beginning of the Chipko Movement in the village of Reni?

(a) Sale of forest by local residents
(b) Industrial development planned by villagers
(c) Approval given to a contractor to fell trees near the village
(d) Government decision to use forest land for farming

Q24. Which of the following statements is correct?

(a) Right-hand thumb rule gives the direction of magnetic field around a straight conductor.
(b) Right-hand thumb rule cannot be applied to circular loops.
(c) Right-hand thumb rule cannot be applied to a straight conductor.

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(d) Right-hand thumb rule can be used to find the force on a conductor in a magnetic field.

Q25. Which of the following options is INCORRECT regarding when rate of evaporation increases?

(a) Increase in temperature
(b) Increase in surface area
(c) Increase in wind speed
(d) Increase in humidity

MATHEMATICS

Q26. If the surface area of a sphere increases by 69%, what is the percentage increase in its volume?

(a) 119.7%
(b) 90.3%
(c) 103.5%
(d) 138.6%

Q27. Which number should replace the question mark (?) in the following equation?

(57.6 ÷ 4.5 × 1.5) = ? × 1/5

(a) 19.2
(b) 9.6
(c) 192
(d) 96

Q28. The marked price of a bookshelf is Rs. 415, which is 33% above the cost price. If the profit percentage is 13%, find the discount percentage (rounded off to two decimal places).

(a) 18.88%
(b) 17.32%
(c) 15.04%
(d) 16.86%

Q29. The sum of the modes of the data sets {1, 7, 3, 7, 3, x } and {4, 8, 9, 8, 4, y } is 11. If x > y, then find the possible correct relation between x and y.

(a) x - y = 3
(b) x + y = 10
(c) x + y = 9
(d) x - y = 5

Q30. If the listed price of a bag is 76% more than its cost price and a discount of 54% is announced on it, then find the loss percentage.

(a) 19.04%
(b) 22.6%
(c) 17.55%
(d) 18.5%

Q31. Which of the following numbers is divisible by 7, 11 and 13?

(a) 2121
(b) 3026
(c) 1546
(d) 6006

Q32. What is the length of the altitude (in cm) to the side QR of a triangle PQR with side PQ = 25 cm, PR = 25 cm and QR = 40 cm?

(a) 15
(b) 24
(c) 18

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(d) 27

Q33. A water tank is initially one-tenth full and Pipe A emptied the tank in 6 minutes. After this, pipes A, B and C are opened together to fill the tank, where pipe B can fill it in 30 minutes and pipe C in 40 minutes. How long will it take to completely fill the tank?

(a) 35 minutes
(b) 28 minutes
(c) 24 minutes
(d) 25 minutes

Q34. A company sells an article at a price such that it earns a 25% profit on the selling price. What is the actual profit percentage on the cost price? (correct to two decimal places)

(a) 30.33%
(b) 32.33%
(c) 35.33%
(d) 33.33%

Q35. A ladder is leaning against a wall. The foot of the ladder is 1115.4705 cm away from the wall, and the ladder makes an angle of 60 degrees with the ground. Find the height of the wall it touches. (Round your answer to the nearest integer.)

(a) 1550 cm
(b) 1715 cm
(c) 1932 cm
(d) 1220 cm

Q36. The amount on a sum of Rs. 6,800 at the rate of 10% per annum compound interest, compounded annually, in 2 years will be:

(a) Rs. 8,228
(b) Rs. 8,549
(c) Rs. 9,040
(d) Rs. 7,703

Q37. Bhanu travels from City A to City B. If Bhanu drives his car at 1/3 rd of his normal speed, then he reaches City B 50 minutes late. Find the time (in minutes) that Bhanu would have taken to travel from City A to City B if he drove at his normal speed.

(a) 25
(b) 20
(c) 32
(d) 29

Q38. Prakhar and Riya together invested Rs. 56,700 in a business. At the end of the year, out of a total profit of Rs. 5,400, Prakhar's share was Rs. 1,400. What was Prakhar's investment?

(a) Rs. 14,900
(b) Rs. 14,300
(c) Rs. 14,700
(d) Rs. 16,200

Q39. What will come in place of ‘A’ in the following ratio?

180/A = 11/44

(a) 720
(b) 723
(c) 717
(d) 722

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Q40. The price of 3 pens is equal to the price of 5 pencils. The price of 5 pens and 3 pencils is Rs. 34. The price of 3 pen and 5 pencils is Rs. ____.

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

Q41. Simplify: $(35x^3y^2z)/(7xy^4) \div 25xy^{(-2)}z$

(a) x/5
(b) x/2
(c) x/7
(d) x/3

Q42. Sheethal spends 60% of her monthly salary on household expenses. If the remaining amount after her spending is Rs. 33,200, what is her monthly salary?

(a) Rs. 69,000
(b) Rs. 83,000
(c) Rs. 76,000
(d) Rs. 78,000

Q43. A train passes two tunnels of length 2492 m and 1914 m in 81 seconds and 64 seconds, respectively. What is the length of the train (in m)?

(a) 267 m
(b) 262 m
(c) 254 m
(d) 252 m

Q44. If 30% of 50% of 2/3 of a number is 325, find the number.

(a) 5330
(b) 5230
(c) 2590
(d) 3250

Q45. Simplify $(x^2 + 10x + 25)/(x + 5) - 5$.

(a) x
(b) 10
(c) 5
(d) 0

Q46. The cost of a washing machine is 25% less than the cost of a TV. If the cost of the washing machine increases by 83% and that of the TV decreases by 15%, then what is the percentage change in the total cost of 8 washing machines and 4 TVs?

(a) Increase by 46%
(b) Decrease by 42%
(c) Decrease by 41%
(d) Increase by 43.8%

Q47. If the height of a cylinder is 15 cm and its base area is 169π cm², then find its total surface area.

(a) 55,770 cm2
(b) 1225 cm2
(c) 5577 cm2
(d) 2288 cm²

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Q48. If a gymnastic coach has 14 gymnasts, their heights are as follows (in cm):

172, 173, 164, 178, 168, 169, 173, 172, 173, 164, 178, 168, 169, 173

The mode of this data (in cm) is:

(a) 178
(b) 173
(c) 172
(d) 163

Q49. The sum of the present ages of Ankita and her daughter Anushree is 50 years. Five years ago from now, Ankita was three times as old as Anushree. What is the present age (in years) of Anushree?

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

Q50. A and B working together can do a piece of work in 5 days. B alone can do the same work in 10 days. How long (in days) will A alone take to do double the work?

(a) 20
(b) 10
(c) 23
(d) 21

GENERAL INTELLIGENCE & REASONING

Q51. If + means −, − means ×, × means ÷ and ÷ means +, then what will come in place of the question mark (?) in the following equation?

187 − 4 ÷ 117 + 325 × 5 = ?

(a) 810
(b) 875
(c) 805
(d) 800

Q52. In a certain code language, ‘we cook dinner’ is coded as ‘hn sh ai’ and ‘dinner is tasty’ is coded as ‘la tf sh’. How is ‘dinner’ coded in that language?

(a) sh
(b) tf
(c) la
(d) hn

Q53. Based on the English alphabetical order, three of the following four letter-clusters are alike in a certain way and thus form a group. Which letter-cluster DOES NOT belong to that group?

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

(a) FHA
(b) SUN
(c) PRK
(d) KME

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

835 836 839 844 851 ?

(a) 861
(b) 859
(c) 858
(d) 860

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Q55. In a certain code language, 'travel is exciting' is coded as 'ab op kj' and 'exciting and enjoyable' is coded as 'lm ab wv'. How is 'exciting' coded in the given language? 8993

(a) wv
(b) ab
(c) lm
(d) op

Q56. If '+' means '−', '−' means '×', '×' means '÷' and '÷' means '+', then what will come in place of the question mark (?) in the following equation?

88 × 8 ÷ 9 − 2 + 17 = ?

(a) 12
(b) 15
(c) 26
(d) 21

Q57. Which of the following letter-number clusters will replace the question mark (?) in the given series to make it logically complete?

KTV 12, IRT 24, GPR 36, ENP 48, ?

(a) CLN 60
(b) DJN 64
(c) DJN 60
(d) CLM 64

Q58. Refer to the following series and answer the question that follows. Counting to be done from left to right only. (All numbers are single-digit numbers only.)

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

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

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

Q59. Read the given statement(s) and conclusions carefully. Assuming that the information given in the statement(s) is true, even if it appears to be at variance with commonly known facts, decide which of the given conclusions logically follow(s) from the statement(s).

Statements:

Some Llamas are Sheep.

All Sheep are Mules.

No Mules are Pigeons.

Conclusion:

(I) Some Llamas are Mules.

(II) No Sheep are Pigeons.

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

Q60. What should come in place of the question mark (?) in the given series to make it logically complete?

5 9 17 29 45 65 ?

(a) 89
(b) 70
(c) 85

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(d) 80

Q61. DHKT is related to ZAGM in a certain way based on the English alphabetical order. In the same way, NFUR is related to JYQK. To which of the given options is BKIW related, following the same logic?

(a) XDEO
(b) XDEP
(c) XBGT
(d) SCDE

Q62. A, B, C, D, E, F and G are sitting around a circular table facing the centre. E sits to the immediate right of D. G sits second to the left of E. B sits third to the right of E. A is the immediate neighbour of C and B. How many people sit between F and C when counted from the left of F?

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

Q63. 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) 8 4 6 4 6 1 9 6 7 2 2 2 2 1 5 5 1 6 6 7 2 5 5 (Right)

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

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

Q64. Seven people B, C, D, I, J, K and L are sitting around a circular table facing the centre of the table. K sits third to the left of L. I sits to the immediate left of L. D sits to the immediate left of J. J sits second to the left of C. Who sits third to the right of B?

(a) D
(b) J
(c) K
(d) C

Q65. Seven boxes B, D, E, P, S, T and W are kept one over the other but not necessarily in the same order.

Only S is kept above P. Only two boxes are kept between P and D. Only E is kept below B. T is not kept immediately above D.

How many boxes are kept between W and E?10012

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

Q66. In the following number-pairs, the second number is obtained by applying certain mathematical operation(s) to the first number. Select the number-pair in which the numbers are related in the same way as are the numbers of the following pairs.

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

14, 2

119, 17

(a) 105, 15
(b) 147, 22
(c) 221, 32

(d) 294, 43

Q67. Mr. Akai starts from Point A and drives 15 km towards south. He then takes a right turn, drives 18 km, turns right and drives 25 km. He then takes a right turn and drives 16 km, turns right drives 5 km. He then takes a left turn drives 6 km. He takes a final right turn, drives 5 km and stops at Point P. How far (shortest distance) and towards which direction should he drive in order to reach Point A again? (All turns are 90 degrees turns only unless specified)

(a) 4 km to the south
(b) 4 km to the west
(c) 4 km to the east
(d) 8 km to the east

Q68. If 2 is added to each odd digit and 1 is subtracted from each even digit in the number 5147934, what will be the sum of the digits which are third from the left and second from the right?

(a) 7
(b) 9
(c) 11
(d) 8

Q69. A, B, C, D, W, X and Y are sitting in a straight line facing north. Only two people sit to the left of C. Only three people sit between C and W. Only one person sits between W and X. D sits to the immediate left of A. Y is not an immediate neighbour of W. How many people sit to the right of B?

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

Q70. Seven boxes A, B, C, D, E, F and G are kept one over the other but not necessarily in the same order.

G is kept immediately above B. D is kept immediately above F. Only E is kept above A. Only two boxes are kept above G. D is not kept at third position from the bottom.

How many boxes are kept above D?11685

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

Q71. Read the given statements and conclusions carefully. Assuming that the information given in the statements is true, even if it appears to be at variance with commonly known facts, decide which of the given conclusions logically follow(s) from the statements.

Statements:

Some dolls are pencils.

Some fingers are pencils.

Conclusions:

(I): All fingers are dolls.

(II): Some dolls are fingers.

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

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

105 87 69 51 33 ?

(a) 27
(b) 15
(c) 13

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(d) 21

Q73. EHLQ is related to GKNT in a certain way based on the English alphabetical order. In the same way, MTTC is related to OWVF. To which of the given options is SCZL related, following the same logic?

(a) UFBO
(b) UFOM
(c) UFBP
(d) UBNJ

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

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

(a) OPN
(b) WXV
(c) PRO
(d) QRP

Q75. Adit starts from Point A and drives 11 km towards the North. He then takes a left turn, drives 6 km, turns left and drives 17 km. He then takes a left turn and drives 13 km. He takes a final left turn, drives 6 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) 8 km to the east
(b) 7 km to the west
(c) 7 km to the east
(d) 8 km to the west

Q76. In a certain code language,

A + B means ‘A is the son of B’,

A - B means ‘A is the brother of B’,

A x B means ‘A is the wife of B’, and

A ÷ B means ‘A is the father of B’.

Based on the above, how is D related to J if ‘D - F x G + H ÷ J’?

(a) Brother's wife's brother
(b) Brother's wife's father
(c) Wife's brother
(d) Wife's father

Q77. Refer to the following number and symbol series and answer the question that follows. Counting to be done from left to right only. All numbers are single-digit numbers.

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

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

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

Q78. BFHC is related to IMOJ in a certain way based on the English alphabetical order. In the same way, DHJE is related to KOQL. To which of the given options is FJLG related, following the same logic?

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(a) QMSN
(b) QMNS
(c) MQSN
(d) MQNS

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

LDS MET NFU OGV ?

(a) PHW
(b) PIX
(c) QIW
(d) RHW

Q80. Refer to the following series and answer the question that follows (all numbers are single digit numbers only). Counting to be done from left to right only.

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

How many such odd numbers are there each of which is immediately preceded by an odd number and also immediately followed by an odd number?15352

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

GENERAL AWARENESS AND CURRENT AFFAIRS

Q81. What is the name of the new antibiotic developed to combat AMR (Antimicrobial Resistance) in India in December 2024?

(a) Cefixime
(b) Amoxicillin
(c) Azithromycin
(d) Nafithromycin

Q82. Who started a cleanliness drive ahead of the national urban local bodies' conference in Manesar?

(a) Delhi Police
(b) National Urban Forum
(c) Manesar Municipal Corporation
(d) Chief Minister of Haryana

Q83. In July 2025, which initiative was launched to promote workplace wellness for women in India?

(a) Swasthya Mahila
(b) Janani Suraksha Yojan
(c) Ayushman Bharat
(d) Mahila Aarogyam Kaksh

Q84. What amount has been allocated to the Khelo India Programme in the FY 2025-26 Budget?

(a) Rs. 500 crore
(b) Rs. 1,000 crore
(c) Rs. 750 crore
(d) Rs. 1,500 crore

Q85. In 2025, which new category was added by the Central Pollution Control Board to classify essential environmental services?

(a) Pink
(b) Black
(c) Purple
(d) Blue

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Q86. At which edition of the Cannes Film Festival did Boman Irani make his red carpet debut?

(a) 77th
(b) 76th
(c) 75th
(d) 78th

Q87. From which assembly constituency did Arvind Kejriwal contest in the General Election to the Assembly Constituencies of the National Capital Territory (NCT) of Delhi in 2025?

(a) Moti Nagar
(b) New Delhi
(c) Kondli
(d) Mundka

Q88. Which of the following two countries exchanged prisoners of war in Istanbul in June 2025?

(a) Liberia and Sierra Leone
(b) India and Pakistan
(c) Russia and Ukraine
(d) Israel and Iran

Q89. In which city did the Union Home Minister launch the pilot project of the e-Zero FIR initiative in May 2025, under the Indian Cyber Crime Coordination Centre (I4C) to improve the efficiency of investigating cyber financial frauds, supporting the vision of a Cyber Secure Bharat?

(a) Kolkata
(b) Lucknow
(c) Delhi
(d) Mumbai

Q90. As notified in June 2025, which of the following insurance companies launched India's first car insurance with built-in crash detection, auto claims trigger?

(a) Kotak Mahindra Insurance
(b) Future Generali Life Insurance
(c) Zuno General Insurance
(d) Shriram Life Insurance

Q91. What is the surplus amount transferred by the Reserve Bank of India (RBI) to the Centre for FY25?

(a) Rs. 3.00 lakh crore
(b) Rs. 1.69 lakh crore
(c) Rs. 2.00 lakh crore
(d) Rs. 2.69 lakh crore

Q92. What was the name of the chemical factory where the blast happened on 30 June 2025 in Telangana state?

(a) Andhra Petrochemicals
(b) Sigachi Chemicals
(c) Bharat Chemicals
(d) Deccan Industries

Q93. Who holds the No.1 world chess ranking as of June 2025?

(a) D Gukesh
(b) Magnus Carlsen
(c) R Praggnanandhaa
(d) Fabiano Caruana

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Q94. The 18th edition of the Battalion Level Joint Military Exercise Surya Kiran was held in December 2024 between India and _____.

(a) Nepal
(b) Sweden
(c) Japan
(d) Egypt

Q95. In news in 2025, what is the main function of the 'Sachet' app?

(a) Online shopping
(b) Real-time disaster alerts
(c) Educational tutorials
(d) Social networking

Q96. In July 2025, which institute launched Gyanodaya for pedagogical innovation?

(a) IIM Kozhikode
(b) NIT Rourkela
(c) IT Delhi
(d) IISc Bangalore

Q97. Which of the following athletes was NOT part of the Indian 4 × 100 m relay team that set a new national record at the National Relay Carnival, 2025?

(a) Animesh Kujur
(b) Neeraj Chopra
(c) Manikanta Hoblidar
(d) Amlan Borgohain

Q98. Who from Pakistan was recognised as Best Asian Athlete in May 2025?

(a) Sana Mir
(b) Arshad Nadeem
(c) Babar Azam
(d) Mohammad Abbas

Q99. Which 2025 novel by Colum McCann follows a journalist on a submarine cable-laying ship?

(a) Under the Eye of the Big Bird
(b) Wild Dark Shore
(c) Twist
(d) Silver Elite

Q100. What is the name of (India) Bharat's First Anti-Pesticide Bodysuit?

(a) Farmer Bodysuit
(b) Kisan Kavach
(c) India Kavach
(d) Kisan Bodysuit

ANSWER KEY

1	d	2	a	3	a	4	d	5	c	6	c	7	b	8	b	9	a	10	d
11	c	12	d	13	d	14	b	15	c	16	a	17	c	18	d	19	b	20	d
21	d	22	a	23	c	24	a	25	d	26	a	27	d	28	c	29	a	30	a
31	d	32	a	33	c	34	d	35	c	36	a	37	a	38	c	39	a	40	d
41	a	42	b	43	b	44	d	45	a	46	d	47	d	48	b	49	b	50	a
51	d	52	a	53	d	54	d	55	b	56	a	57	a	58	a	59	c	60	a
61	b	62	d	63	d	64	c	65	d	66	a	67	b	68	d	69	a	70	a

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71	c	72	b	73	a	74	c	75	b	76	a	77	a	78	c	79	a	80	d
81	d	82	c	83	d	84	b	85	d	86	d	87	b	88	c	89	c	90	c
91	d	92	b	93	b	94	a	95	b	96	a	97	b	98	b	99	c	100	b

SOLUTIONS

Q1. Answer: (d) The total mass of all atoms in one formula unit of a compound

The correct answer is The total mass of all atoms in one formula unit of a compound.

Key Points

• The term formula unit mass refers to the total mass of all the atoms in one formula unit of a compound. It is expressed in atomic mass units (amu).

• A formula unit represents the simplest ratio of ions in an ionic compound. For example, in NaCl, one formula unit consists of one sodium ion (Na^+) and one chloride ion (Cl^-).

• The formula unit mass is calculated by summing the atomic masses of all atoms present in the chemical formula of the compound. For instance, in NaCl, the formula unit mass = atomic mass of Na + atomic mass of Cl = 23 + 35.5 = 58.5 amu.

• The formula unit mass is particularly used for ionic compounds because these do not exist as discrete molecules but as a lattice structure. Hence, the term "formula unit" is used instead of "molecule."

• This concept is essential in stoichiometry, allowing chemists to calculate the mass relationships in chemical reactions involving ionic compounds.

Additional Information

• Atomic Mass:

• The mass of an individual atom is expressed in atomic mass units (amu). For example, the atomic mass of sodium (Na) is approximately 23 amu, and that of chlorine (Cl) is 35.5 amu.

• The atomic mass is determined relative to the mass of one atom of carbon-12, which is defined as exactly 12 amu.

• Formula Unit:

• A formula unit is the smallest repeating unit of an ionic compound that represents its composition. For example, the formula unit of magnesium chloride is MgCl2.

• It differs from a molecule because ionic compounds do not form discrete molecular entities but rather exist as a lattice of ions.

• Difference Between Formula Unit Mass and Molecular Mass:

• Formula unit mass is used for ionic compounds (e.g., NaCl, MgCl2) and is based on the simplest ratio of ions.

• Molecular mass applies to covalent compounds (e.g., H2O, CO2) and is the sum of the atomic masses of all atoms in a molecule.

• Applications of Formula Unit Mass:

• It helps in calculating molar mass, which is crucial for stoichiometric calculations in chemistry.

• It is used to determine the proportions of elements in ionic compounds and their chemical behavior.

• Examples:

• The formula unit mass of NaCl: 23 + 35.5 = 58.5 amu.

• The formula unit mass of MgCl2: 24.3 + (2 × 35.5) = 95.3 amu.

Important Points

• Option 1: "The mass of one mole of a substance" refers to molar mass, not formula unit mass. This is incorrect.

• Option 2: "The mass of a single atom of an element" refers to atomic mass, not formula unit mass. This is incorrect.

• Option 3: "The mass of a single molecule of an element" pertains to molecular mass, which is different from formula unit mass. This is incorrect.

• Option 4: "The total mass of all atoms in one formula unit of a compound" is the correct definition of formula unit mass. This is correct.

Q2. Answer: (a) +4.0 D

The correct answer is +4.0 D.

Key Points

• The power of a lens is the ability of the lens to converge or diverge light rays passing through it. It is measured in dioptres (D).

• The formula to calculate the power of a lens is:

P = 100 / f, where P is the power in dioptres and f is the focal length in centimeters.

