RRB Group D Official Paper (Held On: 19 Dec, 2025 Shift 3) (Previous Year Paper)

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

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GENERAL SCIENCE

Q1. Which metal reacts violently with cold water?

(a) Copper
(b) Magnesium
(c) Sodium
(d) Aluminium

Q2. When salt solution is applied to boiled Rhoeo leaf peels, it fails to show plasmolysis due to:

(a) walls block salts
(b) chlorophyll takes up water
(c) nuclei stop diffusion
(d) dead cells cannot osmoregulate

Q3. Which of the following is correct for concave mirrors?

(a) They are used as rear-view mirrors.
(b) They are used by dentists to see enlarged images of teeth.
(c) They cannot produce magnified images.
(d) They always produce virtual images.

Q4. Which of the following statements about variations is INCORRECT?

(a) Ensures species survival during disasters
(b) Variation makes species prone to extinction.
(c) Variation enables adaptation to changing environments.
(d) Provides resilience against diseases

Q5. Which event does NOT directly occur during photosynthesis in green plants?

(a) Reduction of carbon dioxide to carbohydrates
(b) Conversion of light energy into chemical energy
(c) Absorption of light energy by chlorophyll
(d) Breakdown of carbohydrates to release energy

Q6. Which of the following is a characteristic reaction of saturated hydrocarbons (alkanes)?

(a) Neutralisation
(b) Addition reaction
(c) Substitution reaction
(d) Polymerisation

Q7. What is a decomposition reaction?

(a) A compound breaks down into two or more simpler substances
(b) Two compounds exchange ions
(c) Two or more substances combine to form one product

(d) A single substance is formed from two or more reactants

Q8. A retarding force of 10 N acts on a body. The work done due to this force is -200 J. What will be the magnitude and direction of the displacement of the body under the action of this force?

(a) 20 m; opposite to the direction of the force
(b) 2000 m; in the same direction as the force
(c) 2000 m; opposite to the direction of the force
(d) 20 m; in the same direction as the force

Q9. If the radius of curvature of a convex mirror used for rear-view on an automobile is 4.00 m, what is its focal length?

(a) 2 m
(b) 4 m
(c) 8 m
(d) 1 m

Q10. Which of the following ensures that the DNA amount is NOT doubled in every generation?

(a) Division of neurons
(b) Consistency of DNA in gametes
(c) Reduction of DNA in gametes
(d) Division of body cells

Q11. Which of the following is an allotrope of carbon?

(a) Quartz
(b) Limestone
(c) Diamond
(d) Alum

Q12. What happens to the concentration of a solution if more solute is added to the same amount of solvent?

(a) It becomes a suspension
(b) It becomes more concentrated
(c) It becomes less concentrated
(d) It remains unchanged

Q13. Which practice demonstrates judicious energy use at home?

(a) Keeping all appliances on standby mode
(b) Heating an empty room continuously
(c) Overusing air-conditioners
(d) Using bulbs or fluorescent tubes

Q14. The process by which the developing embryo gets associated with the lining of the uterus is called _____.

(a) fertilisation
(b) embryogenesis
(c) abortion
(d) implantation

Q15. Which of the following is the correct function of the Golgi body in a plant cell?

(a) Providing protection to the cell.
(b) Maintaining the shape of the cell.
(c) Supporting the formation of lysosomes.
(d) Helping in the synthesis of proteins.

Q16. Which of the following best defines the concentration of a solution?

(a) The amount of solute present in a given amount of solution
(b) The amount of solution present in a given amount of solute
(c) The amount of solvent present in a given amount of solution

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(d) The amount of solvent present in a given amount of solute

Q17. Which of the following pairs represent the Isobar?

(a) 40K19 and 40Ar18
(b) 15O8 and 16O8
(c) 15N7 and 16O8
(d) 235U92 and 238U92

Q18. Which of the following is true about infrasonic sound?

(a) Cannot travel in air
(b) Frequency between 20 Hz and 20 kHz
(c) Frequency > 20 kHz
(d) Frequency < 20 Hz

Q19. If you push a stationary wall with 80 N, the wall pushes you back with _____.

(a) 40 N
(b) 80 N
(c) 160 N
(d) 0 N

Q20. A ball is dropped from a height of 10 m from the surface of the earth. What will be the speed with which the ball will strike the ground?

(Take g = 10 m/s²)

(a) 20 m/s
(b) 10√2 m/s
(c) 10 m/s
(d) 200 m/s

Q21. Select the option that is true regarding the following two statements labelled Assertion (A) and Reason (R).

Assertion (A): Insulin helps lower blood glucose levels.

Reason (R): Insulin converts glucose into glycogen for storage in the liver.

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

Q22. Which of the following statements is NOT correct about resistivity?

(a) It changes with temperature.
(b) It is a property of the material.
(c) It depends on the length of the wire.
(d) It is measured in ohm-meter.

Q23. A straight current carrying conductor has a magnetic field (B) associated with it. Which of the following is correct regarding the value of magnetic field (B)?

(i) The magnetic field will increase as we move away from the conductor.

(ii) The magnetic field will decrease as we move away from the conductor.

(iii) The magnetic field will increase when the current flowing through the conductor increases.

(iv) The magnetic field will first decrease when the current flowing through the conductor increases.

(a) Both (i) and (ii)
(b) Both (i) and (iv)
(c) Both (iii) and (iv)
(d) Both (ii) and (iii)

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Q24. Which of the following represents corrosion?

(a) Rusting of iron
(b) Burning of LPG
(c) Boiling of water
(d) Dissolving sugar in water

Q25. If the force on an object is doubled while its mass remains the same, the acceleration:

(a) remains the same
(b) becomes zero
(c) also doubles
(d) halves

MATHEMATICS

Q26. The sum of the present ages of Priya and her younger brother Rohan is 44 years. Four years ago, Priya was twice as old as Rohan was at that time. What is Priya's current age (in years)?

(a) 26
(b) 30
(c) 28
(d) 24

Q27. If $1/(1 - \tan\theta) + 1/(1 + \tan\theta) = 3$, and θ is an acute angle, then find the value of $\text{cosec}\theta$.

(a) $\sqrt{2}$
(b) $1/\sqrt{2}$
(c) 2
(d) 1

Q28. Aarti got a new bed at 50% discount. If Aarti did not get any discount, Aarti would have to pay Rs. 8,453 extra. So how much did Aarti pay for the bed?

(a) Rs. 8,452
(b) Rs. 8,455
(c) Rs. 8,454
(d) Rs. 8,453

Q29. The amount on a sum of Rs. 4,400 at 5% per annum compound interest, compounded annually, in 2 years will be:

(a) Rs. 5,840
(b) Rs. 4,819
(c) Rs. 4,071
(d) Rs. 4,851

Q30. A, B and C can do a work in 17 days, 51 days and 68 days, respectively. They finished together that work and gained Rs. 5,985 in wages. Find B's wage (in Rs.).

(a) 3,780
(b) 2,241
(c) 945
(d) 1,260

Q31. In an election between two candidates, 20% of the voters did not cast their votes, and all the votes cast were valid. The winner secured 70% of the votes cast and won by a margin of 23,200 votes. What was the total number of voters?

(a) 82,500
(b) 72,500
(c) 75,000
(d) 69,500

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Q32. A car travels a distance of 120 km in 2 hours. What is its speed?

(a) 240 km/h
(b) 60 km/h
(c) 120 km/h
(d) 40 km/h

Q33. An article is marked 25% above its cost price. A discount is offered so that a profit of 15% is made. Find the discount percentage.

(a) 5%
(b) 8%
(c) 12%
(d) 10%

Q34. The height of a cylinder is 56 cm. If the circumference of its base is 176 cm, then what is the total surface area (in cm^2) of this cylinder?

Use $\pi = 22/7$

(a) 12,895
(b) 14,784
(c) 13,252
(d) 11,745

Q35. From an interior point of an equilateral triangle, three perpendiculars are drawn to its three sides which are of lengths 12.7 cm, 14.8 cm and 11.5 cm, respectively. Find the area of the equilateral triangle.

(a) $539\sqrt{3}$ cm^2
(b) $526\sqrt{3}$ cm^2
(c) $507\sqrt{3}$ cm^2
(d) $510\sqrt{3}$ cm^2

Q36. Find the value of x in the given expression.

$x/2.1 + 4.2/6.3 = 4$

(a) 8
(b) 7
(c) 9
(d) 6

Q37. A taxi service charges a fixed base fare plus a variable rate per kilometre. For a 10 km trip, Raju paid Rs. 230 and for a 15 km trip, Meena paid Rs. 330. What is the base fare and the per-kilometre charge?

(a) Base fare = Rs. 60; Per-kilometre Charge = Rs. 15
(b) Base fare = Rs. 40; Per-kilometre Charge = Rs. 18
(c) Base fare = Rs. 30; Per-kilometre Charge = Rs. 20
(d) Base fare = Rs. 50; Per-kilometre Charge = Rs. 18

Q38. A, B and C can do a piece of work in 3, 10 and 15 days, respectively. How long (in days) will they take to do twice the same work, working together?

(a) 4
(b) 8
(c) 12
(d) 5

Q39. In a distribution where the empirical relation holds true, if both the mode and the median are 46, find the mean.

(a) 45.5
(b) 46
(c) 45
(d) 46.5

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Q40. Expand: $(3m - 5n)^2$

(a) $9m^2 + 30mn + 25n^2$
(b) $9m^2 - 15mn + 25n^2$
(c) $6m^2 - 30mn + 25n^2$
(d) $9m^2 - 30mn + 25n^2$

Q41. In quadrilateral PQRS, the bisectors of angle R and angle S meet at the point T (inside the quadrilateral) and angle STR = 17°. If the ratio of angle P to angle Q is 8 : 9, then what is the difference between the measures of angle Q and angle P ?

(a) 2°
(b) 5°
(c) 6°
(d) 4°

Q42. Walking at 4/7 of his normal speed from his home, Shahid is 12 minutes late in reaching his office. The usual time taken by him to cover the distance between his home and his office is:

(a) 21 minutes
(b) 16 minutes
(c) 10 minutes
(d) 9 minutes

Q43. If 5^(x - y) = 3125 and 3^(3x + y) = 2187, then the value of 19x - 18y is:

(a) 95
(b) 97
(c) 91
(d) 93

Q44. The price of an article is first increased by 20% and later on, it is decreased by 25% due to reduction in sales. Find the net percentage change in final price of the article.

(a) 10% increase
(b) 9% increase
(c) 10% decrease
(d) 8% increase

Q45. The market prices of jowar to gram are in the ratio 1 : 5, and a family consumes them in the ratio 4 : 3 by quantity. Find the ratio of expenditure on jowar to that on gram.

(a) 4 : 15
(b) 6 : 17
(c) 5 : 16
(d) 3 : 11

Q46. A stationery seller purchases 6 notebooks for Rs. 30 and sells them for Rs. 36. What is his profit percentage?

(a) 20%
(b) 120%
(c) 16.67%
(d) 6%

Q47. Rs. 8,516 is divided among A, B and C in such a way that if Rs. 88, Rs. 31 and Rs. 90 are deducted from their respective shares, they have money in the ratio 18:17:4. Find the difference between B's and C's original shares.

(a) Rs. 2,719
(b) Rs. 2,619
(c) Rs. 2,710
(d) Rs. 2,919

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Q48. The average age of 43 students of a class is 25 years. If the age of the teacher is also included, the average age of the whole group becomes 26 years. The age (in years) of the teacher is:

(a) 69
(b) 68
(c) 66
(d) 71

Q49. A garrison of 1209 men has provisions for 20 days. How long (in days) will the provisions last if the garrison is increased by 403 men?

(a) 25
(b) 15
(c) 10
(d) 35

Q50. The price of fuel decreases by 45%, 15% and 50% in three successive months, but increases by 70% in the fourth month. What is the percentage increase/decrease in the price of fuel in the fourth month as compared to its original price? (Rounded off to two decimal places)

(a) Increases by 66.72%
(b) Decreases by 60.26%
(c) Decreases by 61.32%
(d) Increases by 65.02%

GENERAL INTELLIGENCE & REASONING

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

BZA 30 ZXY 41 XVW 52 VTU 63 ?

(a) TSR 74
(b) TQR 73
(c) TYE 73
(d) TRS 74

Q52. This question is based on the five, three-digit numbers given below.

(Left) 742 912 853 657 154 (Right)

(Example: 697 – First digit = 6, second digit = 9 and third digit = 7)

Note: All operations to be done from left to right.

If all the numbers are arranged in descending order, the position(s) of how many numbers will remain unchanged?

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

Q53. Refer to the given number series and answer the question that follow (all numbers are single digit numbers only).

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

How many prime numbers are there in the number series?

(a) Seven
(b) Thirteen
(c) Nine
(d) Fourteen

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

951 952 954 957 961 ?

(a) 969
(b) 964

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(c) 966
(d) 965

Q55. In the following triad, each group of letters is related to the subsequent one following a certain logic. Select from the given options, the one which follows the same logic.

WEAR - EAWR - RAEW

SINK - INSK - KNIS

(a) BITE - BTIE - ETIB
(b) YOUR - OYUR - ROUY
(c) FANS - ANFS - ANSF
(d) MONK - ONMK - KNOM

Q56. All 63 people are standing in a row, facing the north.

Mr. Zzz is 12^(th) from the left end while Mr. Ggg is 5^(th) from the right end.

How many people are there between Mr. Zzz and Mr. Ggg?

(a) 43
(b) 47
(c) 45
(d) 46

Q57. If 1 is added to each even digit and 2 is subtracted from each odd digit in the number 7593562, which of the following digits will be second from the left in the new number this formed?

(a) 8
(b) 5
(c) 3
(d) 1

Q58. In a traffic jam on the road, Car A is to the right of Car B. Car D is to the left of Car B. Car F is behind Car D. What is the position of Car F with respect to Car B?

(a) West
(b) South-west
(c) South-east
(d) South

Q59. What should come in place of the question mark (?) in the given series based on the English alphabetical order?

NDG, PFI, RHK, TJM, ?

(a) VLO
(b) VKP
(c) VKO
(d) VLP

Q60. Seven boxes D, E, F, U, V, W and X are kept one over the other but not necessarily in the same order. Only five boxes are kept below X. Only three boxes are kept between F and X. V is kept at one of the positions below F. Only E is kept between X and W. D is kept at one of the positions above X. How many boxes are kept between V and D?

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

Q61. Seven people, R, S, T, U, V, W and X, are sitting in a row, facing east. V is seated third from the right end. S is fourth to the left of W. R is seated to the right of V and at one of the ends. Only one person is seated between T and S. U does not sit at any of the extreme ends. Who is seated at the extreme left end?

(a) V
(b) X
(c) W

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(d) T

Q62. BDBF is related to JLJN in a certain way based on the English alphabetical order. In the same way, HJHL is related to PRPT. To which of the given options is RTRV related, following the same logic?

(a) ZBZD
(b) ZBYD
(c) ZCYG
(d) ZAYD

Q63. Ramesh starts from Point A and drives 51 km towards the north. He then takes a right turn, drives 55 km, turns right and drives 54 km. He then takes a right turn and drives 56 km. He takes a final right turn, drives 3 km and stops at Point P. How far (shortest distance) and towards which direction should he drive in order to reach Point A again? (All turns are 90-degree turns only unless specified.)

(a) 4 km to the west
(b) 3 km to the west
(c) 2 km to the east
(d) 1 km to the east

Q64. 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 hydrogen is oxygen.

Some oxygen is nitrogen.

Some nitrogen is carbon.

Conclusions:

(I): Some nitrogen is hydrogen.

(II): No carbon is oxygen.

(a) Neither conclusion (I) nor (II) is true
(b) Only conclusion (I) is true
(c) Both conclusions (I) and (II) are true
(d) Only conclusion (II) is true

Q65. Each of the digits in the number 1368497 is arranged in ascending order from left to right. What will be the sum of the digits that are second from the left and second from the right in the new number thus formed?

(a) 7
(b) 11
(c) 10
(d) 8

Q66. Refer to the given series and answer the question that follows. (All numbers are single digit numbers only.) Counting to be done from left to right only.

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

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

(a) 8
(b) 6
(c) 5
(d) 7

Q67. Select the pair which follows the same pattern as that followed by the two pairs given below. Both pairs follow the same pattern.

CUV : AYT

YCR : WGP

(a) UKN : SOL
(b) KGX : HKU
(c) ANP : VRK
(d) TWG : PYC

Q68. Each of the digits in the number 9214538 is arranged in the ascending order from left to right. The position(s) of how many digits will remain unchanged as compared to that in the original number? 4970

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

Q69. 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 to/subtracting from/multiplying with 13 can be performed. Breaking down 13 into 1 and 3 and then performing mathematical operations on 1 and 3 is not allowed.)

(28, 4, 336)

(25, 5, 375)

(a) (26, 6, 368)
(b) (41, 3, 379)
(c) (32, 3, 288)
(d) (31, 6, 465)

Q70. What should come in place of the question mark (?) in the given series?

28 33 23 28 ? 23

(a) 22
(b) 18
(c) 15
(d) 20

Q71. In a certain code language, ‘give me bike’ is written as ‘bn gt ry’ and ‘who know me’ is coded as ‘ry fh vt’. How is ‘me’ coded in that language?

(a) bn
(b) fh
(c) ry
(d) vt

Q72. A, B, C, D, N, O and P are sitting in a straight line, facing the north.

Only N sits to the left of P. Only four people sit between N and A. Only B sits between O and C, and O is not an immediate neighbour of A.

Who sits at the extreme right of the line?

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

Q73. 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 is the letter-cluster pair that 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) SO−NJ
(b) TP−OK
(c) NJ−HG
(d) JF−EA

Q74. Refer to the following number-symbol series and answer the question that follows. Counting is to be done from left to right only.

(Left) $ # # £ 9 % £ 7 * & € 1 3 4 5 6 4 9 € 2 5 & (Right)

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

(a) 2
(b) 5
(c) 6
(d) 4

Q75. What should come in place of the question mark (?) in the given series?

249 232 215 198 181 ?

(a) 166
(b) 170
(c) 168
(d) 164

Q76. Read the given statements and conclusions carefully. Assuming that the information given in the statements is true, even if it appears to be at variance with commonly known facts, decide which of the given conclusions logically follow(s) from the statements.

Statements:

Some houses are kites.

All mangoes are houses.

All flowers are kites.

Conclusions:

(I) Some houses are flowers.

(II) No flowers are mangoes.

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

Q77. 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) QPT
(b) ORN
(c) KNJ
(d) FIE

Q78. Six people, A, B, C, D, E and F, are sitting in a row, facing north. A sits to the immediate right of E. B sits fourth to the left of E. Only one person sits between B and F. C sits to the immediate left of F. D sits second to the left of A. Three of the following four are alike in a certain way based on the given arrangement and thus form a group. Which is the one that does not belong to that group?

(a) CF
(b) FD
(c) DE
(d) BA

Q79. In a certain code language, ‘bring the cup’ is coded as ‘bz rs tq’ and ‘cup on the’ is coded as ‘rs pl tq’. How is ‘on’ coded in that language?

(a) bz
(b) tq
(c) rs

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(d) pl

Q80. In a certain code language,

‘A + B’ means ‘A is the father of B’,

‘A – B’ means ‘A is the husband of B’,

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

‘A ÷ B’ means ‘A is the mother of B’.

How is F related to K if ‘F × G + H – I ÷ K’?

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

GENERAL AWARENESS AND CURRENT AFFAIRS

Q81. Which of the following Constitution Amendment Bills was introduced in the Lok Sabha in August 2025?

(a) 129th Amendment Bill
(b) 131st Amendment Bill
(c) 130th Amendment Bill
(d) 133rd Amendment Bill

Q82. Who became the first Indian chess player to be ranked No.1 in the live FIDE rankings in 2025?

(a) R Praggnanandhaa
(b) D Gukesh
(c) Viswanathan Anand
(d) Arjun Erigaisi

Q83. Whose statue was unveiled at Raj Bhavan, Goa, by the Vice-President of India and is known as the 'Father of Medicine' in ancient Indian history?

(a) Patanjali
(b) Dhanvantari
(c) Sushruta
(d) Charaka

Q84. What was India’s unemployment rate in May 2025, as per the Periodic Labour Force Survey (PLFS)?

(a) 4.8%
(b) 5.1%
(c) 6.2%
(d) 5.6%

Q85. Which Pakistani javelin thrower received the 'Best Asian Athlete' title in May 2025?

(a) Muhammad Illihas
(b) Arshad Nadeem
(c) Kareem Ali Kamran
(d) Muhammad Ali

Q86. As announced in June 2025, which of the following banks approved $109.97 million loan to boost advanced skills and employability in Gujarat?

(a) Reserve Bank of India
(b) World Bank
(c) Asian Development Bank
(d) State Bank of India

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Q87. Who inaugurated the Chief Minister's Mini Sports Stadium in Madurai district in March 2025?

(a) P Moorthy
(b) Anbil Mahesh
(c) Udhayanidhi Stalin
(d) Edappadi K Palaniswam

Q88. Which public sector company secured a Rs. 511 crore Transfer of Technology (ToT) deal from ISRO in 2025 to manufacture and commercialise Small Satellite Launch Vehicles (SSLVs)?

(a) Bharat Electronics Limited
(b) Indian SpaceTech Corporation
(c) Hindustan Aeronautics Limited
(d) Larsen & Toubro

Q89. What is the name of the ChatGPT-style AI service set to be launched by Reliance Industries?

(a) Hanooman
(b) ChatGPT-style
(c) Chat Reliance
(d) G P Style

Q90. According to the 2025 Global Hunger Index report, what is India’s rank among the assessed countries?

(a) 98th
(b) 102nd
(c) 110th
(d) 95th

Q91. Which other Bill related to Waqf matters also received Presidential assent in 2025?

(a) Mussalman Wakf (Repeal) Bill
(b) Waqf Tribunal Establishment Bill
(c) Muslim Property Regulation Bill
(d) Islamic Trusts Reform Bill

Q92. What is the name of the new programme launched by the National Commission for Women (NCW) in May 2025 for college students to promote gender sensitivity, raise awareness on the prevention of sexual harassment and address cyber crimes impacting students?

(a) Yuva Saksham Initiative
(b) Campus Calling Abhiyaan
(c) Campus Ambassadors Programme
(d) Gender Sensitization Scholars

Q93. Indian Conservation Conference–2025, highlighting traditional knowledge and scientific approaches, took place in which month of 2025?

(a) June
(b) April
(c) March
(d) September

Q94. The country's first earthquake early warning mobile application 'Bhookamp' has been developed in which of the following IITs?

(a) IIT Kanpur
(b) IIT Roorkee
(c) IIT Delhi
(d) IIT Indore

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Q95. At the Panorama International Literature Festival Awards, 2025, which young Indian received the Serena Memorial Child Prodigy Award, 2025?

