RRB Group D Official Paper (Held On: 26 Dec, 2025 Shift 1) (Previous Year Paper)

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

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GENERAL SCIENCE

Q1. Which of the following is NOT a typical characteristic of plants produced through vegetative propagation?

(a) They are genetically identical to the parent.
(b) They do not require pollination.
(c) They show variation in characteristics among offspring.
(d) They flower and fruit earlier than seed-grown plants.

Q2. If the length of a uniform metallic conductor is doubled, and simultaneously its area of cross-section is doubled, how does the resistance of the conductor change?

(a) It remains the same as the original resistance.
(b) It doubles the original resistance.
(c) It becomes four times the original resistance.
(d) It decreases to one-half of the original resistance.

Q3. When a more reactive metal is placed in the salt solution of a less reactive metal, it:

(a) gets reduced
(b) displaces the less reactive metal
(c) gets oxidised
(d) does not react

Q4. What is the primary purpose of the process of nutrition in living organisms?

(a) To form oxygen molecules required for photosynthesis
(b) To regulate visible movement and reproduction
(c) To produce carbon dioxide and other waste materials
(d) To obtain energy and raw materials from external sources

Q5. What happens to the egg if it is NOT fertilised?

(a) It becomes an embryo.
(b) It lives for about one day and then disintegrates.
(c) It implants in the uterus.
(d) It survives for a week.

Q6. A body of mass ‘m’ experiences a force ‘F’, producing an acceleration ‘a’. If the same force acts on a body of mass ‘2m’, the acceleration produced will be:

(a) a/4
(b) a/2
(c) 2a
(d) a

Q7. Which of the following is a homogeneous mixture?

(a) Air
(b) Water and ice
(c) Oil and water
(d) Sand and iron

Q8. Why is carbon able to form a large number of compounds?

(a) It forms strong ionic bonds.
(b) It has high density.
(c) It shows catenation and tetravalency.
(d) It is highly reactive.

Q9. An object of mass 12 kg is located such that its potential energy relative to the ground is 480 J. Assuming g = 10 m s^(-2), what is the height (h) of the object?

(a) 120 m
(b) 40 m
(c) 4 m
(d) 2 m

Q10. The principal focus of a convex lens is _____.

(a) the point where parallel rays converge
(b) the point where diverging rays meet
(c) the point behind the lens where rays diverge
(d) always at infinity

Q11. Muscle cells show higher mitochondrial activity after exercise. The result indicates which of the following?

(a) More energy is required during activity.
(b) Cells are becoming larger.
(c) Mitochondria cause fatigue.
(d) Cell division stops.

Q12. Which of the following best explains the importance of fertilisation in sexual reproduction?

(a) It cleanses the reproductive tract
(b) It increases the number of eggs in females
(c) It helps the uterus for menstrual flow
(d) It allows the formation of an embryo

Q13. Refer to the two statements given below and choose the correct option.

Statement A: Acids react with all metals to form hydrogen gas.

Statement B: Gold and platinum also react with acids to release hydrogen.

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

Q14. What is the energy absorbed during change of state at constant temperature called?

(a) Thermal energy
(b) Specific heat
(c) Latent heat
(d) Kinetic energy

Q15. Hydrometers are tools used to measure the density of liquids. Which scientific principle are they based on?

(a) Pascal's Law
(b) Universal law of Gravitation
(c) Archimedes' Principle

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(d) Newton's First Law

Q16. A basic solution will have a pH:

(a) Greater than 7
(b) Less than 7
(c) Equal to 7
(d) That cannot be predicted

Q17. Which of the following trophic levels is occupied by the tertiary consumers?

(a) Third trophic level
(b) Fourth trophic level
(c) Second trophic level
(d) First trophic level

Q18. What does the term 'formula unit mass' refer to?

(a) Mass of a single proton in an atom
(b) Sum of atomic masses of all atoms in the compound
(c) Mass of one molecule of a covalent compound
(d) Total mass of atoms in one mole of a compound

Q19. A sound wave has a wavelength of 0.5 m and frequency 680 Hz. The speed of sound is:

(a) 340 m/s
(b) 680 m/s
(c) 1360 m/s
(d) 170 m/s

Q20. Which of the following correctly describes the SI unit of electric power and the commercial unit of electrical energy, respectively?

(a) Kilowatt-hour (kWh); Watt (W)
(b) Volt (V); Joule (J)
(c) Watt (W); Kilowatt-hour (kWh)
(d) Watt (W); Joule (J)

Q21. Which cropping pattern involves growing two or more crops together on the same land at the same time, but in a defined row or spatial arrangement?

(a) Mixed cropping
(b) Monocropping
(c) Crop rotation
(d) Intercropping

Q22. When an object is placed at the focus of a convex lens, the formation of image is _____.

(a) between F and 2F
(b) at the centre of curvature
(c) on the same side as the object
(d) at infinity

Q23. What determines the atomic number of an element?

(a) Number of neutrons in an isotope
(b) Difference between mass and charge
(c) Number of electrons in all shells
(d) Total number of protons in nucleus

Q24. Which quantity changes due to an unbalanced force?

(a) Density
(b) Mass
(c) Time

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(d) Velocity

Q25. Which of the following cellular organelles performs the function of storage, modification and packaging of products in vesicles?

(a) Ribosomes
(b) Chloroplast
(c) Vacuoles
(d) Golgi Complex

MATHEMATICS

Q26. A student simplifies the expression: 0.25^6 ÷ 0.125² × 0.5^4. She writes the final answer in the form 0.5^(x+3). What value of x will make both sides equal?

(a) 10
(b) 7
(c) 4
(d) 6

Q27. The arithmetic mean of the observations 52, 40, 76, 99, 52, 27, 80, 27 and 24 is:

(a) 56
(b) 60
(c) 53
(d) 47

Q28. In a test, B got 50 marks while A got 75 marks, out of 85 maximum marks. What percentage of A's marks was B's marks? (Round off the answer to two decimal places.)

(a) 150.28%
(b) 85.79%
(c) 66.67%
(d) 88.23%

Q29. Walking at 5/7th of his normal speed from his home, Shahid is 22 minutes late in reaching his office. The usual time taken by him to cover the distance between his home and his office is:

(a) 61 minutes
(b) 55 minutes
(c) 51 minutes
(d) 48 minutes

Q30. A train covers a distance of 270 km in 4.5 hours. What is the speed of the train?

(a) 55 km/h
(b) 70 km/h
(c) 65 km/h
(d) 60 km/h

Q31. If $\tan\theta = (1-p^2)/2p$ and θ is an acute angle, find the value of $\sin\theta$.

(a) $(1+p^2)/2p$
(b) $(1+p^2)/(1-p^2)$
(c) $(1-p^2)/(1+p^2)$
(d) $2p/(1+p^2)$

Q32. The price of fuel decreases by 50%, 40% and 20% in three successive months, but increases by 50% in the fourth month. What is the percentage increase/decrease in the price of fuel in the fourth month as compared to its original price?

(a) Increases by 61%
(b) Increases by 65%

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(c) Decreases by 64%
(d) Decreases by 62%

Q33. The mean and the mode of a set of data are 86.7 and 51.3, respectively. Find the median of the data, using the empirical formula.
(a) 74.9
(b) 75.8
(c) 76.2
(d) 74

Q34. If $a+b+c=0$, then the value of $(a^3+b^3+c^3)^2$ is:
(a) $3\ a^2\ b^2\ c^2$
(b) $6\ a^2\ b^2\ c^2$
(c) $9\ a^2\ b^2\ c^2$
(d) 9 abc

Q35. Rs. 10,511 is divided among X, Y, and Z in such a way that if Rs. 87, Rs. 42, and Rs. 12 be deducted from their respective shares, they have money in the ratio 6 : 16 : 12. Find the difference between the Y's and Z's original shares.
(a) Rs. 1,320
(b) Rs. 1,370
(c) Rs. 1,120
(d) Rs. 1,250

Q36. If 40% of 50% of 1/2 of a number is 900. Find the number.
(a) 9000
(b) 12730
(c) 11490
(d) 8410

Q37. Raju has Rs. 50 more than Riya. Together they have Rs. 350. How much money does Raju have?
(a) Rs. 150
(b) Rs. 200
(c) Rs. 225
(d) Rs. 250

Q38. If the fourth proportional to P, 15 and 20 is 1, then find the value of P.
(a) 302
(b) 300
(c) 297
(d) 298

Q39. A sphere is lowered into water which is filled up to the brim in a conical vessel of radius 12 cm and height 16 cm. The size of the sphere is such that when it touches the sides of the cone, the sphere is just immersed into the cone. Find the ratio of the volume of water that has overflown to the volume of water left in the cone.
(Use $\pi = 22/7$)
(a) 3 : 5
(b) 5 : 7
(c) 2 : 7
(d) 4 : 5

Q40. One pipe can fill a tank in 6 minutes, while another pipe can empty the completely filled tank in 12 minutes. If both the pipes are opened together when the tank is empty, how many minutes will it take to fill one-half of the tank?
(a) 7
(b) 13
(c) 12

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(d) 6

Q41. If an item is bought for Rs. 800 and sold for Rs. 740, what is the loss percentage?

(a) 6.5%
(b) 7.5%
(c) 9.5%
(d) 8.5%

Q42. The difference between the ages of Girish and Rohan is 10 years. 15 years ago, Girish was twice as old as Rohan. Find Girish's present age.

(a) 35 years
(b) 32 years
(c) 37 years
(d) 39 years

Q43. An agent sells a turbo cooker with a marked price of Rs. 6,370 at a discount of 60%. What is the selling price (in Rs.) of the turbo cooker?

(a) 2,546
(b) 2,548
(c) 2,549
(d) 2,547

Q44. Find the HCF of 44, 110 and 198.

(a) 33
(b) 44
(c) 22
(d) 11

Q45. The base diameter of a closed cylinder is 24 ft and height is 9 ft. Find the total surface area of the cylinder.
(Use $\pi = 22/7$)

(a) 1564 ft^2
(b) 1574 ft^2
(c) 1594 ft^2
(d) 1584 ft^2

Q46. Find a single discount (approximately) equal to three consecutive discounts of 11%, 12% and 2%.

(a) 25.59%
(b) 23.97%
(c) 20.49%
(d) 23.25%

Q47. In a quadrilateral QRST, angle Q = 96° and angle R = 43°. The bisectors of angle S and angle T meet at E. What is the measure of angle TES?

(a) 56°
(b) 70.5°
(c) 69.5°
(d) 78°

Q48. 102 men have enough food supplies for 30 weeks. Along with them, 78 more men join. For how many weeks will the food supplies last?

(a) 21
(b) 19
(c) 15
(d) 17

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Q49. Two pipes, A and B, can fill a cistern in 6 hours and 8 hours, respectively. Pipe C can empty the cistern in 10 hours. Initially, pipes A and B are opened together to fill the cistern for 3 hours. After 3 hours, pipe A is closed, and pipes B and C are opened together. By what percentage was the time taken by pipes B and C to fill the remaining part of the cistern greater than the time taken by pipes A and B to fill it in the first 3 hours?

(a) 100/3%
(b) 150/3%
(c) 200/3%
(d) 50/3%

Q50. Find the simple interest (in Rs.) on Rs. 2,000 at 7% per annum rate of interest for the period from 11 February 2023 to 25 April 2023.

(a) 29
(b) 28
(c) 26
(d) 27

GENERAL INTELLIGENCE & REASONING

Q51. Which of the following letter-number clusters will replace the question mark (?) in the given series to make it logically complete?

YCG 87 IMQ 95 SWA 103 CGK 111 ?

(a) MRX 118
(b) MQU 119
(c) MRT 119
(d) MPT 118

Q52. What should come in place of the question mark (?) in the given series?

63 72 82 93 105 ?

(a) 118
(b) 116
(c) 120
(d) 114

Q53. Prakash starts from Point A and drives 35 km towards the south. He then takes a right turn, drives 38 km, turns right and drives 41 km. He then takes a right turn and drives 54 km. He takes a final right 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-degree turns only unless specified.)

(a) 17 km to the east
(b) 16 km to the west
(c) 18 km to the east
(d) 15 km to the west

Q54. Refer to the given number, symbol series and answer the question that follows. Counting to be done from left to right only. All numbers are single-digit numbers.

(Left) 5 € $ 4 9 & & 4 € @ © 7 @ 7 9 1 8 # 8 % 5 £ (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) 8
(c) 4
(d) 9

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Q55. Select the pair that follows the same pattern as the one followed by the two pairs given below. Both pairs follow the same pattern.

JGF−GDC

FCB−CZY

(a) BYX−XVT
(b) BYX−YVU
(c) BXV−XUT
(d) BXV−YVU

Q56. 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) GIK
(b) WYA
(c) UXY
(d) FHJ

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

17 ÷ 18 + 88 × 2 - 313 = ?

(a) 575
(b) 597
(c) 512
(d) 534

Q58. Which numbers should come in place of the question marks (?) in the same sequence to make the series logically complete?

989 979 969 ? 949 ? 929

(a) 959 and 929, respectively
(b) 929 and 939, respectively
(c) 959 and 939, respectively
(d) 949 and 939, respectively

Q59. In a certain code language, "XANJ" is coded as "98" and "VLQG" is coded as "116". What is the code for "ZRHU" in that language?

(a) 146
(b) 130
(c) 141
(d) 139

Q60. Refer to the given series and answer the question that follows (all numbers are single digit numbers only). Counting to be done from left to right only.

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

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

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

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Q61. Dayanand ranked 17^(th) from the top and 11^(th) from the bottom in his class. How many students are there in the class?

(a) 27
(b) 26
(c) 25
(d) 28

Q62. Anant starts from Point A and drives 32 km towards the south. He then takes a left turn, drives 34 km, turns left and drives 35 km. He then takes a left turn and drives 38 km. He takes a final left turn, drives 3 km and stops at Point P. How far (shortest distance) and towards which direction should he drive in order to reach Point A again? (All turns are 90-degree turns only unless specified.)

(a) 3 km to the east
(b) 5 km to the west
(c) 4 km to the east
(d) 6 km to the west

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

191 181 182 172 173 163 ?

(a) 164
(b) 163
(c) 162
(d) 161

Q64. A, B, C, D, E, F and G are sitting around a circular table, facing the centre.

Only two people sit between F and C, when counted from the right of F. Only two people sit between C and A, when counted from the right of C. Only three people sit between F and G, when counted from the right of F. E sits to the immediate left of D.

How many people sit between D and F, when counted from the right of D?

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

Q65. 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) 7 9 5 6 8 9 2 9 7 2 9 4 3 1 5 4 5 8 2 4 1 4 3 1 4 8 1 (Right)

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

(a) 6
(b) 7
(c) 4
(d) 5

Q66. In a certain code language,

‘A + B’ means ‘A is the brother of B’,

‘A – B’ means ‘A is the sister of B’,

‘A × B’ means ‘A is the mother of B’ and

‘A ÷ B’ means ‘A is the son of B’.

How is V related to Y if ‘V + W × X – Z ÷ Y’?

(a) Daughter's husband
(b) Brother's son
(c) Father's father
(d) Wife's brother

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Q67. Seven friends, L, M, N, O, Q, R and S, are sitting in a straight line facing north. Only four people sit to the right of O. Only three people sit between O and S. Only one person sits between S and L. R sits to the immediate left of M. N is not an immediate neighbour of S. How many people sit to the right of Q?

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

Q68. If 3 is added to each even digit and 2 is added to each odd digit in the number 3267541, what will be the sum of the last two and first two digits in the new number thus formed?

(a) 35
(b) 40
(c) 20
(d) 28

Q69. In a certain code language, "VACP" is coded as "126" and "MHTJ" is coded as "153". What is the code for "OGQE" in that language?

(a) 140
(b) 132
(c) 135
(d) 129

Q70. Select the triad which follows the same pattern as that followed by the two triads given below. Both triads follow the same pattern.

CL-FO-IK

EN-HQ-KM

(a) GP-JS-MO
(b) HP-JS-MN
(c) HP-JR-MN
(d) GP-JS-MN

Q71. 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) ECG
(b) QOS
(c) KJM
(d) USW

Q72. 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) 7 4 1 2 4 9 7 5 3 6 1 5 2 7 4 5 8 3 9 6 5 7 3 9 1 4 2 (Right)

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

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

Q73. KNSM is related to ORWQ in a certain way based on the English alphabetical order. In the same way, NQVP is related to RUZT. To which of the given options is GJOI related, following the same logic?

(a) KNSL
(b) KOSL
(c) KNSM

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(d) KOSM

Q74. 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 brinjals are peppers.

Some peppers are turnips.

Conclusions:

(I) Some brinjals are turnips.

(II) All turnips are peppers.

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

Q75. What should come in place of the question mark (?) in the given series based on the English alphabetical order?

SWE UYG WAI YCK ?

(a) AME
(b) ASE
(c) ADE
(d) AEM

Q76. In a row of 52 people facing north, Neena is 24^(th) from the right end. If Mishti sits 15^(th) to the left of Neena, what is Mishti's position from the left end of the line?

(a) 14th
(b) 16th
(c) 15th
(d) 13th

Q77. If 'A' stands for '÷', 'B' stands for '×', 'C' stands for '+' and 'D' stands for '−', what will come in place of the question mark (?) in the following equation?

65 B 7 D 912 A 6 C 98 = ?

(a) 444
(b) 401
(c) 410
(d) 471

Q78. A, B, C, D, E and F are sitting around a circular table, facing the centre. B sits third to the right of C. C sits second to the left of A. F sits third to the right of D. D sits to the immediate left of E. How many people sit between E and B, when counted from the left of E?

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

Q79. Read the given statements and conclusions carefully. Assuming that the information given in the statements is true, even if it appears to be at variance with commonly known facts, decide which of the given conclusions logically follow(s) from the statements.

Statements:

All fruits are vegetables.

No vegetable is a pumpkin.

Conclusions:

(I): No fruit is a pumpkin.

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(II): Some pumpkins are vegetables.

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

Q80. Select the set in which the numbers are related in the same way as are the numbers of the following sets.

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

(14, 28, 2)

(13, 39, 3)

(a) (11, 55, 6)
(b) (17, 65, 5)
(c) (15, 45, 3)
(d) (16, 32, 3)

GENERAL AWARENESS AND CURRENT AFFAIRS

Q81. In May 2025, the Reserve Bank of India (RBI) approved the renaming of the North East Small Finance Bank to _____.

(a) Synergy Small Finance Bank Limited
(b) Slice Small Finance Bank Limited
(c) North East Regional Finance Bank Limited
(d) Northeast Micro Finance Bank Limited

Q82. The West Bengal workplace safety guidelines (2025) specify that night shifts for women must include _____.

(a) at least two-third female staff or 20 women, whichever is higher
(b) at least 10 women or one-third of the total staff, whichever is higher
(c) at least 50% female security personnel on every shift
(d) only women supervisors

Q83. In March 2025, which 12-year-old swimmer set a record by completing the 17 km open-water swim from Gateway of India to Atal Setu?

(a) Arjun Borse
(b) Tanay Tushar Lad
(c) Rohan Mehta
(d) Vihaan Sharma

Q84. On 24 July 2025, the Ministry of Ports, Shipping and Waterways hosted which event in New Delhi to deliberate on financial strategies for India's maritime future?

(a) India Maritime Vision 2047 Conference
(b) Port & Shipping Investment Summit, 2025
(c) Maritime Development Forum, 2025
(d) Maritime Financing Summit, 2025

Q85. In June 2025, Union Home Minister Amit Shah unveiled the Flood Hazard Zonation Atlas of which state?

(a) Assam
(b) Himachal Pradesh
(c) Maharashtra
(d) Gujarat

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Q86. In which of the following cities was the regional meeting with Waqf Boards held in October 2025?

(a) Hyderabad
(b) Mumbai
(c) Delhi
(d) Bengaluru

Q87. Which of the following institutions co-organised 'the Belém Health Action Plan' event with the WHO and other UN partners at COP30 in November 2025?

(a) National Institutes of Health (NIH)
(b) World Trade Institute (WTI)
(c) United Nations University (UNU)
(d) Global Institute of Public Health (GIPH)

Q88. Who holds the record for most IPL fifty-plus scores as of 2025?

(a) Rohit Sharma
(b) Shikhar Dhawan
(c) David Warner
(d) Virat Kohli

Q89. In April 2025, the Reserve Bank of India (RBI) mandated banks to move to the '.bank.in' domain by _____.

(a) 31 October 2025
(b) 31 December 2025
(c) 30 May 2025
(d) 31 March 2026

Q90. In November 2025, where will COP30 the UN Climate Change Conference be held?

(a) Quito, Ecuador
(b) Belém, Brazil
(c) Nairobi, Kenya
(d) Bangkok, Thailand

Q91. Which automobile company successfully conducted a launch and landing test of its first experimental reusable rocket on June 17, 2025, in Hokkaido, Japan?

(a) Hyundai
(b) Mitsubishi
(c) Honda
(d) Toyota

Q92. The Central Pollution Control Board (CPCB) introduced a new Blue Category for industries through a circular in February 2025. Which industries fall under it?

(a) Essential environmental services like waste-to-energy plants
(b) IT and software service providers such as Infosys
(c) Textile and leather industries
(d) High-polluting industries like refineries

Q93. Which of the following famous footballers was awarded the United States Presidential Medal of Freedom in January 2025, the highest civilian honour of the United States of America?

(a) Lionel Messi
(b) Christiano Ronaldo
(c) Neymar Jr.
(d) Luiz Suarez

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Q94. Where was the World Health Summit Regional Meeting, 2025, held?

(a) Patna
(b) New Delhi
(c) Guwahati
(d) Kolkata

Q95. Which political party has won the bye elections to the constituency of Ludhiana west held in June 2025?

(a) Punjab Seva Dal
(b) Indian National Congress
(c) Bhartiya Janata Party
(d) Aam Aadmi Party

Q96. Which of the following organisations successfully flight-tested the nuclear-capable Agni-5 missile in August 2025?

(a) Defence Research and Development Organisation (DRDO)
(b) Bharat Dynamics Limited (BDL)
(c) Indian Space Research Organisation (ISRO)
(d) Hindustan Aeronautics Limited (HAL)

Q97. What is the title of Arundhati Roy's latest book, released in September 2025?

(a) The Architecture of Modern Empire
(b) Azadi: Freedom. Fascism. Fiction
(c) Mother Mary Comes to Me
(d) The Ministry of Utmost Happiness

Q98. "Operation Abhyaas", a nationwide civil defence mock drill held on 7 May 2025, was organized by which of the following in India?