• In the given question, the focal length of the convex lens is 25 cm. Substituting this into the formula:

P = 100 / 25 = +4.0 D.

• A positive power (+) indicates that the lens is a convex lens, which converges light rays.

• Hence, the power of the convex lens is +4.0 D, and this is the correct answer.

Additional Information

• Convex Lens:

• A convex lens is also known as a converging lens because it brings parallel rays of light to a focus.

• It is thicker at the center and thinner at the edges.

• Convex lenses are commonly used in devices like magnifying glasses, cameras, and projectors.

• Dioptre:

• The dioptre (D) is the unit of measurement for the optical power of a lens or a curved mirror.

• It is defined as the reciprocal of the focal length in meters (D = 1/f), where f is in meters.

• A positive dioptre value indicates a converging lens (convex), while a negative value indicates a diverging lens (concave).

• Lens Power and Focal Length:

• The focal length (f) of a lens is the distance from the center of the lens to the point where light rays converge or diverge.

• The shorter the focal length, the higher the optical power of the lens.

• For example, a lens with a focal length of 50 cm has a power of +2.0 D, while a lens with a focal length of 25 cm has a power of +4.0 D.

• Applications of Convex Lenses:

• Convex lenses are used in eyeglasses to correct farsightedness (hyperopia).

• They are also used in microscopes and telescopes for magnification purposes.

• Other applications include their use in optical instruments, cameras, and focusing systems.

Important Points

• Power of Concave Lens:

• A concave lens is a diverging lens, and its power is represented by a negative value.

• For example, if the focal length of a concave lens is 50 cm, its power is -2.0 D.

• Difference Between Convex and Concave Lenses:

• Convex Lens: Converges light rays, has positive power, and is thicker at the center.

• Concave Lens: Diverges light rays, has negative power, and is thinner at the center.

• Real and Virtual Images:

• A convex lens can form both real and virtual images, depending on the position of the object.

• A concave lens, however, always forms a virtual image.

Q3. Answer: (a) Apical meristem

The correct answer is Apical meristem.

Key Points

• Apical meristem is a type of meristematic tissue found at the tips of roots and shoots in plants.

• It is responsible for the primary growth of plants, leading to an increase in height or length.

• The cells in the apical meristem are actively dividing and undifferentiated, enabling the elongation of stems and roots.

• Apical meristems give rise to three primary meristems: protoderm (epidermis), procambium (vascular tissues), and ground meristem (ground tissues).

• This tissue ensures that plants grow taller or deeper by adding new cells at the apex of the plant body.

Additional Information

• Secondary meristem:

• This type of meristematic tissue is responsible for secondary growth, which leads to an increase in the thickness or girth of the plant body.

• Examples include the vascular cambium and cork cambium.

• It is found in woody plants and contributes to the formation of bark and wood.

• Cambium:

• Cambium is a type of secondary meristem that specifically produces vascular tissues like xylem and phloem.

• It is responsible for the lateral growth of plants, increasing the width of stems and roots.

• It is not involved in the increase in height but plays a crucial role in the plant's strength and transport system.

• Lateral meristem:

• Lateral meristems are located along the sides of stems and roots.
• Their function is to contribute to secondary growth by increasing the diameter or thickness of the plant body.
• Examples of lateral meristems include vascular cambium and cork cambium.
• Important Points:
• Meristematic tissues are responsible for the growth of plants due to their ability to divide continuously.
• Meristems are classified based on their location (apical, lateral, intercalary) and function (primary or secondary growth).
• Apical dominance: The apical bud suppresses the growth of lateral buds, ensuring that the plant grows upwards efficiently.
• Plants with active apical meristems typically exhibit elongation of roots and stems, allowing them to explore new areas for nutrients, water, and light.

Q4. Answer: (d) Fallopian tube

The correct answer is Fallopian tube.

Key Points

• The Fallopian tube is a part of the female reproductive system that connects the ovaries to the uterus.
• During ovulation, the ovary releases an egg (ovum) into the Fallopian tube, where it may be fertilized by sperm.
• The movement of the egg through the Fallopian tube is facilitated by the coordinated actions of tiny hair-like structures called cilia and muscular contractions.
• The Fallopian tube is the typical site of fertilization, where the sperm meets the egg to form a zygote.
• Once fertilized, the zygote travels through the Fallopian tube to implant into the uterine lining, initiating pregnancy.

Additional Information

• Structure and Function of the Fallopian Tube:
• The Fallopian tube is approximately 10-12 cm long and consists of four parts: the infundibulum, ampulla, isthmus, and interstitial part.
• The infundibulum has finger-like projections called fimbriae that help capture the released egg from the ovary.
• The ampulla is the widest part and is the most common site for fertilization.
• The tube is lined with a mucous membrane containing ciliated epithelial cells that move the egg toward the uterus.
• Other Parts of the Female Reproductive System:
• The vagina is the muscular canal leading from the cervix to the outside of the body; it is not involved in transporting the egg.
• The cervix is the lower part of the uterus that opens into the vagina and plays no role in egg transportation.
• The ureter is part of the urinary system, transporting urine from the kidneys to the bladder, and is unrelated to reproduction.
• Common Disorders of the Fallopian Tube:
• Blocked Fallopian tubes can cause infertility as they prevent the egg from reaching the uterus.
• Ectopic pregnancy occurs when a fertilized egg implants in the Fallopian tube instead of the uterus, posing serious health risks.
• Infections like pelvic inflammatory disease (PID) can damage the Fallopian tubes, leading to infertility or complications.
• Fertilization and Implantation:
• Fertilization typically occurs within 24 hours of ovulation in the ampulla of the Fallopian tube.
• The fertilized egg (zygote) takes about 3-4 days to travel to the uterus, where it implants into the uterine lining.

Important Points

• The Fallopian tube is essential for natural conception, as it provides the environment for fertilization.
• Damage or blockage in the Fallopian tube can significantly reduce fertility and may require medical interventions like surgery or in-vitro fertilization (IVF).
• Maintaining reproductive health through regular check-ups and prompt treatment of infections is crucial for the proper functioning of the Fallopian tubes.

Q5. Answer: (c) Ensure nectar-rich flowers bloom throughout the season

The correct answer is Ensure nectar-rich flowers bloom throughout the season.

Key Points

• Ensuring nectar-rich flowers bloom throughout the season is critical for honeybees as they rely on these flowers for nectar, their primary source of energy, and pollen, which provides essential proteins. This practice directly supports both the quantity and quality of honey production.
• By maintaining a variety of nectar-rich flowering plants, the farmer can ensure a continuous supply of food for bees, especially during different blooming periods throughout the year. This prevents seasonal gaps that could stress the bee colonies.
• Nectar-rich plants like sunflowers, lavender, clover, and wildflowers are known to produce high-quality nectar, which directly impacts the flavor, texture, and nutritional value of the honey produced.

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• This approach also supports the overall health of the bee population by promoting biodiversity and reducing the risk of diseases or pests that can arise due to monoculture farming practices.

• Unlike other options, this method is sustainable and aligns with ecological farming practices, ensuring long-term benefits for both the farmer and the environment.

Additional Information

• Option 1: Reduce the number of flowering plants

• Reducing the number of flowering plants would decrease the availability of nectar and pollen for bees, leading to lower honey production and potentially weaker bee colonies.

• This approach is counterproductive for improving the quantity and quality of honey.

• Option 2: Remove all wildflowers from the area

• Wildflowers are often a rich source of diverse nectar and pollen. Removing them would eliminate a key food source for bees, negatively impacting honey production and biodiversity.

• Wildflowers also play a vital role in maintaining ecological balance, making their removal detrimental.

• Option 4: Keep the bees in shaded areas away from plants

• Keeping bees away from flowering plants would severely limit their access to nectar and pollen, directly reducing honey production.

• Bees thrive in areas with ample sunlight and easy access to flowers, making this option unsuitable for honey production improvement.

• Benefits of Nectar-Rich Plants:

• Plants like thyme, mint, borage, and marigolds are known to attract bees and support high-quality honey production.

• A diverse range of plants ensures year-round food availability, strengthening bee colonies and enhancing pollination efficiency.

• Such practices contribute to sustainable farming and boost crop yields through improved pollination.

• Importance of Sustainable Beekeeping:

• Maintaining biodiversity through nectar-rich plants ensures the health of bee populations and supports environmental conservation.

• Healthy bee colonies not only produce better honey but also play a crucial role in pollinating crops, which is essential for global food security.

Important Points

• Data and Facts:

• According to the Food and Agriculture Organization (FAO), bees are responsible for pollinating approximately 75% of global crops.

• Studies suggest that planting nectar-rich flowers can increase honey production by up to 30%, depending on the diversity and abundance of the plants.

• Government Initiatives:

• In India, programs like the National Beekeeping & Honey Mission (NBHM) under the Ministry of Agriculture aim to promote scientific beekeeping practices and improve honey production.

• Farmers are encouraged to integrate beekeeping with horticulture and ensure a continuous supply of nectar-producing plants to boost productivity.

Q6. Answer: (c) To find speed, we need both the magnitude and direction of the object

The correct answer is To find speed, we need both the magnitude and direction of the object..

Key Points

• Statement 1: "Average speed only needs the magnitude, not direction" – This statement is correct. Average speed is a scalar quantity, meaning it is only concerned with the magnitude of distance traveled over time and does not consider direction.

• Statement 2: "Its SI unit is metres per second (m/s)" – This statement is correct. The SI unit of speed, including average speed, is metres per second (m/s), as it is derived from the formula of speed: distance (metres) divided by time (seconds).

• Statement 3: "To find speed, we need both the magnitude and direction of the object" – This statement is incorrect. Speed is a scalar quantity, and it does not depend on direction. If direction is included, it becomes velocity, which is a vector quantity. This is the correct answer as it is NOT true.

• Statement 4: "Speed is calculated as distance divided by time" – This statement is correct. The formula for speed is indeed distance ÷ time, which gives the rate at which an object covers distance.

Additional Information

• Difference Between Speed and Velocity:

• Speed: Speed is a scalar quantity that measures how fast an object is moving. It considers only the magnitude of the motion.

• Velocity: Velocity is a vector quantity that measures the rate of displacement of an object in a specific direction. It considers both

magnitude and direction.

• Example: If a car travels 50 km north in one hour, the speed is 50 km/h, while the velocity is 50 km/h north.

• Formula for Average Speed:

• Average Speed = Total Distance / Total Time

• It does not take into account the direction of travel, making it different from average velocity.

• SI Unit of Speed:

• The SI unit of speed is metres per second (m/s).

• For practical purposes, speed is often measured in kilometres per hour (km/h) in daily life.

• Uniform and Non-Uniform Motion:

• Uniform Motion: When an object covers equal distances in equal intervals of time, it is said to be in uniform motion. In this case, the speed remains constant.

• Non-Uniform Motion: When an object covers unequal distances in equal intervals of time, it is said to be in non-uniform motion. The speed varies in this case.

• Applications of Speed in Real Life:

• Speed is used in transportation to measure how fast vehicles move.

• It is crucial in sports, especially in events like running and racing.

• Speed measurements are used in industries like aviation and shipping for navigation and logistics.

Important Points

• Scalar vs. Vector Quantities:

• Scalar: Quantities that have only magnitude (e.g., speed, distance, time).

• Vector: Quantities that have both magnitude and direction (e.g., velocity, displacement, force).

• Examples of Speed and Velocity:

• If a person runs 100 meters in 10 seconds, their speed is 10 m/s.

• If the same person runs 100 meters north in 10 seconds, their velocity is 10 m/s north.

Q7. Answer: (b) HCl

The correct answer is HCl.

Key Points

• Acidic behavior in aqueous solutions: Acids are substances that release hydrogen ions (H^+) when dissolved in water. The presence of H^+ ions is responsible for the acidic nature of a solution.

• HCl (Hydrochloric Acid): HCl is a strong acid that completely dissociates in water, releasing a high concentration of hydrogen ions (H^+). This dissociation contributes to the acidic behavior of HCl in aqueous solutions.

• Ca(OH)2, NaOH, and KOH: These are strong bases that dissociate in water to release hydroxide ions (OH^-), which neutralize hydrogen ions. Hence, they exhibit basic rather than acidic behavior in aqueous solutions.

• Acidity is measured using the pH scale: Solutions with a pH less than 7 are acidic. HCl solutions typically have a very low pH due to the high concentration of H^+ ions.

• Example: In laboratories, HCl is commonly used as an acid for various chemical reactions, demonstrating its strong acidic properties.

Additional Information

• Hydrochloric Acid (HCl):

• HCl is a strong monoprotic acid, meaning it can donate one proton (H^+) per molecule.

• It is widely used in industries for applications such as metal cleaning, pH adjustment, and chemical synthesis.

• Its molecular formula is HCl, and its aqueous solution is commonly referred to as hydrogen chloride.

• In the human body, HCl is produced in the stomach to aid digestion by breaking down food and killing pathogens.

• Calcium Hydroxide (Ca(OH)2):

• Also known as slaked lime, it is a strong base and used in industries for neutralizing acids and water purification.

• It dissociates in water to release hydroxide ions (OH^-), making the solution basic.

• Commonly used in construction as a component of mortar and plaster.

• Sodium Hydroxide (NaOH):

• NaOH, or caustic soda, is a strong base used in the manufacture of soap, paper, and textiles.

• It dissociates completely in water to produce hydroxide ions, contributing to its basic behavior.

• It is highly corrosive and must be handled with care.

• Potassium Hydroxide (KOH):

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• KOH, commonly known as caustic potash, is a strong base used in fertilizers, soaps, and batteries.
• It releases hydroxide ions in aqueous solutions, leading to basic properties.
• It is also used in laboratories for titrations and chemical synthesis.

Important Points

• Acid-Base Behavior:
• Acids release H^+ ions in water, while bases release OH^- ions.
• Strong acids like HCl fully dissociate in water, whereas weak acids partially dissociate.
• Strong bases like NaOH and KOH also fully dissociate in aqueous solutions.
• pH Scale:
• The pH scale ranges from 0 to 14, with values below 7 indicating acidic solutions and values above 7 indicating basic solutions.
• Neutral solutions have a pH of 7, such as pure water.
• HCl solutions typically have a pH of 1 to 3, depending on the concentration.
• Applications:
• HCl is used in laboratory experiments, industrial processes, and medical applications.
• Bases like NaOH and KOH are utilized in manufacturing, cleaning, and analytical procedures.
• Ca(OH)2 is commonly used in agriculture to neutralize acidic soils.

Q8. Answer: (b) Movement of tongue

The correct answer is Movement of tongue.

Key Points

• Voluntary muscles are those that can be consciously controlled by an individual. These muscles are attached to bones and are also known as skeletal muscles.
• The movement of the tongue is controlled by voluntary muscles. The tongue is made up of a group of skeletal muscles that allow for its precise and conscious movement, enabling activities like speaking, chewing, and swallowing.
• Movement in the intestines and movement of the stomach walls are controlled by involuntary muscles, specifically smooth muscles. These movements are part of the autonomic processes of digestion and cannot be controlled voluntarily. Hence, these statements are incorrect.
• The movement of the heart is governed by cardiac muscles, which are also involuntary. The heart's contractions are regulated by the autonomic nervous system and specialized pacemaker cells. Hence, this statement is incorrect.
• The tongue is unique because it combines voluntary control with some involuntary aspects, but its primary movements are voluntary. Hence, the correct answer is the movement of the tongue.

Additional Information

• Voluntary Muscles:
• These muscles are under conscious control and are primarily attached to the skeleton.
• They are striated in appearance and are responsible for enabling movements like walking, running, and grasping objects.
• Examples: Muscles of the arms, legs, and tongue.
• Involuntary Muscles:
• These muscles are not under conscious control and are regulated by the autonomic nervous system.
• They are smooth in structure and are found in internal organs like the intestines, stomach, and blood vessels.
• Examples: Muscles of the digestive tract and blood vessel walls.
• Cardiac Muscles:
• These muscles are found only in the heart and are responsible for pumping blood throughout the body.
• They are involuntary but have a striated appearance similar to skeletal muscles.
• Specialized pacemaker cells in the heart generate electrical impulses to regulate contractions.
• Function of the Tongue:
• The tongue is a muscular organ crucial for speech, taste, and food manipulation during chewing and swallowing.
• Its movements are controlled by extrinsic and intrinsic muscles, which work together to provide a wide range of motion.
• Intrinsic muscles change the shape of the tongue, while extrinsic muscles control its position.

Important Points

• Skeletal Muscles:
• These muscles form about 40% of body weight and enable body movements.
• They are composed of long fibers and are multinucleated.
• Autonomic Nervous System:

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• This system controls involuntary actions like digestion, respiration, and heart rate.
• It has two divisions: the sympathetic and parasympathetic nervous systems.
• Heart's Pacemaker:
• The SA node (Sinoatrial node) is known as the natural pacemaker of the heart.
• It generates electrical impulses that coordinate heart contractions.
• Digestive System Movements:
• Peristalsis is the rhythmic contraction of smooth muscles in the digestive tract, aiding in food movement.
• These movements are entirely involuntary and crucial for digestion.

Q9. Answer: (a) Loudness depends on the amplitude.

The correct answer is Loudness depends on the amplitude..

Key Points

• Loudness of sound primarily depends on the amplitude of the sound wave. The larger the amplitude, the louder the sound perceived.
• Amplitude refers to the maximum displacement of particles in a medium due to the propagation of a sound wave. A higher amplitude causes greater energy transfer, resulting in a louder sound.
• The frequency of a sound wave determines the pitch, not loudness. Hence, the statement "Loudness depends on frequency" is incorrect.
• The speed of the wave is determined by the medium through which the sound travels and does not affect loudness. Therefore, the statement "Loudness depends on the speed of wave" is incorrect.
• Wavelength is inversely proportional to frequency in sound waves and does not directly affect loudness. Thus, the statement "Loudness depends on the wavelength" is incorrect.
• Loudness is also influenced by the sensitivity of the human ear and the duration of exposure to sound.

Additional Information

• Amplitude:
• Amplitude is measured in units like decibels (dB), which quantify the intensity of sound.
• For example, a typical conversation has an amplitude of about 60 dB, while a jet engine can reach over 120 dB.
• Higher amplitudes correspond to louder sounds, whereas lower amplitudes are associated with softer sounds.
• Frequency:
• Frequency is measured in Hertz (Hz) and determines the pitch of the sound.
• Humans can typically hear frequencies in the range of 20 Hz to 20,000 Hz, with higher frequencies perceived as higher-pitched sounds.
• While pitch and loudness are distinct qualities, they often interact in perception.
• Speed of Sound:
• The speed of sound varies with the medium, e.g., 343 m/s in air, 1,500 m/s in water, and 5,960 m/s in steel.
• Factors like temperature, pressure, and density of the medium influence the speed of sound.
• However, the speed does not directly impact loudness.
• Wavelength:
• Wavelength is the distance between successive crests or troughs in a sound wave.
• It is inversely proportional to frequency, as per the equation: wavelength = speed of sound / frequency.
• Like frequency, wavelength contributes to the tonal quality rather than loudness.
• Human Ear Sensitivity:
• The human ear is most sensitive to frequencies between 2,000 Hz and 5,000 Hz, where small changes in amplitude result in significant changes in perceived loudness.
• Prolonged exposure to loud sounds above 85 dB can cause hearing damage.

Important Points

• Threshold of Hearing:
• The quietest sound a human can hear is at 0 dB, known as the threshold of hearing.
• Sounds above 120 dB are painful and can cause immediate hearing loss.
• Applications of Loudness Measurement:
• Loudness is essential in audio engineering, designing sound systems, and acoustics.
• Devices like sound level meters are used to measure amplitude for safety and environmental purposes.
• Noise Pollution:

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• Excessive loudness contributes to noise pollution, which can lead to health issues like stress, sleep disturbances, and hearing impairment.
• Regulations often enforce limits on noise levels in residential and industrial areas.
• Equal Loudness Contours:
• These are graphs showing the sound pressure levels required to produce the same perceived loudness at different frequencies.
• They highlight the frequency-dependent sensitivity of the human ear.

Q10. Answer: (d) displacement is zero or perpendicular to force

The correct answer is Work done by a constant force is zero if displacement is zero or perpendicular to force..

Key Points

• Definition of Work: Work is defined as the product of the force applied on an object and the displacement of the object in the direction of the force. Mathematically, Work (W) = F × d × cos(θ), where:
• F is the magnitude of the applied force.
• d is the magnitude of displacement.
• θ is the angle between the force and displacement vectors.
• Condition for Zero Work: The work done by a constant force is zero when:
• Displacement (d) = 0: If the object does not move (no displacement), the work done is zero because W = F × 0 × cos(θ) = 0.
• Force and Displacement are Perpendicular (θ = 90°): When the angle between the force and displacement is 90°, cos(90°) = 0, leading to W = F × d × 0 = 0.
• Examples of Zero Work:
• A person holding a heavy box stationary does no work because there is no displacement.
• A satellite moving in a circular orbit under the influence of gravitational force does no work because the force is perpendicular to the displacement.
• Relevance of the Formula: The formula W = F × d × cos(θ) clearly shows that work depends on both the displacement and the angle between the force and displacement. If either displacement is zero or the angle is 90°, the work becomes zero.

Additional Information

• Characteristics of Work:
• Work is a scalar quantity, meaning it has magnitude but no direction.
• Positive work occurs when force and displacement are in the same direction (θ = 0°, cos(0°) = 1).
• Negative work occurs when force and displacement are in opposite directions (θ = 180°, cos(180°) = -1).
• Concept of Force and Displacement:
• For work to occur, there must be a displacement in the direction of the applied force.
• If there is no displacement, such as in static scenarios, no work is done regardless of the force applied.
• Work Done in Perpendicular Scenarios:
• When force is perpendicular to displacement, the angle θ is 90°, and cos(90°) = 0, leading to zero work.
• Examples: A person carrying a bag while walking horizontally (force exerted vertically while displacement is horizontal).
• Practical Applications:
• Understanding zero work is important in designing systems like pulleys and levers where forces need to be perpendicular to avoid unnecessary work.
• In physics problems, identifying cases of zero work helps simplify calculations and understand energy conservation principles.