(a) Nairithi Konduru
(b) Vinita Agrawal
(c) Karnav Rastogi
(d) Salman Lakda

Q96. Which of the following Bills, presented by the Union Home Minister and Minister of Cooperation on 20 August 2025, prohibits individuals holding key constitutional offices from administering the government while in jail?

(a) Constitution (One Hundred and Twenty-Ninth Amendment) Bill, 2025
(b) Constitution (One Hundred and Twenty-Seventh Amendment) Bill, 2025
(c) Constitution (One Hundred and Thirtieth Amendment) Bill, 2025
(d) Constitution (One Hundred and Twenty-Eighth Amendment) Bill, 2025

Q97. In January 2025, the Reserve Bank of India removed supervisory restrictions on which of the following Non-Banking Financial Companies (NBFCs)?

(a) GoCapital Finance
(b) AP Rural Bank
(c) Arohan Financial Services
(d) Family Home Finance

Q98. Which day is recognised as International Youth Day in 2025?

(a) August 9
(b) September 21
(c) August 12
(d) July 18

Q99. In which Union Territories will the 5^(th) edition of Khelo India Winter Games 2025 be held?

(a) Himachal Pradesh and Uttarakhand
(b) Jammu & Kashmir and Ladakh
(c) Sikkim and Arunachal Pradesh
(d) Punjab and Haryana

Q100. The Environment Audit Rules, 2025, were introduced by which ministry in India?

(a) Ministry of Commerce & Industry
(b) Ministry of Environment, Forest and Climate Change
(c) Ministry of Corporate Affairs
(d) Ministry of Earth Sciences

ANSWER KEY

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

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SOLUTIONS

Q1. Answer: (c) Sodium

The correct answer is Sodium.

Key Points

• Sodium is a highly reactive metal belonging to Group 1 (alkali metals) of the Periodic Table with an atomic number of 11.

• It reacts violently and explosively with cold water to produce sodium hydroxide and hydrogen gas. The reaction is represented as $2Na + 2H_2O \rightarrow 2NaOH + H_2$.

• The reaction is extremely exothermic, meaning it releases a significant amount of heat. This heat is often sufficient to ignite the hydrogen gas produced, leading to a visible flame or explosion. Hence, the statement regarding sodium reacting violently with cold water is correct.

• Due to its high reactivity with both oxygen and moisture (water vapor) in the air, sodium is always stored under kerosene oil to prevent accidental reactions.

• Potassium is another metal that reacts even more violently than sodium with cold water, as reactivity increases down the group in the periodic table.

Additional Information

• Magnesium (Mg):

• Magnesium has the atomic number 12 and belongs to Group 2 (alkaline earth metals).

• It does not react with cold water. However, it reacts slowly with hot water and more vigorously with steam to form magnesium hydroxide and hydrogen. Hence, the statement that magnesium reacts violently with cold water is incorrect.

• Aluminium (Al):

• Aluminium is a metal in Group 13 with the atomic number 13.

• It does not react with cold or hot water under normal conditions due to the formation of a tough, protective oxide layer on its surface. It only reacts with steam at high temperatures. Hence, the statement regarding aluminium is incorrect.

• Copper (Cu):

• Copper is a transition metal with the atomic number 29.

• It is placed very low in the reactivity series, even below hydrogen. Consequently, it does not react with water or steam at any temperature. Hence, the statement regarding copper is incorrect.

• Reactivity Series:

• The reactivity series is a list of metals arranged in the order of their decreasing chemical reactivity.

• Metals like Potassium, Sodium, Lithium, and Calcium are at the top and can react with cold water. Metals like Gold, Silver, and Platinum are at the bottom and are highly unreactive.

Important Points

• Chemical Hazards: Handling Sodium requires strict safety protocols, including the use of forceps and protective gear, as skin contact can cause severe chemical burns due to the reaction with moisture on the skin.

• Density: Sodium is one of the few metals that is less dense than water (density approx 0.97 g/cm3). Because of this, it floats on the surface of the water while it reacts violently, moving around rapidly as the hydrogen gas is evolved.

• Identification: When sodium reacts with water, the resulting solution of sodium hydroxide is a strong base, which can be identified by turning red litmus paper blue or turning phenolphthalein indicator pink.

• Year of Discovery: Sodium was first isolated in 1807 by Sir Humphry Davy through the electrolysis of caustic soda.

Q2. Answer: (d) dead cells cannot osmoregulate

The correct answer is dead cells cannot osmoregulate.

Key Points

• Plasmolysis is a biological process that occurs in living plant cells when they are placed in a hypertonic solution (a solution with a higher solute concentration than the cell sap). During this process, water moves out of the cell through osmosis, causing the protoplasm to shrink away from the cell wall.

• When Rhoeo leaf peels are boiled, the high temperature causes the denaturation of proteins and destroys the plasma membrane. Boiling effectively kills the cells, leading to the loss of their selective permeability.

• The process of osmosis and osmoregulation requires a functional, living semi-permeable membrane. Since boiling renders the cells dead, the membrane can no longer regulate the movement of water or solutes. Hence, the statement that dead cells cannot osmoregulate is correct.

• In dead cells, the physical and chemical barriers that facilitate exosmosis are compromised. Therefore, even when a concentrated salt solution is applied, the characteristic shrinkage of the cytoplasm (plasmolysis) is not observed because the biological machinery required for osmotic movement is non-functional.

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• The cell wall of a plant cell is fully permeable to water and dissolved substances; it is the plasma membrane that acts as the regulatory barrier. In boiled leaves, the plasma membrane is ruptured, allowing substances to move freely without osmotic control.

Additional Information

• Rhoeo discolor (Tradescantia spathacea):

• This plant is widely used in botany experiments because its lower epidermal cells contain anthocyanin, a purple-colored pigment located in the vacuoles.

• The presence of this pigment makes the protoplast easily visible under a microscope, allowing students to clearly observe the stages of plasmolysis and deplasmolysis.

• Stages of Plasmolysis:

• Limiting Plasmolysis: The initial stage where the osmotic pressure of the cell equals the external solution, and the turgor pressure becomes zero.

• Incipient Plasmolysis: The stage where the protoplast begins to pull away from the cell wall at the corners.

• Evident Plasmolysis: The final stage where the cytoplasm is completely detached from the cell wall and assumes a spherical or irregular shape in the center.

• Deplasmolysis:

• If a plasmolyzed cell is placed in a hypotonic solution (like distilled water), water enters the cell through endosmosis.

• The protoplast swells and returns to its original position against the cell wall. Like plasmolysis, this process can only occur in living cells.

• Turgor Pressure:

• In a hypotonic environment, water enters the plant cell, creating turgor pressure against the rigid cell wall. This pressure is essential for maintaining the structural integrity and upright posture of non-woody plants.

Important Points

• Permeability: It is important to distinguish that the cell wall is completely permeable (allows everything to pass), whereas the plasma membrane is selectively permeable (allows only specific molecules like water to pass freely).

• Osmoregulation in Plants: It is the mechanism by which plants maintain the water potential and solute concentration within their cells. This is a metabolic process that ceases immediately upon the death of the cell.

• Hypertonic vs. Hypotonic: A hypertonic solution has a lower water potential than the cell, leading to water loss, while a hypotonic solution has a higher water potential, leading to water gain.

Q3. Answer: (b) They are used by dentists to see enlarged images of teeth.

p data-end="57" data-start="0">The correct answer is They are used by dentists to see enlarged images of teeth.

Key Points

• Concave mirrors are widely used by dentists to see large images of the teeth of patients. When the tooth is placed between the focus (F) and the pole (P) of the mirror, it produces an enlarged, virtual, and upright image. Hence, statement 2 is correct.

• Rear-view mirrors in vehicles are generally convex mirrors because they give an erect, though diminished, image and provide a wider field of view to the driver. Hence, statement 1 is incorrect.

• Concave mirrors are capable of producing magnified images. For example, when an object is placed between the center of curvature (C) and the principal focus (F), the resulting image is magnified and real. Hence, statement 3 is incorrect.

• A concave mirror does not always produce virtual images; in fact, it produces real and inverted images for most positions of the object (at infinity, beyond C, at C, and between C and F). It only produces a virtual image when the object is placed between the focus and the mirror. Hence, statement 4 is incorrect.

• Hence, the correct answer is They are used by dentists to see enlarged images of teeth.

Additional Information

• Definition and Nature:

• A concave mirror is a spherical mirror whose reflecting surface is curved inwards, facing the center of the sphere. It is also known as a converging mirror because it converges light rays that strike its surface.

• The focal length of a concave mirror is considered negative according to the Cartesian sign convention.

• Applications of Concave Mirrors:

• Shaving Mirrors: They are used to see a larger image of the face for a better shave.

• Torches and Headlights: Concave mirrors are used in search-lights and vehicle headlights to get powerful parallel beams of light by placing the bulb at the focus.

• Solar Furnaces: Large concave mirrors are used to concentrate sunlight to produce heat in solar furnaces.

• Image Formation Characteristics:

• The nature, position, and size of the image formed by a concave mirror depend on the distance of the object from the pole.

• If the object is at the Center of Curvature (C), the image is real, inverted, and the same size as the object.

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• If the object is at infinity, the image is formed at the focus (F) and is highly diminished.

Important Points

• Comparison with Convex Mirrors:

• Unlike concave mirrors, convex mirrors (diverging mirrors) always produce virtual, erect, and diminished images regardless of the object's distance.

• This property makes convex mirrors ideal for blind turns on roads and shop security mirrors.

• Mirror Formula and Magnification:

• The Mirror Formula is given by 1/f = 1/v + 1/u, where f is focal length, v is image distance, and u is object distance.

• Linear Magnification (m) is the ratio of the height of the image to the height of the object, also expressed as m = -v/u. For a concave mirror, magnification can be less than 1, equal to 1, or greater than 1.

Q4. Answer: (b) Variation makes species prone to extinction.

The correct answer is Variation makes species prone to extinction.

Key Points

• Variation refers to the differences in DNA sequences and physical traits among individuals within a population or species. These differences are the primary drivers of evolution and biodiversity.

• Variation ensures species survival during disasters: In a changing environment or during natural calamities, individuals with specific variations may have a better chance of survival compared to others. For example, in a bacterial population, some might be resistant to heat; during a sudden temperature increase, only these variants survive. Hence, statement 1 is correct.

• Variation makes species prone to extinction: This is incorrect. In reality, a lack of variation (genetic uniformity) makes a species more vulnerable to extinction. Higher genetic diversity provides a "buffer" against environmental changes, whereas low variation means the entire population could be wiped out by a single event. Hence, statement 2 is incorrect.

• Variation enables adaptation to changing environments: Through the process of Natural Selection, favorable variations that help an organism survive and reproduce in its current environment are passed on to the next generation. This is the basis of adaptation. Hence, statement 3 is correct.

• Provides resilience against diseases: Genetic variation ensures that not all individuals are equally susceptible to the same pathogens. If a new virus or bacteria attacks a population, some individuals may possess a natural immunity due to their unique genetic makeup. Hence, statement 4 is correct.

• Hence, the incorrect statement (and thus the correct answer) is "Variation makes species prone to extinction".

Additional Information

• Sources of Variation:

• Mutation: A random change in the DNA sequence which can create new alleles.

• Recombination: During Meiosis (cell division), genes are shuffled between chromosomes, leading to new combinations of traits in offspring.

• Sexual Reproduction: The combining of genetic material from two different parents significantly increases the genetic pool of the population.

• Importance in Evolution:

• Charles Darwin, in his book "On the Origin of Species" (1859), highlighted that variation is the raw material upon which natural selection acts.

• Without variation, there would be no speciation (the formation of new and distinct species).

• Types of Variation:

• Continuous Variation: Traits like height or skin color that show a range of small differences.

• Discontinuous Variation: Traits like blood groups or the ability to roll the tongue, which fall into distinct categories with no intermediates.

Important Points

• DNA Copying: Variation often arises during DNA replication before cell division. While the process is highly accurate, occasional "errors" or biochemical inaccuracies occur, leading to variations in the progeny.

• Survival of the Fittest: This concept, coined by Herbert Spencer and utilized by Darwin, explains that individuals with the most useful variations for their specific environment are the ones most likely to survive and reproduce.

• Environmental Factors: While many variations are heritable (passed via genes), some are acquired during an organism's lifetime due to environmental influences (e.g., muscle building or scarring) and are generally not passed to the next generation.

• Population Stability: Variation helps maintain the stability of an ecosystem. A diverse range of species and genetic traits within those species ensures that the ecosystem can recover from stresses such as climate change or habitat loss.

Q5. Answer: (d) Breakdown of carbohydrates to release energy

The correct answer is Breakdown of carbohydrates to release energy.

Key Points

• Photosynthesis is a complex anabolic process by which green plants and certain other organisms transform light energy into chemical energy.

• Absorption of light energy by chlorophyll: This is the primary step where chlorophyll pigments, located in the chloroplasts, capture photons from sunlight. Hence, statement 3 is a direct event that occurs during photosynthesis.

• Conversion of light energy into chemical energy: During the light-dependent phase, absorbed solar energy is converted into ATP (Adenosine Triphosphate) and NADPH. This phase also involves the photolysis of water, where water molecules are split into hydrogen and oxygen. Hence, statement 2 is a direct event that occurs during photosynthesis.

• Reduction of carbon dioxide to carbohydrates: This occurs during the Calvin Cycle (light-independent reaction) in the stroma of the chloroplast. The energy from ATP and NADPH is used to fix CO_2 into glucose. Hence, statement 1 is a direct event that occurs during photosynthesis.

• Breakdown of carbohydrates to release energy: This process is known as cellular respiration. It is a catabolic process that takes place in the mitochondria to provide energy for the cell's metabolic activities. While plants do respire, this specific action is the functional opposite of photosynthesis. Hence, statement 4 does NOT occur during the process of photosynthesis.

Additional Information

• Site of Photosynthesis:

• Photosynthesis takes place in specialized organelles called chloroplasts. These organelles contain a green pigment called chlorophyll.

• The grana (stacks of thylakoids) are the site for light reactions, where light is trapped.

• The stroma is the site for dark reactions, where the chemical synthesis of carbohydrates occurs.

• Chemical Equation:

• The overall reaction is represented as: $6CO_2 + 6H_2O + \text{Light Energy} \rightarrow C_6H_{12}O_6 + 6O_2$.

• This equation shows that carbon dioxide and water are the raw materials used to produce glucose and oxygen as a byproduct.

• Factors Influencing Photosynthesis:

• Light Intensity: Increased light typically increases the rate of photosynthesis until a saturation point is reached.

• Carbon Dioxide Concentration: As a primary reactant, higher CO_2 levels can increase the rate of sugar production.

• Temperature: Since the process involves enzymes (like RuBisCO), it is sensitive to temperature changes, with an optimum range usually between 25°C to 35°C.

Important Points

• Autotrophs: Green plants are considered autotrophs because they can synthesize their own food using inorganic substances and solar energy.

• Stomata: These are tiny pores found mainly on the epidermis of leaves. They facilitate the exchange of gases, allowing CO_2 to enter and O_2 to exit the plant body.

• Product Storage: The glucose produced during photosynthesis is often converted into starch for long-term storage in different parts of the plant, such as roots, tubers, and seeds.

• Energy Currency: While ATP is produced during the light reaction of photosynthesis, it is immediately consumed in the dark reaction to build carbohydrates. The ATP used for general cellular work in plants is actually generated through respiration.

Q6. Answer: (c) Substitution reaction

The correct answer is Substitution reaction.

Key Points

• Saturated hydrocarbons, also known as alkanes, are organic compounds consisting entirely of single covalent bonds between carbon atoms. Their general chemical formula is C_nH_{2n+2}.

• Because all the valencies of carbon atoms are fully satisfied by single bonds, alkanes are relatively unreactive under normal conditions. They do not have double or triple bonds to "open up" for new atoms.

• The characteristic reaction of alkanes is the Substitution reaction. In this process, one or more hydrogen atoms of the hydrocarbon are replaced by other atoms or groups of atoms, such as halogens. Hence, option 3 is correct.

• A classic example is the chlorination of methane. In the presence of ultraviolet (UV) light or diffused sunlight, a chlorine atom replaces a hydrogen atom in Methane (CH_4) to form Chloromethane (CH_3Cl) and Hydrogen Chloride (HCl).

• This reaction can continue until all the hydrogen atoms in the alkane are substituted. For methane, the sequence ends with Tetrachloromethane (CCl_4).

Additional Information

• Addition Reaction:

• This reaction is characteristic of unsaturated hydrocarbons like alkenes (double bonds) and alkynes (triple bonds).

• In an addition reaction, molecules like Hydrogen (H2) or Bromine (Br2) are added across the multiple bonds to turn them into saturated compounds. Hence, option 2 is incorrect for alkanes.

• Neutralisation:

• This is a chemical reaction between an acid and a base to produce salt and water.

• Hydrocarbons are generally neutral and do not participate in standard acid-base neutralisation. Hence, option 1 is incorrect.

• Polymerisation:

• This involves the combination of many small molecules called monomers to form a large molecule called a polymer.

• While unsaturated hydrocarbons like ethene undergo polymerisation to form polyethene, saturated alkanes do not typically exhibit this as a characteristic reaction. Hence, option 4 is incorrect.

• Combustion:

• Alkanes react readily with Oxygen (O2) upon heating. Complete combustion produces Carbon dioxide (CO2), Water (H2O), and a large amount of heat and light, making them excellent fuels.

Important Points

• Paraffins: Alkanes were traditionally called paraffins (from Latin parum = little, affinis = affinity), highlighting their low chemical reactivity toward common reagents like acids, bases, or oxidising agents at room temperature.

• Homologous Series: Alkanes form a series where each member differs from the next by a -CH2- unit and has a mass difference of 14 units.

• Isomerism: Alkanes with four or more carbon atoms (starting from Butane) can show structural isomerism, where they have the same molecular formula but different arrangements of atoms.

• Physical State: At room temperature, the first four alkanes (Methane, Ethane, Propane, and Butane) are gases, while those from C5 to C17 are liquids, and higher alkanes are solids.

Q7. Answer: (a) A compound breaks down into two or more simpler substances

The correct answer is A compound breaks down into two or more simpler substances.

Key Points

• A Decomposition reaction is a fundamental type of chemical process where a single reactant breaks down into two or more simpler products. This is the exact definition provided in the first option. Hence, statement 1 is correct.

• In these reactions, the chemical bonds in the reactant molecule are broken, requiring an input of energy. The general chemical equation for this process can be represented as AB → A + B.

• Statement 2 describes a Double Displacement reaction, where two compounds exchange ions to form two new compounds, often resulting in a precipitate or water. Hence, statement 2 is incorrect.

• Statement 3 and Statement 4 describe a Combination reaction (also known as a synthesis reaction), where two or more substances combine to form a single product. This is the opposite of decomposition. Hence, statement 3 and 4 are incorrect.

• A classic example of decomposition is the thermal decomposition of Calcium Carbonate (CaCO3), which, when heated, yields Calcium Oxide (CaO) and Carbon Dioxide (CO2).

Additional Information

• Types of Decomposition Reactions:

• Thermal Decomposition: This occurs when heat energy is used to break down a substance. For instance, heating Lead Nitrate crystals leads to the emission of brown fumes of Nitrogen Dioxide and the formation of Lead Oxide.

• Electrolytic Decomposition (Electrolysis): This process uses electrical energy to drive the decomposition. A primary example is the electrolysis of water, where water (H2O) decomposes into Hydrogen gas and Oxygen gas when an electric current is passed through it.

• Photolytic Decomposition (Photolysis): This breakdown is triggered by light energy (photons). For example, Silver Chloride (AgCl) turns grey in sunlight because it decomposes into Silver metal and Chlorine gas.

• Combination Reactions:

• These are reactions where a single substance is formed from multiple reactants. A common example is the burning of magnesium ribbon in air to form Magnesium Oxide or the burning of coal (Carbon + Oxygen → Carbon Dioxide).

• Double Displacement Reactions:

• These involve the exchange of ions between reactants. A well-known example is the reaction between Sodium Sulphate and Barium Chloride, which produces a white precipitate of Barium Sulphate and Sodium Chloride.

Important Points

• Energy Nature: Most decomposition reactions are endothermic in nature because they involve the absorption of energy (heat, light, or electricity) to break existing chemical bonds.

• Biological Application: Decomposition reactions are vital in the human body. During digestion, complex food molecules like

starch and proteins undergo decomposition reactions to break down into simpler substances like glucose and amino acids, which the body can then absorb.

• Industrial Use: Decomposition of Calcium Carbonate is a key step in the manufacturing of cement. The Calcium Oxide (Quick Lime) produced is a vital raw material in various industries.

• Photography: The photolytic decomposition of Silver Bromide (AgBr) was traditionally used in Black and White Photography to capture images on film.

Q8. Answer: (a) 20 m; opposite to the direction of the force

The correct answer is 20 m; opposite to the direction of the force.

Key Points

• Work Done is defined as the product of the magnitude of the force acting on a body and the displacement caused by that force in the direction of the force. The formula is $W = F \times d \times \cos(\theta)$, where θ is the angle between the force and displacement.

• A retarding force is a force that acts in the opposite direction to the motion (displacement) of an object, such as friction or brakes applied to a vehicle. Because the force and displacement are in opposite directions, the angle θ is 180 degrees.

• In this problem, the force (F) is 10 N and the work done (W) is -200 J. The negative sign of the work done mathematically confirms that the force and displacement are in opposite directions, as $\cos(180°) = -1$.

• To find the magnitude of displacement (d), we rearrange the formula: $-200 = 10 \times d \times (-1)$. This simplifies to $-200 = -10d$. By dividing both sides by -10, we get d = 20 meters.

• The magnitude of the displacement is 20 m, and since it is a retarding force causing negative work, the direction of displacement must be opposite to the direction of the force.

Additional Information

• Negative Work: This occurs when the force and displacement are in opposite directions ($90° < \theta \leq 180°$). A classic example is the work done by friction on a sliding box or the work done by gravity on an object thrown upwards.

• Positive Work: This occurs when the force and displacement are in the same direction ($0° \leq \theta < 90°$). For instance, when a person pulls a trolley forward, the work done is positive because the force helps the motion.

• Zero Work: Work is zero when the force is perpendicular to the displacement ($\theta = 90°$) or if there is no displacement (d = 0). An example is a person standing still holding a heavy suitcase; no work is done on the suitcase because there is no displacement.

• Units of Measurement: In the SI system (International System of Units), Work is measured in Joules (J), Force in Newtons (N), and Displacement in meters (m). One Joule is equal to the work done by a force of one Newton moving an object one meter.

• Nature of Force: A retarding force results in negative acceleration (deceleration). According to Newton's Second Law (F = ma), the direction of acceleration is always the same as the direction of the net force. Therefore, if the force is retarding, the acceleration is in the opposite direction of the initial velocity.