(a) Ministry of Finance
(b) Ministry of Home Affairs
(c) Indian Institute of Administrative Sciences
(d) NITI Ayog

Q99. As per the Commission for Air Quality Management (CAQM)–revised Graded Response Action Plan (GRAP) for the entire NCR in November 2025, which measure was advanced from Stage II to Stage I?

(a) Allowing offices to work on 50% strength and the rest from home
(b) Staggering timings for public offices in Delhi and key NCR districts
(c) Ensuring uninterrupted power supply to discourage use of DG sets
(d) Complete ban on all construction activities across NCR

Q100. Which team won the 2025 EFL Championship playoff final and secured promotion to the Premier League?

(a) Sunderland
(b) Leeds United
(c) Southampton
(d) Sheffield United

ANSWER KEY

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

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

SOLUTIONS

Q1. Answer: (c) They show variation in characteristics among offspring.

The correct answer is They show variation in characteristics among offspring.

Key Points

• Vegetative propagation is a type of asexual reproduction in which new plants are produced from vegetative parts like roots, stems, and leaves rather than from seeds.

• One of the primary characteristics of this method is that the offspring are genetically identical to the parent plant. Because they are produced from a single parent without the fusion of gametes, they are essentially clones. Hence, statement 1 is a typical characteristic.

• Since this process does not involve the sexual reproductive cycle of a plant, it does not require pollination or fertilization to occur. This allows plants to reproduce even in the absence of pollinators like bees or butterflies. Hence, statement 2 is a typical characteristic.

• Genetic variation is a hallmark of sexual reproduction, caused by the shuffling of genes during meiosis and the combination of DNA from two parents. In vegetative propagation, since only mitosis is involved, there is no mechanism for genetic reassortment, and offspring do not show variation. Hence, statement 3 is NOT a typical characteristic and is the correct answer.

• Plants produced through vegetative means usually flower and fruit earlier than those grown from seeds. Seed-grown plants must undergo a long juvenile phase to establish themselves, whereas vegetative propagules (like cuttings or grafts) are often taken from mature plants and retain that maturity. Hence, statement 4 is a typical characteristic.

Additional Information

• Natural Methods of Vegetative Propagation:

• Roots: New plants emerge from adventitious buds on the roots, such as in Sweet Potato and Dahlia.

• Stems: Modified underground stems like Tubers (Potato), Rhizomes (Ginger and Turmeric), and Bulbs (Onion and Garlic) are common natural propagules.

• Leaves: Some plants like Bryophyllum produce adventitious buds along their leaf margins, which drop to the ground and grow into new individuals.

• Artificial Methods (Horticulture):

• Cutting: A piece of the stem or root is placed in the soil to generate a new plant; commonly used for Roses and Sugarcane.

• Grafting: Joining a Scion (part of one plant) with a Stock (rooted part of another) to combine desirable traits, widely used in Mango and Citrus cultivation.

• Layering: A branch is bent to the ground and covered with soil to induce root formation while still attached to the parent, used for Jasmine.

• Tissue Culture (Micropropagation): Growing plant cells or tissues in a sterile nutrient medium to produce thousands of identical plantlets, often used for Orchids and Bananas.

• Advantages and Disadvantages:

• The main advantage is the preservation of high-quality traits across generations and the ability to grow plants that do not produce viable seeds, such as seedless grapes or bananas.

• The primary disadvantage is the lack of genetic diversity. If the environment changes or a specific disease strikes, the entire population may be equally susceptible, potentially leading to total crop failure.

Q2. Answer: (a) It remains the same as the original resistance.

The correct answer is It remains the same as the original resistance.

Key Points

• The resistance (R) of a uniform metallic conductor is mathematically expressed by the formula $R = \rho (L / A)$, where ρ (rho) represents the resistivity of the material, L is the length of the conductor, and A is the area of cross-section.

• According to the question, the length is doubled, meaning the new length $L' = 2L$. This factor alone would typically increase the resistance because resistance is directly proportional to length.

• Simultaneously, the area of cross-section is doubled, meaning the new area $A' = 2A$. Increasing the area typically decreases the resistance because resistance is inversely proportional to the area of cross-section.

• By substituting these new values into the resistance formula, we get the new resistance $R' = \rho (2L / 2A)$. The numerical value 2

in the numerator and denominator cancels out, resulting in R' = ρ (L / A).

• Since the final expression for R' is identical to the original expression for R, the resistance remains the same as the original resistance. Hence, the statement in option 1 is correct.

Additional Information

• Factors Affecting Resistance:

• Length (L): Resistance is directly proportional to the length of the conductor. If a wire is stretched to double its length without changing the volume (which would change the area), the resistance would increase by four times. However, in this specific question, the area was also intentionally doubled.

• Area of Cross-section (A): Resistance is inversely proportional to the cross-sectional area. Thicker wires have less resistance compared to thinner wires of the same material and length.

• Nature of Material: Different materials have different resistivity (ρ). For instance, Silver and Copper have very low resistivity and are excellent conductors, while Nichrome has high resistivity and is used in heating elements.

• Temperature: For most metallic conductors, resistance increases with an increase in temperature.

• SI Unit: The standard unit of electrical resistance is the Ohm, symbolized by the Greek letter Ω (Omega). It is defined based on Ohm's Law, where 1 Ohm = 1 Volt / 1 Ampere.

Important Points

• Resistivity vs. Resistance: It is important to note that resistivity (ρ) is an intrinsic property of the material and does not change with the dimensions (length or area) of the conductor. In this problem, while resistance (R) stayed the same due to proportional changes, the resistivity remained constant throughout because the material did not change.

• Ohm's Law: This principle is foundational to current electricity, stating that the current through a conductor between two points is directly proportional to the voltage across the two points, provided physical conditions like temperature remain constant.

• Conductance: The reciprocal of resistance is called conductance (G), measured in Siemens (S) or mho. If resistance remains the same, the conductance also remains unchanged.

Q3. Answer: (b) displaces the less reactive metal

The correct answer is displaces the less reactive metal.

Key Points

• A displacement reaction is a type of chemical reaction where a more reactive metal displaces a less reactive metal from its salt solution. This occurs because the more reactive metal has a greater tendency to lose electrons and form positive ions.

• The relative reactivity of metals is determined by the Reactivity Series (or activity series), which is an arrangement of metals in descending order of their chemical activities. Metals at the top of the series, such as Potassium and Sodium, are highly reactive, while those at the bottom, like Gold and Platinum, are the least reactive.

• During this process, the more reactive metal undergoes oxidation as it loses electrons to become an ion in the solution. Conversely, the less reactive metal ion in the salt solution undergoes reduction as it gains those electrons to form a neutral metal atom.

• A classic example is the reaction between Iron (Fe) and Copper sulfate ($CuSO_4$) solution. Since Iron is more reactive than Copper, it displaces the copper from its solution, resulting in the formation of Ferrous sulfate ($FeSO_4$) and Copper (Cu) metal. Hence, the correct answer is that it displaces the less reactive metal.

• If a less reactive metal is placed in the salt solution of a more reactive metal, no chemical change occurs. For instance, if Copper is placed in a Zinc sulfate solution, there is no reaction because copper is lower than zinc in the reactivity series.

Additional Information

• The Reactivity Series:

• The standard order of reactivity (from most to least reactive) is Potassium (K), Sodium (Na), Lithium (Li), Calcium (Ca), Magnesium (Mg), Aluminium (Al), Zinc (Zn), Iron (Fe), Tin (Sn), Lead (Pb), Hydrogen (H), Copper (Cu), Mercury (Hg), Silver (Ag), and Gold (Au).

• Hydrogen, although a non-metal, is included in the series because it also forms positive ions and serves as a reference point for comparing the reactivity of metals with acids and water.

• Industrial Applications:

• Thermite Reaction: A displacement reaction where Aluminium powder reacts with Iron(III) oxide to produce molten iron. This reaction releases a massive amount of heat and is used for welding railway tracks and broken machine parts.

• Metal Extraction: Highly reactive metals like Sodium or Aluminium are used as reducing agents to displace metals like Chromium or Manganese from their respective oxides during the smelting process.

• Galvanization: To protect iron from corrosion, it is coated with Zinc. Because zinc is more reactive, it reacts with environmental oxygen and moisture first (sacrificial protection), effectively displacing the oxidation process away from the iron.

• Observation of Reactions:

• Displacement reactions are often accompanied by a color change in the solution. For example, when Iron nails are placed in

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blue-colored Copper sulfate, the solution gradually turns light green due to the formation of Iron sulfate.

• Visible deposits also form; in the Iron-Copper reaction, a reddish-brown layer of copper metal is deposited on the iron nail.

Important Points

• Redox Nature: Every single displacement reaction is a Redox reaction, meaning Reduction and Oxidation happen simultaneously. The metal that is more reactive is oxidized, and the metal ion that is displaced is reduced.

• Reaction with Water and Acids: Metals at the very top (K, Na) react violently with cold water to produce Hydrogen gas, while metals like Magnesium react only with hot water. Metals below Hydrogen in the series do not displace hydrogen from dilute acids.

• Chemical Equations: A general representation is A + BC → AC + B, where A is more reactive than B. If B were more reactive than A, the reaction would be represented as A + BC → No Reaction.

Q4. Answer: (d) To obtain energy and raw materials from external sources

The correct answer is To obtain energy and raw materials from external sources.

Key Points

• Nutrition is a fundamental life process that involves the intake of nutrients (food) by an organism and its subsequent utilization for various biological functions.

• Living organisms require a continuous supply of energy to maintain their state of order and perform essential life activities, even when they are not performing any apparent physical work.

• Since life on Earth is primarily based on carbon-based molecules, most food sources are also derived from carbon, necessitating the intake of raw materials from the environment.

• The process of nutrition ensures that the raw materials needed for growth, repair, and synthesis of proteins are made available to the cells. Hence, statement 4 is correct.

• While oxygen is involved in the breakdown of food during respiration, the primary purpose of nutrition itself is the acquisition of the fuel (food) rather than forming oxygen molecules. Hence, statement 1 is incorrect.

• Visible movement and reproduction are life processes facilitated by the energy derived from nutrition, but they are not the "purpose" of the nutrition process itself. Hence, statement 2 is incorrect.

• The production of carbon dioxide and waste materials is a consequence or byproduct of metabolism, not the primary goal of seeking nutrition. Hence, statement 3 is incorrect.

Additional Information

• Autotrophic Nutrition:

• In this mode, organisms like green plants and some autotrophic bacteria synthesize their own organic food using inorganic substances like carbon dioxide and water.

• This process, known as photosynthesis, typically occurs in the presence of sunlight and chlorophyll.

• Heterotrophic Nutrition:

• Organisms that cannot manufacture their own food depend on external sources for organic compounds.

• This group includes animals, fungi, and many bacteria. They must break down complex substances into simpler molecules using biological catalysts called enzymes.

• Metabolism:

• It refers to the sum of all chemical reactions occurring within a cell, categorized into anabolism (building molecules) and catabolism (breaking down molecules to release energy).

• The energy extracted during the catabolic phase of nutrition is often stored in the form of ATP (Adenosine Triphosphate), the energy currency of the cell.

• Balanced Diet:

• For complex organisms like humans, nutrition must include a balanced proportion of carbohydrates, proteins, fats, vitamins, and minerals to ensure optimal physiological health.

• The absence or deficiency of these raw materials can lead to various deficiency diseases and impaired biological development.

Important Points

• Energy Requirement: The chemical energy obtained from food is essential for cellular respiration, which powers the movement of molecules across cell membranes and the contraction of muscle fibers.

• Growth and Maintenance: Nitrogen, Phosphorus, and Iron are examples of essential minerals taken in as raw materials to build molecules like DNA, RNA, and Hemoglobin.

• Evolutionary Adaptation: Different organisms have evolved unique digestive systems (like the alimentary canal in humans or food vacuoles in Amoeba) to maximize the efficiency of obtaining materials from external sources.

Q5. Answer: (b) It lives for about one day and then disintegrates.

The correct answer is It lives for about one day and then disintegrates.

Key Points

• Every month, one of the ovaries releases an egg during a process known as ovulation. The egg then travels into the fallopian tube, where it waits for a sperm to fertilize it.

• If the egg is not fertilized by a sperm, its lifespan is remarkably short; it survives for only about 12 to 24 hours (roughly one day) after being released.

• Because the egg cannot maintain its biological integrity without fertilization, it eventually disintegrates or degenerates within the fallopian tube or uterus. Hence, the correct answer is that it lives for about one day and then disintegrates.

• Once the egg disintegrates, the level of hormones (specifically progesterone and estrogen) drops, signaling the body to shed the thickened lining of the uterus, which is known as the endometrium.

• Evaluating other options: The egg does not become an embryo unless fertilization occurs. Hence, statement 1 is incorrect. It does not implant in the uterus because implantation only happens to a fertilized egg that has developed into a blastocyst. Hence, statement 3 is incorrect. Furthermore, the egg cannot survive for a week, as its viable window is strictly limited to approximately 24 hours. Hence, statement 4 is incorrect.

Additional Information

• The Menstrual Cycle:

• The average menstrual cycle lasts about 28 days, though it can range from 21 to 35 days in healthy adults. It is divided into four main phases: the menstrual phase, the follicular phase, ovulation, and the luteal phase.

• Ovulation typically occurs around day 14 of a standard 28-day cycle. This is the only time during the month when a woman can become pregnant.

• Menstruation (Periods):

• If pregnancy does not occur, the unfertilized egg disintegrates and the uterine lining is shed through the vagina. This discharge of blood and tissue is called menstruation.

• A typical period lasts between 3 to 7 days. This process marks the beginning of a new menstrual cycle.

• Hormonal Regulation:

• The cycle is controlled by the pituitary gland and the ovaries. The primary hormones involved are Luteinizing Hormone (LH), Follicle-Stimulating Hormone (FSH), Estrogen, and Progesterone.

• A sudden surge in LH triggers the release of the egg from the follicle. If no fertilization happens, the corpus luteum withers, causing progesterone levels to fall, which leads to the menstrual flow.

• Fertilization Window:

• While the egg lives for only 24 hours, sperm can survive inside the female reproductive tract for up to 5 days. Therefore, the "fertile window" includes the days leading up to ovulation and the day of ovulation itself.

Q6. Answer: (b) a/2

The correct answer is a/2.

Key Points

• The fundamental principle involved in this problem is Newton's Second Law of Motion, which states that the acceleration of an object is directly proportional to the net force acting on it and inversely proportional to its mass.

• The mathematical representation of this law is given by the formula F = ma, where F is the force applied, m is the mass of the body, and a is the acceleration produced.

• In the first case, a body of mass m experiences a force F and produces an acceleration a. This can be written as a = F / m.

• In the second case, the same force F acts on a body of mass 2m. Let the new acceleration be a'. According to the formula, a' = F / (2m).

• By comparing the two equations, we can substitute F / m with a. Therefore, a' = (1/2) * (F / m), which simplifies to a' = a / 2. Hence, the acceleration produced will be a/2.

Additional Information

• Force (F): It is a vector quantity that can change the state of rest or motion of a body. The SI unit of force is the Newton (N). One Newton is defined as the force required to provide a mass of 1 kg with an acceleration of 1 m/s^2.

• Mass (m): This is a measure of the amount of matter in an object and is a scalar quantity. Its SI unit is the kilogram (kg). Mass is also a measure of inertia; the greater the mass, the greater the resistance to a change in motion.

• Acceleration (a): It is defined as the rate of change of velocity with respect to time. Like force, it is a vector quantity. The SI unit for acceleration is m/s^2 (meters per second squared).

• Inverse Relationship: Under a constant force, acceleration and mass are inversely proportional. This means if you double the mass, the acceleration becomes half. If you triple the mass, the acceleration becomes one-third, provided the force remains the same.

• Direct Relationship: For a constant mass, the acceleration is directly proportional to the applied force. Doubling the force results in doubling the acceleration.

Important Points

• Newton's First Law: Often called the Law of Inertia, it states that an object will not change its motion unless acted upon by an unbalanced force.

• Newton's Third Law: It states that for every action, there is an equal and opposite reaction. These forces always act on two different bodies.

• Weight vs. Mass: While mass is constant regardless of location, weight is a force (W = mg) that depends on the acceleration due to gravity (g), which is approximately 9.8 m/s² on Earth.

• Linear Momentum: Related to the second law, force can also be defined as the rate of change of momentum (p = mv). The formula F = ma is derived from F = dp/dt when the mass is constant.

Q7. Answer: (a) Air

The correct answer is Air.

Key Points

• A homogeneous mixture is a mixture in which the components are distributed uniformly throughout the entire volume. It consists of only one phase of matter, and the individual substances are not visible to the naked eye.

• Air is a gaseous solution that primarily consists of Nitrogen (78%) and Oxygen (21%), with smaller amounts of Argon, Carbon dioxide, and other trace gases. These gases are mixed so thoroughly that the composition is the same everywhere in a given sample. Hence, statement 1 is correct.

• In a homogeneous mixture, the particles are at the molecular or atomic level, meaning they cannot be separated by simple mechanical filtration.

• The properties of the mixture, such as density and refractive index, are uniform throughout the sample.

• Other examples of homogeneous mixtures include saltwater, sugar syrup, and alloys like brass or bronze.

Additional Information

• Heterogeneous Mixtures:

• These are mixtures where the components are not uniform and different samples from the same mixture may have different compositions.

• Sand and iron filings represent a heterogeneous mixture because the individual grains of sand and bits of iron remain distinct and can be seen separately. Hence, statement 4 is incorrect.

• Oil and water are immiscible liquids. When mixed, they form two distinct layers based on their densities and polarities, making them a classic example of a heterogeneous mixture. Hence, statement 3 is incorrect.

• Physical States and Phases:

• Water and ice, while chemically identical as H2O, exist in two different physical phases (liquid and solid). A container holding both has visible boundaries between the phases, so it is classified as a heterogeneous system rather than a homogeneous mixture. Hence, statement 2 is incorrect.

Important Points

• Separation Techniques: Homogeneous mixtures like air can be separated into components using fractional distillation of liquid air. Heterogeneous mixtures like sand and iron can be separated by magnetic separation.

• Solubility: Whether a liquid mixture is homogeneous often depends on solubility. Alcohol and water are miscible (forming a homogeneous mixture), whereas oil and water are not.

• Tyndall Effect: True homogeneous solutions do not scatter a beam of light passing through them, which distinguishes them from colloids (like milk) or suspensions (like muddy water) that appear uniform but are technically heterogeneous at a microscopic level.

Q8. Answer: (c) It shows catenation and tetravalency.

The correct answer is It shows catenation and tetravalency.

Key Points

• Catenation is the unique ability of carbon atoms to form strong covalent bonds with other carbon atoms, resulting in the formation of long chains, branched chains, and closed ring structures. This property allows for an almost infinite variety of molecular architectures.

• Carbon has a valency of 4, known as tetravalency. This means it has four valence electrons in its outermost shell, enabling it to form four chemical bonds with other atoms like hydrogen, oxygen, nitrogen, and halogens.

• The C-C bond energy is exceptionally high (approximately 348 kJ/mol), which makes the structures formed through catenation very stable under normal conditions compared to other elements like Silicon or Sulphur.

• Carbon can form multiple bonds, including double bonds and triple bonds, with itself and other electronegative atoms. This versatility significantly multiplies the number of possible chemical combinations and compounds.

• Because of these combined factors, carbon is the central element of Organic Chemistry, and there are currently over 10 million known carbon-based compounds recorded by scientists.

Additional Information

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• Bonding Nature: Carbon predominantly forms covalent bonds rather than ionic bonds. Removing four electrons to form a C4+ cation or gaining four to form a C4- anion is energetically unfavorable due to the high ionization energy and inter-electronic repulsion.

• Atomic Size: Carbon is a second-period element with a small atomic radius. This small size allows the nucleus to exert a strong pull on the shared pair of electrons, making the resulting covalent bonds very strong and stable.

• Comparison with Silicon: While Silicon (Si) is also tetravalent and belongs to the same group (Group 14), its catenation tendency is much lower because Si-Si bonds are weaker due to its larger atomic size and diffused orbitals.

• Isomerism: Carbon compounds exhibit isomerism, where compounds with the same molecular formula have different structural arrangements. This phenomenon further increases the diversity of carbon compounds found in nature.

Important Points

• Hydrocarbons: These are the simplest carbon compounds consisting only of carbon and hydrogen. They are classified into Saturated (alkanes) with single bonds and Unsaturated (alkenes and alkynes) with multiple bonds.

• Functional Groups: The presence of groups like hydroxyl (-OH), carboxyl (-COOH), and aldehydes (-CHO) attached to the carbon skeleton dictates the specific chemical properties of the compound, regardless of the chain length.

• Allotropes: Carbon exists in different physical forms such as Diamond (3D network), Graphite (layered structure), and Fullerenes (spherical/tubular), demonstrating its structural versatility even in its elemental form.

Q9. Answer: (c) 4 m

The correct answer is 4 m.

Key Points

• The Gravitational Potential Energy (PE) of an object raised to a certain height is given by the formula: PE = m × g × h, where m is the mass, g is the acceleration due to gravity, and h is the height.

• In this specific problem, the mass (m) of the object is 12 kg.

• The acceleration due to gravity (g) is provided as 10 m/s².

• The Potential Energy (PE) relative to the ground is 480 J (Joules).

• To find the height (h), we rearrange the formula: h = PE / (m × g).

• By substituting the given values: h = 480 / (12 × 10).

• Calculating the denominator: 12 × 10 = 120.

• Final calculation: h = 480 / 120 = 4.

• Therefore, the object is located at a height of 4 m above the ground. Hence, the correct answer is 4 m.

Additional Information

• Potential Energy: This is the energy possessed by an object by virtue of its position or configuration. In the context of gravity, it represents the work done against gravity to lift an object to a specific height.

• Mass (m): It is a measure of the amount of matter in an object, usually measured in kilograms (kg). In this problem, it is 12 kg.

• Acceleration due to Gravity (g): On the surface of the Earth, the standard value of g is approximately 9.8 m/s², but for simplicity in competitive exams and school level physics, it is often taken as 10 m/s².

• Joule (J): This is the SI unit of energy and work. One Joule is defined as the work done when a force of one Newton displaces an object by one meter.

• Work-Energy Theorem: The change in the potential energy of an object is equal to the work done by the external force in moving the object from the ground to that height without changing its kinetic energy.