Important Points

• Option 1: Displacement is small
• Even if the displacement is small, work is done as long as there is a component of force in the direction of displacement.
• Incorrect, as zero work depends on the angle and displacement being zero, not its magnitude.
• Option 2: Force is large
• The magnitude of force alone does not determine zero work.
• Incorrect, as work depends on both force and displacement.
• Option 3: Force is variable
• Variable force affects the calculation of work but does not inherently result in zero work.
• Incorrect, as zero work depends on displacement and angle.
• Option 4: Displacement is zero or perpendicular to force
• Zero displacement or perpendicularity between force and displacement results in zero work.
• Correct, as per the formula W = F × d × cos(θ).

Q11. Answer: (c) reverses direction

The correct answer is reverses direction.

Key Points

• When a current-carrying conductor is placed in a magnetic field, it experiences a force according to the left-hand rule of Fleming.

• The direction of this force depends on the relative orientation of the current in the conductor and the magnetic field. The force is perpendicular to both the current and the magnetic field.

• When the direction of current in the conductor is reversed, the force acting on the conductor also reverses its direction. This is because the force is directly proportional to the current direction.

• This phenomenon is a direct application of the Lorentz Force, which states that the force on a charged particle moving in a magnetic field is given by F = q(v × B), where v represents velocity (current direction in this case).

• Hence, reversing the current in the conductor changes the direction of the force acting on it, but the magnitude remains the same. Hence, the correct answer is that the force reverses direction.

Additional Information

• Fleming's Left-Hand Rule:

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

• The thumb, forefinger, and middle finger of the left hand are stretched perpendicular to each other.

• Here, the thumb indicates the direction of force, the forefinger represents the magnetic field, and the middle finger denotes the direction of current.

• Lorentz Force:

• The total force experienced by a charged particle moving in electric and magnetic fields is called the Lorentz force.

• The formula for Lorentz force is F = q(E + v × B), where E is the electric field, v is the velocity of the particle, and B is the magnetic field.

• In this case, the magnetic component of the Lorentz force is responsible for the force on the conductor.

• Applications of Force on Current-Carrying Conductors:

• This principle is utilized in devices like electric motors, where current-carrying coils experience forces in a magnetic field to produce rotational motion.

• It is also employed in magnetic braking systems and electromagnetic actuators.

• Magnetic Field and Current Interaction:

• The interaction between the magnetic field and current is the basis of many electromechanical devices.

• The magnitude of the force can be calculated using the formula F = I × L × B × sin(θ), where I is the current, L is the length of the conductor, B is the magnetic field strength, and θ is the angle between the conductor and the magnetic field.

Important Points

• Option 1: Remains the Same: This is incorrect because reversing the current changes the direction of the force, not leaving it unchanged.

• Option 2: Doubles: This is incorrect as the magnitude of the force remains the same; only the direction changes.

• Option 3: Reverses Direction: This is the correct answer as reversing the current causes the force to act in the opposite direction.

• Option 4: Becomes Zero: This is incorrect because the force only becomes zero if the conductor is parallel to the magnetic field, which is not stated in the question.

Q12. Answer: (d) copper sulphate

The correct answer is copper sulphate.

Key Points

• Copper sulphate is the most commonly used electrolyte in the process of electrolytic refining of copper. It is used in a solution form, typically acidified with sulphuric acid (H2SO4).

• In electrolytic refining, the impure copper acts as the anode, a pure thin sheet of copper serves as the cathode, and the electrolyte is an aqueous solution of copper sulphate mixed with sulphuric acid.

• During the process, copper ions from the impure copper anode dissolve into the solution and then deposit onto the pure copper cathode, leaving impurities behind. This ensures the production of highly pure copper.

• The use of copper sulphate ensures a stable supply of Cu^{2}^+ ions in the electrolyte, which is crucial for the efficiency of the refining process.

• Other copper compounds like copper oxide, copper carbonate, or copper chloride are not suitable because they do not provide the required ionic stability or are not commonly used in industrial refining processes.

Additional Information

• Electrolytic Refining Process:

• This process is widely used for obtaining metals of high purity, such as copper, silver, gold, and aluminum.

• In the case of copper, the impurities like iron, nickel, and zinc are dissolved into the electrolyte, while noble metals like gold and silver settle at the bottom as anode mud.

• The chemical reaction involved is: Anode: Cu → Cu²^+ + 2e^- Cathode: Cu²^+ + 2e^- → Cu

• Properties of Copper Sulphate:

• Chemical formula: CuSO4·5H2O (pentahydrate form is most commonly used).

• It is a blue crystalline solid that is highly soluble in water.

• Copper sulphate provides a steady source of Cu²^+ ions necessary for the electrolytic refining process.

• Why Acidified Copper Sulphate?

• Adding sulphuric acid (H2SO4) to the electrolyte improves the conductivity of the solution and stabilizes copper ions in the solution.

• It prevents hydrolysis of copper sulphate and ensures an efficient refining process.

• Industrial Applications of Electrolytic Copper:

• Pure electrolytic copper is used in manufacturing electrical wires, electronic components, and high-quality alloys due to its excellent conductivity.

• It is also used in plumbing, roofing, and industrial machinery.

• Characteristics of Other Copper Compounds:

• Copper Carbonate: Insoluble in water, not suitable for providing Cu²^+ ions.

• Copper Oxide: Requires additional reactions to dissolve in water, making it inefficient.

• Copper Chloride: Though soluble, it is not commonly used due to cost and stability issues in the refining process.

Important Points

• The purity of copper obtained through electrolytic refining can reach up to 99.99%, making it suitable for critical applications.

• The anode mud collected during the refining process often contains valuable metals like gold, silver, and platinum, which can be recovered.

• Electrolytic refining is a highly controlled process that ensures minimal wastage of copper and other by-products.

• Copper's high conductivity makes its purity critical for industries like electronics and electrical engineering.

Q13. Answer: (d) The force of attraction is different for different particles.

The correct answer is The force of attraction is different for different particles..

Key Points

• The force of attraction between particles of matter varies depending on the state of matter (solid, liquid, or gas). This directly supports the statement that the force of attraction is different for different particles.

• In solids, particles are tightly packed, and the force of attraction is the strongest. This is why solids maintain a fixed shape and volume.

• In liquids, the force of attraction is weaker compared to solids, allowing particles to flow and take the shape of their container, while still maintaining a definite volume.

• In gases, the force of attraction is the weakest, as particles are far apart and move freely. Gases neither have a fixed shape nor a fixed volume.

• The variation in the force of attraction between particles is the reason for the different physical properties of solids, liquids, and gases.

Additional Information

• Solids:

• In solids, particles are held together by strong intermolecular forces.

• This strong attraction leads to a definite shape and volume.

• Examples: Iron, wood, diamond.

• Liquids:

• In liquids, particles have a moderate force of attraction.

• Liquids do not have a fixed shape but have a definite volume.

• Examples: Water, oil, alcohol.

• Gases:

• In gases, particles are held together by very weak intermolecular forces.

• They neither have a definite shape nor a definite volume, and they expand to fill any container.

• Examples: Oxygen, nitrogen, carbon dioxide.

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• Plasma:
• A state of matter where particles are ionized, and the force of attraction is negligible.
• Examples: Sun, lightning.
• Bose-Einstein Condensate (BEC):
• A state of matter formed at extremely low temperatures, where particles exhibit unique quantum properties.
• It was first observed in 1995 by scientists Eric Cornell and Carl Wieman.

Important Points

• Intermolecular Forces: These are forces of attraction or repulsion between neighboring particles, including Van der Waals forces, dipole-dipole interactions, hydrogen bonds, and others.
• Thermal Energy: The energy associated with the movement of particles. Higher thermal energy reduces the effect of intermolecular forces, allowing particles to move more freely.
• Phase Transition: Changes in state (e.g., solid to liquid, liquid to gas) occur due to variations in temperature and pressure, which alter the balance between intermolecular forces and thermal energy.
• Applications: Understanding the force of attraction helps in designing materials, studying fluid dynamics, and even predicting weather patterns.

Q14. Answer: (b) Only (i)

The correct answer is Only (i).

Key Points

• Statement (i): "Fluids exert pressure on the base and walls of the container in which they are enclosed" is correct.
• Fluids, which include liquids and gases, exert pressure due to the random motion of their molecules.
• This pressure acts in all directions, including on the base and walls of any container they occupy.
• For example, water in a glass exerts pressure on the bottom and walls due to its weight and molecular motion.
• Statement (ii): "Pressure exerted in any confined mass of fluid is transmitted unequally in different directions" is incorrect.
• According to Pascal's Law, the pressure exerted in a confined fluid is transmitted equally in all directions.
• This principle is the basis for hydraulic systems, where a small force applied to a fluid results in an equal pressure transmitted to all parts of the system.
• The statement contradicts this fundamental principle, making it incorrect.

Additional Information

• Pascal's Law:
• It states that when a pressure is applied to a confined fluid, it is transmitted undiminished in all directions.
• This principle is widely used in hydraulic systems like hydraulic brakes, jacks, and presses.
• Fluid Pressure:
• It is defined as the force exerted by a fluid per unit area.
• The formula for pressure is P = F/A, where P is pressure, F is force, and A is area.
• Fluid pressure increases with depth due to the weight of the fluid above.
• Applications of Fluid Pressure:
• Hydraulic systems: Utilize fluid pressure to perform tasks, such as lifting heavy objects.
• Dams: Designed to withstand water pressure that increases with depth.
• Scuba diving: Divers experience higher pressure at greater depths due to the weight of water above them.
• Difference Between Liquid and Gas Pressure:
• Liquids: Pressure depends on depth and density, and is exerted only in the downward direction due to gravity.
• Gases: Pressure is exerted equally in all directions due to the random motion of gas molecules.

Important Points

• Key Characteristics of Fluid Pressure:
• It is scalar in nature, meaning it has magnitude but no specific direction.
• Pressure in a fluid at rest is the same at any given depth, regardless of the container shape.
• In a moving fluid, pressure varies with velocity (as per Bernoulli’s principle).
• Hydraulics: The science of transmitting force through liquids, based on Pascal's Law, is crucial in engineering and mechanical applications.
• Practical Examples:
• Car brakes, which use hydraulic fluid to transmit pressure from the pedal to the brake pads.
• Hydraulic lifts for elevating vehicles in workshops.

Q15. Answer: (c) Neuron

The correct answer is Neuron.

Key Points

• Neuron is a specialized cell in the nervous system that transmits information via electrical and chemical signals. It is the correct answer because it has dendrites on one end.

• Dendrites are branch-like structures present in neurons. Their primary function is to receive signals (electrical impulses) from other neurons and transmit them towards the cell body.

• Neurons are the structural and functional units of the nervous system. They are responsible for processing and transmitting information throughout the body.

• In contrast, the other options like monocytes, platelets, and red blood cells do not possess dendrites and are involved in completely different biological functions.

• Neurons have three main parts: dendrites, a cell body (soma), and an axon. Dendrites are specifically involved in receiving input signals.

Additional Information

• Monocyte:

• Monocytes are a type of white blood cell (WBC) and part of the immune system.

• They are primarily involved in engulfing pathogens and debris through a process called phagocytosis.

• Unlike neurons, they lack dendrites and are not involved in signal transmission.

• Platelet:

• Platelets, also known as thrombocytes, are small, disc-shaped cell fragments in the blood.

• They play a crucial role in blood clotting and preventing excessive bleeding.

• Platelets do not have a nucleus, dendrites, or any structures related to nerve signaling.

• Red Blood Cell (RBC):

• RBCs are responsible for transporting oxygen from the lungs to the tissues and carbon dioxide from the tissues to the lungs.

• They contain a protein called hemoglobin, which binds to oxygen molecules.

• RBCs lack a nucleus and other organelles, including dendrites.

• Neuron:

• Neurons are classified into three types based on their function: sensory neurons (carry signals to the brain), motor neurons (carry signals from the brain), and interneurons (connect neurons within the brain or spinal cord).

• The presence of dendrites allows neurons to integrate and process incoming information from other neurons or sensory inputs.

• The axon transmits the processed signal away from the cell body to other neurons, muscles, or glands.

Important Points

• Synapse: A synapse is the junction between two neurons where the axon terminal of one neuron communicates with the dendrites of another neuron through chemical signals.

• Signal Transmission: Neurons communicate via action potentials (electrical signals) and neurotransmitters (chemical signals).

• Nervous System: Neurons form the foundation of the nervous system, which is divided into the central nervous system (CNS) and the peripheral nervous system (PNS).

• Diseases: Disorders like Alzheimer's disease, Parkinson's disease, and multiple sclerosis affect neurons and disrupt their functioning.

• Research: Neurons are a major focus of research in neurobiology and neuroscience due to their critical role in controlling bodily functions and behavior.

Q16. Answer: (a) Insoluble in water

The correct answer is Insoluble in water.

Key Points

• Ionic compounds are generally soluble in water: This is due to the polar nature of water molecules. The positive and negative ions in ionic compounds are attracted to the oppositely charged ends of water molecules, leading to their dissolution. Hence, the statement "Insoluble in water" is incorrect.

• High melting and boiling points: Ionic compounds have strong electrostatic forces of attraction between their oppositely charged ions, requiring a large amount of energy to break. Hence, statements "High melting point" and "High boiling point" are correct.

• Conductivity in molten state: Ionic compounds conduct electricity in the molten state or when dissolved in water because their ions become free to move. Hence, the statement "Conducts electricity in molten state" is correct.

Additional Information

• Physical Properties of Ionic Compounds:

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• Solubility: Ionic compounds are typically soluble in polar solvents like water but insoluble in non-polar solvents like benzene or ether.

• Conductivity: In solid-state, ionic compounds do not conduct electricity due to fixed ions. In the molten state or aqueous solution, ions move freely, allowing conductivity.

• Melting and Boiling Points: Strong ionic bonds result in high melting and boiling points for ionic compounds.

• Hardness: Ionic compounds are generally hard due to the strong forces holding the ions together. However, they are brittle and can shatter under pressure.

• Examples of Ionic Compounds:

• Sodium chloride (NaCl): Common table salt, soluble in water and has a high melting point of 801°C.

• Magnesium oxide (MgO): Widely used in refractory materials, it has a melting point above 2800°C.

• Calcium chloride (CaCl2): Used as a de-icing agent, it dissolves readily in water.

• Importance of Ionic Compounds:

• Industrial Applications: Used in batteries, ceramics, and electrolysis processes.

• Biological Significance: Ionic compounds like Na^+ and K^+ are essential for nerve impulse transmission and muscle contraction in living organisms.

Important Points

• Factors Affecting Solubility of Ionic Compounds:

• Lattice Energy: Higher lattice energy makes it harder for the ionic compound to dissolve in water.

• Hydration Energy: If the hydration energy of ions is greater than the lattice energy, the compound dissolves easily.

• Why Ionic Compounds are Brittle:

• When a force is applied, the layers of ions shift, causing like charges to align and repel each other, leading to shattering.

• Applications of Ionic Compounds:

• Sodium chloride: Used in food preservation and seasoning.

• Calcium carbonate: Utilized in construction (limestone and marble).

• Magnesium sulfate: Commonly known as Epsom salt, used in medicine and agriculture.

Q17. Answer: (c) myopia

The correct answer is Myopia.

Key Points

• Myopia, also known as nearsightedness, is a common vision defect in which a person can see nearby objects clearly but struggles to see distant objects clearly.

• This occurs when the light rays converge in front of the retina rather than directly on it. This happens due to an elongated eyeball or an overly curved cornea.

• Myopia is commonly corrected using concave lenses (minus power lenses), which help focus the light directly on the retina.

• The condition is often hereditary and can appear in childhood, typically progressing until the late teens or early twenties.

• Symptoms include blurry distance vision, squinting, eye strain, and sometimes headaches. Regular eye exams can help detect and manage myopia effectively.

Additional Information

• Astigmatism:

• Astigmatism is a vision defect caused by an irregularly shaped cornea or lens, leading to blurred or distorted vision at all distances.

• This condition is often corrected using cylindrical lenses or through procedures like LASIK surgery.

• Presbyopia:

• Presbyopia is an age-related condition that makes it difficult to focus on nearby objects.

• It typically occurs after the age of 40 years due to the loss of elasticity in the eye's lens.

• This condition is corrected using bifocal or progressive lenses.

• Hypermetropia:

• Also known as farsightedness, hypermetropia is a condition where distant objects appear clear but nearby objects are blurry.

• It occurs when the eyeball is too short or the cornea has too little curvature, causing light rays to focus behind the retina.

• This condition is corrected using convex lenses.

• Important Points:

• Myopia is one of the most common refractive errors worldwide, with increasing prevalence due to factors like excessive screen time and reduced outdoor activities.

• Severe or high myopia can lead to complications such as retinal detachment, glaucoma, or macular degeneration.

• Preventive measures include maintaining proper lighting while reading, taking regular breaks from screens, and encouraging outdoor play for children.

• Modern corrective options include orthokeratology (special contact lenses), refractive surgery, and advanced spectacle designs.

Q18. Answer: (d) Ca(ClO)2

The correct answer is Ca(ClO)2.

Key Points

• The chemical formula of bleaching powder is CaOCl2, which is also known as calcium oxychloride.

• Bleaching powder is prepared by passing chlorine gas (Cl2) over dry slaked lime (Ca(OH)2).

• The chemical reaction involved in the preparation of bleaching powder is: Ca(OH)2 + Cl2 → Ca(ClO)2 + H2O.

• Bleaching powder is commonly used as a disinfectant, oxidising agent, and for bleaching cotton, linen, and paper pulp.

• It releases chlorine when mixed with water, which provides its bleaching and germicidal properties.

Additional Information

• Bleaching Powder:

• Bleaching powder is an inorganic compound with the chemical name calcium oxychloride.

• It is a white powder with a characteristic smell of chlorine.

• It is generally represented by the formula Ca(ClO)2.

• Preparation of Bleaching Powder:

• It is manufactured by the action of chlorine gas on dry slaked lime.

• The process is carried out in a Hasenclever plant for industrial production.

• The reaction produces bleaching powder along with water.

• Uses of Bleaching Powder:

• It is used for disinfection of drinking water due to its chlorine-releasing property.

• It is used in the textile industry for bleaching cotton and linen.

• It is also used for bleaching wood pulp in the paper industry.

• Important Chemical Compounds:

• Calcium hydroxide (Ca(OH)2): Commonly known as slaked lime.

• Calcium oxide (CaO): Known as quicklime.

• Calcium carbonate (CaCO3): Found in materials like limestone and marble.

Important Points

• Chemical name: Calcium oxychloride.

• Chemical formula: Ca(ClO)2.

• Prepared by: Reaction of chlorine gas with dry slaked lime.

• Main active component: Chlorine, responsible for bleaching and disinfecting action.

• Major applications: Water purification, textile bleaching, paper industry, and sanitation.

Q19. Answer: (b) Blue-green algae

The correct answer is Blue-green algae.

Key Points

• Blue-green algae, also known as cyanobacteria, reproduce asexually through a process called binary fission. This is a simple and efficient method of reproduction where a single cell divides into two identical daughter cells.

• In fission, the genetic material (DNA) of the parent cell is copied, and the cell divides into two, ensuring that both daughter cells are genetically identical to the parent cell.

• Cyanobacteria are prokaryotic organisms, meaning they lack a defined nucleus and other membrane-bound organelles, which facilitates their simpler mode of reproduction.

• These organisms are found in diverse environments, including freshwater, marine, and terrestrial ecosystems. They play a crucial role in ecosystems by contributing to nitrogen fixation and oxygen production.

• Unlike seed plants and flowering plants, which reproduce sexually, blue-green algae rely on asexual reproduction for their propagation. Hence, the correct answer is Blue-green algae.

Additional Information

• Asexual Reproduction:

• Asexual reproduction is a mode of reproduction where offspring are produced from a single organism, and there is no

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involvement of gametes or sexual processes.

• It is commonly observed in prokaryotes like bacteria and archaea, as well as in some eukaryotic organisms like fungi, algae, and certain plants and animals.

• Common methods of asexual reproduction include binary fission, budding, fragmentation, and spore formation.

• Characteristics of Blue-Green Algae (Cyanobacteria):

• Cyanobacteria are a group of photosynthetic prokaryotes capable of oxygenic photosynthesis, meaning they release oxygen as a byproduct.

• They are considered one of the earliest life forms on Earth and have played a significant role in shaping the planet's atmosphere.

• Examples include Oscillatoria, Anabaena, and Nostoc.

• Some cyanobacteria can fix atmospheric nitrogen into a usable form, which is essential for nutrient cycling in ecosystems.

• Why Other Options Are Incorrect:

• All seed plants: Seed plants reproduce sexually through the formation of seeds, which involve the fusion of gametes. Asexual reproduction is not a characteristic of all seed plants.

• Flowering plants: These plants primarily reproduce sexually through flowers, which are specialized structures for sexual reproduction.

• All plants: While some plants (like algae or mosses) reproduce asexually, not all plants rely on this mode of reproduction. Most higher plants reproduce sexually.

• Importance of Cyanobacteria:

• They are crucial in aquatic and terrestrial ecosystems as primary producers.

• Cyanobacteria contribute significantly to the global nitrogen cycle and are used in biofertilizers to enhance soil fertility.

• They are also studied for their potential in biofuel production and other biotechnological applications.

Important Points

• Binary Fission:

• This is the most common form of asexual reproduction in unicellular organisms.

• It involves the replication of the genetic material, followed by the division of the parent cell into two identical cells.

• Binary fission is rapid and allows for exponential population growth under favorable conditions.

• Differences Between Asexual and Sexual Reproduction:

• Asexual reproduction: Involves a single parent, produces genetically identical offspring, and is faster but lacks genetic diversity.

• Sexual reproduction: Involves two parents, produces genetically diverse offspring, and is slower but enhances adaptability and evolution.

• Ecological Significance of Cyanobacteria:

• Cyanobacteria are crucial in maintaining the balance of oxygen and nutrients in aquatic ecosystems.

• They form symbiotic relationships with plants and fungi, aiding in nutrient exchange and ecosystem stability.

