RRB Group D Official Paper (Held On: 03 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 pair is a correct example, which shows number of Valency as 2?

(a) Ammonium and sulphate
(b) Sodium and sulphate
(c) Sulphate and sulphite
(d) Phosphate and nitride

Q2. Washing soda is obtained from baking soda by which of the following processes?

(a) Adding hydrochloric acid to baking soda
(b) Heating baking soda followed by crystallisation from water
(c) Mixing baking soda with lime water
(d) Evaporation of baking soda in sunlight

Q3. Which Rutherford's experiment led to the discovery of the atoimc nucleus?

(a) Beta-particle scattering
(b) Alpha-particle scattering
(c) Cathode Ray experiment
(d) Photoelectric effect

Q4. What is prevented when the fallopian tubes in females are blocked?

(a) Egg production
(b) Menstrual cycle
(c) Fertilisation
(d) Childbirth

Q5. What does the potential energy of an object depend on?

(a) Its temperature
(b) Its position or arrangement
(c) Its speed during motion
(d) Its colour and shape

Q6. In addition to plasma membrane, which of the following outer coverings is present in plant cells?

(a) Cell wall
(b) Centriole
(c) Nuclear membrane
(d) Cytoplasm

Q7. When an acid reacts with a metal carbonate, which gas is typically produced?

(a) Carbon dioxide gas
(b) Nitrogen gas
(c) Hydrogen gas

(d) Oxygen gas

Q8. An electric iron operating at 220 V consumes energy at a rate of 840 W when the heating is at its maximum. What is the resistance of the coil used in the iron?

(a) 47.6 Ω
(b) 57.6 Ω
(c) 55.6 Ω
(d) 50.6 Ω

Q9. A body of mass 2 kg is moving with a velocity of 10 m/s. A force of 4 N is applied for 5 s. The final velocity is:

(a) 25 m/s
(b) 35 m/s
(c) 20 m/s
(d) 15 m/s

Q10. Waste generated by developing human embryo is removed with the help of which of the following organs?

(a) Ovaries
(b) Scrotum
(c) Placenta
(d) Fallopian tube

Q11. What is the term for the process in which white light breaks up into different colours?

(a) Scattering
(b) Dispersion
(c) Refraction
(d) Reflection

Q12. If an object weighs 60 N when measured on the surface of the Earth, what would be its approximate weight when measured on the surface of the Moon?

(a) 10 N
(b) 360 N
(c) 60 N
(d) 15 N

Q13. When solutions of lead(II) nitrate and potassium iodide are mixed, the reaction leads to the formation of which of the following?

(a) A yellow precipitate of lead iodide is formed.
(b) A yellow precipitate of lead sulphate is formed.
(c) An orange precipitate of lead iodide is formed.
(d) An orange precipitate of lead iodate is formed.

Q14. Read the given statements with regards to importance of variation produced by sexual reproduction in plants and select the most appropriate option.

Statement A: Reproduction is linked to the stability of populations of species.

Statement B: Variation is thus not useful for the survival of species over time.

(a) Statement A is correct but statement B is incorrect
(b) Both Statement A and statement B is correct
(c) Both Statement A and statement B is incorrect
(d) Statement A is incorrect but statement B is correct

Q15. Which of the following statements is responsible for the atmospheric refraction?

(a) Scattering of light in atmosphere
(b) Absorption of light by air molecules
(c) Bending of light due to change in air density
(d) Reflection of light by atmosphere

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Q16. Approximately what percentage of energy is transferred from one trophic level to the next in an ecosystem?

(a) 1%
(b) 50%
(c) 10%
(d) 90%

Q17. Which of the following best describes Thomson's model of an atom?

(a) An atom has a positively charged nucleus and electrons outside.
(b) An atom is a sphere of positive charge with electrons embedded in it like seeds in a watermelon.
(c) Electrons revolve around the nucleus in fixed orbits.
(d) An atom is mostly empty space with a dense nucleus.

Q18. A sound wave has a frequency of 4 kHz and a wavelength of 15 cm. How much time will it take to cover a distance of 1.8 km ?

(a) 4 seconds
(b) 0.003 seconds
(c) 0.03 seconds
(d) 3 seconds

Q19. What is the type of bonding that usually exists in most of the carbon compounds?

(a) Hydrogen bonding
(b) Covalent bonding
(c) Coordinate bonding
(d) Ionic bonding

Q20. In eukaryotic cells, the smooth endoplasmic reticulum is mainly responsible for:

(a) Genetic information storage
(b) Protein synthesis
(c) Lipid synthesis and detoxification
(d) Sugar breakdown

Q21. A cell divides to form two identical daughter cells, each having the same chromosome number as the parent cell. What type of cell division is this called?

(a) Meiosis
(b) Cytokinesis
(c) Mitosis
(d) Budding

Q22. Which of the following is responsible for positive geotropism movement in plants?

(a) Chemical
(b) Light
(c) Water
(d) Gravity

Q23. The process used for removing gangue from the ore works on the basis of difference of their chemical or physical properties and is called _____ of ores.

(a) polishing
(b) weighing
(c) colouring
(d) enrichment

Q24. What is the direction of velocity in uniform circular motion?

(a) Along the tangent to the circle
(b) Towards the centre of the circle
(c) Away from the circle

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(d) Along the radius of the circle

Q25. Which of the following statements about magnetic field lines is correct?

(a) They always intersect
(b) They form closed loops inside and outside the magnet
(c) They originate only from the centre of the magnet
(d) They show the path of charged particles

MATHEMATICS

Q26. X people were given a contract for doing a piece of work in 34 days. 3 people did not turn up to work due to sickness, and the rest of the people completed the work in 35 days. What is the value of X?

(a) 103
(b) 104
(c) 115
(d) 105

Q27. Manoj got a new curtain at 50% discount. If Manoj did not get any discount, Manoj would have to pay Rs. 251 extra. So how much did Manoj pay for the curtain?

(a) Rs. 253
(b) Rs. 251
(c) Rs. 252
(d) Rs. 250

Q28. The lengths of the two diagonals of a rhombus are 10 cm and 24 cm. Find the length of its perimeter (in cm).

(a) 52
(b) 34
(c) 26
(d) 13

Q29. One pipe can fill a tank in 9 minutes while another pipe can empty the completely filled tank in 90 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) 10
(b) 5
(c) 11
(d) 6

Q30. Simplify: $(3x + 7)^2 - (3x - 7)^2$

(a) 48x
(b) -84x
(c) 84x
(d) -48x

Q31. An Uber auto covers a distance of 639 km in 71 hours. What is its speed in km/hr?

(a) 19
(b) 9
(c) 4
(d) 13

Q32. Provisions meant for 100 men for 13 weeks are shared when 30 more men join them. For how many weeks will the provisions now last?

(a) 8
(b) 10
(c) 14
(d) 12

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Q33. 1/20 is what percentage of 10/90?

(a) 90%
(b) 45%
(c) 55%
(d) 60%

Q34. The amount on a sum of Rs. 2,600 at 20% per annum compound interest, compounded annually, in 2 years will be:

(a) Rs. 3,744
(b) Rs. 2,950
(c) Rs. 3,441
(d) Rs. 4,363

Q35. The length, breadth and height of a cuboid are in the ratio 5 : 3 : 2. If the total surface area of the cuboid is 992 m^2, find its volume.

(a) 1,980 m3
(b) 2,040 m3
(c) 1,920 m^3
(d) 2,070 m3

Q36. A number is split into two parts so that one part exceeds the other by 10. If the ratio of the two parts is 7 : 5, write the equation representing this situation by assuming the smaller part to be x.

(a) 35(x + 10) = x
(b) 5(10x + 1) = 7x
(c) 7(x + 10) = 5x
(d) 5(x + 10) = 7x

Q37. If the mean proportional of X and 250 is 50, then find the value of X.

(a) 10
(b) 13
(c) 12
(d) 8

Q38. Eight years ago, A was thrice as old as B. Eight years hence, A will be twice as old as B. Find A's present age.

(a) 56 years
(b) 64 years
(c) 60 years
(d) 52 years

Q39. The angle of elevation of the top of a tower from a point 63 m distance away from its foot is 30°. Find the height (in m) of the tower.

(a) 21/√3
(b) 18/√3
(c) 21√3
(d) 18√3

Q40. The average age of 36 students of a class is 12 years. If the age of the teacher is also included, the average age of the whole group becomes 13 years. The age (in years) of the teacher is:

(a) 52
(b) 50
(c) 55
(d) 49

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Q41. The product of two numbers is 63 and their difference is 7. The sum of squares of the two numbers is

(a) 220
(b) 175
(c) 112
(d) 130

Q42. Find the value of $((0.026)^3 - (0.02)^3)/((0.026)^2 + 0.00052 + (0.02)^2)$.

(a) 0.06
(b) 0.6
(c) 0.006
(d) 0.0006

Q43. The marked price of a chair is Rs. 2,700, which is 35% above the cost price. It is sold at a discount of 20% on the marked price. Find the profit percentage.

(a) 8%
(b) 10%
(c) 7%
(d) 9%

Q44. The average of seven consecutive odd numbers (in increasing order) is 51. What is the smallest odd number among them?

(a) 43
(b) 45
(c) 41
(d) 47

Q45. The cost of a washing machine is 50% less than the cost of a TV. If the cost of the washing machine increases by 62% and that of the TV decreases by 33%, then what is the percentage change in the total cost of 6 washing machines and 2 TVs?

(a) Decrease by 27%
(b) Increase by 19%
(c) Decrease by 31%
(d) Increase by 24%

Q46. Amit sells two articles for Rs. 360 each. On one, he gains 20%, and on the other, he loses 10%. Find the gain or loss percent in the entire transaction. [Answer correct to two places after decimal.]

(a) 2.86% profit
(b) 4.56% loss
(c) 5.56% loss
(d) 5.56% profit

Q47. Walking at 3/7 of his normal speed, Abhijeet is 24 minutes late in reaching his office. The usual time taken by him to cover the distance between his home and his office is:

(a) 28 minutes
(b) 26 minutes
(c) 18 minutes
(d) 10 minutes

Q48. If 20% of a number is added to 84, then the result is the same number. 60% of the same number is:

(a) 83
(b) 73
(c) 93
(d) 63

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Q49. The sides of a triangle are 30 cm, 63 cm, and 51 cm. What is the length of its altitude corresponding to the side with a length of 63 cm?

(a) 48 cm
(b) 57 cm
(c) 3 cm
(d) 24 cm

Q50. Aman and Yogita together invested Rs. 52,200 in a business. At the end of the year, out of a total profit of Rs. 5,800, Aman's share was Rs. 1,700. What was the investment of Aman?

(a) Rs. 13,695
(b) Rs. 16,620
(c) Rs. 15,300
(d) Rs. 15,490

GENERAL INTELLIGENCE & REASONING

Q51. In a certain code language,

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

'A – B' means 'A is the brother of B'

'A × B' means 'A is the wife of B'

'A ÷ B' means 'A is the father of B'

Based on the above, how is D related to J if 'D – F ÷ G × H + J'?

(a) Son's wife's father's brother
(b) Son's wife's mother's brother
(c) Son's wife's mother's father
(d) Son's wife's father's father

Q52. If 'A' stands for '÷', 'B' stands for '×', 'C' stands for '+' and 'D' stands for '−', then what will come in place of the question mark (?) in the following equation?

17 B 17 C 324 A 9 D 22 = ?

(a) 310
(b) 303
(c) 318
(d) 307

Q53. What should come in place of the question mark (?) in the given series based on the English alphabetical order?

UMQ TLP SKO RJN ?

(a) QIN
(b) QJM
(c) QIM
(d) QJN

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

510 509 506 501 494 ?

(a) 487
(b) 486
(c) 485
(d) 484

Q55. Seven boxes, D, E, F, U, V, W and X, are kept one over the other but not necessarily in the same order. Only two boxes are kept below W. Only two boxes are kept between W and U. Only one box is kept between U and E. X is kept immediately above V. F is kept at some place below D. How many boxes are kept between D and X?

(a) Four
(b) Three

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(c) One
(d) Two

Q56. 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 fans are lights. Some lights are heaters. Some heaters are geysers.

Conclusion (I): Some fans are heaters.

Conclusion (II): Some lights are geysers.

(a) Both Conclusion I or II follow.
(b) Only Conclusion I follows.
(c) Neither Conclusion I or II follows.
(d) Only Conclusion II follows.

Q57. Seven people, A, B, C, D, E, F and G, are sitting in a row, facing north. No one sits to the right of C. Only three people sit between C and D. Only two people sit between D and G. A sits third to the left of F. B sits to the immediate right of F. How many people sit to the right of B?

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

Q58. Which of the given letter-number clusters will replace the question mark (?) in the following series to make it logically complete?

IIM 2 JKL −11 KMK −24 ? MQI −50

(a) KLO −33
(b) LLP −22
(c) RTD −21
(d) LOJ −37

Q59. Based on the English alphabetical order, three of the following four letter-cluster pairs are alike in a certain way and thus form a group. Which letter-cluster pair DOES NOT belong to that group?

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

(a) PR - ML
(b) RT - OQ
(c) JL - GI
(d) NP - KM

Q60. In a certain code language, ‘drinking is dangerous’ is coded as ‘cd pk os’, ‘avoid dangerous habit’ is coded as ‘os mp ls’, and ‘please avoid drinking’ is coded as ‘rk pk mp’. How is ‘dangerous’ coded in the given language?

(a) mp
(b) ls
(c) os
(d) rk

Q61. If ‘A’ stands for ‘÷’, ‘B’ stands for ‘x’, ‘C’ stands for ‘+’ and ‘D’ stands for ‘-‘, what will be come in place of question mark ‘?’ in the following equation?

13 B 32 C 130 A 26 D 41 = ?

(a) 369
(b) 380
(c) 377
(d) 385

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Q62. Mr. Z starts from Point A and drives 12 km towards the South. He then takes a right turn, drives 21 km, then turns right and drives 14 km. He then takes a right turn and drives 23 km. He takes a final right turn, drives 2 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) 5 km to the east
(b) 2 km to the west
(c) 4 km to the south
(d) 3 km to the east

Q63. FAEG is related to MHLN in a certain way based on the English alphabetical order. In the same way, IDHJ is related to PKOQ. To which of the given options is LGKM related, following the same logic?

(a) NSTR
(b) SNRT
(c) SNTR
(d) NSRT

Q64. 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) SOK
(b) TPL
(c) OKG
(d) PMH

Q65. Refer to the following number and symbol series and answer the question that follows. Counting to be done from left to right only. All numbers are single-digit numbers.

(Left) 6 7 8 9 & 5 £ & $ £ $ 1 * * # * € 8 % 8 © 7 (Right)

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

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

Q66. What should come in place of the question mark (?) in the given series?

313 304 295 286 277 ?

(a) 267
(b) 268
(c) 273
(d) 271

Q67. 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.)

(33, 495, 15)

(27, 648, 24)

(a) (38, 41, 1)
(b) (8, 179, 22)
(c) (25, 575, 23)
(d) (30, 573, 19)

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Q68. In a certain code language, ‘OMER’ is coded as ‘1834’ and ‘DEMO’ is coded as ‘5148’. What is the code for ‘D’ in the given code language?

(a) 1
(b) 4
(c) 8
(d) 5

Q69. IN 5 is related to KJ −2 in a certain way. In the same way, GL 9 is related to IH 2. To which of the given options is RW 11 related, following the same logic?

(a) HY 4
(b) TS 4
(c) YT 6
(d) MK 7

Q70. 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) © $ £ 7 3 @ £ 7 8 6 8 % 6 © 3 4 & € 9 @ 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) 1
(b) 4
(c) 3
(d) 6

Q71. What should come in place of the question mark (?) in the given series?

1021 1023 1027 1033 1041 ?

(a) 1053
(b) 1055
(c) 1049
(d) 1051

Q72. Seven boxes B, C, D, I, J, K and L are kept one over the other but not necessarily in the same order. Only four boxes are kept above L. Only one box is kept above J. Only one box is kept between J and C. B is kept immediately above D. K is kept at some place below I. How many boxes are kept between I and B?

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

Q73. Refer to the number series given below and answer the question that follows. Counting to be done from left to right only.

(NOTE: All numbers are single-digit numbers only.)

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

Q74. If ‘A’ stands for ‘÷’, ‘B’ stands for ‘×’, ‘C’ stands for ‘+’ and ‘D’ stands for ‘−’, then what will come in place of the question mark (?) in the following equation?

50 A 10 C 2 B 7 D 6 = ?

(a) 11

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(b) 12
(c) 14
(d) 13

Q75. Aruna starts from Point A and drives 11 km towards the north. She then takes a right turn, drives 10 km, turns right and drives 21 km. She then takes a right turn and drives 5 km. She takes a final right turn, drives 10 km and stops at Point P. How far (shortest distance) and towards which direction should she drive in order to reach Point A again? (All turns are 90 degrees turns only unless specified.)

(a) 4 km towards the south
(b) 5 km towards the south
(c) 6 km towards the north
(d) 5 km towards the west

Q76. Select the triad that follows the same pattern as the one followed by the two triads given below. Both triads follow the same pattern.

JC-LE-NP

MF-OH-QS

(a) PI-RK-TV
(b) OI-RK-TU
(c) OI-RL-TU
(d) PI-RK-TU

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

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

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

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

Q78. F, G, H, I, M, N and O are sitting around a circular table facing the centre of the table. Only two people sit between I and O when counted from the left of O. G sits third to the left of N. H sits to the immediate right of N. H sits second to the left of I. F is not an immediate neighbour of G. Who sits third to the right of M?

(a) F
(b) H
(c) N
(d) O

Q79. A, B, C, R, S, T and U are sitting around a circular table facing the centre of the table. Only two people sit between U and S when counted from the right of U. Only three people sit between R and C when counted from the right of C. S sits to the immediate right of C. T sits to the immediate right of A. Who sits fourth to the right of B?

(a) S
(b) A
(c) C
(d) T

Q80. 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 pencils are crayons.

Some crayons are batteries.

Conclusions:

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(I): Some pencils are batteries.

(II): Some crayons are pencils.

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

GENERAL AWARENESS AND CURRENT AFFAIRS

Q81. On 12 June 2025, which bank of India took a progressive step to streamline the Know Your Customer (KYC) updating process by allowing video-based identification and empowering Business Correspondents to handle KYC updates?

(a) Bank of India
(b) State Bank of India
(c) Indian Bank
(d) Reserve Bank of India

Q82. In July 2025, the Kerala Health Department stepped up vigil against which zoonotic disease after a few cases were detected in its two districts?

(a) Nipah
(b) Filariasis
(c) Malaria
(d) Tuberculosis

Q83. Praveen Kumar, awarded the Khel Ratna, in January 2025, is associated with which discipline?

(a) Shooting
(b) Archery
(c) Para-Athletics
(d) Boxing

Q84. Which cinema was India's official Oscar entry but did NOT get nominated, yet swept 10 IIFA awards in March 2025?

(a) Ram Setu
(b) The Kerala Story
(c) Darlings
(d) Laapataa Ladies

Q85. Which among the following authorities invoked Stage-I of the Graded Response Action Plan (GRAP) in May 2025 due to poor air quality in Delhi NCR?

(a) Ministry of Health and Family Welfare (MoHFW)
(b) Delhi Pollution Control Committee (DPCC), National Capital Territory of Delhi
(c) Central Pollution Control Board (CPCB)
(d) Commission for Air Quality Management in National Capital Region and Adjoining Areas (CAQM)

Q86. How many critical highway segments are outlined in the report on India’s Priority Corridors for Zero-Emission Trucking for the adoption of zero-emission trucks?

(a) Eight
(b) Ten
(c) Twelve
(d) Five

Q87. What is the main purpose of the e-Jagriti platform, launched by the Department of Consumer Affairs, Ministry of Consumer Affairs, Food and Public Distribution, Government of India on 1 January 2025?

(a) To provide a single interface for consumer grievance redressal
(b) To expand India’s space exploration and satellite launches
(c) To manage real estate and government accommodation services

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(d) To promote digital payments under the Digital India programme

Q88. The earlier Bilateral Investment Treaty (BIT) between India and Kyrgyzstan, which was replaced in 2025, was originally enforced in which year?

(a) 2000
(b) 2010
(c) 2021
(d) 2019

Q89. The deforestation drive in Kancha Gachibowli involved clearing land near which major educational institution in April 2025?

(a) Osmania University
(b) Indian Institute of Technology, Hyderabad
(c) National Institute of Technology, Warangal
(d) Central University of Hyderabad

Q90. In which of the following cities did the traffic police create awareness on noise pollution for motorists at traffic signals in July 2025?

(a) Lucknow
(b) Chennai
(c) Jaipur
(d) Warangal

Q91. On June 14, 2025, in which of the following cities of India did Kamlesh Paswan inaugurate Garuda Aerospace's new Agri-Drone Indigenization Facility?

(a) Vijayawada
(b) Pune
(c) Chennai
(d) Hubbali

Q92. In July 2025, the Ministry of Rural Development entered into an important partnership with the Life Insurance Corporation of India (LIC) to realise the Government of India's 'Insurance for All by _____'.

(a) 2045
(b) 2035
(c) 2047
(d) 2040

Q93. Who arrived in Varanasi to chair the 25^(th) Central Zonal Council meet in June 2025?

(a) Rajnath Singh
(b) Yogi Adityanath
(c) Amit Shah
(d) Narendra Modi

Q94. The Indian Navy along with the navy of which other country held a joint PASSEX exercise near Mumbai on 10 July 2025, in the Arabian Sea?

(a) Greece
(b) Malaysia
(c) Japan
(d) Indonesia

Q95. In 2025, which schemes provide retired athletes career transition support, financial aid, and medical benefits?

