RRB Group D Official Paper (Held On: 08 Jan, 2026 Shift 3) (Previous Year Paper)

RRB Group D • 2026 • 100 questions • 90 minutes • Answer key and solutions

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GENERAL SCIENCE

Q1. In a eukaryotic cell observed under a microscope, the three main components visible are:

(a) cell wall, ribosome and vacuole
(b) endoplasmic reticulum, Golgi body and nucleoid
(c) capsule, nucleoid and cytoplasm
(d) plasma membrane, nucleus and cytoplasm

Q2. A ray of light parallel to the principal axis, after reflection from a concave mirror, _____.

(a) remains parallel to the axis
(b) passes through the centre of curvature
(c) passes through the principal focus
(d) passes through the pole

Q3. The sensation of feeling full after eaten enough is perceived in which part of our body?

(a) Fore-brain
(b) Mid-brain
(c) Buccal cavity
(d) Heart

Q4. Consider the following statements and select the correct option.

Statement A: Baking soda is a mild non-corrosive basic salt.

Statement B: It can neutralise acids and relieve stomach acidity.

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

Q5. What quantity is measured in cubic centimetres (cm^3) ?

(a) Mass
(b) Temperature
(c) Volume
(d) Pressure

Q6. Why are megaphones, loudhailers and some musical instruments designed with a tube followed by a conical opening?

(a) To direct most of the sound waves forward toward the audience without spreading it
(b) To make the sound quieter
(c) To spread the sound in all directions
(d) To absorb the sound waves

Q7. Which of the following correctly represents the total number of atoms in one molecule of ammonium sulphate ((NH4)2SO4) ?

(a) 16
(b) 10
(c) 14
(d) 15

Q8. Which roasting operation shown below burns out sulphur from a sulphide ore?

(a) Smelting
(b) Chloridising
(c) Volatilising
(d) Oxidising

Q9. The non-directional movement of plants due to stimulus of sunlight is called:

(a) phototropism
(b) thigmonasty
(c) photonasty
(d) thigmotropism

Q10. In which of the following cases is pregnancy least likely to occur?

(a) Embryo implants in the uterus
(b) Fertilisation happens in the oviduct
(c) Sperm meets egg in the uterus
(d) Egg not released from ovary

Q11. The pattern formed by iron filings around a bar magnet demonstrates _____.

(a) gravitational field lines
(b) magnetic field lines
(c) electrostatic force
(d) electric field lines

Q12. What happens to a substance when it is reduced in a reaction?

(a) It becomes more reactive
(b) It loses protons
(c) It gains electrons
(d) It loses electrons

Q13. What happens to the uterus lining if the egg is not fertilised?

(a) It is unaffected.
(b) It breaks down and is discharged through the vagina.
(c) It gets absorbed by the body.
(d) It becomes thickened.

Q14. Which of the following reactions is an example of a reduction reaction?

(a) 2Mg + O2 → 2MgO
(b) NaOH + HCl → NaCl + H2O
(c) CuO + H2 → Cu + H2O
(d) Zn + H2SO4 → ZnSO4 + H2

Q15. During non-uniform motion of an object along a straight line _____.

(a) the change in velocity over any time interval is zero.
(b) the change in velocity over any time interval is non zero.
(c) the velocity has same values at different points of the path.
(d) the velocity remains constant with time.

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Q16. When is the work done by a constant force on an object maximum?

(a) When the force is opposite to the displacement
(b) When the force is in the same direction as the displacement
(c) When the force makes an angle of 45° with the displacement
(d) When the force is perpendicular to the displacement

Q17. Cytoplasm is made up of an aqueous ground substance called:

(a) chromoplasm
(b) lysosomal fluid
(c) nucleoplasm
(d) cytosol

Q18. A car moves with uniform velocity v. Which of the following statements is true about its velocity–time graph?

(a) Graph passes through origin only
(b) Slope of graph = 0
(c) Slope of graph = velocity
(d) Slope of graph = displacement

Q19. Read the given statements and select the most appropriate option.

Statement 1: When a ball is thrown vertically upward, its velocity decreases at the rate of g.

Statement 2: The acceleration due to gravity acts downward even when the ball moves upward.

(a) Both Statements are incorrect
(b) Only Statement 2 is correct
(c) Only Statement 1 is correct
(d) Both Statements 1 and 2 are correct

Q20. The Rutherford gold foil experiment established the presence of:

(a) Nucleus
(b) Protons
(c) Electrons
(d) Neutrons

Q21. Which of the following best describes fragmentation as a method of asexual reproduction?

(a) The parent body breaks into pieces, and each piece grows into a new organism.
(b) The parent organism divides into many cells which develop into spores.
(c) A single cell divides into two identical daughter cells.
(d) A new organism grows from a bud formed on the parent's body.

Q22. Which of the following statements is correct about the direction of the magnetic field lines inside a current-carrying solenoid?

(a) The magnetic field lines are circular and perpendicular to the axis of the solenoid.
(b) The magnetic field lines are parallel and along the axis of the solenoid from its south pole to north pole.
(c) The magnetic field lines are parallel and along the axis of the solenoid from its north pole to south pole.
(d) The magnetic field lines are random inside the solenoid.

Q23. Using cracked crockery to grow small plants is an example of _____.

(a) Reuse
(b) Recycle
(c) Repurpose
(d) Refuse

Q24. If you want to make water evaporate faster, what should you do?

(a) Cover the container.
(b) Use a narrow, deep container.
(c) Place it in a cool, humid room.

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(d) Increase the temperature and expose it to a fan.

Q25. A person is prescribed spectacles of +2 D. What type of lens is used in the spectacles?

(a) Convex lens
(b) Concave lens
(c) Cylindrical lens
(d) Prism lens

MATHEMATICS

Q26. A ladder 10 metres long leans against a wall making an angle of 60° with the ground. Find the height (in metres) of the wall the ladder reaches.

(a) 10√3
(b) 5√2
(c) 5√3
(d) 10√2

Q27. What is the greatest volume container (in litres) that can measure 300 litres, 280 litres and 180 litres.

(a) 60
(b) 70
(c) 20
(d) 120

Q28. A cistern has a hole at the bottom through which water leaks. A tap can fill the cistern in 9 hours and the hole at the bottom can empty the fully filled cistern in 12 hours. If both the tap and the hole are open, then what will be the time taken to completely fill the empty cistern?

(a) 27 hours
(b) 33.3 hours
(c) 29.9 hours
(d) 36 hours

Q29. What is the mode of the following data?

47, 51, 51, 48, 53, 54, 47, 52, 51, 46, 43, 47, 52, 40, 47, 41, 43, 43, 46, 47

(a) 43
(b) 48
(c) 47
(d) 51

Q30. The fourth proportional to 20, 15 and 8 is the same as the third proportional to A and 30. What is the value of A?

(a) 153
(b) 148
(c) 150
(d) 147

Q31. For 6 innings, a cricketer had an average of 100 runs. In the 7^(th) inning, he scored 235 runs. His average score increased by _____. (Round off the answer to the nearest whole number.)

(a) 19
(b) 11
(c) 9
(d) 21

Q32. In quadrilateral PQRS, the bisectors of angle R and angle S meet at the point T (inside the quadrilateral) and angle STR = 44°. If the ratio of angle P to angle Q is 5 : 6, then what is the difference between the measures of angle Q and angle P?

(a) 5°

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(b) 13°
(c) 7°
(d) 8°

Q33. Rs. 1,411 is divided among Pooja, Harsh and Madhur in such a way that if Rs. 12, Rs. 23 and Rs. 43 are deducted from their respective shares, they have money in the ratio 21:16:6. Find the actual share of Harsh.

(a) Rs. 596
(b) Rs. 519
(c) Rs. 546
(d) Rs. 646

Q34. The product of two numbers is 96 and their sum is 20. Find the value of the square of their difference.

(a) 16
(b) 4
(c) 64
(d) 36

Q35. The monthly incomes of two friends David and Ashish, are in the ratio 5 : 9, respectively, and each of them saves Rs. 39,000 every month. If the ratio of their monthly expenditure is 2 : 4, find the monthly income of David (in Rs.).

(a) 1,96,000
(b) 1,94,000
(c) 2,73,000
(d) 1,95,000

Q36. A shopkeeper marks his goods at 40% above the cost price. He then offers a discount of 20% on the marked price. What is his profit percentage?

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

Q37. The curved surface area and the height of a right circular cylinder are 924 $cm^2$and 14 cm, respectively. Find its diameter (in cm).

Use $\pi = 22/7$

(a) 18
(b) 20
(c) 21
(d) 24

Q38. The amount on a sum of Rs. 1,200 at 15% per annum compound interest, compounded annually, in 2 years will be:

(a) Rs. 1,846
(b) Rs. 1,725
(c) Rs. 1,646
(d) Rs. 1,587

Q39. Find the number of bricks required to build a wall 20 m long, 9.9 m high and 30 cm thick, using bricks of size 25 cm × 11 cm × 8 cm, if 10% of the wall volume is filled with cement.

(a) 25,800
(b) 26,500
(c) 30,200
(d) 24,300

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Q40. The marked price of a washing machine is Rs. 62,000. A shopkeeper allows a discount of 73% and gets a profit of 20%. What is the cost price of the washing machine?

(a) Rs. 13,966
(b) Rs. 14,058
(c) Rs. 14,038
(d) Rs. 13,950

Q41. A garrison of 1209 men has provisions for 24 days. How long (in days) will the provisions last if the garrison is increased by 403 men?

(a) 13
(b) 28
(c) 38
(d) 18

Q42. P and Q together can fill a cistern with water in 9 hours. If P alone can fill the cistern with water in 36 hours, then in how many hours will Q alone fill one-fourth of the same cistern with water?

(a) 7
(b) 3
(c) 6
(d) 4

Q43. Ravi buys a shirt with a marked price of Rs. 1,620. He receives two successive discounts of 20% and 10%. Calculate the price Ravi paid for the shirt.

(a) Rs. 1,166.40
(b) Rs. 1,330.50
(c) Rs. 1,288.25
(d) Rs. 1,260.45

Q44. Find a single discount (approximately) equal to three consecutive discounts of 22%, 8% and 17%.

(a) 40.44%
(b) 43.38%
(c) 43.24%
(d) 42.91%

Q45. The age of T is 20 years more than the age of R. S's age is 10 years less than the age of P. P's age is half the age of R. The sum of ages of all is 130 years. What is the age of R in years?

(a) 40
(b) 30
(c) 36
(d) 44

Q46. Simplify the expression: $(3^{(4+x)} \times 9^{(x-4)})/(27^{(x-3)} \times 3^3)$

(a) 9
(b) 81
(c) 27
(d) 3

Q47. Due to water crisis, 40% of the initial population left the village, and 10% of the remaining left the town for pursuing jobs. If presently, 1080 people inhabit the village, what is the ratio of the initial population to the present population?

(a) 52:32
(b) 50:23
(c) 57:32
(d) 50:27

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Q48. A train of length 164 m takes 10 seconds to pass another train, 136 m long, coming from the opposite direction. If the speed of the first train is 82 km/hr, then find the speed of the second train.

(a) 26 km/hr
(b) 29 km/hr
(c) 34 km/hr
(d) 19 km/hr

Q49. The sum of two numbers is 45. One number is 5 more than the other. Find the larger number.

(a) 15
(b) 35
(c) 20
(d) 25

Q50. A car travels 187 km in the first hour and 273 km in the second hour. What is the average speed (in km/hr) of the car for the whole journey?

(a) 223
(b) 222
(c) 230
(d) 231

GENERAL INTELLIGENCE & REASONING

Q51. Select the term from among the given options that can replace the question mark (?) in the following series.

ZDF1, YGH3, XJJ9, WML27, ?