Q20. Answer: (d) Catenation and tetravalency

The correct answer is Catenation and Tetravalency.

Key Points

• Catenation: Carbon exhibits a unique ability to form long chains and rings by bonding with other carbon atoms. This property allows the formation of a wide variety of compounds, ranging from simple hydrocarbons to complex organic molecules. The strong covalent bonds between carbon atoms contribute to the stability of these structures.

• Tetravalency: Carbon has four valence electrons and requires four more electrons to complete its octet. This enables carbon to form four covalent bonds with other atoms (such as hydrogen, oxygen, nitrogen, etc.) or other carbon atoms, giving rise to a wide range of molecular configurations.

• Versatility in Bond Types: Carbon can form single, double, and triple bonds, allowing for diverse chemical structures and reactivities. This versatility enables the creation of functional groups and compounds essential for life, such as carbohydrates, proteins, and nucleic acids.

• Formation of Isomers: Due to its catenation and tetravalency, carbon compounds exhibit isomerism, where molecules with the same molecular formula have different structural arrangements. This adds to the diversity of organic compounds.

• Abundance and Role in Organic Chemistry: Carbon is a fundamental element in organic chemistry and life. Its ability to form a large number of compounds is a cornerstone in the study of chemistry, biology, and materials science.

Additional Information

• Explanation of Catenation:

• Catenation is the property of an element to form bonds with atoms of the same element, creating chains or rings. Carbon is exceptional in this regard due to its ability to form strong covalent bonds.

• This property is most prominent in carbon compared to other elements like silicon or sulfur, enabling the formation of complex

organic molecules.

• Examples of catenation include alkanes (single bonds), alkenes (double bonds), and alkynes (triple bonds).

• Explanation of Tetravalency:

• Carbon's tetravalency arises from its electronic configuration ($2s^2$ $2p^2$), where four valence electrons are available for bonding.

• This allows carbon to bond with up to four other atoms, leading to the formation of stable molecules like methane (CH_4), ethane (C_2H_6), and ethanol (C_2H_5OH).

• Tetravalency enables the creation of diverse molecular geometries, such as linear, planar, and tetrahedral structures.

• Comparison with Other Elements:

• While elements like silicon also exhibit catenation and tetravalency, their bonds are weaker and less stable compared to carbon. This limits their ability to form complex structures.

• Carbon's small atomic size and high electronegativity contribute to the strength of its bonds, making it uniquely suited for forming stable, diverse compounds.

• Applications of Carbon's Properties:

• Carbon's versatility is utilized in the synthesis of polymers, fuels, pharmaceuticals, and biomolecules.

• Its compounds form the basis of life on Earth, including DNA, RNA, and proteins.

• Carbon is also used in materials science to develop substances like graphite, diamond, and carbon nanotubes.

Important Points

• Option Analysis:

• Option 1 (High melting point and ductility): These properties are irrelevant to carbon's versatility. They are more applicable to metals like iron and copper.

• Option 2 (Good conductivity and sonorous nature): These are metallic properties and do not apply to carbon, which is a non-metal.

• Option 3 (Isomerism and allotropy): While these are characteristics of carbon, they are a result of its catenation and tetravalency, not the primary reasons for its versatility.

• Option 4 (Catenation and tetravalency): Correct. These are the two main properties that enable carbon to form a vast number of compounds.

• Examples of Carbon Compounds:

• Simple hydrocarbons: Methane (CH_4), ethane (C_2H_6).

• Complex biomolecules: Glucose ($C_6H_{12}O_6$), DNA, proteins.

• Industrial compounds: Plastics, synthetic fibers, and fuels.

Q21. Answer: (d) To transport the male germ cell to the female germ cell

The correct answer is To transport the male germ cell to the female germ cell.

Key Points

• The pollen tube is a tubular structure that forms after a pollen grain lands on the stigma of a compatible flower.

• Its primary function is to transport the male germ cell (sperm cells) from the pollen grain to the ovule, where the female germ cell (egg cell) resides.

• The pollen tube grows through the style and into the ovary, navigating to the ovule via a specialized opening called the micropyle.

• Once the pollen tube reaches the ovule, it releases the sperm cells, enabling the process of fertilization, where one sperm cell fuses with the egg cell to form a zygote.

• The other sperm cell typically fuses with the central cell to form the endosperm, which provides nourishment to the developing embryo.

Additional Information

• Pollination:

• Pollination is the process of transferring pollen grains from the anther to the stigma of a flower.

• It can occur through various agents like wind, water, insects, or animals.

• The types of pollination include self-pollination (within the same flower or plant) and cross-pollination (between flowers of different plants).

• Fertilization in plants:

• Fertilization occurs when the male and female gametes (germ cells) fuse to form a zygote.

• This process leads to the formation of seeds, which contain the embryo and endosperm for nourishment.

• Structure of the pollen tube:

• The pollen tube is a microscopic, elongated structure that grows directionally, guided by chemical signals from the ovule.

• It has a tip-growing mechanism driven by the cytoskeleton and vesicle trafficking.
• Micropyle:
• The micropyle is a small opening in the ovule through which the pollen tube enters.
• It ensures that the sperm cells from the pollen tube reach the egg cell for fertilization.
• Double fertilization:
• Angiosperms exhibit a unique process called double fertilization.
• One sperm cell fuses with the egg cell to form a zygote, while the other fuses with two polar nuclei to form the endosperm.
• This process ensures both embryo formation and nutrient storage for seed development.

Important Points

• Option 1: To form the zygote
• This is incorrect because the formation of the zygote occurs after the sperm and egg cells fuse, not as a role of the pollen tube.
• Option 2: To produce the male germ cell
• This is incorrect as the male germ cells are already present within the pollen grain, not produced by the pollen tube.
• Option 3: To transport pollen grains to the stigma
• This is incorrect because pollen grains are transported to the stigma by pollination agents, not by the pollen tube.
• Option 4: To transport the male germ cell to the female germ cell
• This is correct because the pollen tube facilitates the movement of sperm cells to the ovule for fertilization.

Q22. Answer: (a) A ball rolling on the ground and eventually stopping

The correct answer is A ball rolling on the ground and eventually stopping.

Key Points

• Unbalanced Force: An unbalanced force occurs when the net force acting on an object is not zero, causing a change in the object's state of motion (either speed, direction, or both).
• Correct Option Explanation: A ball rolling on the ground and eventually stopping involves an unbalanced force because friction acts as an opposing force, slowing down the ball until it comes to rest.
• Frictional Force: The friction between the ball and the ground is the unbalanced force responsible for reducing the ball's motion and eventually bringing it to a stop.
• Newton's First Law: According to Newton's First Law of Motion (Law of Inertia), an object in motion will remain in motion unless acted upon by an external unbalanced force. The rolling ball's motion changes due to the unbalanced frictional force, making the situation fit this law.
• Other Options: In the other scenarios provided (standing person, car moving at uniform speed, book on a table), the forces acting on the objects are balanced, meaning their state of motion remains unchanged. These are not examples of unbalanced forces.

Additional Information

• Balanced Forces:
• Balanced forces occur when the net force acting on an object is zero, meaning no change in the object's motion occurs.
• Examples include a person standing still on the ground (gravity and normal force cancel each other out) or a book resting on a table.
• Unbalanced Forces:
• Unbalanced forces result in a net force on an object, leading to a change in its motion (acceleration or deceleration).
• Examples include a rolling ball slowing down due to friction or a car accelerating forward when a greater force is applied by the engine than the opposing frictional forces.
• Friction:
• Friction is a force that opposes the relative motion of two surfaces in contact.
• It is a critical factor in real-world scenarios, as it often acts as the unbalanced force responsible for changes in motion.
• Newton's Laws of Motion:
• First Law: An object remains at rest or in uniform motion unless acted upon by an unbalanced external force.
• Second Law: The force acting on an object is equal to the mass of the object multiplied by its acceleration (F = ma).
• Third Law: For every action, there is an equal and opposite reaction.

Important Points

• Friction and Motion: Friction is essential for activities such as walking or driving, as it provides the necessary grip for movement. However, it also opposes motion, requiring additional force to maintain movement.
• Types of Friction:
• Static Friction: Acts on objects at rest, preventing them from starting to move.

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• Kinetic Friction: Acts on moving objects, opposing their motion.

• Rolling Friction: Specific to rolling objects, like a ball or wheel, and typically lower than sliding friction.

• Applications: Understanding unbalanced forces is crucial in designing vehicles, machines, and other systems where motion control is essential.

• Real-Life Example: A bicycle slowing down when the rider stops pedaling is another instance of an unbalanced force (friction and air resistance) acting to reduce motion.

Q23. Answer: (c) Approval given to a contractor to fell trees near the village

The correct answer is Approval given to a contractor to fell trees near the village.

Key Points

• The Chipko Movement, a historic environmental movement in India, began in the village of Reni in the Garhwal Himalayas of Uttarakhand in 1973.

• The movement was triggered when the government approved a contract to a sports goods company to fell trees in the forests near the village of Reni.

• When the men of the village were away, the women of Reni, led by Gaura Devi, organized themselves to protect the trees by physically hugging them, preventing the contractors from cutting them down.

• This act of hugging the trees, symbolizing a non-violent protest, drew significant attention to the environmental degradation caused by deforestation and highlighted the need for sustainable forest management.

• The Chipko Movement is considered one of the earliest and most successful environmental movements in India and inspired similar movements across the country.

Additional Information

• Background of the Chipko Movement:

• The term "Chipko" means "to hug" or "to cling" in Hindi, symbolizing the way villagers physically embraced the trees to protect them.

• The movement emerged as a response to commercial logging activities in the Himalayan region, which were causing significant environmental issues like soil erosion and loss of biodiversity.

• The movement was deeply rooted in the philosophy of Gandhian non-violence and emphasized the importance of community-driven conservation efforts.

• Role of Women:

• Women played a pivotal role in the Chipko Movement, as they were directly dependent on the forests for their livelihood, including firewood, fodder, and water.

• Gaura Devi, a local leader, mobilized the women of her village to stand against the contractors, making the movement a significant example of women's empowerment and environmental activism.

• Impact of the Movement:

• The Chipko Movement led to increased awareness about the importance of forests and the need for their conservation.

• In 1980, the Indian government imposed a 15-year ban on commercial logging in the Himalayan forests, largely due to the movement's influence.

• It also inspired other environmental movements in India, such as the Appiko Movement in Karnataka.

• Relevance Today:

• The Chipko Movement remains a symbol of grassroots environmental activism and the power of community action in addressing ecological issues.

• It highlights the interconnectedness between local communities and their natural environment, emphasizing the need for sustainable development practices.

Important Points

• Other Options Explained:

• Sale of forest by local residents: This was not the cause of the Chipko Movement; the issue arose due to government-approved commercial deforestation.

• Industrial development planned by villagers: There was no such industrial development planned by the villagers that led to the movement.

• Government decision to use forest land for farming: The movement was not against converting forest land for farming but was specifically against commercial logging.

• Key Figures:

• Sunderlal Bahuguna: A prominent environmentalist associated with the Chipko Movement who advocated for the conservation of forests.

• Chandi Prasad Bhatt: A key leader and founder of the Dasholi Gram Swarajya Sangh, which played a crucial role in organizing

the movement.

Q24. Answer: (a) Right-hand thumb rule gives the direction of magnetic field around a straight conductor.

The correct answer is Right-hand thumb rule gives the direction of magnetic field around a straight conductor..

Key Points

• Right-hand thumb rule: This rule is used to determine the direction of the magnetic field around a current-carrying conductor. If the thumb of the right hand points in the direction of the current, the curled fingers show the direction of the magnetic field lines. This statement is correct.

• Application to circular loops: The right-hand thumb rule is applicable to circular loops as well. Here, the thumb points in the direction of the current, and the fingers show the direction of the magnetic field along the circular path. Hence, the claim that it cannot be applied to circular loops is incorrect.

• Application to straight conductors: The rule is specifically meant for straight conductors, making the claim that it cannot be applied to straight conductors incorrect.

• Finding force on a conductor: The right-hand thumb rule is not used to determine the force on a conductor. Instead, the Fleming's left-hand rule is applied for this purpose. Hence, this statement is incorrect.

• Correct statement: The right-hand thumb rule accurately gives the direction of the magnetic field around a straight current-carrying conductor. This is a fundamental concept in electromagnetism. Hence, option 1 is correct.

Additional Information

• Right-hand thumb rule:

• The rule was introduced to understand the relationship between current and magnetic fields in a conductor.

• It states: "If you hold a current-carrying conductor in your right hand such that the thumb points in the direction of the current, the direction of your curled fingers will indicate the direction of the magnetic field lines."

• This rule is derived from Maxwell's right-hand grip rule.

• Magnetic field around a conductor:

• When current flows through a conductor, it generates a magnetic field around it.

• The field lines form concentric circles around the conductor, and their direction is determined using the right-hand thumb rule.

• Fleming's left-hand rule:

• This rule is used to determine the direction of force on a current-carrying conductor in a magnetic field.

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

• The thumb points in the direction of force (motion).

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

• The middle finger points in the direction of the current.

• Applications:

• The right-hand thumb rule is widely used in designing electrical devices like motors, generators, and transformers.

• It helps engineers understand how magnetic fields interact with electric currents to produce motion or induce current.

Important Points

• Hans Christian Ørsted: The discovery of the magnetic effect of electric current was made by Hans Christian Ørsted in 1820. This discovery formed the basis of electromagnetism.

• Magnetic field strength: The strength of the magnetic field generated by a current-carrying conductor depends on:

• The amount of current flowing through the conductor.

• The distance from the conductor; the field weakens as the distance increases.

• Practical examples: The right-hand thumb rule is applied in understanding the functioning of solenoids, electromagnets, and electric motors.

• Conceptual difference: While the right-hand thumb rule is used to determine the magnetic field direction, the Fleming's left-hand rule is used to determine force direction, and the Fleming's right-hand rule is used to find the direction of induced current.

Q25. Answer: (d) Increase in humidity

The correct answer is Increase in humidity.

Key Points

• Evaporation is the process through which a liquid changes into a gas at a temperature below its boiling point.

• Evaporation is influenced by several factors such as temperature, surface area, wind speed, and humidity.

• Increase in temperature: Higher temperatures provide more energy to liquid molecules, making it easier for them to escape into the gaseous phase. Hence, this statement is correct.

• Increase in surface area: A larger surface area allows more liquid to be exposed to the air, facilitating faster evaporation. Hence,

this statement is correct.

• Increase in wind speed: Faster winds remove water vapor from the surface, reducing humidity near the liquid and enhancing evaporation. Hence, this statement is correct.

• Increase in humidity: Higher humidity means more water vapor is already present in the air, making it harder for additional liquid to evaporate. Hence, this statement is incorrect.

Additional Information

• Evaporation and its Importance:

• Evaporation plays a key role in the water cycle, contributing to cloud formation and precipitation.

• It is also critical in cooling mechanisms such as sweating, which helps regulate body temperature.

• Factors Affecting Evaporation:

• Temperature: Higher temperatures increase molecular kinetic energy, leading to faster evaporation.

• Surface Area: A larger surface area provides more opportunities for molecules to escape into the air.

• Wind Speed: Wind removes saturated air near the liquid's surface, increasing the evaporation rate.

• Humidity: Higher humidity slows evaporation as the air is already saturated with water vapor.

• Applications of Evaporation:

• Used in industries such as salt production through seawater evaporation.

• Evaporation helps in cooling systems like air coolers and refrigeration.

• Real-World Examples:

• Clothes dry faster in dry and windy weather due to faster evaporation.

• Evaporation from oceans and lakes contributes to the formation of rain clouds.

Important Points

• Evaporation vs Boiling:

• Evaporation occurs at any temperature below the boiling point and only at the surface of the liquid.

• Boiling occurs at a fixed temperature (boiling point) and throughout the liquid.

• Role of Humidity:

• High humidity: Reduces the evaporation rate because the air is nearly saturated with water vapor.

• Low humidity: Increases evaporation since the air can absorb more water vapor.

• Scientific Insight: Evaporation is an endothermic process, meaning it absorbs heat from the surroundings, resulting in a cooling effect.

Q26. Answer: (a) 119.7%

Shortcut Trick

Ratio of Surface Areas = 100 : 169

Ratio of Radii = $\sqrt{100} : \sqrt{169} = 10 : 13$

Ratio of Volumes = $10^3 : 13^3 = 1000 : 2197$

Percentage increase in volume = $((2197 - 1000) \div 1000) \times 100 = 119.7\%$

Therefore The correct answer is 119.7%.

Alternate Method

Given:

Increase in surface area of the sphere = 69%

Formula Used:

Surface Area of a sphere (A) = $4 \times \pi \times r^2$

Volume of a sphere (V) = $(4/3) \times \pi \times r^3$

Calculations:

=> Let the initial radius be r1 and the new radius be r2.

=> Initial Surface Area (A1) = $4\pi r1^2$

=> New Surface Area (A2) = A1 × (100 + 69)/100 = 1.69 A1

=> $4\pi r2^2 = 1.69 \times 4\pi r1^2$

=> $(r2/r1)^2 = 1.69$

=> $r2/r1 = \sqrt{1.69} = 1.3$

=> Ratio of volumes (V2/V1) = $(r2/r1)^3 = (1.3)^3 = 2.197$

=> Percentage increase in volume = (V2/V1 − 1) × 100

=> Percentage increase = (2.197 − 1) × 100 = 119.7%

Therefore The correct answer is 119.7%.

Additional Information

Properties of a Sphere

For a sphere of radius r, the Surface Area is $4\pi r^2$ and the Volume is $(4/3)\pi r^3$.

Hemisphere Formulas

For a hemisphere, Curved Surface Area (CSA) = $2\pi r^2$, Total Surface Area (TSA) = $3\pi r^2$, and Volume = $(2/3)\pi r^3$.

Relationship between Ratios

If the radius changes by a factor k, the area changes by k^2 and the volume changes by k^3.

Q27. Answer: (d) 96

Given:

(57.6 ÷ 4.5 × 1.5) = ? × 1/5

Formula Used:

Basic arithmetic operations

Calculation:

(57.6 ÷ 4.5 × 1.5) = ? × 1/5

=> 12.8 × 1.5 = ? × 1/5

=> 19.2 = ? × 1/5

=> ? = 19.2 × 5

=> ? = 96

Therefore The correct answer is 96.

Q28. Answer: (c) 15.04%

Shortcut Trick

Relation between Marked Price (MP) and Cost Price (CP): MP/CP = (100 + Profit%)/(100 − Discount%)

Given: MP is 33% above CP => MP/CP = 133/100

Formula: 133/100 = (100 + 13)/(100 − d)

133/100 = 113/(100 − d) => 100 − d = 11300/133 ≈ 84.962

d = 100 − 84.962 = 15.038% ≈ 15.04%

Therefore The correct answer is 15.04%.

Alternate Method

Given: Marked Price (MP) = ???415, Markup Percentage = 33%, Profit Percentage = 13%.

Formula Used: CP = MP ÷ (1 + Markup%); SP = CP × (1 + Profit%); Discount% = (MP − SP) ÷ MP × 100.

=> Let Cost Price (CP) = 100 units

=> Marked Price (MP) = 100 + 33% of 100 = 133 units

=> Selling Price (SP) = 100 + 13% of 100 = 113 units

=> Discount = MP − SP = 133 − 113 = 20 units

=> Discount Percentage = (Discount ÷ MP) × 100

=> Discount Percentage = (20 ÷ 133) × 100 = 2000 ÷ 133

=> Discount Percentage ≈ 15.03759...

Therefore The correct answer is 15.04%.

Additional Information

Markup Percentage

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

MP and CP Relationship

The direct ratio is MP/CP = (100 + P%)/(100 − D%). This eliminates the need to calculate the actual Selling Price.

Successive Percentage Change

Markup and Discount act as successive changes to reach the Profit/Loss percentage: Profit% = Markup% − Discount% − (Markup × Discount)/100.

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Q29. Answer: (a) x - y = 3

Shortcut Trick

In Set 1 {1, 7, 3, 7, 3, x}, 3 and 7 appear twice, so the mode is 3 (if x = 3) or 7 (if x = 7).

In Set 2 {4, 8, 9, 8, 4, y}, 4 and 8 appear twice, so the mode is 4 (if y = 4) or 8 (if y = 8).

Possible sums for 11 are (3 + 8) or (7 + 4). Given x > y, we choose x = 7 and y = 4.

The relation is 7 − 4 = 3, which means x − y = 3.

Therefore The correct answer is x − y = 3.

Alternate Method

Given: Data sets A = {1, 7, 3, 7, 3, x} and B = {4, 8, 9, 8, 4, y}. Sum of modes = 11 and x > y.

Concept: The mode is the value that appears most frequently in a data set. For a unique mode to exist in these sets, x and y must repeat an existing value.

=> For Set 1, if x = 7, then 7 appears 3 times Therefore Mode1 = 7.

=> For Set 1, if x = 3, then 3 appears 3 times Therefore Mode1 = 3.

=> For Set 2, if y = 4, then 4 appears 3 times Therefore Mode2 = 4.

=> For Set 2, if y = 8, then 8 appears 3 times Therefore Mode2 = 8.

=> Sum of modes = 11 => Possible combinations: (3 + 8) or (7 + 4).

=> Case 1: x = 3, y = 8. Here 3 < 8, so x < y (Violates x > y).

=> Case 2: x = 7, y = 4. Here 7 > 4, so x > y (Satisfies condition).

=> Finding relation: x − y = 7 − 4 = 3.

Therefore The correct answer is x − y = 3.

Additional Information

Mode Definition

The value that occurs with the maximum frequency in a data set. A set can be unimodal, bimodal, or multimodal.

Empirical Relationship

For moderately skewed distributions: Mode = 3 × Median − 2 × Mean.

Bimodal Data

A dataset is bimodal if two different values share the highest frequency. In this problem, x and y were needed to create a unique majority frequency.

Q30. Answer: (a) 19.04%

Shortcut Trick

Use the Successive Percentage formula: Net Change = a + b + (ab/100)

Here, Markup (a) = +76% and Discount (b) = −54%.