Important Points

• Reference Level: Potential energy is always measured relative to a reference point, which in most basic physics problems is the ground (where h = 0).

• Energy Conversion: If the object of 12 kg were allowed to fall from 4 m, its Potential Energy would gradually convert into Kinetic Energy (KE). Just before hitting the ground, its KE would be equal to the initial PE of 480 J, assuming no air resistance.

• Scalar Quantity: Energy is a scalar quantity, meaning it has magnitude but no direction. This distinguishes it from force or velocity, which are vector quantities.

• Dimensional Formula: The dimensional formula for Potential Energy is [M1 L2 T-2], which is the same as that for work and torque.

Q10. Answer: (a) the point where parallel rays converge

The correct answer is the point where parallel rays converge.

Key Points

• The principal focus of a convex lens is defined as the point on the principal axis where all the light rays that are travelling parallel to the principal axis actually converge after passing through the lens. Hence, statement 1 is correct.

• A convex lens is also known as a converging lens because it bends incident parallel rays inward toward a single point.

• Since the light rays actually meet at this point, the focus of a convex lens is a real focus.

• The distance between the optical center of the lens and the principal focus is known as the focal length (denoted by f).

• In contrast, a concave lens causes parallel rays to diverge; therefore, its focus is the point from which the rays appear to diverge, making it a virtual focus. Hence, statement 2 and 3 are incorrect.

• The focus is a fixed property based on the curvature of the lens and the refractive index of the material; it is not always at infinity. Hence, statement 4 is incorrect.

Additional Information

• Optical Center: This is the central point of the lens. Any ray of light passing through the optical center emerges without any deviation.

• Principal Axis: An imaginary straight line passing through the centers of curvature of the two surfaces of the lens and its optical center.

• Power of a Lens: The power (P) of a lens is the reciprocal of its focal length (f) in meters. The SI unit of power is the Dioptre (D). A convex lens has positive power, while a concave lens has negative power.

• Lens Formula: The relationship between the object distance (u), image distance (v), and focal length (f) is given by $1/v - 1/u = 1/f$.

• Applications: Convex lenses are widely used in spectacles to correct Hypermetropia (long-sightedness), in magnifying glasses, microscopes, cameras, and astronomical telescopes.

Important Points

• Radius of Curvature: For a spherical lens, the radius of curvature (R) is generally twice the focal length (f), represented as $R = 2f$.

• Image Formation: A convex lens can form both real and inverted images as well as virtual and erect images, depending on the position of the object relative to the focus.

• Aperture: The effective diameter of the circular outline of a spherical lens is called its aperture, which determines the amount of light entering the lens.

• Sign Convention: According to the Cartesian sign convention, the focal length of a convex lens is always taken as positive, whereas for a concave lens, it is negative.

Q11. Answer: (a) More energy is required during activity.

The correct answer is More energy is required during activity.

Key Points

• Mitochondria are known as the "powerhouse of the cell" because they are responsible for synthesizing Adenosine Triphosphate (ATP), which is the primary energy currency for all cellular processes.

• When an individual engages in exercise or physical activity, skeletal muscle cells must contract rapidly and repeatedly. This mechanical work requires a continuous and significantly increased supply of chemical energy.

• To fulfill this heightened demand, the rate of cellular respiration increases. This process occurs within the mitochondria, where oxygen and glucose (or fatty acids) are processed to produce ATP.

• The observation of higher mitochondrial activity after exercise directly reflects the cell's effort to replenish ATP levels that were depleted during the activity. Hence, statement 1 is correct.

• Other options, such as cell division or fatigue, do not directly explain why mitochondrial activity peaks as a response to the metabolic stress of exercise. Hence, statements 2, 3, and 4 are incorrect.

Additional Information

• Mitochondrial Biogenesis:

• Consistent endurance training leads to an adaptation called mitochondrial biogenesis, which is an increase in the volume and density of mitochondria within muscle fibers.

• This adaptation allows athletes to utilize oxygen more efficiently and sustain aerobic activity for longer periods without hitting anaerobic thresholds.

• ATP Structure and Function:

• ATP consists of an adenosine molecule bonded to three phosphate groups. The energy is stored in the high-energy phosphate bonds.

• When muscles contract, ATP is hydrolyzed into ADP (Adenosine Diphosphate) and an inorganic phosphate, releasing energy that powers myosin filaments.

• Aerobic vs. Anaerobic Metabolism:

• Mitochondria are the site of aerobic metabolism. During low to moderate intensity exercise, they provide nearly all the energy required.

• In high-intensity "sprints," the body may rely on anaerobic glycolysis, which happens in the cytoplasm and produces lactic acid as a byproduct, leading to temporary muscle fatigue.

• Muscle Fiber Specialization:

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• Type I (Slow-twitch) muscle fibers are rich in mitochondria and myoglobin, making them resistant to fatigue and ideal for marathon running.

• Type II (Fast-twitch) fibers have fewer mitochondria but are capable of powerful, rapid contractions used in weightlifting or spriting.

Important Points

• Oxygen Debt: After intense exercise, mitochondrial activity remains high to pay off the "oxygen debt." This is the oxygen required to restore ATP levels and clear metabolic byproducts like lactate.

• Cellular Respiration Stages: The mitochondria facilitate the Krebs Cycle (Citric Acid Cycle) and the Electron Transport Chain (ETC). The ETC is the most efficient stage, producing approximately 32 to 34 ATP molecules per glucose molecule.

• Homeostasis: The regulation of mitochondrial activity is a key part of metabolic homeostasis, ensuring that the energy supply matches the energy demand of the organism.

Q12. Answer: (d) It allows the formation of an embryo

The correct answer is option4. The detailed solution will be updated soon.

Q13. Answer: (d) Both statements A and B are incorrect.

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

Key Points

• Statement A asserts that acids react with all metals to form hydrogen gas. This statement is incorrect because only metals that are positioned above Hydrogen in the Reactivity Series can displace hydrogen from dilute acids.

• Metals such as Copper, Mercury, Silver, Gold, and Platinum are less reactive than hydrogen and do not react with dilute Hydrochloric Acid (HCl) or dilute Sulphuric Acid (H_2SO_4) to liberate Hydrogen gas. Hence, statement A is incorrect.

• Statement B claims that Gold and Platinum react with acids to release hydrogen. This statement is incorrect because these are classified as Noble Metals.

• Gold and Platinum are at the very bottom of the Reactivity Series, meaning they are chemically inert under normal conditions and do not react with common mineral acids to release any gas. Hence, statement B is incorrect.

• While most reactive metals like Sodium, Magnesium, and Zinc react with dilute acids to form a salt and evolve Hydrogen gas, the statement "all metals" makes the generalization false.

• Furthermore, even for reactive metals, the reaction with Nitric Acid (HNO_3) usually does not produce hydrogen gas because Nitric Acid is a strong Oxidizing Agent; it oxidizes the hydrogen produced into Water (H_2O) and itself gets reduced to nitrogen oxides.

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

Additional Information

• The Reactivity Series:

• The Reactivity Series is a list of metals arranged in the order of their decreasing chemical reactivity. Metals at the top, such as Potassium (K) and Sodium (Na), are highly reactive, while those at the bottom, like Gold (Au) and Platinum (Pt), are the least reactive.

• Metals placed above Hydrogen can reduce hydrogen ions from dilute acids to form hydrogen molecules (H_2 gas).

• Noble Metals:

• Metals like Gold, Silver, and Platinum are called Noble Metals because they resist oxidation and corrosion in moist air and do not react with ordinary acids.

• These metals are widely used in Jewellery and Electronics due to their stability and lack of reactivity.

• Aqua Regia (Royal Water):

• Although Gold and Platinum do not react with concentrated mineral acids individually, they can be dissolved in a special mixture called Aqua Regia.

• Aqua Regia is a freshly prepared mixture of concentrated Hydrochloric Acid (HCl) and concentrated Nitric Acid (HNO_3) in a molar ratio of 3:1.

• It is a highly corrosive, fuming liquid used to dissolve noble metals for refining and cleaning purposes.

Important Points

• Chemical Reaction General Formula: For a reactive metal (M), the general reaction is: Metal + Dilute Acid → Metal Salt + Hydrogen Gas. For example, $Zn + 2HCl \rightarrow ZnCl_2 + H_2$.

• Exceptions with Nitric Acid: Only Magnesium (Mg) and Manganese (Mn) react with Very Dilute Nitric Acid to evolve Hydrogen gas. For other metals, the oxidizing nature of HNO_3 prevents the release of H_2.

• Displacement Reaction: The reaction between a metal and an acid is a type of Single Displacement Reaction (or Redox Reaction) where the metal atoms lose electrons to become ions, and hydrogen ions gain those electrons to become hydrogen gas.

Q14. Answer: (c) Latent heat

The correct answer is Latent heat.

Key Points

• Latent heat is defined as the heat energy per unit mass required to change the state of a substance without any change in its temperature.

• The term "latent" originates from the Latin word latere, which means hidden. This is because the heat added does not manifest as an increase in the temperature of the substance, making it "hidden" from a thermometer.

• During a phase transition (such as melting or boiling), the energy supplied is utilized to overcome the intermolecular forces of attraction that hold the molecules together in a specific phase.

• The mathematical expression for latent heat is Q = mL, where Q represents the total heat absorbed or released, m is the mass of the substance, and L is the specific latent heat of the substance.

• There are two primary types of latent heat: Latent Heat of Fusion (solid to liquid transition) and Latent Heat of Vaporization (liquid to gas transition).

Additional Information

• Specific Heat Capacity:

• This is the amount of heat energy required to raise the temperature of one kilogram (or gram) of a substance by one degree Celsius (or Kelvin).

• Unlike latent heat, specific heat involves a temperature change within a single phase of matter.

• Thermal Energy:

• It refers to the total internal energy of a system, which is the sum of the potential energy and kinetic energy of all the atoms or molecules in that system.

• It flows from a body at a higher temperature to a body at a lower temperature in the form of heat.

• Kinetic Energy:

• In thermodynamics, Kinetic Energy is the energy possessed by particles due to their motion (vibrational, rotational, or translational).

• The average kinetic energy of the particles is directly proportional to the absolute temperature of the substance; hence, during a state change where temperature is constant, the average kinetic energy remains unchanged.

• Specific Latent Heat of Water:

• The Latent Heat of Fusion for ice is approximately 3.34 x 10^5 J/kg or 80 cal/g.

• The Latent Heat of Vaporization for water is approximately 22.6 x 10^5 J/kg or 540 cal/g, which explains why steam causes more severe burns than boiling water at the same temperature.

Important Points

• The SI unit of specific latent heat is Joules per kilogram (J/kg), while in the CGS system, it is often expressed as calories per gram (cal/g).

• During evaporation, a liquid absorbs latent heat from its surroundings, leading to a cooling effect. This is the fundamental principle behind why humans sweat to regulate body temperature.

• In a heating curve graph (temperature vs. time), the process of latent heat absorption appears as a horizontal line (plateau), indicating that time is passing and heat is being added, but the temperature is not rising.

Q15. Answer: (c) Archimedes' Principle

The correct answer is Archimedes' Principle.

Key Points

• Archimedes' Principle states that any object, totally or partially immersed in a fluid, is buoyed up by a force equal to the weight of the fluid displaced by the object. This upward force is known as the buoyant force.

• A hydrometer is a scientific instrument used to measure the relative density or specific gravity of liquids. It operates based on the principle of flotation derived from Archimedes' findings.

• The device typically consists of a hollow glass tube with a weighted bulb at the bottom to make it float upright. The stem of the hydrometer contains a graduated scale to read the density directly.

• According to the principle, a hydrometer will sink deeper in a low-density liquid (like gasoline or alcohol) because it needs to displace more volume to equal its own weight. Conversely, it will float higher in a high-density liquid (like concentrated sulfuric acid or brine). Hence, the option Archimedes' Principle is correct.

Additional Information

• Pascal's Law:

• Formulated by Blaise Pascal, it states that pressure applied to an enclosed fluid is transmitted undiminished to every portion of the fluid and to the walls of the container.

• This principle is the functional basis for hydraulic lifts, hydraulic brakes in automobiles, and hydraulic presses used in heavy industry.

• Newton's First Law:

• Also known as the Law of Inertia, it states that an object will remain at rest or in uniform motion in a straight line unless acted upon by an external unbalanced force.

• It defines the concept of inertia, which is the tendency of objects to resist changes in their state of motion.

• Universal Law of Gravitation:

• Proposed by Sir Isaac Newton in 1687, this law states that every mass attracts every other mass in the universe with a force proportional to the product of their masses and inversely proportional to the square of the distance between their centers.

• It explains the motion of planets, the occurrence of tides, and why objects fall toward the Earth.

• Types of Hydrometers:

• Lactometer: A specialized hydrometer used to test the purity of milk by measuring its density.

• Saccharometer: Used by brewers and winemakers to determine the sugar content in a solution by measuring the liquid's density.

• Alcoholometer: Used to determine the alcoholic strength of liquids, often calibrated in percent alcohol by volume.

Important Points

• Specific Gravity: It is a dimensionless quantity representing the ratio of the density of a substance to the density of pure water at 4 degrees Celsius. Because it is a ratio, it has no units.

• Temperature Sensitivity: Since the density of a liquid changes with temperature due to thermal expansion, hydrometers are usually calibrated at a specific standard temperature, such as 15.6 degrees Celsius (60 degrees Fahrenheit) or 20 degrees Celsius.

• Reading the Scale: When using a hydrometer, the reading is taken at the point where the surface of the liquid crosses the scale on the stem. In many transparent liquids, this reading is taken at the bottom of the meniscus for maximum accuracy.

• Ballast: The bottom bulb of a hydrometer is filled with a heavy material like lead shot or mercury. This ensures the center of gravity is low, allowing the instrument to float vertically and provide stable readings.

Q16. Answer: (a) Greater than 7

The correct answer is Greater than 7.

Key Points

• The pH scale is a tool used to measure how acidic or basic (alkaline) a water-based solution is. The scale typically ranges from 0 to 14.

• A basic solution is defined as having a pH value greater than 7. This indicates a higher concentration of hydroxide ions (OH-) relative to hydrogen ions (H+). Hence, option 1 is the correct answer.

• At a standard temperature of 25°C (298 K), a solution with a pH equal to 7 is considered neutral, meaning the concentrations of H+ and OH- ions are perfectly balanced. Pure water is a classic example of a neutral substance.

• Solutions with a pH less than 7 are classified as acidic. The lower the pH value, the stronger the acidity of the solution, representing a high concentration of hydrogen ions.

• The term pH stands for "potential of Hydrogen" or "power of Hydrogen". It is mathematically calculated as the negative logarithm (base 10) of the molar concentration of hydrogen ions in the solution.

Additional Information

• Characteristics of Bases:

• Bases have a bitter taste and a slippery or soapy feel to the touch.

• In chemical testing, bases turn red litmus paper to blue and turn phenolphthalein indicator pink.

• Common examples of basic substances include Sodium Hydroxide (NaOH), also known as caustic soda, Calcium Hydroxide (Ca(OH)2), and Ammonia (NH3).

• Daily life examples of bases include baking soda, antacids, soap, and bleach.

• Strong vs. Weak Bases:

• A strong base is one that fully dissociates into its ions in an aqueous solution, such as Potassium Hydroxide (KOH).

• A weak base only partially dissociates in water, such as Ammonium Hydroxide (NH4OH).

• pH and pOH Relationship:

• In any aqueous solution at 25°C, the sum of pH and pOH (potential of hydroxide) always equals 14.

• This relationship is derived from the ionic product of water (Kw), which is 1.0 x 10^-14 at room temperature.

Important Points

• Logarithmic Nature: The pH scale is logarithmic, meaning each whole pH value below 7 is ten times more acidic than the next higher value. For instance, a solution with pH 4 is 10 times more acidic than pH 5 and 100 times more acidic than pH 6.

• Temperature Sensitivity: The neutral point of the pH scale is exactly 7 only at 25°C. If the temperature increases, the

auto-ionization of water increases, which can lower the pH value of neutral water even though it remains chemically neutral.

• Measurement Tools: pH can be measured using universal indicators, pH paper, or high-precision electronic devices called pH meters, which measure the electromotive force between electrodes placed in the solution.

• Biological Significance: Most biological fluids in the human body, such as blood, are slightly basic, with a pH maintained strictly between 7.35 and 7.45.

Q17. Answer: (b) Fourth trophic level

The correct answer is Fourth trophic level.

Key Points

• In an ecosystem, a trophic level represents the specific place or step an organism occupies in a food chain based on its source of nutrition or food.

• The First trophic level is always occupied by producers (autotrophs), such as green plants, algae, and phytoplankton, which fix solar energy through photosynthesis.

• The Second trophic level consists of primary consumers or herbivores. These organisms, such as cows, grasshoppers, and deer, feed directly on the producers.

• The Third trophic level is occupied by secondary consumers (primary carnivores). These are animals that eat herbivores, including species like frogs, small fish, and birds.

• The Fourth trophic level is occupied by tertiary consumers, also known as secondary carnivores or top carnivores. These organisms prey on secondary consumers and are often the apex predators in their environment. Examples include lions, tigers, eagles, and snakes. Hence, the correct answer is the fourth trophic level.

Additional Information

• Energy Flow and the 10% Law:

• The flow of energy in an ecosystem is unidirectional, moving from lower to higher trophic levels.

• According to the 10% Law proposed by Raymond Lindeman in 1942, only about 10 percent of the energy available at one trophic level is transferred to the next higher level. The remaining 90 percent is lost as heat during respiration and other metabolic processes.

• Ecological Pyramids:

• Concept introduced by Charles Elton in 1927, these pyramids represent the relationship between different trophic levels in terms of number, biomass, or energy.

• The Pyramid of Energy is always upright because energy is progressively lost as heat at each step.

• The Pyramid of Biomass can be inverted in aquatic ecosystems where the biomass of phytoplankton (producers) is less than the biomass of fishes (consumers).

• Biological Magnification (Biomagnification):

• This refers to the increase in the concentration of toxic substances (like DDT or mercury) at successive trophic levels.

• Since these chemicals cannot be metabolized or excreted, they accumulate, reaching the highest concentration in tertiary consumers or top carnivores.

• Decomposers:

• Organisms like bacteria and fungi are known as saprotrophs or decomposers. While they are crucial for nutrient cycling, they are generally not assigned a single numerical trophic level in simple food chain diagrams as they feed on dead matter from all levels.

Important Points

• The number of trophic levels in a food chain is usually restricted to four or five because the energy transfer becomes too low to support a viable population at higher levels.

• Omnivores, such as humans and bears, can occupy more than one trophic level simultaneously depending on what they consume.

• A Food Web provides a more realistic representation of ecosystem dynamics than a linear food chain, as it shows the multiple feeding relationships between different organisms across various trophic levels.

Q18. Answer: (b) Sum of atomic masses of all atoms in the compound

The correct answer is Sum of atomic masses of all atoms in the compound.

Key Points

• The formula unit mass of a substance is defined as the sum of the atomic masses of all atoms in a formula unit of a compound.

• This term is specifically used for substances that are ionic in nature, where discrete molecules do not exist. Instead, these substances exist as a three-dimensional lattice of ions.

• The calculation method for formula unit mass is identical to that of molecular mass; the only difference lies in the terminology used for ionic compounds versus covalent compounds.

• It is expressed in atomic mass units (u), where 1 u is defined as exactly 1/12th the mass of one atom of carbon-12.

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• For example, in Sodium Chloride (NaCl), the formula unit consists of one Sodium (Na) ion and one Chloride (Cl) ion. The formula unit mass is calculated by adding the atomic mass of Na (23 u) and Cl (35.5 u), resulting in 58.5 u.

Additional Information

• Molecular Mass:

• This refers to the sum of atomic masses of all atoms in a molecule of a substance. It is used for covalent compounds like Water (H2O) or Methane (CH4).

• For H2O, the molecular mass is (2 x 1.008 u) + 16.00 u = 18.016 u.

• Atomic Mass:

• It is the mass of a single atom of a chemical element. It is approximately equivalent to the number of protons and neutrons in the nucleus.

• The unified atomic mass unit (u) is the standard unit used to indicate mass on an atomic or molecular scale.

• Molar Mass:

• This is the mass of one mole of a substance (element or compound). It is numerically equal to the atomic or molecular mass but is expressed in grams per mole (g/mol).

• One mole contains exactly 6.02214076 x 10^23 elementary entities, a value known as Avogadro's number.

• Ionic Compounds and Lattice Structures:

• In compounds like Calcium Chloride (CaCl2), the formula unit mass is calculated as the sum of the atomic mass of Calcium (40 u) and twice the atomic mass of Chlorine (2 x 35.5 u), totaling 111 u.

• These compounds do not form individual molecules but rather repeating units in a crystalline structure.

Important Points

• Relative Atomic Mass: The atomic masses used in these calculations are relative values compared to the Carbon-12 isotope.

• Stoichiometry: Understanding formula unit mass is crucial for stoichiometric calculations in chemistry, allowing scientists to determine the mass-to-mole ratios in chemical reactions.

• Precision: While whole numbers are often used for simplicity (e.g., O = 16), high-precision chemistry uses decimal values (e.g., O = 15.999) to account for isotopic abundance.

Q19. Answer: (a) 340 m/s

The correct answer is 340 m/s.

Key Points

• The speed of a sound wave is defined as the distance a point on the wave, such as a compression or a rarefaction, travels per unit of time. It is mathematically represented by the wave equation: Speed (v) = Frequency (f) × Wavelength (λ).

• In the given problem, the frequency (f) of the sound wave is 680 Hz (which means 680 vibrations per second).

• The wavelength (λ) is provided as 0.5 m, which represents the distance between two consecutive compressions or rarefactions in the longitudinal wave.

• By substituting these values into the formula: v = 680 Hz × 0.5 m.

• The calculation results in 340. Therefore, the speed of the sound wave is 340 m/s. Hence, the correct answer is 340 m/s.

Additional Information

• Sound Waves:

• Sound is a mechanical wave that requires a medium (solid, liquid, or gas) to propagate. It cannot travel through a vacuum.

• In air, sound waves are longitudinal, meaning the particles of the medium vibrate parallel to the direction of wave propagation.

• Frequency (f):

• It is the number of complete waves (or cycles) produced in one second. The SI unit of frequency is Hertz (Hz).

• Humans can typically hear sounds with frequencies ranging from 20 Hz to 20,000 Hz (the audible range).