(a) VPN81
(b) WPM79
(c) WQM79
(d) VQM81

Q52. In a certain code language, ‘do you sing’ is coded as ‘ln vt df’ and ‘they sing well’ is coded as ‘vt mp bo’. How is ‘sing’ coded in the given language?

(All codes are two-letter codes)

(a) df
(b) ln
(c) mp
(d) vt

Q53. In a certain code language, ‘YARD’ is coded as ‘4579’ and ‘TOYS’ is coded as ‘2385’. What is the code for ‘Y’ in the given code language?

(a) 7
(b) 4
(c) 5
(d) 8

Q54. This question is based on the following words.

TOK, THE, HAS, ALL, COW

If in each of the words, each letter is changed to the next letter in the English alphabetical order, how many words thus formed will have no vowel?

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

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Q55. A, B, C, D, W, X and Y are sitting around a circular table facing the centre of the table. C sits to the immediate left of B. W sits to the immediate left of A. A sits second to the left of X. D sits third to the left of B. Who sits third to the right of Y?

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

Q56. Five people, A, B, C, D and E, are sitting in a row, facing north. D sits third from the left end of the row. E sits fifth from the left end of the row. Only B sits between A and D. Who sits at the extreme left end of the row?

(a) E
(b) B
(c) C
(d) A

Q57. Refer to the following number series and answer the question that follows (all numbers are single-digit numbers only).

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

How many such even numbers are there (from left to right), each of which is immediately preceded by an odd number and also immediately followed by an odd number?

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

Q58. If 'P' stands for '×', 'Q' stands for '÷', 'R' stands for '-' and 'S' stands for '+', what will come in place of the question mark (?) in the following equation?

(24 Q 6) P 15 S (10 Q 2) P 7 R (80 Q 8) P 6 = ?

(a) 21
(b) 49
(c) 35
(d) 58

Q59. What should come in place of the question mark (?) in the given series?

1 3 7 15 ? 63

(a) 31
(b) 30
(c) 20
(d) 26

Q60. Which of the given letter-number clusters will replace the question mark (?) in the following series to make it logically complete?

USO 48 NLH 39 GEA 30 ZXT 21 ?

(a) SRL 12
(b) SQM 12
(c) SWB 11
(d) SPL 11

Q61. 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 radios are microphones.

All radios are speakers.

Conclusions:

(I): Some microphones are speakers.

(II): All speakers are radios.

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

Q62. Seven boxes D, E, F, U, V, W and X are kept one over the other but not necessarily in the same order. No box is kept above X. Only two boxes are kept between W and V. Only U is kept below E. Only three boxes are kept between E and W. D is not kept immediately above V. How many boxes are kept between F and U?

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

Q63. Kiran starts from Point Y and drives 35 km towards south. He then takes a left turn, drives 22 km, turns right and drives 39 km. He then takes a left turn and drives 48 km. He takes a left turn, drives 26 km. He then turns right, drives 12 km, turns left and drives 48 km to stop at Point Z. How far (shortest distance) and towards which direction should he drive in order to reach Point Y again?

(All turns are 90° turns only unless specified.)

(a) 81 km towards west
(b) 82 km towards west
(c) 78 km towards east
(d) 87 km towards east

Q64. Refer to the following number series and answer the question that follows (all numbers are single-digit numbers only).

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

How many unique numbers in the series are perfect cubes (each number counted only once, regardless of repetitions)?

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

Q65. What should come in place of the question mark (?) in the given series?

95 83 72 62 53 ?

(a) 43
(b) 46
(c) 45
(d) 51

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

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

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

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

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

JHK : IEG

JUM : IRI

(a) EOP : DLK
(b) QNN : PKJ
(c) HIJ : GEF
(d) ETI : DQD

Q68. 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) EHA
(b) IMK
(c) GJC
(d) SVO

Q69. Pooja started from point A. She drove 20 km north, then turned west and drove 15 km. She then turned south and drove 5 km to arrive at point B. In which direction is point B with respect to point A? (All turns are 90-degree turns only, unless specified.)

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

Q70. If '+' means '−', '−' means '×', '×' means '÷' and '÷' means '+', then what will come in place of the question mark (?) in the following equation?

15 – 8 ÷ 4 + 40 × 10 + 10 = ?

(a) 114
(b) 108
(c) 110
(d) 112

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

Statements:

Some burgers are fries.

Some fries are tacos.

Conclusions:

(I) Some burgers are tacos.

(II) All tacos are fries.

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

Q72. In a row of 37 people facing north, Gayatri is 10^(th) from the right end. If Mayank sits 12^(th) to the left of Gayatri, what is Mayank's position from the left end of the line?

(a) 17th
(b) 16th
(c) 15th
(d) 19th

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Q73. If 'A' stands for '÷', 'B' stands for '×', 'C' stands for '+' and 'D' stands for '−', what will come in place of the question mark (?) in the following equation?

(90 A 9) B 4 C (28 A 7) B 8 D 9 B 6 C 18 A 2 = ?

(a) 51
(b) 42
(c) 35
(d) 27

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

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

(a) LHA
(b) AWP
(c) GCV
(d) YUM

Q75. In a code language,

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

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

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

A ÷ B means 'A is the brother of B'

Based on the above, how is Q related to P if 'Q + R * S - T ÷ P'?

(a) Mother's father
(b) Mother's brother
(c) Father
(d) Father's brother

Q76. 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 its constituent digits. E.g. 13 – Operations on 13 such as adding / subtracting /multiplying etc. to 13 can be performed. Breaking down 13 into 1 and 3 and then performing mathematical operations on 1 and 3 is not allowed.)

9 - 3 - 27

5 - 4 - 20

(a) 10 - 5 - 50
(b) 8 - 5- 30
(c) 3 - 12 - 46
(d) 4 - 6 - 10

Q77. GCKO is related to VRZD in a certain way based on the English alphabetical order. In the same way, OKSW is related to DZHL. To which of the given options is HDLP related, following the same logic?

(a) WSXD
(b) WSAE
(c) WASE
(d) WESQ

Q78. Select the pair that follows the same pattern as the one followed by the two pairs given below. Both pairs follow the same pattern.

ILK-ORQ

QTS-WZY

(a) CEC-HKJ
(b) CEC-ILK
(c) CFE-HLJ

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(d) CFE-ILK

Q79. What should come in place of the question mark (?) in the given series?

2, 8, 14, 20, 26, ?

(a) 33
(b) 30
(c) 32
(d) 34

Q80. Seven people, A, B, C, D, E, F and G, are sitting in a row, facing north.

Only two people sit between G and B. Only D sits to the right of E. Only one person sits between B and E. F sits at some place to the right of C but at some place to the left of A.

How many people sit to the right of C?

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

GENERAL AWARENESS AND CURRENT AFFAIRS

Q81. Which of the following countries ranked 1^(st) in the Global Innovation Index 2025 published by the World Intellectual Property Organization (WIPO)?

(a) United States of America
(b) Switzerland
(c) Sweden
(d) Singapore

Q82. What medal did India win in the women's 10m air pistol event at the ISSF Junior World Cup, 2025?

(a) Silver
(b) No medal
(c) Gold
(d) Bronze

Q83. Who is the youngest-ever winner of the Carnegie Medal for writing in 2025, for 'Glasgow Boys'?

(a) Banu Mushtaq
(b) Charlotte McConaghy
(c) Nigel Slater
(d) Margaret McDonald

Q84. In June 2025, how many enforcement actions did the Reserve Bank of India take across financial institutions?

(a) 353
(b) 153
(c) 253
(d) 453

Q85. Which organisation developed the 10-ton vertical planetary mixer, the world's largest for solid propellants, as reported in 2025?

(a) Indian Space Research Organisation (ISRO)
(b) Defence Research and Development Organisation (DRDO)
(c) Hindustan Aeronautics Limited (HAL)
(d) Indian Institute of Science (IISc)

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Q86. Which Indian-Colombian pair won the men's doubles title at the 2025 Chile Open?

(a) Arjun Kadhe and Alejandro Gómez
(b) Rithvik Bollipalli and Nicolás Barrientos
(c) Rohan Bopanna and Juan Sebastián Cabal
(d) Yuki Bhambri and Nicolás Barrientos

Q87. Which of the following missiles was successfully fired by the Defence Research and Development Organisation (DRDO) on 24 September 2025 from a rail-mounted mobile launcher in coordination with the Strategic Forces Command?

(a) BrahMos Supersonic Cruise Missile
(b) Intermediate Range Agni-Prime Missile
(c) Akash Surface-to-Air Missile
(d) Prithvi-II Ballistic Missile

Q88. Where was the 11^(th) National Handloom Day celebrated on 7 August 2025, where the President of India presented the Sant Kabir Handloom Awards and National Handloom Awards?

(a) India Gate Lawns, New Delhi
(b) Bharat Mandapam, New Delhi
(c) Rashtrapati Bhavan, New Delhi
(d) Vigyan Bhavan, New Delhi

Q89. Which of the following lunar missions became the first to detect over 250 seismic signals from the Moon's south pole, marking a significant advancement in lunar exploration since the Apollo missions?

(a) Chang'e 5
(b) Luna 1
(c) Artemis I
(d) Chandrayaan-3

Q90. Who among the following was posthumously awarded the Rashtriya Vigyan Puraskar 2025 in 'Vigyan Ratna' category?

(a) Jayant Vishnu Narlikar
(b) Prakash Kumar
(c) Pavannan
(d) Vidya Subramanian

Q91. What is the primary objective of India's Chandrayaan-4 mission scheduled for 2027?

(a) To launch the first Indian astronaut into space
(b) To establish a permanent lunar base on the moon
(c) To bring back samples of moon rocks to Earth
(d) To study Mars' atmosphere in detail

Q92. In January 2025, Gujarat Chief Minister Bhupendra Patel inaugurated the Khel Mahakumbh in Rajkot, Gujarat, India. Which edition of the event was it?

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

Q93. What is the primary objective of the NASA–ISRO Synthetic Aperture Radar (NISAR) satellite launched from the Satish Dhawan Space Centre in Sriharikota in July 2025?

(a) To strengthen military surveillance and border security operations
(b) To enhance global monitoring of climate change and natural disasters
(c) To improve global internet connectivity through satellite communication
(d) To explore deep space and study distant planetary atmospheres

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Q94. In June 2025, Standard & Poor's (S&P) Global Ratings revised India's gross domestic product (GDP) growth forecast for FY26 to _____.

(a) 6.5%
(b) 7.25%
(c) 7.0%
(d) 6.75%

Q95. What is the title of the 2025 UNICEF report on child nutrition?

(a) Nourish the Next: Global Nutrition Review
(b) Feeding Profit: How Food Environments Are Failing Children
(c) Feeding Futures: Nutrition for Children
(d) Growing Well: Global Child Nutrition Index

Q96. Which of the following rivers was affected by flash floods triggered by torrential rain in Uttarkashi district of Uttarakhand in August 2025?

(a) Mandakini River
(b) Kheer Ganga River
(c) Alaknanda River
(d) Bhagirathi River

Q97. Who was appointed as the Chief Minister of Delhi following the 2025 elections?

(a) Atishi Marlena
(b) Rekha Gupta
(c) Manish Sisodia
(d) Arvind Kejriwal

Q98. Which of the following two main types of support are provided to rural families under the Poverty-Free Village Scheme launched by Rajasthan in July 2025?

(a) Housing construction and school education
(b) Irrigation infrastructure and farming tools
(c) Cash assistance and employment opportunities
(d) Health insurance coverage and credit loans

Q99. In which city was the 23^(rd) edition of the National Para Athletics Championships, 2025, organised?