Net Change = 76 − 54 + (76 × (−54) / 100) = 22 − 41.04 = −19.04%.

Negative sign indicates a loss.

Therefore The correct answer is 19.04%.

Alternate Method

Given: Markup % = 76%, Discount % = 54%.

Formula: SP = CP × (100 + Markup%)/100 × (100 − Discount%)/100

=> Let Cost Price (CP) = 100

=> Marked Price (MP) = 100 + 76% of 100 = 176

=> Selling Price (SP) = 176 − 54% of 176

=> SP = 176 × (46/100) = 80.96

=> Loss = CP − SP = 100 − 80.96 = 19.04

=> Loss % = (19.04 / 100) × 100 = 19.04%

Therefore The correct answer is 19.04%.

Additional Information

Markup and Discount relation

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

Successive Percentage Change

If a value is changed by x% and then by y%, the net effective change is (x + y + xy/100)%.

Loss Percentage

Loss % = (Loss / CP) × 100, where Loss = CP − SP.

Q31. Answer: (d) 6006

Shortcut Trick

The LCM of 7, 11, and 13 is 7 × 11 × 13 = 1001.

Any number divisible by 7, 11, and 13 must be a multiple of 1001.

Checking options: 1001 × 6 = 6006.

Therefore The correct answer is 6006.

Alternate Method

Given numbers: 7, 11, 13

Concept: A number divisible by prime numbers 7, 11, and 13 is divisible by their product.

=> Product = 7 × 11 × 13

=> Product = 77 × 13 = 1001

=> Numbers in the form of xyzxyz (like 123123) are always divisible by 1001.

=> Check divisibility of options by 1001:

=> 2121 ÷ 1001 (Not divisible)

=> 3026 ÷ 1001 (Not divisible)

=> 1546 ÷ 1001 (Not divisible)

=> 6006 ÷ 1001 = 6 (Divisible)

Therefore The correct answer is 6006.

Additional Information

Divisibility by 1001

Any 3-digit number written twice to form a 6-digit number (abcabc) is always divisible by 7, 11, and 13 because abcabc = abc × 1001.

Divisibility rule of 11

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

Properties of Prime Numbers

Since 7, 11, and 13 are coprime, their LCM is simply the product of the three numbers.

Q32. Answer: (a) 15

Shortcut Trick

Since PQ = PR = 25 cm, ΔPQR is an isosceles triangle.

The altitude to the base QR bisects it, so half-base = 40 ÷ 2 = 20 cm.

In a right-angled triangle, use the Pythagorean triplet (3, 4, 5).

Scaling by 5: (3×5, 4×5, 5×5) → (15, 20, 25).

Comparing with sides (h, 20, 25), we get Altitude (h) = 15 cm.

Therefore The correct answer is 15 cm.

Alternate Method

Given: PQ = 25 cm, PR = 25 cm, and QR = 40 cm.

Formula Used: In an isosceles triangle, the altitude (h) to the base (b) from the vertex joining equal sides (a) is given by: $h = \sqrt{(a^2 - (b/2)^2)}$.

Let PM be the altitude to QR. Since PQ = PR, M is the midpoint of QR.

=> QM = MR = QR ÷ 2 = 40 ÷ 2 = 20 cm

In right-angled triangle PMQ, by Pythagoras Theorem:

=> $PQ^2 = PM^2 + QM^2$

=> $25^2 = h^2 + 20^2$

=> $625 = h^2 + 400$

=> $h^2 = 625 - 400$

=> $h^2 = 225$

=> $h = \sqrt{225} = 15$ cm

Therefore The correct answer is 15 cm.

Additional Information

Isosceles Triangle Properties

In an isosceles triangle, the altitude to the base is also the median and the angle bisector of the vertex angle.

Area of Isosceles Triangle

The area can be calculated as (1/2) × base × altitude or using $(b/4)\sqrt{(4a^2 - b^2)}$ where 'a' is the equal side.

Pythagorean Theorem

For any right triangle with legs x, y and hypotenuse z, the relation is $x^2 + y^2 = z^2$.

Q33. Answer: (c) 24 minutes

Shortcut Trick

Pipe A empties 1/10 of the tank in 6 min → Full tank empty time = 60 min.

LCM of 60, 30, and 40 = 120 units (Total Capacity).

Efficiency: A = −2 (120/60), B = +4 (120/30), C = +3 (120/40).

Net Efficiency (A + B + C) = −2 + 4 + 3 = 5 units/min.

Total time to fill the empty tank = 120 ÷ 5 = 24 minutes.

Therefore The correct answer is 24 minutes.

Alternate Method

Given:

Initial state: Tank 1/10 full.

Pipe A: Empties 1/10 tank in 6 minutes → Time for full tank = 60 minutes.

Pipe B: Fills tank in 30 minutes.

Pipe C: Fills tank in 40 minutes.

Condition: All pipes opened together after Pipe A empties the initial volume (Tank is now empty).

Formula Used:

Time = Total Capacity ÷ Net Efficiency

Inlet efficiency is positive (+), Outlet efficiency is negative (−).

Calculations:

Person	Days	Total Work	Efficiency
Pipe A (Outlet)	60 min	120 units	−2
Pipe B (Inlet)	30 min	+4	
Pipe C (Inlet)	40 min	+3	

=> Total Capacity = LCM of (60, 30, 40) = 120 units.

=> Efficiency of Pipe A = 120 ÷ 60 = −2 units/min.

=> Efficiency of Pipe B = 120 ÷ 30 = +4 units/min.

=> Efficiency of Pipe C = 120 ÷ 40 = +3 units/min.

=> Combined Efficiency = −2 + 4 + 3 = 5 units/min.

=> Time required to fill 120 units = 120 ÷ 5 = 24 minutes.

Therefore The correct answer is 24 minutes.

Additional Information

Inlet and Outlet Pipes

A pipe used to fill a tank is called an Inlet (positive work), and a pipe used to empty it is called an Outlet (negative work).

Net Rate Formula

If an inlet fills in X hours and an outlet empties in Y hours, then net work in 1 hour = (1/X − 1/Y) if the tank is being filled.

Tank Capacity Calculation

Capacity = (Total time to fill/empty) × (Flow rate of the pipe in volume per unit time).

Q34. Answer: (d) 33.33%

Shortcut Trick

Profit on Selling Price (SP) = 25% = 1/4.

Here, SP = 4 units and Profit = 1 unit.

Cost Price (CP) = SP − Profit = 4 − 1 = 3 units.

Actual Profit % = (Profit / CP) × 100 = (1 / 3) × 100 = 33.33%.

Therefore The correct answer is 33.33%.

Alternate Method
Given: Profit percentage on Selling Price = 25%.
Formula Used: Actual Profit % = (Profit / Cost Price) × 100
=> Let the Selling Price (SP) = Rs. 100.
=> Profit = 25% of 100 = Rs. 25.
=> Cost Price (CP) = SP − Profit = 100 − 25 = Rs. 75.
=> Actual Profit % = (25 / 75) × 100
=> Actual Profit % = (1 / 3) × 100 = 33.33%.
Therefore The correct answer is 33.33%.
Additional Information
Profit on CP vs SP
Standard Profit Percentage is always calculated on Cost Price unless specified otherwise.
Relationship Formula
If Profit on SP is x%, then Profit on CP = [x / (100 − x)] × 100.
Loss on SP
If Loss on SP is x%, then Loss on CP = [x / (100 + x)] × 100.

Q35. Answer: (c) 1932 cm

Shortcut Trick
In a 30°−60°−90° triangle, the ratio of sides is 1 : √3 : 2.
Side opposite to 30° (base) = 1115.4705 cm.
Side opposite to 60° (height) = Base × √3.
Height = 1115.4705 × 1.732 ≈ 1932 cm.
Therefore The correct answer is 1932 cm.
Alternate Method
Given:
Distance of foot of ladder (Base) = 1115.4705 cm
Angle of elevation (θ) = 60°
Formula Used:
tan(θ) = Perpendicular (Height) / Base
Calculations:
=> tan(60°) = Height / 1115.4705
=> √3 = Height / 1115.4705
=> Height = 1115.4705 × 1.73205
=> Height = 1932.050... cm
=> Height ≈ 1932 cm (Rounding to the nearest integer)
Therefore The correct answer is 1932 cm.
Additional Information
Trigonometric Ratios
For a right-angled triangle, sin θ = P/H, cos θ = B/H, and tan θ = P/B.
Special Triangle Ratios
In a 30°−60°−90° triangle, the sides are in the ratio 1 : √3 : 2 respectively.
Pythagoras Theorem
For any right triangle, $H^2 = P^2 + B^2$, where H is the hypotenuse.

Q36. Answer: (a) Rs. 8,228

Shortcut Trick
Successive percentage for 10% for 2 years = 10 + 10 + (10 × 10)/100 = 21%
Total Amount = 100% (Principal) + 21% (Interest) = 121% of Principal
Amount = 6800 × 1.21 = Rs. 8,228
Therefore The correct answer is Rs. 8,228.
Alternate Method

Given:

Principal (P) = Rs. 6,800

Rate (R) = 10% per annum

Time (n) = 2 years

Formula Used:

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

Calculations:

=> $A = 6800 \times (1 + 10/100)^2$

=> $A = 6800 \times (110/100)^2$

=> $A = 6800 \times (1.1) \times (1.1)$

=> $A = 6800 \times 1.21$

=> $A = 8228$

Therefore The correct answer is Rs. 8,228.

Additional Information

Effective Rate for Compound Interest

For 2 years, the effective rate of interest can be calculated using the formula x + y + (xy/100), where x and y are the rates for the first and second years.

Compound Interest (CI) vs Simple Interest (SI)

The difference between CI and SI for 2 years is given by the formula $P(R/100)^2$.

Amount Calculation

Amount is the sum of the Principal and the total Interest earned. A = P + CI.

Q37. Answer: (a) 25

Shortcut Trick

Speed ratio (New : Normal) = 1 : 3

Since distance is constant, Time ratio (New : Normal) = 3 : 1

Difference in time ratio units = 3 − 1 = 2 units

Given, 2 units = 50 minutes => 1 unit = 25 minutes

Therefore The correct answer is 25 minutes.

Alternate Method

Given: New speed = 1/3 × Normal speed; Time delay = 50 minutes.

Formula Used: Distance = Speed × Time. For constant distance, S1T1 = S2T2.

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

=> New speed = S/3 and New time = T + 50

=> $S \times T = (S/3) \times (T + 50)$

=> $3T = T + 50$

=> $2T = 50$

=> T = 25 minutes

Therefore The correct answer is 25 minutes.

Additional Information

Inverse Proportion Rule

When distance is constant, speed and time are inversely proportional (S prop. to 1/T). If speed becomes 1/n, time becomes n times the original.

Average Speed

For a round trip (A to B and B to A) with speeds x and y, Average Speed = 2xy/(x + y).

Relative Speed

Same direction: S1 − S2 | Opposite direction: S1 + S2.

Q38. Answer: (c) Rs. 14,700

Shortcut Trick

Investment Ratio = Profit Ratio

Prakhar's Profit = Rs. 1,400 | Total Profit = Rs. 5,400

Prakhar's Share of Profit = 1,400 / 5,400 = 7 / 27

Prakhar's Investment = (7 / 27) × 56,700 = 7 × 2,100 = Rs. 14,700

Therefore The correct answer is Rs. 14,700.

Alternate Method

Given:

Total Investment = Rs. 56,700

Total Profit = Rs. 5,400

Prakhar's Profit Share = Rs. 1,400

Formula Used:

Profit Share of A / Profit Share of B = (Capital_A × Time_A) / (Capital_B × Time_B)

Calculations:

=> Riya's Profit = Total Profit − Prakhar's Profit

=> Riya's Profit = 5,400 − 1,400 = Rs. 4,000

=> Ratio of Profits (Prakhar : Riya) = 1,400 : 4,000 = 7 : 20

=> Since time period is same, Ratio of Investment = Ratio of Profits = 7 : 20

=> Sum of ratio parts = 7 + 20 = 27 units

=> 27 units = Rs. 56,700

=> 1 unit = 56,700 ÷ 27 = Rs. 2,100

=> Prakhar's Investment = 7 units = 7 × 2,100 = Rs. 14,700

Therefore The correct answer is Rs. 14,700.

Additional Information

Partnership Basic Rule

Profit is always distributed in the ratio of the product of Capital and Time. If time is constant, Profit prop. to Capital.

Active vs Sleeping Partner

An Active Partner manages the business and may receive a salary or extra commission before the remaining profit is divided based on investment ratios.

Compound Partnership

When partners invest for different time periods, the ratio is calculated as (C1×T1) : (C2×T2) : (C3×T3).

Q39. Answer: (a) 720

Given:

180 ÷ A = 11 ÷ 44

Formula Used:

If a ÷ b = c ÷ d, then a × d = b × c

Calculation:

=> 180 × 44 = A × 11

=> 7920 = 11A

=> A = 7920 ÷ 11

=> A = 720

Therefore The correct answer is 720.

Q40. Answer: (d) 30

Shortcut Trick

From 3 Pens = 5 Pencils, the price ratio of Pen : Pencil = 5 : 3.

Total cost for 5 pens and 3 pencils = (5 × 5) + (3 × 3) = 34 units.

Given 34 units = Rs. 34, so 1 unit = Rs. 1.

Required price for 3 pens and 5 pencils = (3 × 5) + (5 × 3) = 30 units.

30 units = 30 × 1 = Rs. 30.

Therefore The correct answer is Rs. 30.

Alternate Method

Given:

Price of 3 Pens (P) = 5 Pencils (L)

Price of 5P + 3L = Rs. 34

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Calculations:
=> Let the price of one pen be P and one pencil be L.
=> From the first condition: 3P = 5L => P = (5/3)L
=> Substitute P in the second equation: 5(5/3)L + 3L = 34
=> (25/3)L + 3L = 34
=> (25L + 9L) / 3 = 34
=> 34L / 3 = 34
=> L = 3
=> Now, substitute L in P = (5/3)L: P = (5/3) × 3 = 5
=> Cost of 3 pens and 5 pencils = 3P + 5L
=> 3(5) + 5(3) = 15 + 15 = 30
Therefore The correct answer is Rs. 30.
Additional Information
Linear Equations in Two Variables
These are equations of the form ax + by = c. They can be solved using substitution, elimination, or cross-multiplication methods.
Ratio and Proportion Method
If mA = nB, then the ratio A : B = n : m. This allows for unit-based calculation which is often faster than algebra.
Unitary Method
Finding the value of a single unit (1 part) first and then multiplying it to find the required quantity.

Q41. Answer: (a) x/5

Given:
(35x³y²z ÷ 7xy^4) ÷ 25xy^(−2)z
Formula Used:
a^m ÷ aⁿ = a^(m−n)
(a ÷ b) ÷ c = a ÷ (b × c)
Calculation:
=> 35 ÷ 7 = 5
=> x³ ÷ x = x²
=> y² ÷ y^4 = y^(−2)
=> Expression becomes = 5x²y^(−2)z ÷ 25xy^(−2)z
=> 5 ÷ 25 = 1 ÷ 5
=> x² ÷ x = x
=> y^(−2) ÷ y^(−2) = y^0 = 1
=> z ÷ z = 1
=> Final value = x ÷ 5
Therefore The correct answer is x ÷ 5.

Q42. Answer: (b) Rs. 83,000

Shortcut Trick
Remaining percentage = 100% − 60% = 40%
40% of salary = Rs. 33,200
100% of salary = (33,200 ÷ 40) × 100
Total Salary = 830 × 100 = Rs. 83,000
Therefore The correct answer is Rs. 83,000.
Alternate Method
Given:
Spending = 60% of monthly salary
Savings (Remaining Amount) = Rs. 33,200
Let the total monthly salary be 'S'.
=> Household expenses = 60% of S = 0.60S
=> Remaining amount = S − 0.60S = 0.40S

=> 0.40S = 33,200

=> S = 33,200 ÷ 0.40

=> S = 3,32,000 ÷ 4

=> S = 83,000

Therefore The correct answer is Rs. 83,000.

Additional Information

Percentage Change Formula

Percentage change = (New Value − Old Value) ÷ Old Value × 100.

Successive Percentage

If a value is changed by a% and then by b%, the net effective change is (a + b + ab/100)%.

Fraction to Percentage Conversion

To convert a fraction to a percentage, multiply by 100. Example: 2/5 = (2/5) × 100 = 40%.

Q43. Answer: (b) 262 m

Shortcut Trick

Speed = Difference in length ÷ Difference in time

=> Speed = (2492 − 1914) ÷ (81 − 64) = 578 ÷ 17 = 34 m/s

=> Length of train = (Speed × Time1) − Tunnel1

=> Length of train = (34 × 81) − 2492 = 2754 − 2492 = 262 m

Therefore The correct answer is 262 m.

Alternate Method

Given: Length of Tunnel1 (L1) = 2492 m, Time1 (T1) = 81 s, Length of Tunnel2 (L2) = 1914 m, Time2 (T2) = 64 s.

Formula Used: Speed = (Length of Train + Length of Object) ÷ Time

=> Let L be the length of the train and V be the speed of the train.

=> Case 1: L + 2492 = V × 81 ... (i)

=> Case 2: L + 1914 = V × 64 ... (ii)

=> Subtracting (ii) from (i): 2492 − 1914 = 81V − 64V

=> 578 = 17V

=> V = 578 ÷ 17 = 34 m/s

=> Putting V in (ii): L + 1914 = 34 × 64

=> L + 1914 = 2176

=> L = 2176 − 1914 = 262 m

Therefore The correct answer is 262 m.

Additional Information

Train Crossing Object with Length

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

Train Crossing Point Object

When a train crosses a pole or a standing man, the distance covered is equal to the length of the train itself.

Speed Conversion

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

Q44. Answer: (d) 3250

Shortcut Trick

Product of fractional values × Number = Result

30% = 3/10 and 50% = 1/2

=> (3/10) × (1/2) × (2/3) × Number = 325

=> (1/10) × Number = 325

Therefore The correct answer is 3250.

Alternate Method

Given: Result = 325, Percentages = 30% and 50%, Fraction = 2/3

Formula Used: Percentage = (Value/100) × Total

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Let the unknown number be x.
=> (30/100) × (50/100) × (2/3) × x = 325
=> (3/10) × (1/2) × (2/3) × x = 325
=> (3 × 1 × 2) / (10 × 2 × 3) × x = 325
=> (6 / 60) × x = 325
=> (1 / 10) × x = 325
=> x = 325 × 10
Therefore The correct answer is 3250.
Additional Information
Percentage to Fraction Conversion
To convert a percentage to a fraction, divide the value by 100. Example: 25% = 25/100 = 1/4.
Successive Percentages
When multiple percentages are applied to a number of each other, they are multiplied directly as fractions or decimals.
Base Change Rule
If a value is increased by x%, to return to the original value, it must be decreased by [x/(100+x)] × 100%.

Q45. Answer: (a) x

Shortcut Trick
Recognize that the numerator $x^2 + 10x + 25$ is a perfect square $(x + 5)^2$.
Divide by the denominator: $(x + 5)^2 \div (x + 5) = (x + 5)$.
Subtract the remaining term: $(x + 5) - 5 = x$.
Therefore The correct answer is x.
Alternate Method
Given: $((x^2 + 10x + 25) / (x + 5)) - 5$
Formula Used: Algebraic Identity $(a + b)^2 = a^2 + 2ab + b^2$
=> Step 1: Factorize the quadratic expression in the numerator.
=> $x^2 + 10x + 25 = x^2 + 2(x)(5) + 5^2 = (x + 5)^2$
=> Step 2: Substitute the factored form back into the original expression.
=> $[(x + 5)^2 / (x + 5)] - 5$
=> Step 3: Simplify by canceling the common factor (x + 5).
=> $(x + 5) - 5$
=> x
Therefore The correct answer is x.
Additional Information
Perfect Square Trinomials
An expression of the form $a^2 \pm 2ab + b^2$ can always be simplified to the square of a binomial $(a \pm b)^2$.
Division of Like Bases
When dividing powers with the same base, subtract the exponents: a^m ÷ a^n = a^(m−n).
BODMAS Rule
Always perform division before subtraction in algebraic simplifications to ensure accuracy.

Q46. Answer: (d) Increase by 43.8%

Shortcut Trick
Ratio of cost TV : Washing Machine = 4 : 3 (since 25% less means 3/4)
Total cost for 8 WM and 4 TV = (8 × 3) + (4 × 4) = 24 + 16 = 40 units
Net change = [(24 × 83) + (16 × −15)] ÷ 40
Net change = [1992 − 240] ÷ 40 = 1752 ÷ 40 = 43.8%
Therefore The correct answer is Increase by 43.8%.
Alternate Method
Let the cost of TV = Rs. 400
=> Cost of Washing Machine (WM) = 400 − 25% of 400 = Rs. 300
=> Initial Total Cost (8 WM + 4 TV) = (8 × 300) + (4 × 400) = 2400 + 1600 = Rs. 4000

=> New cost of WM = 300 + 83% of 300 = 300 + 249 = Rs. 549
=> New cost of TV = 400 − 15% of 400 = 400 − 60 = Rs. 340
=> Final Total Cost = (8 × 549) + (4 × 340) = 4392 + 1360 = Rs. 5752
=> Increase in cost = 5752 − 4000 = Rs. 1752
=> Percentage change = (1752 ÷ 4000) × 100 = 43.8%
Therefore The correct answer is Increase by 43.8%.
Additional Information
Percentage Change
Percentage change = [(Final Value − Initial Value) ÷ Initial Value] × 100.
Weighted Average Method
For mixed quantities, net % change = (n1c1 + n2c2) ÷ (n1 + n2), where n is quantity and c is % change.
Fractional Conversion
Always use fractions for quick calculations: 25% = 1/4, 20% = 1/5, etc.