• Wavelength (λ):

• It is the linear distance between two successive points in the same phase, such as the distance between two adjacent compressions or rarefactions. It is measured in meters (m).

• Speed of Sound in Different Media:

• The speed of sound depends on the elasticity and density of the medium.

• Sound travels fastest in solids (e.g., steel at approx 5960 m/s), followed by liquids (e.g., water at approx 1480 m/s), and slowest in gases (e.g., air at approx 343 m/s at 20°C).

Important Points

• Relationship: For a constant speed, frequency and wavelength are inversely proportional. If the frequency of a sound wave increases, its wavelength must decrease.

• Effect of Temperature: The speed of sound in a gas is proportional to the square root of its absolute temperature (v prop. to √T).

As the temperature increases, the speed of sound also increases. In air, the speed increases by approximately 0.6 m/s for every 1°C rise in temperature.

• Effect of Humidity: Sound travels faster in humid air than in dry air because water vapor is less dense than dry air (nitrogen and oxygen), which reduces the overall density of the air-vapor mixture.

• Mach Number: This is a dimensionless quantity representing the ratio of the speed of an object to the speed of sound in the surrounding medium. If the Mach number is greater than 1, the object is traveling at supersonic speed.

Q20. Answer: (c) Watt (W); Kilowatt-hour (kWh)

The correct answer is Watt (W); Kilowatt-hour (kWh).

Key Points

• Electric Power is defined as the rate at which electrical energy is consumed or dissipated in an electrical circuit. It represents how fast work is being done by an electric current.

• The SI unit of electric power is the Watt (W). One Watt is equivalent to 1 Joule per second (1 J/s). This means if an appliance uses one joule of energy every second, its power rating is one watt.

• Electrical Energy refers to the total energy consumed by an electrical appliance over a specific duration. It is calculated by the product of power and time (Energy = Power × Time).

• The commercial unit of electrical energy is the Kilowatt-hour (kWh). This unit is used for billing purposes in households and industries because the standard SI unit (Joule) is too small to represent large-scale energy consumption conveniently.

• One Kilowatt-hour is defined as the amount of energy consumed when an electrical appliance with a power rating of 1000 Watts (1 kW) is used for a duration of 1 hour.

• In the given question, the SI unit for power is Watt (W) and the commercial unit for energy is Kilowatt-hour (kWh). Hence, Option 3 is the correct description.

Additional Information

• James Watt: The unit of power is named after the Scottish inventor James Watt (1736–1819), who significantly improved the steam engine, leading to the Industrial Revolution.

• SI Unit of Energy: While kWh is the commercial unit, the SI unit of energy is the Joule (J). A Joule is the amount of work done when a force of 1 Newton moves an object by 1 meter in the direction of the force.

• Unit Conversion: The relationship between the commercial unit and the SI unit is 1 kWh = 3.6 × 10^6 Joules (or 3,600,000 J). This is derived by multiplying 1000 Watts by 3600 seconds (the number of seconds in an hour).

• Horsepower (hp): Another common unit of power used in the automotive and mechanical industry is Horsepower. One metric horsepower is approximately equal to 735.5 Watts, while one imperial horsepower is approximately 746 Watts.

• Voltage and Current: The Volt (V) is the SI unit of electric potential or electromotive force, and the Ampere (A) is the SI unit of electric current. Power can also be expressed as P = V × I.

Important Points

• Domestic Electricity Bills: In general terminology, 1 Kilowatt-hour is simply referred to as 1 Unit of electricity. When a utility company charges for "units" consumed, they are charging per kWh.

• Board of Trade (B.O.T.) Unit: Historically, the Kilowatt-hour was also known as the Board of Trade Unit in the United Kingdom and its former colonies.

• Measuring Consumption: An electric meter (energy meter) installed in homes measures the consumption in kWh. For example, if a 100-watt bulb is left on for 10 hours, it consumes exactly 1 unit (100W × 10h = 1000Wh = 1kWh).

• Power Formulas: Electric power is also calculated using $P = I^2R$ (where I is current and R is resistance) or $P = V^2/R$, depending on the known variables in a circuit.

Q21. Answer: (d) Intercropping

The correct answer is Intercropping.

Key Points

• Intercropping is an advanced cropping pattern where two or more crops are grown simultaneously on the same piece of land in a definite row arrangement or spatial pattern.

• In this system, a specific number of rows of the main crop alternate with a specific number of rows of a subsidiary crop (e.g., a 1:1 or 1:2 ratio).

• The primary objective of intercropping is to increase productivity per unit area by utilizing resources like solar radiation, water, and soil nutrients more efficiently than a single crop would.

• Crops selected for this pattern usually have different growth habits and nutrient requirements to minimize inter-specific competition. For example, a tall-growing crop might be paired with a shorter, shade-tolerant crop.

• Common examples of intercropping include Soybean + Maize, Finger Millet + Cowpea, and Bajra + Lobia.

• This method helps in pest management, as the spread of pathogens and insects is often hindered by the presence of a different

plant species in adjacent rows.

Additional Information

• Mixed Cropping:

• This involves growing two or more crops simultaneously on the same land, but without any definite row arrangement.

• The seeds are typically mixed together before sowing. It is primarily used as an insurance against crop failure due to uncertain monsoon or weather conditions.

• Monocropping:

• Also known as Monoculture, it is the practice of growing only one type of crop on the same piece of land year after year.

• Continuous monocropping can lead to the depletion of specific soil nutrients and the buildup of specialized pests and diseases.

• Crop Rotation:

• This is the practice of growing different crops on the same land in a pre-planned succession or sequence.

• For instance, planting a leguminous crop (like pulses) after a cereal crop (like wheat) helps in nitrogen fixation and restores soil fertility.

Important Points

• Types of Intercropping:

• Row Intercropping: Growing crops in a specific row arrangement.

• Strip Intercropping: Growing crops in wide strips that allow for mechanical cultivation but are close enough for the plants to interact agronomically.

• Relay Intercropping: Sowing a second crop into a standing first crop before the first one is harvested, effectively overlapping their growth cycles.

• Benefits of Diverse Patterns:

• Soil Health: Patterns like intercropping and crop rotation prevent soil erosion and maintain a balance of organic matter.

• Economic Stability: By diversifying crops, farmers reduce the economic risk associated with market price fluctuations for a single commodity.

Q22. Answer: (d) at infinity

The correct answer is at infinity.

Key Points

• When an object is placed exactly at the principal focus (F) of a convex lens, the rays of light starting from the object and passing through the lens become parallel to the principal axis after refraction.

• Since parallel rays are considered to meet only at infinity, the image is formed at an infinite distance from the lens. Hence, the correct answer is at infinity.

• The nature of the image formed in this specific case is real, inverted, and highly enlarged (magnified).

• This principle is the reverse of the case where parallel rays coming from an object at infinity converge at the focus of the convex lens.

• In a ray diagram, one ray passes through the optical center (O) undeviated, and another ray, starting from the object and traveling parallel to the principal axis, passes through the focus (F) on the other side; both these refracted rays emerge parallel to each other.

Additional Information

• Convex Lens (Converging Lens):

• A convex lens is thicker at the center than at the edges. It is known as a converging lens because it converges a beam of parallel light rays.

• The focal length of a convex lens is always taken as positive according to the Cartesian sign convention.

• Lens Formula: The relationship between object distance (u), image distance (v), and focal length (f) is given by 1/v - 1/u = 1/f.

• Image Formation at Other Positions:

• Between F and O: The image is virtual, erect, and magnified, formed on the same side as the object (used as a magnifying glass).

• At 2F: The image is formed at 2F on the other side, and it is real, inverted, and the same size as the object.

• Between F and 2F: The image is formed beyond 2F, and it is real, inverted, and magnified.

• Beyond 2F: The image is formed between F and 2F, and it is real, inverted, and diminished.

Important Points

• Linear Magnification (m): It is the ratio of the height of the image to the height of the object, expressed as m = v/u. For an object at focus, the magnification is infinite.

• Optical Center: The central point of the lens through which a ray of light passes without any deviation.

• Power of a Lens: The reciprocal of the focal length (in meters) is called the power (P) of the lens, measured in Dioptres (D). P = 1/f.

• Applications: Convex lenses are used in spectacles to correct Hypermetropia (long-sightedness), in cameras, microscopes, and telescopes.

Q23. Answer: (d) Total number of protons in nucleus

The correct answer is Total number of protons in nucleus.

Key Points

• The atomic number (represented by the symbol Z) of a chemical element is defined as the total number of protons found in the nucleus of every atom of that element.

• It is the fundamental property that determines the identity of an element; for example, every atom with 6 protons is Carbon, and every atom with 79 protons is Gold.

• The concept was significantly advanced by Henry Moseley in 1913, who used X-ray spectroscopy to show that the atomic number is a physical property linked to the nuclear charge.

• In the Modern Periodic Table, elements are arranged in increasing order of their atomic numbers, as per the Modern Periodic Law.

• While the number of electrons can change (forming ions) and the number of neutrons can vary (forming isotopes), the number of protons remains constant for a specific element. Hence, the correct answer is Total number of protons in nucleus.

Additional Information

• Mass Number (A):

• This is the sum of the total number of protons and neutrons present in the nucleus of an atom. These particles are collectively known as nucleons.

• The formula is expressed as A = Z + N, where N is the number of neutrons.

• Isotopes:

• These are atoms of the same element that possess the same atomic number but different mass numbers due to a varying number of neutrons.

• For example, Hydrogen has three isotopes: Protium (0 neutrons), Deuterium (1 neutron), and Tritium (2 neutrons).

• Electrons and Ions:

• In a neutral atom, the number of electrons is equal to the atomic number (protons).

• When an atom gains or loses electrons, it becomes an ion (cation or anion), but its atomic number remains unchanged because the proton count does not change.

• Isobars:

• These are atoms of different elements that have the same mass number but different atomic numbers. An example is Calcium and Argon, both having a mass number of 40.

Important Points

• Discovery of Subatomic Particles:

• The Electron was discovered by J.J. Thomson in 1897 through his cathode ray tube experiment.

• The Proton was effectively discovered following Ernest Rutherford's gold foil experiment in 1911, which identified the atomic nucleus.

• The Neutron was discovered by James Chadwick in 1932, explaining the additional mass in the nucleus that protons could not account for alone.

• Chemical Properties:

• The atomic number determines the electronic configuration of an atom, which in turn determines its chemical behavior and reactivity.

• The number of valence electrons (electrons in the outermost shell) is what primarily dictates how an element bonds with others.

Q24. Answer: (d) Velocity

The correct answer is Velocity.

Key Points

• Newton’s Second Law of Motion: This fundamental principle of physics states that the acceleration of an object is produced when an unbalanced force acts on it. The magnitude of the acceleration is directly proportional to the net force and inversely proportional to the mass of the object (represented by the formula F = ma).

• Unbalanced Force: A force is considered unbalanced when the resultant or net force acting on an object is not zero. Unlike balanced forces, which cancel each other out, an unbalanced force causes a change in the object's state of motion.

• Change in Velocity: Since acceleration is the rate of change of velocity over time, the presence of a net unbalanced force ensures that the velocity must change. Velocity is a vector quantity, which means it includes both magnitude (speed) and

direction.

• Effects on Motion: An unbalanced force can cause an object at rest to start moving, an object in motion to speed up, slow down, or change its direction. For example, when a cyclist applies brakes, the frictional force becomes an unbalanced force that reduces the velocity.

• Inertia: Objects tend to resist changes in their motion. This resistance is called inertia. Only an unbalanced force is capable of overcoming this inertia to alter the velocity.

Additional Information

• Mass:

• Mass is a measure of the amount of matter in an object. It is an intrinsic property and remains constant regardless of the forces applied to it in classical mechanics.

• Applying an unbalanced force changes how the mass moves (its velocity), but it does not change the numerical value of the mass itself.

• Density:

• Density is defined as mass per unit volume (Density = Mass / Volume).

• Since mass and volume are independent of the velocity of an object (under non-relativistic conditions), an unbalanced force acting to move an object does not alter its density.

• Time:

• Time is a scalar quantity and is considered an independent variable in Newtonian physics.

• The application of a mechanical force on a macroscopic object does not have the power to alter the progression of time.

• Balanced Forces:

• If the forces acting on an object are balanced, the net force is zero.

• In this state, the object will either remain at rest or continue to move with a constant velocity in a straight line, as described by Newton's First Law of Motion.

Important Points

• Vector vs. Scalar: It is important to distinguish that Velocity is a vector, while speed is a scalar. An unbalanced force might change only the direction of an object (like in uniform circular motion) while keeping the speed constant; even in this case, the velocity is said to have changed because the direction changed.

• Units of Measurement:

• Force is measured in Newtons (N).

• Velocity is measured in meters per second (m/s).

• Acceleration is measured in meters per second squared (m/s^2).

• Application Example: When a planet orbits a star, the gravitational force acts as an unbalanced centripetal force. This force constantly changes the direction of the planet, thereby constantly changing its velocity, even if its orbital speed remains relatively stable.

Q25. Answer: (d) Golgi Complex

The correct answer is Golgi Complex.

Key Points

• The Golgi Complex, also known as the Golgi apparatus or Golgi body, was first described by the Italian biologist Camillo Golgi in 1898. It is a vital organelle found in most eukaryotic cells.

• It consists of a system of membrane-bound vesicles (flattened sacs) arranged approximately parallel to each other in stacks called cisternae. These membranes often have connections with the membranes of the Endoplasmic Reticulum (ER).

• The primary function of the Golgi apparatus is the storage, modification, and packaging of products in vesicles. It acts like a "post office" or a "dispatch station" for the cell, where proteins and lipids are sorted.

• Material synthesized near the Endoplasmic Reticulum (ER) is packaged and dispatched to various targets both inside and outside the cell through the Golgi apparatus.

• The Golgi complex is also involved in the biochemical transformation of molecules; for instance, complex sugars may be manufactured from simple sugars within this organelle.

• Furthermore, it plays a critical role in the formation of lysosomes, which are membrane-bound sacs filled with digestive enzymes used for cellular waste disposal.

Additional Information

• Ribosomes:

• These are small, granular structures found in both prokaryotic and eukaryotic cells.

• They are the primary sites for protein synthesis and are often referred to as the "protein factories" of the cell.

• They can be found floating freely in the cytoplasm or attached to the Rough Endoplasmic Reticulum (RER).

• Chloroplast:

• These are specialized organelles found only in plant cells and algae.

• They contain the green pigment known as chlorophyll, which captures light energy for the process of photosynthesis.

• Chloroplasts are double-membrane structures and possess their own DNA and ribosomes, making them semi-autonomous.

• Vacuoles:

• These are storage sacs for solid or liquid contents. In animal cells, vacuoles are typically small and temporary.

• In plant cells, vacuoles are very large (often occupying 50% to 90% of the cell volume) and provide turgidity and rigidity to the cell.

• They store important substances like amino acids, sugars, various organic acids, and some proteins.

• Endoplasmic Reticulum (ER):

• The ER is a large network of membrane-bound tubes and sheets that serves as a transport system for materials (especially proteins) between various regions of the cytoplasm or between the cytoplasm and the nucleus.

• The Rough ER (RER) is involved in protein manufacturing, while the Smooth ER (SER) helps in the manufacture of fat molecules, or lipids, important for cell function and membrane biogenesis.

Q26. Answer: (b) 7

Shortcut Trick

Convert all decimal bases to powers of 0.5:

$0.25 = 0.5^2$ and $0.125 = 0.5^3$

Substitute these into the expression: $(0.5^2)^6 \div (0.5^3)^2 \times 0.5^4 = 0.5^{(x+3)}$

$\Rightarrow 0.5^{12} \div 0.5^6 \times 0.5^4 = 0.5^{(12 - 6 + 4)} = 0.5^{(10)}$

Equating the powers of 0.5: $10 = x + 3 \Rightarrow x = 7$.

Therefore The correct answer is 7.

Alternate Method

Given:

$0.25^6 \div 0.125^2 \times 0.5^4 = 0.5^{(x+3)}$

Formula Used:

$a^m \div a^n = a^{(m-n)}$

$a^m \times a^n = a^{(m+n)}$

$(a^m)^n = a^{(mn)}$

Calculations:

$0.256 \div 0.1252 \times 0.54 = 0.5x+3$

$\Rightarrow 0.25 = 1 \div 4 = 0.52$

$\Rightarrow 0.125 = 1 \div 8 = 0.53$

$\Rightarrow$ Expression = $(0.52)6 \div (0.53)2 \times (0.5)4$

$\Rightarrow = 0.512 \div 0.56 \times 0.54$

$\Rightarrow = 0.512-6+4$

$\Rightarrow = 0.510$

$\Rightarrow 0.5x+3 = 0.510$

$\Rightarrow x + 3 = 10$

$\Rightarrow x = 7$

Therefore The correct answer is 7 units.

Additional Information

BODMAS Rule

BODMAS stands for Brackets, Orders (powers/roots), Division, Multiplication, Addition, and Subtraction. In mathematical expressions with both division and multiplication, calculations are always performed from left to right sequentially.

Laws of Exponents

When multiplying terms with the identical base, add their exponents together: $a^m \times a^n = a^{(m+n)}$. When dividing terms with the same base, subtract the exponent of the divisor from the dividend: $a^m \div a^n = a^{(m-n)}$.

Power of a Power Rule

When a number raised to a power is raised to another power, you simply multiply the inner and outer exponents: $(a^m)^n = a^{(mn)}$.

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Q27. Answer: (c) 53

Shortcut Trick

Assume a base mean of 50 for all observations.

Calculate deviations from 50: +2, −10, +26, +49, +2, −23, +30, −23, −26.

Net deviation sum = 2 + 26 + 49 + 2 + 30 − 10 − 23 − 23 − 26 = 27.

Average deviation = 27 ÷ 9 = 3.

Actual Arithmetic Mean = 50 + 3 = 53.

Therefore The correct answer is 53.

Alternate Method

Given:

The observations are 52, 40, 76, 99, 52, 27, 80, 27, and 24.

Total count of observations (n) = 9.

Formula Used:

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

Calculations:

=> Sum = 52 + 40 + 76 + 99 + 52 + 27 + 80 + 27 + 24

=> Sum = 477

=> Arithmetic Mean = 477 ÷ 9

=> Arithmetic Mean = 53

Therefore The correct answer is 53.

Additional Information

Sum of Deviations from Mean

The sum of the deviations of all observations from their arithmetic mean is always zero: $\Sigma(x_i - \text{Mean}) = 0$.

Effect of Change of Origin

If a constant value k is added to or subtracted from every observation, the new mean will also increase or decrease by k.

Weighted Arithmetic Mean

When different observations have different weights (importance), the mean is calculated as $\Sigma(w_i \times x_i) \div \Sigma w_i$.

Q28. Answer: (c) 66.67%

Shortcut Trick

Identify the base value (A's marks) and the target value (B's marks).

Required Percentage = (B's marks ÷ A's marks) × 100

Calculation: (50 ÷ 75) × 100 = 2/3 × 100 = 66.666...

Therefore The correct answer is 66.67%.

Alternate Method

Given:

Marks obtained by A = 75

Marks obtained by B = 50

Maximum Marks = 85 (Not required for this calculation)

Formula Used:

Percentage = (Value / Base Value) × 100

Calculations:

=> Required Percentage = (50 ÷ 75) × 100

=> Dividing both numbers by 25: (2 ÷ 3) × 100

=> 200 ÷ 3 = 66.6666...

=> Rounding off to two decimal places = 66.67%

Therefore The correct answer is 66.67%.

Additional Information

Percentage Change

To find how much more or less B got than A: Percentage Change = ((B − A) / A) × 100.

Fraction to Percentage Conversion

Common fractions like 1/3 = 33.33% and 2/3 = 66.67% are helpful for quick calculations in competitive exams.

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Base Selection

The value following the word 'than' or 'of' in the question (A's marks) usually acts as the denominator (base).

Q29. Answer: (b) 55 minutes

Shortcut Trick

Speed Ratio (Normal : New) = 7 : 5

Since Distance is constant, Time Ratio (Normal : New) = 5 : 7

Difference in time units = 7 − 5 = 2 units

Given, 2 units = 22 minutes => 1 unit = 11 minutes

Usual Time = 5 units = 5 × 11 = 55 minutes

Therefore The correct answer is 55 min.

Alternate Method

Given: New Speed = 5/7 of Normal Speed; Late time = 22 minutes.

Formula Used: Distance = Speed × Time; If Distance is constant, Time prop. to 1/Speed.

=> Let Normal Speed be S and Normal Time be T.

=> New Speed = (5/7)S and New Time = (T + 22)

=> S × T = (5/7)S × (T + 22)

=> T = (5/7)(T + 22)

=> 7T = 5T + 110

=> 2T = 110

=> T = 55 minutes

Therefore The correct answer is 55 min.

Additional Information

Inversely Proportional Relation

When the distance is constant, the ratio of speeds is the inverse of the ratio of time taken: S1/S2 = T2/T1.

Usual Time Shortcut

If a person walks at a/b of his usual speed and is 't' minutes late, the usual time taken is [a / (b − a)] × t.

Average Speed

Average speed for the same distance at two different speeds x and y is given by 2xy / (x + y).

Q30. Answer: (d) 60 km/h

Shortcut Trick

Speed = Distance ÷ Time

Speed = 270 ÷ 4.5 = 2700 ÷ 45

Speed = 60 km/h

Therefore The correct answer is 60 km/h.

Alternate Method

Given:

Distance = 270 km

Time = 4.5 hours

Formula Used:

Speed = Distance / Time

Calculations:

=> Speed = 270 / 4.5

=> Speed = 270 / (9/2)

=> Speed = (270 × 2) / 9

=> Speed = 30 × 2

=> Speed = 60 km/h

Therefore The correct answer is 60 km/h.

Additional Information

Unit Conversion (km/h to m/s)

To convert speed from km/h to m/s, multiply the value by 5/18.

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Average Speed

Average Speed = Total Distance ÷ Total Time. For two equal distances at speeds x and y, Average Speed = 2xy/(x + y).

Relative Speed

When two objects move in opposite directions, relative speed is the sum (s1 + s2). In the same direction, it is the difference (s1 − s2).

Q31. Answer: (c) $(1-p^2)/(1+p^2)$

Shortcut Trick

Given $\tan\theta = (1 - p^2) / 2p$, which represents Perpendicular / Base.