(a) Hyderabad
(b) Chennai
(c) New Delhi
(d) Bengaluru

Q100. As per the Sustainable Development Goals — National Indicator Framework Progress Report, 2025, published in June 2025, what percentage of the rural population used improved sources of drinking water during the year 2024–2025?

(a) 99.62%
(b) 97.80%
(c) 95.45%
(d) 98.25%

ANSWER KEY

1	d	2	c	3	a	4	a	5	c	6	a	7	d	8	d	9	c	10	d
11	b	12	c	13	b	14	c	15	b	16	b	17	d	18	b	19	d	20	a
21	a	22	b	23	c	24	d	25	a	26	c	27	c	28	d	29	c	30	c
31	a	32	d	33	b	34	a	35	d	36	b	37	c	38	d	39	d	40	d
41	d	42	b	43	a	44	a	45	a	46	a	47	d	48	a	49	d	50	c

51	a	52	d	53	c	54	d	55	b	56	d	57	a	58	c	59	a	60	b
61	c	62	b	63	b	64	d	65	c	66	d	67	b	68	b	69	d	70	c
71	c	72	b	73	d	74	d	75	a	76	a	77	b	78	d	79	c	80	a
81	b	82	c	83	d	84	a	85	a	86	b	87	b	88	b	89	d	90	a
91	c	92	b	93	b	94	a	95	b	96	b	97	b	98	c	99	b	100	a

SOLUTIONS

Q1. Answer: (d) plasma membrane, nucleus and cytoplasm

The correct answer is plasma membrane, nucleus and cytoplasm.

Key Points

• Every eukaryotic cell, whether plant or animal, displays three basic structural features when observed under a standard microscope: the plasma membrane, the nucleus, and the cytoplasm.

• The plasma membrane is the outermost boundary of the cell that separates the internal contents from the external environment. It is selectively permeable, meaning it regulates the entry and exit of specific substances. Hence, this component is part of the correct answer.

• The nucleus is a prominent, usually spherical organelle that contains the genetic material (DNA) of the organism. It acts as the control center for cellular activities like growth and reproduction. Hence, this component is part of the correct answer.

• The cytoplasm is the translucent, jelly-like substance found between the plasma membrane and the nuclear envelope. It houses various specialized organelles and is the site for most metabolic reactions. Hence, this component is part of the correct answer.

• Other structures like the nucleoid and capsule are characteristic features of prokaryotic cells (such as bacteria) and are not found in eukaryotic cells. Hence, options 2 and 3 are incorrect.

• While ribosomes and vacuoles are present in eukaryotic cells, they are often considered secondary organelles or are too small to be identified as one of the "three main components" compared to the fundamental structure of the membrane, nucleus, and cytoplasm. Hence, option 1 is incorrect.

Additional Information

• Plasma Membrane:

• It is primarily composed of a phospholipid bilayer interspersed with proteins and cholesterol.

• Its thickness ranges from 5 to 10 nanometers and it follows the Fluid Mosaic Model proposed by Singer and Nicolson in 1972.

• Nucleus:

• It was first discovered and described by the scientist Robert Brown in the year 1831.

• It contains chromosomes, which are made of DNA and histone proteins. The nucleus is bounded by a double membrane called the nuclear envelope.

• Cytoplasm:

• The liquid part of the cytoplasm is called cytosol, which consists of 80% water, salts, and organic molecules.

• It provides the turgidity to the cell and facilitates the movement of materials through cytoplasmic streaming.

• Eukaryotic vs. Prokaryotic Cells:

• Eukaryotes have a well-defined nucleus and membrane-bound organelles (e.g., humans, plants, fungi).

• Prokaryotes lack a nuclear membrane; their genetic material is naked in a region called the nucleoid (e.g., E. coli bacteria).

Important Points

• Cell Wall: While present in plant cells, it is absent in animal cells. Therefore, it cannot be considered a universal "main component" for all eukaryotic cells.

• Cell Theory: Proposed by M.J. Schleiden (1838) and Theodore Schwann (1839), it states that all living organisms are composed of cells and the cell is the basic unit of life.

• Microscopy: Most organelles like mitochondria or ribosomes require an electron microscope for detailed viewing, whereas the nucleus and cell boundary are often visible under a compound light microscope.

Q2. Answer: (c) passes through the principal focus

The correct answer is passes through the principal focus.

Key Points

• When a ray of light is parallel to the principal axis of a concave mirror, it always passes through the principal focus (F) after reflection. Hence, option 3 is correct.

• A concave mirror is a spherical mirror whose reflecting surface is curved inwards, meaning it faces towards the center of the

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sphere.

• Because of its ability to converge parallel rays of light at a single point, the concave mirror is also widely known as a converging mirror.

• The point on the principal axis where all parallel incident rays meet after reflection is defined as the principal focus of the mirror.

• This behavior is consistent with the laws of reflection, where the angle of incidence is equal to the angle of reflection at the point of impact on the curved surface.

Additional Information

• Terminology of Spherical Mirrors:

• Pole (P): The geometric center of the reflecting surface of a spherical mirror.

• Centre of Curvature (C): The center of the sphere of which the mirror's reflecting surface forms a part.

• Principal Axis: An imaginary straight line passing through the pole and the centre of curvature of the mirror.

• Radius of Curvature (R): The distance between the pole and the centre of curvature.

• Focal Length (f): The distance between the pole and the principal focus. For mirrors with small apertures, the relationship is R = 2f.

• Convex Mirror Behavior: In a convex mirror (diverging mirror), a ray parallel to the principal axis appears to diverge from the principal focus located behind the mirror.

• Applications of Concave Mirrors: They are commonly used in shaving mirrors to see an enlarged image, in torches and car headlights to get powerful parallel beams of light, and in solar furnaces to concentrate sunlight.

Important Points

• Standard Ray Rules for Image Formation:

• Rule 1: A ray parallel to the principal axis passes through the focus after reflection.

• Rule 2: A ray passing through the principal focus will emerge parallel to the principal axis after reflection.

• Rule 3: A ray passing through the centre of curvature is reflected back along the same path because it strikes the mirror normally (at 90 degrees).

• Rule 4: A ray incident obliquely to the principal axis, towards the pole, is reflected obliquely following the laws of reflection.

• Image Characteristics: Depending on the position of the object, a concave mirror can produce real and inverted images or virtual and erect images (when the object is between P and F).

Q3. Answer: (a) Fore-brain

The correct answer is Fore-brain.

Key Points

• The Fore-brain (Prosencephalon) is the largest and most complex part of the human brain, serving as the main thinking part and the center for perceiving various sensations, including the feeling of being full (satiety).

• Within the Fore-brain, the Hypothalamus plays a critical role in maintaining homeostasis. It contains specialized centers that control hunger and thirst.

• A specific region known as the satiety center is located in the ventromedial nuclei of the hypothalamus. When we have eaten enough, this center is activated to suppress the desire for more food. Hence, statement 1 is correct.

• The Fore-brain processes sensory information from various parts of the body. When the stomach is distended after a meal, neural signals are transmitted to the brain, which the Fore-brain interprets as the sensation of fullness.

• Apart from hunger, the Fore-brain is responsible for voluntary actions, intelligence, memory, emotions, and the regulation of body temperature.

Additional Information

• Mid-brain (Mesencephalon):

• The Mid-brain connects the fore-brain and the hind-brain. It is primarily involved in controlling reflex movements of the head, neck, and trunk in response to visual and auditory stimuli.

• It does not possess the higher-order centers required for interpreting metabolic states like satiety.

• Buccal Cavity:

• The Buccal cavity, or oral cavity, is the beginning of the alimentary canal. Its primary functions are ingestion, mastication (chewing) of food, and the initiation of carbohydrate digestion through salivary amylase.

• While it provides sensory feedback regarding taste and texture, the "perception" of being full is a neurological process occurring in the central nervous system, not the mouth.

• Heart:

• The Heart is a muscular organ responsible for pumping oxygenated blood to the tissues and deoxygenated blood to the lungs.

• It belongs to the circulatory system and does not have a role in the cognitive perception of hunger or satiety.

• Hind-brain (Rhombencephalon):

• Consists of the Pons, Cerebellum, and Medulla Oblongata. The Medulla controls involuntary actions like heartbeat, breathing, and blood pressure, while the Cerebellum maintains body balance and posture.

Important Points

• Hormonal Regulation: The sensation of fullness is heavily influenced by hormones. Leptin, produced by adipose (fat) tissue, signals the hypothalamus in the Fore-brain to decrease appetite. Conversely, Ghrelin, produced by the stomach, signals hunger.

• Neural Pathway: The Vagus nerve (the 10th cranial nerve) acts as a vital communication link between the digestive tract and the brain, carrying information about stomach stretch and nutrient levels to the satiety centers.

• Cerebrum: This part of the Fore-brain allows us to consciously realize we are full and make the voluntary decision to stop eating.

Q4. Answer: (a) Both statements A and B are correct.

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

Key Points

• Baking soda is chemically known as Sodium Hydrogen Carbonate or Sodium Bicarbonate, represented by the formula NaHCO3.

• It is produced on a large scale using the Solvay process, where Sodium Chloride reacts with Ammonia, Water, and Carbon Dioxide.

• It is a mild non-corrosive basic salt. It is considered a salt of a strong base (Sodium Hydroxide) and a weak acid (Carbonic Acid), which gives it its basic properties. Hence, statement A is correct.

• Because of its basic nature, it acts as an antacid. When consumed in small quantities, it reacts with the Hydrochloric acid present in the stomach to produce salt, water, and Carbon Dioxide, thereby neutralizing the excess acid. Hence, statement B is correct.

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

Additional Information

• Uses in the Food Industry:

• Baking soda is a key component of baking powder, which is a mixture of baking soda and a mild edible acid like tartaric acid.

• When baking powder is heated or mixed with water, it releases Carbon Dioxide gas, which makes bread and cakes soft and spongy by creating small air bubbles.

• Chemical Reactions:

• When Sodium Hydrogen Carbonate is heated during cooking, it undergoes thermal decomposition to form Sodium Carbonate (Na2CO3), Water (H2O), and Carbon Dioxide (CO2).

• The chemical equation is: 2NaHCO3 → Na2CO3 + H2O + CO2.

• Fire Safety:

• It is extensively used in soda-acid fire extinguishers. The reaction between the carbonate and acid releases a large volume of CO2, which helps in extinguishing the fire by cutting off the oxygen supply.

Important Points

• Physical Properties: Baking soda appears as a white crystalline solid, but it often looks like a fine powder. It has a slightly alkaline (bitter) taste.

• pH Level: The pH of a Sodium Bicarbonate solution is approximately 8.3, confirming its status as a weak base.

• Medicinal Use: It is used to treat acid indigestion and heartburn because of its rapid neutralization effect on gastric acids.

• Other Applications: It is also used as a water softener in laundry, a mild abrasive for cleaning teeth, and for removing odors from refrigerators.

Q5. Answer: (c) Volume

The correct answer is Volume.

Key Points

• The quantity measured in cubic centimetres (cm3) is Volume. It represents the amount of three-dimensional space occupied by an object or a substance.

• A cubic centimetre is a unit of volume that corresponds to the volume of a cube that measures 1 cm x 1 cm x 1 cm.

• In the CGS (Centimetre-Gram-Second) system of units, the cubic centimetre was the base unit for volume. While the SI (International System of Units) uses cubic metres (m3) as the standard unit, the cm3 remains widely used in chemistry, medicine, and automotive engine displacement.

• There is a direct relationship between metric units of volume and capacity: 1 cm3 is exactly equal to 1 millilitre (mL).

• In medicine, the term "cc" is often used as an abbreviation for cubic centimetre, particularly when measuring dosages of liquid medications.