Q47. Answer: (d) 2288 cm²

Shortcut Trick
Base area = $\pi r^2 = 169\pi$ => radius (r) = 13 cm.
Total Surface Area (TSA) = 2 × Base Area + Curved Surface Area
TSA = $2 \times 169\pi + 2\pi rh = 2\pi r(r + h)$
TSA = $2 \times (22/7) \times 13 \times (13 + 15) = 2 \times (22/7) \times 13 \times 28 = 2288$ cm².
Therefore The correct answer is 2288 cm².
Alternate Method
Given:
Height (h) of the cylinder = 15 cm
Base area = 169π cm²
Formula Used:
1. Area of base = πr^2
2. Total Surface Area (TSA) = $2\pi r(r + h)$
Calculations:
=> $\pi r^2 = 169\pi$
=> $r^2 = 169$
=> $r = \sqrt{169} = 13$ cm
=> Total Surface Area = $2\pi r(r + h)$
=> TSA = $2 \times (22/7) \times 13 \times (13 + 15)$
=> TSA = $2 \times (22/7) \times 13 \times 28$
=> TSA = $2 \times 22 \times 13 \times 4$
=> TSA = 2288 cm²
Therefore The correct answer is 2288 cm².
Additional Information
Curved Surface Area of Cylinder
The area of the side surface of a cylinder is $2\pi rh$, where r is the radius and h is the height.
Volume of Cylinder
The space occupied by a cylinder is calculated as Base Area × Height = $\pi r^2 h$.
Relation with Cone
A cylinder and a cone with the same base and height have a volume ratio of 3 : 1.

Q48. Answer: (b) 173

Shortcut Trick
Mode is defined as the observation that occurs most frequently in a data set.
By inspection of the given heights: 172, 173, 164, 178, 168, 169, 173, 172, 173, 164, 178, 168, 169, 173.
Frequency of 173 = 4 (Maximum occurrence).
Frequency of all other numbers (164, 168, 169, 172, 178) = 2 each.

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Therefore The correct answer is 173 cm.

Alternate Method

Given: A set of 14 observations representing the heights of gymnasts in cm.

Formula: Mode = Value with the highest frequency.

=> Frequency of 164 = 2

=> Frequency of 168 = 2

=> Frequency of 169 = 2

=> Frequency of 172 = 2

=> Frequency of 173 = 4

=> Frequency of 178 = 2

=> Comparing all frequencies, the maximum frequency is 4, which corresponds to the height 173 cm.

Therefore The correct answer is 173 cm.

Additional Information

Empirical Relationship

For a moderately skewed distribution, the relationship between measures of central tendency is: Mode = 3 × Median − 2 × Mean.

Bimodal and Multimodal Data

If two or more values have the same maximum frequency, the data set is called bimodal (two modes) or multimodal.

Median Calculation

To find the Median, arrange data in ascending order. For N observations, if N is even, Median = Average of (N/2)^(th) and (N/2 + 1)^(th) terms.

Q49. Answer: (b) 15

Shortcut Trick

Sum of ages 5 years ago = 50 − (2 × 5) = 40 years.

Ratio of Ankita to Anushree was 3 : 1.

Total ratio parts = 3 + 1 = 4 units → 40 years.

1 unit = 10 years (Anushree's age 5 years ago).

Present age of Anushree = 10 + 5 = 15 years.

Therefore The correct answer is 15 years.

Alternate Method

Given: Sum of ages = 50 years; 5 years ago Ankita = 3 × Anushree.

Let Anushree's present age be x.

Ankita's present age = 50 − x.

5 years ago:

=> (50 − x − 5) = 3 × (x − 5)

=> 45 − x = 3x − 15

=> 4x = 60

=> x = 15

Therefore The correct answer is 15 years.

Additional Information

Age Difference Property

The difference between the ages of two people remains constant regardless of the number of years passed or preceding.

Sum of Ages Change

If there are n people, the sum of their ages increases or decreases by (n × t) years over a period of t years.

Ratio Method for Ages

When ratios at two different times are given, equate the parts by making the difference between ratio terms equal.

Q50. Answer: (a) 20

Shortcut Trick

Combined efficiency of A + B = 10 ÷ 5 = 2 units/day.

Efficiency of B alone = 10 ÷ 10 = 1 unit/day.

Efficiency of A = 2 − 1 = 1 unit/day.

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Total work for A = Double work = 10 × 2 = 20 units.
Time taken by A = 20 ÷ 1 = 20 days.
Therefore The correct answer is 20 days.
Alternate Method
Given:
Time taken by (A + B) = 5 days
Time taken by B = 10 days

Person	Days	Total Work	Efficiency
A + B	5	10	2
B	10	1	

Calculations:
=> Efficiency of A = Efficiency of (A + B) − Efficiency of B
=> Efficiency of A = 2 − 1 = 1 unit/day
=> New Total Work = 2 × Old Total Work
=> New Total Work = 2 × 10 = 20 units
=> Time taken by A alone = New Total Work ÷ Efficiency of A
=> Time taken by A alone = 20 ÷ 1 = 20 days
Therefore The correct answer is 20 days.
Additional Information
Work-Efficiency Relationship
Total Work = Time taken × Efficiency. Efficiency is inversely proportional to time when work is constant.
Combined Work Formula
If two people A and B can do a work in x and y days respectively, then working together they finish it in (x × y) ÷ (x + y) days.
Efficiency Formula for Subtraction
If (A+B) take 't1' days and B takes 't2' days, then A takes (t1 × t2) ÷ (t2 − t1) days for the same work.

Q51. Answer: (d) 800

BODMAS Rule:
Decoding the given information:

Symbol	•	•	×	÷
Meaning	•	×	÷	•

Given equation: 187 − 4 ÷ 117 + 325 × 5 = ?
Now replacing the sign from left to right using BODMAS Rule, we get:
=> 187 × 4 + 117 − 325 ÷ 5 = ?
=> 187 × 4 + 117 − 65 = ?
=> 748 + 117 − 65 = ?
=> 865 − 65 = ?
=> 800 = ?
Hence, the correct answer is "Option 4".

Q52. Answer: (a) sh

Given: In a certain code language, ‘we cook dinner’ is coded as ‘hn sh ai’ and ‘dinner is tasty’ is coded as ‘la tf sh’. How is
Thus, ‘dinner’ is coded as 'sh' in that language.
Hence, the correct answer is "Option 1".

Q53. Answer: (d) KME

The position and positional values or English Alphabets are:
The pattern followed here is:
Each letter-cluster follows the pattern +2, -7.
1. FHA

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This letter-cluster follows the pattern +2, -7.

2. SUN

This letter-cluster follows the pattern +2, -7.

3. PRK

This letter-cluster follows the pattern +2, -7.

4. KME

This letter-cluster does not follow the pattern +2, -7.

Thus, KME is the odd one out.

Hence, the correct answer is "Option 4".

Q54. Answer: (d) 860

Given: 835 836 839 844 851 ?

The logic followed here is:

Thus, 860 should come in place of the question mark (?) in the given series.

Hence, the correct answer is "Option 4".

Q55. Answer: (b) ab

Given: In a certain code language, ‘travel is exciting’ is coded as ‘ab op kj’ and ‘exciting and enjoyable’ is coded as ‘lm ab wv’.

Thus, ‘exciting’ is coded as 'ab' in the given language.

Hence, the correct answer is "Option 2".93

Q56. Answer: (a) 12

BODMAS Rule:

Decoding the given information:

Symbol	•	•	×	÷
Meaning	•	×	÷	•

Given equation: 88 × 8 ÷ 9 − 2 + 17 = ?

Now replacing the sign from left to right using BODMAS Rule, we get:

=> 88 ÷ 8 + 9 × 2 − 17 = ?

=> 11 + 9 × 2 − 17 = ?

=> 11 + 18 − 17 = ?

=> 29 − 17 = ?

=> 12 = ?

Hence, the correct answer is "Option 1".

Q57. Answer: (a) CLN 60

The position and positional values or English Alphabets are:

Given: KTV 12, IRT 24, GPR 36, ENP 48, ?

The logic followed here is:

Thus, CLN 60 will replace the question mark (?) in the given series to make it logically complete.

Hence, the correct answer is "Option 1".

Q58. Answer: (a) One

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

Now,

Odd digits, each of which is immediately preceded by an odd digit and also immediately followed by an odd digit.

So, the needed pattern is: Odd — Odd — Odd

Thus, there is one odd digit, which is immediately preceded by an odd digit and also immediately followed by an odd digit.

Hence, the correct answer is "Option 1".

Q59. Answer: (c) Both conclusions (I) and (II) follow.

Statements:

Some Llamas are Sheep.

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All Sheep are Mules.

No Mules are Pigeons.

The least possible Venn diagram for the given statement is:

Conclusion:

(I) Some Llamas are Mules. - True (Because Some Llamas are Sheep and All Sheep are Mules, which means Some Llamas are Mules.)

(II) No Sheep are Pigeons. - True (Because All Sheep are Mules and No Mules are Pigeons, which means No Sheep are Pigeons.)

Thus, both conclusions (I) and (II) follow.

Hence, the correct answer is "Option 3".

Q60. Answer: (a) 89

Given: 5 9 17 29 45 65 ?

The logic followed here is:

Thus, 89 should come in place of the question mark (?) in the given series to make it logically complete.

Hence, the correct answer is "Option 1".

Q61. Answer: (b) XDEP

The position and positional values or English Alphabets are:

The logic followed here is:

Similarly,

Thus, BKIW is related to XDEP.

Hence, the correct answer is "Option 2".

Q62. Answer: (d) Two

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

1. E sits to the immediate right of D.

2. G sits second to the left of E.

3. B sits third to the right of E.

4. A is the immediate neighbour of C and B.

F, the only person left will occupy the vacant position.

Thus, two people sit between F and C when counted from the left of F.

Hence, the correct answer is "Option 4".

Q63. Answer: (d) Two

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

Now,

Odd digits, each of which is immediately preceded by an odd digit and also immediately followed by an even digit.

So, the needed pattern is: Odd — Odd — Even

Thus, there are two odd digits, each of which is immediately preceded by an odd digit and also immediately followed by an even digit.

Hence, the correct answer is "Option 4".

Q64. Answer: (c) K

Given: Seven people B, C, D, I, J, K and L are sitting around a circular table facing the centre of the table.

1. K sits third to the left of L.

2. I sits to the immediate left of L.

3. D sits to the immediate left of J.

4. J sits second to the left of C.

Thus, K sits third to the right of B.

Hence, the correct answer is "Option 3".

Q65. Answer: (d) Two

Given: Seven boxes B, D, E, P, S, T and W are kept one over the other but not necessarily in the same order.

1. Only S is kept above P.

2. Only two boxes are kept between P and D.

3. Only E is kept below B.

4. T is not kept immediately above D.

S
P
T
D
B
E

W, the only person left will occupy the vacant position.

S
P
T
W
D
B
E

Thus, two boxes are kept between W and E.10

Hence, the correct answer is "Option 4".01

Q66. Answer: (a) 105, 15

The logic followed here is:

Logic: a : b → a ÷ b = 7

14 : 2 → 14 ÷ 2 = 7

119 : 17 → 119 ÷ 17 = 7

Similarly,

105 : 15 → 105 ÷ 15 = 7

Thus, 105 and 15 follow the same relationship.

Hence, the correct answer is "Option 1".

Q67. Answer: (b) 4 km to the west

Given: Mr. Akai starts from Point A and drives 15 km towards south. He then takes a right turn, drives 18 km, turns right and drives 25 km. He then takes a right turn and drives 16 km, turns right drives 5 km. He then takes a left turn drives 6 km. He takes a final right turn, drives 5 km and stops at Point P.

Thus, he should drive 4 km to the west to reach point A from point P.

Hence, the correct answer is "Option 2".

Q68. Answer: (d) 8

Given: If 2 is added to each odd digit and 1 is subtracted from each even digit in the number 5147934, then:

Digit third from the left → 3

Digit second from the right → 5

Sum = 3 + 5 = 8

Thus, 8 will be the sum of the digits which are third from the left and second from the right.

Hence, the correct answer is "Option 4".

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Q69. Answer: (a) One

Given: A, B, C, D, W, X and Y are sitting in a straight line facing north.

1. Only two people sit to the left of C.

3. Only three people sit between C and W.

3. Only one person sits between W and X.

4. D sits to the immediate left of A.

5. Y is not an immediate neighbour of W.

So, Y sits between C and X.

B, the only person left will occupy the vacant position.

Thus, one people sit to the right of B.

Hence, the correct answer is "Option 1".

Q70. Answer: (a) 5

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. Only E is kept above A.

2. Only two boxes are kept above G.

3. G is kept immediately above B.

4. D is kept immediately above F.

5. D is not kept at third position from the bottom.

E
A
G
B
D
F

C, the only person left will occupy the vacant position.

E
A
G
B
C
D
F

Thus, 5 boxes are kept above D.

Hence, the correct answer is "Option 1".5

Q71. Answer: (c) Neither conclusion (I) nor (II) follows

Statements:

Some dolls are pencils.

Some fingers are pencils.

The least possible Venn diagram for the given statement is:

Conclusions:

(I): All fingers are dolls. - False (There is no definite relation between fingers and dolls, it can be possible but it is not definite)

(II): Some dolls are fingers. - False (There is no definite relation between fingers and dolls, it can be possible but it is not definite)

Thus, Neither conclusion (I) nor (II) follows.

Hence, the correct answer is "Option 3".

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Q72. Answer: (b) 15

Given: 105 87 69 51 33 ?

The logic followed here is:

Thus, 15 should come in place of the question mark (?) in the given series.

Hence, the correct answer is "Option 2".

Q73. Answer: (a) UFBO

The position and positional values or English Alphabets are:

The logic followed here is:

Similarly,

Thus, SCZL is related to UFBO.

Hence, the correct answer is "Option 1".

Q74. Answer: (c) PRO

The position and positional values or English Alphabets are:

The pattern followed here is:

Each letter-cluster follows the pattern +1, -2.

1. OPN

This letter-cluster follows the pattern +1, -2.

2. WXV

This letter-cluster follows the pattern +1, -2.

3. PRO

This letter-cluster does not follow the pattern +1, -2.

4. QRP

This letter-cluster follows the pattern +1, -2.

Thus, PRO is the odd one out.

Hence, the correct answer is "Option 3".

Q75. Answer: (b) 7 km to the west

Given: Adit starts from Point A and drives 11 km towards the North. He then takes a left turn, drives 6 km, turns left and drives 17 km. He then takes a left turn and drives 13 km. He takes a final left turn, drives 6 km and stops at Point P.

Thus, he should drive 7 km to the west to reach point A from point P.

Hence, the correct answer is "Option 2".

Q76. Answer: (a) Brother's wife's brother

Family Chart:

Decoding the Symbols:

A is				
Symbol	•	•	x	÷
Meaning	son	brother	wife	father
to B				

Given: D - F x G + H ÷ J

It means: D is the brother of F, F is the wife of G, G is the son of H, H is the father of J.

Thus, D is J's Brother's wife's brother.

Hence, the correct answer is "Option 1".

Q77. Answer: (a) 3

Given: (Left) 6 © % © 7 # 5 % 5 4 2 # © 5 6 2 © $ € 1 € 8 (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 are 3 symbols, each of which is immediately preceded by a number and also immediately followed by a number.

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Hence, the correct answer is "Option 1".

Q78. Answer: (c) MQSN

The position and positional values or English Alphabets are:

The logic followed here is:

Similarly,

Thus, FJLG is related to MQSN.

Hence, the correct answer is "Option 3".

Q79. Answer: (a) PHW

The position and positional values or English Alphabets are:

Given: LDS MET NFU OGV ?

The logic followed here is:

Thus, PHW should come in place of the question mark (?) in the given series based on the English alphabetical order.

Hence, the correct answer is "Option 1".

Q80. Answer: (d) 2

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

Now,

Odd 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 — Odd — Odd

Thus, there are 2 such odd numbers, each of which is immediately preceded by an odd number and also immediately followed by an odd number.

Hence, the correct answer is "Option 4".

Q81. Answer: (d) Nafithromycin

The correct answer is Nafithromycin.

Key Points

• Nafithromycin is a novel antibiotic developed to tackle the growing challenge of Antimicrobial Resistance (AMR).

• AMR occurs when bacteria, viruses, fungi, and parasites evolve resistance to medications, rendering traditional antibiotics ineffective.

• This antibiotic is considered a breakthrough in the fight against AMR, especially in India, where the burden of drug-resistant infections is significant.

• Developed in December 2024, Nafithromycin is specifically designed to combat respiratory and other bacterial infections that no longer respond to conventional antibiotics.

• It is categorized as a macrolide antibiotic, a class of drugs known for inhibiting bacterial protein synthesis.

Additional Information

• Cefixime:

• Cefixime is a third-generation cephalosporin antibiotic used to treat bacterial infections such as urinary tract infections and respiratory infections.

• It is not specifically aimed at combating AMR but remains effective against certain bacterial strains.

• Amoxicillin:

• Amoxicillin is a widely used penicillin-type antibiotic for treating bacterial infections, including ear, throat, and skin infections.

• Due to widespread use, some bacterial strains have developed resistance to Amoxicillin, contributing to the AMR problem.

• Azithromycin:

• Azithromycin is a macrolide antibiotic, commonly prescribed for respiratory infections and sexually transmitted diseases.

• Though effective, misuse and overuse have led to emerging resistance among bacterial populations.

• Key features of Nafithromycin:

• It targets resistant strains of bacteria, making it a crucial tool against AMR.

• Nafithromycin is designed to offer improved efficacy and reduced side effects compared to other antibiotics.

• This antibiotic could significantly reduce the dependence on older antibiotics, which have seen diminishing effectiveness.

Important Points

• Antimicrobial Resistance (AMR):

• AMR is recognized as a global health threat by organizations like the World Health Organization (WHO).

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• It is projected to cause 10 million deaths annually worldwide by 2050 if left unaddressed.

• India has one of the highest rates of AMR due to overuse and misuse of antibiotics in human and veterinary medicine.

• Addressing AMR involves a multi-faceted approach, including the development of new antibiotics, improved diagnostic tools, and stricter regulations on antibiotic usage.

• Significance of Nafithromycin:

• Nafithromycin represents India's commitment to tackling the AMR crisis through innovation and research.

• Its development aligns with global efforts to promote sustainable and effective antimicrobial treatments.

Q82. Answer: (c) Manesar Municipal Corporation

The correct answer is Manesar Municipal Corporation.

Key Points

• The cleanliness drive ahead of the national urban local bodies' conference in Manesar was initiated by the Manesar Municipal Corporation.

• Manesar Municipal Corporation is responsible for maintaining cleanliness, sanitation, and managing waste in the region under its jurisdiction.

• The conference aimed at addressing urban development issues, including waste management and sanitation, making the cleanliness drive a significant preparatory activity.

• The initiative aligns with the Swachh Bharat Mission, a flagship program by the Government of India to promote cleanliness and hygiene across urban and rural areas.

• Municipal corporations like Manesar play a crucial role in implementing policies related to urban infrastructure and ensuring compliance with environmental standards.

Additional Information

• Swachh Bharat Mission:

• Launched on 2nd October 2014, this mission aims to achieve universal sanitation coverage and eliminate open defecation by constructing toilets and promoting behavioral changes.

• Municipal corporations across India are key stakeholders in implementing this mission in urban areas.

• Under this mission, cities and towns are ranked based on their cleanliness in the Swachh Survekshan survey.

• The initiative encourages partnerships with local bodies, NGOs, and citizens for better waste management practices.

• Role of Municipal Corporations:

• Municipal corporations are urban local government bodies responsible for managing civic amenities such as water supply, sanitation, waste management, and public health.

• They are governed by the 74th Constitutional Amendment Act, which provides autonomy to urban local bodies.

• Funding for their activities comes from taxes, grants, and schemes like the Smart Cities Mission.

• Municipal corporations also implement policies related to urban development and disaster management.

• National Urban Local Bodies' Conference:

• This conference serves as a platform for discussing urban governance, development strategies, and challenges faced by local bodies.

• It highlights best practices in urban planning, waste management, and sustainable development.

• Participants include representatives from municipal corporations, policymakers, and urban development experts.

• Such conferences contribute to capacity building and improving the efficiency of local governance mechanisms.

• Environmental Standards Compliance:

• Municipal corporations must adhere to guidelines provided by Central Pollution Control Board (CPCB) and state pollution control boards.

• Compliance includes proper disposal of solid waste, sewage treatment, and reducing air pollution.

• They also focus on creating awareness among citizens about environmental conservation.

• Innovative approaches like waste-to-energy plants and segregation of waste at source are promoted.

Important Points

• Significance of Cleanliness Drives:

• Such drives promote public awareness about cleanliness and hygiene, especially before events of national importance.

• They ensure the region hosting the event reflects a positive image and complies with environmental standards.

• Involvement of local stakeholders increases community participation in maintaining urban cleanliness.

• Manesar as an Emerging Urban Center:

• Located in the state of Haryana, Manesar is a growing industrial and residential hub.

• Its development is linked to urban planning efforts and the presence of industries, making cleanliness and waste management

critical.

• Events like the national urban local bodies' conference further contribute to its recognition as a center for urban governance discussions.

Q83. Answer: (d) Mahila Aarogyam Kaksh

The correct answer is Mahila Aarogyam Kaksh.

Key Points

• The Mahila Aarogyam Kaksh initiative was launched in July 2025 to promote workplace wellness for women in India.

• This program focuses on creating healthier work environments by addressing physical, mental, and emotional well-being among women employees.

• It is aimed at ensuring that women, particularly in organized and unorganized sectors, have access to essential health resources and support systems.

• The initiative includes measures like regular health check-ups, counseling services, and awareness programs about health and nutrition.

• It also emphasizes the importance of menstrual hygiene management and provides workplace infrastructure such as sanitary napkin dispensers and separate restrooms for women.

Additional Information

• Other Initiatives for Women's Health in India:

• Swasthya Mahila: A proposed program to enhance healthcare facilities for women, especially in rural and remote areas. However, it is not related to workplace wellness.

• Janani Suraksha Yojana (JSY): A safe motherhood intervention under the National Health Mission, launched in 2005, to reduce maternal and neonatal mortality by promoting institutional delivery among pregnant women.

• Ayushman Bharat: Launched in 2018, this is a national initiative aimed at providing health coverage of up to Rs. 5 lakh per family annually for secondary and tertiary care hospitalization. It primarily focuses on low-income families and does not specifically target women's workplace wellness.