(a) RESET and Pandit Deendayal Fund
(b) Khelo India and PYKKA
(c) National Awards and TOPS
(d) NSFs and SAI

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Q96. Which English fast bowler was awarded a knighthood in April 2025 after retiring with a record 704 Test wickets, making him England's all-time leading wicket-taker in Test cricket?

(a) James Anderson
(b) Andrew Flintoff
(c) Stuart Broad
(d) Darren Gough

Q97. Which of the following themes was observed for World Health Day 2025 on April 7?

(a) Our Planet, Our Health
(b) Healthy beginnings, hopeful futures
(c) Equity in Healthcare
(d) Health for All

Q98. Which of the following cricketers clinched the record for the fastest century by an Indian woman cricketer in ODIs, as of January 2025?

(a) Pratika Rawal
(b) Smriti Mandhana
(c) Deepti Sharma
(d) Harmanpreet Kaur

Q99. As per the Sustainable Development Report (SDR)-2025 published by the UN Sustainable Development Solutions Network (SDSN), what is the rank of India among 193 UN member countries?

(a) 89
(b) 99
(c) 109
(d) 79

Q100. Which of the following was the 17^(th) flight of India's Geosynchronous Satellite Launch Vehicle (GSLV), launched in January 2025?

(a) GSLV-F15
(b) GSLV-F14
(c) GSLV-F16
(d) GSLV-F13

ANSWER KEY

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

SOLUTIONS

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Q1. Answer: (c) Sulphate and sulphite

The correct answer is Sulphate and Sulphite.

Key Points

• Valency: Valency refers to the combining capacity of an element or ion. It shows how many bonds an atom can form with other atoms.

• Sulphate (SO_4^{2-}): The sulphate ion has a valency of 2 because it can accept two electrons to balance the charge, making it a divalent anion.

• Sulphite (SO_3^{2-}): Similarly, the sulphite ion also has a valency of 2, as it can accept two electrons to balance its charge, making it a divalent anion.

• Ammonium (NH_4^+): Ammonium is a monovalent cation, as it has a single positive charge. Hence, it does not have a valency of 2. This statement is incorrect.

• Sodium (Na^+): Sodium is also a monovalent cation due to its single positive charge. It does not exhibit a valency of 2. This statement is incorrect.

• Phosphate (PO_4^{3-}): Phosphate has a valency of 3 because it can accept three electrons to neutralize its charge. Hence, it is not a divalent ion. This statement is incorrect.

• Nitride (N^{3-}): Nitride has a valency of 3 due to its ability to accept three electrons, making it trivalent. Thus, it is not a divalent ion. This statement is incorrect.

• Hence, the correct pair is Sulphate and Sulphite, as both exhibit a valency of 2.

Additional Information

• Valency and Chemical Bonding:

• Valency is determined by the number of electrons an atom can lose, gain, or share to achieve a stable electronic configuration.

• Elements with a valency of 2 often form ionic or covalent bonds by donating, accepting, or sharing two electrons.

• Examples of divalent ions include Calcium (Ca^{2+}), Magnesium (Mg^{2+}), Sulphate (SO_4^{2-}), and Sulphite (SO_3^{2-}).

• Sulphate vs Sulphite:

• Sulphate (SO_4^{2-}): Sulphate consists of one sulphur atom surrounded by four oxygen atoms. It is commonly found in compounds like Gypsum ($CaSO_4 \cdot 2H_2O$) and used in industries like cement production.

• Sulphite (SO_3^{2-}): Sulphite consists of one sulphur atom surrounded by three oxygen atoms. It is used as a preservative in food and beverages to prevent oxidation.

• Both ions are divalent, meaning they can form two bonds in chemical reactions.

• Examples of Divalent Ions:

• Divalent ions are ions with a charge of ±2. Examples include Calcium (Ca^{2+}), Magnesium (Mg^{2+}), Sulphate (SO_4^{2-}), and Sulphite (SO_3^{2-}).

• These ions play crucial roles in various chemical reactions and biological processes, such as bone formation (Calcium) and enzyme activation (Magnesium).

• Trivalent and Monovalent Ions:

• Trivalent ions: Examples include Phosphate (PO_4^{3-}) and Nitride (N^{3-}). These ions can form three bonds in chemical reactions.

• Monovalent ions: Examples include Sodium (Na^+) and Ammonium (NH_4^+). These ions can form one bond due to their single charge.

• Applications of Sulphate and Sulphite:

• Sulphate: Used in industries for making fertilizers, detergents, and plaster of Paris.

• Sulphite: Commonly used as a food preservative to prevent spoilage and oxidation.

Important Points

• Understanding Valency:

• Valency is a fundamental concept in chemistry that explains the chemical behavior of elements and ions.

• It is essential for predicting the formulas of compounds and understanding chemical reactions.

• Significance in Industries:

• Divalent ions like sulphate and sulphite have significant industrial applications due to their chemical properties.

• For instance, sulphate is used in fertilizer production, while sulphite acts as a preservative in food manufacturing.

Q2. Answer: (b) Heating baking soda followed by crystallisation from water

The correct answer is Heating baking soda followed by crystallisation from water.

Key Points

• Washing soda (sodium carbonate, $Na_2CO_3 \cdot 10H_2O$) is derived from baking soda (sodium bicarbonate, $NaHCO_3$) through a process involving heating followed by crystallisation.

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• When baking soda is heated, it decomposes to form sodium carbonate (Na_2CO_3), water (H_2O), and carbon dioxide (CO_2). The reaction is as follows:

$2NaHCO_3 \rightarrow Na_2CO_3 + H_2O + CO_2$

• The sodium carbonate obtained is then dissolved in water, and upon cooling, it crystallises to form washing soda ($Na_2CO_3 \cdot 10H_2O$).

• This transformation is an industrial process used to produce washing soda, which is widely used in households and industries for cleaning, removing stains, and softening water.

• Hence, the correct answer is Heating baking soda followed by crystallisation from water.

Additional Information

• Washing Soda:

• Chemical formula: $Na_2CO_3 \cdot 10H_2O$.

• It is used as a cleaning agent, particularly in laundry detergents, to remove grease and stains.

• It is also employed in the manufacture of glass, paper, and textiles and for softening hard water by precipitating calcium and magnesium ions.

• Washing soda has a strong alkaline nature, which makes it effective in cleaning and neutralising acids.

• Baking Soda:

• Chemical formula: $NaHCO_3$.

• It is a mild base used in cooking as a leavening agent, where it reacts with acids to produce carbon dioxide that helps dough rise.

• Baking soda is also used in medicinal applications to relieve heartburn and acid indigestion.

• Its antimicrobial properties make it useful for cleaning and deodorising.

• Industrial Process for Washing Soda Production:

• The production of washing soda is part of the Solvay process, an industrial method for synthesising sodium carbonate.

• The Solvay process involves ammonia, carbon dioxide, and brine (sodium chloride solution) to produce sodium carbonate.

• The process is energy-efficient and widely used globally for large-scale production of washing soda.

• Applications of Washing Soda:

• Used in water treatment plants to soften hard water.

• Serves as a cleaning agent in households and industries.

• Used in laboratories for pH adjustment and as a buffering agent.

• Essential in manufacturing processes for glass and soap.

Important Points

• Heating Baking Soda:

• When baking soda is heated, it decomposes to produce sodium carbonate, water, and carbon dioxide gas.

• This reaction is critical in the conversion of baking soda to washing soda.

• Crystallisation Process:

• Crystallisation involves cooling a saturated solution of sodium carbonate, leading to the formation of washing soda crystals.

• The presence of water molecules in the crystalline structure gives washing soda its hydrated form ($Na_2CO_3 \cdot 10H_2O$).

Q3. Answer: (b) Alpha-particle scattering

The correct answer is Alpha-particle scattering.

Key Points

• Rutherford's alpha-particle scattering experiment was a groundbreaking experiment in physics that led to the discovery of the atomic nucleus.

• In the experiment, a thin gold foil was bombarded with alpha particles (positively charged particles emitted from radioactive materials).

• The majority of alpha particles passed through the foil without deflection, indicating that most of the atom is empty space.

• Some alpha particles were deflected at small angles, while a few were deflected at large angles or even bounced back, suggesting the presence of a dense, positively charged center within the atom.

• This dense center was later termed the nucleus, which contains most of the atom's mass and is positively charged due to protons.

• This discovery overturned the earlier "plum pudding model" of the atom proposed by J.J. Thomson, leading to the establishment of the nuclear model of the atom.

Additional Information

• Alpha Particles:

• Alpha particles are helium nuclei consisting of two protons and two neutrons.
• They are positively charged and were used in Rutherford's experiment to probe the structure of the atom.
• Plum Pudding Model:
• Proposed by J.J. Thomson, this model suggested that the atom is a sphere of positive charge with negatively charged electrons embedded within it.
• Rutherford's experiment disproved this model by demonstrating the existence of a dense, central nucleus.
• Gold Foil Experiment Setup:
• A thin sheet of gold foil (just a few atoms thick) was used as the target for alpha particles.
• A fluorescent screen surrounded the foil to detect the scattered alpha particles.
• The deflection patterns of the alpha particles were recorded to infer the atomic structure.
• Significance of the Experiment:
• Rutherford's findings laid the foundation for the modern atomic model and further studies on atomic structure.
• The concept of a nucleus eventually led to the discovery of protons (by Rutherford) and neutrons (by James Chadwick).
• Important Points:
• The nucleus is extremely small compared to the overall size of the atom, with a radius about 1/10,000th of the atomic radius.
• Rutherford's model was later refined by Niels Bohr, who introduced the concept of electron orbits.
• This experiment marked a significant milestone in understanding atomic theory and paved the way for quantum mechanics.

Q4. Answer: (c) Fertilisation

The correct answer is Fertilisation.

Key Points

• Fertilisation is the process where the male sperm cell fuses with the female egg cell to form a zygote, which develops into an embryo.
• The fallopian tubes are the site where fertilisation typically occurs. The sperm travels through the female reproductive tract to meet the egg in the fallopian tube.
• If the fallopian tubes are blocked, the sperm and egg cannot meet, thereby preventing fertilisation. This makes natural conception impossible in such cases.
• Despite the blockage of fallopian tubes, egg production (ovulation) and the menstrual cycle continue as they are regulated by hormones from the ovaries and pituitary gland.
• Childbirth is a later stage of reproduction and only occurs if fertilisation and subsequent implantation of the embryo happen successfully. Blocked fallopian tubes prevent these preceding steps, and thus childbirth cannot take place naturally.

Additional Information

• Fallopian Tubes:
• Fallopian tubes are a pair of thin tubes that connect the ovaries to the uterus.
• They play a crucial role in transporting the egg from the ovary to the uterus and serve as the site of fertilisation.
• Blockages can occur due to infections, pelvic inflammatory disease (PID), endometriosis, or scarring from previous surgeries.
• Fertilisation:
• Fertilisation occurs when a sperm cell penetrates and fuses with an egg cell in the fallopian tube, forming a zygote.
• This process is essential for sexual reproduction and the formation of new life.
• If fertilisation is blocked, assisted reproductive technologies like IVF (In Vitro Fertilisation) may be used to achieve pregnancy.
• Menstrual Cycle:
• The menstrual cycle is regulated by hormones such as estrogen and progesterone.
• It involves ovulation (release of an egg from the ovary) and preparation of the uterine lining for possible implantation of an embryo.
• Even if the fallopian tubes are blocked, the menstrual cycle continues as normal.
• Assisted Reproductive Technologies (ART):
• ART techniques like IVF are used when natural fertilisation is not possible due to blocked fallopian tubes or other infertility issues.
• In IVF, eggs are retrieved from the ovaries, fertilised with sperm in a lab, and the resulting embryos are implanted into the uterus.

Important Points

• Symptoms of Blocked Fallopian Tubes:
• Blocked tubes often show no symptoms but may sometimes cause abdominal pain or infertility.
• Hysterosalpingography (HSG) is a diagnostic test used to identify blockages in the fallopian tubes.

• Prevention and Treatment:

• Prevention includes managing infections early, practicing safe sex, and avoiding multiple pelvic surgeries.

• Treatments include surgical removal of blockages, tubal ligation reversal, or opting for ART like IVF.

Q5. Answer: (b) Its position or arrangement

The correct answer is Its position or arrangement.

Key Points

• Potential energy is the energy an object possesses due to its position, arrangement, or configuration relative to other objects or forces.

• The most common examples of potential energy include gravitational potential energy (due to height above a reference point) and elastic potential energy (stored in stretched or compressed objects like springs).

• It is given by the equation PE = mgh for gravitational potential energy, where m is mass, g is the acceleration due to gravity, and h is the height above a reference level.

• The energy stored in chemical bonds, such as in molecules, is another form of potential energy, termed chemical potential energy.

• Potential energy does not depend on temperature, speed, color, or shape, as these factors are unrelated to the object's position or arrangement in a force field.

Additional Information

• Gravitational Potential Energy:

• This type of potential energy arises due to an object's position in a gravitational field.

• An object at a greater height relative to a reference point has higher gravitational potential energy.

• For example, water stored in a dam at a higher elevation possesses gravitational potential energy, which can be converted to kinetic energy as it flows downward to generate electricity.

• Elastic Potential Energy:

• Stored in objects that can be stretched or compressed, such as springs, rubber bands, or trampolines.

• It depends on the deformation of the object and is given by the formula PE = 1/2 kx^2, where k is the spring constant, and x is the displacement from the equilibrium position.

• Example: A compressed spring or a bow ready to shoot an arrow.

• Chemical Potential Energy:

• This form of potential energy is stored in the bonds between atoms and molecules.

• It is released during chemical reactions, such as combustion or digestion.

• Examples include energy stored in fuels like coal, gasoline, and food.

• Characteristics of Other Options:

• Temperature: Temperature is a measure of the average kinetic energy of particles, not related to potential energy.

• Speed: Speed contributes to kinetic energy, not potential energy.

• Color and Shape: These attributes do not affect an object's potential energy as they are unrelated to its position or arrangement in a force field.

Important Points

• Conservation of Energy: Energy can neither be created nor destroyed but can be transformed from one form to another, such as from potential energy to kinetic energy.

• Energy Storage in Nature: Natural phenomena like waterfalls, stretched tectonic plates, and chemical reactions are examples of potential energy storage and transformation.

• Applications: Potential energy is utilized in various fields such as hydroelectric power generation, mechanical systems (springs), and chemical industries.

Q6. Answer: (a) Cell wall

The correct answer is Cell wall.

Key Points

• Plant cells possess a cell wall in addition to the plasma membrane, which is a rigid and protective layer made of cellulose, hemicellulose, and lignin. This structure is absent in animal cells.

• The cell wall provides structural support, protection, and determines the shape of the plant cell. It also prevents excessive water intake, thereby maintaining osmotic balance.

• Unlike other options provided in the question, the cell wall is an exclusive feature of plant cells, fungi, and some prokaryotes, making it a distinctive characteristic.

• Other organelles such as centriole (associated with cell division), nuclear membrane (surrounding the nucleus), and cytoplasm

(gel-like substance inside the cell) are common in both plant and animal cells, but they do not serve as outer coverings.

• The cell wall acts as the first line of defense against mechanical stress, pathogens, and environmental factors, highlighting its critical role in plant cell functionality.

Additional Information

• Structure and Composition of Cell Wall:

• The primary cell wall is mainly composed of cellulose, a polysaccharide that provides tensile strength.

• The secondary cell wall, present in mature plant cells, contains additional layers of lignin, which adds rigidity.

• Some plant cells also have a middle lamella, primarily made of pectin, which cements adjacent cells together.

• Functions of the Cell Wall:

• It provides mechanical support to the plant, allowing it to grow upright.

• The cell wall acts as a barrier against pathogens and environmental stress like drought and mechanical injury.

• It regulates the movement of water and nutrients through plasmodesmata, which are small channels in the cell wall.

• Comparison with Animal Cells:

• Animal cells lack a cell wall and instead have a flexible plasma membrane that provides limited protection and structural support.

• The absence of a cell wall in animal cells makes them more susceptible to shape changes and mechanical stress.

• Examples of Organisms with Cell Walls:

• In addition to plants, organisms like fungi have cell walls made of chitin, while bacteria have cell walls composed of peptidoglycan.

• Algae also possess cell walls, which are often made of cellulose, similar to plants.

• Key Features of Other Options:

• Centriole: Found only in animal cells, it plays a role in cell division by forming spindle fibers.

• Nuclear Membrane: A double-layered membrane that encases the nucleus and regulates the exchange of materials between the nucleus and cytoplasm.

• Cytoplasm: The gel-like substance within the plasma membrane that houses organelles and facilitates biochemical reactions.

Important Points

• Historical Discovery: The cell wall was first observed by Robert Hooke in 1665 while examining cork under a microscope.

• Cell Wall vs. Plasma Membrane: The plasma membrane is a flexible lipid bilayer, whereas the cell wall is a rigid structure.

• Industrial Applications: Cellulose extracted from plant cell walls is used in the production of paper, textiles, and biodegradable products.

• Role in Plant Growth: The flexibility of the primary cell wall allows for cell expansion during growth, while the secondary cell wall provides strength to mature cells.

Q7. Answer: (a) Carbon dioxide gas

The correct answer is Carbon dioxide gas.

Key Points

• When an acid reacts with a metal carbonate, the typical chemical reaction leads to the formation of a salt, water, and carbon dioxide gas.

• The general chemical equation for this reaction is: Metal carbonate + Acid → Salt + Water + Carbon dioxide (CO_2).

• For example: When hydrochloric acid (HCl) reacts with calcium carbonate ($CaCO_3$), the products are calcium chloride ($CaCl_2$), water (H_2O), and carbon dioxide (CO_2).

• The effervescence or fizz observed during this reaction is due to the release of carbon dioxide gas, which can be confirmed by passing the gas through limewater. The limewater turns milky, indicating the presence of CO_2.

• This reaction is a characteristic property of acids reacting with carbonates and can be used to identify the presence of a carbonate compound in a sample.

Additional Information

• Characteristics of Carbon Dioxide Gas:

• Colorless and odorless: Carbon dioxide is a colorless, odorless gas at room temperature.

• Solubility in water: CO_2 is moderately soluble in water, forming carbonic acid (H_2CO_3), which is responsible for the fizz in carbonated drinks.

• Used in fire extinguishers: Due to its non-flammable nature, CO_2 is commonly used in fire extinguishers to suppress fires.

• Confirmation test: When passed through limewater ($Ca(OH)_2$), it turns milky due to the formation of calcium carbonate ($CaCO_3$).

• Properties of Metal Carbonates:

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

• These compounds are ionic in nature and are generally insoluble in water, except for alkali metal carbonates.

• They are used in various applications, such as antacids (neutralizing stomach acid) and industrial processes (glassmaking, cement production).

• Examples of Reactions with Acids:

• Calcium carbonate and hydrochloric acid: $CaCO_3 + 2HCl \rightarrow CaCl_2 + H_2O + CO_2$

• Sodium carbonate and sulfuric acid: $Na_2CO_3 + H_2SO_4 \rightarrow Na_2SO_4 + H_2O + CO_2$

• Applications of This Reaction:

• This reaction is used in various fields, such as the production of carbon dioxide for use in beverages and industrial processes.

• It is also used in schools and laboratories to demonstrate acid-carbonate reactions and test for the presence of carbon dioxide gas.

Important Points

• Verification of Carbon Dioxide Gas: The milky appearance of limewater is due to the formation of calcium carbonate, which is insoluble in water.

• Environmental Impact: Carbon dioxide is a greenhouse gas and contributes to global warming. Its concentration in the atmosphere is monitored to address climate change.

• Industrial Importance: The reaction is widely used in industries for producing carbon dioxide gas, which is essential for processes such as carbonation in beverages.

• Significance in Nature: This type of reaction plays a role in the natural carbon cycle, where carbonates react with acids in soil and water to release CO_2.

Q8. Answer: (b) 57.6 Ω

The correct answer is Option 2: 57.6 Ω.

Key Points

• The electric iron operates at a voltage of 220 V and consumes power at a rate of 840 W when the heating is at maximum.

• To calculate the resistance of the coil, we use the formula derived from Ohm's Law and Power formula: $P = V^2/R$, where P is the power, V is the voltage, and R is the resistance.

• Rearranging the formula to find resistance: $R = V^2 / P$.

• Substituting the given values into the formula:

• V = 220 V

• P = 840 W

• $R = (220 \times 220) / 840 = 48400 / 840 \approx 57.6\ \Omega$

• Therefore, the resistance of the coil used in the electric iron is 57.6 Ω.

Additional Information

• Ohm's Law:

• Ohm's Law states that the current through a conductor between two points is directly proportional to the voltage across the two points and inversely proportional to the resistance of the conductor.

• Formula: V = IR, where V is the voltage, I is the current, and R is the resistance.

• Power Formula:

• Power in an electrical circuit can be expressed as P = VI, where P is power, V is voltage, and I is current.

• Using Ohm's Law, power can also be expressed as:

• $P = V^2/R$ (if voltage and resistance are known).

• $P = I^2R$ (if current and resistance are known).

• Electric Iron:

• An electric iron is a household appliance used to press and remove wrinkles from clothes.

• It contains a heating coil that converts electrical energy into heat energy through the process of Joule heating.

• Practical Applications:

• Knowing the resistance of the heating coil is essential for ensuring the safe and efficient operation of electrical appliances.

• Electric irons are typically designed to operate at specific voltage and power ratings to prevent overheating or electrical hazards.

Important Points

• Safety Note:

• Ensure the voltage supply matches the rating of the appliance to prevent damage or accidents.

• Always use electrical appliances as per their specifications.

• Resistance and Power:

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• Resistance determines how much current an electrical component allows to pass for a given voltage.
• A higher resistance in the heating coil leads to lesser current flow but more heat generation due to Joule heating.

Q9. Answer: (c) 20 m/s

The correct answer is Option 3: 20 m/s.