Identify the standard Pythagorean triplet: $(1 - p^2)$, $2p$, and $(1 + p^2)$.

Here, Perpendicular = $1 - p^2$, Base = $2p$, and Hypotenuse = $1 + p^2$.

Since $\sin\theta$ = Perpendicular / Hypotenuse, the value is $(1 - p^2) / (1 + p^2)$.

Therefore The correct answer is $(1 - p^2) / (1 + p^2)$.

Alternate Method

Given: $\tan\theta = (1 - p^2) / 2p$

Formula Used: $\sec^2\theta = 1 + \tan^2\theta$ and $\sin\theta = \tan\theta / \sec\theta$

=> Hypotenuse² = Perpendicular² + Base²

=> $H^2 = (1 - p^2)^2 + (2p)^2$

=> $H^2 = 1 + p^4 - 2p^2 + 4p^2$

=> $H^2 = 1 + p^4 + 2p^2 = (1 + p^2)^2$

=> $H = 1 + p^2$

=> $\sin\theta$ = Perpendicular / Hypotenuse = $(1 - p^2) / (1 + p^2)$

Therefore The correct answer is $(1 - p^2) / (1 + p^2)$.

Additional Information

Trigonometric Triplets

For any variable p, the expressions $(1 - p^2)$, $2p$, and $(1 + p^2)$ always satisfy the Pythagoras Theorem.

Reciprocal Identities

Remember the basic relations: $\sin\theta = 1/\text{cosec}\,\theta$, $\cos\theta = 1/\sec\theta$, and $\tan\theta = \sin\theta / \cos\theta$.

Square Identities

Fundamental identities include $\sin^2\theta + \cos^2\theta = 1$ and $1 + \tan^2\theta = \sec^2\theta$.

Q32. Answer: (c) Decreases by 64%

Shortcut Trick

Using Successive Multipliers: Initial Price = 100%.

Final Price = 100 × (1/2) × (3/5) × (4/5) × (3/2) = 36%.

Net change = 100% − 36% = 64% decrease.

Therefore The correct answer is Decreases by 64%.

Alternate Method

Given: Initial fuel price decreases by 50%, 40%, 20% and then increases by 50%.

Assume original price of fuel = Rs. 100

=> Price after 1^(st) month (50% decrease) = 100 − 50 = Rs. 50

=> Price after 2^(nd) month (40% decrease) = 50 − (40% of 50) = 50 − 20 = Rs. 30

=> Price after 3^(rd) month (20% decrease) = 30 − (20% of 30) = 30 − 6 = Rs. 24

=> Price after 4^(th) month (50% increase) = 24 + (50% of 24) = 24 + 12 = Rs. 36

=> Total Percentage Change = [(Original − Final) ÷ Original] × 100

=> Change = [(100 − 36) ÷ 100] × 100 = 64%

Therefore The correct answer is Decreases by 64%.

Additional Information

Successive Percentage Formula

For two successive changes of x% and y%, the effective change is (x + y + xy/100)%.

Fraction Equivalents

50% = 1/2, 40% = 2/5, 20% = 1/5. Use multiplying factors (1±r/100) for faster calculation in series.

Base Value Selection

When calculating percentage increase or decrease, always use 100 as the base for the initial value to simplify the final calculation.

Q33. Answer: (a) 74.9

Shortcut Trick

Direct application of the Empirical Formula: 3 × Median = Mode + 2 × Mean

3 × Median = 51.3 + 2 × 86.7

3 × Median = 51.3 + 173.4 = 224.7

Median = 224.7 ÷ 3 = 74.9

Therefore The correct answer is 74.9.

Alternate Method

Given:

Mean = 86.7

Mode = 51.3

Formula Used:

Mode = 3(Median) − 2(Mean)

Calculations:

=> Mode = 3 × Median − 2 × Mean

=> 51.3 = 3 × Median − 2 × 86.7

=> 51.3 = 3 × Median − 173.4

=> 3 × Median = 51.3 + 173.4

=> 3 × Median = 224.7

=> Median = 224.7 ÷ 3

=> Median = 74.9

Therefore The correct answer is 74.9.

Additional Information

The Empirical Formula

For a moderately skewed distribution, the relationship is Mode ≈ 3 × Median − 2 × Mean. This is often used when one of the three measures of central tendency is missing.

Symmetric Distribution

In a perfectly Symmetric Distribution (like the Normal Distribution), the values of Mean, Median, and Mode are all equal (Mean = Median = Mode).

Skewed Distributions

In a Positively Skewed distribution, Mean > Median > Mode. In a Negatively Skewed distribution, Mode > Median > Mean.

Karl Pearson's Coefficient of Skewness

It measures the degree of asymmetry: Skewness = (Mean − Mode) ÷ Standard Deviation or 3 × (Mean − Median) ÷ Standard Deviation.

Q34. Answer: (c) 9 $a^2 b^2 c^2$

Shortcut Trick

If the sum of three terms is zero (a + b + c = 0), then the sum of their cubes equals thrice their product: $a^3 + b^3 + c^3 = 3abc$.

Required value = $(a^3 + b^3 + c^3)^2$

Substitute 3abc: $(3abc)^2 = 9\ a^2 b^2 c^2$.

Therefore The correct answer is $9\ a^2 b^2 c^2$.

Alternate Method

Given: a + b + c = 0

Formula Used: $a^3 + b^3 + c^3 - 3abc = (a + b + c)(a^2 + b^2 + c^2 - ab - bc - ca)$

=> $a^3 + b^3 + c^3 - 3abc = (0) \times (a^2 + b^2 + c^2 - ab - bc - ca)$

=> $a^3 + b^3 + c^3 - 3abc = 0$

=> $a^3 + b^3 + c^3 = 3abc$

Now, we need to find the value of $(a^3 + b^3 + c^3)^2$ by squaring both sides:

=> $(a^3 + b^3 + c^3)^2 = (3abc)^2$

=> $(a^3 + b^3 + c^3)^2 = 3^2 \times a^2 \times b^2 \times c^2$

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=> $(a^3 + b^3 + c^3)^2 = 9\ a^2\ b^2\ c^2$

Therefore The correct answer is $9\ a^2\ b^2\ c^2$.

Additional Information

Special Case of Cubic Identity

The identity $a^3 + b^3 + c^3 = 3abc$ holds true if either $a + b + c = 0$ or $a = b = c$.

Square of a Trinomial

The expansion of $(a + b + c)^2$ is $a^2 + b^2 + c^2 + 2(ab + bc + ca)$.

BODMAS Rule

Always follow Brackets, Orders, Division, Multiplication, Addition, and Subtraction for simplification steps.

Q35. Answer: (d) Rs. 1,250

Shortcut Trick

Total amount to be divided in ratio = 10511 − (87 + 42 + 12) = 10511 − 141 = 10370.

Ratio of remaining shares X : Y : Z = 6 : 16 : 12.

Sum of ratio parts = 6 + 16 + 12 = 34 units.

Difference between Y and Z in ratio = 16 − 12 = 4 units.

Value of 4 units = (10370 ÷ 34) × 4 = 305 × 4 = 1220.

Difference between original shares = (Y − 42) − (Z − 12) = (Y − Z) − 30. Since Y − Z (after deduction) is 1220, original difference = 1220 + (42 − 12) = 1250.

Therefore The correct answer is Rs. 1,250.

Alternate Method

Given: Total = Rs. 10,511. Reductions = Rs. 87, Rs. 42, Rs. 12. Ratio = 6 : 16 : 12.

=> Total reduction = 87 + 42 + 12 = Rs. 141

=> Remaining amount = 10511 − 141 = Rs. 10,370

=> 34k = 10370

=> k = 10370 ÷ 34 = 305

=> Y's original share = 16k + 42 = 16 × 305 + 42 = 4880 + 42 = Rs. 4,922

=> Z's original share = 12k + 12 = 12 × 305 + 12 = 3660 + 12 = Rs. 3,672

=> Difference = 4922 − 3672 = Rs. 1,250

Therefore The correct answer is Rs. 1,250.

Additional Information

Ratio and Proportion

If a total quantity A is divided in the ratio a:b:c, then the parts are $[a/(a+b+c)]\times A$, $[b/(a+b+c)]\times A$, and $[c/(a+b+c)]\times A$.

Handling Deductions

When fixed amounts are deducted from shares to obtain a ratio, always subtract the total deduction from the original sum before applying the ratio units.

Q36. Answer: (a) 9000

Shortcut Trick

Combine all percentages and fractions into a single multiplier: 0.4 × 0.5 × 0.5 = 0.1.

Let the number be N.

0.1 × N = 900

N = 9000

Therefore The correct answer is 9000.

Alternate Method

Given:

Percentage 1 = 40% = 40/100 = 2/5

Percentage 2 = 50% = 50/100 = 1/2

Fraction = 1/2

Resulting Value = 900

Calculations:

Let the unknown number be 'x'.

=> (40/100) × (50/100) × (1/2) × x = 900

=> (2/5) × (1/2) × (1/2) × x = 900
=> (2/20) × x = 900
=> (1/10) × x = 900
=> x = 900 × 10
=> x = 9000
Therefore The correct answer is 9000.
Additional Information
Percentage to Fraction Conversion
To convert percentage to fraction, divide by 100. Example: x% = x/100.
Successive Percentages
When multiple percentages are applied 'of' each other, they are multiplied together as fractions or decimals.
Base Change Rule
If the result is known and the initial value is required, divide the result by the product of all percentage multipliers.

Q37. Answer: (b) Rs. 200

Shortcut Trick
In problems where Sum and Difference of two quantities are given:
Larger Value (Raju) = (Sum + Difference) ÷ 2
Raju's amount = (350 + 50) ÷ 2 = 400 ÷ 2 = 200
Therefore The correct answer is Rs. 200.
Alternate Method
Given:
Total amount (Raju + Riya) = Rs. 350
Difference (Raju − Riya) = Rs. 50
Calculations:
=> Let Riya have Rs. x.
=> Then Raju has Rs. (x + 50).
=> x + (x + 50) = 350
=> 2x + 50 = 350
=> 2x = 300
=> x = 150
=> Raju's share = 150 + 50 = 200
Therefore The correct answer is Rs. 200.
Additional Information
Sum and Difference Formula
If A + B = S and A − B = D, then the larger value A = (S + D) ÷ 2 and the smaller value B = (S − D) ÷ 2.
Linear Equations
In problems involving two variables, substitution or elimination methods are standard techniques to find individual values.
Verification
Always verify: Raju (200) + Riya (150) = 350; Raju (200) − Riya (150) = 50. Conditions satisfied.

Q38. Answer: (b) 300

Shortcut Trick
For fourth proportional to P, 15 and 20 to be 1:
P / 15 = 20 / 1
P = 15 × 20 = 300
Therefore The correct answer is 300.
Alternate Method
Given: First term = P, Second term = 15, Third term = 20, Fourth term = 1.
Formula Used: If a, b, c, d are in proportion, then a : b = c : d or a/b = c/d.
=> P ÷ 15 = 20 ÷ 1
=> P × 1 = 15 × 20

=> P = 300

Therefore The correct answer is 300.

Additional Information

Mean Proportional

The mean proportional between two numbers a and b is √(a × b).

Third Proportional

The third proportional to a and b is calculated as (b²) ÷ a.

Basic Proportion Property

In any proportion, the product of the extremes is always equal to the product of the means (ad = bc).

Q39. Answer: (a) 3 : 5

Shortcut Trick

The radius (r) of a sphere just immersed in a cone of radius (R), height (H), and slant height (L) is given by: r = (R × H) ÷ (R + L).

Given R = 12 cm, H = 16 cm => L = √(12² + 16²) = 20 cm.

Radius of sphere (r) = (12 × 16) ÷ (12 + 20) = 192 ÷ 32 = 6 cm.

Volume ratio = V_(sphere) : (V_(cone) − V_(sphere)) = (4/3 π r³) : (1/3 π R²H − 4/3 π r³).

Volume ratio = (4 × 6³) : (12² × 16 − 4 × 6³) = 864 : (2304 − 864) = 864 : 1440 = 3 : 5.

Therefore The correct answer is 3 : 5.

Alternate Method

Given: Radius of conical vessel (R) = 12 cm, Height (H) = 16 cm.

Formula Used:

1. Slant height (L) of cone = √(R² + H²)
2. Volume of cone (V_c) = (1/3) × π × R² × H
3. Volume of sphere (V_s) = (4/3) × π × r³

Calculations:

=> Slant height (L) = √(12² + 16²) = √(144 + 256) = √400 = 20 cm.

=> Let radius of sphere be r. Since it touches the sides and top, it is the incircle of the triangular cross-section.

=> Using similarity of triangles: r ÷ (H − r) = R ÷ L

=> r ÷ (16 − r) = 12 ÷ 20 = 3 ÷ 5

=> 5r = 48 − 3r => 8r = 48 => r = 6 cm.

=> Volume of water overflown = Volume of sphere (V_s) = (4/3) × π × 6³ = 288π cm³.

=> Total volume of cone (V_c) = (1/3) × π × 12² × 16 = 768π cm³.

=> Volume of water left = V_c − V_s = 768π − 288π = 480π cm³.

=> Required Ratio = 288π : 480π = 288 : 480 = 3 : 5.

Therefore The correct answer is 3 : 5.

Additional Information

Volume of Archimedes' Displacement

When an object is fully submerged in a liquid, the volume of liquid overflown or displaced is exactly equal to the volume of the object.

Inscribed Sphere in a Cone

For a sphere of radius r inscribed in a cone of radius R and height H, touching the base, the radius is r = [R × H] ÷ [R + √(R² + H²)].

Surface Area Formulas

Surface area of sphere = 4πr² | Curved surface area of cone = πRL.

Q40. Answer: (d) 6

Shortcut Trick

Net efficiency = Filling pipe − Emptying pipe

Net efficiency = 1/6 − 1/12 = 1/12 per minute.

Time to fill full tank = 12 minutes.

Time to fill one-half (1/2) tank = 12 ÷ 2 = 6 minutes.

Therefore The correct answer is 6 minutes.

Alternate Method

Given: Filling pipe time = 6 min, Emptying pipe time = 12 min.

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

Pipe Type	Time (min)	Total Capacity (Units)	Efficiency (Units/min)
Filling Pipe	6	12	+2
Emptying Pipe	12	−1	

=> Net Efficiency when both opened = +2 − 1 = 1 unit/min

=> Required Volume (half tank) = 12 ÷ 2 = 6 units

=> Time taken = Required Volume ÷ Net Efficiency

=> Time taken = 6 ÷ 1 = 6 minutes

Therefore The correct answer is 6 minutes.

Additional Information

Net Work Principle

When pipes work together, filling pipes have positive efficiency and emptying pipes (outlets) have negative efficiency. Total time = Capacity ÷ (Sum of efficiencies).

Fractional Work

If a tank is filled in T minutes, the time to fill 'n' fraction of the tank is simply n × T.

Q41. Answer: (b) 7.5%

Shortcut Trick

Identify Cost Price (CP) = 800 and Selling Price (SP) = 740.

Loss = CP − SP = 800 − 740 = 60.

Loss% = (Loss ÷ CP) × 100.

Loss% = (60 ÷ 800) × 100 = 60 ÷ 8 = 7.5%.

Therefore The correct answer is 7.5%.

Alternate Method

Given: CP = 800, SP = 740.

Formulas: Loss = CP − SP | Loss% = (Loss ÷ CP) × 100

=> Loss = 800 − 740 = 60

=> Loss% = (60 ÷ 800) × 100

=> Loss% = 6000 ÷ 800 = 7.5%

Therefore The correct answer is 7.5%.

Additional Information

Cost Price and Selling Price

Cost Price (CP) is the price at which an item is purchased. Selling Price (SP) is the price at which it is sold.

Loss Condition

A loss occurs when the Cost Price is greater than the Selling Price (CP > SP).

Q42. Answer: (a) 35 years

Shortcut Trick

The age difference between two people remains constant throughout their lives.

15 years ago, Ratio of ages (Girish : Rohan) = 2 : 1

Difference in ratio = 2 − 1 = 1 unit → Given as 10 years.

Girish's age 15 years ago = 2 units = 2 × 10 = 20 years.

Present age of Girish = 20 + 15 = 35 years.

Therefore The correct answer is 35 years.

Alternate Method

Given: Age difference = 10 years; 15 years ago, Girish = 2 × Rohan.

Let Rohan's age 15 years ago be x.

=> Girish's age 15 years ago = 2x.

=> Present age of Rohan = x + 15.

=> Present age of Girish = 2x + 15.

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=> (2x + 15) − (x + 15) = 10

=> x = 10.

=> Girish's present age = 2(10) + 15 = 20 + 15 = 35 years.

Therefore The correct answer is 35 years.

Additional Information

Constant Difference Property

The difference between the ages of two individuals is a constant value and never changes with time.

Ratio Method for Ages

If the ratio of ages changes from a:b to c:d over 'n' years, the value of 1 unit can be found by equating the difference in parts if the difference is same.

Algebraic Representation

Always define variables for the past or present age consistently to avoid calculation errors in age-based problems.

Q43. Answer: (b) 2,548

Shortcut Trick

Selling Price (SP) = Marked Price (MP) × (100 − Discount%) ÷ 100

SP = 6,370 × (100 − 60) ÷ 100

SP = 6,370 × 40 ÷ 100 = 63.7 × 40

SP = 2,548

Therefore The correct answer is Rs. 2,548.

Alternate Method

Given: Marked Price (MP) = Rs. 6,370, Discount Percentage = 60%.

Formula: Selling Price (SP) = MP − Discount | Discount = (Discount% ÷ 100) × MP

=> Discount Amount = (60 ÷ 100) × 6,370

=> Discount Amount = 0.6 × 6,370 = 3,822

=> Selling Price = 6,370 − 3,822

=> Selling Price = 2,548

Therefore The correct answer is Rs. 2,548.

Additional Information

Marked Price & Discount

The Marked Price is the price printed on the label. Discount is always calculated on the Marked Price unless stated otherwise.

Selling Price Calculation

If the discount is d%, the buyer pays (100 − d)% of the MP. SP = MP × Multiplier.

Q44. Answer: (c) 22

Shortcut Trick

Identify the smallest difference between the given numbers.

Differences: 110 − 44 = 66, 198 − 110 = 88.

Smallest difference is 66. The HCF must be a factor of 66 (1, 2, 3, 6, 11, 22, 33, 66).

Check the largest factor of 66 that divides 44, 110, and 198: 22 × 2 = 44, 22 × 5 = 110, 22 × 9 = 198.

Therefore The correct answer is 22.

Alternate Method

Given: Numbers are 44, 110, and 198.

Method Used: Prime Factorization Method

Perform prime factorization for each number:

=> 44 = 2 × 2 × 11 = $2^2 \times 11^1$

=> 110 = 2 × 5 × 11 = $2^1 \times 5^1 \times 11^1$

=> 198 = 2 × 3 × 3 × 11 = $2^1 \times 3^2 \times 11^1$

The Highest Common Factor (HCF) is the product of the lowest powers of common prime factors.

=> Common prime factors are 2 and 11.

=> HCF = $2^1 \times 11^1$

=> HCF = 22

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Therefore The correct answer is 22.

Additional Information

Highest Common Factor (HCF)

HCF (or GCD) is the largest positive integer that divides each of the integers without leaving a remainder.

HCF and LCM Relation

For two numbers a and b, the product of the numbers is equal to the product of their HCF and LCM: a × b = HCF(a, b) × LCM(a, b).

HCF of Fractions

HCF of fractions = HCF of Numerators ÷ LCM of Denominators.

Co-prime Numbers

Two numbers are said to be co-prime if their HCF is exactly 1.

Q45. Answer: (d) 1584 ft²

Shortcut Trick

Directly apply the formula for Total Surface Area of a Cylinder: 2πr(r + h).

Here, Radius (r) = 24 ÷ 2 = 12 ft and Height (h) = 9 ft.

TSA = 2 × (22/7) × 12 × (12 + 9) = 2 × (22/7) × 12 × 21

TSA = 44 × 12 × 3 = 1584 ft².

Therefore The correct answer is 1584 ft².

Alternate Method

Given:

Base Diameter of the Cylinder = 24 ft

Height (h) of the Cylinder = 9 ft

Formula Used:

Total Surface Area (TSA) = 2 × π × r × (r + h)

Where r is the Radius and h is the Height.

Calculations:

=> Radius (r) = Diameter ÷ 2

=> r = 24 ÷ 2 = 12 ft

=> TSA = 2 × (22/7) × 12 × (12 + 9)

=> TSA = 2 × (22/7) × 12 × 21

=> TSA = 2 × 22 × 12 × 3

=> TSA = 44 × 36

=> TSA = 1584 ft²

Therefore The correct answer is 1584 ft².

Additional Information

Curved Surface Area (CSA)

The area of only the vertical surface of the Cylinder, calculated as CSA = 2 × π × r × h.

Volume of Cylinder

The total space occupied inside the Cylinder, given by the formula V = π × r² × h.

Total Surface Area of Open Cylinder

If the Cylinder is open at one end, the area is 2πrh + πr². If open at both ends, it is just 2πrh.

Q46. Answer: (d) 23.25%

Shortcut Trick

Successive discount multiplier method: Net multiplier = (1 − d1/100) × (1 − d2/100) × (1 − d3/100).

Net Multiplier = 0.89 × 0.88 × 0.98 = 0.7832 × 0.98 = 0.767536.

Single discount% = (1 − Net Multiplier) × 100.

Discount% = (1 − 0.767536) × 100 = 0.232464 × 100 = 23.2464%.

Therefore The correct answer is 23.25%.

Alternate Method

Given → Three consecutive discounts of 11%, 12% and 2%.

Formulas: Successive discount = a + b − (a × b) ÷ 100.

=> Step 1: Calculate single discount for 11% and 12%.

=> Discount12 = 11 + 12 − (11 × 12) ÷ 100 = 23 − 1.32 = 21.68%.

=> Step 2: Combine result with the 3rd discount of 2%.

=> Total Discount = 21.68 + 2 − (21.68 × 2) ÷ 100.

=> Total Discount = 23.68 − (43.36 ÷ 100) = 23.68 − 0.4336 = 23.2464%.

=> Approximately 23.25%.

Therefore The correct answer is 23.25%.

Additional Information

Single Equivalent Discount

It is the single discount rate that provides the same Selling Price as multiple consecutive discounts on the Marked Price.

Order of Discounts

The final Equivalent Discount remains the same regardless of the order in which the successive discounts are applied (Commutative Property).