Additional Information

• Mass:

• Mass is a measure of the amount of matter contained in an object.
• The SI unit for mass is the kilogram (kg), though grams (g) and milligrams (mg) are frequently used for smaller quantities.
• Unlike weight, mass is an intrinsic property and does not change regardless of the gravitational field the object is placed in.
• Temperature:
• Temperature is a physical quantity that expresses the degree of hotness or coldness of a substance.
• The SI unit is Kelvin (K). Other commonly used scales include Celsius (C) and Fahrenheit (F).
• It is a measure of the average kinetic energy of the particles in a system.
• Pressure:
• Pressure is defined as the force applied perpendicular to the surface of an object per unit area over which that force is distributed.
• The SI unit for pressure is the Pascal (Pa), which is equivalent to 1 Newton per square metre (N/m2).
• Other units include atmosphere (atm), bar, and millimetres of mercury (mmHg).
• Volume Conversions:
• 1,000 cubic centimetres are equal to 1 Litre (L).
• 1 cubic metre (m3) is equal to 1,000,000 cubic centimetres.
• The density of a substance is calculated by dividing its mass by its volume (Density = Mass/Volume), with common units being g/cm3.

Important Points

• Measurement Tools: The volume of liquids is typically measured using graduated cylinders, beakers, pipettes, or burettes.
• Archimedes' Principle: For irregularly shaped solids, volume can be determined using the water displacement method. The volume of the displaced water is equal to the volume of the submerged object.
• State of Matter: While solids and liquids have a fixed volume at a given temperature and pressure, the volume of a gas will expand to fill whatever container it is placed in.

Q6. Answer: (a) To direct most of the sound waves forward toward the audience without spreading it

The correct answer is To direct most of the sound waves forward toward the audience without spreading it.

Key Points

• Megaphones, loudhailers, and instruments like trumpets and shehnais are designed based on the principle of multiple reflection of sound.
• The tube followed by a conical opening acts as a guide that reflects sound waves multiple times within the internal walls of the device.
• This specific conical shape ensures that the sound waves do not spread out in all directions but are instead focused and directed forward toward the intended audience. Hence, statement 1 is correct.
• By preventing the spherical spreading of sound energy, these devices maintain a higher intensity of sound over a greater distance.
• The amplitude of the sound waves in the forward direction is effectively increased because the energy is concentrated in a narrower beam.

Additional Information

• Reflection of Sound:
• Similar to light, sound waves follow the laws of reflection, where the angle of incidence is equal to the angle of reflection.
• In a megaphone, the successive reflections within the conical flare allow the sound to exit with a more uniform phase and direction.
• Acoustic Impedance Matching:
• The conical opening serves as an acoustic transformer. It helps in matching the high acoustic impedance of the narrow tube to the low acoustic impedance of the open air.
• This matching allows for a more efficient transfer of sound energy from the source to the atmosphere, making the instrument or device louder.
• Musical Instruments:
• Instruments like the trombone, tuba, and French horn use a flared "bell" at the end to project sound.
• The size and curvature of the conical flare determine the timbre and directional characteristics of the musical notes produced.
• Practical Applications:
• Megaphones are widely used by coaches, police officers, and protest leaders to amplify voices without electronic assistance.
• The design is purely mechanical, relying on the physics of geometry and acoustics to enhance communication in open spaces.

Important Points

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• Inverse Square Law: Normally, sound intensity decreases inversely with the square of the distance from the source. However, by using a conical opening, this energy loss is mitigated in a specific direction.

• Speed of Sound: It is important to note that while the direction and intensity are altered, the speed of sound (approx. 343 meters per second in air at 20 degrees Celsius) remains constant.

• Frequency and Wavelength: The design of the cone is often optimized for human vocal frequencies (roughly 300 Hz to 3400 Hz) to ensure maximum clarity and intelligibility.

Q7. Answer: (d) 15

The correct answer is 15.

Key Points

• The chemical formula for Ammonium Sulphate is (NH4)2SO4. To find the total number of atoms, we must sum the atoms of each individual element present in one molecule of the compound.

• The formula contains the ammonium ion (NH4) enclosed in parentheses with a subscript 2. This indicates that there are two units of the ammonium group.

• Inside one NH4 group, there is 1 Nitrogen (N) atom and 4 Hydrogen (H) atoms, making a total of 5 atoms per ammonium ion. Since there are two such groups, the total for the ammonium part is 2 × 5 = 10 atoms (specifically, 2 Nitrogen and 8 Hydrogen atoms).

• The sulphate ion part of the formula is SO4. It consists of 1 Sulphur (S) atom and 4 Oxygen (O) atoms.

• Calculating the total atoms in the sulphate group: 1 (S) + 4 (O) = 5 atoms.

• Adding the atoms from both parts together: 10 atoms (from ammonium) + 5 atoms (from sulphate) = 15 atoms. Hence, the correct answer is 15.

Additional Information

• Chemical Nature and Properties: Ammonium Sulphate is an inorganic salt that appears as a white crystalline solid. It is highly soluble in water but insoluble in alcohol.

• Molar Mass: The molar mass of (NH4)2SO4 is approximately 132.14 g/mol. This is calculated by adding the atomic masses: (2 × 14.01 for N) + (8 × 1.008 for H) + (1 × 32.06 for S) + (4 × 16.00 for O).

• Commercial Uses: Its primary use is as a soil fertilizer. It is particularly effective for alkaline soils as the ammonium ion is released and forms a small amount of acid, lowering the pH balance of the soil while contributing essential Nitrogen for plant growth.

• Industrial Production: It is produced by treating ammonia with sulphuric acid (H2SO4). The reaction is represented as: 2NH3 + H2SO4 → (NH4)2SO4.

• Atomicity: The total number of atoms present in a molecule of a substance is known as its atomicity. In this context, the atomicity of Ammonium Sulphate is 15.

Important Points

• Understanding Subscripts: In chemical formulas, a subscript after a parenthesis multiplies every atom inside the parenthesis. For example, in (NH4)2, the 2 multiplies both the 1 Nitrogen and the 4 Hydrogen atoms.

• Polyatomic Ions: Ammonium (NH4+) and Sulphate (SO4^2-) are examples of polyatomic ions, which are groups of atoms that stay together as a single charged unit during chemical reactions.

• Valency and Balancing: The formula (NH4)2SO4 is derived because the Ammonium ion has a valency of +1 and the Sulphate ion has a valency of -2. To create a neutral compound, two ammonium ions are needed for every one sulphate ion.

Q8. Answer: (d) Oxidising

The correct answer is Oxidising.

Key Points

• Oxidising Roasting is a metallurgical process where sulphide ores are heated to a high temperature (below their melting point) in the presence of an excess of oxygen or air.

• The primary objective of this operation is to burn out sulphur from the ore, which escapes as sulphur dioxide (SO2) gas. Hence, the option "Oxidising" is correct.

• During this process, the metal sulphides are converted into metal oxides or metal sulphates, which are easier to reduce in subsequent stages of extraction.

• A classic example is the roasting of Zinc Blende (ZnS), represented by the chemical equation: 2ZnS + 3O2 → 2ZnO + 2SO2. In this reaction, the sulphur is effectively removed as a gaseous byproduct.

• This operation is typically carried out in a Reverberatory Furnace or a Fluidized Bed Roaster, where the temperature and air supply can be strictly controlled to ensure maximum oxidation.

Additional Information

• Chloridising Roasting:

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• This involves heating the ore with a chlorinating agent, such as Sodium Chloride (NaCl) or Chlorine gas.

• It is used to convert certain metal compounds into volatile or soluble chlorides. This process is historically significant in the extraction of Silver (the Patera process) and Copper.

• Volatilising Roasting:

• In this operation, the ore is heated specifically to remove volatile impurities such as Arsenic, Antimony, and Bismuth.

• These impurities are converted into their respective volatile oxides (e.g., As2O3) which escape as vapours, leaving behind a purified ore residue.

• Smelting:

• Smelting is not a type of roasting but a subsequent stage in pyrometallurgy.

• It involves heating the roasted ore with a reducing agent (like Coke) and a flux at temperatures exceeding the melting point of the metal.

• The goal is to produce the molten metal and a byproduct called slag.

Important Points

• Roasting vs. Calcination: While roasting is used for sulphide ores in the presence of air, calcination is used for carbonate or hydrated oxide ores. Calcination involves heating the ore in the absence or limited supply of air to remove carbon dioxide or moisture.

• Environmental Impact: The sulphur dioxide (SO2) released during oxidising roasting is a major air pollutant. In modern plants, this gas is captured and used to manufacture Sulphuric Acid (H2SO4) to prevent acid rain and environmental degradation.

• Temperature Control: It is crucial that the temperature during roasting does not reach the melting point of the ore, as fusion would prevent the air from reacting with the inner parts of the ore particles.

Q9. Answer: (c) photonasty

The correct answer is photonasty.

Key Points

• Photonasty is defined as a non-directional movement of plant organs, such as leaves or flower petals, in response to the stimulus of light.

• In nastic movements, the direction of the response is determined by the anatomy of the plant rather than the direction from which the stimulus (light) originates. Hence, statement 3 is correct.

• A classic example of photonasty is the Dandelion flower, which opens its petals in the morning when exposed to bright sunlight and closes them in the evening when the light intensity decreases.

• Another example is the Moonflower (Ipomoea alba), which exhibits the opposite behavior by opening its flowers at night and closing them during the day.

• These movements are often temporary and reversible, frequently caused by changes in turgor pressure or differential growth rates on the upper and lower sides of the plant part.

Additional Information

• Phototropism:

• This is a directional growth movement where a plant part grows toward or away from a light source.

• Shoots generally show positive phototropism (growing toward light), while roots may show negative phototropism (growing away from light). Hence, statement 1 is incorrect.

• Thigmonasty:

• This refers to non-directional movements in response to the stimulus of touch or physical contact.

• The most famous example is the Mimosa pudica (Touch-me-not plant), whose leaves fold inward and droop immediately when touched to protect themselves. Hence, statement 2 is incorrect.

• Thigmotropism:

• This is a directional growth response to mechanical stimuli or touch.

• It is commonly seen in the tendrils of climbing plants, which coil around a support or object they come into contact with to help the plant climb. Hence, statement 4 is incorrect.

• Nyctinasty:

• This is a specific type of nastic movement known as "sleep movements," occurring in response to the diurnal cycle of light and darkness. It is a combination of photonasty and thermonasty.

Important Points

• Tropic vs. Nastic Movements:

• Tropic movements (Tropisms) are slow, growth-dependent, and directional responses (e.g., Geotropism, Hydrotropism).

• Nastic movements are typically faster, may or may not be growth-dependent, and are independent of the stimulus direction.

• Biological Significance: These movements allow plants to optimize photosynthesis, protect reproductive organs, or conserve

moisture based on environmental conditions.

Q10. Answer: (d) Egg not released from ovary

The correct answer is Egg not released from ovary.

Key Points

• Egg not released from ovary: This condition is known as anovulation. For pregnancy to occur, a mature egg (oocyte) must be released from the ovary during ovulation to be fertilized by a sperm. If no egg is released, fertilization is biologically impossible, making this the case where pregnancy is least likely (zero probability). Hence, statement 4 is correct.

• Embryo implants in the uterus: Implantation is the process where a fertilized egg (now a blastocyst) attaches to the lining of the uterus (endometrium). This is a definitive sign that conception has been successful and pregnancy has begun. Hence, statement 1 is incorrect.

• Fertilisation happens in the oviduct: The oviduct, or fallopian tube, is the natural site where fertilization occurs. Specifically, the sperm meets the egg in the ampulla of the tube. This is a standard step in a healthy pregnancy process. Hence, statement 2 is incorrect.

• Sperm meets egg in the uterus: While fertilization typically occurs in the fallopian tubes, if the sperm and egg were to meet in the uterus, there is still a biological possibility of conception, although it is less common than tubal fertilization. Compared to the total absence of an egg, this scenario is much more likely to result in pregnancy. Hence, statement 3 is incorrect.