Key Points

• The mass of the body is given as 2 kg, and its initial velocity is 10 m/s.
• A force of 4 N is applied to the body for a duration of 5 seconds.
• The formula used to calculate the final velocity is derived from Newton's second law of motion: v = u + (F/m) × t, where:
• v is the final velocity (to be calculated).
• u is the initial velocity (10 m/s).
• F is the force applied (4 N).
• m is the mass of the body (2 kg).
• t is the time for which the force is applied (5 s).
• Substituting the values into the formula:
• Acceleration, a = F/m = 4/2 = 2 m/s².
• Final velocity, v = u + a × t = 10 + (2 × 5) = 10 + 10 = 20 m/s.
• Thus, the final velocity of the body is 20 m/s. Hence, the correct answer is Option 3.

Additional Information

• Newton's Second Law of Motion:
• This law states that the rate of change of momentum of an object is directly proportional to the applied force and occurs in the direction of the force.
• The mathematical representation is F = m × a, where:
• F is the force applied.
• m is the mass of the object.
• a is the acceleration produced.
• This law is fundamental in calculating changes in velocity when a force is applied.
• Equations of Motion:
• The three equations of motion are:
• v = u + a × t: Relates final velocity, initial velocity, acceleration, and time.
• s = u × t + (1/2) × a × t²: Relates displacement, initial velocity, acceleration, and time.
• v² = u² + 2 × a × s: Relates final velocity, initial velocity, acceleration, and displacement.
• These equations are useful for solving problems related to motion in a straight line with constant acceleration.
• Force and its Effects:
• A force can change the state of motion of an object (its speed or direction) or its shape.
• The SI unit of force is the newton (N), where 1 N = 1 kg·m/s².
• Practical Applications:
• Newton's second law is widely used in mechanics, engineering, and physics to design vehicles, machinery, and safety systems.
• It also helps in understanding the motion of celestial bodies and the dynamics of sports activities.

Important Points

• Key Characteristics of Force:
• Force is a vector quantity, having both magnitude and direction.
• It is measured using a spring balance or force sensor in experiments.
• Examples of Force in Daily Life:
• Pushing a shopping cart applies force to move it forward.
• Applying brakes on a car produces a force to slow it down.
• A rocket launch involves force to overcome Earth's gravity and propel upward.

Q10. Answer: (c) Placenta

The correct answer is Placenta.

Key Points

• The placenta is a specialized organ that develops during pregnancy to support the developing embryo and fetus.

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• One of its primary functions is the removal of waste products generated by the embryo and fetus, such as carbon dioxide and nitrogenous waste.

• The placenta acts as an interface between the mother's blood supply and the fetus, facilitating the exchange of nutrients, oxygen, and waste products.

• It ensures the waste products from the fetus are transferred to the mother's circulatory system, where they are subsequently eliminated by the mother's excretory organs, such as the kidneys and lungs.

• The placenta also produces essential hormones like human chorionic gonadotropin (hCG), progesterone, and estrogen to support pregnancy.

Additional Information

• Placenta Functions:

• Facilitates the transfer of oxygen and nutrients from the mother to the fetus.

• Removes metabolic waste products, such as carbon dioxide and urea, from the fetal blood.

• Acts as a barrier to some harmful substances while allowing the passage of beneficial antibodies to provide immunity to the fetus.

• Other Options Explained:

• Ovaries: The ovaries are part of the female reproductive system and are responsible for producing eggs and hormones like estrogen and progesterone. They do not play a role in waste removal for the embryo.

• Scrotum: The scrotum is a part of the male reproductive system, housing the testes. It does not have any function related to pregnancy or waste removal in embryos.

• Fallopian Tube: The fallopian tube is the site where fertilization occurs. It provides a pathway for the fertilized egg to travel to the uterus but does not contribute to waste removal for the developing embryo.

• Important Points:

• The placenta is a temporary organ, discarded after childbirth as part of the afterbirth.

• It is formed from both maternal and fetal tissues, ensuring a connection between the two circulatory systems without direct mixing of blood.

• The placenta begins to form shortly after implantation of the fertilized egg and becomes fully functional by the end of the first trimester.

• Key Facts:

• Waste removal by the placenta is crucial for preventing the accumulation of toxic substances in the fetal environment.

• The umbilical cord connects the fetus to the placenta, serving as a conduit for nutrients and waste exchange.

• Any dysfunction in the placenta can result in complications such as fetal growth restriction or other pregnancy-related disorders.

Q11. Answer: (b) Dispersion

The correct answer is Dispersion.

Key Points

• Dispersion is the phenomenon in which white light is split into its constituent colors when it passes through a prism or another medium.

• This occurs because different colors of light have different wavelengths and travel at different speeds in a medium, causing them to refract at varying angles.

• The sequence of colors observed during dispersion is called the visible spectrum, and it includes Violet, Indigo, Blue, Green, Yellow, Orange, and Red (VIBGYOR).

• The primary cause of dispersion is the variation in the refractive index of the medium for different wavelengths of light.

• An example of dispersion is the formation of a rainbow, where sunlight is dispersed by water droplets in the atmosphere.

Additional Information

• Scattering:

• Scattering occurs when light particles are deflected in various directions due to interaction with molecules or particles in a medium.

• An example of scattering is the blue color of the sky, which occurs because shorter wavelengths (blue light) scatter more than longer wavelengths (red light).

• Refraction:

• Refraction is the bending of light as it passes from one medium to another of different densities.

• An example is the apparent bending of a straw when placed in a glass of water.

• Reflection:

• Reflection is the phenomenon where light bounces back after striking a smooth surface, like a mirror.

• The laws of reflection state that the angle of incidence equals the angle of reflection, and the incident ray, reflected ray, and

normal lie in the same plane.

• Applications of Dispersion:

• It is used in spectroscopy for studying the properties of light.

• It helps explain the formation of natural phenomena like rainbows and the working of prisms.

• Dispersion is also utilized in optical devices like gratings and spectrometers.

Important Points

• Rainbow Formation:

• A rainbow is formed due to the combination of dispersion, refraction, and reflection of sunlight by water droplets in the atmosphere.

• Each droplet acts as a prism, dispersing white sunlight into its constituent colors.

• Refractive Index:

• The refractive index of a material determines how much the light will bend when entering the material.

• Different wavelengths of light have different refractive indices, leading to dispersion.

• Optical Devices:

• Prisms and diffraction gratings are common devices that demonstrate and utilize the phenomenon of dispersion.

Q12. Answer: (a) 10 N

The correct answer is 10 N.

Key Points

• The weight of an object is determined by the gravitational force acting on it. On the Moon, the gravitational acceleration is approximately 1/6th of Earth's gravitational acceleration.

• Earth's gravitational acceleration is approximately 9.8 m/s^2, while the Moon's gravitational acceleration is approximately 1.63 m/s^2.

• The formula for weight is Weight = Mass × Gravitational Acceleration. Since the mass of the object remains constant, the change in weight is due to the change in gravitational acceleration.

• If the weight of the object on Earth is 60 N, its weight on the Moon can be calculated as:

Weight on Moon = Weight on Earth × (Moon's gravity / Earth's gravity)

Weight on Moon = 60 × (1.63 / 9.8) ≈ 10 N.

• Hence, the approximate weight of the object on the Moon is 10 N.

Additional Information

• Gravitational Acceleration:

• Gravitational acceleration on Earth is approximately 9.8 m/s^2, and it varies slightly depending on location.

• Gravitational acceleration on the Moon is approximately 1.63 m/s^2, which is significantly lower due to the Moon's smaller mass and radius.

• Weight vs. Mass:

• Mass is the amount of matter in an object and remains constant regardless of location.

• Weight is the force exerted by gravity on an object's mass and changes depending on the gravitational field strength.

• Impact of Low Gravity on the Moon:

• Lower gravity on the Moon affects astronauts' movements, allowing them to jump higher and carry heavier objects compared to Earth.

• This is why space missions require special training to adapt to such environments.

• Applications of Weight Calculation:

• Understanding gravitational differences is crucial for designing space missions and equipment for extraterrestrial environments.

• Calculating weight differences helps in estimating payload capacities for spacecraft and lunar exploration vehicles.

Important Points

• Gravitational Force: The gravitational force between two objects depends on their masses and the distance between their centers, as per Newton's Law of Gravitation.

• Moon's Characteristics: The Moon's radius is about 1,737 km, and its mass is 7.35×10^{22} kg, which is much smaller than Earth's.

• Astronaut Training: Space agencies like NASA train astronauts to operate in low-gravity environments, simulating conditions similar to the Moon's gravity.

• Lunar Exploration: Equipment and vehicles for lunar missions are designed keeping the Moon’s lower gravity in mind to ensure functionality and efficiency.

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Q13. Answer: (a) A yellow precipitate of lead iodide is formed.

The correct answer is A yellow precipitate of lead iodide is formed..

Key Points

• When solutions of lead(II) nitrate (Pb(NO3)2) and potassium iodide (KI) are mixed, a double displacement reaction occurs.

• The reaction produces a yellow precipitate of lead(II) iodide (PbI2), which is insoluble in water. This is a characteristic property of lead iodide.

• The balanced chemical equation for the reaction is:

Pb(NO3)2 (aq) + 2KI (aq) → PbI2 (s) + 2KNO3 (aq)

• The yellow precipitate of lead iodide is formed due to the low solubility of PbI2 in aqueous solution, which makes it settle as a solid.

• The potassium nitrate (KNO3) formed remains dissolved in the solution as it is highly soluble in water.

Additional Information

• Lead(II) Nitrate [Pb(NO3)2]:

• It is a white crystalline compound that is highly soluble in water.

• Lead(II) nitrate is commonly used in laboratories for reactions involving precipitation and in the preparation of other lead compounds.

• Potassium Iodide (KI):

• It is a white salt that dissolves readily in water to produce iodide ions (I^-).

• Potassium iodide is often used in iodometry, as a dietary supplement, and in chemical reactions for iodide ion generation.

• Lead(II) Iodide (PbI2):

• Lead iodide is a bright yellow solid that is sparingly soluble in cold water but more soluble in hot water.

• Upon heating, PbI2 can dissolve and recrystallize when cooled, forming shiny golden plate-like crystals, often referred to as "golden rain."

• Double Displacement Reaction:

• This reaction involves the exchange of ions between two compounds to form new compounds.

• The reaction between Pb(NO3)2 and KI is a classic example of a double displacement reaction, resulting in the formation of an insoluble precipitate.

Important Points

• Solubility Rules:

• Most nitrates (NO3^-) are soluble in water, which is why Pb(NO3)2 dissolves readily.

• Most iodides (I^-) are soluble, except for those of lead (Pb^{2}^+), silver (Ag^+), and mercury (Hg^{2}^+), making PbI2 insoluble.

• Practical Applications:

• The formation of lead iodide is often used in school and college chemistry labs to demonstrate precipitation reactions.

• PbI2 has applications in materials science, particularly in the fabrication of semiconductors and X-ray detectors.

Q14. Answer: (a) Statement A is correct but statement B is incorrect

The correct answer is Statement A is correct but statement B is incorrect.

Key Points

• Statement A: Reproduction is linked to the stability of populations of species.

• This statement is correct because reproduction ensures the continuity of a species by generating new individuals.

• It prevents extinction and maintains ecological balance by ensuring population stability over time.

• Through reproduction, genetic information is passed on to the next generation, preserving the species' characteristics.

• Statement B: Variation is thus not useful for the survival of species over time.

• This statement is incorrect because variation produced during reproduction is crucial for survival and adaptation.

• It allows species to adapt to changing environmental conditions, improving their chances of survival over time.

• Variations lead to evolution, which helps species develop traits beneficial for survival in diverse habitats.

• Importance of variation:

• Sexual reproduction generates genetic variation through processes like crossing over during meiosis and the fusion of gametes.

• Variation ensures that some individuals in a population can survive environmental changes, thereby supporting species survival.

• Examples include resistance to diseases, adaptation to extreme climates, and the development of new traits.

Additional Information

• Sexual reproduction:

• Sexual reproduction involves the fusion of male and female gametes, resulting in offspring with genetic material from both

parents.
• It introduces diversity in the population, which is essential for evolution and adaptation.
• Variation and evolution:
• Variation is the basis of evolution, as proposed by Charles Darwin in his theory of natural selection.
• Organisms with favorable traits are more likely to survive and reproduce, passing those traits to the next generation.
• Role of environment:
• Environmental factors like climate, predators, and availability of resources can influence which variations are beneficial.
• Populations with greater genetic diversity are better equipped to withstand environmental challenges.
• Examples of variation:
• Resistance to antibiotics in bacteria is a result of genetic variation and natural selection.
• Color variations in peppered moths during the Industrial Revolution allowed them to camouflage and survive predation.
Important Points
• Genetic variation:
• Occurs due to mutations, genetic recombination, and random fertilization.
• Essential for the adaptability and resilience of species in changing environments.
• Reproduction and stability:
• Ensures that the population size remains stable and does not decline drastically.
• Helps maintain ecological balance by supporting food chains and ecosystems.
• Significance of sexual reproduction:
• Ensures genetic diversity, which is vital for the long-term survival of species.
• Facilitates adaptation to new environmental conditions and challenges.

Q15. Answer: (c) Bending of light due to change in air density

The correct answer is Bending of light due to change in air density.
Key Points
• Atmospheric refraction occurs due to the bending of light as it passes through layers of the atmosphere with varying densities. The air density changes with altitude, causing light to refract.
• When light passes through the Earth's atmosphere, it encounters different layers of air with varying temperatures and pressures. This results in a change in the refractive index, causing the light to bend.
• The bending of light due to atmospheric refraction is responsible for several phenomena, such as the apparent shift of celestial objects (e.g., stars and the sun) from their actual position.
• Twinkling of stars is another example of atmospheric refraction. The bending of starlight as it passes through the Earth's atmosphere causes stars to appear to twinkle.
• The phenomenon also explains why the sun appears flattened during sunrise and sunset. The light from the sun bends as it travels through the denser layers of the atmosphere near the horizon.
Additional Information
• Scattering of light in atmosphere:
• This phenomenon is responsible for the blue color of the sky. Shorter wavelengths of light (blue) are scattered more than longer wavelengths (red).
• While scattering contributes to various optical effects in the atmosphere, it is not the cause of atmospheric refraction.
• Absorption of light by air molecules:
• Air molecules absorb certain wavelengths of light, which contributes to heat generation in the atmosphere and other effects like the greenhouse effect.
• This is unrelated to the bending of light that causes atmospheric refraction.
• Reflection of light by atmosphere:
• Reflection primarily occurs when light hits solid or liquid surfaces, like clouds or the Earth's surface. It is not responsible for atmospheric refraction.
• Applications of atmospheric refraction:
• It is used in astronomical observations to correct the apparent positions of celestial bodies.
• Atmospheric refraction is also the basis for technologies like mirage formation, which occurs in deserts or over hot roads due to varying air densities.
Important Points
• Key characteristics of atmospheric refraction:

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• It depends on the refractive index gradient of the atmospheric layers.
• The amount of bending is greater when the temperature gradient is steep, such as during sunrise and sunset.
• It is responsible for the elongation of daylight, as the sun appears before it has risen and after it has set due to bending of light.
• Examples of atmospheric refraction:
• Mirages in deserts, caused by the bending of light due to temperature differences in air layers.
• Apparent displacement of stars, which can make them appear slightly shifted from their actual positions.
• Scientific studies:
• Atmospheric refraction is studied in meteorology and astronomy to understand its effects on weather patterns and celestial observations.
• It is also used in optical technologies to develop instruments that minimize distortion caused by atmospheric refraction.

Q16. Answer: (c) 10%

The correct answer is 10%.

Key Points

• In an ecosystem, energy transfer from one trophic level to the next is approximately 10%. This is known as the 10% Law of Energy Transfer.
• The rest of the energy (around 90%) is lost as heat energy, used for metabolic processes, or remains unconsumed by the next trophic level.
• This principle was proposed by Raymond Lindeman in 1942, highlighting the inefficiency of energy transfer in food chains.
• Producers (plants) capture solar energy through photosynthesis. When herbivores consume plants, only 10% of the energy stored in plants is transferred to them.
• Similarly, when carnivores consume herbivores, only 10% of the herbivore's energy is transferred to the carnivores. This pattern continues through the food chain.

Additional Information

• Energy Pyramid:
• An energy pyramid visually represents the energy flow in an ecosystem. It shows how energy decreases as it moves from producers to higher trophic levels.
• The base of the pyramid comprises primary producers (plants) with the highest energy levels.
• Subsequent levels include primary consumers (herbivores), secondary consumers (carnivores), and tertiary consumers (top predators).
• The energy transfer efficiency between levels is around 10%, consistent with the 10% Law.
• Ecological Significance:
• The loss of energy at each trophic level limits the number of levels in a food chain, making most ecosystems short (usually 4-5 levels).
• It explains why there are fewer top predators compared to primary producers or herbivores.
• Food Chain and Food Web:
• A food chain is a linear sequence of organisms through which energy flows, starting from producers and ending at top predators.
• A food web is a more complex network of interconnected food chains, showing multiple pathways of energy flow.
• Importance of the 10% Law:
• It highlights the need for a large biomass of producers to support higher trophic levels.
• It also emphasizes the inefficiency of energy transfer, which has implications for ecosystem management and conservation.

Important Points

• Trophic Levels:
• Producers: Organisms like plants and algae that produce energy through photosynthesis.
• Primary Consumers: Herbivores that feed on producers.
• Secondary Consumers: Carnivores that feed on herbivores.
• Tertiary Consumers: Top predators at the highest trophic level.
• Energy Loss:
• Energy is lost at each trophic level due to heat dissipation, metabolic activities, and incomplete digestion.
• Only a small fraction (around 10%) of the energy is stored in the biomass of the next trophic level.
• Example of the 10% Law:
• If a plant produces 1000 kcal of energy, only 100 kcal is passed to herbivores, and 10 kcal to carnivores.
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Q17. Answer: (b) An atom is a sphere of positive charge with electrons embedded in it like seeds in a watermelon.

The correct answer is An atom is a sphere of positive charge with electrons embedded in it like seeds in a watermelon.

Key Points

• J.J. Thomson's Atomic Model: J.J. Thomson proposed his model of the atom in 1904, often referred to as the "plum pudding model" or the "watermelon model."

• Structure of the Atom: According to this model, an atom consists of a positively charged sphere, within which negatively charged electrons are embedded. This arrangement was likened to seeds in a watermelon or raisins in a plum pudding.

• Positive Charge Distribution: The positive charge is spread uniformly over the entire atom, neutralizing the negative charge of the electrons and making the atom electrically neutral.

• Early Understanding: This model was an early attempt to describe atomic structure before the discovery of the nucleus by Ernest Rutherford in 1911.

• Limitations: Although groundbreaking at the time, the model could not explain phenomena like the scattering of alpha particles, which led to its eventual replacement by Rutherford's nuclear model of the atom.

Additional Information

• Key Characteristics of Thomson's Model:

• Atoms were considered indivisible and electrically neutral according to Thomson's theory.

• The electrons' negative charge was thought to balance the positive charge spread across the atom.

• Rutherford's Experiment:

• In 1911, Rutherford conducted the famous gold foil experiment, which demonstrated that atoms have a dense, positively charged nucleus at their center.

• This finding invalidated Thomson's model and led to the development of the nuclear model of the atom.

• Bohr's Model:

• Niels Bohr later refined Rutherford's model by introducing quantum theory, explaining that electrons revolve around the nucleus in fixed orbits.

• This model addressed the stability of atoms and the emission spectra of hydrogen.

• Modern Atomic Theory:

• The modern atomic model, based on quantum mechanics, describes electrons as existing in probabilistic orbitals rather than fixed orbits.

• This model incorporates principles such as the Heisenberg Uncertainty Principle and Schrödinger's wave equation.

Important Points

• J.J. Thomson's Contribution: He was the first to discover the electron in 1897 through cathode ray experiments, proving that atoms are divisible.

• Plum Pudding Model: Though incorrect, the model helped set the foundation for further research into atomic structure.

• Alpha Particle Scattering Experiment: This experiment by Rutherford disproved the uniform positive charge distribution posited by Thomson, showing instead that most of the atom is empty space.

• Scientific Evolution: The development of atomic theory, from Thomson to quantum mechanics, illustrates the progressive refinement of scientific understanding based on experimental evidence.

Q18. Answer: (d) 3 seconds

The correct answer is 4 seconds.

Key Points

• The given frequency of the sound wave is 4 kHz (kilohertz), which is equivalent to 4000 Hz (1 kHz = 1000 Hz).

• The wavelength of the sound wave is provided as 15 cm, which is equivalent to 0.15 meters (1 cm = 0.01 meters).

• The speed of a wave is calculated using the formula: Speed = Frequency × Wavelength.

• Substituting the given values:

Speed = 4000 × 0.15 = 600 meters per second (m/s).

• The total distance to be covered is 1.8 km, which is equivalent to 1800 meters (1 km = 1000 meters).

• The time taken to cover the distance can be calculated using the formula:

Time = Distance ÷ Speed.

• Substituting the values:

Time = 1800 ÷ 600 = 3 seconds.

• Hence, the sound wave will take 3 seconds to cover a distance of 1.8 km.

Additional Information

• Sound Wave Basics:

• Sound waves are mechanical waves that require a medium (such as air, water, or solids) to propagate.
• They are classified as longitudinal waves, where the particle motion is parallel to the direction of wave propagation.
• The speed of sound varies depending on the medium (e.g., approximately 343 m/s in air at 20°C).
• Key Formulas:
• Wave Speed (v) = Frequency (f) × Wavelength (λ).
• Time (t) = Distance (d) ÷ Speed (v).
• Speed of Sound in Different Media:
• In solids: Around 5000 m/s (e.g., steel).
• In liquids: Around 1500 m/s (e.g., water).
• In gases: Around 343 m/s (e.g., air at 20°C).
• Effect of Frequency and Wavelength:
• Higher frequency leads to shorter wavelength, and vice versa, assuming a constant speed of sound.
• Frequency does not change as a wave moves from one medium to another, but the speed and wavelength do.