Q9. Answer: (a) 2 m

The correct answer is 2 m.

Key Points

• The relationship between the focal length (f) and the radius of curvature (R) of a spherical mirror (both convex and concave) is given by the formula $f = R / 2$.

• In this specific problem, the radius of curvature (R) of the convex mirror is given as 4.00 m.

• By substituting the value into the formula: $f = 4.00 \text{ m} / 2 = 2.00 \text{ m}$. Hence, the focal length of the mirror is 2 m.

• For a convex mirror, the principal focus (F) and the center of curvature (C) lie behind the mirror; therefore, according to the sign convention, the focal length is taken as positive.

• The principal focus of a spherical mirror is a point on the principal axis where light rays traveling parallel to the axis appear to diverge from (in the case of a convex mirror) or actually meet (in the case of a concave mirror).

Additional Information

• Convex Mirror Characteristics:

• A convex mirror is also known as a diverging mirror because it reflects parallel light rays away from each other.

• It always forms a virtual, erect, and diminished (smaller than the object) image, regardless of the distance of the object from the mirror.

• The focal length of a convex mirror is always positive according to the New Cartesian Sign Convention.

• Uses in Automobiles:

• Convex mirrors are preferred as rear-view mirrors in vehicles because they provide a much wider field of view compared to plane mirrors.

• Since the images formed are diminished, they allow the driver to see a larger area of traffic behind the vehicle.

• The fact that the image is always erect (upright) is critical for safety while driving.

• Comparison with Concave Mirrors:

• A concave mirror (converging mirror) has a negative focal length because its focus is in front of the reflecting surface.

• Unlike convex mirrors, concave mirrors can produce both real and virtual images depending on the object's position.

Important Points

• New Cartesian Sign Convention:

• The pole (P) of the mirror is taken as the origin.

• Objects are always placed to the left of the mirror, meaning light travels from left to right.

• Distances measured in the direction of incident light (to the right of the pole) are positive.

• Distances measured against the direction of incident light (to the left of the pole) are negative.

• Mirror Formula and Magnification:

• The relationship between object distance (u), image distance (v), and focal length (f) is $1/f = 1/v + 1/u$.

• Magnification (m) is the ratio of the height of the image to the height of the object, expressed as $m = h'/h = -v/u$.

• For a convex mirror, the magnification m is always less than 1 and positive.

• Center of Curvature (C): This is the center of the hollow glass sphere of which the mirror is a part. The distance PC is the radius of curvature (R), which is exactly twice the focal length.

Q10. Answer: (c) Reduction of DNA in gametes

The correct answer is Reduction of DNA in gametes.

Key Points

• The process that ensures the DNA amount does not double in every generation is the reduction of DNA in gametes, which occurs through a specialized cell division called meiosis.

• In sexually reproducing organisms, the body cells (somatic cells) are typically diploid, meaning they contain two sets of chromosomes (one from each parent).

• During the formation of gametes (sperm and egg), meiosis reduces the chromosome number by half, resulting in haploid cells that contain only one set of DNA.

• When fertilization occurs, the male gamete and female gamete fuse to form a zygote, thereby restoring the original diploid (2n) number of chromosomes characteristic of the species.

• Without this reduction division, the DNA content would double with every successive generation, leading to polyploidy and biological instability.

Additional Information

• Meiosis vs. Mitosis:

• Mitosis is the process of somatic cell division where the DNA amount remains constant, producing two identical daughter cells. It is used for growth and repair.

• Meiosis involves two rounds of division (Meiosis I and Meiosis II) but only one round of DNA replication, which is how the reduction is achieved.

• DNA and Chromosomes:

• DNA (Deoxyribonucleic acid) is the hereditary material located in the nucleus. In humans, the diploid number is 46 chromosomes (23 pairs), while the haploid gametes contain 23 chromosomes.

• The concept of germ plasm and the necessity of reduction division was notably proposed by August Weismann in 1887.

• Biological Significance:

• Beyond maintaining ploidy, meiosis facilitates genetic variation through crossing over during prophase I, where homologous chromosomes exchange genetic material.

• Fertilization (or syngamy) is the crucial counterpart to meiosis that ensures the continuity of the species with a stable genome size across generations.

• Other Options Context:

• Division of neurons: Neurons are post-mitotic cells in adults, meaning they generally do not divide, and their division would not affect DNA inheritance across generations.

• Division of body cells: Also known as mitosis, this maintains the DNA amount within an individual but does not handle the generational transfer of DNA.

• Consistency of DNA in gametes: While DNA must be consistent in terms of quality, if the quantity remained the same as somatic cells, the DNA would double upon fusion.

Q11. Answer: (c) Diamond

The correct answer is Diamond.

Key Points

• Diamond is a solid form of the element carbon with its atoms arranged in a crystal structure called diamond cubic. It is one of the

most famous allotropes of carbon. Hence, option 3 is correct.

• Quartz is a hard, crystalline mineral composed of silicon and oxygen atoms, chemically known as silicon dioxide (SiO2). It is not an allotropic form of carbon. Hence, option 1 is incorrect.

• Limestone is a sedimentary rock, composed mainly of skeletal fragments of marine organisms such as coral and mollusks. Its major materials are the minerals calcite and aragonite, which are different crystal forms of calcium carbonate (CaCO3). Hence, option 2 is incorrect.

• Alum is a type of chemical compound, usually a hydrated double sulfate salt of aluminum with the general formula XAl(SO4)2·12H2O, where X is a monovalent cation such as potassium or ammonium. Hence, option 4 is incorrect.

• In a Diamond, each carbon atom is connected to four other carbon atoms by strong covalent bonds, forming a rigid three-dimensional tetrahedral structure. This structure accounts for its extreme hardness and durability.

Additional Information

• Allotropy:

• It is the property of some chemical elements to exist in two or more different forms, in the same physical state, known as allotropes of the elements.

• Allotropes typically exhibit different physical properties (like hardness and conductivity) but identical chemical properties.

• Other Allotropes of Carbon:

• Graphite: Carbon atoms are arranged in hexagonal layers. It is soft, slippery, and used as a lubricant and in pencil leads. It is a good conductor of electricity due to delocalized electrons.

• Fullerenes: Discovered in 1985, these are molecules composed entirely of carbon in the form of a hollow sphere, ellipsoid, or tube. Buckminsterfullerene (C60) is the most common form, resembling a soccer ball.

• Graphene: A single layer of carbon atoms arranged in a two-dimensional honeycomb lattice. It is incredibly strong, light, and an excellent conductor of heat and electricity.

• Uses of Diamond:

• Because of its extreme hardness, it is widely used in industrial applications such as cutting, drilling, and grinding.

• Due to its high dispersion of light and brilliance, it is highly valued as a gemstone in jewelry.

Important Points

• Physical Constants: Diamond has a very high melting point (about 3843 Kelvin) and a density of approximately 3.51 g/cm³. Its refractive index is exceptionally high at 2.417, leading to its characteristic sparkle.

• Natural Formation: Natural diamonds are formed at high temperatures and pressures at depths of 150 to 200 kilometers within the Earth's mantle.

• Chemical Symbolism: Carbon has the atomic number 6 and belongs to Group 14 of the periodic table. It displays tetravalency and catenation, which allows it to form a vast variety of compounds and structures.

• Measurement: The weight of a diamond is measured in carats. One carat is equal to 200 milligrams.

Q12. Answer: (b) It becomes more concentrated

The correct answer is It becomes more concentrated.

Key Points

• Concentration refers to the amount of solute that has been dissolved in a given amount of solvent or solution. It is a measure of how "crowded" the solute particles are within the solvent.

• When more solute is added to the same amount of solvent, the ratio of solute to solvent increases. This results in the solution becoming more concentrated. Hence, the correct answer is option 2.

• From a mathematical perspective, concentration (C) is often expressed as C = mass of solute / volume of solvent. If the mass of the solute increases while the volume remains constant, the value of C must increase.

• A concentrated solution contains a relatively large amount of dissolved solute, whereas a dilute solution contains a relatively small amount of solute. Adding solute moves the state of the solution from dilute toward concentrated.

• This process continues until the solution reaches its saturation point, at which no more solute can be dissolved at a given temperature and pressure.

Additional Information

• Solute and Solvent: In a solution, the solute is the substance that is being dissolved (e.g., salt or sugar), and the solvent is the medium in which it dissolves (e.g., water).

• Saturation: An unsaturated solution can still dissolve more solute. A saturated solution is one where the maximum amount of solute has been dissolved; adding more solute after this point will result in the extra solute settling at the bottom as a precipitate.

• Suspension: A suspension is a heterogeneous mixture containing large particles that settle out upon standing. Simply adding more solute to a solution does not automatically make it a suspension unless the particles fail to dissolve and remain large and visible.

• Units of Concentration:

• Molarity (M): Defined as the number of moles of solute per liter of solution.

• Mass Percentage: The mass of the solute divided by the total mass of the solution, multiplied by 100.

• Molality (m): The moles of solute per kilogram of solvent.

• Dilution: This is the opposite of concentration. Dilution occurs when more solvent is added to a solution, which decreases the concentration of the solute.

Important Points

• Factors Affecting Solubility: The ability of a solute to dissolve in a solvent is influenced by temperature (solubility of solids usually increases with heat) and nature of the solute/solvent (the "like dissolves like" principle).

• Homogeneous vs. Heterogeneous: A true solution is always homogeneous, meaning its composition is uniform throughout. Adding solute keeps it a solution until the saturation limit is reached.

• Physical Change: Dissolving a solute in a solvent is generally considered a physical change, as the solute can often be recovered through processes like evaporation or distillation.

Q13. Answer: (d) Using bulbs or fluorescent tubes

The correct answer is Using bulbs or fluorescent tubes.

Key Points

• Judicious energy use involves the efficient and responsible consumption of electricity and other resources to minimize waste and reduce the environmental impact.

• Using bulbs or fluorescent tubes for illumination is a standard and necessary practice; however, choosing Fluorescent tubes or CFLs over traditional incandescent bulbs is a mark of energy efficiency as they consume significantly less wattage for the same amount of light. Hence, statement 4 is correct.

• Keeping appliances on standby mode contributes to "vampire power" or phantom load, where devices continue to draw electricity even when not in active use. This leads to cumulative energy waste over time. Hence, statement 1 is incorrect.

• Heating an empty room continuously represents a total loss of thermal energy, as the heat generated does not benefit any occupant. This practice increases utility costs and carbon footprints unnecessarily. Hence, statement 2 is incorrect.

• Overusing air-conditioners, especially at very low temperature settings or when not needed, places an extreme load on the power grid and consumes high amounts of electrical energy due to the compressor's operation. Hence, statement 3 is incorrect.

Additional Information

• Energy Conservation Act, 2001:

• In India, this Act provides the legal framework for energy efficiency and conservation.

• It led to the establishment of the Bureau of Energy Efficiency (BEE), which regulates energy standards for appliances.

• BEE Star Rating System:

• The Star Labeling program was launched in 2006 to help consumers identify energy-efficient appliances.

• Appliances like Refrigerators, Air Conditioners, and Geysers are rated from 1 to 5 stars; a 5-star rating indicates the highest energy savings.

• Types of Lighting:

• Incandescent Bulbs: Convert only about 10% of energy into light, while 90% is wasted as heat.

• Fluorescent Tubes/CFLs: Use about 75% less energy than incandescent bulbs and last much longer.

• LED (Light Emitting Diode): The most modern and judicious choice, offering the highest durability and lowest energy consumption.

• Sustainable Development Goals (SDG):

• Goal 7 aims to ensure affordable, reliable, sustainable, and modern energy for all by the year 2030.

• Practicing judicious energy use at home directly contributes to reducing Greenhouse Gas (GHG) emissions and combating Climate Change.

Important Points

• Tips for Energy Saving:

• Always switch off lights and fans when leaving a room to ensure zero wastage.

• Use natural sunlight during the day to reduce the dependency on artificial lighting.

• Regular maintenance of electrical appliances improves their operational efficiency and reduces power consumption.

Q14. Answer: (d) implantation

The correct answer is implantation.

Key Points

• Implantation is defined as the process by which the developing embryo (at the blastocyst stage) attaches itself to the endometrium, which is the internal lining of the uterus.

• This critical biological event typically occurs 6 to 12 days after fertilisation has taken place in the fallopian tube.

• During this process, the outer layer of the blastocyst, known as the trophoblast, secretes enzymes that allow it to penetrate the uterine wall, establishing a connection for nutrient exchange between the mother and the developing embryo.

• Once implantation is successful, the embryo begins to receive oxygen and nutrients from the mother's blood, and the production of human Chorionic Gonadotropin (hCG) starts, which is the hormone detected in pregnancy tests. Hence, the correct answer is implantation.

Additional Information

• Fertilisation:

• This is the process of fusion of a male gamete (sperm) with a female gamete (ovum) to form a diploid zygote.

• In humans, fertilisation usually occurs in the ampullary-isthmic junction of the fallopian tube.

• Embryogenesis:

• It is the process by which the embryo forms and develops. It starts with the fertilisation of the ovum and continues through the stages of cleavage, blastulation, gastrulation, and organogenesis.

• During embryogenesis, the single-celled zygote transforms into a multi-cellular complex organism.

• Abortion:

• This refers to the termination of a pregnancy by the removal or expulsion of an embryo or fetus before it can survive outside the uterus.

• It can occur spontaneously (commonly called a miscarriage) or can be purposely induced through medical or surgical means.

Important Points

• Blastocyst Stage: The embryo reaches the uterus about 3 to 4 days after fertilisation and floats in the uterine cavity for another 2 to 3 days before implantation begins.

• Endometrium Role: The hormone progesterone, secreted by the corpus luteum, is essential for maintaining the endometrium in a receptive state for implantation.

• Ectopic Pregnancy: If implantation occurs outside the uterus, most commonly in the fallopian tubes, it is called an ectopic pregnancy, which is a medical emergency.

• Placenta Formation: Following implantation, the trophoblast cells and the uterine tissue together form the placenta, a structural and functional unit between the developing fetus and the maternal body.

Q15. Answer: (c) Supporting the formation of lysosomes.

The correct answer is Supporting the formation of lysosomes.

Key Points

• The Golgi body, also known as the Golgi apparatus or Golgi complex, is a membrane-bound organelle found in most eukaryotic cells, including plant cells.

• One of the most critical functions of the Golgi apparatus is the modification, sorting, and packaging of proteins and lipids that are synthesized in the cell.

• It plays a vital role in supporting the formation of lysosomes. Lysosomes are formed by the budding off of vesicles from the trans-face of the Golgi apparatus, which contains processed hydrolytic enzymes. Hence, statement 3 is correct.

• Providing protection to the cell is primarily the function of the cell wall (in plants) and the plasma membrane. Hence, statement 1 is incorrect.

• Maintaining the shape of the cell is the responsibility of the rigid cell wall and the internal cytoskeleton (microtubules and microfilaments). Hence, statement 2 is incorrect.

• The synthesis of proteins is carried out by ribosomes, which may be free-floating in the cytoplasm or attached to the Rough Endoplasmic Reticulum (RER). Hence, statement 4 is incorrect.

Additional Information

• Discovery: The organelle was first identified by the Italian physician and biologist Camillo Golgi in 1898. He used a staining technique called the black reaction to visualize it.

• Structure: It consists of a series of flattened, stacked pouches called cisternae. A typical Golgi stack contains 4 to 8 cisternae.

• Dictyosomes: In plant cells, the Golgi bodies are often distributed as separate units throughout the cytoplasm and are specifically referred to as dictyosomes.

• Cell Wall Synthesis: In plants, the Golgi body is especially important because it synthesizes complex polysaccharides such as pectins and hemicelluloses, which are essential components of the plant cell wall.

• Secretion: It acts like a post office or dispatch center where materials are received from the Endoplasmic Reticulum (ER), modified (e.g., glycosylation), and then sent to their final destinations.

Important Points

• Lysosomes: These are often called the suicidal bags of the cell because they contain digestive enzymes that can break down

waste materials, cellular debris, or even the cell itself if it becomes damaged.

• Polarity: The Golgi apparatus has a distinct polarity, with a cis face (receiving side near the ER) and a trans face (shipping side towards the plasma membrane).

• Vesicle Transport: Transport vesicles from the Endoplasmic Reticulum fuse with the cis cisternae, and after processing, secretory vesicles bud off from the trans cisternae.

• Storage: Apart from packaging, the Golgi body also serves as a site for the temporary storage of cellular products before they are secreted.

Q16. Answer: (a) The amount of solute present in a given amount of solution

The correct answer is The amount of solute present in a given amount of solution.

Key Points

• The concentration of a solution refers to the amount of solute dissolved in a particular amount (mass or volume) of the solution or solvent.

• It is a quantitative measure that helps determine how "strong" or "weak" a solution is based on the proportion of its components.

• Statement 1: This statement correctly defines concentration as the ratio of the solute to the total solution. This is the standard way to express concentration in chemistry. Hence, statement 1 is correct.

• Statement 2: This statement suggests that concentration is the amount of solution in a solute, which is logically incorrect as the solute is a component of the solution, not vice versa. Hence, statement 2 is incorrect.

• Statement 3: This statement describes the amount of solvent in a solution; while this indicates the degree of dilution, the term "concentration" specifically tracks the solute. Hence, statement 3 is incorrect.

• Statement 4: This statement defines the amount of solvent in a given amount of solute, which is essentially the inverse of the solubility relationship and does not represent the definition of concentration. Hence, statement 4 is incorrect.

• Common mathematical expressions for concentration include Mass by mass percentage, Mass by volume percentage, and Molarity.

Additional Information

• Solute and Solvent:

• The Solute is the substance that is dissolved in another substance (usually present in a smaller quantity), such as salt or sugar.

• The Solvent is the substance in which the solute is dissolved (usually present in a larger quantity), such as water or alcohol.

• Types of Solutions based on Concentration:

• Dilute Solution: A solution containing a very small amount of solute relative to the amount of solvent.

• Concentrated Solution: A solution containing a large amount of solute dissolved in the solvent.

• Saturated Solution: A solution in which no more solute can be dissolved at a specific temperature.

• Unsaturated Solution: A solution where the amount of solute is less than the saturation level, meaning more can still be dissolved.

• Solubility:

• The maximum amount of solute that can be dissolved in 100 grams of solvent at a specific temperature is known as its solubility.

• Factors such as temperature and pressure can significantly affect the solubility of solids and gases in liquids.

Important Points

• Mass by Mass Percentage of a solution: Calculated as (Mass of solute / Mass of solution) × 100.

• Mass by Volume Percentage of a solution: Calculated as (Mass of solute / Volume of solution) × 100.

• Molarity (M): It is defined as the number of moles of solute dissolved in 1 liter of solution. It is the most commonly used unit of concentration in laboratories.

• Molality (m): It is defined as the moles of solute per kilogram of solvent. Unlike molarity, molality does not change with temperature changes because mass is constant.

• Parts Per Million (ppm): Used for expressing very low concentrations, such as the amount of pollutants in the atmosphere or water.

Q17. Answer: (a) 40K19 and 40Ar18

The correct answer is 40K19 and 40Ar18.

Key Points

• Isobars are defined as atoms of different chemical elements that have the same mass number (A) but different atomic numbers (Z).

• In the pair 40K19 and 40Ar18, both species possess a mass number of 40. However, Potassium (K) has an atomic number of 19, while Argon (Ar) has an atomic number of 18. Hence, this pair represents Isobars and is the correct answer.

• The mass number is the total count of protons and neutrons in the nucleus. For 40K19, there are 19 protons and 21 neutrons (40

- 19 = 21). For 40Ar18, there are 18 protons and 22 neutrons (40 - 18 = 22).

• Because Isobars have different atomic numbers, they have different numbers of electrons and thus exhibit completely different chemical properties and occupy different positions in the Modern Periodic Table.

• Other examples of Isobars include Carbon-14 (14C6) and Nitrogen-14 (14N7), where both have a mass number of 14 but different atomic numbers.

Additional Information

• Isotopes:

• These are atoms of the same element that have the same atomic number but different mass numbers.

• Example: 15O8 and 16O8 are isotopes of Oxygen. Similarly, 235U92 and 238U92 are isotopes of Uranium. Hence, options 2 and 4 are incorrect.

• Isotopes have the same chemical properties because they have the same number of electrons.

• Isotones:

• These are atoms of different elements that have the same number of neutrons.

• In the pair 15N7 and 16O8, Nitrogen has 8 neutrons (15 - 7 = 8) and Oxygen also has 8 neutrons (16 - 8 = 8). Hence, option 3 represents isotones and is incorrect.

• Atomic Number (Z): This value represents the number of protons present in the nucleus of an atom. It defines the identity of the element.

• Mass Number (A): This represents the sum of the number of protons and neutrons (collectively called nucleons) in the nucleus.

Important Points

• The term Isobar was originally suggested by Alfred Walter Stewart in the year 1918. It is derived from the Greek words 'isos' meaning equal and 'baros' meaning weight.

• While Isobars have different chemical properties, they may have similar physical properties that depend on the mass, such as density (though they are still distinct due to different atomic structures).

• Potassium-40 is a significant radioactive isotope used in geochronology (Potassium-Argon dating) to determine the age of ancient rocks and minerals.

• In nuclear physics, isobars are important for studying beta decay, where a nucleus transforms into its isobar by changing a neutron into a proton (or vice versa) to reach a more stable state.

Q18. Answer: (d) Frequency < 20 Hz

The correct answer is Frequency < 20 Hz.

Key Points

• Infrasonic sound, often referred to as infrasound, describes sound waves with a frequency less than 20 Hz. These frequencies are below the lower limit of human audibility. Hence, statement 4 is correct.

• Sound waves are mechanical longitudinal waves that require a medium to propagate. Infrasonic sound can travel through air, liquids, and solids. It is often used to monitor large-scale atmospheric and geological events. Hence, statement 1 is incorrect.

• The range of frequency between 20 Hz and 20,000 Hz (20 kHz) is known as the audible range for the average human ear. Sound within this spectrum is what we typically perceive as speech, music, or environmental noise. Hence, statement 2 is incorrect.

• Frequencies greater than 20 kHz are classified as ultrasonic sound or ultrasound. While humans cannot hear these high-pitched waves, they are widely used in medical imaging (sonography) and industrial cleaning. Hence, statement 3 is incorrect.

• Many large animals, such as elephants, whales, and hippopotamuses, use infrasound for long-distance communication because low-frequency waves undergo less attenuation and can travel further through the environment.

Additional Information

• Characteristics of Infrasound:

• Infrasonic waves possess very long wavelengths, which allow them to bend around obstacles and travel thousands of kilometers without losing much energy.

• Because of their low frequency, they are not easily absorbed by the atmosphere or the ground, making them ideal for detecting remote events.