• Key Features of Mahila Aarogyam Kaksh:

• Focuses on workplace wellness, a domain often overlooked in public health initiatives.

• Incorporates employer participation to ensure the sustainability of health practices in workplaces.

• Encourages gender-sensitive policies and practices in organizational structures.

• Challenges in Women's Workplace Wellness:

• Lack of awareness: Many workplaces remain uninformed about gender-specific health issues.

• Inadequate infrastructure: Absence of facilities like restrooms, lactation rooms, and health kiosks in workplaces.

• Work-life balance: Women often struggle with dual responsibilities of professional and personal life, which affects their mental and physical well-being.

• Global Comparison:

• Countries like Sweden and Norway have integrated workplace wellness programs specifically for women, which include paid maternity leave, flexible working hours, and health benefits.

• India's Mahila Aarogyam Kaksh is a step toward aligning with global standards of workplace wellness for women.

Q84. Answer: (b) Rs. 1,000 crore

The correct answer is Rs. 1,000 crore.

Key Points

• The Khelo India Programme is a flagship initiative of the Government of India under the Ministry of Youth Affairs and Sports aimed at promoting sports and physical fitness across the nation.

• In the FY 2025-26 Budget, an allocation of Rs. 1,000 crore has been earmarked for the programme to enhance infrastructure, training facilities, and support for athletes at grassroots and elite levels.

• The programme emphasizes creating a strong sports culture in India by identifying and nurturing young talent through initiatives like Khelo India Youth Games and Khelo India University Games.

• It also aims to strengthen the school and college sports ecosystem by providing financial assistance for sports infrastructure development and training programs.

• Rs. 1,000 crore is a significant increase in funding compared to previous years, demonstrating the government's commitment to fostering sports excellence and promoting physical fitness among citizens.

Additional Information

• Khelo India Programme Overview:

• The programme was launched in 2018 with the objective of creating a sports culture and infrastructure across India.

• It includes various components such as Talent Identification and Development, Sports Infrastructure Development, Fitness Assessment, and Promotion of Indigenous Games.

• Under this initiative, athletes are provided scholarships worth Rs. 5 lakh per annum for eight years to support their training and participation in national and international events.

• Khelo India Youth Games (KIYG):

• The Khelo India Youth Games is an annual multi-disciplinary grassroots sports event launched to encourage young talent.

• It features participation from schools and colleges across India in multiple sports disciplines.

• The event plays a crucial role in identifying and nurturing future sports stars.

• Sports Infrastructure Development:

• Under the Khelo India Programme, the government has invested in developing sports facilities such as stadiums, training centers, and fitness hubs across rural and urban areas.

• Special focus is given to regions with limited access to sports infrastructure.

• National Fitness Campaign:

• The programme includes initiatives to promote physical fitness among citizens through fitness assessments and awareness campaigns.

• Schools and colleges are encouraged to integrate fitness activities into their curriculum.

Important Points

• Key Achievements:

• The programme has successfully identified and nurtured several athletes who have represented India at international events like the Olympics, Asian Games, and Commonwealth Games.

• It has contributed to the rise in India's medal tally in international competitions by providing world-class training and facilities.

• Future Plans:

• The increased allocation of Rs. 1,000 crore will be used to expand the programme's reach to more schools, colleges, and rural areas.

• The government plans to introduce advanced technology and analytics to monitor athlete performance and improve training methodologies.

• Support for Indigenous Games:

• The programme includes the promotion of traditional and indigenous sports like Kabaddi, Kho-Kho, and Mallakhamb to preserve India's rich sporting heritage.

• Dedicated funds are allocated for the development of facilities and training programs for such games.

Q85. Answer: (d) Blue

The correct answer is Blue.

Key Points

• The Central Pollution Control Board (CPCB) introduced a new classification category named Blue in 2025 to identify and monitor essential environmental services.

• This classification aims to emphasize industries and services that have a minimal environmental impact while playing a crucial role in environmental preservation and sustainability.

• Such services include water purification plants, renewable energy services, and waste management systems that actively contribute to environmental conservation.

• The CPCB categorized industries and services based on their pollution index. The newly introduced Blue category represents activities with an index of less than 10, indicating negligible environmental harm.

• This initiative aligns with India’s commitment to achieving sustainable development goals (SDGs) and addressing climate change challenges.

Additional Information

• Pollution Index Categories by CPCB:

• Industries are classified into four categories based on their pollution index: Red, Orange, Green, and Blue.

• The Red category includes industries with a pollution index greater than 60, representing the highest pollution potential.

• The Orange category covers industries with a pollution index between 41 and 59, posing moderate pollution risks.

• The Green category includes industries with a pollution index between 21 and 40, indicating low pollution potential.

• The newly added Blue category includes industries and services with a pollution index of less than 10, emphasizing negligible environmental impact.

• Examples of Blue Category Services:

• Water purification plants that ensure clean and safe drinking water.

• Renewable energy services like solar and wind energy production, which support eco-friendly energy solutions.
• Waste management systems that include recycling, composting, and waste-to-energy conversion.
• Sustainable Development Goals (SDGs):
• The classification of industries into pollution categories aligns with global efforts to achieve the United Nations' SDG 13 (Climate Action) and SDG 6 (Clean Water and Sanitation).
• Blue category services actively contribute to reducing environmental degradation and promoting sustainable practices.
• Importance of CPCB's Role:
• The CPCB is India's principal body for controlling pollution and ensuring environmental regulations are implemented effectively.
• Its classification system helps in monitoring and regulating industrial activities while promoting cleaner and greener alternatives.

Important Points

• Blue Category Threshold:
• The pollution index for the Blue category is less than 10, ensuring that the classified services and industries have almost no adverse environmental impact.
• Global Environmental Commitment:
• India is a signatory to the Paris Agreement and other international environmental treaties, which emphasize reducing pollution and promoting sustainability.
• The introduction of the Blue category reflects India's proactive approach to fulfilling its environmental responsibilities.
• CPCB Guidelines:
• The CPCB provides detailed guidelines for industries and services to minimize their environmental impact and comply with pollution control norms.
• Industries in the Blue category are encouraged to adopt innovative, eco-friendly technologies.

Q86. Answer: (d) 78th

The correct answer is Option 4 – 78th.

Key Points

• Boman Irani made his red carpet debut at the 78th Cannes Film Festival.
• The 78th Cannes Film Festival was held in 2025 in Cannes, France.
• Irani's appearance at the festival marked his first appearance on the prestigious Cannes red carpet.
• The Cannes Film Festival is one of the world's most prestigious international film festivals and is held annually in Cannes, France.
• Hence, the correct answer is Option 4 – 78th.

Additional Information

• 78th Cannes Film Festival → 2025
• Venue → Cannes, France
• Boman Irani → Indian actor and filmmaker
• Irani is widely known for his work in Hindi cinema and has appeared in numerous critically acclaimed and commercially successful films.
• The Cannes Film Festival is commonly known for its prestigious Palme d'Or, the festival's highest award for the competition section.

Important Points

• Boman Irani's Cannes red carpet debut → 78th Cannes Film Festival
• 78th Cannes Film Festival → 2025
• Location → Cannes, France
• Festival's highest award → Palme d'Or

Q87. Answer: (b) New Delhi

The correct answer is New Delhi.

Key Points

• Arvind Kejriwal, the current Chief Minister of Delhi and leader of the Aam Aadmi Party (AAP), contested from the New Delhi Assembly Constituency in the 2025 General Election to the Assembly Constituencies of the National Capital Territory (NCT) of Delhi.
• The New Delhi Assembly Constituency is considered a significant constituency as it comprises the heart of the capital city, including administrative and political hubs.
• Kejriwal has a historical connection with the New Delhi seat, having contested and won from this constituency in the 2013, 2015,

and 2020 Delhi Assembly Elections.

• The New Delhi seat is known for its diverse electorate, comprising government employees, urban professionals, and residents of prominent localities.

• In the 2025 election, Kejriwal's candidacy from this seat reaffirms his focus on urban governance, public welfare schemes, and grassroots development in Delhi.

Additional Information

• New Delhi Assembly Constituency:

• The New Delhi Assembly Constituency is one of the 70 assembly constituencies in the National Capital Territory of Delhi.

• It is part of the New Delhi Lok Sabha Constituency, one of the seven parliamentary constituencies in Delhi.

• The constituency includes prominent areas such as Connaught Place, Janpath, Rajpath, and the administrative regions of central Delhi.

• It is a high-profile constituency, often contested by influential candidates due to its strategic and symbolic importance in Indian politics.

• Arvind Kejriwal's Political Legacy:

• Arvind Kejriwal became the Chief Minister of Delhi for the first time in 2013 after defeating incumbent Chief Minister Sheila Dikshit from the New Delhi Assembly Constituency.

• He has led the Aam Aadmi Party (AAP) since its inception in 2012, focusing on issues such as anti-corruption, education, health, and public welfare.

• Kejriwal's tenure has been marked by several flagship schemes, including the Mohalla Clinics initiative, free electricity and water schemes, and improvements in Delhi's education infrastructure.

• Significance of the 2025 Delhi Assembly Election:

• The 2025 election was crucial for the Aam Aadmi Party (AAP) to consolidate its political dominance in the National Capital Territory of Delhi.

• It served as a litmus test for Arvind Kejriwal's governance model, which emphasized citizen-centric policies and development-driven governance.

• The New Delhi constituency, being a high-profile seat, was closely watched for voter turnout and candidate performance.

• Other Constituencies Mentioned:

• Moti Nagar: This constituency is located in West Delhi and is known for its industrial and residential zones.

• Kondli: Part of East Delhi, this constituency is primarily a residential area with a mix of urban and semi-urban voters.

• Mundka: Situated in the rural outskirts of West Delhi, this constituency has a predominantly agrarian population.

Important Points

• Historical Performance: Arvind Kejriwal has consistently won from the New Delhi Assembly Constituency since 2013, defeating prominent candidates from opposition parties.

• Electoral Strategy: Kejriwal's focus on grassroots engagement, public welfare schemes, and addressing local issues has played a pivotal role in his electoral success.

• Challenges in New Delhi: The constituency faces challenges such as traffic congestion, pollution, and infrastructure development, which remain key issues during elections.

• Voter Demographics: The electorate of New Delhi is diverse, comprising government employees, professionals, traders, and residents of high-profile localities.

Q88. Answer: (c) Russia and Ukraine

The correct answer is Russia and Ukraine.

Key Points

• Russia and Ukraine have been involved in an ongoing conflict since 2014, which escalated significantly in February 2022 with the start of the full-scale Russian invasion of Ukraine.

• In June 2025, a prisoner exchange agreement was facilitated through efforts involving third-party mediators, including Turkey, which has played a neutral role in the conflict.

• The prisoner exchange occurred in Istanbul, Turkey, a country that has consistently offered to mediate peace talks between the two nations.

• This exchange involved the release of captured soldiers and civilians from both sides, aiming to reduce humanitarian concerns and build trust for future negotiations.

• Such exchanges are part of broader confidence-building measures to de-escalate tensions, even as the larger conflict remains unresolved.

Additional Information

• Background of Russia-Ukraine Conflict:

• The conflict began in 2014 when Russia annexed Crimea and supported separatist movements in eastern Ukraine (Donetsk and Luhansk regions).

• The war escalated in February 2022 when Russia launched a full-scale invasion of Ukraine, leading to widespread destruction and a humanitarian crisis.

• Role of Turkey in Mediating:

• Turkey, under the leadership of President Recep Tayyip Erdoğan, has maintained diplomatic relations with both Russia and Ukraine.

• Istanbul has served as a key location for peace negotiations and humanitarian exchanges due to Turkey's neutral stance.

• Humanitarian Impact of the Conflict:

• Millions of people have been displaced, with over 8 million Ukrainian refugees seeking asylum in various European countries.

• Prisoner exchanges, like the one in Istanbul, are crucial for addressing the plight of captured soldiers and civilians.

• Prisoner Exchange Agreements:

• Such agreements are often brokered through third-party mediators or international organizations like the United Nations or the International Committee of the Red Cross (ICRC).

• The exchange includes clear identification and verification processes to ensure the safe return of individuals.

Important Points

• Geopolitical Significance of Istanbul:

• Istanbul, located at the crossroads of Europe and Asia, has historically been a hub for international diplomacy.

• It serves as a neutral ground for talks involving contentious parties like Russia and Ukraine.

• Confidence-Building Measures:

• Prisoner exchanges are often seen as a step toward initiating broader peace talks.

• Such measures help to reduce tensions and address humanitarian concerns.

• Global Reactions:

• Countries and international organizations have praised prisoner exchanges as a positive development amidst the ongoing conflict.

• However, there is continued pressure on Russia and Ukraine to negotiate a comprehensive peace agreement.

Q89. Answer: (c) Delhi

The correct answer is Delhi.

Key Points

• The Union Home Minister launched the pilot project of the e-Zero FIR initiative in Delhi in May 2025 under the Indian Cyber Crime Coordination Centre (I4C).

• This initiative is aimed at improving the efficiency of investigating cyber financial frauds and aligns with the vision of a Cyber Secure Bharat.

• The e-Zero FIR allows victims to lodge a First Information Report (FIR) online without visiting a police station, streamlining the process for addressing cybercrime complaints.

• The selection of Delhi as the launch city highlights its role as a central hub for technology and administration, making it a suitable choice for piloting innovative cybercrime solutions.

• The I4C initiative is a flagship program of the Ministry of Home Affairs, aimed at tackling the increasing challenges posed by cybercrime through coordination and advanced technological tools.

Additional Information

• Indian Cyber Crime Coordination Centre (I4C):

• I4C was established in 2018 under the Ministry of Home Affairs to act as a nodal agency to deal with all types of cybercrime in India.

• The center facilitates coordination among different states and union territories, providing advanced technologies and training to tackle cybercrimes.

• It includes components such as a National Cyber Crime Reporting Portal, Cyber Forensic Laboratory, and Cyber Training Centre.

• Cyber Financial Frauds:

• Cyber financial frauds include crimes like phishing, identity theft, credit card frauds, online scams, and unauthorized transactions.

• These crimes have increased significantly with the growth of digital transactions and require advanced tools and frameworks like the e-Zero FIR initiative for effective investigation and resolution.

• FIR (First Information Report):

• An FIR is a written document prepared by the police when they receive information about the commission of a cognizable offense.

• The e-Zero FIR initiative allows individuals to file FIRs online, reducing the need for physical visits to police stations and expediting the process.

• Cyber Secure Bharat Vision:

• The vision of a Cyber Secure Bharat aims to create a safe and secure digital environment for citizens, businesses, and government entities.

• It includes initiatives like cyber literacy campaigns, technological advancements, and improved legal frameworks to combat cybercrime.

Important Points

• Significance of Delhi:

• Delhi, being the capital city, serves as a hub for technological infrastructure and administrative coordination, making it an ideal location for pilot projects like the e-Zero FIR initiative.

• It houses several government offices, research institutions, and cybersecurity units, providing logistical advantages for implementing such projects.

• Technological Advancements:

• Projects like e-Zero FIR reflect the government's commitment to leveraging technology to address modern challenges, especially in the domain of cybersecurity.

• Such advancements help in reducing delays and improving transparency in the investigation process.

Q90. Answer: (c) Zuno General Insurance

The correct answer is Zuno General Insurance.

Key Points

• Zuno General Insurance, formerly known as Edelweiss General Insurance, launched India's first car insurance policy with built-in crash detection and auto claims trigger in June 2025.

• This innovative insurance product uses advanced telematics and IoT (Internet of Things) technology to detect car crashes accurately and initiate claims automatically.

• The crash detection feature ensures that policyholders get immediate assistance in case of an accident, improving the response time and reducing hassles during emergencies.

• The auto claims trigger functionality helps in streamlining the claims process, making it quicker and more efficient for customers.

• This new car insurance policy highlights Zuno General Insurance's commitment to leveraging technology for enhancing customer experience and safety.

Additional Information

• Telematics Technology in Insurance:

• Telematics refers to the integration of communication technologies with vehicles, enabling real-time data collection and analysis.

• It helps insurance companies monitor driving behavior, vehicle usage, and accident patterns to offer customized premiums and improve road safety.

• Telematics-based insurance policies are often referred to as usage-based insurance (UBI) or pay-as-you-drive insurance.

• IoT in Car Insurance:

• The Internet of Things (IoT) enables devices and vehicles to communicate and share data seamlessly.

• IoT applications in car insurance include crash detection, real-time location tracking, theft prevention, and maintenance alerts.

• These technologies enhance customer safety and reduce the administrative burden on insurance providers.

• Other Innovations in Insurance:

• Many insurance companies are adopting AI-powered chatbots, mobile apps, and blockchain technologies to improve customer service and claims processing.

• Some insurers offer on-demand insurance, allowing customers to purchase coverage only when needed, such as for short-term travel or specific events.

• About Zuno General Insurance:

• Zuno General Insurance is a prominent player in the Indian insurance market, known for its tech-driven solutions and customer-centric approach.

• The company rebranded from Edelweiss General Insurance to Zuno General Insurance to reflect its focus on innovation and digital transformation.

• Zuno offers a wide range of insurance products, including health, motor, and travel insurance, designed to cater to the evolving needs of modern customers.

Important Points

• Crash Detection Technology:

• Crash detection involves using sensors, accelerometers, and algorithms to identify collisions and determine their severity.

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• This technology can automatically alert emergency services, insurance companies, and family members in case of an accident.

• Auto Claims Trigger:

• The auto claims trigger feature ensures that claims are initiated automatically after a crash is detected, reducing paperwork and saving time for policyholders.

• This functionality relies on real-time data transmission and integration with the insurer's backend systems.

• Benefits of Tech-Driven Insurance:

• Enhanced customer experience through faster claims processing and personalized policies.

• Improved road safety due to better monitoring and preventive measures.

• Cost efficiency for insurers and policyholders by minimizing fraudulent claims and optimizing premiums.

Q91. Answer: (d) Rs. 2.69 lakh crore

The correct answer is Rs. 2.69 lakh crore.

Key Points

• The Reserve Bank of India (RBI) has transferred a surplus amount of Rs. 2.69 lakh crore to the central government for the financial year 2024-25 (FY25).

• This transfer represents a significant increase compared to previous years, reflecting robust earnings, including from investments in government securities and foreign exchange operations.

• The surplus amount is transferred under the provisions of the RBI Act, 1934, which mandates the transfer of surplus profits after meeting the contingency reserve requirements.

• The increase in surplus transfer can be attributed to factors such as higher interest income on domestic and foreign investments, effective forex reserve management, and reduced expenditure by the RBI.

• Such a transfer plays a crucial role in the central government's fiscal management, providing additional resources for public spending, reducing fiscal deficit, and funding welfare schemes.

• The decision on the surplus transfer is made annually by the RBI's Central Board of Directors based on the recommendations of the Economic Capital Framework (ECF).

Additional Information

• RBI Surplus Transfer Mechanism:

• The Reserve Bank of India is required to transfer its surplus profits to the central government under Section 47 of the RBI Act, 1934.

• The surplus is calculated after meeting all expenses, including operational costs, provisions for contingency funds, and maintaining a sufficient reserve buffer.

• In 2019, the RBI adopted a revised Economic Capital Framework (ECF) based on the recommendations of the Bimal Jalan Committee to determine the appropriate level of reserves to be maintained by the central bank.

• The ECF ensures a balance between retaining sufficient reserves for financial stability and transferring excess profits to the government.

• Key Components of RBI's Income:

• Interest income: Derived from government securities, foreign currency assets, and other investments.

• Foreign exchange operations: Profits from buying and selling foreign currencies.

• Fees and commissions: Income from banking services provided to the government and other entities.

• Other income: Includes penalties, grants, or miscellaneous revenue.

• Impact of Surplus Transfer on Economy:

• The surplus transfer provides an additional fiscal cushion to the government, helping in reducing the fiscal deficit.

• It supports increased spending on development projects, infrastructure, and welfare schemes, boosting economic growth.

• However, a higher transfer could also raise concerns about the central bank's financial autonomy and its ability to manage contingencies.

• Historical Trends in RBI Surplus Transfer:

• In FY21, the RBI transferred a surplus of Rs. 99,122 crore, while in FY22, it transferred Rs. 30,307 crore.

• The sharp rise in FY25's transfer to Rs. 2.69 lakh crore is attributed to increased earnings from domestic and foreign operations.

• The adoption of the revised ECF has also streamlined the calculation of surplus, ensuring transparency and consistency.

Important Points

• Bimal Jalan Committee Report:

• Formed in 2018, this committee was tasked with reviewing the RBI's economic capital framework.

• It recommended maintaining the RBI's reserves within a range of 5.5%-6.5% of its balance sheet.

• The framework ensures that surplus transfers do not compromise the central bank's ability to handle financial or external shocks.

• Economic Implications of Fiscal Deficit Reduction:

• Higher surplus transfers can help the government reduce its fiscal deficit, leading to lower borrowing requirements.

• Reduced fiscal deficit strengthens investor confidence and enhances India's credit rating.

• However, excessive reliance on surplus transfers could limit the RBI's ability to address potential economic crises.

Q92. Answer: (b) Sigachi Chemicals

The correct answer is Sigachi Chemicals.

Key Points

• The chemical blast that occurred on 30 June 2025 in the state of Telangana took place at Sigachi Chemicals.

• Sigachi Chemicals is a renowned chemical manufacturing company located in Telangana, known for producing industrial chemicals and specialty products used in various industries.

• The explosion caused significant damage to the factory premises and raised concerns about industrial safety and hazard management protocols in chemical plants.

• Investigations revealed that the cause of the blast was related to the mishandling of volatile chemicals during the production process, highlighting the need for strict adherence to safety guidelines.

• It was reported that multiple workers were affected, and the incident emphasized the importance of implementing occupational safety measures and training programs in high-risk industries like chemical manufacturing.

Additional Information

• Sigachi Chemicals Overview:

• Sigachi Chemicals is a prominent player in the chemical manufacturing sector, headquartered in Telangana, India.

• The company specializes in producing fine chemicals, industrial solvents, and specialty chemicals for sectors like pharmaceuticals, agriculture, and textiles.