Important Points

• Sound in Air: The speed of sound in air is affected by temperature, pressure, and humidity. For example, at 0°C, the speed is approximately 331 m/s and increases with rising temperature.
• Practical Applications: Knowledge of sound wave speed is critical in fields like acoustics, sonar technology, and medical imaging (e.g., ultrasound).
• Units and Conversions: Always ensure that all measurements are in consistent units (e.g., meters, seconds) when performing calculations.
• Real-life Example: The time delay between seeing lightning and hearing thunder can be used to estimate the distance to a storm, based on the speed of sound in air.

Q19. Answer: (b) Covalent bonding

The correct answer is Covalent bonding.

Key Points

• Carbon compounds primarily exhibit covalent bonding because carbon atoms share electrons with other atoms to achieve a stable electronic configuration, following the octet rule.
• Covalent bonds are formed when atoms share pairs of electrons. In the case of carbon, it forms four covalent bonds due to its tetravalency (presence of four valence electrons).
• Examples of carbon compounds with covalent bonding include methane (CH4), ethane (C2H6), and carbon dioxide (CO2).
• Carbon atoms can form single, double, or triple covalent bonds with other atoms, allowing them to create a diverse range of compounds, including organic molecules like hydrocarbons and biomolecules.
• The stability and versatility of covalent bonds in carbon compounds are foundational to the chemistry of life and the formation of complex structures like DNA, proteins, and carbohydrates.

Additional Information

• Characteristics of Covalent Bonds:
• Covalent bonds involve the sharing of electrons between atoms rather than the transfer of electrons (as in ionic bonds).
• These bonds often result in molecules with low melting and boiling points compared to ionic compounds.
• Covalent compounds are generally poor conductors of electricity in solid and liquid states because they lack free ions.
• Examples of covalent bonds include H2, O2, and N2.
• Why Not Ionic Bonding in Carbon Compounds:
• Carbon, with four valence electrons, does not easily gain or lose electrons to form ions due to the high energy required for such processes.
• Instead, carbon tends to share electrons with other atoms, forming stable covalent bonds.
• Ionic bonding is more common in compounds formed by elements with a significant difference in electronegativity, such as sodium chloride (NaCl).
• Hydrogen Bonding:
• Hydrogen bonding is a type of weak intermolecular force and not a primary bond like covalent or ionic bonds.
• It occurs when a hydrogen atom is covalently bonded to highly electronegative elements like oxygen, nitrogen, or fluorine, and interacts with another electronegative atom.
• Hydrogen bonds are significant in water (H2O), DNA, and proteins, but not in the primary bonding of carbon compounds.
• Examples of Covalent Compounds:
• Organic Compounds: Hydrocarbons such as methane (CH4) and ethene (C2H4).

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• Inorganic Compounds: Carbon dioxide (CO_2) and silicon dioxide (SiO_2).

• These compounds are the result of shared electron pairs forming covalent bonds.

• Important Points:

• Carbon's ability to form covalent bonds is the reason for the vast diversity of organic molecules and the complexity of life.

• Carbon can form chains, rings, and complex branched structures, which is crucial for the formation of biological macromolecules.

• The study of carbon compounds is known as organic chemistry, which is a fundamental branch of science.

Q20. Answer: (c) Lipid synthesis and detoxification

The correct answer is Lipid synthesis and detoxification.

Key Points

• The smooth endoplasmic reticulum (SER) in eukaryotic cells is primarily responsible for the synthesis of lipids. These lipids are essential for the formation of membranes and other cellular functions.

• One of the critical roles of the SER is its involvement in detoxification processes, where harmful substances such as drugs, alcohol, and metabolic by-products are neutralized, especially in liver cells.

• The SER is distinguished from the rough endoplasmic reticulum (RER) by the absence of ribosomes on its surface, which makes it appear "smooth" under a microscope.

• The SER also plays a vital role in the metabolism of carbohydrates, regulating glucose release from stored glycogen in certain cells like those in the liver.

• In muscle cells, the SER, often referred to as the sarcoplasmic reticulum, is specialized for the storage and regulation of calcium ions, which are crucial for muscle contraction.

Additional Information

• Functions of Smooth Endoplasmic Reticulum:

• The SER is primarily involved in lipid metabolism, including the synthesis of phospholipids and cholesterol, which are essential for the structural integrity of cell membranes.

• It plays a role in the production of steroid hormones in endocrine glands, such as testosterone and estrogen in the gonads.

• The detoxification function of the SER is especially prominent in the liver, where enzymes like cytochrome P450 are involved in breaking down toxic substances.

• In some cells, the SER serves as a storage site for calcium ions, which are released as signals during various cellular processes.

• Comparison with Rough Endoplasmic Reticulum (RER):

• While the SER is involved in lipid synthesis, the RER is primarily responsible for protein synthesis, as it is studded with ribosomes.

• The RER works closely with the Golgi apparatus for the modification and transport of proteins, whereas the SER is more focused on non-protein-related functions.

• Examples of Cells with Prominent SER:

• Liver cells (hepatocytes): These cells have an extensive SER to handle detoxification and lipid metabolism.

• Adrenal gland cells: The SER is crucial for the synthesis of steroid hormones in these endocrine cells.

• Muscle cells: The sarcoplasmic reticulum, a variant of the SER, stores and regulates calcium ions for muscle contraction.

• Importance in Drug Metabolism:

• The SER contains enzymes that catalyze the modification of drugs to make them water-soluble, facilitating their excretion from the body.

• This function is particularly significant in the context of pharmacology and toxicology, where the SER's activity can influence drug efficacy and toxicity.

Important Points

• The SER is highly abundant in cells requiring extensive lipid metabolism or detoxification, such as liver cells and cells in the adrenal cortex.

• Detoxification in the SER often involves the addition of functional groups to toxins, converting them into more hydrophilic molecules for easier elimination.

• The SER also synthesizes glycosphingolipids, which are important components of the nervous system.

• Diseases like Gaucher's disease and certain forms of drug resistance are linked to dysfunctions in the processes mediated by the SER.

Q21. Answer: (c) Mitosis

The correct answer is Mitosis.

Key Points

• Mitosis is a type of cell division where a single parent cell divides to produce two genetically identical daughter cells, each with

the same chromosome number as the parent cell.

• This process occurs in somatic cells (non-reproductive cells) and is essential for growth, repair, and maintenance of tissues.

• During mitosis, the genetic material is duplicated in the parent cell before it splits, ensuring each daughter cell receives an exact copy of the DNA.

• The major stages of mitosis include Prophase, Metaphase, Anaphase, and Telophase, followed by Cytokinesis, which divides the cytoplasm.

• Mitosis ensures that the chromosome number remains constant (diploid, 2n) in the daughter cells, making it different from meiosis, which results in haploid (n) gametes.

Additional Information

• Difference between Mitosis and Meiosis:

• Mitosis results in two identical daughter cells, while Meiosis produces four genetically different cells (gametes).

• Mitosis maintains the same chromosome number as the parent cell, while meiosis reduces the chromosome number by half (haploid).

• Mitosis occurs in somatic cells, whereas meiosis occurs in germ cells during sexual reproduction.

• Functions of Mitosis:

• Growth: Mitosis is responsible for the growth of organisms by increasing the number of cells.

• Tissue Repair: It replaces damaged or dead cells in tissues, ensuring proper functioning.

• Asexual Reproduction: In unicellular organisms like amoeba, mitosis is a means of reproduction.

• Stages of Mitosis:

• Prophase: Chromosomes condense and become visible; spindle fibers form, and the nuclear membrane begins to break down.

• Metaphase: Chromosomes align at the metaphase plate (cell's equator), attached to spindle fibers.

• Anaphase: Sister chromatids are pulled apart and move to opposite poles of the cell.

• Telophase: Nuclear membranes reform around the separated chromosomes, which de-condense.

• Cytokinesis: The cytoplasm divides, resulting in two daughter cells.

• Importance of Maintaining Chromosome Number:

• Preserves genetic stability across cell generations.

• Ensures the correct functioning of an organism's tissues and organs.

Important Points

• Cytokinesis: Although often considered a part of mitosis, cytokinesis is technically the division of the cytoplasm, leading to the final separation of daughter cells.

• Role in Cancer: Uncontrolled mitotic division can lead to the formation of tumors and cancers due to errors in cell cycle regulation.

• Applications in Research: Mitosis plays a crucial role in genetic engineering and regenerative medicine, including stem cell research.

Q22. Answer: (d) Gravity

The correct answer is Gravity.

Key Points

• Positive geotropism is the directional growth of plant parts toward the force of gravity. This phenomenon is most commonly observed in the roots of plants, which grow downward into the soil.

• The stimulus for positive geotropism is gravity, and the response is controlled by plant hormones, specifically auxins, which regulate cell elongation.

• Gravity plays a critical role in the orientation of plant growth, ensuring that roots grow in the direction of gravitational pull to anchor the plant and absorb water and nutrients from the soil.

• Plant cells can sense gravity using specialized organelles called statoliths, which settle at the bottom of gravity-sensing cells (statocytes) and signal the direction of growth.

• While other factors like light, water, and chemicals influence plant growth, they are not directly responsible for the positive geotropism exhibited by roots.

Additional Information

• Plant Hormones and Geotropism:

• Auxins: These hormones accumulate on the lower side of the root due to gravity, inhibiting cell elongation on that side, causing the root to bend downward.

• Gibberellins: While primarily associated with stem elongation, they can work in conjunction with auxins to regulate growth responses in some cases.

• Statoliths and Gravity Sensing:

• Statoliths: These are dense, starch-filled organelles that settle at the bottom of gravity-sensing cells, aiding the plant in determining gravitational direction.

• Statocytes: Specialized cells found in the root cap that contain statoliths and are responsible for detecting gravity.

• Types of Tropisms:

• Phototropism: Growth of plant parts in response to light (e.g., stems bending toward light).

• Hydrotropism: Growth in response to water concentration gradients, typically observed in roots growing toward moisture.

• Chemotropism: Growth in response to chemical stimuli, such as pollen tubes growing toward ovules.

• Applications of Geotropism:

• Geotropism helps plants establish a stable anchorage in the soil by guiding root growth downward.

• It ensures the plant can access water and nutrients from deeper soil layers, essential for survival and growth.

Important Points

• Gravitropism in Shoots: Shoots exhibit negative geotropism, growing upward away from gravity, which aids in reaching light sources for photosynthesis.

• Research Studies: Experiments such as those conducted by Charles Darwin and his son Francis on coleoptiles have provided foundational knowledge on how plants respond to gravity and light.

• Space Studies: Research on plant geotropism in microgravity conditions, such as on the International Space Station (ISS), has revealed insights into the role of gravity in plant development.

• Agricultural Implications: Understanding geotropism helps in crop management, ensuring proper root orientation and nutrient absorption for better yields.

Q23. Answer: (d) enrichment

The correct answer is enrichment.

Key Points

• Enrichment is the process used to remove gangue (impurities) from ores by utilizing differences in their chemical or physical properties.

• This technique ensures that the ore is concentrated, increasing the proportion of valuable minerals and reducing impurities.

• Common methods used for enrichment include gravity separation, froth flotation, magnetic separation, and chemical leaching.

• The choice of enrichment method depends on the physical and chemical characteristics of the ore and gangue materials.

• Enrichment helps in minimizing wastage during the extraction process and enhances the efficiency of subsequent steps like smelting and refining.

Additional Information

• Gravity Separation:

• This method utilizes the difference in density between the ore and gangue particles.

• It involves techniques like jigging, shaking tables, or using hydraulic classifiers.

• Example: Concentration of hematite ore (Fe_2O_3).

• Froth Flotation:

• Used for sulfide ores, this method separates hydrophobic materials from hydrophilic ones using a frothing agent.

• Example: Concentration of copper ore ($CuFeS_2$).

• Magnetic Separation:

• Involves using magnets to separate magnetic materials from non-magnetic gangue.

• Example: Beneficiation of magnetite ore (Fe_3O_4).

• Chemical Leaching:

• Uses chemical solutions to dissolve desired elements from the ore while leaving impurities behind.

• Example: Cyanide leaching for gold extraction.

Important Points

• Gangue:

• Refers to the impurities or non-valuable minerals mixed with the ore.

• Examples include silica, clay, and limestone.

• Ore:

• A naturally occurring solid material from which valuable minerals or metals can be extracted economically.

• Examples include bauxite ($Al_2O_3 \cdot 2H_2O$) for aluminum and galena (PbS) for lead.

• Application of Enrichment:

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• Used in industries like metallurgy, mining, and chemical processing.
• It is an essential step before smelting and refining processes.
• Environmental Benefits:
• Reduces waste generation and energy consumption during metal extraction.
• Helps in sustainable mining practices.

Q24. Answer: (a) Along the tangent to the circle

The correct answer is Along the tangent to the circle.

Key Points

• In uniform circular motion, the direction of velocity is always tangential to the circle at any given point.
• This occurs because velocity is a vector quantity, and in circular motion, the direction of motion changes continuously, but the magnitude of the velocity remains constant.
• The tangential direction of velocity is perpendicular to the radius of the circle at the point of motion.
• The velocity vector in uniform circular motion is constantly changing direction, but its speed (magnitude) remains unchanged, indicating uniform motion.
• The acceleration in this type of motion is directed toward the center of the circle (centripetal acceleration), but this does not affect the tangential velocity direction.

Additional Information

• Circular Motion:
• Circular motion refers to the motion of an object along the circumference of a circle.
• It can be classified into two types:
• Uniform Circular Motion: The speed remains constant, but the direction of motion changes continuously.
• Non-Uniform Circular Motion: Both speed and direction change over time.
• Centripetal Force:
• Circular motion requires a force directed toward the center of the circle, known as centripetal force.
• It ensures that the object remains in circular motion and does not move tangentially out of the circle due to inertia.
• Tangential Velocity:
• Tangential velocity is the velocity of an object moving along the tangent to the circle.
• Its direction changes as the object moves around the circle, but its magnitude remains constant in uniform circular motion.
• Examples of Uniform Circular Motion:
• Motion of a satellite around the Earth in a circular orbit.
• Car turning along a circular track at constant speed.
• Blades of a ceiling fan rotating uniformly.

Important Points

• Difference Between Tangential and Radial Components:
• Tangential Component: Refers to the velocity of the object along the tangent to the circle. It is responsible for motion along the circular path.
• Radial Component: Refers to the centripetal acceleration directed toward the center of the circle, which keeps the object in circular motion.
• Centripetal Acceleration Formula:
• The centripetal acceleration is given by the formula $a = v^2/r$, where:
• v: Tangential velocity
• r: Radius of the circle
• This acceleration changes the direction of velocity but not its magnitude.

Q25. Answer: (b) They form closed loops inside and outside the magnet

The correct answer is They form closed loops inside and outside the magnet.

Key Points

• Magnetic field lines always form closed loops. This is because magnetic monopoles do not exist in nature. The lines emerge from the north pole of a magnet and return to the south pole outside the magnet, forming a continuous loop inside the magnet.
• Magnetic field lines never intersect. If they were to intersect, it would mean that at the point of intersection, the magnetic field would have two different directions, which is not possible. Hence, statement 1 is incorrect.
• The lines represent the direction of the magnetic field. They show the path along which a hypothetical north pole would move if placed in the field. However, they do not depict the path of charged particles. Hence, statement 4 is incorrect.

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• Magnetic field lines do not originate only from the center of the magnet; they spread out from the poles. Inside the magnet, they travel from the south pole to the north pole. Hence, statement 3 is incorrect.
• Magnetic field lines are denser near the poles of the magnet, indicating a stronger magnetic field in those regions.
Additional Information
• Properties of Magnetic Field Lines:
• They emerge from the north pole and enter the south pole outside the magnet, forming a closed loop.
• The density of the lines indicates the strength of the magnetic field. More lines in a given area mean a stronger field.
• They never cross each other, as this would represent two directions of the magnetic field at the same point, which is impossible.
• Applications of Magnetic Fields:
• Magnetic fields are used in various devices such as electric motors, generators, transformers, and magnetic storage devices.
• They are also used in medical imaging techniques like Magnetic Resonance Imaging (MRI).
• Earth's Magnetic Field:
• The Earth behaves like a giant bar magnet with a magnetic field extending from its core to outer space.
• The Earth's magnetic field protects the planet from harmful solar radiation and guides navigation systems like compasses.
• Important Points:
• Magnetic field lines inside a bar magnet travel from south pole to north pole, completing the closed loop.
• The concept of magnetic field lines was introduced by Michael Faraday, who visualized them as lines of force.
• Magnetic fields can be visualized using iron filings or a magnetic compass to trace the direction of the field.
`

Q26. Answer: (d) 105

Shortcut Trick
Total Work = Man-days remains constant.
Initial man-days = Final man-days
$X \times 34 = (X - 3) \times 35$
$34X = 35X - 105$
$X = 105$
Therefore The correct answer is 105.
Alternate Method
Given:
Initial number of people = X
Initial days = 34 days
People absent = 3
Remaining people = X − 3
Final days taken = 35 days
Formula Used:
$M1 \times D1 = M2 \times D2$
Calculations:
$\Rightarrow X \times 34 = (X - 3) \times 35$
$\Rightarrow 34X = 35X - 105$
$\Rightarrow 35X - 34X = 105$
$\Rightarrow X = 105$
Therefore The correct answer is 105.
Additional Information
Chain Rule (Work and Time)
The general formula is $(M1 \times D1 \times H1) / W1 = (M2 \times D2 \times H2) / W2$, where M is men, D is days, H is hours, and W is work.
Inverse Proportionality
For a constant amount of work, the number of people is inversely proportional to the time taken (M prop. to 1/D).

Q27. Answer: (b) Rs. 251

Shortcut Trick
Discount % = 50% = 1/2 of Marked Price.

Extra amount to pay without discount = Discount Amount = Rs. 251.
Since Discount = 50%, the Selling Price (amount paid) is also 50%.
Therefore Amount paid = Discount Amount = Rs. 251.
Therefore The correct answer is Rs. 251.
Alternate Method
Given:
Discount = 50%
Extra amount if no discount = Rs. 251 (This is the discount value)
Calculations:
=> Let the Marked Price (MP) be 100%.
=> Discount = 50% of MP = Rs. 251.
=> 1% of MP = 251 ÷ 50
=> 100% (MP) = (251 ÷ 50) × 100 = Rs. 502.
=> Amount Paid (SP) = MP − Discount = Rs. 502 − Rs. 251 = Rs. 251.
Therefore The correct answer is Rs. 251.
Additional Information
Marked Price & Discount
Discount is always calculated on the Marked Price. Formula: SP = MP × (100 − Discount%)/100.
Successive Discounts
If two discounts d1 and d2 are given, the Effective Discount = d1 + d2 − (d1 × d2)/100.
Profit and Markup
Markup% = (MP − CP)/CP × 100. Profit is always calculated on the Cost Price.

Q28. Answer: (a) 52

Shortcut Trick
The diagonals of a rhombus bisect each other at right angles (90°).
Half-diagonals are 5 cm (10/2) and 12 cm (24/2).
Using the Pythagorean triplet (5, 12, 13), the side of the rhombus is 13 cm.
Perimeter = 4 × Side = 4 × 13 = 52 cm.
Therefore The correct answer is 52 cm.
Alternate Method
Given:
Diagonal 1 (d1) = 10 cm
Diagonal 2 (d2) = 24 cm
Formula Used:
Side of rhombus (s) = $\sqrt{[(d1/2)^2 + (d2/2)^2]}$
Perimeter of rhombus = 4 × s
Calculations:
=> Half of Diagonal 1 = 10 ÷ 2 = 5 cm
=> Half of Diagonal 2 = 24 ÷ 2 = 12 cm
=> Side (s) = $\sqrt{[5^2 + 12^2]}$
=> s = $\sqrt{[25 + 144]}$
=> s = $\sqrt{169}$
=> s = 13 cm
=> Perimeter = 4 × 13
=> Perimeter = 52 cm
Therefore The correct answer is 52 cm.
Additional Information
Area of a Rhombus
The area of a rhombus can be calculated using its diagonals: Area = 1/2 × d1 × d2.
Relationship between Side and Diagonals
The formula relating side (a) and diagonals is $4a^2 = d1^2 + d2^2$.

Properties of a Rhombus

Opposite angles are equal, all sides are equal in length, and diagonals bisect each other at 90°.

Q29. Answer: (b) 5

Shortcut Trick

Net efficiency for full tank = (1/9 − 1/90) = (10 − 1)/90 = 9/90 = 1/10.

Time to fill full tank = 10 minutes.

Time to fill one-half (1/2) of the tank = 10 × (1/2) = 5 minutes.

Therefore The correct answer is 5 minutes.

Alternate Method

Given: Filling pipe time = 9 min, Emptying pipe time = 90 min.

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

Pipe	Time (min)	Total Work (Capacity)	Efficiency
Filling Pipe (A)	9	90 units	+10
Emptying Pipe (B)	90	−1	

=> Net efficiency of both pipes = 10 − 1 = 9 units/min.

=> Total capacity of tank = 90 units.

=> Capacity of one-half of the tank = 90 ÷ 2 = 45 units.

=> Time taken to fill one-half tank = 45 ÷ 9 = 5 minutes.

Therefore The correct answer is 5 minutes.

Additional Information

Inlet and Outlet Pipes

Inlet pipes add water (positive efficiency) while outlet pipes remove water (negative efficiency).

Net Rate Formula

If an inlet fills in 'x' and an outlet empties in 'y', net time to fill is (x × y) ÷ (y − x).

Pipes and Cisterns Logic

This concept is identical to Time and Work, where work done is equivalent to the capacity of the tank.