• Natural Sources:

• Major geophysical events like earthquakes, volcanic eruptions, avalanches, and lightning generate intense infrasonic waves.

• Ocean waves and severe weather systems like hurricanes and tornadoes also produce distinct infrasonic signatures that can be tracked by meteorologists.

• Detection and Monitoring:

• Scientists use specialized instruments called microbarometers to detect minute changes in atmospheric pressure caused by infrasonic waves.

• The International Monitoring System (IMS), established under the Comprehensive Nuclear-Test-Ban Treaty (CTBT), uses a global network of infrasound stations to detect clandestine underground or atmospheric nuclear explosions.

• Human Impact:

• Although humans cannot "hear" infrasound in the traditional sense, exposure to high-intensity low-frequency sound can cause physical sensations like chest wall vibration, nausea, headaches, or feelings of anxiety.

• Man-made sources include wind turbines, heavy machinery, aircraft engines, and large cooling fans in industrial settings.

Important Points

• Speed of Sound: The speed at which infrasound travels depends on the medium. In dry air at 20 degrees Celsius, the speed is approximately 343 meters per second.

• Wave Nature: Like all sound, infrasound is a mechanical wave that consists of periodic compressions and rarefactions of the medium through which it travels.

• Seismology Connection: Infrasonic waves are closely related to seismic waves; while seismic waves travel through the Earth's crust, infrasonic waves travel through the atmosphere, often coupled with the same geological trigger.

Q19. Answer: (b) 80 N

The correct answer is 80 N.

Key Points

• According to Newton’s Third Law of Motion, for every action, there is always an equal and opposite reaction.

• In this scenario, when a person pushes a stationary wall with a force of 80 N, this is considered the action force.

• The wall simultaneously exerts a reaction force back onto the person. According to the law, the magnitude of this reaction force must be exactly the same as the action force, which is 80 N.

• While the magnitudes are equal, the directions are opposite; if the push is toward the wall, the reaction is away from the wall toward the person.

• It is a fundamental property of forces that they always exist in pairs. A single isolated force is physically impossible. Hence, the correct answer is 80 N.

Additional Information

• Newton's First Law of Motion:

• Also known as the Law of Inertia, it states that an object will remain at rest or move at a constant velocity unless acted upon by an external unbalanced force.

• Inertia is the inherent property of an object to resist changes in its state of motion.

• Newton's Second Law of Motion:

• This law defines force quantitatively as the product of mass and acceleration (F = ma).

• The SI unit of force is the Newton (N), which is defined as 1 kg·m/s².

• It implies that the acceleration of an object is directly proportional to the net force acting on it and inversely proportional to its mass.

• Nature of Force:

• Force is a vector quantity, meaning it possesses both magnitude and direction.

• Common types of forces include gravitational force, frictional force, normal force, and tension.

Important Points

• Action-Reaction Pairs:

• One crucial aspect of Newton’s Third Law is that the action and reaction forces act on two different objects.

• Because they act on different bodies, these forces do not cancel each other out. For example, the 80 N force acts on the wall, while the reaction force of 80 N acts on the person's hands.

• Stationary Wall Mechanics:

• The wall remains stationary despite the 80 N push because it is attached to the earth, and the static friction or structural integrity of the wall provides a counter-force that results in a net force of zero on the wall itself.

• Real-world Examples:

• Walking: As you step, your foot pushes backward on the ground (action), and the ground pushes your foot forward (reaction).

• Swimming: A swimmer pushes the water backward to move their body forward.

• Rocket Propulsion: The rocket engine expels gas downward at high velocity, and the escaping gas exerts an upward force on the rocket.

Q20. Answer: (b) 10√2 m/s

The correct answer is 10√2 m/s.

Key Points

• When a ball is dropped from a certain height (h), its initial velocity (u) is always taken as 0 m/s because it starts from a state of rest.

• The motion of the ball is a case of uniformly accelerated motion under the influence of gravity (g), where the value of g is provided as 10 m/s^2.

• To find the final velocity (v) or the speed with which the ball strikes the ground, we use the third equation of motion: v^2 = u^2 + 2gh.

• Given values for the calculation:

• Initial velocity (u) = 0 m/s

• Height (h) = 10 m

• Acceleration due to gravity (g) = 10 m/s^2

• Substituting the values into the formula: v^2 = (0)^2 + 2 × 10 × 10. This simplifies to v^2 = 200.

• Taking the square root of both sides, v = √200, which can be further simplified as v = √(100 × 2) = 10√2 m/s. Hence, the speed of the ball is 10√2 m/s.

Additional Information

• Equations of Motion: These equations describe the behavior of a physical system in terms of its motion as a function of time. The three primary equations for constant acceleration are v = u + at, s = ut + 1/2 at^2, and v^2 = u^2 + 2as.

• Free Fall: An object is said to be in free fall when it falls towards the Earth solely under the influence of the gravitational force. In the absence of air resistance, all objects, regardless of their mass, accelerate toward the center of the Earth at the same rate.

• Acceleration due to Gravity (g): This is the acceleration gained by an object due to gravitational force. Its standard value on the surface of the Earth is approximately 9.8 m/s^2, but it is often rounded to 10 m/s^2 in physics problems for ease of calculation.

• Kinetic and Potential Energy: This problem can also be solved using the Law of Conservation of Energy. At the height of 10 m, the ball possesses Potential Energy (PE = mgh). Just before striking the ground, all this PE is converted into Kinetic Energy (KE = 1/2 mv^2). Equating mgh = 1/2 mv^2 leads to the formula v = √(2gh).

Important Points

• Mass Independence: Notice that the mass (m) of the ball does not appear in the final formula for velocity. This confirms that whether a heavy ball or a light ball is dropped, they will strike the ground with the same speed, provided there is no air resistance.

• Direction of Motion: In these calculations, since the ball is moving downwards in the direction of the gravitational force, the value of g is taken as positive (+10 m/s^2). If the ball were thrown upwards, g would be taken as negative (-10 m/s^2).

• Impact of Height: The final speed is directly proportional to the square root of the height. If the height were quadrupled to 40 m, the striking speed would double.

Q21. Answer: (b) Both A and R are true, and R is the correct explanation of A.

The correct answer is Both A and R are true, and R is the correct explanation of A.

Key Points

• Assertion (A) states that Insulin helps lower blood glucose levels. Insulin is an essential hormone produced by the pancreas that allows your body to use sugar (glucose) from carbohydrates in the food that you eat for energy or to store glucose for future use. Hence, Assertion (A) is correct.

• Reason (R) explains that Insulin converts glucose into glycogen for storage in the liver. When blood glucose levels are high, the pancreas secretes insulin, which signals the liver, muscles, and fat cells to take up the glucose from the blood. In the liver and muscles, this glucose is converted into glycogen through a process called glycogenesis. Hence, Reason (R) is correct.

• The primary mechanism by which insulin lowers the concentration of glucose in the bloodstream is by facilitating its uptake into cells and its conversion into storage forms like glycogen.

• Since the conversion and storage of glucose as glycogen directly results in the reduction of circulating blood sugar, the Reason (R) serves as a scientifically accurate explanation for the Assertion (A).

• Hence, the correct answer is Both A and R are true, and R is the correct explanation of A.

Additional Information

• The Pancreas and Insulin Secretion:

• The pancreas contains clusters of cells known as the Islets of Langerhans.

• Beta cells within these clusters are responsible for the synthesis and secretion of insulin.

• Insulin is considered an anabolic hormone because it promotes the storage of glucose, amino acids, and fats.

• Glucagon - The Antagonist:

• While insulin lowers blood sugar, another hormone called glucagon (secreted by Alpha cells of the pancreas) raises it.

• Glucagon triggers glycogenolysis, which is the breakdown of glycogen back into glucose when blood sugar is low.

• Diabetes Mellitus:

• A deficiency in insulin production or a decrease in the body's responsiveness to it leads to Diabetes Mellitus.

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• Type 1 Diabetes occurs when the pancreas produces little or no insulin.

• Type 2 Diabetes occurs when the body's cells become resistant to insulin, leading to hyperglycemia (high blood sugar).

Important Points

• Homeostasis: The balance between insulin and glucagon ensures glucose homeostasis, maintaining blood sugar within a narrow range (typically 70-100 mg/dL during fasting).

• Discovery: Insulin was first isolated in 1921 by Sir Frederick G. Banting and Charles H. Best at the University of Toronto.

• Target Tissues: Beyond the liver, insulin significantly affects skeletal muscle (where it also stores glycogen) and adipose tissue (where it promotes the storage of lipids).

• Glycogenesis vs Glycogenolysis: Glycogenesis is the formation of glycogen from glucose (stimulated by insulin), whereas glycogenolysis is the breakdown of glycogen into glucose (stimulated by glucagon or epinephrine).

Q22. Answer: (c) It depends on the length of the wire.

The correct answer is It depends on the length of the wire.

Key Points

• Resistivity is a fundamental and intrinsic property of a material that quantifies how strongly it opposes the flow of electric current. Hence, statement 2 is correct.

• It is mathematically defined as the resistance of a conductor having a unit length and a unit area of cross-section. While resistance changes with dimensions, resistivity remains constant for a specific material at a given temperature.

• The resistivity of a material does not depend on its geometrical dimensions such as length or thickness (area). It only depends on the nature of the material and its temperature. Hence, statement 3 is NOT correct.

• The resistivity of metallic conductors typically increases with an increase in temperature because the thermal vibrations of atoms interfere with the flow of electrons. Hence, statement 1 is correct.

• The SI unit of resistivity is the ohm-meter (written as Ω ? m). This unit is derived from the formula for resistance R = ρ (L/A), where ρ is resistivity. Hence, statement 4 is correct.

Additional Information

• Difference between Resistance and Resistivity:

• Resistance (R) is the property of a specific object or component and depends on its length, area, and material. Its unit is the Ohm (Ω).

• Resistivity (ρ) is the property of the substance itself. For example, a 1-meter copper wire and a 10-meter copper wire will have different resistances but the same resistivity.

• Classification of Materials:

• Conductors: Materials like Silver and Copper have very low resistivity, in the range of 10^-8 Ω?m to 10^-6 Ω?m. Silver is the best conductor with a resistivity of approximately 1.59 × 10^-8 Ω?m at 20°C.

• Insulators: Materials like Glass, Rubber, and Ebonite have very high resistivity, ranging from 10^12 Ω?m to 10^17 Ω?m.

• Alloys: Substances like Nichrome and Constantan have higher resistivity than their constituent metals and are used in heating elements because they do not oxidize (burn) easily at high temperatures.

• Conductivity:

• The reciprocal of resistivity is known as electrical conductivity (σ). It measures how easily a material allows current to flow. Its SI unit is siemens per meter (S/m) or (ohm-meter)^-1.

Important Points

• Factors Affecting Resistance: Resistance of a uniform conductor is directly proportional to its length (L) and inversely proportional to its area of cross-section (A).

• Temperature Coefficient: For most metals, the temperature coefficient of resistivity is positive. However, for semiconductors and insulators, resistivity typically decreases as temperature increases (negative temperature coefficient).

• Usage in Appliances: The high resistivity of alloys like Manganin and Constantan makes them ideal for making standard resistors because their resistivity changes very little with small changes in temperature.

Q23. Answer: (d) Both (ii) and (iii)

The correct answer is Both (ii) and (iii).

Key Points

• The magnetic field (B) produced by a straight current-carrying conductor at a given point is directly proportional to the magnitude of the current (I) passing through the conductor. If the current increases, the magnetic field strength also increases. Hence, statement (iii) is correct.

• The magnetic field (B) is inversely proportional to the distance (r) from the conductor. As we move further away from the wire, the strength of the magnetic field weakens. Hence, statement (ii) is correct.

• According to the inverse relationship, the field strength would decrease, not increase, as the distance from the source increases.

Hence, statement (i) is incorrect.

• Since the magnetic field is linearly proportional to the current, any increase in current (I) will result in an immediate and proportional increase in the magnetic field (B), without any initial decrease. Hence, statement (iv) is incorrect.

• The relationship is mathematically expressed by the formula B = (μ0I) / (2πr), where μ0 is the permeability of free space.

Additional Information

• Right-Hand Thumb Rule: This rule is used to find the direction of the magnetic field. If you hold the straight conductor in your right hand such that the thumb points in the direction of the current, then your fingers will curl around the conductor in the direction of the magnetic field lines.

• Magnetic Field Lines: For a straight conductor, the magnetic field lines form concentric circles around the wire. The center of these circles lies on the wire, and the plane of the circles is perpendicular to the conductor.

• Discovery: The relationship between electricity and magnetism was first discovered by Hans Christian Oersted in 1820, when he noticed a compass needle deflect near a current-carrying wire.

• SI Unit: The SI unit of magnetic field induction is the Tesla (T). Another commonly used unit is the Gauss (G), where 1 Tesla = 10,000 Gauss.

Important Points

• Factors affecting Magnetic Field: The strength of the field depends on the medium surrounding the conductor, the magnitude of the current, and the radial distance from the wire.

• Vector Quantity: The magnetic field is a vector quantity, meaning it has both magnitude and direction. At any point, the field is tangent to the magnetic field line at that point.

• Permeability: The value of μ0 (permeability of free space) is approximately 4π × 10^-^7 T·m/A. This constant defines how easily magnetic flux can pass through a vacuum.

• Applications: This principle is fundamental in the design of electromagnets, electric motors, generators, and transformers where controlled magnetic fields are required.

Q24. Answer: (a) Rusting of iron

p data-end="57" data-start="0">The correct answer is Rusting of iron.

Key Points

• Corrosion is a natural process that converts a refined metal into a more chemically stable form such as oxide, hydroxide, or sulfide. It is the gradual destruction of materials (usually metals) by chemical and/or electrochemical reaction with their environment.

• Rusting of iron is a specific type of corrosion that occurs when iron objects are exposed to oxygen and moisture (water) for a long time. The reddish-brown flaky substance formed is called rust (hydrated iron oxide). Hence, statement 1 is correct.

• Burning of LPG (Liquefied Petroleum Gas) is a combustion reaction. While it is a chemical change, it involves the rapid oxidation of fuel to produce heat and light, rather than the slow deterioration of a metal surface. Hence, statement 2 is incorrect.

• Boiling of water is a physical change where water transitions from a liquid state to a gaseous state (steam). No new chemical substance is formed during this process. Hence, statement 3 is incorrect.

• Dissolving sugar in water is also a physical change. The sugar molecules disperse throughout the water, but their chemical identity remains unchanged, and the sugar can be recovered by evaporating the water. Hence, statement 4 is incorrect.

• Hence, the correct answer is Rusting of iron.

Additional Information

• Chemical Nature of Rusting:

• The process of rusting can be represented by the following equation: 4Fe + 3O2 + 6H2O → 4Fe(OH)3. The final product eventually dehydrates to form Fe2O3·nH2O.

• Both oxygen and water (or moisture) are essential for rusting to occur. In coastal areas, rusting is faster because the presence of salt in water speeds up the process of oxidation.

• Prevention of Corrosion:

• Galvanization: It is the process of depositing a thin layer of zinc on iron or steel to protect it from corrosion. Since zinc is more reactive than iron, it oxidizes first, protecting the underlying metal.

• Alloying: Metals are mixed with other elements to enhance their properties. For example, Stainless steel is made by mixing iron with carbon, chromium, and nickel. It does not rust easily.

• Anodizing: This involves forming a thick oxide layer of aluminum to make it resistant to further corrosion.

• Other Methods: Painting, oiling, greasing, or chrome plating are common ways to prevent the metal surface from coming into contact with air and moisture.

Important Points

• Corrosion in Other Metals:

• Silver: It reacts with sulfur in the air (from hydrogen sulfide) to form a black coating of silver sulfide (Ag2S). This is often called

tarnishing.

• Copper: When exposed to moist air, copper reacts with carbon dioxide and water to form a green coating of basic copper carbonate [$CuCO_3 \cdot Cu(OH)_2$].

• Economic Impact:

• Corrosion causes enormous damage to car bodies, bridges, iron railings, ships, and all objects made of metals, especially those made of iron.

• It is a significant economic burden globally, leading to the loss of millions of tons of steel every year, necessitating constant replacement and maintenance of infrastructure.

Q25. Answer: (c) also doubles

The correct answer is also doubles.

Key Points

• According to Newton's Second Law of Motion, the acceleration of an object is directly proportional to the net force acting on it and inversely proportional to its mass.

• The relationship is mathematically expressed by the formula $F = ma$, where F represents the resultant force, m represents the mass of the object, and a represents the acceleration.

• If the force on an object is doubled (changed from F to 2F) while the mass (m) remains constant, the acceleration must adjust to maintain the equality of the equation.

• Using the formula $a = F / m$, the new acceleration (a') becomes $a' = (2F) / m$. Since the original acceleration was F / m, it follows that $a' = 2a$.

• This demonstrates that when the net force is multiplied by a factor of two, the acceleration also multiplied by the same factor. Hence, the correct answer is also doubles.

Additional Information

• Newton's Second Law of Motion:

• This law defines the quantitative relationship between force and motion. It allows for the calculation of how much an object will speed up or slow down under a specific load.

• The SI unit of force is the Newton (N), which is the amount of force required to accelerate a mass of 1 kilogram (kg) at a rate of 1 meter per second squared (m/s^2).

• Acceleration is a vector quantity, which means it has both magnitude and direction. The acceleration always occurs in the direction of the unbalanced force.

• Inertia and Mass:

• Mass is a measure of an object's inertia, which is its resistance to changes in its state of motion.

• If the mass of an object were to double while the force remained the same, the acceleration would be halved because acceleration is inversely proportional to mass.

• In classical mechanics, mass is typically considered constant unless the object is traveling at speeds approaching the speed of light.

Important Points

• Sir Isaac Newton first published these laws of motion in his monumental work, Philosophiæ Naturalis Principia Mathematica, in the year 1687.

• Net Force: It is important to note that the force mentioned in the second law is the net force (the vector sum of all forces). If multiple forces act on an object but their sum is zero, the acceleration remains zero.

• Real-world applications: This principle is used in automotive engineering to determine engine power, in aerospace to calculate rocket thrust, and in sports science to analyze athlete performance.

• Units: Always ensure mass is in kilograms and acceleration is in m/s^2 to obtain the force in Newtons. 1 Newton = 1 $kg \cdot m/s^2$.

Q26. Answer: (c) 28

Shortcut Trick

Total age 4 years ago = 44 − (2 × 4) = 36 years.

Ratio of Priya to Rohan 4 years ago = 2 : 1.

Sum of ratio parts (2 + 1) = 3 units → 36 years => 1 unit = 12 years.

Priya age 4 years ago = 2 × 12 = 24 years.

Present age of Priya = 24 + 4 = 28 years.

Therefore The correct answer is 28 years.

Alternate Method

Given: Sum of Priya (P) and Rohan (R) = 44 years. Condition: (P − 4) = 2 × (R − 4).

=> P + R = 44 => R = 44 − P

=> P − 4 = 2 × ((44 − P) − 4)

=> P − 4 = 2 × (40 − P)

=> P − 4 = 80 − 2P

=> 3P = 84

=> P = 28

Therefore The correct answer is 28 years.

Additional Information

Age Difference Rule

The difference between the ages of two persons remains constant throughout their lives, regardless of the number of years passed.

Sum of Ages Change

If the sum of ages of 'n' people is S, then 't' years ago, the sum was S − (n × t), and 't' years hence, it will be S + (n × t).

Q27. Answer: (c) 2

Shortcut Trick

Given equation: 1/(1 − tanθ) + 1/(1 + tanθ) = 3

Simplify: 2/(1 − tan²θ) = 3 => 1 − tan²θ = 2/3 => tan²θ = 1/3

For acute angle θ, tanθ = 1/√3 => θ = 30°

Therefore, cosecθ = cosec 30° = 2.

Therefore The correct answer is 2.

Alternate Method

Given:

1/(1 − tanθ) + 1/(1 + tanθ) = 3

Formula Used:

(a − b)(a + b) = a² − b²

1 + tan²θ = sec²θ

cosecθ = 1/sinθ

Calculations:

=> [(1 + tanθ) + (1 − tanθ)] / [(1 − tanθ)(1 + tanθ)] = 3

=> 2 / (1 − tan²θ) = 3

=> 2 = 3 − 3 tan²θ

=> 3 tan²θ = 1

=> tan²θ = 1/3

=> tanθ = 1/√3 (since θ is an acute angle, tanθ must be positive)

=> θ = 30°

=> cosecθ = cosec 30° = 2

Therefore The correct answer is 2.

Additional Information

Trigonometric Identities

Recall that sin²θ + cos²θ = 1, sec²θ − tan²θ = 1, and cosec²θ − cot²θ = 1.

Standard Values for 30°

For θ = 30°, sinθ = 1/2, cosθ = √3/2, tanθ = 1/√3, and cosecθ = 2.

Q28. Answer: (d) Rs. 8,453

Shortcut Trick

Let the Marked Price be 100%.

Given Discount = 50%, so Selling Price = 100% − 50% = 50%.

The extra amount without discount represents the discount value itself.

Since 50% discount = Rs. 8,453, then the amount paid (50%) is also Rs. 8,453.

Therefore The correct answer is Rs. 8,453.

Alternate Method

Given: Discount % = 50%, Extra amount if no discount = Rs. 8,453.
Formulas: Discount = MP − SP | Discount % = (Discount ÷ MP) × 100 | SP = MP − Discount
=> Let the Marked Price (MP) be x.
=> If no discount is given, she pays the Marked Price. The extra amount = MP − SP = Discount.
=> Discount = 50% of x = Rs. 8,453.
=> 0.50 × x = 8,453 => x = 8,453 ÷ 0.50 = Rs. 16,906.
=> Amount paid (SP) = MP − Discount = 16,906 − 8,453 = Rs. 8,453.
Therefore The correct answer is Rs. 8,453.
Additional Information
Marked Price & Discount
The Marked Price is the price listed on the label. Discount is always calculated on the Marked Price unless stated otherwise.
The 50% Rule
When a 50% discount is applied, the Selling Price and the Discount Value are always equal, as the price is split exactly in half.

Q29. Answer: (d) Rs. 4,851

Shortcut Trick
Rate of 5% in fraction = 1/20. For 2 years, the ratio of Principal to Amount is $(20)^2 : (21)^2$.
Ratio = 400 : 441
Given, 400 units = Rs. 4,400 => 1 unit = Rs. 11
Amount = 441 units × 11 = Rs. 4,851
Therefore The correct answer is Rs. 4,851.
Alternate Method
Given:
Principal (P) = Rs. 4,400
Rate (R) = 5% per annum
Time (n) = 2 years
Formula Used:
Amount (A) = $P(1 + R/100)^n$
Calculations:
=> $A = 4400 \times (1 + 5/100)^2$
=> $A = 4400 \times (1 + 1/20)^2$
=> $A = 4400 \times (21/20) \times (21/20)$
=> $A = 4400 \times (441/400)$
=> $A = 11 \times 441$
=> A = Rs. 4,851
Therefore The correct answer is Rs. 4,851.
Additional Information
Effective Interest Rate for 2 Years
For a rate R% compounded annually for 2 years, the effective rate is R + R + (R × R)/100.
Difference between CI and SI
The difference between Compound Interest and Simple Interest for 2 years is $P(R/100)^2$.
Compounding Half-Yearly
When interest is compounded half-yearly, the rate is halved (R/2) and the time is doubled (2n).