Q47. Answer: (c) 69.5°

Shortcut Trick

For any quadrilateral, the angle formed by the angle bisectors of two adjacent angles is equal to half the sum of the other two interior angles.

angle TES = (angle Q + angle R) ÷ 2

angle TES = (96° + 43°) ÷ 2

angle TES = 139° ÷ 2 = 69.5°

Therefore The correct answer is 69.5°.

Alternate Method

Given:

In quadrilateral QRST:

angle Q = 96°

angle R = 43°

SE and TE are the angle bisectors of angle S and angle T respectively, meeting at E.

Formula Used:

Sum of interior angles of a quadrilateral = 360°

Sum of angles of a triangle = 180°

Calculations:

In quadrilateral QRST:

=> angle Q + angle R + angle S + angle T = 360°

=> 96° + 43° + angle S + angle T = 360°

=> 139° + angle S + angle T = 360°

=> angle S + angle T = 360° − 139°

=> angle S + angle T = 221°

Since SE and TE are the angle bisectors of angle S and angle T respectively:

=> angle EST = angle S ÷ 2

=> angle ETS = angle T ÷ 2

In triangle ΔTES:

=> angle TES + angle EST + angle ETS = 180°

=> angle TES + (angle S ÷ 2) + (angle T ÷ 2) = 180°

=> angle TES + (angle S + angle T) ÷ 2 = 180°

=> angle TES + 221° ÷ 2 = 180°

=> angle TES + 110.5° = 180°

=> angle TES = 180° − 110.5°

=> angle TES = 69.5°

Why other options are incorrect:

=> Option (1) is 56°: Incorrect because it does not satisfy the angle sum property of the triangle formed by the bisectors.

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=> Option (2) is 70.5°: Incorrect because it would require the sum of angle Q and angle R to be 141°, whereas the actual sum is 139°.

=> Option (4) is 78°: Incorrect because it would require the sum of angle Q and angle R to be 156°, which contradicts the given values.

Therefore The correct answer is 69.5°.

Additional Information

Angle Bisector Theorem in Quadrilaterals

The angle formed by the bisectors of two adjacent angles of a quadrilateral is always equal to half the sum of the remaining two angles. For example, in quadrilateral ABCD, the angle between bisectors of angle A and angle B is equal to (angle C + angle D) ÷ 2.

Sum of Interior Angles of a Polygon

The sum of the interior angles of any n-sided polygon is given by the formula (n − 2) × 180°. For a quadrilateral (n = 4), the sum is (4 − 2) × 180° = 360°.

Angle Bisectors of Opposite Angles

If the bisectors of two opposite angles of a quadrilateral are drawn, the angle between them is equal to half the difference of the other two opposite angles.

Q48. Answer: (d) 17

Shortcut Trick

Total Food Supply is constant: M1 × D1 = M2 × D2

Initially, 102 men have food for 30 weeks.

New number of men = 102 + 78 = 180 men.

102 × 30 = 180 × Weeks => Weeks = (102 × 30) ÷ 180 = 102 ÷ 6 = 17 weeks.

Therefore The correct answer is 17 weeks.

Alternate Method

Given: Initial men (M1) = 102, Initial time (T1) = 30 weeks, Men joining = 78.

Formula: M1T1 = M2T2 (since the total quantity of food remains the same).

=> Total Food Units = 102 × 30 = 3060 man-weeks.

=> New total number of men (M2) = 102 + 78 = 180 men.

=> New time (T2) = Total Food Units ÷ M2

=> T2 = 3060 ÷ 180

=> T2 = 306 ÷ 18

=> T2 = 17 weeks.

Therefore The correct answer is 17 weeks.

Additional Information

Chain Rule Concept

For work or food consumption, the relationship is M1D1H1/W1 = M2D2H2/W2, where M is men, D is days/weeks, H is hours, and W is work or total food.

Inverse Proportion

When the quantity of food is constant, the number of men is inversely proportional to the number of days (M prop. to 1/D). If men increase, days decrease.

Q49. Answer: (c) 200/3%

Shortcut Trick

LCM of 6, 8, 10 = 120 units (Total Capacity).

Efficiencies: A = 20, B = 15, C = −12.

Part filled by (A+B) in 3 hours = (20 + 15) × 3 = 105 units.

Remaining part = 120 − 105 = 15 units.

Time for (B+C) = 15 ÷ (15 − 12) = 15 ÷ 3 = 5 hours.

Percentage increase = [(5 − 3) ÷ 3] × 100 = 200/3 %.

Therefore The correct answer is 200/3%.

Alternate Method

Given: Pipe A fills in 6h, Pipe B fills in 8h, Pipe C empties in 10h.

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Person	Days	Total Work	Efficiency
Pipe A	6	120	20
Pipe B	8	15	
Pipe C	10	−12	

=> Efficiency of (A + B) = 20 + 15 = 35 units/h

=> Work done in 3 hours = 35 × 3 = 105 units

=> Remaining Work = 120 − 105 = 15 units

=> Efficiency of (B + C) = 15 − 12 = 3 units/h

=> Time taken by (B + C) = 15 ÷ 3 = 5 hours

=> Difference in time = 5 − 3 = 2 hours

=> Percentage increase = (2 ÷ 3) × 100% = 200/3 %

Therefore The correct answer is 200/3%.

Additional Information

Pipes and Cisterns Efficiency

Inlet pipes have positive efficiency, while outlet (leakage) pipes have negative efficiency. Total efficiency is the algebraic sum of individual efficiencies.

Percentage Increase Formula

Percentage change = [(Final Value − Initial Value) ÷ Initial Value] × 100.

Work and Time Relationship

Total Work = Efficiency × Time. If work is constant, time is inversely proportional to efficiency.

Q50. Answer: (b) 28

Shortcut Trick

Calculate Total Days: Feb(17) + Mar(31) + Apr(25) = 73 days.

Time (T) in years = 73 ÷ 365 = 1/5 years.

Interest for 1 year = 7% of Rs. 2000 = Rs. 140.

Interest for 1/5 year = 140 ÷ 5 = Rs. 28.

Therefore The correct answer is Rs. 28.

Alternate Method

Given:

Principal (P) = Rs. 2,000

Rate (R) = 7% per annum

Time Period: 11 February 2023 to 25 April 2023

Formula Used:

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

Calculations:

=> Total days in February (non-leap year) from 11th = 28 − 11 = 17 days

=> Days in March = 31 days

=> Days in April = 25 days

=> Total Days (T) = 17 + 31 + 25 = 73 days

=> T (in years) = 73 ÷ 365 = 1/5 years

=> SI = (2000 × 7 × (1/5)) ÷ 100

=> SI = (2000 × 7) ÷ 500

=> SI = 4 × 7 = 28

Therefore The correct answer is Rs. 28.

Additional Information

Time Calculation in Simple Interest

While calculating days, the day of deposit is generally excluded and the day of withdrawal is included. For a normal year, use 365 days, and for a leap year, use 366 days if February 29 is included.

Standard Days Shortcut

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73 days is exactly 1/5 (20%) of a standard year. Similarly, 146 days = 2/5 and 219 days = 3/5 of a year.

Compound Interest Formula

Amount (A) = $P(1 + R/100)^n$, where n is the number of conversion periods. Compound Interest (CI) = A − P.

Q51. Answer: (b) MQU 119

Logic followed here is:

The all the letter of each cluster is increased by 10 positions in the alphabetical series to get the first letter of the next cluster.

Therefore, the cluster that replaces the question mark is MQU 119.

Hence, the correct answer is "Option 2".

Q52. Answer: (a) 118

Logic followed here is.

Logic: The series follows a pattern where the difference between consecutive numbers increases by 1 in each step.

Therefore, the number that should come in place of the question mark is 118.

Hence, the correct answer is "Option 1".

Q53. Answer: (b) 16 km to the west

Given:

Prakash starts from Point A.

1. Drives 35 km south
2. Turns right and drives 38 km
3. Turns right and drives 41 km
4. Turns right and drives 54 km
5. Turns right and drives 6 km to reach Point P

Step-by-step movement:

Point P is 16 km east of Point A.

Therefore, to reach Point A again, Prakash must travel 16 km towards the west.

Hence, the correct answer is "Option 2".

Q54. Answer: (a) 3

Given:

(Left) 5 € $ 4 9 & & 4 € @ © 7 @ 7 9 1 8 # 8 % 5 £ (Right)

We need to find the symbols which are:

→ Immediately preceded by a number

→ Immediately followed by a number

Required pattern: Number → Symbol → Number

Checking the series:

(Left) 5 € $ 4 9 & & 4 € @ © 7 @ 7 9 1 8 # 8 % 5 £ (Right)

The valid symbols are:

→ @ in (7 @ 7)

→ # in (8 # 8)

→ % in (8 % 5)

Therefore, there are 3 such symbols.

Hence, the correct answer is "Option 1".

Q55. Answer: (b) BYX−YVU

Logic followed here is: The second group of letters is determined by shifting each letter of the first group 3 positions backward in the alphabetical order.

For

JGF is related to GDC →

FCB is related to CZY →

Similarly, Option 2) BYX − YVU:

Therefore, the pair that follows the same pattern is 'BYX − YVU'.

Hence, the correct answer is "Option 2".

Q56. Answer: (c) UXY

Logic followed here is:

Three of the letter-clusters follow a specific pattern where there is a gap of +2 between the positional values of consecutive letters in the English alphabet. One cluster does not follow this pattern.

For

1) GIK →

2) WYA →

3) But for UXY →

4) FHJ →

The pattern observed in other clusters is: +2, +2 gaps. However, UXY follows a +3, +1 gap pattern.

Therefore, the letter-cluster that does not belong to the group is UXY.

Hence, the correct answer is "Option 3".

Q57. Answer: (a) 575

Given Equation:

17 ÷ 18 + 88 × 2 − 313 = ?

•	−	×	÷
−	•	÷	×

After interchanging the signs based on the table above, the new equation is:

= 17 × 18 − 88 ÷ 2 + 313 = ?

= 306 - 44 + 313 = ?

= 619 - 44 = ?

= 575 = ?

Therefore, the value that comes in place of the question mark is 575.

Hence, the correct answer is "Option 1".

Q58. Answer: (c) 959 and 939, respectively

Logic followed here is.

Logic: The sequence is formed by subtracting 10 from each preceding term to obtain the next number in the series.

The missing terms are 959 and 939.

Therefore, the numbers that should come in place of the question marks are 959 and 939, respectively.

Hence, the correct answer is "Option 3".

Q59. Answer: (a) 146

Logic followed here is.

Logic: The code for a word is determined by summing the positional values of its letters and then multiplying the sum by a constant factor.

For

XANJ is coded as 98 →

X	A	N	J
24	1	14	10

Sum of positional values = 24 + 1 + 14 + 10 = 49

Code = 49 × 2 = 98

VLQG is coded as 116 →

V	L	Q	G
22	12	17	7

Sum of positional values = 22 + 12 + 17 + 7 = 58

Code = 58 × 2 = 116

The pattern observed is: (Sum of positional values of letters) × 2.

Similarly, let's find the code for ZRHU:

Z	R	H	U
26	18	8	21

Sum of positional values = 26 + 18 + 8 + 21 = 73

Code = 73 × 2 = 146

Therefore, the code for 'ZRHU' is 146.

Hence, the correct answer is "Option 1".

Q60. Answer: (c) 4

Given:

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

We need to find the odd digits which are:

→ Immediately preceded by an odd digit

→ Immediately followed by an even digit

Required pattern: Odd digit → Odd digit → Even digit

Checking the series:

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

The valid odd digits are:

→ 7 in (9 7 6)

→ 7 in (7 7 8)

→ 5 in (5 5 2)

→ 1 in (3 1 4)

Therefore, there are 4 such odd digits.

Hence, the correct answer is "Option 3".

Q61. Answer: (a) 27

Given:

Dayanand ranked 17^(th) from the top and 11^(th) from the bottom in his class.

Formula:

Total students = Rank from top + Rank from bottom − 1

Substituting the values:

= 17 + 11 − 1

= 28 − 1

= 27

Therefore, the total number of students in the class is 27.

Hence, the correct answer is "Option 1".

Q62. Answer: (c) 4 km to the east

Given:

Anant starts from Point A.

1. Drives 32 km south
2. Takes a left turn and drives 34 km
3. Takes a left turn and drives 35 km
4. Takes a left turn and drives 38 km
5. Takes a final left turn and drives 3 km to reach Point P

Point P is 4 km west of Point A.

Therefore, to reach Point A again, Anant must travel 4 km towards the east.

Hence, the correct answer is "Option 3".

Q63. Answer: (a) 164

Logic followed here is:

The series follows an alternating mathematical pattern where 10 is subtracted from the first number to get the second, and then 1 is added to the second number to get the third.

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Given Series: 191 181 182 172 173 163 ?
The pattern is as follows:
The pattern observed is: -10, +1, -10, +1, -10, +1.
Therefore, the number that should come in place of the question mark is 164.
Hence, the correct answer is "Option 1".

Q64. Answer: (a) 4

Given:
A, B, C, D, E, F and G are sitting around a circular table facing the centre.
1. Only two people sit between F and C, when counted from the right of F.
2. Only two people sit between C and A, when counted from the right of C.
3. Only three people sit between F and G, when counted from the right of F.
4. E sits to the immediate left of D.
Finding the answer:
From the right of D
The people between D and F are:
B, E, G, C
So, there are 4 people between D and F when counted from the right of D.
Hence, the correct answer is "Option 1".

Q65. Answer: (d) 5

Given:
(Left) 7 9 5 6 8 9 2 9 7 2 9 4 3 1 5 4 5 8 2 4 1 4 3 1 4 8 1 (Right)
We need to find the even digits which are:
→ Immediately preceded by an odd digit
→ Immediately followed by an odd digit
Required pattern: Odd digit → Even digit → Odd digit
Checking the series:
(Left) 7 9 5 6 8 9 2 9 7 2 9 4 3 1 5 4 5 8 2 4 1 4 3 1 4 8 1 (Right)
The valid even digits are:
→ 2 in (9 2 9)
→ 2 in (7 2 9)
→ 4 in (9 4 3)
→ 4 in (5 4 5)
→ 4 in (1 4 3)
Therefore, there are 5 such even digits.
Hence, the correct answer is "Option 4".

Q66. Answer: (d) Wife's brother

Given:
‘A + B’ means ‘A is the brother of B’
‘A − B’ means ‘A is the sister of B’
‘A × B’ means ‘A is the mother of B’
‘A ÷ B’ means ‘A is the son of B’
Expression:
V + W × X − Z ÷ Y
Family Analysis:
Since Z is the son of Y, Y is the parent of Z.
X is the sister of Z, so X is also the child of Y.
W is the mother of X, therefore W is also the mother of Z.
V is the brother of W.
Thus, V is the brother of Y’s mother.
So, V is related to Y as wife's brother.

Hence, the correct answer is "Option 4".

Q67. Answer: (b) One

Given:

Seven friends, L, M, N, O, Q, R and S, are sitting in a straight line facing north.

1. Only four people sit to the right of O.
2. Only three people sit between O and S.
3. Only one person sits between S and L.
4. R sits to the immediate left of M.
5. N is not an immediate neighbour of S.

Q is at position 4.

People to the right of Q are: L, N and S

So, there are 3 people to the right of Q.

Hence, the correct answer should be "Option 3".

Q68. Answer: (c) 20

Shortcut Trick

Identify target digits: First two (3, 2) and last two (4, 1).

Apply rules: Even digit + 3 | Odd digit + 2.

New first two: 3(Odd) + 2 = 5 and 2(Even) + 3 = 5.

New last two: 4(Even) + 3 = 7 and 1(Odd) + 2 = 3.

Sum = 5 + 5 + 7 + 3 = 20.

Therefore The correct answer is 20.

Alternate Method

Given number: 3267541

Rules: Add 3 to even digits (2, 4, 6) and add 2 to odd digits (1, 3, 5, 7).

Step-by-step transformation of the digits:

=> First digit (3): 3 is odd → 3 + 2 = 5

=> Second digit (2): 2 is even → 2 + 3 = 5

=> Sixth digit (4): 4 is even → 4 + 3 = 7

=> Seventh digit (1): 1 is odd → 1 + 2 = 3

=> Sum of the first two digits = 5 + 5 = 10

=> Sum of the last two digits = 7 + 3 = 10

=> Total sum = 10 + 10 = 20

Therefore The correct answer is 20.

Additional Information

Even and Odd Digit Rule

Even digits are {0, 2, 4, 6, 8} and odd digits are {1, 3, 5, 7, 9}. Transformations based on parity require careful individual digit processing.

Digit Position in Numbers

In a number with n digits, the first digit is at position 1 (leftmost) and the last digit is at position n (rightmost).

Sum of Digits Properties

The sum of digits is often used in divisibility tests; for example, a number is divisible by 3 or 9 if the sum of its digits is divisible by 3 or 9 respectively.

Q69. Answer: (b) 132

Logic followed here is:

The code for a word is determined by summing the positional values of its letters and then multiplying the sum by a constant factor.

For

VACP is coded as 126 →

V	A	C	P

22	1	3	16

Sum of positional values = 22 + 1 + 3 + 16 = 42

Code = 42 × 3 = 126

MHTJ is coded as 153 →

M	H	T	J
13	8	20	10

Sum of positional values = 13 + 8 + 20 + 10 = 51

Code = 51 × 3 = 153

The pattern observed is: (Sum of positional values of letters) × 3.

Similarly, let's find the code for OGQE:

O	G	Q	E
15	7	17	5

Sum of positional values = 15 + 7 + 17 + 5 = 44

Code = 44 × 3 = 132

Therefore, the code for 'OGQE' is 132.

Hence, the correct answer is "Option 2".

Q70. Answer: (a) GP-JS-MO

Logic followed here is:

The first letter of each pair in the triad increases by +3 sequentially, while the second letter of each pair increases by +3 and then decreases by -4.

For CL-FO-IK →

For EN-HQ-KM →

Similarly,Option 1) GP-JS-MO:

Therefore, the triad that follows the same pattern is GP-JS-MO.

Hence, the correct answer is "Option 1".

Q71. Answer: (c) KJM

Logic followed here is: The difference between the positional values of consecutive letters in each letter-cluster follows a specific pattern.

1) ECG:

2) QOS:

3) KJM:

4) USW:

The pattern observed in ECG, QOS, and USW is: (1st Letter - 2) = 2nd Letter; (2nd Letter + 4) = 3rd Letter. However, KJM follows a different pattern.

Therefore, the letter-cluster that does not belong to the group is KJM.

Hence, the correct answer is "Option 3".

Q72. Answer: (d) Three

Given:

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

We need to find the odd digits which are:

→ Immediately preceded by an even digit

→ Immediately followed by an even digit

Required pattern: Even digit → Odd digit → Even digit

Checking the series:

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

The valid odd digits are:

→ 1 in (4 1 2)

→ 7 in (2 7 4)

→ 5 in (4 5 8)

Therefore, there are 3 such odd digits.

Hence, the correct answer is "Option 4".

Q73. Answer: (c) KNSM

Logic followed here is:

Each letter of the first group is moved forward by four positions in the English alphabetical order to obtain the corresponding letter of the second group.

For

KNSM is related to ORWQ →

NQVP is related to RUZT →

The pattern observed is: (Positional value of each letter) + 4.

Similarly, let's find the relation for GJOI:

Therefore, the code for 'GJOI' is KNSM.

Hence, the correct answer is "Option 3".

Q74. Answer: (b) Neither conclusion (I) nor (II) follows.

Given Statements:

Some brinjals are peppers.

Some peppers are turnips.

Venn Diagram Logic:

Conclusions:

(I) Some brinjals are turnips: Does not follows (Because no direct relation between brinjals and turnips is definitely given.)

(II) All turnips are peppers: Does not follows (The statement says only “Some peppers are turnips”, not all turnips are peppers.)

Therefore, neither conclusion (I) nor (II) follows.

Hence, the correct answer is "Neither conclusion (I) nor (II) follows".

Q75. Answer: (d) AEM

Logic followed here is:

Each term in the series is obtained by shifting each letter of the preceding term forward by 2 positions in the English alphabetical sequence.

Therefore, the term that should come in place of the question mark is 'AEM'.

Hence, the correct answer is "Option 4".

Q76. Answer: (a) 14th

Given:

Total people in the row = 52

Neena is 24^(th) from the right end.

Mishti sits 15 places to the left of Neena.

Step 1:

Find Neena’s position from the left end.

Formula:

Position from left = Total people − Position from right + 1

= 52 − 24 + 1

= 29

So, Neena is 29^(th) from the left end.

Step 2:

Mishti sits 15 places to the left of Neena.

So,

29 − 15 = 14

Therefore, Mishti is 14^(th) from the left end.

Hence, the correct answer is "Option 1".

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Q77. Answer: (b) 401

Given:

A	B	C	D
÷	×	•	•

Equation:

65 B 7 D 912 A 6 C 98 = ?

Replacing the symbols:

= 65 × 7 − 912 ÷ 6 + 98

= 455 − 152 + 98

= 303 + 98

= 401

Therefore, the value that comes in place of the question mark is 401.

Hence, the correct answer is "Option 2".

Q78. Answer: (d) One

Given:

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

1. B sits third to the right of C.
2. C sits second to the left of A.
3. F sits third to the right of D.
4. D sits to the immediate left of E.

Finding the answer:

From the left of E:

E → F→ B

Only one person sits between E and B.

Therefore, the number of people sitting between E and B is One.

Hence, the correct answer is "Option 4".

Q79. Answer: (c) Only conclusion (I) follows

Statements:

All fruits are vegetables.

No vegetable is a pumpkin.

Venn Diagram Logic:

Conclusions:

(I) No fruit is a pumpkin: Follows (Because all fruits are vegetables and no vegetable is a pumpkin. Therefore, no fruit can be a pumpkin.)

(II) Some pumpkins are vegetables: Does not follows (Because it is clearly stated that no vegetable is a pumpkin.)

Therefore, only conclusion (I) follows.

Hence, the correct answer is "Option 3".

Q80. Answer: (c) (15, 45, 3)

Logic followed here is:

The second number in each set is the product of the first number and the third number.

For (14, 28, 2) →

1st	2nd	3rd
14	28	2

Product of first and third values = 14 × 2 = 28

For (13, 39, 3) →

1st	2nd	3rd
13	39	3

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Product of first and third values = 13 × 3 = 39

The pattern observed is: (First number × Third number) = Second number.