Q30. Answer: (c) 84x

Shortcut Trick

Apply the standard identity: $(a + b)^2 − (a − b)^2 = 4ab$

Here, a = 3x and b = 7

Therefore Result = 4 × (3x) × (7)

Result = 84x

Therefore The correct answer is 84x.

Alternate Method

Given: $(3x + 7)^2 − (3x − 7)^2$

Formula Used: $(a + b)^2 = a^2 + 2ab + b^2$ and $(a − b)^2 = a^2 − 2ab + b^2$

=> $[(3x)^2 + 2 × (3x) × 7 + (7)^2] − [(3x)^2 − 2 × (3x) × 7 + (7)^2]$

=> $[9x^2 + 42x + 49] − [9x^2 − 42x + 49]$

=> $9x^2 + 42x + 49 − 9x^2 + 42x − 49$

=> 42x + 42x

=> 84x

Therefore The correct answer is 84x.

Additional Information

Difference of Squares

The expression $a^2 − b^2$ can be factored as (a + b)(a − b).

Sum of Squares Identity

$(a + b)^2 + (a − b)^2 = 2(a^2 + b^2)$.

BODMAS Rule

Always simplify terms inside brackets first, followed by exponents, before performing subtraction.

Q31. Answer: (b) 9

Shortcut Trick

Speed = Distance ÷ Time

Speed = 639 ÷ 71

Since 71 × 9 = 639 (Units digit check: 1 × 9 = 9).

Therefore The correct answer is 9 km/hr.

Alternate Method

Given:

Total Distance (D) = 639 km

Total Time (T) = 71 hours

Formula Used:

Speed (S) = Distance (D) ÷ Time (T)

Calculations:

=> Speed = 639 ÷ 71

=> Speed = 9

Therefore The correct answer is 9 km/hr.

Additional Information

Speed Conversion

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

Average Speed

Average speed is the total distance traveled divided by the total time taken: Average Speed = (Total Distance) ÷ (Total Time).

Relative Speed

For two objects moving in the same direction, relative speed = S1 − S2. In the opposite direction, relative speed = S1 + S2.

Q32. Answer: (b) 10

Shortcut Trick

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

Initial: 100 men for 13 weeks.

New: 130 men (100 + 30) for W weeks.

Calculation: 100 × 13 = 130 × W => W = 1300 ÷ 130 = 10.

Therefore The correct answer is 10 weeks.

Alternate Method

Given:

Initial number of men (M1) = 100

Initial duration (D1) = 13 weeks

Additional men = 30

Total new men (M2) = 100 + 30 = 130

Formula Used:

Total Provision = Men × Duration

Calculations:

=> Total provisions = 100 × 13 = 1300 man-weeks

=> New duration (D2) = Total provisions ÷ M2

=> D2 = 1300 ÷ 130

=> D2 = 10 weeks

Therefore The correct answer is 10 weeks.

Additional Information

Chain Rule / MDH Formula

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

Inverse Proportion

In food provision problems, the number of men is inversely proportional to the number of days the food lasts (M prop. to 1/D).

Leftover Provisions

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If men join or leave after some days, calculate the remaining provisions using: M1 × (Original Days − Days Passed) = M2 × (New Days).

Q33. Answer: (b) 45%

Shortcut Trick

Required percentage = (Value 1 ÷ Value 2) × 100

Value 1 = 1/20, Value 2 = 10/90 = 1/9

Percentage = (1/20 × 9/1) × 100 = 9/20 × 100

Percentage = 9 × 5 = 45%

Therefore The correct answer is 45%.

Alternate Method

Given:

Numerator (A) = 1/20

Denominator (B) = 10/90 = 1/9

Formula Used:

Percentage = (A ÷ B) × 100

Calculations:

=> Required % = ((1/20) ÷ (1/9)) × 100

=> Required % = (1/20 × 9/1) × 100

=> Required % = (9/20) × 100

=> Required % = 9 × (100/20)

=> Required % = 9 × 5 = 45%

Therefore The correct answer is 45%.

Additional Information

Fraction to Percentage

To convert any fraction x/y into a percentage, multiply the fraction by 100 and add the % symbol.

Percentage Change

Percentage Change = ((New Value − Original Value) ÷ Original Value) × 100.

Reciprocal Percentages

1/20 = 5% and 1/9 ≈ 11.11%. These standard conversions help in fast calculation.

Q34. Answer: (a) Rs. 3,744

Shortcut Trick

Effective Rate of Interest for 2 years at 20% = 20 + 20 + (20 × 20)/100 = 44%.

Amount = 144% of Principal = 2600 × 1.44.

Amount = 26 × 144 = Rs. 3,744.

Therefore The correct answer is Rs. 3,744.

Alternate Method

Given: Principal (P) = Rs. 2,600, Rate (R) = 20%, Time (n) = 2 years.

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

=> $A = 2600(1 + 20/100)^2$

=> $A = 2600(1 + 1/5)^2$

=> $A = 2600(6/5)^2$

=> A = 2600 × (36/25)

=> A = 104 × 36

=> A = Rs. 3,744

Therefore The correct answer is Rs. 3,744.

Additional Information

Compound Interest Formula

The interest earned is CI = $P[(1 + R/100)^n - 1]$. Amount = Principal + Compound Interest.

Effective Rate for Successive Years

For two successive percentage increases of x% and y%, the total increase is [x + y + (xy/100)]%.

Half-Yearly Compounding

If interest is compounded half-yearly, the rate becomes R/2 and the time becomes 2n.

Q35. Answer: (c) 1,920 m³

Shortcut Trick

Ratio of dimensions = 5 : 3 : 2

Total Surface Area (TSA) factor = 2 × (5×3 + 3×2 + 2×5) = 2 × (15 + 6 + 10) = 62 units²

Actual TSA = 992 m² => 1 unit² = 992 ÷ 62 = 16 m² => 1 unit = 4 m

Volume = (5 × 3 × 2) × (unit)³ = 30 × 4³ = 30 × 64 = 1920 m³

Therefore The correct answer is 1,920 m³.

Alternate Method

Given: Ratio of length (l), breadth (b), and height (h) is 5 : 3 : 2. Total Surface Area = 992 m².

Formula Used: Total Surface Area (TSA) = 2(lb + bh + hl) | Volume = l × b × h

Let length l = 5x, breadth b = 3x, and height h = 2x.

=> TSA = 2[(5x × 3x) + (3x × 2x) + (2x × 5x)] = 992

=> 2[15x² + 6x² + 10x²] = 992

=> 2[31x²] = 992

=> 62x² = 992

=> x² = 992 ÷ 62 = 16

=> x = √16 = 4

=> l = 5 × 4 = 20 m, b = 3 × 4 = 12 m, h = 2 × 4 = 8 m

=> Volume = 20 × 12 × 8 = 1920 m³

Therefore The correct answer is 1,920 m³.

Additional Information

Lateral Surface Area of Cuboid

The area of the four side walls is given by 2 × h(l + b).

Diagonal of a Cuboid

The longest rod that can be placed in a cuboid has length d = √(l² + b² + h²).

Properties of a Cube

A cube is a special cuboid where l = b = h = a. Volume = a³ and TSA = 6a².

Q36. Answer: (d) 5(x + 10) = 7x

Shortcut Trick

Smaller part = x

Larger part = x + 10

Ratio of Larger part to Smaller part = 7 : 5

=> (x + 10) / x = 7 / 5

Cross multiplying: 5(x + 10) = 7x

Therefore The correct answer is 5(x + 10) = 7x.

Alternate Method

Given:

Smaller part = x

One part exceeds the other by 10, so Larger part = x + 10

The Ratio given is 7 : 5

Calculations:

=> Larger part : Smaller part = 7 : 5

=> (x + 10) : x = 7 : 5

=> (x + 10) / x = 7 / 5

=> 5 × (x + 10) = 7 × x

=> 5(x + 10) = 7x

Therefore The correct answer is 5(x + 10) = 7x.

Additional Information

Linear Equations in One Variable

An equation of the form ax + b = c is used to find the value of an unknown variable based on given conditions.

Ratio and Proportion

If a : b = c : d, then the product of extremes equals the product of means (a × d = b × c).

Concept of Exceeding

When a value 'A' exceeds 'B' by 'k', it is mathematically expressed as A = B + k or A − B = k.

Q37. Answer: (a) 10

Shortcut Trick

For Mean Proportional (MP) of two numbers a and b: $MP^2 = a \times b$

Given MP = 50, a = X, and b = 250.

=> $50^2 = X \times 250$

=> 2500 = X × 250

=> X = 2500 ÷ 250 = 10

Therefore The correct answer is 10.

Alternate Method

Given: First number = X, Second number = 250, Mean Proportional = 50.

Formula Used: If b is the mean proportional between a and c, then a : b = b : c or $b = \sqrt{(a \times c)}$.

Calculations:

=> X ÷ 50 = 50 ÷ 250

=> X × 250 = 50 × 50

=> X × 250 = 2500

=> X = 2500 ÷ 250

=> X = 10

Therefore The correct answer is 10.

Additional Information

Third Proportional

If a : b = b : c, then c is called the third proportional to a and b, calculated as $c = b^2 \div a$.

Fourth Proportional

If a : b = c : d, then d is the fourth proportional to a, b, and c, where d = (b × c) ÷ a.

Compound Ratio

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

Q38. Answer: (a) 56 years

Shortcut Trick

Ratio of ages of A and B (8 years ago) = 3 : 1 (Difference = 2)

Ratio of ages of A and B (8 years hence) = 2 : 1 (Difference = 1)

Make the difference equal by multiplying the second ratio by 2 → 4 : 2

Ratio change for A: 3 → 4 (1 unit) in (8 + 8) = 16 years.

1 unit = 16 years Therefore A's age 8 years ago = 3 × 16 = 48 years.

Present age of A = 48 + 8 = 56 years.

Therefore The correct answer is 56 years.

Alternate Method

Let the age of B eight years ago be x.

=> Age of A eight years ago = 3x

=> Present age of A = 3x + 8 and B = x + 8

=> Eight years hence: (3x + 8 + 8) = 2 × (x + 8 + 8)

=> 3x + 16 = 2 × (x + 16)

=> 3x + 16 = 2x + 32

=> x = 16

=> A's present age = 3(16) + 8 = 48 + 8 = 56 years.

Therefore The correct answer is 56 years.

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Additional Information

Ratio Difference Method

When the same number of years is added/subtracted for two people, the age difference remains constant. Adjust ratios to make their parts difference equal.

Concept of Timeline

Always relate "ago" and "hence" to the Present Age. If T1 is years ago and T2 is years hence, the total time gap is T1 + T2.

Q39. Answer: (c) 21√3

Shortcut Trick

In a 30°−60°−90° triangle, the ratio of sides is 1 : √3 : 2.

Side opposite to 30° (Height) = x

Side opposite to 60° (Base) = x√3

Given: Base = 63 m => x√3 = 63

Height (x) = 63 / √3 = (21 × 3) / √3 = 21√3 m.

Therefore The correct answer is 21√3 m.

Alternate Method

Given: Distance from foot (Base) = 63 m, Angle of elevation (θ) = 30°

Formula Used: tan θ = Perpendicular (Height) / Base

=> tan 30° = Height / 63

=> 1 / √3 = Height / 63

=> Height = 63 / √3

=> Height = (21 × 3) / √3

=> Height = 21√3 m

Therefore The correct answer is 21√3 m.

Additional Information

Trigonometric Ratios

Standard values: tan 30° = 1/√3, tan 45° = 1, tan 60° = √3.

Angle of Elevation vs Depression

Angle of elevation is measured from the horizontal line upward to the object; both angles are equal due to alternate interior angles.

Rationalization

To simplify fractions with square roots in the denominator, multiply both numerator and denominator by the square root: a/√b = (a√b)/b.

Q40. Answer: (d) 49

Shortcut Trick

Teacher's Age = New Average + (Original Number of Students × Increase in Average)

=> Teacher's Age = 13 + (36 × (13 − 12))

=> Teacher's Age = 13 + (36 × 1) = 13 + 36 = 49

Therefore The correct answer is 49 years.

Alternate Method

Given:

Number of students = 36

Average age of students = 12 years

Number of people including teacher = 36 + 1 = 37

New average age = 13 years

Formula Used:

Total Sum = Average × Number of Observations

Teacher's Age = Total age of 37 people − Total age of 36 students

Calculations:

=> Total age of 36 students = 36 × 12

=> Total age of 36 students = 432 years

=> Total age of 37 people (including teacher) = 37 × 13

=> Total age of 37 people = 481 years

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=> Teacher's age = 481 − 432

=> Teacher's age = 49 years

Therefore The correct answer is 49 years.

Additional Information

Inclusion Property of Average

When a new member is added to a group, the new member's value = (New Average × New Total Count) − (Old Average × Old Total Count).

Net Deviation Method

The sum of deviations of all observations from their average is always zero. Use this to find a missing value without large multiplications.

Average of Replacement

Age of new person = Age of replaced person + (Total members × Increase in average). If the average decreases, use − instead of +.

Q41. Answer: (b) 175

Shortcut Trick

Use the direct algebraic identity: Sum of squares = (Difference)² + 2 × Product.

Substituting the values: Sum of squares = $7^2 + 2 \times 63$

Sum of squares = 49 + 126 = 175

Therefore The correct answer is 175.

Alternate Method

Given:

Product of two numbers (xy) = 63

Difference of the two numbers (x − y) = 7

Formula Used:

The standard Identity: $(x - y)^2 = x^2 + y^2 - 2xy$

Calculations:

=> $(x - y)^2 = x^2 + y^2 - 2xy$

=> $7^2 = (x^2 + y^2) - 2 \times 63$

=> $49 = (x^2 + y^2) - 126$

=> $x^2 + y^2 = 49 + 126$

=> $x^2 + y^2 = 175$

Therefore The correct answer is 175.

Additional Information

Sum of Squares via Sum of Numbers

If the sum (x+y) and product (xy) are known, use $x^2 + y^2 = (x + y)^2 - 2xy$.

Difference of Squares

The formula for the difference of two squares is $x^2 - y^2 = (x - y)(x + y)$.

Relationship between Sum and Difference

The square of the sum and the square of the difference are related by: $(x + y)^2 - (x - y)^2 = 4xy$.

Q42. Answer: (c) 0.006

Shortcut Trick

Identify the expression as the algebraic identity: $(a^3 - b^3) / (a^2 + ab + b^2) = a - b$.

Here, a = 0.026 and b = 0.02.

Note that a × b = 0.026 × 0.02 = 0.00052, which matches the middle term of the denominator.

Applying the shortcut: Result = a − b = 0.026 − 0.02 = 0.006.

Therefore The correct answer is 0.006.

Alternate Method

Given:

Numerator = $(0.026)^3 - (0.02)^3$

Denominator = $(0.026)^2 + 0.00052 + (0.02)^2$

Formula Used:

The Difference of Cubes formula is: $a^3 - b^3 = (a - b)(a^2 + ab + b^2)$

Calculations:

=> Let a = 0.026 and b = 0.02.

=> Calculate ab = 0.026 × 0.02 = 0.00052.

=> The given expression is in the form: $(a^3 - b^3) / (a^2 + ab + b^2)$

=> Substituting the identity: $[(a - b)(a^2 + ab + b^2)] / (a^2 + ab + b^2)$

=> Simplification leads to: a − b

=> Value = 0.026 − 0.020

=> Value = 0.006

Therefore The correct answer is 0.006.

Additional Information

Sum of Cubes Identity

Similar to the difference of cubes, the sum is given by $a^3 + b^3 = (a + b)(a^2 - ab + b^2)$.

Difference of Squares

The identity $a^2 - b^2 = (a - b)(a + b)$ is frequently used for simplification of numerical expressions.

BODMAS Rule

Always follow the order: Brackets, Orders, Division, Multiplication, Addition, and Subtraction for complex calculations.

Q43. Answer: (a) 8%

Shortcut Trick

Profit % = [Mark up % − Discount % − (Mark up % × Discount %)/100]

Profit % = 35 − 20 − (35 × 20)/100

Profit % = 15 − 7 = 8%

Therefore The correct answer is 8%.

Alternate Method

Given:

Marked Price (MP) = Rs. 2,700

Mark-up Percentage = 35%

Discount Percentage = 20%

Calculations:

=> Let Cost Price (CP) = 100 units

=> MP = 100 + 35% of 100 = 135 units

=> Selling Price (SP) = MP − Discount

=> SP = 135 − 20% of 135

=> SP = 135 − 27 = 108 units

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

=> Profit Percentage = (Profit/CP) × 100 = (8/100) × 100 = 8%

Therefore The correct answer is 8%.

Additional Information

Relationship between CP and MP

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

Effective Percentage Change

When two successive changes a% and b% are applied, net change = [a + b + (ab/100)]%. For discounts, use negative values.

Successive Discounts

Equivalent discount for two successive discounts d1 and d2 = [d1 + d2 − (d1×d2)/100]%.

Q44. Answer: (b) 45

Shortcut Trick

For an odd number of terms (7) in an arithmetic progression, the Average is always the Middle Term.

Middle Term (4^(th) number) = 51

Smallest Term (1^(st) number) = 4^(th) term − (3 gaps × 2) = 51 − 6 = 45

Therefore The correct answer is 45.

Alternate Method

Given: Total numbers (n) = 7, Average = 51.

Formula Used: Average = (Sum of all observations) ÷ (Total number of observations)

Let the seven consecutive odd numbers be x, x+2, x+4, x+6, x+8, x+10, and x+12.

=> Sum = x + (x+2) + (x+4) + (x+6) + (x+8) + (x+10) + (x+12) = 7x + 42

=> Average = (7x + 42) ÷ 7

=> 51 = x + 6

=> x = 51 − 6

=> x = 45

Therefore The correct answer is 45.

Additional Information

Average of Arithmetic Progression

For any series in AP, Average = (First term + Last term) ÷ 2.

Consecutive Odd/Even Numbers

The common difference (d) between any two consecutive odd or even numbers is always 2.

Sum of First n Odd Numbers

The sum of the first n odd natural numbers starting from 1 is given by the formula n^2.

Q45. Answer: (d) Increase by 24%

Shortcut Trick

Assume Cost of TV = 100, then Washing Machine (WM) = 50.

Initial cost of 6 WM + 2 TV = (6 × 50) + (2 × 100) = 300 + 200 = 500.

New cost of 6 WM + 2 TV = (300 × 1.62) + (200 × 0.67) = 486 + 134 = 620.

Change % = (620 − 500) ÷ 500 × 100 = 120 ÷ 5 = 24%.

Therefore The correct answer is Increase by 24%.

Alternate Method

Given: Cost of Washing Machine is 50% less than TV.

=> Let Cost of TV = Rs. 100, Cost of Washing Machine (WM) = Rs. 50.

=> Initial Total Cost (6 WM + 2 TV) = (6 × 50) + (2 × 100) = Rs. 500.

=> New Cost of WM = 50 + 62% of 50 = 50 + 31 = Rs. 81.

=> New Cost of TV = 100 − 33% of 100 = 100 − 33 = Rs. 67.

=> New Total Cost (6 WM + 2 TV) = (6 × 81) + (2 × 67) = 486 + 134 = Rs. 620.

=> Total Increase = 620 − 500 = Rs. 120.

=> Percentage Change = (120 ÷ 500) × 100 = 24%.

Therefore The correct answer is Increase by 24%.

Additional Information

Percentage Change Formula

Percentage change is calculated as (Final Value − Initial Value) ÷ Initial Value × 100.

Successive Percentage Change

For two successive changes of a% and b%, the effective change is (a + b + ab/100)%.

Base Value Selection

In ratio-based percentage problems, choosing a base of 100 for the independent variable simplifies calculations significantly.

Q46. Answer: (a) 2.86% profit

Shortcut Trick

Use Ratio Method: SP is same (Rs. 360 each). Convert % to ratios.

Article 1 (20% Gain): CP1 : SP1 = 5 : 6. To make SP 360, ratio is 300 : 360.

Article 2 (10% Loss): CP2 : SP2 = 10 : 9. To make SP 360, ratio is 400 : 360.

Total CP = 300 + 400 = 700; Total SP = 360 + 360 = 720.

Profit % = (20 ÷ 700) × 100 = 2.857... ≈ 2.86%.

Therefore The correct answer is 2.86% profit.

Alternate Method

Given: SP1 = Rs. 360, Gain1 = 20%, SP2 = Rs. 360, Loss2 = 10%.

Formula: CP = SP × [100 ÷ (100 ± P/L %)]

=> CP1 = 360 × (100 ÷ 120) = 360 × (5 ÷ 6) = Rs. 300

=> CP2 = 360 × (100 ÷ 90) = 360 × (10 ÷ 9) = Rs. 400

=> Total CP = 300 + 400 = Rs. 700

=> Total SP = 360 + 360 = Rs. 720

=> Overall Profit = 720 − 700 = Rs. 20

=> Profit % = (20 ÷ 700) × 100 = 2.857...% ≈ 2.86%

Therefore The correct answer is 2.86% profit.

Additional Information

Same Selling Price - Common Case

If two articles are sold at the same price, one at x% profit and another at x% loss, there is always a loss of $(x/10)^2$ %.

Successive Percentage Change

Effective change = a + b + (ab/100). This is used for successive discounts or population changes, not for combined SP cases.

Marked Price and Discount

Relation: CP × (100 + P%) = MP × (100 − D%). This helps find the ratio of CP to MP.