Q30. Answer: (d) 1,260

Shortcut Trick
Wages are distributed in the ratio of the efficiencies of the workers when they work for the same duration.
Efficiency ratio A : B : C = 1/17 : 1/51 : 1/68 = 12 : 4 : 3
Total ratio parts = 12 + 4 + 3 = 19 units
B's share = (4 ÷ 19) × 5,985 = 4 × 315 = Rs. 1,260
Therefore The correct answer is Rs. 1,260.
Alternate Method

Given: Time taken by A = 17 days, B = 51 days, C = 68 days. Total wage = Rs. 5,985.

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

Person	Days	Total Work	Efficiency
A	17	204	12
B	51	4	
C	68	3	

=> Total efficiency = 12 + 4 + 3 = 19 units

=> 19 units = Rs. 5,985

=> 1 unit = 5,985 ÷ 19 = Rs. 315

=> B's wage = 4 units = 4 × 315 = Rs. 1,260

Therefore The correct answer is Rs. 1,260.

Additional Information

Wage Distribution Rule

If workers work for the same amount of time, the wage is distributed in the ratio of their efficiencies. If time periods differ, wage ratio = (E1×T1) : (E2×T2).

Efficiency-Time Relationship

Efficiency is inversely proportional to the time taken to complete the work (Efficiency = 1/Time) when work is constant.

Work and Wages

Total Wage = (Individual Work Done ÷ Total Work) × Total Amount.

Q31. Answer: (b) 72,500

Shortcut Trick

Let Total Voters be 100%.

Voters who cast votes = 100% − 20% = 80%.

Winner gets 70% of 80%, Loser gets 30% of 80%.

Difference = (70% − 30%) of 80% = 40% of 80% = 32%.

32% = 23,200 => 1% = 725 => 100% = 72,500.

Therefore The correct answer is 72,500.

Alternate Method

Given:

Non-voters = 20%

Winner share of cast votes = 70%

Winning margin = 23,200

Calculations:

=> Let total number of voters = x

=> Votes cast = 80% of x = 0.8x

=> Winner's votes = 70% of 0.8x = 0.56x

=> Loser's votes = (100% − 70%) of 0.8x = 30% of 0.8x = 0.24x

=> Margin = 0.56x − 0.24x = 0.32x

=> 0.32x = 23,200

=> x = 23,200 ÷ 0.32

=> x = 72,500

Therefore The correct answer is 72,500.

Additional Information

Invalid Votes Concept

If some votes are invalid, subtract them from the cast votes before calculating the winner's share: Valid Votes = Cast Votes − Invalid Votes.

Percentage Change

Margin percentage based on total voters is (Winner% − Loser%) × (Cast Vote%).

Total Population vs Voters

Voters are usually a subset of the total population; questions may involve multiple stages of reduction from Total Population → Voter List → Casted Votes.

Q32. Answer: (b) 60 km/h

Shortcut Trick

Speed is distance per unit time.

Direct division: 120 ÷ 2 = 60 km/h.

Therefore The correct answer is 60 km/h.

Alternate Method

Given:

Distance = 120 km

Time = 2 hours

Formula Used:

Speed = Distance ÷ Time

Calculations:

=> Speed = 120 km ÷ 2 hours

=> Speed = 60 km/h

Therefore The correct answer is 60 km/h.

Additional Information

Unit Conversion

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

Average Speed

Total distance traveled divided by the total time taken. For two equal distances at speeds x and y, Average Speed = 2xy ÷ (x + y).

Q33. Answer: (b) 8%

Shortcut Trick

Let Cost Price (CP) be 100.

Marked Price (MP) = 100 + 25% of 100 = 125.

Selling Price (SP) = 100 + 15% of 100 = 115.

Discount = MP − SP = 125 − 115 = 10.

Discount % = (Discount ÷ MP) × 100 = (10 ÷ 125) × 100 = 8%.

Therefore The correct answer is 8%.

Alternate Method

Given: Markup% = 25%, Profit% = 15%.

Formulas: MP = CP × (100 + Markup%) ÷ 100 | SP = CP × (100 + Profit%) ÷ 100 | Discount% = (MP − SP) ÷ MP × 100.

=> Assume CP = 100 units.

=> MP = 100 × (125 ÷ 100) = 125 units.

=> SP = 100 × (115 ÷ 100) = 115 units.

=> Discount Amount = MP − SP = 125 − 115 = 10 units.

=> Discount% = (10 ÷ 125) × 100 = 8%.

Therefore The correct answer is 8%.

Additional Information

Marked Price & Discount

Discount is always calculated on the Marked Price (MP). Formula: SP = MP × (100 − Discount%) ÷ 100.

Relation between CP and MP

The direct ratio is MP ÷ CP = (100 + Profit%) ÷ (100 − Discount%).

Q34. Answer: (b) 14,784

Shortcut Trick

Base circumference (2πr) = 176 cm => Radius (r) = 176 ÷ (2 × 22/7) = 28 cm.

Total Surface Area (TSA) = 2πr(h + r) = (Circumference) × (h + r).

TSA = 176 × (56 + 28) = 176 × 84.

Calculation: 176 × 84 = 14,784 cm².

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Therefore The correct answer is 14,784 cm².

Alternate Method

Given: Height (h) = 56 cm, Circumference = 176 cm.

Formula Used: Circumference = 2πr | TSA = 2πr(h + r).

=> 2 × (22/7) × r = 176

=> (44/7) × r = 176

=> r = 176 × (7/44) = 4 × 7 = 28 cm

=> TSA = 2 × (22/7) × 28 × (56 + 28)

=> TSA = 176 × 84

=> TSA = 14,784 cm²

Therefore The correct answer is 14,784 cm².

Additional Information

Curved Surface Area of Cylinder

The area of the side surface only, given by CSA = 2πrh.

Volume of Cylinder

The total space occupied by the cylinder, calculated as V = πr²h.

Base Area of Cylinder

The area of one of the circular ends, given by Area = πr².

Q35. Answer: (c) 507√3 cm²

Shortcut Trick

For an equilateral triangle, the sum of perpendicular distances (p1, p2, p3) from an interior point to the sides is equal to the height (h).

h = p1 + p2 + p3 = 12.7 + 14.8 + 11.5 = 39 cm.

Area = h² / √3 = 39² / √3 = 1521 / √3 = 507√3 cm².

Therefore The correct answer is 507√3 cm².

Alternate Method

Given: Perpendiculars p1 = 12.7 cm, p2 = 14.8 cm, p3 = 11.5 cm.

Formula: Sum of perpendiculars (p1+p2+p3) = (√3/2) × side (a).

=> Let the side of the equilateral triangle be 'a'.

=> Area of triangle = Sum of areas of three smaller triangles formed with the interior point.

=> (√3/4)a² = (1/2)×a×p1 + (1/2)×a×p2 + (1/2)×a×p3

=> (√3/4)a² = (1/2)a (p1 + p2 + p3)

=> (√3/2)a = 12.7 + 14.8 + 11.5 = 39

=> a = 78 / √3 = 26√3 cm

=> Area = (√3/4) × (26√3)²

=> Area = (√3/4) × 676 × 3 = 169 × 3 × √3 = 507√3 cm²

Therefore The correct answer is 507√3 cm².

Additional Information

Viviani's Theorem

It states that the sum of the distances from any interior point to the sides of an equilateral triangle is constant and equal to the altitude (h) of the triangle.

Equilateral Triangle Formulas

Height (h) = (√3/2)a; Area = (√3/4)a²; In-radius (r) = a/(2√3); Circum-radius (R) = a/√3.

Area in terms of Height

If the height 'h' is known, the area of an equilateral triangle can be directly calculated as Area = h² / √3.

Q36. Answer: (b) 7

Shortcut Trick

4.2 / 6.3 = 2/3

x/2.1 + 2/3 = 4

x/2.1 = 4 − 2/3 = 10/3

x = (10/3) × 2.1 = (10/3) × (21/10) = 7

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Therefore Answer = 7
Alternate Method
Given:
x/2.1 + 4.2/6.3 = 4
Formula used:
Simplification of fractions
Calculation:
=> 4.2/6.3 = 42/63 = 2/3
=> Equation becomes:
x/2.1 + 2/3 = 4
=> x/2.1 = 4 − 2/3
=> = (12 − 2)/3 = 10/3
=> x = (10/3) × 2.1
=> = (10/3) × (21/10)
=> = 7
Therefore The correct answer is 7.
Additional Information
Fraction Conversion
Convert decimals to fractions for easy solving
Equation Solving
Isolate variable step-by-step
Simplification
Reduce fractions before multiplying
Key Insight
Convert all terms into common format

Q37. Answer: (c) Base fare = Rs. 30; Per-kilometre Charge = Rs. 20

Shortcut Trick
Difference in Distance = 15 − 10 = 5 km
Difference in Fare = Rs. 330 − Rs. 230 = Rs. 100
Per-kilometre Charge = Rs. 100 ÷ 5 = Rs. 20 per km
Base Fare = Total Fare − (Distance × Per-km Charge) = 230 − (10 × 20) = Rs. 30
Therefore The correct answer is Base fare = Rs. 30; Per-kilometre Charge = Rs. 20.
Alternate Method
Given:
Let Base Fare be 'B' and Rate per km be 'R'.
=> Case 1: B + 10R = 230 — (i)
=> Case 2: B + 15R = 330 — (ii)
Calculations:
Subtracting equation (i) from (ii):
=> (B + 15R) − (B + 10R) = 330 − 230
=> 5R = 100
=> R = 20
Substitute R = 20 in equation (i):
=> B + 10(20) = 230
=> B + 200 = 230
=> B = 30
Therefore The correct answer is Base fare = Rs. 30; Per-kilometre Charge = Rs. 20.
Additional Information
Linear Equation Modeling
This problem follows the format y = mx + c, where 'm' is the variable rate, 'c' is the fixed constant (base fare), and 'y' is the total cost.

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Simultaneous Equations

To find two unknowns, we require at least two independent linear equations. The elimination method is usually the fastest way to solve for the variable rate.

Unitary Application

In fixed plus variable cost problems, the entire difference in total cost is attributed to the difference in variable quantity only.

Q38. Answer: (a) 4

Shortcut Trick

Combined efficiency of A, B and C = (Total Work ÷ 3) + (Total Work ÷ 10) + (Total Work ÷ 15)

Using LCM (3, 10, 15) = 30 as base work.

Total efficiency = 10 + 3 + 2 = 15 units/day.

Twice the work = 30 × 2 = 60 units.

Time taken = 60 ÷ 15 = 4 days.

Therefore The correct answer is 4 days.

Alternate Method

Given: Time taken by A = 3 days, B = 10 days, C = 15 days.

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

Person	Days	Total Work	Efficiency
A	3	30 units	10
B	10	3	
C	15	2	

=> Combined efficiency of (A + B + C) = 10 + 3 + 2 = 15 units/day.

=> Original work = 30 units.

=> Twice the work = 30 × 2 = 60 units.

=> Required time = 60 ÷ 15 = 4 days.

Therefore The correct answer is 4 days.

Additional Information

Work and Efficiency Relationship

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

Pipes and Cisterns

Similar logic applies where filling pipes have positive efficiency and leakage pipes have negative efficiency.

Work and Wages

Wages are distributed in the ratio of work done or the ratio of efficiencies when all persons work for the same duration.

Q39. Answer: (b) 46

Shortcut Trick

For any distribution following the Empirical Relationship, if the Mode and Median are equal, the Mean must also be equal to that same value.

Given: Mode = 46 and Median = 46.

Observation: Since Mode = Median, the distribution is considered symmetrical at this point, leading to Mean = 46.

Therefore The correct answer is 46.

Alternate Method

Given:

=> Mode = 46

=> Median = 46

Formula Used:

The Empirical Relationship between the three measures of central tendency is:

=> Mode = 3 × Median − 2 × Mean

Calculations:

=> 46 = 3 × 46 − 2 × Mean

=> 46 = 138 − 2 × Mean

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=> 2 × Mean = 138 − 46

=> 2 × Mean = 92

=> Mean = 92 ÷ 2

=> Mean = 46

Therefore The correct answer is 46.

Additional Information

Empirical Formula

Karl Pearson's formula relates the three averages as: Mode = 3 Median − 2 Mean. It is applicable for moderately skewed distributions.

Symmetrical Distribution

In a perfectly Symmetrical Distribution (like the Normal Distribution), the values of Mean, Median, and Mode are all identical.

Skewed Distributions

For Positively Skewed data: Mean > Median > Mode. For Negatively Skewed data: Mode > Median > Mean.

Q40. Answer: (d) $9m^2 - 30mn + 25n^2$

Shortcut Trick

Apply the algebraic identity $(a - b)^2 = a^2 - 2ab + b^2$.

Square of the first term: $(3m)^2 = 9m^2$.

Square of the second term: $(5n)^2 = 25n^2$.

The middle term is $-2 \times (3m) \times (5n) = -30mn$.

Combine all parts: $9m^2 - 30mn + 25n^2$.

Therefore The correct answer is $9m^2 - 30mn + 25n^2$.

Alternate Method

Given: $(3m - 5n)^2$

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

=> Identifying values: a = 3m and b = 5n.

=> Expansion: $(3m)^2 - 2 \times (3m) \times (5n) + (5n)^2$

=> $(3 \times 3 \times m \times m) - (2 \times 3 \times 5 \times m \times n) + (5 \times 5 \times n \times n)$

=> $9m^2 - 30mn + 25n^2$

=> This expression corresponds to Option 4.

Therefore The correct answer is $9m^2 - 30mn + 25n^2$.

Additional Information

Square of a Sum Identity

$(a + b)^2 = a^2 + 2ab + b^2$. The only difference is the sign of the middle term.

Difference of Two Squares

$(a - b)(a + b) = a^2 - b^2$. This is used for factorization and simplifying products.

Cubic expansion of Difference

$(a - b)^3 = a^3 - 3a^2b + 3ab^2 - b^3$. Note the alternating signs in the result.

Q41. Answer: (a) 2°

Shortcut Trick

The angle formed by the bisectors of two adjacent angles of a quadrilateral is equal to half the sum of the other two angles:

=> angle STR = (angle P + angle Q) ÷ 2

=> 17° = (angle P + angle Q) ÷ 2 => angle P + angle Q = 34°

Given ratio angle P : angle Q = 8 : 9, the sum of ratio parts is 8 + 9 = 17 units.

Difference between angle Q and angle P = 9 − 8 = 1 unit = 34° × (1 ÷ 17) = 2°.

Therefore The correct answer is 2°.

Alternate Method

Given:

=> In quadrilateral PQRS, the bisectors of angle R and angle S meet at point T.

=> angle STR = 17°

=> Ratio of angle P to angle Q = 8 : 9

Formula Used:

=> Sum of interior angles of a quadrilateral = 360°

=> Sum of angles in a triangle = 180°

Calculations:

In triangle STR:

=> angle STR + angle TSR + angle TRS = 180°

Since ST and RT are the angle bisectors of angle S and angle R respectively:

=> angle TSR = angle S ÷ 2

=> angle TRS = angle R ÷ 2

Substituting these values into the triangle angle sum equation:

=> 17° + (angle S ÷ 2) + (angle R ÷ 2) = 180°

=> (angle S + angle R) ÷ 2 = 180° − 17°

=> (angle S + angle R) ÷ 2 = 163°

=> angle S + angle R = 326°

In quadrilateral PQRS, the sum of all interior angles is 360°:

=> angle P + angle Q + angle R + angle S = 360°

=> angle P + angle Q + 326° = 360°

=> angle P + angle Q = 360° − 326°

=> angle P + angle Q = 34°

Given that the ratio of angle P to angle Q is 8 : 9, let angle P = 8x and angle Q = 9x:

=> 8x + 9x = 34°

=> 17x = 34°

=> x = 2°

The difference between the measures of angle Q and angle P is:

=> angle Q − angle P = 9x − 8x = x

=> x = 2°

Therefore The correct answer is 2°.

Additional Information

Angle Bisector Theorem in Quadrilaterals

The angle formed by the bisectors of two adjacent angles of a quadrilateral is always equal to half the sum of the remaining two opposite angles.

Sum of Interior Angles of a Polygon

For any convex polygon with n sides, the sum of all interior angles is given by the formula (n − 2) × 180°.

Q42. Answer: (b) 16 minutes

Shortcut Trick

When distance is constant, Speed is inversely proportional to Time.

Speed Ratio (Usual : New) = 7 : 4 → Time Ratio (Usual : New) = 4 : 7.

Difference in time units = 7 − 4 = 3 units.

Given, 3 units = 12 minutes => 1 unit = 4 minutes.

Usual Time = 4 units × 4 minutes = 16 minutes.

Therefore The correct answer is 16 min.

Alternate Method

Given: New Speed = 4/7 of Normal Speed, Delay = 12 minutes.

Formula Used: Usual Time = [Late time × Numerator] ÷ [Difference between Numerator and Denominator]

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

=> Distance D = S × T

=> New Speed = 4/7 S, New Time = T + 12

=> D = (4/7 S) × (T + 12)

=> S × T = 4/7 S × (T + 12)

=> 7T = 4T + 48

=> 3T = 48

=> T = 16 minutes.

Therefore The correct answer is 16 min.

Additional Information

Proportionality Rule

If Speed becomes a/b of its original value, the Time taken becomes b/a of the original time.

Average Speed

Average speed for equal distances at different speeds x and y is given by 2xy ÷ (x + y).

Relative Speed

When two objects move in the same direction, relative speed is the difference of their speeds.

Q43. Answer: (d) 93

Shortcut Trick

3125 = 5^5 => x − y = 5

2187 = 3^7 => 3x + y = 7

Solve => x = 3, y = −2

19x − 18y = 19×3 − 18(−2)

= 57 + 36 = 93

Therefore Answer = 93

Alternate Method

Given:

5^(x − y) = 3125

3^(3x + y) = 2187

Formula used:

a^m = a^n => m = n

Calculation:

=> 3125 = 5^5

=> x − y = 5 ...(1)

=> 2187 = 3^7

=> 3x + y = 7 ...(2)

=> Add (1) and (2)

=> 4x = 12 => x = 3

=> Substitute in (1)

=> 3 − y = 5 => y = −2

=> 19x − 18y = 19×3 − 18(−2)

=> = 57 + 36

=> = 93

Therefore The correct answer is 93.

Additional Information

Exponent Rule

If bases are same, equate powers

Simultaneous Equations

Solve linear equations step-by-step

Substitution Method

Find one variable and substitute

Q44. Answer: (c) 10% decrease

Shortcut Trick

Apply the successive percentage change formula: Net Change = a + b + (a × b)/100

Given: a = +20% (increase) and b = −25% (decrease)

Net Change = 20 − 25 + (20 × (−25))/100

Net Change = −5 − 5 = −10%

Therefore The correct answer is 10% decrease.

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Alternate Method

Given: First increase = 20%, Second decrease = 25%

Formula Used: Final Price = Initial Price × (100 + %change1)/100 × (100 + %change2)/100

=> Let the initial price be 100 units.

=> Price after 20% increase = 100 + 20% of 100 = 120 units.

=> Price after 25% decrease = 120 − 25% of 120

=> 120 − (25/100 × 120) = 120 − 30 = 90 units.

=> Net change = 100 − 90 = 10 units.

=> Net percentage change = (10/100) × 100 = 10%.

Therefore The correct answer is 10% decrease.

Additional Information

Successive Percentage Change

When a value is changed by x% and then by y%, the effective change is (x + y + xy/100)%. Use positive for increase and negative for decrease.

Fractional Conversion

20% increase is a multiplier of 6/5 and 25% decrease is a multiplier of 3/4. Net multiplier = 6/5 × 3/4 = 18/20 = 9/10, which indicates a 1/10 or 10% decrease.

Product Stability

If an item price increases by x%, the consumption must decrease by [x/(100+x)] × 100 to keep the expenditure constant.

Q45. Answer: (a) 4 : 15

Shortcut Trick

Expenditure ratio is the product of Price ratio and Quantity ratio.

Expenditure (Jowar : Gram) = (1 × 4) : (5 × 3)

Expenditure (Jowar : Gram) = 4 : 15

Therefore The correct answer is 4 : 15.

Alternate Method

Given:

Ratio of Market Prices (Jowar : Gram) = 1 : 5

Ratio of Quantities Consumed (Jowar : Gram) = 4 : 3

Formula Used:

Expenditure = Price × Quantity

Calculations:

=> Let the prices be 1x and 5x respectively.

=> Let the quantities be 4y and 3y respectively.

=> Expenditure on Jowar = 1x × 4y = 4xy

=> Expenditure on Gram = 5x × 3y = 15xy

=> Ratio of expenditure = 4xy : 15xy

=> Ratio = 4 : 15

Therefore The correct answer is 4 : 15.

Additional Information

Ratio Multiplication

When two independent variables contribute to a third variable (like Price and Quantity to Expenditure), their respective ratios are multiplied component-wise.

Inverse Relationship

If expenditure is constant, price and quantity are inversely proportional (Price1/Price2 = Quantity2/Quantity1).

Percentage Change in Expenditure

Net % change in expenditure = a + b + (a × b)/100, where a and b are percentage changes in price and quantity.

Q46. Answer: (a) 20%

Shortcut Trick

Total Cost Price (CP) of 6 notebooks = Rs. 30.

Total Selling Price (SP) of 6 notebooks = Rs. 36.

Multiplier for SP = CP × (100 + P%) ÷ 100.

Profit% = (SP − CP) ÷ CP × 100 = (36 − 30) ÷ 30 × 100.

Profit% = 6 ÷ 30 × 100 = 1 ÷ 5 × 100 = 20%.

Therefore The correct answer is 20%.

Alternate Method

Given: CP of 6 notebooks = Rs. 30; SP of 6 notebooks = Rs. 36.

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

=> Cost Price (CP) of 1 notebook = 30 ÷ 6 = Rs. 5.

=> Selling Price (SP) of 1 notebook = 36 ÷ 6 = Rs. 6.

=> Profit per notebook = SP − CP = 6 − 5 = Rs. 1.

=> Profit Percentage = (1 ÷ 5) × 100 = 20%.

Therefore The correct answer is 20%.

Additional Information

Profit and Loss Basics

Profit occurs when Selling Price is greater than Cost Price. It is always calculated on the Cost Price unless specified otherwise.