• Hence, the correct answer is Egg not released from ovary.

Additional Information

• The Process of Ovulation: Ovulation is a phase in the menstrual cycle triggered by a surge in Luteinizing Hormone (LH). It usually occurs around day 14 of a 28-day cycle. Without this release, the reproductive cycle cannot proceed to conception.

• Role of Fallopian Tubes: These tubes act as the primary conduit. They pick up the egg from the ovary and provide the environment for sperm to travel upward. Fertilization must happen within 12 to 24 hours after the egg is released, as the egg survives for a very short duration.

• Uterine Implantation: Once fertilization occurs in the fallopian tube, the zygote undergoes cell division as it travels toward the uterus. It takes about 6 to 10 days for the embryo to reach and implant in the uterine wall.

• Hormonal Regulation: Progesterone and estrogen play vital roles in thickening the uterine lining to prepare for a potential pregnancy. If implantation does not occur, these hormone levels drop, leading to menstruation.

Important Points

• Anovulation Causes: Common causes for the failure to release an egg include Polycystic Ovary Syndrome (PCOS), thyroid disorders, excessive stress, or hormonal imbalances involving the pituitary gland.

• Sperm Viability: While an egg lives for only 24 hours, sperm can survive inside the female reproductive tract for up to 5 days, meaning intercourse occurring several days before ovulation can still lead to pregnancy.

• Contraceptive Methods: Many birth control pills work specifically by preventing ovulation (the release of the egg), mimicking the "least likely" scenario to prevent conception effectively.

Q11. Answer: (b) magnetic field lines

The correct answer is magnetic field lines.

Key Points

• The pattern formed by iron filings around a bar magnet is a visual representation of the magnetic field lines. These filings align themselves along the lines of force existing in the space surrounding the magnet.

• When iron filings are sprinkled on a surface near a magnet, each tiny piece of iron acts like a small magnetic compass. Due to magnetic induction, they become magnetized and align their long axes parallel to the direction of the magnetic field at that point.

• The magnetic field is a region around a magnetic material or a moving electric charge within which the force of magnetism acts. Since the field is invisible, the filings serve as a practical tool to observe its shape and direction.

• The density or closeness of the lines in the pattern indicates the strength of the magnetic field. The filings are most concentrated at the poles (North and South), showing that the magnetic force is strongest at these points.

• Magnetic field lines are continuous loops. Outside the magnet, the direction of these lines is taken to be from the North pole to the South pole, while inside the magnet, they travel from the South pole to the North pole.

Additional Information

• Magnetic Field (B): It is a vector quantity, meaning it has both magnitude and direction. The SI unit of magnetic field strength is the Tesla (T), named after Nikola Tesla.

• Electric Field Lines: These represent the path a positive test charge would follow in an electric field. Unlike magnetic lines, electric field lines originate from positive charges and end at negative charges; they do not typically form closed loops.

• Electrostatic Force: This is the attractive or repulsive force between particles caused by their electric charges. It is governed by Coulomb's Law, which was formulated in 1785.

• Gravitational Field Lines: These represent the gravitational force exerted by a mass. Gravitational lines always point inward

toward the center of the mass, as gravity is strictly an attractive force.

• Bar Magnet: A common type of permanent magnet usually made of Alnico (an alloy of Aluminum, Nickel, and Cobalt) or Ferrite. It always has two poles, and if broken in half, each piece will still possess both a North and a South pole.

Important Points

• Properties of Magnetic Field Lines:

• They never intersect or cross each other. If they did, it would imply that at the point of intersection, the magnetic field has two different directions, which is physically impossible.

• The relative strength of the magnetic field is shown by the degree of closeness of the field lines.

• The tangent drawn at any point on a field line gives the direction of the magnetic field at that specific point.

• Historical Context: The concept of field lines was introduced by Michael Faraday in the 19th century. He referred to them as "lines of force" to explain how magnets and charges interact over a distance without physical contact.

• Comparison with Earth: The Earth itself acts like a giant bar magnet with its own magnetic field lines. This is why a magnetic compass needle, which is a small magnet, aligns itself with the Earth's magnetic North and South poles.

Q12. Answer: (c) It gains electrons

The correct answer is It gains electrons.

Key Points

• Reduction is a fundamental chemical process where a substance gains one or more electrons during a reaction. This process is the opposite of oxidation, which involves the loss of electrons.

• In terms of oxidation states, reduction results in a decrease in the oxidation number of the atom or ion. For example, if a Copper(II) ion (Cu^{2+}) gains two electrons, it is reduced to metallic Copper (Cu^0), reducing its oxidation state from +2 to 0.

• A substance that undergoes reduction acts as the oxidizing agent. This is because it facilitates the oxidation of another substance by accepting or "pulling" electrons away from it.

• The concept of electron transfer is often remembered using the mnemonic OIL RIG, which stands for Oxidation Is Loss and Reduction Is Gain (of electrons).

• In biological and classical chemistry, reduction can also be described as the gain of Hydrogen or the loss of Oxygen from a molecule. Hence, the statement that it gains electrons is correct.

Additional Information

• Redox Reactions: Reduction and oxidation always occur simultaneously in a chemical reaction; such reactions are termed Redox reactions. Electrons lost by one species are immediately gained by another.

• Reducing Agent: The substance that donates electrons is called the reducing agent (or reductant). It gets oxidized in the process. For instance, in the reaction between Zinc and Copper Sulfate, Zinc acts as the reducing agent.

• Oxidation (Option 4): This is the chemical process where an atom or molecule loses electrons. This leads to an increase in the oxidation state. Hence, statement 4 is incorrect.

• Protons (Option 2): Chemical reactions involve the transfer or sharing of valence electrons, not protons. The number of protons determines the identity of the element and remains constant in the nucleus during a standard chemical reaction. Hence, statement 2 is incorrect.

• Reactivity (Option 1): While reduction changes the chemical nature of a substance, it does not universally mean it becomes "more reactive." Often, ions are reduced to their stable elemental forms, which may be less reactive. Hence, statement 1 is not the defining characteristic.

Important Points

• Historical Definition: Originally, reduction referred to the "reduction" of metal ores to pure metals, which typically involved the removal of oxygen (e.g., reducing Iron Oxide to Iron using carbon).

• Mnemonic Devices: Apart from OIL RIG, another popular mnemonic is LEO the lion says GER, which stands for Loss of Electrons is Oxidation and Gain of Electrons is Reduction.

• Applications: Reduction is vital in electroplating, battery technology (where reduction occurs at the cathode), and biological processes like photosynthesis and cellular respiration.

• Electronegativity: More electronegative elements, such as Fluorine and Oxygen, have a high tendency to undergo reduction because they strongly attract electrons.

Q13. Answer: (b) It breaks down and is discharged through the vagina.

The correct answer is It breaks down and is discharged through the vagina..

Key Points

• The uterus prepares itself every month to receive and nurture a fertilized egg by thickening its inner lining, called the endometrium, which becomes rich in blood vessels and tissues.

• If the egg is not fertilized by a sperm, it survives for only about 24 hours after being released from the ovary during ovulation.

• Without fertilization, the corpus luteum stops producing high levels of progesterone, leading to a hormonal drop that causes the uterine lining to disintegrate. Hence, statement 2 is correct.

• The unfertilized egg and the broken-down lining are expelled from the body through the vagina as blood and mucous, a biological process known as menstruation. Hence, statement 1 is incorrect.

• The lining does not get absorbed by the body; instead, it must be cleared out to allow a new cycle to begin. Hence, statement 3 is incorrect.

• While the lining thickens during the luteal phase in anticipation of pregnancy, it does not continue to thicken if fertilization fails; it sheds instead. Hence, statement 4 is incorrect.

Additional Information

• The Menstrual Cycle: This is a natural cycle of changes in the female reproductive system that makes pregnancy possible. A typical cycle lasts for 28 days, though it can range from 21 to 35 days in healthy adults.

• Hormonal Regulation: The cycle is controlled by the endocrine system, specifically hormones like Follicle Stimulating Hormone (FSH), Luteinizing Hormone (LH), Estrogen, and Progesterone.

• Phases of the Cycle:

• Menstrual Phase: The shedding of the endometrium (Days 1 to 5).

• Follicular Phase: The development of follicles in the ovary (Days 1 to 13).

• Ovulation: The release of the mature egg (around Day 14).

• Luteal Phase: The preparation of the uterus for potential implantation (Days 15 to 28).

• Menarche and Menopause: The first menstrual period, known as menarche, usually occurs between the ages of 10 and 15. The permanent end of menstrual cycles is called menopause, which typically happens between 45 and 55 years of age.

Important Points

• Endometrium Function: The endometrium serves as the site for implantation. If a zygote is formed, it embeds itself into this thick, nutrient-rich layer to grow into an embryo.

• Menstrual Flow: The menstrual fluid consists of blood, cervical mucus, and endometrial tissue. An average person loses about 30 to 50 ml of blood during a single period, which typically lasts for 3 to 7 days.

• Ovulation Timing: Ovulation occurs roughly 14 days before the start of the next period. This is the most fertile period of the cycle for conception.

• Failure of Menstruation: If a woman misses her period, it is often the first clinical sign of pregnancy, although it can also be caused by stress, hormonal imbalances, or nutritional deficiencies.

Q14. Answer: (c) CuO + H2 → Cu + H2O

The correct answer is CuO + H2 → Cu + H2O.

Key Points

• Reduction Reaction: In classical chemistry, reduction is defined as the removal of oxygen from a substance or the addition of hydrogen to a substance.

• In the reaction CuO + H2 → Cu + H2O, Copper(II) Oxide (CuO) reacts with Hydrogen gas (H2). During this process, CuO loses its Oxygen atom to become metallic Copper (Cu). Hence, statement 3 is correct.

• Simultaneously, the Hydrogen (H2) gains the oxygen lost by the copper oxide to form Water (H2O). This gain of oxygen is termed oxidation.

• Because both oxidation and reduction occur at the same time in this reaction, it is classified as a Redox Reaction (Reduction-Oxidation).

• In this specific example, CuO acts as the oxidizing agent (it provides oxygen), while H2 acts as the reducing agent (it removes oxygen).

Additional Information

• Oxidation Reaction:

• Oxidation is the gain of oxygen or the loss of hydrogen. In the reaction 2Mg + O2 → 2MgO, Magnesium gains oxygen to form Magnesium Oxide. Hence, statement 1 is incorrect.

• This reaction is often demonstrated in laboratories by burning a magnesium ribbon in the air, producing a dazzling white flame.

• Neutralization Reaction:

• The reaction NaOH + HCl → NaCl + H2O is a neutralization reaction where a Base (Sodium Hydroxide) and an Acid (Hydrochloric Acid) react to form Salt (Sodium Chloride) and Water. Hence, statement 2 is incorrect.

• There is no change in the oxidation state of the elements involved in this specific acid-base reaction; therefore, it is not a redox process.

• Displacement Reaction:

• In Zn + H2SO4 → ZnSO4 + H2, Zinc displaces Hydrogen from Sulphuric Acid. Hence, statement 4 is incorrect.

• While this is a redox reaction (Zinc is oxidized from 0 to +2, and Hydrogen is reduced from +1 to 0), the primary focus of the question is to identify the classical example of reduction via the loss of oxygen, which is most clearly illustrated in the CuO example.

Important Points

• Electronic Concept of Reduction: In modern chemistry, reduction is defined as the gain of electrons by an atom, ion, or molecule. A helpful mnemonic is OIL RIG (Oxidation Is Loss, Reduction Is Gain).