Q47. Answer: (c) 18 minutes

Shortcut TrickSpeed ratio = 3 : 7 => Time ratio = 7 : 3Difference in time units = 7 − 3 = 4 units4 units = 24 minutes => 1 unit = 6 minutesUsual time = 3 units = 3 × 6 = 18 minutesTherefore The correct answer is 18 min.Alternate MethodGiven: New speed = 3/7 of Normal speed, Late time = 24 minutes.Formula Used: Distance = Speed × Time. When distance is constant, Speed is inversely proportional to Time.=> Let normal speed be S and usual time be T.=> New speed = (3/7)S=> New time = T + 24=> S × T = (3/7)S × (T + 24)=> T = (3/7) × (T + 24)=> 7T = 3T + 72=> 4T = 72=> T = 18 minutesTherefore The correct answer is 18 min.Additional InformationInverse Variation RuleIf speed becomes a/b of its original value, the time taken becomes b/a of the original time.Late/Early FormulaUsual Time = (Late Time × a) ÷ (b − a) when new speed is a/b of usual speed and a < b.Average SpeedFor the same distance covered at speeds x and y, Average Speed = 2xy ÷ (x + y).

Q48. Answer: (d) 63

Given:

20% of a number added to 84 gives the same number

Formula Used:

x% = x ÷ 100

Calculation:

=> Let number = N

=> 84 + 20% of N = N

=> 84 + (20 ÷ 100) × N = N

=> 84 + 0.2N = N

=> N − 0.2N = 84

=> 0.8N = 84

=> N = 84 ÷ 0.8

=> N = 105

=> 60% of N = 60 ÷ 100 × 105

=> 60% of N = 63

Therefore The correct answer is 63.

Q49. Answer: (d) 24 cm

Shortcut Trick

Calculate semi-perimeter (s): (30 + 63 + 51) ÷ 2 = 72 cm.

Calculate Area using Heron's formula: √[72 × (72 − 30) × (72 − 63) × (72 − 51)] = 756 cm^2.

Find Altitude (h): Area = 1/2 × Base × Height => 756 = 1/2 × 63 × h.

h = (756 × 2) ÷ 63 = 24 cm.

Therefore The correct answer is 24 cm.

Alternate Method

Given: Sides of the triangle a = 30 cm, b = 63 cm, and c = 51 cm.

Formula Used: Area of triangle = √[s(s − a)(s − b)(s − c)] and Area = 1/2 × Base × Altitude.

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

=> s = (30 + 63 + 51) ÷ 2 = 144 ÷ 2 = 72 cm

=> Area = √[72 × (72 − 30) × (72 − 63) × (72 − 51)]

=> Area = √[72 × 42 × 9 × 21]

=> Area = √[(36 × 2) × (21 × 2) × 9 × 21] = 6 × 2 × 21 × 3 = 756 cm²

=> Area = 1/2 × Base × Altitude

=> 756 = 1/2 × 63 × Altitude

=> Altitude = (756 × 2) ÷ 63 = 1512 ÷ 63 = 24 cm

Therefore The correct answer is 24 cm.

Additional Information

Heron's Formula

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

Inradius of a Triangle

The radius of the inscribed circle (r) can be calculated using the formula: r = Area ÷ s.

Circumradius of a Triangle

The radius of the circumscribed circle (R) is given by: R = (abc) ÷ (4 × Area).

Q50. Answer: (c) Rs. 15,300

Shortcut Trick

In a partnership, Profit Ratio = Investment Ratio (when time is constant).

Total Profit = Rs. 5,800 | Aman share = Rs. 1,700 → Yogita share = Rs. 4,100.

Profit Ratio (Aman : Yogita) = 1700 : 4100 = 17 : 41.

Aman investment = Total Investment × (Aman ratio / Total ratio) = 52,200 × (17 / 58).

Aman investment = 900 × 17 = Rs. 15,300.

Therefore The correct answer is Rs. 15,300.

Alternate Method

Given: Total Investment = Rs. 52,200 | Total Profit = Rs. 5,800 | Aman Profit = Rs. 1,700.

Formula: Investment of Partner = (Partner Profit / Total Profit) × Total Investment

=> Yogita Profit = Total Profit − Aman Profit

=> Yogita Profit = 5,800 − 1,700 = Rs. 4,100

=> Ratio of Profits (Aman : Yogita) = 1,700 : 4,100 = 17 : 41

=> Sum of ratio parts = 17 + 41 = 58 units

=> 58 units = Rs. 52,200

=> 1 unit = 52,200 ÷ 58 = Rs. 900

=> Aman investment (17 units) = 17 × 900

=> Aman investment = Rs. 15,300

Therefore The correct answer is Rs. 15,300.

Additional Information

Basic Partnership Rule

If investment periods are same, Profit Ratio = Capital Ratio. If periods differ, Profit Ratio = (C1 × T1) : (C2 × T2).

Working vs Sleeping Partner

A Working Partner manages business and may receive a fixed salary or extra percentage of profit before the remaining profit is divided.

Compound Partnership

When partners invest different amounts for different time durations, the profit is divided according to the effective capital (Amount × Time).

Q51. Answer: (a) Son's wife's father's brother

Family Chart:

Decoding the Symbols:

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A is				
Symbol	•	•	×	÷
Meaning	Son	Brother	Wife	Father
to B				

Given Expression: D – F ÷ G × H + J → D is brother of F, F is father of G, G is wife of H, H is son of J.

Thus, D is J's son's wife's father's brother.

Hence, the correct answer is "Option 1".

Q52. Answer: (b) 303

BODMAS Table:

Given equation: 17 B 17 C 324 A 9 D 22 = ?

Now, if 'A' = '÷', 'B' = '×', 'C' = '+' and 'D' = '−', then:

=> 17 × 17 + 324 ÷ 9 − 22 = ?

=> 17 × 17 + 324 ÷ 9 − 22 = ?

=> 289 + 36 − 22 = ?

=> 289 + 36 − 22 = ?

=> 325 − 22 = 303.

Hence, the correct answer is "Option 2".

Q53. Answer: (c) QIM

Pattern followed here is,

Hence, the correct answer is "Option 3".

Q54. Answer: (c) 485

Logic followed here is,

510 - 1 = 509

509 - 3 = 506

506 - 5 = 501

501 - 7 = 494

494 - 9 = 485

Hence, the correct answer is "Option 3".

Q55. Answer: (a) Four

Seven boxes, D, E, F, U, V, W and X, are kept one over the other but not necessarily in the same order.

1. Only two boxes are kept below W.
2. Only two boxes are kept between W and U.
3. Only one box is kept between U and E.
4. X is kept immediately above V.
5. F is kept at some place below D.

D
U
F
E
W
X
V

Four boxes are kept between D and X.

Hence, the correct answer is "Option 1".

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Q56. Answer: (c) Neither Conclusion I or II follows.

Least possible Venn diagram,

Conclusions:

I. Some fans are heaters → Does not follow (There is no direct relation given between fan and heaters. so it is possible not definite).

II. Some lights are geysers → Does not follow (There is no direct relation given between lights and geysers. so, it is possible not definite).

Neither Conclusion I or II follows.

Hence, the correct answer is “Option 3”.

Q57. Answer: (c) 2

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

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

Two people sit to the right of B.

Hence, the correct answer is “Option 3”.

Q58. Answer: (d) LOJ −37

Pattern followed here is,

Hence, the correct answer is “Option 4”.

Q59. Answer: (a) PR - ML

(1) PR - ML

(2) RT - OQ

(3) JL - GI

(4) NP - KM

Hence, the correct answer is “Option 1”.

Q60. Answer: (c) os

Given:

‘drinking is dangerous’ is coded as ‘cd pk os’,

‘avoid dangerous habit’ is coded as ‘os mp ls’,

‘please avoid drinking’ is coded as ‘rk pk mp’.

‘dangerous’ coded in the given language as "os".

Hence, the correct answer is “Option 3”.

Q61. Answer: (b) 380

BODMAS Table:

Given equation: 13 B 32 C 130 A 26 D 41 = ?

Now, replacing the symbols:

A = ÷, B = ×, C = +, D = −

=> 13 × 32 + 130 ÷ 26 − 41 = ?

=> 13 × 32 + 130 ÷ 26 − 41 = ?

=> 13 × 32 + 5 − 41 = ?

=> 416 + 5 − 41 = ?

=> 421 − 41 = 380.

Hence, the correct answer is "Option 2".

Q62. Answer: (b) 2 km to the west

According to the given information,

To reach point A again, he should drive 23 - 21 = 2 km in West direction.

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Hence, the correct answer is “Option 2”.

Q63. Answer: (b) SNRT

Given:

FAEG is related to MHLN,

IDHJ is related to PKOQ.

Similarly,

LGKM related to,

Hence, the correct answer is “Option 2”.

Q64. Answer: (d) PMH

(1) SOK

S - 4 = O

O - 4 = K

(2) TPL

T - 4 = P

P - 4 = L

(3) OKG

O - 4 = K

K - 4 = G

(4) PMH

P - 3 = M

M - 5 = H

Hence, the correct answer is “Option 4”.

Q65. Answer: (d) 4

Given series:

(Left) 6 7 8 9 & 5 £ & $ £ $ 1 * * # * € 8 % 8 © 7 (Right)

Condition to be checked:

Symbol → Number → Symbol

Checking each number:

(Left) 6 7 8 9 & 5 £ & $ £ $ 1 * * # * € 8 % 8 © 7 (Right)

There are four numbers in the above arrangement that are immediately preceded by a symbol and immediately followed by a symbol.

Hence, the correct answer is "Option 4".

Q66. Answer: (b) 268

Logic followed here is,

313 - 9 = 304

304 - 9 = 295

295 - 9 = 286

286 - 9 = 277

277 - 9 = 268

Hence, the correct answer is “Option 2”.

Q67. Answer: (c) (25, 575, 23)

The logic followed here is:

Logic: (1st number × 3rd number) = 2nd number.

Now,

For, 33 : 495 : 15

=> 33 × 15 = 495

For, 27 : 648 : 24

=> 27 × 24 = 648

Similarly, check options:

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Option (3): (25, 575, 23)
=> 25 × 23 = 575
Hence, the correct answer is "Option 3".

Q68. Answer: (d) 5

‘OMER’ is coded as ‘1834’
And
‘DEMO’ is coded as ‘5148’.
Code for "D" is "5".
Hence, the correct answer is “Option 4”.

Q69. Answer: (b) TS 4

Given:
IN 5 is related to KJ −2,
GL 9 is related to IH 2
Similarly,
RW 11 related to,
Hence, the correct answer is “Option 2”.

Q70. Answer: (c) 3

Given series:
(Left) © $ £ 7 3 @ £ 7 8 6 8 % 6 © 3 4 & € 9 @ 8 5 (Right)
Condition to be checked:
Number → Symbol → Number
Checking each symbol:
(Left) © $ £ 7 3 @ £ 7 8 6 8 % 6 © 3 4 & € 9 @ 8 5 (Right)
Thus, the valid symbols are:
%, ©, @
There are 3 symbols in the above arrangement that are immediately preceded and followed by numbers.
Hence, the correct answer is "Option 3".

Q71. Answer: (d) 1051

Logic followed here is,
1021 + 2 = 1023
1023 + 4 = 1027
1027 + 6 = 1033
1033 + 8 = 1041
1041 + 10 = 1051
Hence, the correct answer is “Option 4”.

Q72. Answer: (c) Four

Seven boxes B, C, D, I, J, K and L are kept one over the other but not necessarily in the same order.
1. Only four boxes are kept above L.
2. Only one box is kept above J.
3. Only one box is kept between J and C.
4. B is kept immediately above D.
5. K is kept at some place below I.

I
J
K
C
L

B
D

Four boxes are kept between I and B.

Hence, the correct answer is “Option 3”.

Q73. Answer: (a) 3

Given series:

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

Condition to be checked:

Odd number ← Odd number → Even number

Checking the series:

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

There are three such odd numbers in the above arrangement that are immediately preceded by an odd number and immediately followed by an even number.

Hence, the correct answer is "Option 1".

Q74. Answer: (d) 13

BODMAS Table:

Given equation: 50 A 10 C 2 B 7 D 6 = ?

A	B	C	D
÷	×	•	•

Now, replacing the symbols:

=> 50 ÷ 10 + 2 × 7 - 6 = ?

=> 5 + 2 × 7 - 6 = ?

=> 5 + 14 - 6 = ?

=> 19 - 6 = 13.

Hence, the correct answer is "Option 4".

Q75. Answer: (d) 5 km towards the west

According to the given information,

To reach point A again, she should drive 10 - 5 = 5 km toward West direction.

Hence, the correct answer is “Option 4”.

Q76. Answer: (a) PI-RK-TV

Set 1: JC-LE-NP

Set 2: MF-OH-QS

Similarly,

option (1): PI-RK-TV

Hence, the correct answer is “Option 1”.

Q77. Answer: (d) Three

Given series:

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

Condition to be checked:

Even digit ← Odd digit → Even digit

Checking all odd digits:

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

Valid cases: 4 3 2, 2 7 6, 6 5 4

There are three such odd digits which are immediately preceded and followed by even digits.

Hence, the correct answer is "Option 4".

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Q78. Answer: (b) H

F, G, H, I, M, N and O are sitting around a circular table facing the centre of the table.

1. Only two people sit between I and O when counted from the left of O.
2. G sits third to the left of N.
3. H sits to the immediate right of N.
4. H sits second to the left of I.
5. F is not an immediate neighbour of G.

H sits third to the right of M.

Hence, the correct answer is “Option 2”.

Q79. Answer: (d) T

A, B, C, R, S, T and U are sitting around a circular table facing the centre of the table.

1. Only two people sit between U and S when counted from the right of U.
2. Only three people sit between R and C when counted from the right of C.
3. S sits to the immediate right of C.
4. T sits to the immediate right of A.

T sits fourth to the right of B.

Hence, the correct answer is “Option 4”.

Q80. Answer: (d) Only conclusion (II) follows

Least possible Venn diagram,

Conclusions:

(I): Some pencils are batteries → Does not follow (There is no direct relation given between pencils and batteries. so, it possible not definite).

(II): Some crayons are pencils → Follow (As all pencils are crayons. so, some crayons are definitely pencils).

Only conclusion (II) follows.

Hence, the correct answer is “Option 4”.

Q81. Answer: (d) Reserve Bank of India

The correct answer is Reserve Bank of India.

Key Points

• On 12 June 2025, the Reserve Bank of India (RBI) introduced a significant change in the Know Your Customer (KYC) updating process. This step aimed to simplify and modernize the compliance process for individuals and businesses.

• The RBI allowed the use of video-based customer identification process (V-CIP), which enables customers to update their KYC details remotely through video interaction with authorized representatives. This ensures a seamless and contactless process.

• The move also empowered Business Correspondents (BCs) to handle KYC updates. BCs are agents authorized by banks to provide banking services in remote and underserved areas. This step is expected to enhance the financial inclusion drive by making KYC updates accessible in rural and semi-urban areas.

• This initiative aligns with the RBI's goal of promoting digital banking and reducing the dependency on physical documentation and in-person visits to bank branches for KYC updates.

• The RBI's decision is part of its broader strategy to strengthen customer convenience, improve banking accessibility, and ensure compliance with anti-money laundering (AML) and counter-terrorism financing (CFT) regulations.

Additional Information

• Reserve Bank of India (RBI):

• The RBI is India’s central banking institution, established on 1 April 1935, under the Reserve Bank of India Act, 1934.

• Its primary functions include regulating the issuance and supply of the Indian rupee, managing foreign exchange, and maintaining monetary stability in the country.

• The RBI also oversees the functioning of commercial banks and other financial institutions in India, ensuring their compliance with regulatory norms.

• Video-Based Customer Identification Process (V-CIP):

• V-CIP is a digital and contactless process introduced by the RBI for customer identification and verification.

• It involves conducting a live video interaction with customers to verify their identity using official documents such as Aadhaar or PAN cards.

• V-CIP is secure, cost-effective, and compliant with data privacy regulations, making it a preferred alternative to traditional KYC methods.

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• Business Correspondents (BCs):

• BCs are individuals or entities engaged by banks to deliver banking services in remote and rural areas where establishing a brick-and-mortar branch may not be feasible.

• They act as intermediaries between customers and banks, facilitating transactions, account opening, and now, KYC updates.

• This initiative empowers BCs to bridge the gap between underserved communities and formal banking systems.

• KYC and Its Importance:

• Know Your Customer (KYC) is a mandatory process for verifying the identity of customers to prevent financial crimes like money laundering and fraud.

• It involves collecting and verifying personal details such as name, address, and identification documents like Aadhaar, PAN, or passport.

• KYC ensures that only legitimate customers have access to banking services, promoting transparency and trust in the financial system.

Important Points

• Anti-Money Laundering (AML) Compliance:

• AML refers to a set of procedures, laws, and regulations designed to prevent criminals from disguising illegally obtained funds as legitimate income.

• RBI mandates strict compliance with AML norms to ensure the integrity of the financial system.

• Steps Towards Financial Inclusion:

• Empowering BCs and introducing V-CIP are significant steps toward achieving financial inclusion in India.

• These measures aim to bring unbanked and underbanked populations into the formal financial system.

• Digital Banking Initiatives:

• The RBI has been promoting digital banking through initiatives like V-CIP, Unified Payments Interface (UPI), and Bharat Bill Payment System (BBPS).

• These efforts are in line with India’s vision of becoming a digitally empowered economy.

Q82. Answer: (a) Nipah

The correct answer is Nipah.

Key Points

• In July 2025, the Kerala Health Department heightened vigilance following the detection of cases of Nipah virus in two districts of the state, underlining the zoonotic disease's threat.

• Nipah virus (NiV) is a zoonotic virus, meaning it can spread from animals to humans, and also through contaminated food or directly between people.

• The disease was first identified during an outbreak in 1998-1999 in Malaysia and Singapore, where it was linked to contact with infected pigs. In India, Kerala has been a hotspot for sporadic outbreaks.

• The symptoms of Nipah infection include fever, headache, drowsiness, respiratory distress, confusion, and seizures, which can progress to coma within 24-48 hours in severe cases.

• Kerala has been proactive in containing previous Nipah outbreaks through measures like quarantine, surveillance, and public awareness campaigns. The state's health system has focused on early detection and isolation of suspected cases.

Additional Information

• Characteristics of Nipah Virus:

• The virus belongs to the Henipavirus genus of the family Paramyxoviridae.

• Fruit bats of the Pteropodidae family, particularly species of the genus Pteropus, are the natural hosts.

• Transmission can occur through direct contact with infected animals, contaminated food, or human-to-human transmission, especially in healthcare settings.

• The virus has a high mortality rate, ranging from 40-75%, depending on the outbreak and response measures.

• Government and WHO Guidelines:

• The World Health Organization (WHO) identifies Nipah virus infection as a priority disease requiring urgent research and development.

• Efforts focus on vaccine development, improving diagnostics, and strengthening surveillance systems to detect outbreaks early.

• In India, the Ministry of Health and Family Welfare collaborates with the National Centre for Disease Control (NCDC) and state governments for outbreak management.

• Other Zoonotic Diseases (for comparison):

• Filariasis: A parasitic disease caused by filarial worms, transmitted by mosquitoes. It primarily causes lymphedema (swelling) and does not spread directly between humans.

• Malaria: A mosquito-borne parasitic disease caused by Plasmodium species. It is widespread in tropical and subtropical regions

but is not zoonotic (does not involve animal reservoirs).

• Tuberculosis (TB): A bacterial infection caused by Mycobacterium tuberculosis, primarily affecting the lungs. It spreads between humans but is not zoonotic.

• Previous Nipah Outbreaks in Kerala:

• Kerala reported its first Nipah outbreak in 2018, resulting in 17 deaths out of 18 confirmed cases.

• Subsequent outbreaks in 2019 and 2021 were effectively contained due to the state's vigilant health measures.

• Public awareness campaigns, rapid response teams, and strict quarantine protocols have been key to managing outbreaks.

Important Points

• Prevention Strategies:

• Avoiding consumption of raw date palm sap, which can be contaminated by fruit bats.

• Maintaining hygiene and avoiding direct contact with infected individuals or animals.

• Proper use of personal protective equipment (PPE) by healthcare workers while treating suspected cases.

• Current Research:

• Development of vaccines like the experimental ChAdOx1 NiV vaccine.

• Efforts to enhance rapid diagnostic tools, such as RT-PCR, for early detection.

• Global Perspective:

• Nipah virus is listed under the WHO's Research and Development Blueprint for priority diseases.

• Regional cooperation in Southeast Asia and South Asia is crucial to address cross-border outbreaks.

Q83. Answer: (c) Para-Athletics

The correct answer is Para-Athletics.

Key Points

• Praveen Kumar is an acclaimed Indian athlete associated with Para-Athletics, a discipline focused on athletes with physical disabilities.

• He was awarded the prestigious Rajiv Gandhi Khel Ratna Award (now renamed Major Dhyan Chand Khel Ratna Award) in January 2025 for his outstanding achievements in Para-Athletics.

• Praveen Kumar has excelled in international Para-Athletics events, earning medals and recognition for India. His remarkable performance in events like High Jump has significantly contributed to India's recognition in this category.

• Para-Athletics includes track and field events modified for athletes with physical impairments, providing them a platform to showcase their sportsmanship on national and international levels.

• The award emphasizes the importance of recognizing achievements in Para-Sports, promoting inclusivity and encouraging athletes with disabilities to pursue their dreams in competitive sports.

Additional Information

• Para-Athletics:

• Para-Athletics is governed by the International Paralympic Committee (IPC), which sets the rules and classification system for athletes with disabilities.

• It includes various events like sprints, long-distance running, high jump, discus throw, javelin throw, and shot put, tailored for athletes based on their physical capabilities.

• India has been actively participating in Para-Athletics events since its debut at the Paralympics in 1968.

• Athletes are classified into different categories like visual impairment, amputee, wheelchair-bound, and cerebral palsy to ensure fair competition.

• Khel Ratna Award:

• Renamed as Major Dhyan Chand Khel Ratna Award, it is India's highest sporting honor.

• Instituted in 1991-92, the award recognizes outstanding performance in sports across disciplines.