Unitary Method

To find profit percentage, you can compare the total CP and total SP for the same quantity of items, or find the price per single unit.

Q47. Answer: (c) Rs. 2,710

Shortcut Trick

Total amount = Rs. 8,516.

Total deduction = 88 + 31 + 90 = Rs. 209.

Remaining amount = 8516 − 209 = Rs. 8,307.

Ratio after deduction = 18 : 17 : 4 (Total parts = 18 + 17 + 4 = 39).

Value of (B − C) ratio difference = (17 − 4) = 13 units.

Difference in original shares = (Difference in ratio parts × Value per unit) + (B deduction − C deduction) = (13 × 8307 ÷ 39) + (31 − 90) = 2769 − 59 = Rs. 2,710.

Therefore The correct answer is Rs. 2,710.

Alternate Method

Given: Total = Rs. 8,516 | Deductions: A = Rs. 88, B = Rs. 31, C = Rs. 90 | Ratio (A−88):(B−31):(C−90) = 18:17:4.

Formula: Share = (Ratio Part ÷ Total Parts) × Remaining Sum + Deduction Amount

=> Sum after deduction = 8516 − (88 + 31 + 90) = 8516 − 209 = 8307

=> Total ratio parts = 18 + 17 + 4 = 39 units

=> 39 units = 8307

=> 1 unit = 8307 ÷ 39 = 213

=> B's share = (17 × 213) + 31 = 3621 + 31 = 3652

=> C's share = (4 × 213) + 90 = 852 + 90 = 942

=> Difference = 3652 − 942 = 2710

Therefore The correct answer is Rs. 2,710.

Additional Information

Ratio and Proportion Basics

If a sum S is divided in the ratio a:b:c, the shares are (a/Σr)×S, (b/Σr)×S, and (c/Σr)×S respectively.

Effective Sum Adjustment

When fixed amounts are added or subtracted from shares, always adjust the Total Sum first to align with the given ratio.

Compound Ratio

The compound ratio of a:b and c:d is (a×c):(b×d). This is useful in Partnership and Mixture problems.

Q48. Answer: (a) 69

Shortcut Trick

Teacher's Age = New Average + (Old Count × Increase in Average)

Given: Old Average = 25 years | New Average = 26 years

Old Count = 43 students | Increase = 26 − 25 = 1 year

=> Teacher's Age = 26 + (43 × 1) = 26 + 43 = 69 years

Therefore The correct answer is 69 years.

Alternate Method

Given: Number of students = 43, Average age = 25 years, Average with teacher included = 26 years.

Formula Used: Total Sum = Average × Number of Observations

=> Total age of 43 students = 43 × 25 = 1075 years

=> Total persons (including teacher) = 43 + 1 = 44

=> Total age of 44 persons = 44 × 26 = 1144 years

=> Teacher's age = (Total age of 44 persons) − (Total age of 43 students)

=> Teacher's age = 1144 − 1075 = 69 years

Therefore The correct answer is 69 years.

Additional Information

General Inclusion Formula

Value of new entry = (New Number of items × New Average) − (Old Number of items × Old Average).

Net Deviation Method

Sum of deviations from the average is always zero. If the average increases, the new value must be greater than the old average by (Total New Count × Increase).

Average of Groups

Combined Average = (n1x1 + n2x2) ÷ (n1 + n2), where n is the count and x is the average of each group.

Q49. Answer: (b) 15

Shortcut Trick

Apply the inverse proportionality rule: Total Work (Man-Days) remains constant.

M1 × D1 = M2 × D2

1209 × 20 = (1209 + 403) × D2

1209 × 20 = 1612 × D2

D2 = (1209 × 20) ÷ 1612 = 15 days.

Therefore The correct answer is 15 days.

Alternate Method

Given: Initial men (M1) = 1209, Initial days (D1) = 20, Men added = 403.

Formula Used: M1D1 = M2D2

=> Total food capacity = 1209 × 20 units

=> New number of men (M2) = 1209 + 403 = 1612

=> Let the new number of days be D2.

=> 1209 × 20 = 1612 × D2

=> D2 = (1209 × 20) ÷ 1612

=> D2 = 24180 ÷ 1612

=> D2 = 15

Therefore The correct answer is 15 days.

Additional Information

Chain Rule (Inverse Proportion)

When the number of men increases, the number of days for which provisions last decreases proportionally. M1D1 = M2D2.

Total Work Concept

The product of men and time gives the total volume of work or resources (like food units). Constant Resource = Men × Days.

Man-Hours Formula

If hours per day are also given, use: (M1 × D1 × H1) ÷ W1 = (M2 × D2 × H2) ÷ W2.

Q50. Answer: (b) Decreases by 60.26%

Shortcut Trick

Use the multiplying factor method for successive changes.

Net multiplier = (1 − 0.45) × (1 − 0.15) × (1 − 0.50) × (1 + 0.70)

Net multiplier = 0.55 × 0.85 × 0.50 × 1.70 = 0.397375

Decrease % = (1 − 0.397375) × 100 = 60.2625%
Therefore The correct answer is Decreases by 60.26%.
Alternate Method
Given:
Initial price of fuel = 100 units
Successive changes: 45% decrease, 15% decrease, 50% decrease, and 70% increase.
Calculations:
=> Price after 1st month = 100 × (55/100) = 55
=> Price after 2nd month = 55 × (85/100) = 46.75
=> Price after 3rd month = 46.75 × (50/100) = 23.375
=> Price after 4th month = 23.375 × (170/100) = 39.7375
=> Net Change = Final Price − Original Price = 39.7375 − 100 = −60.2625
=> Percentage Change = (−60.2625 / 100) × 100 = −60.2625%
Therefore The correct answer is Decreases by 60.26%.
Additional Information
Successive Percentage Change
For two changes x% and y%, the net change is given by the formula: [x + y + (xy/100)]%.
Base Value Change
Percentage increase/decrease is always calculated on the preceding value in a successive series, not the original 100 throughout.
Multiplying Factor
An x% decrease corresponds to a multiplier of (1 − x/100), while an x% increase corresponds to (1 + x/100).

Q51. Answer: (d) TRS 74

The logic followed here is:
So, the missing term = TRS 74
Hence, the correct answer is Option 4.

Q52. Answer: (a) Two

The logic followed here is:
Given numbers: 742, 912, 853, 657, 154

Position	1st	2nd	3rd	4th	5th
Numbers	742	912	853	657	154

Arranging in descending order: 912, 853, 742, 657, 154

Position	1st	2nd	3rd	4th	5th
Numbers	912	853	742	657	154

Here,
→ 657 remains in the 4th position
→ 154 remains in the 5th position
So, total numbers with unchanged positions = 2
Hence, the correct answer is Option 1.

Q53. Answer: (d) Fourteen

Given: (Left) 4 2 1 5 7 9 8 5 3 6 2 1 5 7 3 7 8 4 3 6 9 7 4 5 2 4 1 (Right)
Now,
We need to find the total count of prime numbers in the series.
Prime Numbers = 2, 3, 5, 7
(Left) 4 2 1 5 7 9 8 5 3 6 2 1 5 7 3 7 8 4 3 6 9 7 4 5 2 4 1 (Right)

Prime Number	Occurrences
2	3
3	3

5	4
7	4

Total prime numbers = 3 + 3 + 4 + 4 = 14
So, total prime numbers = 14
Hence, the correct answer is Option 4.

Q54. Answer: (c) 966

The logic followed here is:
thus, "966" will replace the question mark in the given series.
Hence, the correct option is "Option 3".

Q55. Answer: (d) MONK - ONMK - KNOM

The logic followed here is:
For, WEAR → EAWR → RAEW
For, SINK → INSK → KNIS
Now, check the options:
Option 1) BITE → BTIE → ETIB
Option 2) YOUR → OYUR → ROUY
Option 3) FANS → ANFS → ANSF
Option 4) MONK → ONMK → KNOM
Hence, the correct answer is Option 4.

Q56. Answer: (d) 46

Given: Mr. Zzz is 5th from the right in a row of 63 people. Mr. Ggg is 12th from the left.
Mr. Zzz's position from right = 5
Mr. Ggg's position from left = 12
Total number of people = 63
Number of people between = 63 − (12 + 5)
= 63 − 17
= 46
Hence, the correct answer is Option 4.

Q57. Answer: (c) 3

The logic followed here is:
Given number: 7593562
Logic:
Add 1 to each even digit
Subtract 2 from each odd digit
Original number: 7 5 9 3 5 6 2

Digit	Type	Operation	New Digit
7	Odd	7 − 2	5
5	Odd	5 − 2	3
9	Odd	9 − 2	7
3	Odd	3 − 2	1
5	Odd	5 − 2	3
6	Even	6 + 1	7
2	Even	2 + 1	3

New number: 5 3 7 1 3 7 3
Now, second digit from the left = 3

Hence, the correct answer is Option 3.

Q58. Answer: (b) South-west

The logic followed here is:
Given:
Car A is to the right of Car B
Car D is to the left of Car B
Car F is behind Car D
So,F lies in the South-West direction with respect to B.
Hence, the correct answer is Option 2.

Q59. Answer: (a) VLO

The logic followed here is:
So, the missing term = VLO
Hence, the correct answer is Option 1.

Q60. Answer: (d) Five

Given: Seven boxes D, E, F, U, V, W and X are kept one over the other but not necessarily in the same order.
Only five boxes are kept below X.
Only three boxes are kept between F and X.
V is kept at one of the positions below F.
Only E is kept between X and W.
D is kept at one of the positions above X.

Position	Box
7 (Top)	D
6	X
5	E
4	W
3	U
2	F
1 (Bottom)	V

Boxes between V and D → F, U, W, E, X
Hence, the correct answer is Option 4.

Q61. Answer: (b) X

Given: Seven people, R, S, T, U, V, W and X are sitting in a row facing east.
V is seated third from the right end.
S is fourth to the left of W.
R is seated to the right of V and at one of the ends.
Only one person is seated between T and S.
U does not sit at any of the extreme ends.
Extreme left end = position 1 = X
Hence, the correct answer is Option 2.

Q62. Answer: (a) ZBZD

The logic followed here is:
For, BDBF → JLJN
For, HJHL → PRPT
Now, apply the same to RTRV:
So, RTRV → ZBZD
Hence, the correct answer is Option 1.

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Q63. Answer: (d) 1 km to the east

The logic followed here is:

Given:

Ramesh starts from Point A (0, 0)

51 km North

Right turn → 55 km East

Right turn → 54 km South

Right turn → 56 km West

Right turn → 3 km North

So, To return to Point A, Ramesh must move 1 km East.

Hence, the correct answer is Option 4.

Q64. Answer: (a) Neither conclusion (I) nor (II) is true

Given Statements:

All hydrogen is oxygen.

Some oxygen is nitrogen.

Some nitrogen is carbon.

The least possible Venn diagram for the given statement is:

Conclusions:

I. Some nitrogen is hydrogen – Does not follow (There is no definite connection or overlap given between nitrogen and hydrogen, so this cannot be concluded.)

II. No carbon is oxygen – Does not follow (There is no stated restriction between carbon and oxygen, so we cannot conclude they are completely separate.)

So, neither conclusion I nor II follows.

Hence, the correct answer is "Option 1".

Q65. Answer: (b) 11

The logic followed here is:

Given number: 1368497

Original number: 1 3 6 8 4 9 7

Digits arranged in ascending order: 1 3 4 6 7 8 9

→ Second digit from the left = 3

→ Second digit from the right = 8

Sum = 3 + 8 = 11

Hence, the correct answer is Option 2.

Q66. Answer: (a) 8

Given: (Left) 9 1 7 9 7 3 1 9 1 7 7 5 (Right)

Now,

Odd digits, which are immediately preceded by an odd digit and also immediately followed by an odd digit.

So, Needed pattern is: Odd - Odd - Odd

(Left) 9 1 7 9 7 3 1 9 1 7 7 5 (Right)

So, total valid odd digits = 8

Hence, the correct answer is Option 1.

Q67. Answer: (a) UKN : SOL

The logic followed here is:

For, CUV : AYT

For, YCR : WGP

Now, check the options using the same pattern:

Option 1) UKN : SOL

Option 2) KGX : HKU

Option 3) ANP : VRK

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Option 4) TWG : PYC

Hence, the correct answer is Option 1.

Q68. Answer: (a) Three

The logic followed here is:

Given number: 9214538

Original number: 9 2 1 4 5 3 8

Digits arranged in ascending order: 1 2 3 4 5 8 9

Position	Original Digit	New Digit	Position Same?
1st	9	1	No
2nd	2	2	Yes
3rd	1	3	No
4th	4	4	Yes
5th	5	5	Yes
6th	3	8	No
7th	8	9	No

Digits with unchanged positions = 2, 4, 5

Total unchanged digits = 3

Hence, the correct answer is Option 1.

Q69. Answer: (c) (32, 3, 288)

The logic followed here is:

Logic: third number = (first number × second number) × 3

For, (28, 4, 336)

=> 28 × 4 = 112

=> 112 × 3 = 336

For, (25, 5, 375)

=> 25 × 5 = 125

=> 125 × 3 = 375

Now, checking the options using the same pattern:

Option 1) (26, 6, 368)

=> 26 × 6 = 156

=> 156 × 3 = 468 ≠ 368

Option 2) (41, 3, 379)

=> 41 × 3 = 123

=> 123 × 3 = 369 ≠ 379

Option 3) (32, 3, 288)

=> 32 × 3 = 96

=> 96 × 3 = 288

Option 4) (31, 6, 465)

=> 31 × 6 = 186

=> 186 × 3 = 558 ≠ 465

Hence, the correct answer is Option 3.

Q70. Answer: (b) 18

The logic followed here is:

thus, "18" will replace the question mark in the given series.

Hence, the correct option is "Option 2".

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Q71. Answer: (c) ry

Given:

'give me bike' is written as 'bn gt ry'

'who know me' is coded as 'ry fh vt'

So, me = ry

Hence, the correct answer is Option 3.

Q72. Answer: (b) D

Given: A, B, C, D, N, O and P are sitting in a straight line facing north.

Only N sits to the left of P.

Only four people sit between N and A.

Only B sits between O and C, and O is not an immediate neighbour of A.

Extreme right end = position 7 = D

Hence, the correct answer is Option 2.

Q73. Answer: (c) NJ−HG

The logic followed here is based on the alphabetical position pattern:

Option 1: SO – NJ

Option 2: TP – OK

Option 3: NJ – HG

Option 4: JF – EA

Thus, NJ – HG is different from the rest given options.

Hence, the odd one out is Option 3.

Q74. Answer: (a) 2

Given: (Left) $ # # £ 9 % £ 7 * & € 1 3 4 5 6 4 9 € 2 5 & (Right)

Now,

Numbers, which are immediately preceded by a symbol and also immediately followed by a symbol.

So, Needed pattern is: Symbol - Number - Symbol

(Left) $ # # £ 9 % £ 7 * & € 1 3 4 5 6 4 9 € 2 5 & (Right)

So, total valid numbers = 2

Hence, the correct answer is Option 1.

Q75. Answer: (d) 164

Shortcut Trick

The sequence follows a pattern of constant subtraction.

249 − 232 = 17

232 − 215 = 17

The pattern is to subtract 17 from the previous number.

Next number = 181 − 17 = 164.

Therefore The correct answer is 164.

Alternate Method

Given series: 249, 232, 215, 198, 181, ?

249

−17

→

232

−17

→

215

−17

→

198

−17

→

181

−17

→

164

The series is an Arithmetic Progression where each successive term is obtained by subtracting a fixed number (17).

=> 249 − 17 = 232

=> 232 − 17 = 215

=> 215 − 17 = 198

=> 198 − 17 = 181

=> 181 − 17 = 164

Therefore The correct answer is 164.

Additional Information

Arithmetic Progression (AP)

A sequence of numbers in which the difference between any two consecutive terms is constant, known as the common difference (d).

General Term of AP

The n^(th) term of an AP is given by a_n = a + (n − 1)d, where 'a' is the first term and 'd' is the common difference.

Common Difference Formula

The common difference can be calculated as d = a_n − a_(n−1). In this series, d = 232 − 249 = −17.

Q76. Answer: (c) Neither conclusion (I) nor (II) follows.

Given Statements:

Some houses are kites.

All mangoes are houses.

All flowers are kites.

The least possible Venn diagram for the given statement is:

Conclusions:

I. Some houses are flowers – Does not follow (Flowers are inside kites, and houses only partially overlap with kites.)

II. No flowers are mangoes – Does not follow (Flowers are inside kites and mangoes are inside houses, but there is no fixed restriction between flowers and mangoes.)

So, neither conclusion I nor II follows.

Hence, the correct answer is "Option 3".

Q77. Answer: (a) QPT

The logic followed here is based on the alphabetical position pattern:

Option 1: QPT

Option 2: ORN

Option 3: KNJ

Option 4: FIE

Thus, ORN, KNJ and FIE follow the same (+3, −4) positional pattern, while QPT follows a different pattern.

Hence, the odd one out is Option 1.

Q78. Answer: (d) BA

Given: Six people, A, B, C, D, E and F, are sitting in a row facing north.

A sits to the immediate right of E.

B sits fourth to the left of E.

Only one person sits between B and F.

C sits immediately to the left of F.

D sits second to the left of A.

Three pairs (CF, FD, DE) are adjacent consecutive neighbors, while BA is not.

Hence, the correct answer is Option 4 (BA).

Q79. Answer: (d) pl

Given:

'bring the cup' is coded as 'bz rs tq'

'cup on the' is coded as 'rs pl tq'

So,

the → rs / tq

cup → rs / tq

Remaining word = on

Remaining code = pl

So, on = pl

Hence, the correct answer is Option 4.

Q80. Answer: (a) Father's mother

Family Chart:

Decoding the Symbols:

Symbol →	**•**	**−**	**×**	**÷**
Meaning →	Father	Husband	Wife	Mother

Given: F × G + H − I ÷ K

It means: F is the wife of G, G is the father of H, H is the husband of I, and I is the mother of K.

Hence, F is Father's mother.

Therefore, the correct answer is Option 1.

Q81. Answer: (c) 130th Amendment Bill

The correct answer is 130th Amendment Bill.

Key Points

• The 130th Constitution Amendment Bill was introduced in the Lok Sabha in August 2025 to address specific socio-political and administrative requirements regarding the categorization of communities.

• This bill primarily focuses on the modification of the list of Scheduled Tribes in certain states, specifically aimed at ensuring that marginalized communities receive the benefits of reservation and social welfare schemes.

• The introduction of such bills is usually handled by the Ministry of Tribal Affairs or the Ministry of Social Justice and Empowerment, depending on the specific community being addressed.

• The 130th Amendment Bill seeks to amend the Constitution (Scheduled Tribes) Order, 1950, which is the primary legal instrument defining which communities are recognized as STs in various states of India.

• By being introduced in the lower house of Parliament (Lok Sabha), the bill follows the legislative procedure outlined under Article 368 of the Constitution, although amendments to the ST list specifically follow the procedure under Article 342.

Additional Information

• Procedure for Constitutional Amendments:

• As per Article 368, an amendment of the Constitution can be initiated only by the introduction of a Bill for the purpose in either House of Parliament.

• The Bill must be passed in each House by a special majority, which is a majority of the total membership of that House and a majority of not less than two-thirds of the members of that House present and voting.

• There is no provision for a joint sitting in case of a deadlock between the two Houses over a Constitutional Amendment Bill.

• Scheduled Tribes and Article 342:

• Article 342 of the Indian Constitution empowers the President to specify the tribes or tribal communities which shall be deemed to be Scheduled Tribes in relation to a State or Union Territory.

• However, any inclusion or exclusion from the list of Scheduled Tribes after the initial notification can only be done by an Act of Parliament.

• This process ensures that changes to the tribal status of a community undergo rigorous legislative scrutiny and debate within the Lok Sabha and Rajya Sabha.

• Significance of the 130th Bill:

• The bill is significant for communities like the Hattee community (often associated with Himachal Pradesh) or similar groups who have long-standing demands for ST status to improve their socio-economic standing.

• Granting ST status provides access to institutional reservations in educational institutions and government jobs, as well as

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protection under the Scheduled Castes and the Scheduled Tribes (Prevention of Atrocities) Act, 1989.

• Difference between Bills and Acts:

• A Bill is a draft legislative proposal that becomes an Act only after it has been passed by both Houses of Parliament and received the assent of the President.

• The numbering of Amendment Bills is continuous and often differs from the numbering of Amendment Acts because not every bill introduced in Parliament successfully becomes law.

Important Points

• Role of the Registrar General of India (RGI): Before a community is added to the ST list via an amendment bill, the proposal must be vetted by the Registrar General of India and the National Commission for Scheduled Tribes (NCST).

• Socio-Economic Criteria: The criteria used to define a community as a Scheduled Tribe include primitive traits, distinctive culture, geographical isolation, shyness of contact with the community at large, and backwardness.

• Legislative Timeline: While the 128th Amendment Act (Women's Reservation) was a major milestone in 2023, the sequence of subsequent bills like the 129th and 130th demonstrates the government's ongoing focus on social inclusion and administrative adjustments.

Q82. Answer: (a) R Praggnanandhaa

The correct answer is R Praggnanandhaa.

Key Points

• Rameshbabu Praggnanandhaa emerged as the top-ranked Indian player in the Live FIDE Rankings in early 2025, following a series of exceptional performances in elite international tournaments.

• In January 2025, during the Tata Steel Chess Tournament held in Wijk aan Zee, Netherlands, Praggnanandhaa gained critical rating points to leapfrog his compatriots in the live ratings list.

• By achieving this feat, he briefly surpassed the ratings of long-time India No. 1 Viswanathan Anand and the high-flying Arjun Erigaisi.

• At the age of 19, Praggnanandhaa became one of the youngest players in history to lead the Indian contingent in the FIDE live rating charts, which update after every single game played in rated tournaments.

• His rise to the top spot highlights the intense competition in Indian Chess, where multiple players are currently ranked within the World Top 15.

Additional Information

• Arjun Erigaisi:

• Arjun Erigaisi is a Grandmaster from Telangana who became the second Indian after Viswanathan Anand to cross the 2800 ELO rating mark in 2024.

• He has been a consistent performer in the French Top 12 and various Open tournaments, maintaining a spot in the World Top 5 throughout late 2024 and 2025.

• D Gukesh (Dommaraju Gukesh):

• D Gukesh created history in December 2024 by defeating Ding Liren to become the youngest-ever World Chess Champion.

• Hailing from Chennai, Tamil Nadu, Gukesh won the Candidates Tournament 2024 in Toronto, Canada, to earn his title shot.

• Viswanathan Anand:

• A five-time World Chess Champion, Viswanathan Anand became India's first Grandmaster in 1988.

• Often referred to as the "Tiger of Madras," he held the India No. 1 position for over three decades before the emergence of the "Golden Generation" of Indian chess prodigies.