Similarly, let's check for the set (15, 45, 3):

1st	2nd	3rd
15	45	3

Product of first and third values = 15 × 3 = 45

Therefore, the set (15, 45, 3) follows the same relationship.

Hence, the correct answer is "Option 3".

Q81. Answer: (b) Slice Small Finance Bank Limited

The correct answer is Slice Small Finance Bank Limited.

Key Points

• In May 2025, the Reserve Bank of India (RBI) gave its formal approval for the rebranding and renaming of North East Small Finance Bank (NESFB) to Slice Small Finance Bank Limited.

• This renaming marks the culmination of the strategic merger between the fintech unicorn GaragePreneurs Internet Private Limited (Slice) and North East Small Finance Bank, which was first initiated in late 2023.

• The transition allows the entity to function as a unified banking platform, combining Slice's digital expertise with NESFB's established banking infrastructure in the North-Eastern states of India.

• The RBI approval is a critical step in the fintech-to-bank transition, ensuring that the new entity complies with all regulatory norms under the Banking Regulation Act, 1949.

• The headquarters for the new entity remains strategically focused on Guwahati, Assam, to maintain its commitment to the financial inclusion of the North-East region.

Additional Information

• Small Finance Banks (SFBs):

• These are niche banking entities established to provide financial services to the underserved and unserved sections of society, including small business units, small and marginal farmers, and micro and small industries.

• SFBs were established based on the recommendations of the Nachiket Mor Committee on Comprehensive Financial Services for Small Businesses and Low Income Households.

• They are required to maintain a Capital to Risk-Weighted Assets Ratio (CRAR) of 15% and extend 75% of their Adjusted Net Bank Credit (ANBC) to the Priority Sector Lending (PSL).

• North East Small Finance Bank (NESFB):

• Originally started as RGVN (North East) Microfinance Limited, it received the Small Finance Bank license from the RBI in 2017.

• It is headquartered in Guwahati and serves the eight states of the North-East region, aiming to bridge the gap in formal credit availability.

• The Fintech Merger Significance:

• The merger of Slice and NESFB is one of the first of its kind in India, where a fintech company merged with a Small Finance Bank to gain a full banking license.

• Slice, founded by Rajan Bajaj, was primarily known for its credit cards and payment services before this pivot into the banking sector.

• This model allows fintechs to access a stable CASA (Current Account Savings Account) deposit base, reducing their overall cost of funds.

Important Points

• Regulatory Framework: Any change in the name of a banking company requires approval from the Reserve Bank of India under Section 49B of the Banking Regulation Act, 1949, as well as clearance from the Registrar of Companies (RoC).

• Geographic Focus: Even after the renaming to Slice Small Finance Bank Limited, the bank is mandated to maintain its regional focus, ensuring that its operations significantly benefit the socio-economic development of Northeast India.

• Service Portfolio: The new entity offers a full suite of products including savings accounts, recurring deposits, fixed deposits, and instant credit through a mobile-first approach, targeting the Gen-Z and millennial demographic.

Q82. Answer: (b) at least 10 women or one-third of the total staff, whichever is higher

The correct answer is at least 10 women or one-third of the total staff, whichever is higher.

Key Points

• The Government of West Bengal introduced new safety guidelines for women in 2024-2025 to ensure a secure working environment, specifically targeting those working during night hours.

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• As per the notification, women should be engaged in night shifts only in groups, and the strength of such groups should be at least 10 women or one-third of the total staff, whichever is higher. This measure is designed to prevent isolation and enhance collective security.

• The guidelines specify that a night shift for this purpose is defined as any work performed between 7:00 PM and 6:00 AM.

• The employer or the head of the establishment is held responsible for ensuring that these numbers are maintained and that security protocols are strictly followed.

• The policy also suggests that, wherever possible, women should be avoided for night shifts unless adequate security arrangements are in place and the group size requirement is met.

Additional Information

• Rattirer Sathi (Helpers of the Night): This is a flagship initiative launched by the West Bengal government that includes a mobile application equipped with a panic button. The app is directly linked to local police stations and the Police Control Room (PCR).

• Safe Transport: It is mandatory for employers to provide security-vetted transport facilities for women working night shifts, ensuring safe pick-up and drop-off from their residences.

• Security Measures: The guidelines mandate that all private security agencies employed by establishments must be registered, and their guards must undergo breathalyzer tests regularly to ensure they are fit for duty.

• Infrastructure Requirements: Workplaces must have high-quality CCTV cameras installed in all sensitive areas, including entrances, exits, and dark zones, with a dedicated team monitoring the footage 24/7.

• Restrooms and Hygiene: Establishments are required to provide separate, well-lit, and secure washrooms and restrooms for female employees, which must be located in safe areas of the building.

Important Points

• Identification: Every employee, including security personnel and contractual staff, must wear a visible Identity Card at all times to prevent the entry of unauthorized persons.

• Dark Zone Mapping: Authorities must conduct a "safety audit" to identify dark zones (poorly lit areas) within the premises and ensure they are immediately illuminated with LED lights.

• Duty Rosters: The Health Department and Home Department have been tasked with monitoring the implementation of these rosters to ensure that no woman is forced to work alone or in an understaffed environment during the night.

• Emergency Response: In case of any emergency, the 100/112 helpline numbers should be prominently displayed across the workplace for immediate assistance.

Q83. Answer: (b) Tanay Tushar Lad

The correct answer is Tanay Tushar Lad.

Key Points

• Tanay Tushar Lad, a young and talented 12-year-old swimmer, made headlines in March 2025 by setting a new record in open-water swimming.

• He successfully completed a grueling 17 km swim in the Arabian Sea, navigating the waters between two of Mumbai's most prominent landmarks.

• The swimming expedition commenced at the historic Gateway of India and concluded at the Atal Setu, which is also known as the Mumbai Trans Harbour Link (MTHL).

• This specific route is considered challenging due to the unpredictable tidal currents and the maritime traffic in the Mumbai harbour area.

• By completing this 17 km stretch, Tanay Tushar Lad has established a benchmark for young endurance athletes in India, promoting the sport of long-distance swimming.

Additional Information

• Atal Setu (MTHL):

• Inaugurated in early 2024, the Atal Bihari Vajpayee Sewri–Nhava Sheva Atal Setu is India's longest sea bridge.

• It spans approximately 21.8 km, with 16.5 km over the sea, connecting South Mumbai to Navi Mumbai.

• The bridge has become a new focal point for sports and photography in Maharashtra due to its engineering brilliance.

• Gateway of India:

• Located in Colaba, Mumbai, this monument was built to commemorate the visit of King George V and Queen Mary to India in 1911.

• It is the traditional starting point for several famous swimming routes, including the 35 km swim from Dharamtar to the Gateway of India.

• Open-Water Swimming in India:

• This discipline involves swimming in natural bodies of water such as oceans, rivers, and lakes.

• Athletes must contend with various factors such as water temperature, salinity, and marine life, which are not present in pool swimming.

• The Swimming Federation of India (SFI) is the primary body governing such aquatic sports in the country.

Important Points

• Safety Protocols: For such record-breaking attempts, swimmers are usually accompanied by pilot boats, navigators, and medical observers to ensure safety during the transit.

• Environmental Factors: In March, the sea conditions near Mumbai can vary, and swimmers often have to time their attempts according to the high tide and low tide schedules to gain assistance from the water flow.

• Endurance Training: To cover a distance of 17 km, young swimmers like Tanay undergo rigorous physical training for several months, focusing on cardiovascular strength and mental resilience.

Q84. Answer: (d) Maritime Financing Summit, 2025

The correct answer is Maritime Financing Summit, 2025.

Key Points

• The Maritime Financing Summit, 2025 was organized by the Ministry of Ports, Shipping and Waterways (MoPSW) on 24 July 2025 in New Delhi.

• The summit served as a critical platform to deliberate on financial strategies and investment frameworks necessary to propel India toward its goal of becoming a global maritime power.

• The primary objective of the event was to foster a dialogue between policymakers, financial institutions, and industry stakeholders to unlock the investment potential within the maritime sector.

• The discussions were strategically aligned with the Maritime Amrit Kaal Vision 2047, which envisions an investment of over Rs. 80 trillion to transform the maritime infrastructure of the country.

• The event highlighted the importance of Public-Private Partnerships (PPP) and innovative funding mechanisms like Maritime Development Funds to support port modernization and shipping fleet expansion.

• Key focus areas included sustainable financing for green shipping initiatives and the enhancement of Ease of Doing Business in the maritime financial ecosystem.

Additional Information

• Maritime Amrit Kaal Vision 2047:

• Launched to outline the roadmap for the next 25 years, this vision aims to increase the capacity of Indian ports to 10,000 MTPA (Million Tonnes Per Annum) by 2047.

• It focuses on port-led industrialization, coastal shipping, and the development of Smart Ports through digitization and Automation.

• Ministry of Ports, Shipping and Waterways (MoPSW):

• This ministry is the apex body responsible for formulating and implementing policies related to ports, shipping, and inland water transport in India.

• Under the leadership of Shri Sarbananda Sonowal (as of recent administrative records), the ministry has prioritized the Sagarmala Project to reduce logistics costs.

• Investment Opportunities in Maritime Sector:

• India offers 100% FDI (Foreign Direct Investment) under the automatic route for port construction and maintenance projects.

• The Blue Economy policy of India aims to contribute significantly to the national GDP by utilizing ocean resources sustainably while ensuring environmental conservation.

• Green Shipping and Sustainability:

• The Harit Sagar Guidelines 2023 emphasize the reduction of carbon footprints at ports and the promotion of renewable energy integration.

• India is working toward establishing Green Hydrogen Hubs at major ports like Deendayal Port and Chidambaranar Port.

Important Points

• Logistics Efficiency: One of the core themes of the 2025 Summit was to lower India's logistics cost from 13-14% of GDP to the global average of 8%.

• Global Rankings: India aims to enter the top 10 in the Logistics Performance Index (LPI) by improving port turnaround times and multimodal connectivity.

• Major Ports: Currently, India has 12 Major Ports and over 200 non-major ports, which together handle approximately 95% of the country's foreign trade by volume.

• Shipbuilding Industry: The government is promoting the Shipbuilding Financial Assistance Policy (SBFAP) to encourage domestic vessel manufacturing and reduce dependency on foreign ships.

Q85. Answer: (a) Assam

The correct answer is Assam.

Key Points

• Union Home Minister Amit Shah unveiled the Flood Hazard Zonation Atlas for the state of Assam in June 2025 to enhance the state's preparedness against annual flood disasters.

• The atlas has been developed by the National Remote Sensing Centre (NRSC), ISRO, in collaboration with the Assam State Disaster Management Authority (ASDMA).

• It utilizes satellite data acquired over the last 25 years (from 2000 to 2024) to identify and categorize flood-prone areas into different risk levels.

• This scientific tool is designed to assist policymakers and district administrations in planning disaster mitigation, infrastructure development, and early warning systems.

• With the launch of this atlas, Assam becomes one of the few states in India, following Odisha, to possess a comprehensive, data-driven flood hazard map for better resource allocation during emergencies.

Additional Information

• Geographical Context of Assam:

• The state is situated in the Brahmaputra and Barak river valleys, making it highly susceptible to riverine flooding and erosion.

• The Brahmaputra River, one of the largest in the world, enters India through Arunachal Pradesh and flows through the heart of Assam, carrying massive amounts of silt and water during the Monsoon season.

• Flood Hazard Mapping Technology:

• The atlas uses Geographic Information System (GIS) and Remote Sensing technologies to map "hazard zones" ranging from Very High to Very Low.

• It factors in historical flood frequency, inundation depth, and the duration of waterlogging across different districts.

• Disaster Management Framework:

• The initiative aligns with the National Disaster Management Act, 2005, which mandates states to create comprehensive plans for prevention and mitigation of disasters.

• The National Disaster Management Authority (NDMA) provides the overarching guidelines for such digital interventions to minimize the loss of life and property.

Important Points

• Socio-Economic Impact: Floods in Assam affect nearly 30-40 lakh people annually and cause heavy damage to agriculture, specifically the Kharif crops, and wildlife in the Kaziranga National Park.

• Early Warning Systems: The data from the atlas will be integrated into the Flood Early Warning System (FLEWS) to provide real-time alerts to villages and revenue circles.

• Infrastructure Resilience: By identifying hazard zones, the state government can avoid constructing critical infrastructure like hospitals, schools, and power stations in "Very High" risk areas.

• Brahmaputra Board: Established under the Brahmaputra Board Act, 1980, this statutory body works under the Ministry of Jal Shakti to manage flood control and drainage in the North Eastern Region.

Q86. Answer: (d) Bengaluru

The correct answer is Bengaluru.

Key Points

• The regional meeting with Waqf Boards was organized in the city of Bengaluru in October 2025 to discuss administrative reforms and the protection of Waqf properties.

• This high-level meeting was primarily focused on the Southern States and Union Territories, including Karnataka, Kerala, Tamil Nadu, Andhra Pradesh, Telangana, and Puducherry.

• The session was presided over by the Union Minister of Minority Affairs, who emphasized the importance of transparency and accountability in the management of community assets.

• A primary agenda of the Bengaluru conference was the review of the digitization process of Waqf records to prevent illegal encroachments and ensure better land survey accuracy.

• The discussions also touched upon the implementation of the Waqf Amendment guidelines, aiming to streamline the functioning of State Waqf Boards and enhance their legal framework.

• Hence, the correct answer is Bengaluru.

Additional Information

• Waqf Act, 1995:

• The Waqf Act, 1995 is the primary legislation in India that governs the administration of Waqf (properties dedicated for religious or charitable purposes under Islamic law).

• The Act was significantly amended in 2013 to provide more powers to the Waqf Tribunals and to make the encroachment of Waqf property a cognizable and non-bailable offense.

• Central Waqf Council (CWC):

• Established in 1964, the Central Waqf Council is a statutory body under the administrative control of the Ministry of Minority Affairs.

• It acts as an advisory body to the Government of India on matters concerning the working of State Waqf Boards and the administration of Auqaf (plural of Waqf) in the country.

• WAMSI Portal:

• The Waqf Assets Management System of India (WAMSI) is an online portal launched to digitize the registration and tracking of Waqf properties across all states.

• As of recent reports, there are over 6 lakh registered Waqf properties in India, making it one of the largest landholders after the Railways and the Defense Ministry.

• Socio-Economic Utilization:

• The Government encourages using Waqf land for the construction of schools, hospitals, and skill development centers under schemes like the Pradhan Mantri Jan Vikas Karyakram (PMJVK).

• This ensures that the income generated from these properties contributes to the education and health of the underprivileged sections of the Minority communities.

Important Points

• Regional Significance: The meeting in Bengaluru specifically addressed the unique logistical and legal hurdles faced by South Indian boards due to diverse local land revenue laws.

• Legal Reforms: In 2024 and 2025, there has been a significant push for the Waqf (Amendment) Bill to ensure that Waqf Boards have representative characters, including the mandatory inclusion of women and non-Muslim members in certain administrative roles.

• Monitoring: The Union Ministry uses these regional meetings to audit the financial performance and litigation status of various State Waqf Boards.

Q87. Answer: (c) United Nations University (UNU)

The correct answer is option3. The detailed solution will be updated soon.

Q88. Answer: (d) Virat Kohli

The correct answer is option4. The detailed solution will be updated soon.

Q89. Answer: (a) 31 October 2025

The correct answer is 31 October 2025.

Key Points

• In April 2025, the Reserve Bank of India (RBI) issued a significant directive aimed at enhancing the cybersecurity framework of the Indian financial sector.

• The mandate requires all scheduled commercial banks, including public and private sector banks, to migrate their official websites and email services to the .bank.in domain by 31 October 2025.

• This transition is designed to provide a verified and secure digital identity for banks, making it easier for customers to distinguish between legitimate banking websites and fraudulent ones.

• The .bank.in domain is a specialized, restricted top-level domain that is exclusively available to RBI-regulated entities, ensuring a higher level of trust in the digital ecosystem.

• By standardizing on this domain, the RBI aims to drastically reduce instances of phishing, identity theft, and spoofing attacks that often target unsuspecting bank customers. Hence, the correct answer is 31 October 2025.

Additional Information

• The .bank.in Domain:

• Unlike generic extensions like .com or .in, the .bank.in domain involves a rigorous verification process conducted by the Institute for Development and Research in Banking Technology (IDRBT).

• The IDRBT, which is the technical arm of the Reserve Bank of India, manages the registration to ensure that only authorized financial institutions gain access.

• Security Protocols:

• Migration to this domain necessitates the implementation of Domain Name System Security Extensions (DNSSEC).

• DNSSEC adds a layer of security by digitally signing DNS data, which prevents "man-in-the-middle" attacks and ensures that users are not redirected to malicious servers.

• Role of the Reserve Bank of India (RBI):

• The RBI, established on 1 April 1935, functions as the central bank of India and regulates the banking system under the Banking Regulation Act, 1949.

• It continuously updates its Cybersecurity Resilience Framework to combat the evolving nature of digital threats in the global

financial landscape.

• Global Context:

• The move aligns with global best practices, such as the use of the .bank domain in the United States and other developed economies, which serves as a "gold standard" for security.

Important Points

• Customer Impact: After the 31 October 2025 deadline, any banking communication received from a non-.bank.in domain should be flagged as potentially fraudulent by customers.

• Compliance: Banks are required to submit progress reports to the RBI regarding their migration status to ensure the deadline is met without disrupting banking operations.

• Scope: The mandate covers all customer-facing portals, internal communication systems, and official email IDs of bank employees to ensure end-to-end security.

• Verification: The registration process for .bank.in includes multi-factor authentication for any changes to the domain records, providing an additional safeguard against unauthorized modifications.

Q90. Answer: (b) Belém, Brazil

The correct answer is Belém, Brazil.

Key Points

• The 30th Conference of the Parties (COP30) to the United Nations Framework Convention on Climate Change (UNFCCC) is scheduled to take place in November 2025.

• Belém is a city located in the northern region of Brazil, specifically in the state of Pará.

• This region is part of the Amazon Rainforest, which is the largest tropical rainforest in the world and a critical zone for addressing global climate change concerns.

• The choice of Belém as the host city for COP30 highlights the importance of the Amazon biome in the global fight against deforestation and carbon emissions.

• Hosting COP30 in Belém will bring significant global attention to the Amazon region, encouraging discussions on its preservation and sustainable development.

• The decision to hold COP30 in Brazil aligns with the country’s renewed focus on environmental policies and combating deforestation under the leadership of President Luis Inácio Lula da Silva.

• Previous COPs were held in various global locations, but this will be one of the few COPs hosted in the Amazon region, symbolizing the region’s critical role in mitigating the effects of climate change.

Additional Information

• Quito, Ecuador

• Quito is the capital city of Ecuador and is located in the Andes mountains.

• Although Quito is not hosting COP30, it is significant as a city with a rich cultural heritage and a focus on sustainability.

• The city has been recognized for its efforts in urban environmental management and climate adaptation strategies.

• Nairobi, Kenya

• Nairobi is the capital city of Kenya and a hub for several international organizations, including the United Nations Environment Programme (UNEP).

• While Nairobi is not hosting COP30, it plays a vital role in global environmental policies and initiatives, particularly for the African continent.

• Bangkok, Thailand

• Bangkok is the capital of Thailand and a major economic center in Southeast Asia.

• The city faces significant challenges related to urban flooding and climate resilience, making it an important location for discussions on sustainable urban development.

Q91. Answer: (c) Honda

The correct answer is Honda.

Key Points

• On June 17, 2025, the Honda Motor Co., Ltd. successfully conducted a landmark launch and landing test of its first experimental reusable rocket.

• The test was carried out in Hokkaido, Japan, specifically utilizing the coastal geography which is ideal for aerospace testing and safe recovery operations.

• This successful mission marked Honda's official entry into the competitive field of reusable launch vehicles, joining a select group of global entities capable of vertical landing technology.

• The primary objective of the test was to validate the autonomous guidance and control systems required for the rocket to return to a vertical landing pad after flight.

• By developing reusable technology, the company aims to drastically reduce the cost of launching small satellites into Low Earth Orbit (LEO).

Additional Information

• Honda's Space Vision: In September 2021, Honda announced its intention to expand its R&D into space technology as part of its "Vision 2030" strategy, aiming to transform from a traditional automobile manufacturer into a multi-modal mobility company.

• Strategic Applications: The company plans to use its own satellite constellation to provide high-precision connectivity and data services for its future autonomous vehicles and eVTOL (electric Vertical Take-off and Landing) aircraft.

• Propulsion Technology: The experimental rocket leverages Honda's decades of expertise in combustion engines and fluid dynamics to optimize fuel efficiency and thrust control during the critical landing phase.

• Regional Impact: The use of Hokkaido as a testing site supports Japan's growing "Space Port" initiative, positioning the northern island as a hub for the commercial space industry in Asia.

• Competitor Context: While Toyota is collaborating with JAXA (Japan Aerospace Exploration Agency) on the Lunar Cruiser, Honda has focused its internal resources on launch vehicle hardware to ensure independent access to space.

Important Points

• Key Milestone: The 2025 test represents the transition from theoretical research to physical prototyping and operational verification for Honda's aerospace division.

• Environmental Focus: Future iterations of the rocket are expected to use liquid methane or other cleaner propellants to align with global sustainability goals within the aviation and space sectors.

• Economic Significance: The shift toward reusable rockets is essential for Japan to maintain technological sovereignty and compete with private firms like SpaceX and Blue Origin in the global satellite launch market.

• Technical Specifics: The rocket tested in June featured advanced landing legs and grid fins for aerodynamic stability during the atmospheric descent.

Q92. Answer: (a) Essential environmental services like waste-to-energy plants

The correct answer is Essential environmental services like waste-to-energy plants.

Key Points

• In February 2025, the Central Pollution Control Board (CPCB) issued a circular introducing the Blue Category of industries to classify entities providing essential environmental services.

• This new category includes facilities such as Waste-to-Energy plants, Common Effluent Treatment Plants (CETPs), Sewage Treatment Plants (STPs), and Common Bio-Medical Waste Treatment Facilities. Hence, the statement regarding essential environmental services is correct.

• The primary objective behind this reclassification is to recognize the positive environmental footprint of these services, which were previously categorized under Red or Orange due to their operational emissions, despite their role in pollution control.

• By moving these industries to the Blue Category, the government aims to facilitate Ease of Doing Business and promote a Circular Economy by providing a more supportive regulatory framework for waste management and recycling infrastructure.