• Oxidation State: In the reaction CuO + H2 → Cu + H2O, the Copper ion in CuO has an oxidation state of +2. After the reaction, the metallic Copper (Cu) has an oxidation state of 0. This decrease in oxidation number is a clear indicator of reduction.

• Applications: Reduction reactions are fundamental in metallurgy for extracting pure metals from their ores. For instance, the reduction of Iron Oxide with Carbon Monoxide in a blast furnace is essential for steel production.

• Reducing Agents: Common reducing agents used in industrial and chemical processes include Hydrogen (H2), Carbon (C), Carbon Monoxide (CO), and highly reactive metals like Sodium (Na) or Aluminium (Al).

Q15. Answer: (b) the change in velocity over any time interval is non zero.

The correct answer is the change in velocity over any time interval is non zero.

Key Points

• Non-uniform motion is defined as a type of motion where an object covers unequal distances in equal intervals of time, regardless of how small the time intervals are.

• In this type of motion, the velocity of the object does not remain constant; it changes as the object moves along a straight line. This means the acceleration of the object is non-zero.

• Because the velocity is constantly varying, the change in velocity (calculated as the difference between the final and initial velocity) over any specific time interval will result in a value other than zero. Hence, statement 2 is correct.

• If the change in velocity were zero, it would imply that the initial and final velocities are identical, which characterizes uniform motion rather than non-uniform motion. Hence, statement 1 is incorrect.

• In non-uniform motion, the object has different velocities at different points of its path because the speed or direction (or both) is changing. Hence, statement 3 is incorrect.

• Since the definition of non-uniform motion involves a variable rate of displacement, the velocity cannot remain constant with time. Hence, statement 4 is incorrect.

Additional Information

• Velocity and its Nature:

• Velocity is a vector quantity, meaning it has both magnitude (speed) and direction.

• The SI unit of velocity is meters per second (m/s).

• In rectilinear motion (motion along a straight line), non-uniformity arises when the speed of the object changes over time.

• Uniform vs. Non-Uniform Motion:

• Uniform Motion: An object covers equal distances in equal intervals of time. The velocity-time graph for this motion is a horizontal straight line parallel to the time axis, and acceleration is zero.

• Non-Uniform Motion: The distance-time graph for this motion is a curve (parabolic or irregular), indicating that the speed is changing. Common examples include a car moving through a crowded market or a train starting from a station.

• Acceleration:

• Acceleration is the measure of the rate of change of velocity. It is calculated as a = (v - u) / t, where v is final velocity and u is initial velocity.

• In non-uniform motion, the acceleration is non-zero. It can be uniform acceleration (velocity changes by equal amounts in equal time) or non-uniform acceleration (velocity changes by unequal amounts in equal time).

Important Points

• Average and Instantaneous Velocity:

• In non-uniform motion, the instantaneous velocity (velocity at a specific moment) is usually different from the average velocity (total displacement divided by total time).

• For a body in non-uniform motion, the average speed is often used to describe the overall rate of motion, as the actual speed fluctuates.

• Real-world Examples:

• A stone dropped from a building undergoes uniformly accelerated non-uniform motion due to gravity (acceleration of approximately 9.8 m/s^2).

• An athlete running a 100m race exhibits non-uniform motion because they accelerate from rest and decelerate after crossing the finish line.

• A bus moving in city traffic is a classic example of non-uniform motion due to frequent stops and changes in speed.

Q16. Answer: (b) When the force is in the same direction as the displacement

The correct answer is When the force is in the same direction as the displacement.

Key Points

• The work done by a constant force on an object is mathematically defined as the product of the magnitude of the force, the magnitude of the displacement, and the cosine of the angle between the force and displacement vectors.

• The formula for work is expressed as W = F s cos(theta), where F represents force, s represents displacement, and theta is the angle between them.

• When the force is in the same direction as the displacement, the angle theta is 0 degrees. Since the value of cos(0) is 1, the work done is W = Fs, which is the maximum positive work possible for a given force and displacement. Hence, statement 2 is correct.

• When the force is opposite to the displacement (e.g., friction acting on a moving body), the angle theta is 180 degrees. Since cos(180) is -1, the work done is negative (W = -Fs). Hence, statement 1 is incorrect.

• When the force makes an angle of 45 degrees with the displacement, the work done is calculated as W = Fs cos(45). Since cos(45) is approximately 0.707, the work done is positive but significantly less than the maximum value. Hence, statement 3 is incorrect.

• When the force is perpendicular to the displacement, the angle theta is 90 degrees. Since cos(90) is 0, the work done is zero, regardless of the magnitude of the force or displacement. Hence, statement 4 is incorrect.

Additional Information

• Nature of Work: Work is a scalar quantity, which means it only has magnitude and no specific direction in space, even though it is derived from two vector quantities (force and displacement).

• Units of Measurement: In the SI system (International System of Units), the unit of work is the Joule (J). One Joule is equal to one Newton-meter (N-m). In the CGS system, work is measured in ergs, where 1 Joule equals 10^7 ergs.

• Dimensions: The dimensional formula for work is [M1 L2 T-2]. This is identical to the dimensions of energy, which aligns with the Work-Energy Theorem stating that work done on an object results in a change in its kinetic energy.

• Types of Work:

• Positive Work: Occurs when the force has a component in the direction of displacement (angle between 0 and 90 degrees).

• Negative Work: Occurs when the force has a component opposite to the direction of displacement (angle between 90 and 180 degrees).

• Zero Work: Occurs when there is no displacement, the force is zero, or the force and displacement are mutually perpendicular.

Important Points

• Real-world Examples:

• A person lifting a box vertically performs positive work because the upward force is in the same direction as the upward displacement.

• The force of gravity on a satellite moving in a circular orbit does zero work because the gravitational force is always perpendicular to the instantaneous displacement (velocity) of the satellite.

• A coolie walking on a horizontal platform with a load on his head does no work against gravity because the force he applies to hold the load is vertical, while the displacement is horizontal.

• Brakes applied to a moving car perform negative work because the braking force acts in the opposite direction to the car's motion.

• Force-Displacement Graphs: For a variable force, the work done can be calculated by finding the area under the curve in a Force-Displacement (F-s) graph.

Q17. Answer: (d) cytosol

The correct answer is cytosol.

Key Points

• Cytoplasm is the jelly-like substance that fills the interior of a cell and is surrounded by the plasma membrane. It consists of the cytosol, organelles, and various inclusions.

• The cytosol is specifically the aqueous ground substance or the liquid component of the cytoplasm in which the organelles are suspended. Hence, the correct answer is cytosol.

• It is a complex mixture of substances dissolved in water, which typically makes up about 70% to 90% of its total volume.

• The cytosol contains dissolved ions (like potassium, sodium, and magnesium), small molecules (such as glucose, amino acids, and nucleotides), and large water-soluble molecules like proteins and enzymes.

• It serves as the site for several vital metabolic pathways, including glycolysis, protein synthesis (translation), and cell division (cytokinesis).

• The cytosol also plays a crucial role in providing structural support to the cell by housing the cytoskeleton, which maintains cell shape and enables intracellular transport.

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Additional Information

• Nucleoplasm:

• This is the type of protoplasm found specifically within the nucleus of a eukaryotic cell.

• It is enclosed by the nuclear envelope and contains the nucleolus and chromatin (DNA and proteins).

• Its primary function is to serve as a suspension medium for the genetic material and to maintain the nuclear shape.

• Chromoplasm:

• Chromoplasm refers to the peripheral, pigmented portion of the cytoplasm found in certain prokaryotic cells, particularly cyanobacteria (blue-green algae).

• It contains photosynthetic pigments like chlorophyll a, phycocyanin, and phycoerythrin organized into thylakoids.

• It is distinct from the centroplasm, which is the colorless inner region containing the DNA.

• Lysosomal Fluid:

• This is the specialized fluid contained within lysosomes, which are membrane-bound vesicles used for cellular digestion.

• The fluid is highly acidic, typically maintaining a pH of 4.5 to 5.0, which is optimal for the activity of hydrolytic enzymes (acid hydrolases).

• These enzymes break down macromolecules, damaged organelles, and foreign particles like bacteria.

• Protoplasm:

• The term protoplasm is a general term used to describe the entire living matter of a cell, comprising both the cytoplasm and the nucleus.

• It was first coined by J.E. Purkinje in 1839 to denote the substance of the animal embryo.

Q18. Answer: (b) Slope of graph = 0

The correct answer is Slope of graph = 0.

Key Points

• In kinematics, a velocity–time (v-t) graph is used to represent the motion of an object by plotting velocity on the y-axis and time on the x-axis.

• Uniform velocity means that the velocity of the car remains constant over time. The car does not speed up or slow down, and its direction remains unchanged.

• When velocity is constant, the graph is a straight horizontal line parallel to the time axis.

• The slope of a velocity–time graph represents the acceleration of the object. Mathematically, slope is the change in velocity divided by the change in time ($\Delta v/\Delta t$).

• Since the velocity is uniform, the change in velocity (Δv) is zero. Therefore, the slope of the graph is zero. Hence, statement 2 is correct.

• A graph passes through the origin (0,0) only if the initial velocity at time t = 0 is zero. For a car moving with a constant velocity v (where v is not zero), the graph will intersect the y-axis at the value v. Hence, statement 1 is incorrect.

• The slope of the graph is acceleration, not the velocity itself. The velocity is represented by the y-intercept or the constant height of the line. Hence, statement 3 is incorrect.

• The displacement of the car is represented by the area under the velocity–time graph, not by the slope. Hence, statement 4 is incorrect.

Additional Information

• Velocity:

• Velocity is a vector quantity that signifies the rate of change of displacement.

• The SI unit of velocity is meters per second (m/s).

• In uniform motion, the average velocity is equal to the instantaneous velocity.

• Acceleration and Graphs:

• Acceleration is defined as the rate of change of velocity. Its SI unit is m/s^2.

• If the slope of a v-t graph is positive, the object is accelerating.

• If the slope is negative, the object is decelerating (retardation).

• For uniform velocity, acceleration is always 0.

• Area Under the Curve:

• For a velocity-time graph, the area between the line and the time axis within a specific time interval gives the magnitude of displacement.

• For uniform velocity, the area forms a rectangle, where Displacement = Velocity × Time.

Important Points

• Comparison with Position-Time Graphs:

• In a position-time (s-t) graph, a straight line with a constant non-zero slope indicates uniform velocity.

• In contrast, in a velocity-time (v-t) graph, a straight horizontal line with zero slope indicates uniform velocity.

• Key Characteristics:

• Uniform Motion: Acceleration = 0; Velocity = Constant; Distance increases linearly with time.

• Non-Uniform Motion: Acceleration ≠ 0; Velocity changes over time.

Q19. Answer: (d) Both Statements 1 and 2 are correct

The correct answer is Both Statements 1 and 2 are correct.

Key Points

• Statement 1: When a ball is thrown vertically upward, it moves against the force of gravity. This force produces a constant acceleration directed toward the center of the Earth. Because the direction of velocity (upward) is opposite to the direction of acceleration (downward), the ball undergoes retardation. The velocity of the ball decreases at a constant rate of approximately 9.8 m/s^2, which is the value of g. Hence, statement 1 is correct.

• Statement 2: Gravity is a vector quantity that always acts toward the center of the Earth, regardless of the object's state of motion. Whether the ball is moving upward, downward, or is momentarily at rest at its maximum height, the acceleration due to gravity (g) consistently acts downward. Hence, statement 2 is correct.

• At the highest point of the ball's trajectory, its instantaneous velocity becomes zero. However, the acceleration is not zero; it remains 9.8 m/s^2 acting downward. If the acceleration were zero at the top, the ball would remain suspended in the air.

• The motion of the ball is a classic example of uniformly accelerated motion (or uniformly retarded motion during the ascent). The rate at which the velocity changes is defined by the gravitational field strength of the planet.