• FIDE (International Chess Federation):

• FIDE is the governing body of the sport of chess, headquartered in Lausanne, Switzerland.

• It maintains the official ELO rating system and organizes the World Chess Championship cycle. Live Rankings are unofficial real-time updates of these ratings between the publication of the official monthly lists.

Important Points

• Live vs. Official Ratings: The Live FIDE Ranking is a real-time tracking of rating changes, whereas FIDE publishes the official rating list on the 1st of every month.

• Milestone Dates: The year 2024 was a watershed year for Indian chess with the 45th Chess Olympiad in Budapest, where both the Indian Men’s and Women’s teams won Gold Medals for the first time.

• Grandmaster Title: To become a Grandmaster (GM), a player must achieve a FIDE rating of at least 2500 and earn three GM norms in international competition.

Q83. Answer: (d) Charaka

The correct answer is Charaka.

Key Points

• The statue of Charaka, renowned as the "Father of Medicine" in ancient India, was unveiled by the Vice-President of India, Jagdeep Dhankhar.

• The unveiling ceremony took place at the Raj Bhavan in Goa in November 2023, coinciding with events celebrating India's rich medicinal heritage.

• Charaka was a principal contributor to Ayurveda, the traditional Indian system of medicine, and is best known for authoring the Charaka Samhita.

• He served as a court physician during the reign of the Kushana King Kanishka around the 1st or 2nd century CE.

• His teachings emphasized that prevention is better than cure, and he focused on the holistic well-being of the human body through a balance of Vata, Pitta, and Kapha.

Additional Information

• Charaka Samhita:

• It is one of the oldest and most important foundational texts of Ayurveda, written in Sanskrit.

• The text is divided into eight books (Sthanas) and contains 120 chapters covering various aspects of internal medicine.

• It details the etiology (causes), pathogenesis (development), and therapeutics of a wide range of diseases.

• Sushruta:

• Known as the "Father of Surgery" and the "Father of Plastic Surgery".

• He authored the Sushruta Samhita in ancient Varanasi around 600 BCE.

• His work describes over 300 surgical procedures and 120 surgical instruments, including early methods for rhinoplasty (nose reconstruction) and cataract surgery.

• Patanjali:

• Recognized as the "Father of Yoga" for his work in systematizing yoga practices.

• He authored the Yoga Sutras, a collection of 196 aphorisms compiled around the 2nd century BCE.

• He is also traditionally associated with works on Sanskrit grammar (Mahabhasya) and Ayurveda (though distinct from the medical Charaka).

• Dhanvantari:

• In Hindu mythology, he is worshipped as the God of Medicine and an avatar of Lord Vishnu.

• He is said to have emerged during the Samudra Manthan (Churning of the Ocean) carrying the pot of Amrita (nectar of immortality).

• The National Ayurveda Day in India is celebrated every year on the occasion of Dhanwantari Jayanti (Dhanteras).

Important Points

• Ayurveda is considered the Upaveda (applied knowledge) of the Atharva Veda.

• The "Brihat Trayi" (The Great Three) of Ayurveda consists of the Charaka Samhita, Sushruta Samhita, and Astanga Hridayam (by Vagbhata).

• The Ministry of AYUSH was established by the Government of India on November 9, 2014, to ensure the optimal development and propagation of traditional systems of healthcare like Ayurveda, Yoga, Unani, Siddha, and Homoeopathy.

• The unveiling of the statue at Goa signifies the modern integration of ancient wisdom into the current educational and administrative landscape of India.

Q84. Answer: (d) 5.6%

The correct answer is 5.6%.

Key Points

• The Periodic Labour Force Survey (PLFS) data indicates that the unemployment rate in India for the period of May 2025 stood at 5.6%.

• The unemployment rate (UR) is calculated as the percentage of persons unemployed among the total persons in the labour force.

• The PLFS is an initiative by the National Sample Survey Office (NSSO), which functions under the Ministry of Statistics and Programme Implementation (MoSPI) of the Government of India.

• The primary objective of the PLFS is to estimate the key employment and unemployment indicators such as the Worker Population Ratio (WPR), Labour Force Participation Rate (LFPR), and Unemployment Rate (UR) in a short time interval of three months for urban areas only in the Current Weekly Status (CWS).

• The survey was launched in April 2017 to ensure the availability of more frequent labour force data to help in evidence-based policy making.

Additional Information

• Labour Force Participation Rate (LFPR):

• This refers to the percentage of the population that is either working or actively seeking work. It includes both the employed and

the unemployed seeking employment.

• Worker Population Ratio (WPR):

• It is defined as the percentage of employed persons in the total population. This metric helps in understanding the proportion of the population that is actively contributing to the production of goods and services in the economy.

• Activity Status Definitions:

• Usual Status: The activity status is determined based on the reference period of the last 365 days preceding the date of the survey.

• Current Weekly Status (CWS): The activity status is determined based on a reference period of the last 7 days preceding the date of the survey.

• Significance of PLFS:

• Before the PLFS, the NSSO used to conduct quinquennial (every five years) surveys on employment. The shift to PLFS allows the Government to track the employment market dynamics with much higher frequency, especially in urban centers.

Important Points

• The unemployment rate of 5.6% reflects the status of individuals who were available for work but could not find even one hour of work during the reference week.

• MoSPI releases quarterly bulletins that provide estimates for urban areas and annual reports that cover both rural and urban sectors of India.

• Data from the PLFS is often compared with other reports like those from the Centre for Monitoring Indian Economy (CMIE), though the methodologies and definitions used by the NSSO are considered the official benchmarks for Government planning.

• Factors influencing these rates include economic growth, educational attainment, skill development initiatives, and seasonal variations in sectors like agriculture and construction.

Q85. Answer: (b) Arshad Nadeem

The correct answer is Arshad Nadeem.

Key Points

• Arshad Nadeem, the star javelin thrower from Pakistan, was officially honored with the Best Asian Athlete title by the Asian Athletics Association (AAA). This recognition was bestowed upon him in May 2025 following his unprecedented achievements on the global stage.

• The award acknowledges his historic performance at the Paris 2024 Olympic Games, where he ended Pakistan's 32-year Olympic medal drought by clinching the Gold Medal in the men’s javelin throw event.

• During the Olympic final, Arshad Nadeem set a monumental Olympic Record with a throw of 92.97 meters, surpassing the previous record of 90.57 meters set by Andreas Thorkildsen in 2008.

• He is the first Pakistani athlete to win an individual Olympic Gold, a feat that transformed him into a national hero and a prominent figure in Asian athletics.

• The Asian Athletics Association selects the "Best Athlete" based on performance consistency, record-breaking achievements, and the impact of the athlete on the sport within the Asian continent.

Additional Information

• Personal Profile: Arshad Nadeem was born on January 2, 1997, in Mian Channu, located in the Khanewal District of Punjab, Pakistan. He began his journey in sports with a focus on cricket before transitioning to the javelin throw under the guidance of local coaches.

• Career Milestones: Before his Olympic glory, Nadeem secured a Gold Medal at the 2022 Commonwealth Games in Birmingham with a throw of 90.18 meters. He also earned a Silver Medal at the 2023 World Athletics Championships held in Budapest, becoming the first Pakistani to medal at the event.

• The Asian Athletics Association (AAA): Established in 1973 and headquartered in Pathum Thani, Thailand, the AAA is the continental governing body for athletics in Asia. It oversees the Asian Athletics Championships and works to promote track and field sports across its 45 member nations.

• South Asian Rivalry: The competition between Arshad Nadeem and India's Neeraj Chopra has significantly boosted the popularity of javelin throwing in South Asia. Their mutual respect and high-level performances have been praised globally as a symbol of healthy sportsmanship.

Important Points

• National Recognition: For his exceptional service to the nation through sports, Arshad Nadeem was conferred with the Hilal-e-Imtiaz, Pakistan's second-highest civilian award, in 2024. He has also received the Pride of Performance award previously.

• Physical Resilience: Throughout his career, Nadeem has overcome significant challenges, including major knee and elbow surgeries in 2022 and early 2024. His ability to return to peak form and break the 90-meter barrier repeatedly is considered a rare feat in the sport.

• World Ranking: His performances have consistently placed him among the top 5 in the World Athletics rankings for men's javelin, making him one of the most successful Asian field athletes in history.

Q86. Answer: (c) Asian Development Bank

The correct answer is Asian Development Bank.

Key Points

• The Asian Development Bank (ADB) approved a $109.97 million loan in June 2024/2025 to significantly enhance advanced skills and employability in the state of Gujarat, India.

• The primary objective of this funding is to support the Gujarat Skill Development Project, which aims to create a high-quality, industry-aligned workforce to meet the demands of modern economic sectors.

• A major component of this project is the establishment of the Gujarat Skill University (GSU), which will serve as a premier institution for higher vocational education and advanced technical training.

• The project focuses on emerging and high-growth sectors such as renewable energy, advanced manufacturing, electric vehicles, and digital technology, aligning with Industry 4.0 standards.

• The initiative seeks to improve the Technical and Vocational Education and Training (TVET) ecosystem by fostering Public-Private Partnerships (PPP) and ensuring that training programs are relevant to the needs of the private sector.

• The program also emphasizes social inclusion, providing specialized training and support to women and marginalized communities to improve their participation in the formal labor market.

Additional Information

• Asian Development Bank (ADB):

• Established on 19 December 1966, it is a regional development bank committed to achieving a prosperous, inclusive, and sustainable Asia and the Pacific.

• It is headquartered in Mandaluyong, Metro Manila, Philippines.

• As of 2024, it has 69 members, with India being one of its founding members and a top borrower.

• World Bank:

• Founded in 1944 at the Bretton Woods Conference, it is headquartered in Washington, D.C., USA.

• It provides loans and grants to the governments of low- and middle-income countries for the purpose of pursuing capital projects and poverty reduction.

• Reserve Bank of India (RBI):

• It is India's central bank and regulatory body responsible for the regulation of the Indian banking system.

• Established on 1 April 1935 under the Reserve Bank of India Act, 1934, it is headquartered in Mumbai.

• State Bank of India (SBI):

• It is the largest public sector bank in India and a Fortune Global 500 company.

• It has its headquarters in Mumbai, Maharashtra, and traces its origins to the Bank of Calcutta founded in 1806.

Important Points

• Gujarat’s Industrial Significance: As a leading industrial state in India, Gujarat accounts for a significant portion of the country's manufacturing output and exports, necessitating a constant supply of highly skilled labor.

• Employment Trends: The transition toward automation and digitalization in Gujarat's industries has created a gap between traditional skills and industry requirements, which this ADB-funded project intends to bridge.

• Strategic Partnership: India is the largest borrower from the ADB's ordinary capital resources, with various projects spanning transport, energy, urban development, and human capital development across several states.

Q87. Answer: (c) Udhayanidhi Stalin

The correct answer is Udhayanidhi Stalin.

Key Points

• The Chief Minister's Mini Sports Stadium in Madurai district was inaugurated by Udhayanidhi Stalin in March 2025.

• Udhayanidhi Stalin, who serves as the Deputy Chief Minister of Tamil Nadu and the Minister for Youth Welfare and Sports Development, led the ceremony as part of the state's mission to decentralize sports infrastructure. Hence, the correct answer is Udhayanidhi Stalin.

• The construction of these mini-stadiums is a flagship initiative of the DMK-led government, fulfilling a poll promise to establish high-quality sports facilities in every Assembly Constituency of the state.

• The Madurai facility is designed to provide rural and semi-urban athletes with access to modern amenities, including multipurpose courts, gymnasiums, and athletic tracks, reducing their need to travel to the city center for training.

• This inauguration in March 2025 highlights the government's focus on the Dravidian Model of development, which emphasizes inclusive growth and the empowerment of youth through sports.

Additional Information

• Udhayanidhi Stalin: He was elevated to the rank of Deputy Chief Minister in September 2024. Under his leadership, the Sports Development Authority of Tamil Nadu (SDAT) has undergone significant modernization.

• Sports Infrastructure in Madurai: Madurai has emerged as a major sports hub in South India. Besides the mini-stadiums, the district is home to the Kalaignar Centenary Jallikattu Arena in Alanganallur, which was inaugurated in 2024 to preserve traditional sports.

• Budgetary Allocation: The Tamil Nadu Government allocated substantial funds in the 2024-2025 Budget for the Youth Welfare and Sports Development Department to ensure the completion of 100 mini-stadiums across the state.

• Grassroots Talent Scouting: These stadiums serve as the primary venues for the CM Trophy Sports Meet, a state-wide competition aimed at identifying Olympic-level talent from the village level.

• Facility Standards: Most Chief Minister's Mini Stadiums are built at an estimated cost of Rs. 3 crore each and include facilities for Volleyball, Kabaddi, Silambam, and Athletics.

Important Points

• Khelo India: Tamil Nadu successfully hosted the Khelo India Youth Games in January 2024, which significantly boosted the sporting culture under the supervision of Udhayanidhi Stalin.

• TN Champion Foundation: This foundation was established to provide financial assistance to athletes from economically weaker sections, ensuring that financial constraints do not hinder sporting excellence.

• Administrative Significance: The inauguration in Madurai in March 2025 serves as a milestone in the state's preparation for upcoming national and international sporting events, positioning Tamil Nadu as the "Sports Capital of India."

Q88. Answer: (c) Hindustan Aeronautics Limited

The correct answer is Hindustan Aeronautics Limited.

Key Points

• Hindustan Aeronautics Limited (HAL), a premier aerospace and defense Public Sector Undertaking (PSU), emerged as the successful bidder for the Transfer of Technology (ToT) for the Small Satellite Launch Vehicle (SSLV) in 2025.

• The deal, valued at approximately Rs. 511 crore, was facilitated by NewSpace India Limited (NSIL), the commercial arm of the Indian Space Research Organisation (ISRO).

• The primary objective of this ToT is to enable HAL to manufacture, assemble, and commercialize the SSLV, thereby shifting the responsibility of routine satellite launches from ISRO to the industry.

• The SSLV is specifically designed to cater to the growing global demand for launching small satellites (mini, micro, or nanosatellites) into Low Earth Orbit (LEO).

• This move is a significant step under the Indian Space Policy 2023, which aims to enhance the participation of the Indian industry in end-to-end space activities.

Additional Information

• Small Satellite Launch Vehicle (SSLV):

• It is a three-stage launch vehicle that uses solid propulsion stages and a liquid propulsion-based Velocity Trimming Module (VTM) as a terminal stage.

• The vehicle is capable of launching up to 500 kg satellites into a 500 km planar orbit, providing a "launch on demand" capability with low turnaround time.

• It offers cost-effective access to space, requiring minimal infrastructure and a small team for launch operations compared to the PSLV or GSLV.

• Hindustan Aeronautics Limited (HAL):

• Established in 1940 as Walchand Aircraft and later renamed, it is headquartered in Bengaluru.

• HAL plays a vital role in India's defense sector, manufacturing fighter jets like the Tejas (LCA), helicopters like the Dhruv (ALH), and various aero-engines.

• The company has a long-standing partnership with ISRO, having manufactured structural components for the PSLV, GSLV, and the Chandrayaan and Gaganyaan missions.

• NewSpace India Limited (NSIL):

• Incorporated in March 2019, NSIL is a Wholly Owned Government of India Company under the administrative control of the Department of Space (DOS).

• Its mandate is to commercially exploit the R&D work of ISRO Centers and units, including the production of launch vehicles through Indian industry.

Important Points

• Strategic Impact: The SSLV ToT marks the first time a complete launch vehicle technology is being transferred to a PSU/Industry partner in its entirety for commercial production.

• Global Market: With the rise of satellite constellations for internet and earth observation, the small satellite market is projected to grow exponentially, and HAL is now positioned to capture a significant share of this global market.

• Self-Reliance: This initiative aligns with the Atmanirbhar Bharat (Self-Reliant India) vision, fostering a robust domestic space ecosystem and reducing the burden on ISRO, allowing it to focus on deep-space exploration and advanced research.

Q89. Answer: (a) Hanooman

The correct answer is Hanooman.

Key Points

• Reliance Industries Limited (RIL), in partnership with the BharatGPT group, is set to launch a series of Large Language Models (LLMs) called Hanooman.

• The Hanooman AI service is designed as a ChatGPT-style multimodal AI tool that can communicate in more than 11 Indian languages, including Hindi, Tamil, Telugu, Malayalam, and Marathi. Hence, the correct answer is Hanooman.

• This initiative is a collaborative effort between Jio Platforms, the Department of Science and Technology, and eight Indian Institutes of Technology (IITs), with IIT Bombay playing a leading role.

• The AI model is specifically tailored to provide solutions in four critical sectors: Healthcare, Governance, Financial Services, and Education.

• Unlike global models, Hanooman aims to solve the unique challenges of the Indian landscape by offering speech-to-text capabilities in local dialects, catering to a vast population that may not be proficient in English or formal script.

Additional Information

• BharatGPT Consortium: This is a unique public-private partnership led by IIT Bombay. It represents India's effort to create indigenous AI that reflects the country's linguistic and cultural diversity.

• Seetha Mahalaxmi Healthcare (SML): This is the AI startup that worked alongside the BharatGPT group to develop the Hanooman series of models.

• Integration with Jio: Reliance plans to integrate these AI capabilities into its Jio ecosystem, potentially powering services like Jio Brain, which aims to use AI for better data management and customer service across its telecom and retail arms.

• Competitors: While Hanooman is a localized model, it enters a space currently dominated by global players like OpenAI (ChatGPT), Google (Gemini), and other Indian initiatives like Krutrim by Ola and Airavata.

Important Points

• Technical Scale: The Hanooman series will include models of varying sizes, ranging from 1.5 billion to 40 billion parameters, allowing for flexibility in different use cases from mobile apps to heavy enterprise servers.

• Launch Context: The first set of models was showcased at a technology conference in Mumbai in February 2024, highlighting India's push for "Sovereign AI".

• Open Source Potential: There are discussions regarding making parts of the Hanooman stack open-source to encourage developers in India to build localized applications on top of the base model.

• Multimodality: The model is multimodal, meaning it can process and generate not just text, but also voice, images, and videos, which is crucial for a country with diverse literacy levels.

Q90. Answer: (b) 102nd

The correct answer is 102nd.

Key Points

• In the 2025 Global Hunger Index (GHI) report, India has been ranked 102nd out of the 127 countries that were assessed.

• India’s performance is categorized under the "Serious" level of hunger, with a specific GHI score that reflects the ongoing challenges in nutrition and food security. Hence, the statement regarding the rank is correct.

• The report is a peer-reviewed annual publication produced by two international NGOs: Concern Worldwide (based in Ireland) and Welthungerhilfe (based in Germany).

• The 2025 ranking shows a slight improvement in India's position compared to the previous year (2024), where it was ranked 105th out of 127 nations.

• The report highlights that while India has made strides in certain areas, the levels of child wasting and undernourishment remain significant concerns for policy makers.

Additional Information

• The Four Indicators of GHI:

• Undernourishment: This measures the share of the entire population with insufficient caloric intake.

• Child Stunting: This refers to the share of children under age five who have low height for their age, reflecting chronic undernutrition.

• Child Wasting: This indicates the share of children under age five who have low weight for their height, reflecting acute undernutrition.

• Child Mortality: The mortality rate of children under the age of five, partially reflecting the fatal mix of inadequate nutrition and unhealthy environments.

• Scoring Methodology:

• The GHI determines hunger on a 100-point scale, where 0 is the best possible score (no hunger) and 100 is the worst.

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• Values less than 9.9 are considered low, 10.0–19.9 are moderate, 20.0–34.9 are serious, 35.0–49.9 are alarming, and above 50.0 are extremely alarming.

Important Points

• Regional Comparisons: In the 2025 report, several of India's neighbors, including Bangladesh, Nepal, and Sri Lanka, often rank higher (better) than India, despite having smaller economies. Pakistan generally ranks close to or lower than India in these assessments.

• Government Perspective: The Ministry of Women and Child Development in India has frequently questioned the methodology of the GHI. The government argues that the index relies heavily on opinion polls and that the sample size is too small to represent a country of 1.4 billion people.

• Child Wasting in India: India historically reports one of the highest rates of child wasting in the world, a metric that significantly pulls down its overall GHI ranking.

• Global Context: The 2025 report emphasizes that global progress against hunger has largely stagnated since 2015, due to climate change, conflicts, and economic shocks.

Q91. Answer: (a) Mussalman Wakf (Repeal) Bill

The correct answer is Mussalman Wakf (Repeal) Bill.

Key Points

• The Mussalman Wakf (Repeal) Bill, 2025, was introduced to formally repeal the Mussalman Wakf Act, 1923, a colonial-era legislation that had become redundant following the enactment of more comprehensive laws.

• This Bill received the Presidential assent in January 2025, following its passage in both the Lok Sabha and the Rajya Sabha during the legislative sessions focusing on Waqf reforms.

• The primary objective of this repeal was to remove the obsolete 1923 Act from the statute books, as its provisions regarding the submission of accounts by Mutawallis were already covered under the Waqf Act, 1995.

• The repeal process was carried out alongside the Waqf (Amendment) Bill, 2024, which sought to bring significant transparency and accountability to the management of Waqf properties across India.

• The Ministry of Minority Affairs spearheaded these legislative changes to streamline the administration of religious endowments and ensure better utilization of land for community welfare. Hence, the correct answer is Mussalman Wakf (Repeal) Bill.

Additional Information

• The Waqf Act, 1995:

• This is the principal legislation governing Waqf in India. It provides for the establishment of State Waqf Boards and the Central Waqf Council.

• The 2024-2025 reforms proposed renaming this act to the Unified Waqf Management, Empowerment, Efficiency and Development Act.

• The Act defines Waqf as the permanent dedication of any movable or immovable property for purposes recognized by Muslim Law as pious, religious, or charitable.

• Waqf Boards and Governance:

• Every State in India has a Waqf Board, which is a body corporate having perpetual succession and a common seal.

• The Mutawalli is the person who manages the Waqf property, but they are overseen by the State Waqf Board to prevent mismanagement.

• The new amendments aim to include Muslim women and non-Muslims in these boards to increase diversity and professional oversight.

• The Mussalman Wakf Act, 1923:

• This British-era law was limited in scope, focusing mainly on the obligation of managers to furnish statements of particulars and accounts to the District Court.

• Because the 1995 Act provided a much more robust mechanism for audits and judicial oversight through Waqf Tribunals, the 1923 Act was no longer necessary.

Important Points

• Joint Parliamentary Committee (JPC):

• A 31-member JPC, chaired by Jagdambika Pal, was constituted in 2024 to examine the Waqf (Amendment) Bill and related matters before they were finalized in 2025.

• The committee held several meetings across India, including locations like Mumbai, Ahmedabad, and Delhi, to gather feedback from stakeholders, including All India Muslim Personal Law Board and various Sufi organizations.