• It is recognized for its contribution to the industrial growth of Telangana and providing employment opportunities in the region.

• Industrial Safety Concerns:

• Industrial accidents, such as chemical blasts, highlight the need for stringent safety protocols and regular audits of manufacturing facilities.

• Handling volatile chemicals requires proper storage, monitoring, and training of personnel to minimize risks.

• Governments and industrial bodies worldwide have established guidelines and standards like OSHA (Occupational Safety and Health Administration) and India's Factories Act to enforce workplace safety.

• Impact of Chemical Plant Accidents:

• Chemical plant accidents can lead to significant human and environmental harm, including injuries, fatalities, and ecological damage.

• Such incidents often result in legal actions, financial penalties, and a loss of public trust in affected companies.

• They also act as a catalyst for improvements in industrial safety laws and the adoption of advanced technology to prevent future incidents.

• Other Major Industrial Accidents in India:

• Bhopal Gas Tragedy (1984): One of the world's worst industrial disasters, caused by a gas leak at the Union Carbide India Limited pesticide plant in Bhopal, Madhya Pradesh.

• Visakhapatnam Gas Leak (2020): A styrene gas leak from LG Polymers in Andhra Pradesh, affecting thousands of residents in the surrounding area.

• Such incidents emphasize the importance of robust industrial safety mechanisms and disaster management plans.

Important Points

• Industrial Safety Regulations:

• The Factories Act, 1948 governs workplace safety in India, ensuring safe working conditions for employees.

• The Environment Protection Act, 1986, and the Hazardous Waste Management Rules address the management of hazardous substances to prevent accidents.

• Recommendations for Chemical Industries:

• Regular safety audits and risk assessments to identify potential hazards.

• Implementation of advanced monitoring systems for chemical storage and handling.

• Periodic training programs for employees on emergency response and safety protocols.

Q93. Answer: (b) Magnus Carlsen

The correct answer is Magnus Carlsen.

Key Points

• Magnus Carlsen, a Norwegian chess grandmaster, has consistently held the No.1 world chess ranking since 2011 in the FIDE World Chess rankings.

• As of June 2025, Carlsen continues to dominate the chess world due to his remarkable skills, exceptional strategies, and unwavering consistency in international tournaments.

• Magnus Carlsen became the World Chess Champion in 2013 by defeating Viswanathan Anand and has successfully defended his title multiple times since then.

• He is known for his high Elo rating, which peaked at an all-time record of 2882 in May 2014, showcasing his unparalleled mastery in the game.

• Carlsen's versatile playing style and ability to adapt to different opponents have solidified his position as one of the greatest chess players in history.

Additional Information

• Magnus Carlsen's Career:

• Born on 30 November 1990 in Tønsberg, Norway, Carlsen showed exceptional talent in chess from a young age.

• He became a chess prodigy by achieving the title of Grandmaster at the age of 13 years and 148 days, making him the third-youngest grandmaster in history at the time.

• Carlsen has won numerous prestigious tournaments, including the Tata Steel Chess Tournament, Sinquefield Cup, and Grand Chess Tour.

• FIDE World Rankings:

• The Fédération Internationale des Échecs (FIDE) is the governing body for chess, and its world rankings are based on Elo ratings.

• Magnus Carlsen has been the undisputed leader in the FIDE rankings due to his consistency and high performance in classical, rapid, and blitz formats.

• Other Options:

• D Gukesh: An emerging Indian chess prodigy, Gukesh D has shown great promise and achieved the title of Grandmaster at the age of 12 years and 7 months, becoming the second-youngest Grandmaster in history.

• R Praggnanandhaa: Another Indian chess sensation, Praggnanandhaa became a Grandmaster at the age of 12 years and 10 months, showcasing immense potential on the international stage.

• Fabiano Caruana: An Italian-American Grandmaster, Caruana is a prominent figure in the chess world. He was the runner-up in the 2018 World Chess Championship against Magnus Carlsen.

• Magnus Carlsen's Contribution to Chess:

• Carlsen has made chess more accessible and popular through platforms like Chess.com and the Play Magnus app.

• He has also founded the Magnus Carlsen Invitational, an online chess tournament that gained immense popularity during the COVID-19 pandemic.

Important Points

• Elo Rating System:

• The Elo rating system is used to calculate the skill levels of chess players. A higher Elo rating signifies better performance.

• Magnus Carlsen's peak Elo rating of 2882 is the highest ever recorded in chess history.

• World Chess Championship:

• The World Chess Championship is the ultimate competition in chess, where the reigning champion defends their title against a challenger.

• Carlsen's dominance in this championship since 2013 highlights his superiority in the sport.

Q94. Answer: (a) Nepal

The correct answer is Nepal.

Key Points

• The 18th edition of the Battalion Level Joint Military Exercise named Surya Kiran was conducted in December 2024.

• This exercise is held annually between the armies of India and Nepal.

• Surya Kiran focuses on enhancing interoperability, sharing military expertise, and strengthening defense ties between the two nations.

• The exercise includes training on counter-terrorism operations, disaster management, and jungle warfare.

• This bilateral exercise is part of the larger framework of friendly relations between India and Nepal, which share historic, cultural, and geographical ties.

Additional Information

• About Surya Kiran:

• It is one of the largest bilateral military exercises conducted by India with any of its neighboring countries.

• The exercise is held alternatively in India and Nepal.
• The first edition of Surya Kiran was conducted in 2011.
• The exercise aims to build mutual trust and understanding between the two armies, which share a long-standing relationship.
• India-Nepal Relations:
• India and Nepal share a 1,751 km long border and have a special relationship based on geographical proximity, cultural affinity, and historical ties.
• Nepal is a key partner for India in the Himalayan region, and both nations collaborate on various regional and global platforms.
• The Gorkha regiment of the Indian Army includes personnel of Nepalese origin, further strengthening the military bond.
• Key Features of Joint Military Exercises:
• Military exercises like Surya Kiran enhance operational coordination and promote skills transfer between participating forces.
• They focus on counter-terrorism, peacekeeping operations, disaster response, and humanitarian assistance.
• Such exercises also provide an opportunity for the exchange of tactics, techniques, and procedures in a simulated environment.
• Other Joint Exercises of India:
• Yudh Abhyas: Conducted with the United States.
• Sampriti: Conducted with Bangladesh.
• Hand-in-Hand: Conducted with China.
• Garuda Shakti: Conducted with Indonesia.

Q95. Answer: (b) Real-time disaster alerts

The correct answer is Real-time disaster alerts.

Key Points

• The Sachet app is specifically designed to provide real-time disaster alerts to individuals and communities, helping them prepare for and respond to natural or man-made disasters effectively.
• It offers instant notifications about potential hazards such as earthquakes, floods, cyclones, landslides, and other emergencies, ensuring timely dissemination of critical information.
• The app integrates with meteorological data and disaster management agencies to provide accurate and region-specific alerts.
• Users can customize settings to receive alerts for their specific location or other regions of interest.
• This application is a key tool in disaster preparedness and mitigation, minimizing the impact of disasters by enabling early action.

Additional Information

• Real-time disaster management:
• Real-time disaster management involves the use of technology to monitor, predict, and alert populations about disasters as they occur or before they happen.
• It includes collecting data from sources like weather stations, satellites, sensors, and geospatial technology.
• Applications like Sachet are instrumental in implementing real-time disaster alerts.
• Example: Early warning systems for cyclones have reduced fatalities significantly in cyclone-prone areas like Odisha, India.
• Integration of technology in disaster alerts:
• Technologies like AI, machine learning, and IoT are leveraged to enhance the accuracy of disaster prediction models.
• Smartphones with GPS technology aid in localized disaster warnings.
• Social media platforms and apps like Sachet play a significant role in disseminating information quickly.
• Other similar disaster management apps:
• MyShake: An app that provides earthquake early warnings in California.
• Disaster Alert: Developed by the Pacific Disaster Center, it provides information about active hazards worldwide.
• NDMA App: Launched by the National Disaster Management Authority in India, it focuses on disaster preparedness and mitigation.
• Importance of disaster alerts:
• Early alerts can save lives by providing enough time for evacuation and preparation.
• They reduce economic losses by minimizing damage to property and infrastructure.
• Alerts foster a culture of disaster preparedness and resilience among communities.

Important Points

• Key features of the Sachet app:
• Provides location-specific alerts based on geospatial mapping and user preferences.
• Includes multilingual support to cater to diverse user groups in disaster-prone areas.
• Offers educational resources on disaster preparedness, including evacuation plans and safety tips.

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• Integrates with local and national disaster response systems for seamless coordination.

• Global disaster trends:

• Climate change has led to an increase in the frequency and intensity of natural disasters like hurricanes, floods, and wildfires.

• Regions like South Asia and the Pacific are particularly vulnerable due to their geographical location and socio-economic conditions.

• Efforts are being made globally to strengthen early warning systems and disaster resilience programs.

Q96. Answer: (a) IIM Kozhikode

The correct answer is IIM Kozhikode.

Key Points

• IIM Kozhikode launched Gyanodaya in July 2025 as a platform for pedagogical innovation, aiming to enhance teaching methodologies and learning experiences.

• The initiative seeks to integrate technology and modern pedagogical tools to create a transformative impact on education delivery.

• Gyanodaya focuses on promoting across disciplines, emphasizing research-driven and experiential learning approaches.

• It aims to address the evolving needs of higher education by fostering collaboration among educators, researchers, and industry professionals.

• IIM Kozhikode, located in Kozhikode, Kerala, is known for pioneering educational initiatives and contributing significantly to management and leadership development in India.

Additional Information

• IIM Kozhikode:

• Indian Institute of Management Kozhikode (IIM Kozhikode) was established in 1996 and is one of the premier management institutes in India.

• Located in Kozhikode, Kerala, it is renowned for its focus on academic excellence, research, and innovative programs.

• The institute offers postgraduate programs, doctoral programs, and executive education catering to diverse aspects of management studies.

• IIM Kozhikode is particularly known for its unique initiatives such as interactive online learning and programs for women entrepreneurs.

• Pedagogical Innovation:

• Pedagogical innovation refers to the use of new methodologies, technologies, and tools to improve the teaching-learning process.

• It aims to address the challenges of traditional education methods by promoting personalized and active learning.

• Examples include flipped classrooms, experiential learning, gamification, and the integration of AI in education.

• Such innovations enhance student engagement, critical thinking, and skill development, making education more effective and future-oriented.

• Educational Collaboration:

• Collaborations between academic institutions, industry leaders, and research organizations play a pivotal role in advancing education.

• They help bridge the gap between theoretical knowledge and practical applications, ensuring students are prepared for real-world challenges.

• Such partnerships foster the development of innovative curricula, research projects, and training programs.

• Role of Technology in Education:

• Technology has emerged as a key enabler in modern education, facilitating access to resources, interactive learning, and remote education.

• Tools like virtual classrooms, AI-driven learning platforms, and educational apps have revolutionized teaching methods.

• It allows for personalized learning experiences, catering to the unique needs and pace of individual students.

• Technology also enables data-driven decision-making for educators, improving the effectiveness of teaching strategies.

Important Points

• About Gyanodaya:

• Gyanodaya is an initiative to explore and implement innovative teaching practices in the field of management education.

• The program emphasizes the integration of modern pedagogical tools and technology to address the challenges of traditional teaching methods.

• Significance of Pedagogical Innovation:

• Pedagogical innovation ensures that education evolves to meet the changing demands of society and the workforce.

• It promotes critical thinking, problem-solving skills, and active learning.

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Q97. Answer: (b) Neeraj Chopra

The correct answer is Neeraj Chopra.

Key Points

• Neeraj Chopra, India's celebrated javelin thrower, was not a part of the Indian 4 × 100 m relay team at the National Relay Carnival, 2025. He specializes in individual field events rather than track relay races.

• The Indian 4 × 100 m relay team, which set a new national record in 2025, included athletes like Animesh Kujur, Manikanta Hoblidar, and Amlan Borgohain, who are renowned sprinters excelling in relay races.

• Neeraj Chopra is primarily known for his achievements in the sport of javelin throw, including his gold medal win at the Tokyo Olympics 2020, making him one of India's most successful track and field athletes.

• Relay teams consist of four sprinters who specialize in running short distances and are trained for baton exchanges, a key component of relay races. Neeraj Chopra's expertise lies in the javelin throw, which is a field event, not a track relay event.

• The inclusion of sprinters like Animesh Kujur, Manikanta Hoblidar, and Amlan Borgohain in the relay team highlights their competence and specialization in the track events, whereas Neeraj Chopra's absence is in line with his focus on field events.

Additional Information

• Neeraj Chopra:

• Age: Born on 24 December 1997, Neeraj Chopra is an Indian track and field athlete specializing in the javelin throw.

• Achievements: He won the gold medal at the Tokyo Olympics 2020, becoming the first Indian to win an Olympic gold medal in athletics.

• Recognition: Neeraj has received several awards, including the Major Dhyan Chand Khel Ratna Award, India's highest sporting honor.

• Specialization: Javelin throw, a field event that involves throwing a spear-like equipment over a distance.

• Amlan Borgohain:

• Role: An Indian sprinter known for his expertise in short-distance track events such as the 100m and 200m races.

• Achievements: Holds the national record in the 200m sprint as of 2022.

• Specialization: A regular participant in relay teams, showcasing his skills in baton exchanges and sprinting.

• Relay Races:

• Definition: A track event where four athletes run equal segments of a race while passing a baton.

• Key Skills: Speed, coordination, and precision in baton exchanges are critical to relay success.

• India's Achievements: Indian relay teams have consistently improved their performance in international and national competitions, setting records like the one at the National Relay Carnival, 2025.

• Track vs. Field Events:

• Track Events: Include races such as sprints, middle-distance, and long-distance events.

• Field Events: Include javelin throw, shot put, long jump, and other events that focus on physical strength and technique.

• Neeraj Chopra's Domain: As a field athlete, Neeraj excels in javelin throw, which is distinct from track events like relay races.

Important Points

• Indian Relay Team: The team composition for relay races is determined based on athletes' sprinting capabilities and their proficiency in baton exchanges.

• Javelin Throw: Requires strength, technique, and precision, and is categorized as a field event. Athletes like Neeraj Chopra dedicate their training to excelling in this specific sport.

• National Records: Setting national records in athletics showcases the progress and talent in Indian sports, encouraging further development and international recognition.

• Tokyo Olympics 2020: Neeraj Chopra's gold medal win was a landmark achievement for Indian athletics, inspiring future generations of athletes.

Q98. Answer: (b) Arshad Nadeem

The correct answer is Arshad Nadeem.

Key Points

• Arshad Nadeem, a prominent athlete from Pakistan, was recognized as the Best Asian Athlete in May 2025 due to his exceptional achievements in the field of athletics.

• He specializes in the javelin throw and has consistently brought laurels to Pakistan with his remarkable performances in international sporting events.

• Arshad Nadeem became a household name after his gold medal win at the 2023 World Athletics Championships, where he set a

new personal and national record.

• He also secured a historic silver medal at the 2024 Paris Olympics, marking Pakistan's first-ever Olympic medal in athletics.

• His recognition as the Best Asian Athlete is a testament to his dedication, hard work, and ability to compete at the highest level, elevating Pakistan's profile in global athletics.

Additional Information

• Arshad Nadeem:

• Born on January 2, 1997, in Mian Channu, Punjab, Pakistan.

• Arshad holds the distinction of being the first athlete from Pakistan to directly qualify for the Olympics in athletics.

• His personal best throw of 90.18 meters in javelin came during the 2023 World Athletics Championships.

• He trained under the guidance of Fayyaz Bukhari and received support from the Pakistan Sports Board.

• Arshad is known for his resilience, having overcome injuries to continue performing at the top level.

• Other notable Pakistani athletes:

• Sana Mir: Former captain of the Pakistan women's cricket team, a pioneer in women's cricket in Pakistan.

• Babar Azam: Current captain of the Pakistan men's cricket team and one of the world's best batsmen.

• Mohammad Abbas: A key player in Pakistan's cricket team, known for his consistent performances as a fast bowler.

• Javelin Throw:

• A field event in track and field athletics where athletes attempt to throw a spear-like implement as far as possible.

• Requires a combination of strength, speed, and technique for optimal performance.

• The javelin must be thrown overhand and land tip-first within the designated sector.

• Asian Athletics Recognition:

• The Best Asian Athlete award is a prestigious recognition given by the Asian Athletics Association (AAA).

• It honors athletes who exhibit outstanding performances in international competitions, breaking records or achieving significant milestones.

• Arshad Nadeem’s recognition highlights Pakistan’s growing prominence in Asian athletics.

Important Points

• Arshad Nadeem's Achievements:

• First Pakistani to win a gold medal in the Commonwealth Games javelin throw event (2022).

• Winner of multiple medals in Asian Games and other international championships.

• Impact on Sports in Pakistan:

• Arshad's achievements have inspired a new generation of athletes in Pakistan, particularly in track and field events.

• His success has led to increased investment in athletics infrastructure and training programs in the country.

Q99. Answer: (c) Twist

The correct answer is Twist.

Key Points

• Twist, written by Colum McCann, is a novel set to be published in 2025. It focuses on the intricate and often overlooked process of laying submarine cables.

• The book follows a journalist who embarks on a journey aboard a submarine cable-laying ship, delving into the technical, emotional, and philosophical aspects of intercontinental communication.

• The title "Twist" metaphorically represents the entanglement of human stories, technology, and the vast expanse of the ocean.

• Colum McCann is known for his immersive storytelling and has previously written acclaimed novels such as Let the Great World Spin and Apeirogon, which explore themes of interconnectedness and humanity.

• This novel is expected to provide a unique perspective on the hidden infrastructure that powers global communication, offering both a technical and emotional narrative.

Additional Information

• Submarine Cable-Laying Ships:

• These specialized ships are used for deploying undersea cables that transmit data across continents.

• Submarine cables are the backbone of global internet infrastructure, handling about 99% of international communications.

• The process involves meticulous planning, advanced technology, and a deep understanding of oceanic conditions.

• Colum McCann's Writing Style:

• McCann is celebrated for his ability to weave multiple narratives into a cohesive and emotionally resonant story.

• He often draws from real-life events and historical contexts, blending them with fictional elements to create a rich tapestry of human experiences.

• Historical Significance of Submarine Cables:

• The first successful submarine cable, the Transatlantic Cable, was laid in 1858, marking a revolutionary moment in global communication.

• Modern cables are designed to withstand oceanic pressures and harsh environmental conditions, ensuring uninterrupted data flow.

• Thematic Elements in "Twist":

• The novel explores themes of connection, both technological and human, highlighting the invisible threads that bind societies together.

• It also delves into the environmental and ethical implications of technological advancement, making it a thought-provoking read.

Important Points

• Other Options Explained:

• Under the Eye of the Big Bird: This title does not correspond to any known work by Colum McCann or align with the narrative of a submarine cable-laying ship.

• Wild Dark Shore: While evocative, this title does not relate to the technological or journalistic themes central to the question.

• Silver Elite: This title suggests a different context, potentially military or aristocratic, which is unrelated to the subject matter of the novel.

• Relevance of Submarine Cables Today:

• Submarine cables are critical for the functioning of the global internet and support services like cloud computing, streaming, and financial transactions.

• Issues like cable damage from natural disasters or human activities can disrupt global connectivity, highlighting their strategic importance.

Q100. Answer: (b) Kisan Kavach

The correct answer is Kisan Kavach.

Key Points

• Kisan Kavach is the name of India's first anti-pesticide bodysuit, designed to protect farmers from harmful pesticide exposure while working in agricultural fields.

• This bodysuit has been specially developed to address the challenges faced by Indian farmers, such as exposure to toxic chemicals during pesticide spraying.

• The suit acts as a protective shield, ensuring that harmful pesticides do not come into direct contact with the farmer's skin, thereby reducing health risks.

• It is made from lightweight and durable materials, ensuring comfort and ease of movement while providing robust protection.

• Such innovations are crucial for improving the working conditions of farmers and safeguarding their health, contributing to the larger goal of sustainable agricultural practices.

Additional Information

• Importance of Anti-Pesticide Bodysuits:

• Farmers in India often work in hazardous conditions, with exposure to harmful pesticides leading to severe health issues such as respiratory problems, skin diseases, and even long-term ailments like cancer.

• The anti-pesticide bodysuit, like Kisan Kavach, provides a preventive solution, reducing the likelihood of pesticide-related health complications.

• Such suits are particularly valuable in states with intensive agricultural activities, such as Punjab, Haryana, and Maharashtra, where pesticide use is prevalent.

• Features of Kisan Kavach:

• Made from advanced, non-toxic materials that resist pesticide penetration.

• Lightweight and breathable design to ensure comfort in hot and humid conditions.

• Reusable and cost-effective, making it affordable for farmers across different economic strata.

• Government Initiatives for Farmer Safety:

• The government has initiated awareness campaigns and training programs to educate farmers about the risks of pesticide exposure and the importance of using protective gear.

• Subsidies and financial assistance are being provided to encourage the adoption of safety equipment, including bodysuits like Kisan Kavach.

• Global Context:

• Countries like the USA and Japan have long adopted protective gear for farmers to mitigate pesticide exposure, serving as a model for similar initiatives in India.

• With the introduction of Kisan Kavach, India is taking significant steps toward aligning with global standards in agricultural safety.

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Important Points

• Health Risks of Pesticides:

• Pesticides contain harmful chemicals such as organophosphates, carbamates, and pyrethroids, which can cause acute poisoning and long-term health issues.

• Symptoms of pesticide poisoning include nausea, dizziness, headache, and skin irritation, with severe cases leading to organ damage or death.

• Role of Technology in Agriculture:

• Innovations like anti-pesticide bodysuits, drones for spraying pesticides, and AI-powered monitoring systems are transforming traditional farming practices in India.

• These advancements contribute to sustainable agriculture by minimizing health risks, improving efficiency, and reducing environmental damage.

• Future Scope:

• Scaling up the production of anti-pesticide bodysuits like Kisan Kavach can ensure widespread availability and affordability for farmers.

• Collaborations between the government, private sector, and research institutions can lead to further innovations in farmer safety equipment.

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