• Hence, the correct answer is Both Statements 1 and 2 are correct.

Additional Information

• Acceleration due to Gravity (g):

• On Earth, the average value of g is taken as 9.8 m/s^2 or 32.2 ft/s^2.

• This value can vary slightly based on latitude, altitude, and local geological structures. It is slightly higher at the poles and lower at the equator due to the Earth's rotation and oblate spheroid shape.

• Equations of Motion:

• For an object thrown upward, the equations of motion are modified by replacing 'a' with -g.

• $v = u - gt$ (Final velocity = Initial velocity - gravity * time).

• $h = ut - 1/2\ gt^2$ (Height = Initial velocity * time - 0.5 * gravity * time squared).

• $v^2 = u^2 - 2gh$.

• Symmetry of Vertical Motion:

• In the absence of air resistance, the time of ascent (time to reach maximum height) is exactly equal to the time of descent (time to return to the starting level).

• The speed with which the ball is thrown upward will be equal to the speed with which it returns to the same horizontal level, though the velocity will have an opposite sign.

Important Points

• Mass Independence: The acceleration due to gravity is independent of the mass of the object. As famously demonstrated by Galileo, in a vacuum, a heavy ball and a light ball will fall (or be retarded when thrown up) at the same rate.

• Vector Relationship: Velocity and acceleration are both vectors. When they point in the same direction, the object speeds up; when they point in opposite directions, the object slows down. This is why the upward-moving ball slows down.

• Sign Convention: In physics problems, it is common to assign upward as the positive (+) direction and downward as the negative (-) direction. Under this convention, velocity is positive during ascent, and acceleration (g) is always -9.8 m/s^2.

Q20. Answer: (a) Nucleus

The correct answer is Nucleus.

Key Points

• The gold foil experiment, also known as the Geiger-Marsden experiment, was conducted in 1911 by Ernest Rutherford to study the internal structure of the atom.

• In this experiment, highly energetic alpha particles (positively charged helium ions) were bombarded onto a very thin gold foil, which was approximately 1000 atoms thick.

• Rutherford observed that most of the alpha particles passed straight through the foil without any deflection, suggesting that most of the space inside an atom is empty.

• A very small fraction of the particles were deflected by small angles, and about 1 in 12,000 particles rebounded completely (180-degree deflection).

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• These observations led Rutherford to conclude that the positive charge and nearly all the mass of the atom are concentrated in a very small, dense region at the center, which he named the nucleus.

Additional Information

• Electrons:

• Discovered by J.J. Thomson in 1897 through his experiments with cathode ray tubes.

• He proposed the Plum Pudding Model, where negative electrons were embedded in a positive sphere, which was later disproved by Rutherford.

• Neutrons:

• Discovered by James Chadwick in 1932.

• He observed that when beryllium was bombarded with alpha particles, a new type of radiation consisting of uncharged particles with a mass slightly greater than a proton was emitted.

• Protons:

• While Eugen Goldstein discovered canal rays (positive ions) in 1886, the identification of the proton as a fundamental particle is credited to Ernest Rutherford in 1917 through nuclear transmutation experiments.

• Atomic Models:

• The Dalton Model (early 1800s) suggested atoms were indivisible spheres.

• The Bohr Model (1913) later modified Rutherford's model by proposing that electrons travel in fixed orbits or shells with discrete energy levels.

Important Points

• Rutherford's nuclear model stated that electrons revolve around the nucleus in circular paths, similar to how planets revolve around the sun, leading it to be called the planetary model.

• The radius of the nucleus is estimated to be about 10 to the power of -15 meters, whereas the radius of the atom is about 10 to the power of -10 meters.

• This means the nucleus is roughly 100,000 times smaller than the atom itself, yet it contains more than 99.9% of the atom's mass.

• A major drawback of Rutherford's model was its inability to explain atomic stability; according to classical physics, an accelerating electron should lose energy and eventually collapse into the nucleus.

Q21. Answer: (a) The parent body breaks into pieces, and each piece grows into a new organism.

The correct answer is The parent body breaks into pieces, and each piece grows into a new organism.

Key Points

• Fragmentation is a type of asexual reproduction where the body of a multicellular organism breaks into two or more distinct parts, each of which can grow into a complete new individual.

• This process is commonly observed in organisms with simple body organization, such as Spirogyra (a filamentous algae). Upon reaching maturity, the Spirogyra filament simply breaks into smaller pieces or fragments. Hence, the statement in option 1 is correct.

• Unlike more complex organisms, these fragments undergo mitosis to develop into full-sized organisms that are genetically identical to the original parent, essentially acting as clones.

• Fragmentation differs from regeneration in that fragmentation is a standard method of reproduction used to increase population, whereas regeneration is often a mechanism to replace lost or damaged body parts.

• It is an efficient way for organisms like fungi, lichens, and certain sea stars to proliferate in favorable environmental conditions without the need for a mate.

Additional Information

• Spore Formation (Option 2):

• This method involves the parent organism producing microscopic, reproductive units called spores. These spores are often protected by a thick wall to survive unfavorable conditions.

• Examples include Rhizopus (bread mould) and Mucor. When conditions become favorable, the spores germinate into new individuals. Hence, statement 2 is incorrect regarding fragmentation.

• Binary Fission (Option 3):

• This is the most common form of asexual reproduction in unicellular organisms like Bacteria and Amoeba.

• In this process, the nucleus and cytoplasm of a single cell divide into two equal halves, resulting in two identical daughter cells. Hence, statement 3 is incorrect regarding fragmentation.

• Budding (Option 4):

• In budding, a small outgrowth or bud forms on the parent body due to repeated cell division at one specific site.

• These buds develop into tiny individuals and, when fully mature, detach from the parent body to become independent organisms.

This is seen in Hydra and Yeast. Hence, statement 4 is incorrect regarding fragmentation.

Important Points

• Asexual Reproduction ensures rapid population growth as it does not involve the time-consuming process of finding a mate or the complex fusion of gametes.

• However, the lack of genetic variation makes the entire population vulnerable to environmental changes or diseases, as every individual is a genetic copy of the parent.

• In Planaria (flatworms), the organism exhibits a high degree of regeneration, where if it is cut into pieces, each piece can grow back into a complete worm. While similar to fragmentation, it is biologically categorized under specialized regenerative cells.

• Organisms like Annelids (earthworms) and Echinoderms (starfish) also utilize fragmentation as a means of accidental or intentional reproduction depending on the species and environmental triggers.

Q22. Answer: (b) The magnetic field lines are parallel and along the axis of the solenoid from its south pole to north pole.

The correct answer is The magnetic field lines are parallel and along the axis of the solenoid from its south pole to north pole.

Key Points

• A solenoid is a coil of many circular turns of insulated copper wire wrapped closely in the shape of a cylinder. When current passes through it, it behaves like a bar magnet.

• The magnetic field lines inside a current-carrying solenoid are parallel straight lines. This indicates that the magnetic field is uniform at all points inside the solenoid.

• The direction of the magnetic field lines inside the solenoid is from the South pole to the North pole. This completes the closed loops of the magnetic field lines. Hence, statement 2 is correct.

• The magnetic field lines are not circular or perpendicular to the axis; they are directed longitudinally along the axis. Hence, statement 1 is incorrect.

• While the lines outside the solenoid travel from North to South, the internal lines must travel from South to North to maintain continuity. Hence, statement 3 is incorrect.

• The magnetic field inside a solenoid is highly organized and consistent, not random. Hence, statement 4 is incorrect.

Additional Information

• Uniform Magnetic Field: The parallel nature of the field lines inside the solenoid signifies that the strength of the field does not vary from the center to the internal edges.

• Electromagnets: A strong magnetic field produced inside a solenoid can be used to magnetize a piece of magnetic material, such as a soft iron core, when placed inside the coil. The combination of the coil and the core is called an electromagnet.

• Magnetic Field Strength: The magnitude of the magnetic field (B) inside a long solenoid is given by the formula $B = \mu_0 nI$, where μ_0 is the permeability of free space, n is the number of turns per unit length, and I is the current.

• Polarity: The ends of the solenoid act as North and South poles. One can determine the polarity using the Clock Rule; if the current appears to flow clockwise at one end, that end is the South pole.

Important Points

• Factors Affecting Strength: The strength of the magnetic field can be increased by increasing the number of turns in the coil, increasing the magnitude of current, or using a material with high magnetic permeability as a core.

• Comparison with Bar Magnets: Unlike a permanent bar magnet, the magnetic field of a solenoid can be switched on or off and its polarity can be reversed by changing the direction of the current.

• Right-Hand Thumb Rule: If you wrap your right hand around the solenoid with your fingers pointing in the direction of the conventional current, your thumb will point towards the North pole of the solenoid.

• Applications: Solenoids are widely used in industrial applications, including relay switches, electric bells, and fuel injectors in automobiles.

Q23. Answer: (c) Repurpose

The correct answer is Repurpose.

Key Points

• Repurposing (also known as creative reuse or upcycling) is the process of taking an item that can no longer serve its original function and finding a new use for it.

• In the given scenario, cracked crockery (such as cups, bowls, or pots) can no longer be used for its primary purpose of dining or food storage because the cracks may harbor bacteria or cause leaks. By using it to grow small plants, the item is given a second life in a completely different capacity. Hence, the correct answer is Repurpose.

• Reuse refers to using an item multiple times for the same purpose for which it was originally intended, such as refilling a glass water bottle. Since the crockery is cracked and cannot be used for eating/drinking safely, it is not being "reused" in the strict sense. Hence, option 1 is incorrect.

• Recycle involves breaking down a waste product into its raw materials to create a completely new product (e.g., melting down glass to make new jars). Using a cracked pot as a planter does not involve physical or chemical reprocessing of the material. Hence, option 2 is incorrect.

• Refuse is the act of declining or saying no to items that are not needed, such as single-use plastics or promotional flyers, to prevent waste from being created in the first place. This does not apply to an item already in one's possession that has become damaged. Hence, option 4 is incorrect.

Additional Information

• The Waste Hierarchy (5 Rs):

• The modern approach to waste management follows a hierarchy to minimize environmental impact. These are often listed as Refuse, Reduce, Reuse, Repurpose, and Recycle.

• Repurposing sits higher than recycling in the hierarchy because it requires less energy and no industrial processing.

• Environmental Benefits of Repurposing:

• It reduces the volume of solid waste sent to landfills.

• It conserves natural resources by delaying the need for new products.

• It lowers carbon emissions because no manufacturing energy is consumed to create the "new" item (the planter).

• Common Examples of Repurposing:

• Turning old tires into garden swings or furniture.

• Using glass honey jars to store buttons or stationery.

• Converting old t-shirts into cleaning rags.

• Using plastic containers as organizers for tools or hardware.

Important Points

• Circular Economy: Repurposing is a fundamental pillar of a circular economy, where the goal is to keep materials and products in use for as long as possible.

• Sustainability: By choosing to repurpose items like cracked crockery, individuals contribute to sustainable living practices. Ceramics are particularly good candidates for repurposing because they are durable but often difficult to recycle in standard municipal facilities.

• Distinction: The key distinction between Repurpose and Recycle is that repurposing maintains the physical integrity of the object, while recycling destroys it to recover the base material.

Q24. Answer: (d) Increase the temperature and expose it to a fan.

The correct answer is Increase the temperature and expose it to a fan.

Key Points

• Evaporation is the process by which a liquid turns into a gas at temperatures below its boiling point. It is a surface phenomenon, meaning it occurs only at the boundary between the liquid and the air.

• Increasing the temperature of the water provides the molecules with more kinetic energy. This allows a greater number of molecules to overcome the intermolecular forces of attraction and escape from the liquid surface into the atmosphere. Hence, the statement regarding increasing temperature is correct.