• Key Features of the 2025 Reform Era:

• Digitization: A centralized portal (WAMSI) is being enhanced to map all Waqf properties using GIS technology to prevent encroachments.

• Audit Requirements: The new reforms mandate that Waqf accounts must be audited by auditors appointed by the State

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Government or the Comptroller and Auditor General (CAG) in certain cases.

• Tribunal Powers: The Waqf Tribunals have been restructured to ensure that disputes regarding property titles are settled within a stipulated timeframe of 6 months to 1 year.

Q92. Answer: (b) Campus Calling Abhiyaan

The correct answer is Campus Calling Abhiyaan.

Key Points

• The National Commission for Women (NCW) launched the Campus Calling Abhiyaan in May 2025 specifically designed for college and university students across India.

• The primary objective of the Campus Calling Abhiyaan is to promote gender sensitivity and create a safe environment within educational ecosystems by engaging with the youth directly.

• It aims to raise significant awareness regarding the prevention of sexual harassment, ensuring that students are well-versed with the legal protections and redressal mechanisms available to them. Hence, the correct option is Campus Calling Abhiyaan.

• A major component of this programme is addressing the rising tide of cyber crimes impacting the student community, including issues like cyberstalking, identity theft, and online bullying.

• The initiative seeks to empower students to become change agents in society, fostering a culture of mutual respect and equality regardless of gender.

Additional Information

• National Commission for Women (NCW):

• It is a statutory body of the Government of India, established in January 1992 under the provisions of the National Commission for Women Act, 1990.

• The first Chairperson of the commission was Jayanti Patnaik.

• The mandate of the NCW includes reviewing the Constitutional and Legal safeguards for women, recommending remedial legislative measures, and advising the government on all policy matters affecting women.

• Prevention of Sexual Harassment (POSH):

• The Sexual Harassment of Women at Workplace (Prevention, Prohibition and Redressal) Act was enacted in 2013.

• It defines sexual harassment and provides a mechanism for complaint redressal through Internal Committees (IC) and Local Committees (LC).

• Educational institutions are required to maintain active committees to ensure the safety of students and staff alike.

• Cyber Crime Awareness:

• With the increase in digital learning, students have become more vulnerable to cyber-enabled crimes.

• The NCW frequently collaborates with the Cyber Crime Coordination Centre (I4C) under the Ministry of Home Affairs to educate women on digital safety.

• Common threats addressed include phishing, revenge porn, and the unauthorized use of Artificial Intelligence for deepfakes.

Important Points

• The Campus Calling Abhiyaan serves as a bridge between the National Commission for Women and the Ministry of Education to implement gender-just policies at the grassroots level.

• Through interactive workshops, seminars, and digital modules, the programme targets Tier-1, Tier-2, and Tier-3 cities to ensure widespread reach.

• In 2021, the NCW also launched the 'She is a Changemaker' programme to improve leadership skills in women, highlighting their continuous effort in capacity building.

• Statistics indicate that awareness campaigns in colleges significantly reduce the rate of unreported harassment cases by improving trust in administrative bodies.

Q93. Answer: (a) June

The correct answer is June.

Key Points

• The Indian Conservation Conference–2025 was organized in June 2025 as a premier event to foster dialogue between environmental scientists and indigenous communities.

• The core theme of the conference revolved around the integration of traditional ecological knowledge (TEK) with modern scientific methodologies to tackle the rising threats of climate change and habitat fragmentation.

• It emphasized that indigenous practices, honed over centuries by tribal populations in India, provide invaluable insights into sustainable harvesting and biodiversity preservation.

• The scientific approaches discussed included the use of Artificial Intelligence (AI) for wildlife tracking, satellite imagery for monitoring forest cover, and biotechnology for ex-situ conservation.

• The conference concluded with the drafting of a Roadmap for 2030, aligning India's domestic conservation goals with the

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Kunming-Montreal Global Biodiversity Framework.

Additional Information

• World Environment Day: Observed annually on June 5, this international day served as a backdrop for the 2025 conference, highlighting India's Mission LiFE (Lifestyle for Environment) initiative launched in 2022.

• Legal Framework in India: Conservation efforts in the country are primarily governed by the Wildlife Protection Act, 1972 and the Biological Diversity Act, 2002, both of which provide a legal basis for protecting endangered species and ecosystems.

• Traditional Knowledge Digital Library (TKDL): India has pioneered the protection of traditional knowledge through the TKDL, preventing the bio-piracy of ancient medicinal and ecological practices.

• Role of MoEFCC: The Ministry of Environment, Forest and Climate Change (MoEFCC) is the nodal agency responsible for planning, promoting, and coordinating India's environmental and forestry programs.

• International Collaboration: India actively participates in COP (Conference of Parties) meetings under the United Nations Framework Convention on Climate Change (UNFCCC), striving for Net Zero emissions by the year 2070.

Important Points

• Biodiversity Hotspots: India hosts four of the world's 36 biodiversity hotspots: the Himalayas, the Western Ghats, the Indo-Burma region, and the Sundaland (including the Nicobar Islands).

• Community Reserves: The 2025 conference highlighted the success of Community Reserves, where local residents take the lead in conservation, demonstrating the power of decentralized environmental management.

• Article 48A: The Constitution of India, under Directive Principles of State Policy, mandates that the State shall endeavor to protect and improve the environment and safeguard forests and wildlife.

• Article 51A(g): It is a Fundamental Duty of every citizen of India to protect and improve the natural environment, including forests, lakes, rivers, and wildlife.

• National Biodiversity Authority (NBA): Established in 2003 and headquartered in Chennai, the NBA performs a facilitative and advisory role for the Government of India on issues of conservation and sustainable use of biological resources.

Q94. Answer: (b) IIT Roorkee

The correct answer is IIT Roorkee.

Key Points

• The country's first Earthquake Early Warning (EEW) mobile application, named 'Uttarakhand Bhookamp Alert', was developed by the Indian Institute of Technology (IIT) Roorkee.

• The project was carried out in collaboration with the Uttarakhand State Disaster Management Authority (USDMA) to provide timely alerts to the public.

• This application is the first-of-its-kind in India and is designed to detect the onset of an earthquake and issue warnings before the destructive waves reach a particular location.

• One of the standout features of the app is its ability to send the geographic location of people who might be trapped during a disaster, facilitating faster search and rescue operations.

• The app functions by receiving data from a network of seismic sensors placed across high-risk areas in the Himalayan region.

Additional Information

• Seismic Vulnerability: Uttarakhand is a seismically active state in India, with a significant portion of its territory falling under Seismic Zone IV (High Damage Risk Zone) and Seismic Zone V (Very High Damage Risk Zone).

• IIT Roorkee: Established in 1847 as the Thomason College of Civil Engineering, it is the oldest technical institution in Asia. It houses a dedicated Department of Earthquake Engineering, which is a pioneer in the field of seismic research in India.

• Working Mechanism: The EEW system relies on the detection of P-waves (Primary waves), which are non-destructive and travel faster than the destructive S-waves (Secondary waves). By detecting P-waves, the system can provide a lead time ranging from a few seconds to a minute before the tremors are felt.

• Central Seismic Gap: The app is particularly crucial for the Central Seismic Gap in the Himalayas, a region that has not experienced a major earthquake for a long time and is considered overdue for a high-magnitude event.

• National Center for Seismology (NCS): While IIT Roorkee developed this specific app, the NCS under the Ministry of Earth Sciences is the nodal agency for monitoring earthquake activity across the entire country.

Important Points

• Official Launch: The application was officially launched on August 4, 2021, by the Chief Minister of Uttarakhand, Pushkar Singh Dhami.

• Availability: The app is available on both Android and iOS platforms to ensure that a large section of the population can benefit from the warning system.

• Public Safety: In addition to alerts, the application provides a set of standard operating procedures (SOPs) and safety guidelines that individuals should follow during and after an earthquake to minimize casualties.

• Data Fact: The app was initially supported by the Ministry of Earth Sciences, Government of India, as a pilot project before being

fully integrated with the state's disaster management framework.

Q95. Answer: (a) Nairithi Konduru

The correct answer is Nairithi Konduru.

Key Points

• Nairithi Konduru, a young Indian talent, has been honored with the Serena Memorial Child Prodigy Award 2025 at the Panorama International Literature Festival (PILF).

• The award was conferred by the Writers Capital International Foundation (WCIF) during their global literary event held in 2025 to recognize her exceptional contributions to literature and creative expression.

• The Serena Memorial Child Prodigy Award is a prestigious international recognition specifically designed to identify and encourage children who exhibit extraordinary skills and intellectual depth in the field of arts and letters.

• The Panorama International Literature Festival is one of the world's largest literary programs, aiming to unite authors, poets, and artists from across the globe under a single platform to promote humanitarian values.

• Nairithi Konduru's achievement reflects the rising influence of young Indian writers on the global literary stage, showcasing creative maturity far beyond her age.

Additional Information

• Writers Capital International Foundation:

• The foundation is a non-profit organization that works toward fostering global peace, unity, and cultural exchange through literature and education.

• It organizes the Panorama International Literature Festival annually, which sees participation from over 100 countries and features various categories of awards for literary excellence.

• The Serena Memorial Award:

• This specific award is named in memory of Serena, a child prodigy whose life and talents inspired the creation of a platform to support gifted children.

• It aims to provide global visibility to children like Nairithi Konduru, helping them refine their creative crafts and connect with international mentors.

• Panorama International Literature Festival (PILF) 2025:

• The 2025 edition of the festival focused on themes related to sustainability, peace, and the digital future of literature.

• Apart from the child prodigy category, the festival also honors seasoned writers; for instance, Vinita Agrawal is a noted Indian poet and editor who has been associated with such international literary forums.

• Impact on Young Authors:

• Such awards serve as a significant milestone for young authors, often leading to opportunities for international publishing and literary fellowships.

• Karnav Rastogi and Salman Lakda are also names frequently associated with youth achievement and literature in various regional and national contexts, highlighting a vibrant culture of child authors in India.

Important Points

• Selection Process: The winners are selected by an international jury based on the originality, depth, and impact of their written works or artistic contributions.

• Global Recognition: Receiving an award at PILF places the recipient among a community of global thinkers and literary icons, providing a foundation for a professional career in humanities.

• Year 2025: This year marked a significant increase in technological integration within the festival, allowing for hybrid participation from young prodigies across different continents.

Q96. Answer: (c) Constitution (One Hundred and Thirtieth Amendment) Bill, 2025

The correct answer is Constitution (One Hundred and Thirtieth Amendment) Bill, 2025.

Key Points

• On 20 August 2025, the Union Home Minister and Minister of Cooperation presented the Constitution (One Hundred and Thirtieth Amendment) Bill, 2025 in the Parliament.

• The primary objective of this legislative measure is to prohibit individuals holding key constitutional offices, such as Chief Ministers or Union Ministers, from administering the government or exercising executive functions while being held in judicial custody or jail.

• This bill seeks to address a legal lacuna regarding the ethical and administrative feasibility of a government-in-absentia, ensuring that the dignity of the Constitutional office is maintained.

• The amendment introduces specific clauses that mandate the immediate vacation of office or the appointment of an officiating authority if the incumbent is remanded to jail for a period exceeding a specified duration.

• By barring governance from prison, the bill aims to uphold the sanctity of the Constitution and ensure that public administration

remains transparent and accessible to the citizenry.

Additional Information

• Constitutional Framework for Amendments:

• Under Article 368 of the Indian Constitution, the Parliament has the power to amend the Constitution by way of addition, variation, or repeal of any provision.

• A Constitution Amendment Bill like the 130th Amendment requires a special majority in both the Lok Sabha and the Rajya Sabha to be passed.

• Administrative Integrity:

• The concept of administrative integrity implies that those in executive power must be able to perform their statutory duties without physical or legal constraints that hinder governance.

• Prior to this 2025 bill, there was no explicit Constitutional provision that automatically disqualified a Minister or Chief Minister from continuing in office solely due to being in custody, provided they had not been convicted of a crime.

• Role of the Home Ministry:

• The Ministry of Home Affairs (MHA), led by the Union Home Minister, is responsible for matters relating to the internal security, inter-state relations, and the administration of Union Territories.

• Introducing such amendments often falls under the purview of the MHA when they relate to the structural integrity of the Indian state and legal governance.

Important Points

• Significance of the Bill:

• The Constitution (One Hundred and Thirtieth Amendment) Bill is a landmark move to prevent political instability caused by leaders attempting to run state machinery from confinement.

• It reinforces the principle of accountability, ensuring that those who cannot physically attend Cabinet meetings or access classified documents due to incarceration cannot hold the reins of power.

• Comparison with Representation of the People Act:

• While the Representation of the People Act, 1951 deals with the disqualification of MPs and MLAs upon conviction (usually for 2 years or more), this new Amendment focuses specifically on the custodial stage for Constitutional heads.

• It distinguishes between the right to represent a constituency and the executive authority to lead a government.

Q97. Answer: (c) Arohan Financial Services

The correct answer is Arohan Financial Services.

Key Points

• The Reserve Bank of India (RBI), in January 2025, lifted the supervisory restrictions on Arohan Financial Services, allowing the firm to resume its sanction and disbursement of loans.

• These restrictions were originally imposed on October 17, 2024, due to concerns regarding usurious interest rates and non-compliance with the regulatory framework for microfinance loans.

• The central bank had observed that the Weighted Average Lending Rate (WALR) and the interest margins charged by the company were significantly higher than the benchmarks, violating Fair Practices Code guidelines.

• Alongside Arohan Financial Services, the RBI also removed similar curbs on Asirvad Microfinance and DMI Finance in early January 2025 after they demonstrated improvement in their pricing policies.

• The lifting of the "cease and desist" order signifies that the company has aligned its internal control systems and pricing mechanisms with the RBI's regulatory expectations for NBFC-MFIs.

Additional Information

• Regulatory Framework for NBFCs:

• The RBI exercises its powers under Section 45L(1)(b) of the Reserve Bank of India Act, 1934, to issue directions to Non-Banking Financial Companies to ensure financial stability.

• In 2024, the RBI intensified its scrutiny on the microfinance sector to prevent excessive interest rates and ensure that the benefits of low-cost funding are passed to low-income borrowers.

• Arohan Financial Services:

• Headquartered in Kolkata, West Bengal, it is a prominent NBFC-MFI (Micro Finance Institution) serving the under-banked populations in India.

• The organization primarily focuses on providing credit facilities to women in rural and semi-urban areas for income-generating activities.

• The October 2024 Action:

• In a rare move, the RBI had simultaneously barred four NBFCs—Navi Finserv, Asirvad Microfinance, Arohan Financial Services, and DMI Finance—from loan disbursements.

• The action was part of a broader supervisory campaign to curb irresponsible lending and ensure that digital lenders and MFIs maintain transparency in their Annual Percentage Rate (APR).

Important Points

• Microfinance Pricing Policy: Under the RBI's March 2022 regulatory framework, NBFC-MFIs have the freedom to set interest rates but must ensure they are not usurious. The Board-approved policy must include a transparent pricing model.

• Impact of Curbs: The imposition of curbs usually leads to a temporary halt in Asset Under Management (AUM) growth and affects the liquidity and credit ratings of the concerned entities.

• Compliance: To have restrictions removed, entities must provide written commitments and audit reports confirming that their lending practices and customer protection measures are in full compliance with RBI norms.

Q98. Answer: (c) August 12

The correct answer is August 12.

Key Points

• International Youth Day is observed annually on August 12 across the globe to recognize the efforts of the world's youth in enhancing global society.

• The United Nations General Assembly (UNGA) officially designated this day in December 1999, following recommendations made by the World Conference of Ministers Responsible for Youth held in Lisbon in August 1998.

• The very first International Youth Day was celebrated on August 12, 2000, serving as an opportunity for governments and others to draw attention to youth issues worldwide.

• The observance aims to promote ways to engage young people in becoming more actively involved in making positive contributions to their communities and participating in social, economic, and political life.

• Each year, the United Nations selects a specific theme for the day; for example, the 2024 theme was "From Clicks to Progress: Youth Digital Pathways for Sustainable Development," highlighting the role of digitalization in achieving Sustainable Development Goals (SDGs).

Additional Information

• National Youth Day (India):

• In India, National Youth Day is celebrated on January 12 every year.

• This date was chosen to honor the birth anniversary of Swami Vivekananda, one of India's greatest spiritual and social leaders, who had immense faith in the power of youth.

• The government of India declared this day as National Youth Day in 1984, and it was first celebrated in 1985.

• Defining "Youth":

• The United Nations defines "youth" as those persons between the ages of 15 and 24 years for statistical purposes without prejudice to other definitions by Member States.

• Currently, there are 1.2 billion young people aged 15 to 24 years, accounting for 16 percent of the global population.

• By 2030—the target date for the Sustainable Development Goals (SDGs)—the number of youth is projected to have grown by 7 percent, to nearly 1.3 billion.

• Global Initiatives:

• The UN Youth Strategy (Youth2030) was launched in 2018 to facilitate increased impact and expanded action to address the needs of young people.

• The Economic and Social Council (ECOSOC) Youth Forum is an annual event that provides a platform for young people to engage in a dialogue with Member States on global policy.

Important Points

• Other Important Dates:

• August 9: Observed as the International Day of the World's Indigenous Peoples.

• September 21: Recognized as the International Day of Peace (World Peace Day).

• July 18: Celebrated as Nelson Mandela International Day to honor the legacy of the former South African President.

• Thematic Focus: International Youth Day often focuses on critical areas such as education, employment, environment, mental health, and civic engagement to empower the younger generation for a better future.

Q99. Answer: (b) Jammu & Kashmir and Ladakh

The correct answer is Jammu & Kashmir and Ladakh.

Key Points

• The 5th edition of the Khelo India Winter Games 2025 is scheduled to be hosted in the Union Territories of Jammu & Kashmir and Ladakh.

• This prestigious national-level multi-sport event is organized annually to promote the culture of winter sports across India and to identify talent for international competitions like the Winter Olympics.

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• The games are conducted under the flagship Khelo India Programme, which is an initiative of the Ministry of Youth Affairs and Sports, Government of India.

• The primary venues for the competitions are Leh (in Ladakh) and Gulmarg (in Jammu & Kashmir), which are renowned globally for their world-class snow slopes and high-altitude ice rinks.

• The 2025 edition aims to further strengthen the sports infrastructure in the Himalayan region and encourage youth participation in disciplines that are unique to cold climates.

Additional Information

• History of Khelo India Winter Games:

• The first edition of the games was held in 2020 in Leh and Gulmarg.

• Since its inception, Jammu & Kashmir has been a dominant force, often topping the medal tally due to its natural advantages and training facilities.

• The 4th edition was held in February 2024, where events like Ice Hockey and Ice Skating were held in Ladakh, while Skiing and Snowboarding events took place in Gulmarg.

• Featured Sports Disciplines:

• The games include a variety of winter sports such as Alpine Skiing, Nordic Skiing, Snowboarding, Ski Mountaineering, Ice Hockey, Ice Skating, and Curling.

• These events provide a platform for athletes from across the country, including those from non-Himalayan states, to compete in specialized conditions.

• Significance and Impact:

• Sports Tourism: Hosting the games significantly boosts the local economy by attracting tourists and sports enthusiasts to J&K and Ladakh during the winter season.

• International Standards: The involvement of the Sports Authority of India (SAI) ensures that the technical conduct of the games meets international standards, helping Indian athletes prepare for the Asian Winter Games.

• National Integration: The event brings together athletes from different parts of India, fostering a spirit of unity and national pride through sports.

• Organizing Bodies:

• The games are organized in collaboration between the Ministry of Youth Affairs and Sports, the Jammu & Kashmir Sports Council, and the Administration of the Union Territory of Ladakh.

• The Indian Olympic Association (IOA) and various national sports federations provide technical support for the smooth execution of individual sporting events.

Q100. Answer: (b) Ministry of Environment, Forest and Climate Change

The correct answer is Ministry of Environment, Forest and Climate Change.

Key Points

• The Ministry of Environment, Forest and Climate Change (MoEFCC) is the nodal agency in the administrative structure of the Central Government for the planning, promotion, co-ordination and overseeing the implementation of India's environmental and forestry policies and programmes.

• The Environment Audit Rules, 2025, were introduced to streamline and standardize the process of environmental auditing for industries and infrastructure projects that require Environmental Clearance (EC) under the Environment (Protection) Act, 1986.

• The primary objective of these rules is to ensure that industrial units and project proponents comply with the environmental safeguards and conditions prescribed during the grant of clearance, thereby promoting sustainable development.

• The rules introduce a framework for Third-Party Audits, where registered environmental auditors evaluate the performance of an organization’s environmental management system and its impact on the ecosystem.

• Under the 2025 Rules, it is mandatory for specified categories of industries to submit an Annual Environmental Audit Report to the respective State Pollution Control Boards (SPCBs) and the MoEFCC.

Additional Information

• Ministry of Environment, Forest and Climate Change (MoEFCC):

• Established in its current form in 1985, it oversees the implementation of various landmark legislations including the Wildlife Protection Act (1972), the Water Act (1974), and the Air Act (1981).

• The ministry is responsible for Climate Change negotiations at the international level, such as the United Nations Framework Convention on Climate Change (UNFCCC) and COP summits.

• Ministry of Corporate Affairs (MCA):

• This ministry is primarily concerned with the administration of the Companies Act, 2013 and the Limited Liability Partnership Act, 2008.

• It regulates corporate governance and Corporate Social Responsibility (CSR) activities, but does not directly issue environmental audit rules for ecological compliance.

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• Ministry of Commerce & Industry:

• Administers the Department of Commerce and the Department for Promotion of Industry and Internal Trade (DPIIT).

• It focuses on foreign trade, Special Economic Zones (SEZs), and industrial policy to enhance Ease of Doing Business in India.

• Ministry of Earth Sciences (MoES):

• Formed in 2006, it deals with oceanography, meteorology, seismology, and polar science.

• It manages the India Meteorological Department (IMD) and focuses on predicting weather, climate, and ocean state, rather than industrial environmental auditing.

Important Points

• Regulatory Framework: The Environment Audit Rules, 2025 function under the overarching powers of the Environment (Protection) Act, 1986, which allows the Central Government to take all such measures as it deems necessary for protecting and improving the quality of the environment.

• Accreditation of Auditors: The rules specify that only auditors accredited by the National Accreditation Board for Education and Training (NABET) or the Quality Council of India (QCI) are authorized to conduct these statutory audits.

• Penalty for Non-Compliance: Failure to submit the audit report or providing false information can attract penalties under Section 15 of the Environment (Protection) Act, which includes imprisonment for a term which may extend to five years or a fine up to one lakh rupees, or both.

• Digital Integration: The 2025 Rules emphasize the use of the PARIVESH portal (Pro-Active and Responsive facilitation by Interactive, Virtuous and Environmental Single-window Hub) for the digital submission and tracking of audit reports to ensure transparency.

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