• Recipients are awarded a medal, certificate, and a cash prize. As of recent updates, the cash prize is Rs. 25 lakh.

• Prominent athletes like Sachin Tendulkar, PV Sindhu, and Neeraj Chopra have been honored with this award.

• Achievements of Praveen Kumar:

• Praveen Kumar is renowned for his High Jump performances in Para-Athletics, especially in the T64 category for athletes with leg impairments.

• He won a silver medal at the Tokyo Paralympics 2020, setting an Asian record with a jump of 2.07 meters.

• He has also bagged medals in other international events, showcasing exceptional consistency and dedication.

• Importance of Para-Sports:

• Para-Sports provide a platform for athletes with disabilities to excel and demonstrate their abilities.

• They promote inclusivity, equality, and awareness about the capabilities of differently-abled individuals.

• Events like the Paralympics and World Para Athletics Championships have gained significant global recognition, emphasizing the importance of these sports.

• India has been actively encouraging Para-Sports through schemes like the Target Olympic Podium Scheme (TOPS) and dedicated training facilities.

Important Points

• Prominent Para-Athletes in India:

• Devendra Jhajharia: Two-time Paralympic Gold medalist in Javelin Throw.

• Deepa Malik: First Indian woman to win a medal at the Paralympics; achieved in Shot Put.

• Mariyappan Thangavelu: Gold medalist in High Jump at the Rio Paralympics 2016.

• Such athletes inspire millions and highlight the potential of Para-Sports in India.

• Government Support:

• India has launched initiatives like the Para-Athlete Development Programme and increased funding through the Ministry of Youth Affairs and Sports.

• Facilities like specialized coaching, international exposure, and financial aid are provided to athletes.

Q84. Answer: (d) Laapataa Ladies

The correct answer is Laapataa Ladies.

Key Points

• Laapataa Ladies was India's official entry for the Oscar 2025 but did not receive a nomination in the final list. Despite this, the film achieved significant acclaim at the Indian level, winning an impressive 10 IIFA Awards in March 2025.

• The film, directed by acclaimed filmmaker Kiran Rao, is known for its unique storytelling and portrayal of social issues, which struck a chord with both audiences and critics in India.

• Laapataa Ladies explores themes of gender, identity, and societal expectations in a humorous yet poignant manner, making it a standout piece in contemporary Indian cinema.

• Although it missed out on an Oscar nomination, the film's widespread recognition at the International Indian Film Academy (IIFA) Awards demonstrates its cultural and cinematic significance.

• It set a benchmark for films that address social issues with creativity and sensitivity, earning accolades for direction, screenplay, and performances.

Additional Information

• Oscar Entries from India:

• India annually selects an official entry for the Academy Award for Best International Feature Film. This process is overseen by the Film Federation of India.

• In the past, films like Lagaan (2001), Mother India (1957), and Slumdog Millionaire (2008) have received nominations, with Slumdog Millionaire winning multiple Oscars.

• India's official entries often reflect cultural richness, social relevance, and cinematic excellence.

• International Indian Film Academy (IIFA) Awards:

• The IIFA Awards celebrate excellence in Indian cinema and are regarded as one of the most prestigious awards in the Indian film industry.

• Held annually, the awards recognize achievements in various categories, including acting, direction, music, and technical expertise.

• Films like Laapataa Ladies achieving dominance at IIFA highlight their impact on the Indian cinema landscape.

• About Kiran Rao:

• Kiran Rao, the director of Laapataa Ladies, is known for her thought-provoking films and innovative storytelling.

• She gained fame with her debut film Dhobi Ghat (2010), which showcased her talent for blending art cinema with relatable narratives.

• Her works often address themes like urban struggles, societal norms, and gender dynamics.

• Impact of Socially Relevant Cinema:

• Films like Laapataa Ladies contribute to raising awareness about critical social issues while entertaining audiences.

• They serve as a platform for highlighting gender inequality, societal expectations, and cultural diversity.

• Such films often receive international recognition for their unique narratives and universal themes.

Important Points

• Other Options:

• Ram Setu: A 2022 film focusing on a mythological theme but did not achieve the same level of critical acclaim as Laapataa Ladies.

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• The Kerala Story: A controversial 2023 film that highlighted sensitive social issues but was not India's Oscar entry.

• Darlings: A 2022 dark comedy film featuring Alia Bhatt, which gained popularity but was not considered for an Oscar entry.

• Significance of Awards:

• Winning multiple IIFA Awards is a testament to a film's quality, creativity, and impact on audiences.

• Such recognition bolsters the film's legacy and encourages filmmakers to pursue socially relevant themes.

Q85. Answer: (d) Commission for Air Quality Management in National Capital Region and Adjoining Areas (CAQM)

The correct answer is Commission for Air Quality Management in National Capital Region and Adjoining Areas (CAQM).

Key Points

• The Commission for Air Quality Management in National Capital Region and Adjoining Areas (CAQM) invoked Stage-I of the Graded Response Action Plan (GRAP) in May 2025 in response to deteriorating air quality in Delhi NCR.

• GRAP is a set of measures designed to combat air pollution in a graded manner based on the Air Quality Index (AQI) levels, ranging from moderate to severe plus (emergency) conditions.

• The CAQM was established under the Commission for Air Quality Management in National Capital Region and Adjoining Areas Act, 2021, and is responsible for tackling air pollution in Delhi NCR and its adjoining areas.

• The commission is empowered to enforce measures to reduce pollution, coordinate between states, and ensure compliance with pollution control laws.

• Stage-I of GRAP is triggered when the AQI falls into the "poor" category (AQI between 201-300) and includes measures such as banning diesel generator sets, increasing public transport, and ensuring proper waste disposal.

Additional Information

• Graded Response Action Plan (GRAP):

• GRAP was notified in January 2017 by the Ministry of Environment, Forest, and Climate Change (MoEFCC) based on the recommendations of the Environment Pollution (Prevention and Control) Authority (EPCA).

• It is a dynamic plan that mandates specific actions for air pollution control based on the AQI levels in Delhi NCR.

• The measures under GRAP are categorized into four stages: Moderate to Poor, Very Poor, Severe, and Severe Plus or Emergency.

• Examples of measures include banning construction activities, restricting vehicular movement, and shutting down industries during severe or emergency conditions.

• Commission for Air Quality Management (CAQM):

• The CAQM was established in October 2020 to consolidate efforts for tackling air pollution in Delhi NCR.

• It replaced multiple agencies like the Central Pollution Control Board (CPCB) and the Environment Pollution (Prevention and Control) Authority (EPCA) for better coordination and efficiency.

• The commission has the authority to issue directions to state governments, industries, and other stakeholders regarding pollution control measures.

• It also monitors the implementation of GRAP and other pollution control measures in the region.

• Air Quality Index (AQI):

• The AQI is a numerical scale used to measure and communicate air quality levels to the public.

• It categorizes air quality into six levels: Good (0-50), Satisfactory (51-100), Moderate (101-200), Poor (201-300), Very Poor (301-400), and Severe (401-500).

• The AQI is calculated based on the concentration of pollutants such as PM2.5, PM10, NO2, SO2, CO, and Ozone in the air.

• Central Pollution Control Board (CPCB):

• The CPCB is a statutory organization under the Ministry of Environment, Forest, and Climate Change (MoEFCC).

• It was established under the Water (Prevention and Control of Pollution) Act, 1974 and is tasked with promoting cleanliness of streams and wells, air quality improvement, and pollution abatement in the country.

• The CPCB works closely with the CAQM and state pollution control boards to implement pollution control measures.

Important Points

• Delhi NCR Air Pollution:

• The Delhi NCR region frequently experiences severe air pollution, especially during the winter months due to factors such as stubble burning, vehicular emissions, industrial activities, and construction dust.

• In 2022, the AQI in Delhi NCR reached "severe" levels on multiple occasions, prompting emergency measures under GRAP.

• Role of State Governments:

• State governments in Delhi NCR, including Haryana, Uttar Pradesh, Punjab, and Rajasthan, play a crucial role in implementing pollution control measures.

• They coordinate with the CAQM to implement GRAP and other regulatory actions for air quality management.

Q86. Answer: (b) Ten

The correct answer is Ten.

Key Points

• The report on India's Priority Corridors for Zero-Emission Trucking identifies Ten critical highway segments for the adoption of zero-emission trucks (ZETs).

• These corridors were selected based on factors like freight volume, economic importance, and environmental impact.

• The adoption of zero-emission trucks along these corridors is aimed at reducing greenhouse gas emissions and promoting sustainable transport systems in India.

• The identified corridors are part of a larger strategy to transition India's transport and logistics sector towards cleaner energy alternatives.

• This initiative aligns with India's commitment to achieve net-zero carbon emissions by 2070, as outlined at the UN Climate Change Conference (COP26).

Additional Information

• Zero-Emission Trucks (ZETs):

• ZETs are vehicles powered by electricity or hydrogen fuel cells, producing no tailpipe emissions.

• They play a crucial role in reducing air pollution and mitigating the impact of climate change.

• Examples include electric trucks like Tesla Semi and hydrogen-powered trucks from companies like Toyota and Nikola.

• In India, the adoption of ZETs is gaining momentum due to government incentives and advancements in battery technology.

• India's Freight Corridors:

• India's freight corridors are the backbone of its logistics and transport sector, connecting major cities and industrial hubs.

• Examples include the Golden Quadrilateral, which links Delhi, Mumbai, Chennai, and Kolkata, and the Dedicated Freight Corridors (DFCs) under construction.

• The identified ten critical highway segments are likely to include parts of these high-traffic routes, ensuring maximum impact of ZET adoption.

• Environmental Impact of Trucking:

• The transport sector contributes around 13.5% of India's total greenhouse gas emissions, with trucking being a major contributor.

• Transitioning to zero-emission trucks can significantly reduce carbon dioxide (CO_2) emissions and improve air quality, particularly in urban areas.

• Government Initiatives:

• The Indian government has launched several programs, such as the Faster Adoption and Manufacturing of (Hybrid &) Electric Vehicles (FAME) scheme, to promote the use of electric vehicles (EVs), including trucks.

• Policies like the National Electric Mobility Mission Plan (NEMMP) aim to make India a global hub for electric vehicle manufacturing.

• Global Context:

• Several countries, including the US, China, and members of the European Union, are adopting zero-emission trucking technologies to meet their climate goals.

• India's emphasis on zero-emission trucks aligns with global efforts to decarbonize the transport sector and achieve climate resilience.

Important Points

• Key Challenges:

• High initial costs of ZETs compared to diesel trucks.

• Limited charging infrastructure and range anxiety among fleet operators.

• Need for policy support and subsidies to make ZETs economically viable.

• Future Prospects:

• With advances in battery technology and declining costs, the adoption of ZETs is expected to rise significantly in the coming years.

• Collaborations between the public and private sectors can accelerate the development of charging infrastructure and manufacturing capabilities.

• Examples of Success:

• Countries like Norway and the Netherlands have made significant progress in deploying zero-emission trucks through policy incentives and infrastructure development.

• India can learn from these global examples to overcome challenges and achieve its sustainability goals in the transport sector.

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Q87. Answer: (a) To provide a single interface for consumer grievance redressal

The correct answer is To provide a single interface for consumer grievance redressal.

Key Points

• The e-Jagriti platform was launched by the Department of Consumer Affairs, Ministry of Consumer Affairs, Food and Public Distribution, Government of India on 1 January 2025.

• Its primary purpose is to provide a single interface for consumer grievance redressal, enabling consumers to raise complaints and track their resolution status seamlessly.

• This platform is a step toward strengthening consumer rights and protection under the framework of the Consumer Protection Act, 2019.

• The platform integrates with other consumer-centric initiatives such as the National Consumer Helpline (NCH), mediation services, and consumer awareness programs.

• It ensures transparency, accountability, and efficiency in addressing consumer grievances, thereby promoting trust between consumers and service providers.

Additional Information

• Consumer Protection Act, 2019:

• This Act replaced the Consumer Protection Act, 1986, and introduced several provisions to strengthen consumer rights.

• Key features include the establishment of the Central Consumer Protection Authority (CCPA) to address unfair trade practices and misleading advertisements.

• It also includes provisions for e-filing of complaints, mediation, and penalties for false or misleading advertisements.

• National Consumer Helpline (NCH):

• The NCH is a toll-free helpline established to address consumer grievances and provide guidance on consumer rights and responsibilities.

• It works in collaboration with various regulatory bodies and state consumer helplines.

• Digital India Initiative:

• The e-Jagriti platform aligns with the Digital India initiative, which aims to transform India into a digitally empowered society and knowledge economy.

• It leverages digital technology to enhance transparency and accessibility for consumers across the country.

• Consumer Awareness Programs:

• The government conducts regular campaigns to educate consumers about their rights, responsibilities, and the mechanisms available for grievance redressal.

• Examples include the "Jago Grahak Jago" campaign, which emphasizes consumer empowerment and vigilance.

Important Points

• Significance of e-Jagriti:

• It simplifies the process of lodging complaints and tracking their progress, reducing delays in resolution.

• The platform is accessible to consumers across rural and urban areas, ensuring inclusivity.

• It serves as a centralized repository for consumer complaints and their redressal status, enabling better data analysis and policy formulation.

• Other Key Initiatives:

• The Consumer Protection (E-commerce) Rules, 2020 were introduced to regulate e-commerce platforms and protect consumer interests.

• The government has also launched various apps and portals, such as UMANG and CPGRAMS, to facilitate citizen-centric services.

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Q88. Answer: (a) 2000

The correct answer is 2000.

Key Points

• The earlier Bilateral Investment Treaty (BIT) between India and Kyrgyzstan was originally enforced in the year 2000.

• A Bilateral Investment Treaty is a legal agreement between two countries promoting and protecting investments made by each other's investors.

• The BIT between India and Kyrgyzstan aimed to create a favorable environment for investments by ensuring protection against non-commercial risks.

• In 2025, the earlier treaty was replaced with an updated version to align with modern investment frameworks and address changing economic dynamics.

• The treaty provided provisions for dispute resolution mechanisms, including arbitration, ensuring protection for investors.

Additional Information

• Bilateral Investment Treaties (BITs):

• These treaties are signed between two countries to provide reciprocal protections for investors and encourage foreign investments.

• BITs typically ensure non-discrimination, fair treatment, and protection against expropriation of investments.

• The inclusion of provisions for arbitration and dispute resolution mechanisms is a hallmark of BITs.

• India's BIT Framework:

• India has signed numerous BITs with various countries, promoting economic cooperation and foreign direct investments.

• In 2016, India adopted a new model BIT, emphasizing the state's regulatory power while ensuring investor protection.

• The new framework aims to balance economic interests and state sovereignty over policy decisions.

• Kyrgyzstan's Economic Relations with India:

• Kyrgyzstan is an important partner for India in Central Asia, with cooperation in trade, defense, and investments.

• India has supported Kyrgyzstan through initiatives like training programs and joint ventures.

• Replacement of BIT in 2025:

• The replacement of the 2000 BIT in 2025 reflects evolving global investment standards and economic realities.

• It ensures alignment with India's modern investment protection policies and Kyrgyzstan's economic interests.

Important Points

• Key Features of BITs:

• Promote economic cooperation between signatory countries.

• Ensure protection of investors from risks like expropriation or unfair treatment.

• Facilitate dispute resolution through mechanisms such as arbitration.

• Encourage foreign direct investments (FDI) by providing legal guarantees.

• India's BIT Policy Evolution:

• India's new model BIT, adopted in 2016, includes provisions for transparency and regulatory autonomy.

• It excludes clauses like most-favored-nation treatment, focusing on balancing investor rights and state interests.

• Kyrgyzstan's Economic Landscape:

• Kyrgyzstan, a landlocked country in Central Asia, relies heavily on foreign investments for economic growth.

• The country's cooperation with India spans trade, defense, and cultural exchanges.

• Historical Context:

• The original BIT signed in 2000 marked an important step in strengthening India-Kyrgyzstan relations.

• The treaty's replacement in 2025 reflects changes in global investment norms and bilateral priorities.

Q89. Answer: (d) Central University of Hyderabad

The correct answer is Central University of Hyderabad.

Key Points

• The deforestation drive in Kancha Gachibowli involved clearing land near the Central University of Hyderabad, which is a prominent educational institution located in Hyderabad.

• Kancha Gachibowli is an area located in close proximity to the Central University of Hyderabad, which is known for its sprawling green campus and biodiversity.

• The deforestation in this area was reportedly carried out in April 2025, raising concerns about the environmental impact and loss of green cover near the university.

• Such deforestation drives often occur to make way for urban expansion, infrastructure projects, or other developmental activities, but they also lead to debates on balancing development with environmental conservation.

• Among the options provided, Central University of Hyderabad is the only educational institution near Kancha Gachibowli, making it the correct answer.

Additional Information

• Central University of Hyderabad (CUH):

• Established in 1974, the Central University of Hyderabad is one of India’s premier institutions for post-graduate education and research.

• The campus is spread over 2,300 acres and is known for its rich biodiversity, including rare flora and fauna.

• The university is located in Gachibowli, a rapidly developing area in Hyderabad, Telangana.

• Deforestation in Urban Areas:

• Deforestation in urban areas often occurs to make space for infrastructure projects like roads, buildings, and commercial complexes.

• It leads to the loss of green cover, increased air pollution, and reduced biodiversity, impacting the local ecosystem.

• Environmental Concerns:

• The clearing of forests near educational institutions like CUH raises concerns about the loss of greenery and its impact on the quality of life for residents and students.

• It highlights the need for sustainable urban planning that balances development with environmental preservation.

• Kancha Gachibowli:

• Kancha Gachibowli is a locality in Hyderabad that has witnessed rapid urbanization due to its proximity to IT hubs and educational institutions.

• The region is undergoing significant infrastructural changes, often at the cost of environmental degradation.

Important Points

• Urbanization and Environmental Impact:

• Rapid urbanization in areas like Gachibowli has led to increased deforestation, impacting the natural balance and local climate.

• Authorities and policymakers need to focus on sustainable development practices to mitigate such negative impacts.

• Role of Universities in Conservation:

• Institutions like the Central University of Hyderabad can play a pivotal role in raising awareness about environmental conservation and sustainability.

• They can also engage in tree plantation drives and biodiversity conservation initiatives within and around their campuses.

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Q90. Answer: (d) Warangal

The correct answer is Warangal.

Key Points

• The traffic police in Warangal, a city located in the state of Telangana, conducted an awareness campaign in July 2025 to educate motorists on the harmful effects of noise pollution.

• This initiative aimed to sensitize drivers about the importance of reducing unnecessary honking and adhering to traffic rules to minimize noise levels at traffic signals.

• Noise pollution can have adverse effects on human health, including stress, hearing loss, and cardiovascular problems. Campaigns like these play a vital role in promoting healthier urban environments.

• The awareness program was conducted at key traffic junctions in Warangal, where traffic police used banners, public announcements, and other communication tools to reach a wide audience.

• Such campaigns are part of broader efforts by city administrations across India to address environmental concerns in urban areas. These efforts align with the National Green Tribunal's emphasis on controlling noise pollution in cities.

Additional Information

• Noise Pollution:

• Noise pollution refers to unwanted or harmful sounds that disrupt the environment, typically measured in decibels (dB).

• Common sources of noise pollution include vehicle honking, industrial activities, construction work, and loudspeakers.

• According to the World Health Organization (WHO), prolonged exposure to noise levels above 85 dB can cause hearing damage.

• In India, the Noise Pollution (Regulation and Control) Rules, 2000, lay down permissible noise levels for different zones, including residential, commercial, and industrial areas.

• Warangal:

• Warangal is a historic city in the state of Telangana, known for its rich cultural heritage and ancient architecture.

• The city is part of the Warangal Urban and Warangal Rural districts and is one of the state's major urban centers.

• In recent years, Warangal has been part of various smart city initiatives, focusing on urban development and sustainability.

• Health Effects of Noise Pollution:

• Exposure to high noise levels can cause stress, hypertension, sleep disturbances, and hearing impairments.

• Noise pollution is also linked to reduced productivity and impaired cognitive functions in children.

• Efforts to reduce noise pollution, such as awareness campaigns and stricter enforcement of noise regulations, are critical for public health.

• Government Initiatives:

• The Indian government has implemented noise control measures under the Environment Protection Act, 1986, and the Noise Pollution (Regulation and Control) Rules, 2000.

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• Local authorities and traffic police often organize awareness campaigns and enforce penalties for violations such as unnecessary honking.

• Public participation in such initiatives is crucial for their success, as behavior change is key to reducing noise pollution.

Important Points

• Noise Standards in India: Permissible noise levels in residential areas are 55 dB during the day and 45 dB at night. For industrial areas, the limits are 75 dB during the day and 70 dB at night.

• Role of Traffic Police: Traffic police play a crucial role in enforcing noise pollution laws by penalizing offenders and conducting awareness drives.

• Public Awareness: Educating the public about the adverse effects of noise pollution is essential for achieving long-term reductions in urban noise levels.

Q91. Answer: (c) Chennai

The correct answer is Chennai.

Key Points

• Garuda Aerospace, a leading drone manufacturing company in India, inaugurated its new Agri-Drone Indigenization Facility in Chennai on June 14, 2025.

• This facility is dedicated to enhancing the design, development, and manufacturing of agricultural drones, aiming to support the modernization of India's agricultural sector.

• The inauguration was conducted by Kamlesh Paswan, emphasizing the importance of drones in improving agricultural productivity and efficiency.

• The initiative aligns with the government's vision of promoting Atmanirbhar Bharat (self-reliant India) by encouraging the indigenization of drone technology.

• Chennai was chosen as the location for the facility due to its strong industrial base, skilled workforce, and proximity to key agricultural regions in South India.

Additional Information

• Garuda Aerospace:

• Garuda Aerospace is an Indian drone manufacturing company that specializes in creating drones for various applications, including agriculture, surveillance, and disaster management.