• The classification helps in distinguishing pollution-generating industries from those dedicated to pollution mitigation and resource recovery.

Additional Information

• Industrial Categorization in India:

• The CPCB introduced a classification system based on the Pollution Index (PI), which is a number from 0 to 100. A higher PI indicates a higher degree of pollution potential from the industrial sector.

• Red Category: Includes industries with a Pollution Index score of 60 and above. These are high-polluting industries like refineries, tanneries, and thermal power plants.

• Orange Category: Includes industries with a Pollution Index score between 41 and 59. These have a moderate pollution footprint, such as food processing or pharmaceutical formulations.

• Green Category: Includes industries with a Pollution Index score between 21 and 40. These are low-polluting industries like small-scale tea processing or poultry farms.

• White Category: Includes industries with a Pollution Index score up to 20. These are practically non-polluting and do not require Consent to Operate (CTO), such as solar power generation or IT and software services.

Important Points

• Regulatory Impact: The introduction of the Blue Category allows these essential services to obtain Consents (CTE and CTO) under a streamlined process, often with longer validity periods compared to Red category industries.

• Date of Implementation: The directive was officially circulated in February 2025, marking a shift in India’s environmental governance from a purely emission-based view to a utility-based view of industrial activity.

• Authority: The Central Pollution Control Board (CPCB) is a statutory organization constituted in September 1974 under the Water (Prevention and Control of Pollution) Act, 1974. It also serves under the Air (Prevention and Control of Pollution) Act, 1981.

• Sustainable Development: This move aligns with India's commitments toward Net Zero goals and efficient waste management under the Swachh Bharat Mission.

Q93. Answer: (a) Lionel Messi

The correct answer is Lionel Messi.

Key Points

• In January 2025, the legendary Argentine footballer Lionel Messi was honored with the Presidential Medal of Freedom by the United States government.

• The award was conferred by President Joe Biden, recognizing Messi's extraordinary contributions to the world of sports and his massive influence on the cultural fabric of the United States since his move to the Major League Soccer (MLS).

• Lionel Messi joined the American club Inter Miami CF in July 2023, a move that is credited with revolutionizing the popularity of football (soccer) in North America.

• The Presidential Medal of Freedom is the highest civilian honour in the United States, typically awarded to individuals who have made an "especially meritorious contribution to the security or national interests of the United States, world peace, cultural or other significant public or private endeavors."

• Messi's recognition follows his historic achievement in leading Argentina to victory in the 2022 FIFA World Cup and his record-breaking 8 Ballon d'Or titles. Hence, the correct answer is Lionel Messi.

Additional Information

• The Presidential Medal of Freedom:

• Established by President John F. Kennedy via Executive Order 11085 in 1963, it succeeded the original Medal of Freedom established by Harry S. Truman in 1945.

• While usually awarded to U.S. citizens, it can also be granted to foreign nationals who have made significant contributions to the world or the interest of the USA.

• Other notable sports figures who have received this medal include Tiger Woods (2019), Michael Jordan (2016), and Muhammad Ali (2005).

• Impact of Lionel Messi in the USA:

• Since joining Inter Miami, Messi has significantly increased the commercial value of MLS, leading to record-breaking Apple TV subscriptions and ticket sales.

• His presence is seen as a crucial catalyst for the growth of the sport in the USA ahead of the 2026 FIFA World Cup, which the country will co-host.

• In 2023, he was named TIME Magazine's Athlete of the Year, further cementing his status as a global icon beyond just the football pitch.

Important Points

• Lionel Messi's Achievements: He holds the record for the most goals scored in La Liga (474) and has won 44 professional trophies, making him the most decorated player in football history.

• Other Options:

• Cristiano Ronaldo: A Portuguese legend currently playing for Al Nassr in Saudi Arabia; while a global superstar, he has not been awarded the U.S. Presidential Medal of Freedom.

• Neymar Jr.: A Brazilian forward playing for Al Hilal; known for his skill but lacks this specific American civilian honor.

• Luis Suarez: A teammate of Messi at Inter Miami and an Uruguayan legend, but he was not the recipient of the award in 2025.

• The award ceremony in January 2025 marked one of the final significant acts of the Biden administration regarding civilian recognitions for international figures.

Q94. Answer: (b) New Delhi

The correct answer is New Delhi.

Key Points

• The World Health Summit (WHS) Regional Meeting 2025 was hosted in New Delhi, India. This marked a historic milestone as it was the first time that this prestigious regional health forum was held in the Indian subcontinent.

• The meeting was organized by the Ministry of Health and Family Welfare (MoHFW), Government of India, in close collaboration with the World Health Summit foundation based in Berlin.

• The summit, held in April 2025, brought together global health leaders, researchers, and policymakers to discuss the specific health challenges and opportunities within the Global South and the Asian region.

• The primary focus of the 2025 Regional Meeting was to foster international cooperation in areas such as pandemic preparedness, digital health innovations, and strengthening primary healthcare systems.

• By hosting this event, India showcased its leadership in global health, particularly highlighting its role as the 'Pharmacy of the World' and its efforts towards achieving Universal Health Coverage (UHC).

Additional Information

• World Health Summit (WHS):

• The World Health Summit was founded in 2009 on the occasion of the 300th anniversary of the Charité – Universitätsmedizin Berlin.

• While the main annual summit always takes place in Berlin, Germany, the Regional Meetings are held annually in different parts of the world, hosted by the member of the M8 Alliance that holds the regional presidency for that year.

• M8 Alliance:

• The M8 Alliance of Academic Health Centers, Universities and National Academies is the academic foundation of the World Health Summit.

• It is a network of currently 31 members in 20 countries, including the InterAcademy Partnership (IAP), which represents the national academies of medicine and science in over 100 countries.

• Themes of the Meeting:

• The 2025 New Delhi meeting emphasized the 'One Health' approach, which recognizes the interconnection between people, animals, and our shared environment.

• Discussions also revolved around the integration of Artificial Intelligence (AI) in healthcare and the implementation of the National Digital Health Mission (NDHM) model on a global scale.

• Previous Meetings:

• Before the 2025 meeting in India, other regional meetings have been held in locations such as Melbourne (2024), Rome (2022), and Coimbra (2019). Each meeting addresses unique regional priorities aligned with the United Nations Sustainable Development Goals (SDG 3).

• India's Healthcare Initiatives:

• The selection of New Delhi as a venue aligns with India's successful initiatives like Ayushman Bharat, which is the world's largest government-funded healthcare program, providing coverage to over 500 million citizens.

Q95. Answer: (d) Aam Aadmi Party

The correct answer is Aam Aadmi Party.

Key Points

• The Aam Aadmi Party (AAP) emerged victorious in the Ludhiana West constituency during the bye-elections held in June 2025.

• The bye-election was conducted to fill a vacancy in the Punjab Legislative Assembly, which consists of 117 seats in total.

• This victory solidified the Aam Aadmi Party's position in the state of Punjab, where it had previously won a massive mandate in the 2022 Assembly Elections. Hence, the statement regarding AAP's win is correct.

• The Ludhiana West seat is considered a crucial urban constituency, reflecting the political sentiment of the industrial hub of Ludhiana.

• The election was managed by the Election Commission of India (ECI), utilizing Electronic Voting Machines (EVMs) and VVPAT units to ensure transparency.

Additional Information

• Aam Aadmi Party (AAP):

• Formed in November 2012 following the India Against Corruption movement led by Arvind Kejriwal.

• The party's election symbol is the Broom (Jhadu), signifying its intent to clean the political system.

• In March 2022, the party formed the government in Punjab for the first time, with Bhagwant Mann as the Chief Minister.

• Ludhiana West Constituency:

• It is one of the key assembly segments in the Ludhiana district, characterized by a mix of residential and high-end commercial areas.

• Political dynamics in this region are often influenced by the business community and urban development issues.

• Bye-Elections in India:

• Also known as bypolls, these are held when a seat in the Legislature becomes vacant before the regular five-year term ends.

• Vacancies usually occur due to the resignation, death, or disqualification of an elected representative.

Important Points

• Constitutional Framework: Under Article 324 of the Constitution of India, the Election Commission of India has the authority to direct and control all elections to the Parliament and State Legislatures.

• Representation of the People Act, 1951: This Act governs the conduct of elections in India, including the process for filling vacancies through bye-elections within a period of six months from the date of the vacancy.

• Ludhiana District: Known as the Manchester of India, it is the largest city in Punjab and a major industrial center for hosiery and cycle parts. Political wins in this district are often seen as a barometer for the state's economic and urban policies.

• Voter Demographics: The Ludhiana West constituency features a diverse demographic, including a significant population of

traders, industrialists, and service-class voters.

Q96. Answer: (a) Defence Research and Development Organisation (DRDO)

The correct answer is Defence Research and Development Organisation (DRDO).

Key Points

• The Defence Research and Development Organisation (DRDO) successfully conducted a flight test of the Agni-5 missile in August 2025, reinforcing India's strategic deterrent capabilities.

• Agni-5 is an Intercontinental Ballistic Missile (ICBM) developed indigenously by DRDO, capable of striking targets at ranges exceeding 5,000 kilometres.

• The missile is a three-stage solid-fueled engine system, designed to carry nuclear warheads weighing over 1,000 kg, significantly enhancing India's second-strike capability.

• This specific test in 2025 focused on validating advanced sensors and new guidance systems to ensure high accuracy for long-range strikes. Hence, statement 1 is correct.

• The Agni-5 incorporates Canister Launch technology, which allows for road mobility and reduces the time required for launch, ensuring a higher level of operational flexibility.

Additional Information

• Evolution of the Agni Series:

• The Agni missile family is a critical component of India's minimum credible deterrence. It began under the Integrated Guided Missile Development Programme (IGMDP), managed by Dr. APJ Abdul Kalam in the early 1980s.

• While Agni-1 had a range of 700 km, the series evolved through Agni-2 (2,000 km), Agni-3 (3,000 km), and Agni-4 (4,000 km), culminating in the Agni-5 ICBM.

• Newer variants like Agni Prime (Agni-P) have also been developed as two-stage, canisterized missiles with ranges between 1,000 and 2,000 km.

• Technical Features of Agni-5:

• The missile uses a Ring Laser Gyroscope (RLG) based high-accuracy Inertial Navigation System (INS) and Micro Navigation System (MINGS) to reach its target with precision.

• Recent advancements in the Agni-5 program include Multiple Independently Targetable Re-entry Vehicle (MIRV) technology, which allows a single missile to deliver multiple warheads to different locations.

• The Agni-5 project was led by mission directors and scientists at the Advanced Systems Laboratory (ASL), a premier lab of DRDO located in Hyderabad.

• Organization Roles:

• ISRO (Indian Space Research Organisation): Primarily responsible for India's space program, satellite launches, and planetary exploration, established in 1969 with headquarters in Bengaluru.

• HAL (Hindustan Aeronautics Limited): An aerospace and defence company headquartered in Bengaluru, primarily involved in the design and manufacture of fighter jets, helicopters, and gas turbine engines.

• BDL (Bharat Dynamics Limited): Acts as the manufacturing base for guided weapon systems in India, producing missiles designed by DRDO, founded in 1970 in Hyderabad.

Important Points

• DRDO Background: Established in 1958 by merging the Technical Development Establishment (TDEs) of the Indian Army and the Directorate of Technical Development & Production (DTDP) with the Defence Science Organisation (DSO).

• It functions under the Ministry of Defence, Government of India, and is headed by the Secretary, Department of Defence R&D.

• The Agni-5 flight tests are usually conducted from the Dr. APJ Abdul Kalam Island (formerly Wheeler Island) located off the coast of Odisha in the Bay of Bengal.

• The success of the Agni-5 puts India in an elite group of nations possessing ICBM technology, which includes the USA, Russia, China, France, and the UK.

Q97. Answer: (c) Mother Mary Comes to Me

The correct answer is Mother Mary Comes to Me.

Key Points

• The world-renowned Indian author Arundhati Roy announced her highly anticipated memoir titled Mother Mary Comes to Me, which is scheduled for a global release in September 2025.

• This book represents a significant milestone in her literary career as it is her first memoir, providing a personal narrative that spans her childhood in Kerala to her journey as a public intellectual. Hence, the correct answer is Mother Mary Comes to Me.

• The title of the memoir is famously inspired by a lyric from the Beatles' iconic song "Let It Be," reflecting the cultural and personal influences on her life.

• The memoir is published by Hamish Hamilton (an imprint of Penguin Books) and is expected to be released simultaneously in

India, the UK, the USA, and several other countries.

• The book is described as a "theatrical" and "profoundly moving" account that explores her relationship with her mother, Mary Roy, a pioneering educator and women's rights activist whose legal battles changed inheritance laws for Christian women in India.

Additional Information

• The God of Small Things:

• This was Arundhati Roy's debut novel, published in 1997.

• It won the prestigious Man Booker Prize for Fiction in the same year, catapulting her to international fame.

• The story is set in Aymanam, Kerala, and deals with themes of caste, class, and the "Love Laws" that dictate who should be loved and how.

• The Ministry of Utmost Happiness:

• Released in 2017, this was her second novel, published twenty years after her first.

• It was longlisted for the Man Booker Prize in 2017 and explores the complex socio-political fabric of modern India, ranging from Old Delhi to the Kashmir Valley. Hence, option 4 is incorrect as it was released in 2017.

• Azadi: Freedom. Fascism. Fiction:

• Published in 2020, this is a collection of essays that examines the meaning of freedom in an increasingly authoritarian world.

• The book reflects her role as a political activist and critic of neoliberalism and communalism. Hence, option 2 is incorrect as it was released in 2020.

• Non-Fiction Works:

• Roy is prolific in her non-fiction writing, with notable titles including The Algebra of Infinite Justice (2001), Listening to Grasshoppers (2009), and Capitalism: A Ghost Story (2014).

• She was awarded the Sydney Peace Prize in 2004 and the Sahitya Akademi Award in 2006 (which she declined in protest against the Indian government).

Important Points

• Literary Impact: Arundhati Roy is considered one of the most influential voices in contemporary literature, known for her lyrical prose and fearless political commentary.

• Recent Awards: In 2024, she was awarded the PEN Pinter Prize for her "unflinching" and "powerful" body of work.

• September 2025 Release: The memoir Mother Mary Comes to Me is anticipated to be one of the biggest literary events of the year 2025, offering readers an intimate look at the woman behind the novels.

• The Architecture of Modern Empire: This title is often associated with themes found in her essays regarding globalization and US foreign policy, but it is not the title of her 2025 release. Hence, option 1 is incorrect.

Q98. Answer: (b) Ministry of Home Affairs

The correct answer is Ministry of Home Affairs.

Key Points

• Operation Abhyaas is a significant nationwide civil defence mock drill organized by the Ministry of Home Affairs (MHA) on 7 May 2025.

• The primary objective of this exercise was to assess and enhance the preparedness, coordination, and response capabilities of various civil defence units and local administrative bodies across India.

• The drill simulated multiple emergency scenarios, including natural disasters and man-made crises, to test the real-time mobilization of Civil Defence volunteers and Home Guards.

• The Ministry of Home Affairs orchestrated the event to ensure that the Standard Operating Procedures (SOPs) for disaster management are effectively implemented at the grassroots level.

• This initiative is part of the government's broader strategy to strengthen internal security and community resilience during large-scale emergencies.

Additional Information

• Ministry of Home Affairs (MHA):

• The MHA is a nodal ministry of the Government of India responsible for the maintenance of internal security and domestic policy.

• It oversees the Central Armed Police Forces (CAPFs) and provides administrative support to the Union Territories.

• The ministry is headed by the Union Home Minister, who is a senior member of the Union Council of Ministers.

• Civil Defence in India:

• Civil Defence measures are designed to protect the civilian population against any hostile attack or disaster.

• In India, the Civil Defence Act, 1968, provides the legal framework for the organization and operation of civil defence bodies.

• The Directorate General of Fire Service, Civil Defence & Home Guards under the MHA coordinates these activities nationwide.

• Disaster Management Framework:

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• The Disaster Management Act, 2005, led to the creation of the National Disaster Management Authority (NDMA), which is chaired by the Prime Minister.

• Mock drills like Operation Abhyaas are essential tools used by the NDMA and MHA to identify gaps in the disaster response mechanism.

• Other Entities:

• NITI Aayog: A policy think tank of the Government of India that focuses on sustainable development goals and cooperative federalism, but does not usually organize field-level mock drills.

• Ministry of Finance: Responsible for the economy of India, including taxation, financial legislation, and the Union Budget.

• Indian Institute of Administrative Sciences: Primarily an academic and training institution rather than an operational body for nationwide civil defence drills.

Important Points

• Geographical Reach: The drill on 7 May 2025 covered all States and Union Territories, making it one of the largest civil-military coordination exercises in recent years.

• Stakeholder Involvement: Apart from the MHA, the exercise saw participation from the National Disaster Response Force (NDRF), State Disaster Response Forces (SDRF), and various Non-Governmental Organizations (NGOs).

• Technological Integration: During Operation Abhyaas, advanced communication tools and drones were deployed to monitor response times and simulated search and rescue operations.

Q99. Answer: (c) Ensuring uninterrupted power supply to discourage use of DG sets

The correct answer is Ensuring uninterrupted power supply to discourage use of DG sets.

Key Points

The Commission for Air Quality Management (CAQM) revised the Graded Response Action Plan (GRAP) for the National Capital Region (NCR) to be implemented for the 2024-25 winter season and beyond.

One of the most significant changes in the revised schedule is the advancement of the measure to ensure uninterrupted power supply by DISCOMs to discourage the use of Diesel Generator (DG) sets.

This specific measure was previously classified under Stage II (Very Poor) but has been moved to Stage I (Poor) to provide a pre-emptive check on emissions from power backups as soon as air quality starts deteriorating. Hence, statement 3 is correct.

Stage I is triggered when the Air Quality Index (AQI) in Delhi is between 201 and 300. By moving this measure to Stage I, the CAQM aims to minimize carbon soot and particulate matter emissions from DG sets much earlier in the season.

The revised GRAP emphasizes that uninterrupted power supply is a basic requirement to prevent residents and businesses from switching to polluting alternatives like diesel-run generators.

Additional Information

Graded Response Action Plan (GRAP) Stages:

Stage I (Poor - AQI 201-300): Focuses on heavy fines for garbage burning, mechanical sweeping, and water sprinkling on roads. It now includes uninterrupted power supply.

Stage II (Very Poor - AQI 301-400): Includes increasing parking fees to discourage private vehicle use and providing additional bus and metro services.

Stage III (Severe - AQI 401-450): Imposes a strict ban on non-essential construction and demolition activities. It also restricts the operation of BS-III petrol and BS-IV diesel light motor vehicles (LMVs). Hence, statement 4 is incorrect as it occurs at Stage III/IV, not Stage I.

Stage IV (Severe Plus - AQI > 450): This is the most stringent phase where truck entry into Delhi is banned (except essentials), and the government may allow 50% strength in offices or shift schools to online mode. Hence, statements 1 and 2 are incorrect as they are Stage IV emergency measures.

Commission for Air Quality Management (CAQM):

It is a statutory body established under the Commission for Air Quality Management in National Capital Region and Adjoining Areas Act, 2021.

The commission is responsible for coordinating and overseeing actions to improve air quality in the NCR and adjoining states like Punjab, Haryana, Rajasthan, and Uttar Pradesh.

The CAQM has the power to issue directions and entertain complaints for the protection and improvement of air quality.

Important Points

Diesel Generator (DG) Set Regulations: Under the revised guidelines, even in Stage I, there is a push for converting DG sets to dual-fuel mode (Gas and Diesel) or retrofitting them with Emission Control Devices (ECDs).

Pre-emptive Action: Unlike earlier versions of GRAP which were reactive, the current framework allows the CAQM to invoke stages based on AQI forecasts provided by the Indian Institute of Tropical Meteorology (IITM) and the India Meteorological Department (IMD), typically 3 days in advance.

Geographical Scope: These measures are applicable across the entire National Capital Region, covering Delhi and specific

districts of Haryana, Uttar Pradesh, and Rajasthan.

Q100. Answer: (a) Sunderland

The correct answer is Sunderland.

Key Points

• Sunderland AFC emerged victorious in the 2025 EFL Championship playoff final, a feat that ensured their promotion to the Premier League for the 2025-26 season.

• The high-stakes match took place at Wembley Stadium in London, which serves as the traditional neutral venue for all English Football League (EFL) playoff finals.

• By winning this final, Sunderland secured the third and final promotion spot, joining the two clubs that achieved automatic promotion by finishing in the top two positions of the Championship table. Hence, the statement regarding their victory is correct.

• This victory marks a significant return to the top flight for the club, often referred to as the Black Cats, after a period of rebuilding in the lower divisions of English football.

• The Championship playoff final is famously dubbed the "richest game in football" because of the immense financial windfall guaranteed to the winner upon entering the Premier League.

Additional Information

• EFL Championship Promotion Rules:

• The Championship consists of 24 teams. The teams finishing 1st and 2nd at the end of the regular season earn automatic promotion.

• Teams finishing from 3rd to 6th place enter a knockout playoff system consisting of two-legged semi-finals and a single-match final.

• Sunderland AFC Details:

• The club was founded in 1879 and is based in the city of Sunderland in North East England.

• Their home ground is the Stadium of Light, which has a seating capacity of approximately 49,000 spectators, making it one of the largest club stadiums in England.

• Financial Implications:

• Winning the promotion final is estimated to be worth at least £140 million to £170 million over three years, driven primarily by global television rights and commercial sponsorships.

• Even if a promoted club is relegated after one season, they receive parachute payments from the Premier League to ease the financial transition back to the Championship.

• Other Contenders:

• Leeds United: A historic club from West Yorkshire that has a long-standing rivalry with Manchester United and has spent significant periods in the First Division.

• Southampton and Sheffield United: These clubs are frequently involved in the promotion and relegation battle, often characterized as "yo-yo clubs" due to their movement between the Premier League and the second tier.

Important Points

• 2024-25 Season Timeline: The EFL Championship regular season typically runs from August to May, with the playoff final concluding the domestic calendar in late May 2025.

• Broadcasting: The match is broadcast to over 200 countries, reflecting the global interest in the English football pyramid and the quest for Premier League status.

• Tactical Significance: The playoff final is known for its intense pressure, as a single 90-minute match (plus potential extra time and penalties) determines the sporting and financial future of the participating organizations for the following year.

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