• The company has been actively involved in developing agricultural drones to assist farmers in precision farming, crop monitoring, and pesticide spraying.

• Garuda Aerospace has also collaborated with the government to deploy drones for various initiatives, including surveys and disaster relief operations.

• Importance of Agricultural Drones:

• Agricultural drones are used for precision farming, which involves monitoring crop health, mapping fields, and optimizing the use of water and fertilizers.

• They help in reducing the usage of pesticides and fertilizers, thereby promoting sustainable agricultural practices.

• Drones can cover large agricultural areas in a short time, increasing efficiency and reducing the labor-intensive nature of farming.

• Atmanirbhar Bharat:

• The Government of India launched the Atmanirbhar Bharat initiative to promote self-reliance by boosting local manufacturing and reducing dependency on imports.

• Encouraging the indigenization of drone technology is part of this initiative, as drones play a crucial role in modernizing agriculture, security, and other sectors.

• Chennai as a Strategic Location:

• Chennai is known for its strong industrial ecosystem, skilled workforce, and supportive infrastructure for manufacturing activities.

• The city is also strategically located near major agricultural regions, making it an ideal hub for agricultural drone development and deployment.

Important Points

• Potential of Drone Technology in Agriculture:

• The use of drones in agriculture is expected to grow significantly in the coming years, driven by advancements in technology and increasing awareness among farmers.

• India's agricultural sector contributes significantly to the GDP, and the adoption of drones can play a transformative role in improving productivity and sustainability.

• Government Support for Drone Industry:

• The Government of India has introduced several policies and incentives to promote the use of drones, including the Liberalized

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Drone Rules 2021.

• These policies aim to make India a global hub for drone manufacturing and innovation.

Q92. Answer: (c) 2047

The correct answer is 2047.

Key Points

• In July 2025, the Ministry of Rural Development signed a significant partnership with the Life Insurance Corporation of India (LIC) under the Government of India's initiative of "Insurance for All by 2047."

• The year 2047 holds symbolic importance as it marks the centenary of India's Independence, aligning with the long-term vision of achieving universal insurance coverage.

• This initiative is a part of the government's broader mission to ensure financial inclusion and social security for every citizen, especially in rural areas.

• The partnership with LIC, a trusted insurance provider in India, aims to bolster the penetration of insurance schemes in uninsured and underinsured populations.

• This vision aligns with India's larger developmental goals under the framework of Amrit Kaal, which aims to drive sustainable growth and empower citizens by 2047.

Additional Information

• Key Features of the "Insurance for All by 2047" Initiative:

• It focuses on increasing the penetration of life, health, and other insurance products to all socio-economic groups, especially in rural and semi-urban areas.

• The initiative aims to integrate the unorganized sector and provide coverage to vulnerable groups like agricultural workers, daily wage earners, and small entrepreneurs.

• Insurance schemes under this initiative will emphasize affordability, accessibility, and ease of claim settlements.

• Role of LIC:

• LIC, being India's largest life insurance provider, plays a pivotal role in the implementation and management of this initiative.

• As a trusted financial institution, LIC ensures transparency, reliability, and extensive reach, even to the remotest parts of the country.

• LIC will serve as the fund manager for various insurance schemes under this mission.

• Significance of the Year 2047:

• The year marks 100 years of India's Independence and is a milestone for achieving long-term national goals under the "Amrit Kaal" vision.

• It represents the government's vision for a fully developed, self-reliant India with robust social security systems.

• Insurance Penetration in India:

• As of recent reports, India's insurance penetration is around 4.2% of GDP, which is below the global average of 7.3%.

• The "Insurance for All by 2047" initiative aims to bridge this gap by increasing awareness and accessibility to insurance products.

• Amrit Kaal:

• Introduced during the Union Budget 2022-23, Amrit Kaal refers to a 25-year roadmap leading to 2047, focusing on achieving a self-reliant and inclusive India.

• The "Insurance for All by 2047" initiative is a crucial component of this vision, ensuring social security and financial resilience for citizens.

Q93. Answer: (c) Amit Shah

The correct answer is Amit Shah.

Key Points

• Amit Shah, the Union Home Minister of India, chaired the 25th Central Zonal Council meeting held in Varanasi in June 2025.

• The Central Zonal Council comprises states like Madhya Pradesh, Uttar Pradesh, Uttarakhand, and Chhattisgarh.

• The purpose of the Zonal Council meetings is to discuss and resolve inter-state disputes, enhance coordination, and improve policy implementation on critical topics like security, border disputes, infrastructure, and economic development.

• Amit Shah has been actively involved in fostering cooperative federalism through such platforms, ensuring that states and the central government work together on shared objectives.

• Varanasi, being the location for this significant meeting, holds cultural and political importance as it is also the parliamentary constituency of Prime Minister Narendra Modi.

Additional Information

• Central Zonal Council:

• The Central Zonal Council is one of the five Zonal Councils created under the States Reorganisation Act, 1956.

• It aims to promote regional cooperation and address inter-state issues related to development, law and order, and resource sharing.

• The council's composition includes the Chief Ministers of member states, the Union Home Minister as the chairman, and other relevant central and state officials.

• Amit Shah's Role as Union Home Minister:

• As the Union Home Minister, Amit Shah oversees crucial matters like internal security, border management, and state cooperation.

• He has been instrumental in addressing issues like Naxalism, terrorism, and border security while strengthening federal cooperation through platforms like Zonal Councils.

• Varanasi:

• Varanasi is a historic city located in the state of Uttar Pradesh and is considered a cultural and spiritual hub of India.

• It is also the parliamentary constituency of Prime Minister Narendra Modi, adding significance to hosting high-level political meetings.

• Purpose of Zonal Councils:

• The Zonal Councils were established to promote cooperative federalism and provide a platform for states to collaborate with the central government.

• They help in resolving inter-state disputes and improving policy implementation on issues like infrastructure development, education, health, and security.

Important Points

• Zonal Councils Structure:

• The five Zonal Councils include North, South, East, West, and Central.

• Each Zonal Council is chaired by the Union Home Minister, and its meetings are attended by the Chief Ministers and administrators of the member states.

• Key Issues Discussed in Zonal Council Meetings:

• Matters such as border disputes, infrastructure development, internal security, and socio-economic planning are usually discussed.

• Emphasis is placed on enhancing inter-state collaboration and addressing grievances of individual states.

Q94. Answer: (a) Greece

The correct answer is Greece.

Key Points

• On 10 July 2025, the Indian Navy conducted a Passing Exercise (PASSEX) with the Hellenic Navy (Greece) in the Arabian Sea near Mumbai.

• The exercise was aimed at enhancing interoperability, improving maritime cooperation, and strengthening the growing defence relationship between India and Greece.

• The PASSEX included various naval operations such as:

• Communication drills.

• Tactical manoeuvres.

• Replenishment approaches.

• Cross-deck interactions and coordinated maritime operations.

• Such exercises help both navies improve operational coordination and promote security in the Indian Ocean Region (IOR).

• Hence, the correct answer is Option 1 – Greece.

Additional Information

• PASSEX (Passing Exercise):

• A short-duration naval exercise conducted when warships of friendly countries meet at sea.

• It aims to enhance communication, tactical coordination, and mutual understanding between participating navies.

• Hellenic Navy:

• The naval branch of the Hellenic Armed Forces (Greece).

• Arabian Sea:

• An important part of the Indian Ocean, playing a vital role in global maritime trade and regional security.

Important Points

• Exercise: PASSEX (Passing Exercise).

• Date: 10 July 2025.

• Location: Arabian Sea, near Mumbai.

• Participating Navies: Indian Navy and Hellenic Navy (Greece).

• Objective: Enhance interoperability and strengthen maritime cooperation.

Q95. Answer: (a) RESET and Pandit Deendayal Fund

The correct answer is RESET and Pandit Deendayal Fund.

Key Points

• RESET (Retired Sports Excellence and Transition) is a government initiative aimed at providing career transition support, financial aid, and medical benefits to retired athletes who have represented India at various national and international sporting events.

• The scheme focuses on reskilling and upskilling athletes to help them transition into new careers post-retirement. It includes training, education, and job placement services.

• The Pandit Deendayal Fund is another scheme that provides financial assistance to athletes who are in need, especially post-retirement. It is designed to ensure financial security and promote a dignified life for retired sportspersons.

• Both schemes are managed under the Ministry of Youth Affairs and Sports, ensuring proper implementation and support to athletes who have contributed to the country's sporting achievements.

• The beneficiaries of these schemes include athletes who have represented India in disciplines recognized by the National Sports Federations (NSFs) and have retired from active sports participation.

Additional Information

• Khelo India Program:

• The Khelo India Program was introduced by the Government of India to revive the sports culture in the country at the grassroots level.

• Its main aim is to identify and nurture young talent, but it does not focus on providing financial or career transition support to retired athletes.

• The program includes funding for academies, organizing sports events, and promoting fitness among the youth.

• PYKKA (Panchayat Yuva Krida Aur Khel Abhiyan):

• PYKKA was launched to promote sports at the village and block level by providing basic sports infrastructure and equipment.

• Its focus is primarily on rural youth and grassroots-level development rather than retired athletes.

• National Awards and TOPS:

• National Sports Awards such as the Arjuna Award and Rajiv Gandhi Khel Ratna are given to recognize the achievements of athletes. However, these awards are honorary and do not include career transition support.

• TOPS (Target Olympic Podium Scheme) is aimed at supporting elite athletes in their preparation for the Olympics and other international events but does not cater to retired athletes.

• NSFs and SAI (Sports Authority of India):

• The National Sports Federations (NSFs) and the Sports Authority of India (SAI) are responsible for promoting sports and providing training facilities for athletes.

• However, their roles are limited to active athletes and do not include comprehensive career transition or post-retirement benefits for athletes.

Important Points

• RESET and Pandit Deendayal Fund are specifically designed to address the challenges faced by retired athletes, such as financial instability, lack of career opportunities, and health issues.

• These schemes aim to ensure a smooth transition from an athletic career to mainstream professions, thereby enhancing the quality of life for retired sportspersons.

• Financial assistance under the Pandit Deendayal Fund includes provisions for medical expenses, pensions, and other forms of support based on the athlete's needs.

• The Ministry of Youth Affairs and Sports actively monitors the implementation of these schemes to ensure that eligible athletes receive the benefits in a timely and efficient manner.

• Such initiatives highlight the government's commitment to acknowledging and supporting the contributions of athletes to national pride and glory.

Q96. Answer: (a) James Anderson

The correct answer is James Anderson.

Key Points

• James Anderson is England's most successful Test bowler, with a record of 704 Test wickets as of his retirement in April 2025, making him the all-time leading wicket-taker for England in Test cricket.

• He was awarded a knighthood in April 2025 for his exceptional contributions to cricket, recognizing his longevity, skill, and impact on the game.

• Anderson made his Test debut for England in 2003 and became one of the most consistent performers in international cricket, known for his mastery of swing bowling.

• He is the first fast bowler in the history of cricket to surpass 700 Test wickets, a milestone achieved in the twilight years of his career.

• His career spanned over two decades, during which he played a pivotal role in England's success, including their famous Ashes victories and other memorable Test wins.

Additional Information

• James Anderson's Career Highlights:

• Born on July 30, 1982, in Burnley, Lancashire, England.

• Known for his exceptional ability to swing the ball both ways, particularly in English conditions, making him one of the most feared bowlers in Test cricket.

• He has played a total of 179 Test matches, the most by any fast bowler in cricket history.

• Anderson has taken 32 five-wicket hauls and 3 ten-wicket hauls in Test matches.

• Stuart Broad:

• Another legendary English fast bowler, Broad retired in 2023 with over 600 Test wickets, making him the second-highest wicket-taker for England after Anderson.

• Known for his fiery spells, Broad's career also featured memorable performances in the Ashes series.

• Andrew Flintoff:

• Flintoff was a charismatic all-rounder who played for England between 1998 and 2009.

• While he contributed with both bat and ball, he did not achieve the longevity or wicket tally of Anderson and Broad.

• Darren Gough:

• Gough was a prominent England fast bowler in the 1990s and early 2000s, known for his reverse swing and aggressive bowling style.

• He retired with 229 Test wickets, but his career was not as statistically dominant as Anderson's.

Important Points

• Knighthood for Cricketers:

• Knighthood is one of the highest civilian honors in the UK, awarded for exceptional achievements in various fields, including sports.

• Previous cricketers knighted include Sir Ian Botham, Sir Alastair Cook, and Sir Geoffrey Boycott.

• Fast Bowling Records:

• Anderson is the leading wicket-taker among all fast bowlers in Test cricket history, surpassing legends like Glenn McGrath and Courtney Walsh.

• He is fourth on the overall list of wicket-takers, behind spinners like Muttiah Muralitharan, Shane Warne, and Anil Kumble.

Q97. Answer: (b) Healthy beginnings, hopeful futures

The correct answer is Healthy beginnings, hopeful futures.

Key Points

• World Health Day is celebrated annually on April 7 to mark the founding of the World Health Organization (WHO) in 1948.

• The theme for World Health Day 2025 was "Healthy beginnings, hopeful futures," emphasizing the importance of investing in the health and well-being of children and adolescents globally.

• This theme highlights the critical period of childhood and adolescence as the foundation for a healthy and productive adult life.

• Child and adolescent health includes addressing malnutrition, mental health challenges, access to education, and preventive healthcare services.

• The WHO advocated for increased global awareness and policy measures to ensure that every child has access to a healthy start in life, ensuring equity in healthcare for vulnerable populations.

Additional Information

• World Health Day Themes:

• The themes of World Health Day are carefully chosen by WHO to address pressing global health issues. For example:

• 2022: Our Planet, Our Health – Highlighting the impact of environmental challenges on health.

• 2023: Health for All – Focusing on universal healthcare access.

• 2024: Equity in Healthcare – Addressing disparities in healthcare access and outcomes.

• Significance of the 2025 Theme:

• Childhood and adolescence are pivotal stages for physical, emotional, and mental development.

• Investments in child health can break the cycle of poverty and provide a hopeful future for individuals and communities.

• The theme aligns with the Sustainable Development Goals (SDGs), particularly SDG 3 (Good Health and Well-being) and SDG 4 (Quality Education).
• Global Challenges for Children's Health:
• Malnutrition: Affects millions of children globally, leading to stunted growth and developmental delays.
• Access to Healthcare: In many low-income countries, children face barriers to basic immunizations and preventive care.
• Mental Health: Increasing rates of anxiety and depression among adolescents require attention and resources.
• Education and Health Link: Access to education is a critical determinant of long-term health outcomes.
• Past WHO Initiatives for Children:
• Global Vaccine Action Plan: Aims to ensure universal access to immunizations for children.
• Integrated Management of Childhood Illness (IMCI): Focuses on reducing deaths from preventable diseases in children under 5.
• Mental Health Action Plan: Addresses the growing mental health needs of adolescents and young people.

Important Points

• Role of Governments:
• Governments worldwide are encouraged to prioritize child health in their national policies and budgets.
• Examples include school meal programs, vaccination campaigns, and free healthcare for children.
• WHO Recommendations:
• Strengthening primary healthcare systems to ensure accessibility for children and adolescents.
• Investing in health education and awareness campaigns targeting families and communities.
• Global Data on Child Health:
• According to WHO, approximately 45% of child deaths under the age of five are linked to malnutrition.
• Over 260 million children globally are out of school, impacting their long-term health and development.

Q98. Answer: (b) Smriti Mandhana

The correct answer is Smriti Mandhana.

Key Points

• Smriti Mandhana holds the record for the fastest century by an Indian woman cricketer in One Day Internationals (ODIs) as of January 2025.
• She achieved this remarkable feat against New Zealand in a match held on February 7, 2019. Smriti scored her century in just 57 balls, showcasing her extraordinary batting skills.
• This achievement placed her among the elite women cricketers globally, as she became one of the fastest century-makers in the history of women's ODI cricket.
• Smriti Mandhana has consistently been a key player for the Indian Women's Cricket Team and is known for her aggressive batting style and ability to anchor innings effectively.
• Her record-breaking century reflects her ability to adapt to different formats of the game and perform under pressure, solidifying her status as one of the best female cricketers in the world.

Additional Information

• Smriti Mandhana:
• Born on July 18, 1996, in Mumbai, Maharashtra, Smriti Mandhana is one of the most successful women cricketers in India.
• She is a left-handed batter and has been a consistent performer for India in both ODIs and T20Is.
• Smriti was awarded the ICC Women's Cricketer of the Year in both 2018 and 2021.
• She also became the Youngest T20I captain for India in 2019.
• Women's ODI Records:
• The record for the fastest century in women's ODIs globally is held by Deandra Dottin of the West Indies, who scored a century in just 38 balls in a T20I game in 2010.
• Smriti Mandhana's 57-ball century is one of the fastest ODI centuries among Indian players, across both men's and women's cricket.
• Other Options:
• Pratika Rawal: Not a known cricketer in Indian women's cricket. This option is incorrect.
• Deepti Sharma: A talented Indian all-rounder, but she has not achieved a record for the fastest century. This option is incorrect.
• Harmanpreet Kaur: Known for her explosive 171* against Australia in the 2017 World Cup semifinal, but she does not hold the fastest century record. This option is incorrect.
• Women's Cricket in India:

• Women's cricket has been gaining popularity in India, especially after the team's outstanding performance in the 2017 ICC Women's Cricket World Cup.

• Players like Smriti Mandhana, Harmanpreet Kaur, and Mithali Raj have been instrumental in inspiring young girls to take up cricket as a career.

Important Points

• Smriti Mandhana's Achievements:

• Smriti was the first Indian woman to score a double century in a domestic ODI game (2013).

• She was named in the ICC Women's ODI Team of the Year for multiple years, including 2016, 2018, and 2019.

• Growth of Women's Cricket:

• With increased media coverage and sponsorships, women's cricket in India has seen significant growth over the past decade.

• The Women's Premier League (WPL), launched in 2023, has provided a platform for domestic and international players to showcase their talent.

Q99. Answer: (b) 99

The correct answer is 99.

Key Points

• According to the Sustainable Development Report (SDR) 2025, published by the UN Sustainable Development Solutions Network (SDSN), India ranked 99th among 193 UN member countries.

• India improved its position from 109th in SDR 2024 to 99th in SDR 2025, reflecting progress in achieving the Sustainable Development Goals (SDGs).

• India secured an SDG Index Score of 67.0 in the 2025 report.

• The report evaluates countries based on their progress toward achieving the 17 Sustainable Development Goals (SDGs) adopted by the United Nations under the 2030 Agenda for Sustainable Development.

• Hence, the correct answer is Option 2 – 99.

Additional Information

• Sustainable Development Report (SDR):

• Published annually by the UN Sustainable Development Solutions Network (SDSN).

• Measures each country's progress toward achieving the 17 Sustainable Development Goals (SDGs).

• Top-ranked Countries in SDR 2025:

• 1st: Finland.

• Other top-performing countries include Sweden and Denmark.

• Sustainable Development Goals (SDGs):

• Adopted by all UN Member States in 2015.

• Target year for achievement: 2030.

Important Points

• India's Rank (SDR 2025): 99th.

• Total Countries Ranked: 193.

• Publisher: UN Sustainable Development Solutions Network (SDSN).

• India's SDG Index Score (2025): 67.0.

• Top-ranked Country: Finland.

Q100. Answer: (a) GSLV-F15

The correct answer is GSLV-F15.

Key Points

• GSLV-F15 is the 17th flight of India's Geosynchronous Satellite Launch Vehicle (GSLV) and is scheduled for launch in January 2025.

• The GSLV series is developed by the Indian Space Research Organisation (ISRO) for launching satellites into geosynchronous transfer orbits.

• GSLV-F15 uses the Cryogenic Upper Stage (CUS), which significantly enhances its payload capacity for heavier satellites.

• The GSLV series, including GSLV-F15, is part of India's endeavor to achieve self-reliance in satellite launching capabilities for both commercial and scientific missions.

• It is capable of launching satellites weighing up to 5,000 kg into lower Earth orbit and up to 2,500 kg into geostationary orbit.

• The launch aligns with India's goals to establish a strong presence in space exploration, telecommunication, and scientific research.

Additional Information

• Geosynchronous Satellite Launch Vehicle (GSLV):

• The GSLV series is an expendable launch vehicle designed and operated by ISRO.

• It consists of three stages: solid rocket motor (first stage), hypergolic liquid engine (second stage), and cryogenic engine (third stage).

• The cryogenic engine, developed indigenously, is a major technological milestone for India.

• GSLV is primarily used for launching communication satellites into geostationary orbit.

• ISRO’s Role:

• ISRO is India's national space agency, headquartered in Bengaluru.

• It is responsible for executing India’s space missions, including satellite launches, interplanetary missions, and technological developments.

• Key achievements include missions like Chandrayaan, Mangalyaan, and the launch of GSAT series satellites.

• Applications of GSLV Missions:

• Supports telecommunication, broadcasting, and navigation systems through the launch of communication satellites.

• Enables weather forecasting and disaster monitoring with geostationary satellites.

• Contributes to scientific research and interplanetary exploration missions.

• Previous Milestones:

• Earlier GSLV missions successfully launched satellites such as GSAT-7, GSAT-6A, and GSAT-30, showcasing India’s growing expertise in space technology.

• GSLV Mk III, a higher-capacity version, was used for the Chandrayaan-2 mission.

Important Points

• India’s Space Goals: India aims to establish itself as a leader in the global space industry by developing advanced technologies and launching capabilities.

• Commercial Launch Services: GSLV vehicles are also utilized for commercial satellite launches, generating revenue for ISRO.

• Cryogenic Engine: The cryogenic technology is a game-changer, allowing heavier payloads and enhancing the efficiency of India’s launch vehicles.

• Geostationary Orbit: Satellites placed in geostationary orbit appear stationary relative to Earth, making them ideal for communication and weather monitoring.

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