• Exposing the water to a fan increases the wind speed over the surface. Moving air carries away the water vapor that has already evaporated, preventing the air near the surface from becoming saturated. This maintains a steep concentration gradient, allowing more molecules to escape rapidly. Hence, the statement regarding the use of a fan is correct.

• By combining both an increase in heat and airflow, the rate of evaporation is maximized compared to static or cool conditions.

• Conversely, covering the container traps the water vapor, leading to a state of equilibrium where evaporation and condensation occur at the same rate, effectively stopping net evaporation. Hence, statement 1 is incorrect.

• Using a narrow, deep container reduces the surface area exposed to the air, which significantly slows down the evaporation process. Hence, statement 2 is incorrect.

• Placing the water in a cool, humid room reduces the energy available to the molecules and minimizes the capacity of the surrounding air to hold more moisture, thereby slowing evaporation. Hence, statement 3 is incorrect.

Additional Information

• Factors Affecting the Rate of Evaporation:

• Temperature: The rate of evaporation is directly proportional to the temperature. As the temperature rises, the kinetic energy of the particles increases, facilitating a faster transition from the liquid phase to the gaseous phase.

• Surface Area: Since evaporation is a surface-based process, increasing the exposed surface area (e.g., pouring water into a wide tray instead of a glass) allows more molecules to escape simultaneously, thus increasing the rate.

• Humidity: This refers to the amount of water vapor present in the air. The rate of evaporation is inversely proportional to humidity. If the air is already saturated with moisture, it cannot easily accept more vapor, slowing down the process.

• Wind Speed: Higher wind speeds physically remove the accumulated vapor from the immediate vicinity of the liquid surface. This keeps the vapor pressure low above the liquid, encouraging continuous evaporation.

• Real-world Applications and Examples:

• Drying Clothes: Clothes dry faster on a sunny day (high temperature), a windy day (high wind speed), and when they are spread out (large surface area).

• Cooling Effect: Evaporation causes cooling because the escaping high-energy molecules take latent heat of vaporization from the remaining liquid, lowering its temperature. This is the principle behind perspiration (sweating) in humans and the use of earthen pots (Matka) to keep water cool.

• Salt Production: Seawater is collected in large, shallow ponds to allow solar evaporation to remove the water, leaving behind sodium chloride (common salt).

Important Points

• Latent Heat of Vaporization: This is the energy required to change a unit mass of a substance from liquid to gas without changing its temperature. During evaporation, the liquid absorbs this heat from the surroundings or its own bulk, which is why we feel cold when spirit or petrol evaporates from our palm.

• Distinction from Boiling: Unlike boiling, which is a bulk phenomenon that occurs at a specific boiling point (e.g., 100°C for water at 1 atm), evaporation happens at all temperatures and only at the surface.

Q25. Answer: (a) Convex lens

The correct answer is Convex lens.

Key Points

• A lens with a positive power value, such as +2 D, is consistently identified as a convex lens. This lens is also widely known as a converging lens because it converges parallel rays of light passing through it to a focal point.

• The power of a lens (P) is mathematically defined as the reciprocal of its focal length (f), measured in meters. The standard formula used in optics is P = 1/f.

• In this specific case, for a prescribed power of +2 D, the focal length can be calculated as f = 1/2 = 0.5 meters, or 50 cm. Since the value is positive, it confirms the lens is convex.

• Convex lenses are characterized by being thicker at the center and thinner at the edges. They are used in spectacles to help the eye focus light correctly on the retina when the natural eye lens cannot do so efficiently.

• This type of spectacle is primarily prescribed for individuals suffering from Hypermetropia, commonly referred to as long-sightedness or farsightedness.

Additional Information

• Hypermetropia: This is a vision defect where a person can see distant objects clearly but cannot see nearby objects distinctly. In a hypermetropic eye, the image of a nearby object is formed behind the retina instead of on it. This defect arises either because the eyeball is too short or the focal length of the eye lens is too long.

• Concave Lens: These are diverging lenses that possess negative power (e.g., -2 D). They are used to correct Myopia (near-sightedness), where the image of a distant object is formed in front of the retina.

• Cylindrical Lens: These lenses are specifically used to correct Astigmatism. This condition occurs when the cornea or the internal lens has an irregular curvature, causing light to focus on multiple points rather than a single point on the retina, leading to blurred vision at all distances.

• Prism Lens: These are used in spectacles to correct issues related to eye alignment or double vision (Diplopia). They do not change the focus of the light but rather shift the image position to align it correctly for both eyes.

• Dioptre (D): This is the SI unit of optical power. One Dioptre is equivalent to the power of a lens with a focal length of 1 meter (1 D = 1/m).

Important Points

• Presbyopia: As people age, the ciliary muscles weaken and the eye lens loses its flexibility, making it difficult to focus on nearby objects. This condition is often treated with convex lenses for reading or bifocal lenses if the person also has myopia.

• Sign Convention: In optics, Cartesian sign conventions dictate that the focal length of a convex lens is always taken as positive, while the focal length of a concave lens is always negative.

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

• Magnification: Convex lenses can produce both real and virtual images depending on the position of the object, whereas concave lenses always produce a virtual, erect, and diminished image.

Q26. Answer: (c) 5√3

Shortcut Trick

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

The Hypotenuse (Ladder) corresponds to 2 units → 10 m.

The Height (Opposite to 60°) corresponds to √3 units.

=> Value of 1 unit = 10 ÷ 2 = 5 m.

=> Height of the wall = 5 × √3 = 5√3 m.

Therefore The correct answer is 5√3 m.

Alternate Method

Given:

Length of the Ladder (Hypotenuse, AC) = 10 m

Angle of elevation (θ) = 60°

Formula Used:

sin θ = Perpendicular / Hypotenuse

Calculations:

=> sin 60° = Height of wall / Length of ladder

=> √3 / 2 = Height / 10

=> Height = 10 × (√3 / 2)

=> Height = 5√3 m

Therefore The correct answer is 5√3 m.

Additional Information

Trigonometric Ratios

For a right-angled triangle, sin θ = P/H, cos θ = B/H, and tan θ = P/B.

Standard Values

sin 30° = 1/2, sin 45° = 1/√2, sin 60° = √3/2.

Pythagoras Theorem

In any right-angled triangle: $(\text{Hypotenuse})^2 = (\text{Base})^2 + (\text{Perpendicular})^2$.

Q27. Answer: (c) 20

Shortcut Trick

To find the greatest volume container, we need to calculate the HCF (Highest Common Factor) of the given quantities.

Given volumes: 300, 280, and 180 litres.

Common factor 10: 10 × (30, 28, 18)

Common factor 2: 10 × 2 × (15, 14, 9)

HCF = 10 × 2 = 20.

Therefore The correct answer is 20 litres.

Alternate Method

Given: Volumes are 300 litres, 280 litres, and 180 litres.

Formula Used: Required container volume = HCF of (300, 280, 180).

=> Prime Factorization of 300 = $2^2 \times 3 \times 5^2$

=> Prime Factorization of 280 = $2^3 \times 5 \times 7$

=> Prime Factorization of 180 = $2^2 \times 3^2 \times 5$

=> HCF = 2^(min(2,3,2)) × 5^(min(2,1,1))

=> HCF = $2^2 \times 5^1 = 4 \times 5 = 20$.

Therefore The correct answer is 20 litres.

Additional Information

HCF (Highest Common Factor)

It is the largest positive integer that divides each of the integers without a remainder. Used for maximum capacity or equal distribution problems.

LCM (Least Common Multiple)

It is the smallest positive integer that is divisible by each of the given numbers. Used for simultaneous events or recurring interval problems.

Relation between HCF and LCM

For two numbers a and b, HCF(a, b) × LCM(a, b) = a × b.

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Q28. Answer: (d) 36 hours

Shortcut Trick

Net work done in 1 hour = (1/Filling Time) − (1/Emptying Time)

Combined efficiency = 1/9 − 1/12 = (4 − 3)/36 = 1/36

Time taken = 36 hours

Therefore The correct answer is 36 hr.

Alternate Method

Given:

Time taken by Filling Tap = 9 hours

Time taken by Emptying Hole = 12 hours

Source	Time (hr)	Total Work (LCM)	Efficiency
Filling Tap	9	36	+4
Emptying Hole	12	−3	

Calculations:

=> Net efficiency when both are open = 4 + (−3) = 1 unit/hr

=> Total time required to fill the empty cistern = Total Work ÷ Net Efficiency

=> Time = 36 ÷ 1 = 36 hr

Therefore The correct answer is 36 hr.

Additional Information

Pipes and Cisterns Logic

Efficiency of a filling pipe is taken as positive, while the efficiency of an outlet/leakage is taken as negative.

Direct Formula

If pipe A fills in x hours and pipe B empties in y hours, combined time T = (x × y) ÷ (y − x) provided y > x.

Q29. Answer: (c) 47

Shortcut Trick

In any data set, the Mode is the value that has the highest frequency (occurs most often).

By scanning the given values, we count the frequency of each number:

Number 47 appears 5 times, while 51 and 43 appear only 3 times each.

Since 47 has the maximum repetition, it is the mode.

Therefore The correct answer is 47.

Alternate Method

Given: Data set = 47, 51, 51, 48, 53, 54, 47, 52, 51, 46, 43, 47, 52, 40, 47, 41, 43, 43, 46, 47

Formula Used: Mode = Observation with the highest frequency.

To find the mode, we list the frequency of all distinct observations:

=> Number 40: 1 time

=> Number 41: 1 time

=> Number 43: 3 times (43, 43, 43)

=> Number 46: 2 times (46, 46)

=> Number 47: 5 times (47, 47, 47, 47, 47)

=> Number 48: 1 time

=> Number 51: 3 times (51, 51, 51)

=> Number 52: 2 times (52, 52)

=> Number 53: 1 time

=> Number 54: 1 time

=> The maximum frequency is 5.

=> The value corresponding to frequency 5 is 47.

Therefore The correct answer is 47.

Additional Information

Empirical Relationship

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

Types of Mode

A data set with one mode is Unimodal, two modes is Bimodal, and more than two is Multimodal.

Mean and Median

Mean is the average of all values (Sum ÷ Count), and Median is the middle value when data is arranged in ascending order.

Q30. Answer: (c) 150

Shortcut Trick

Fourth proportional to 20, 15, 8 => (15 × 8) ÷ 20 = 6.

This is equal to the third proportional to A and 30.

Third proportional formula => $30^2 \div A = 6$.

A = 900 ÷ 6 = 150.

Therefore The correct answer is 150.

Alternate Method

Given: First set (20, 15, 8) and Second set (A, 30).

Formula Used: Fourth Proportional (x) of a, b, c is $x = (b \times c) / a$. Third Proportional (c) of a, b is $c = b^2 / a$.

=> Fourth proportional (x) = (15 × 8) ÷ 20

=> x = 120 ÷ 20 = 6

=> Third proportional to A and 30 is also 6.

=> 6 = (30 × 30) ÷ A

=> 6 × A = 900

=> A = 900 ÷ 6 = 150

Therefore The correct answer is 150.

Additional Information

Mean Proportional

The mean proportional between two numbers a and b is $\sqrt{(a \times b)}$.

Continued Proportion

Three numbers a, b, c are in continued proportion if $a/b = b/c$, which implies $b^2 = ac$.

Fourth Proportional Rule

If a : b :: c : d, then d is the fourth proportional and Product of Extremes = Product of Means (ad = bc).

Q31. Answer: (a) 19

Shortcut Trick

Extra runs scored above the previous average = 235 − 100 = 135.

This excess is distributed across all 7 innings to find the average increase.

Increase in average = 135 ÷ 7 = 19.285...

Rounding 19.28 to the nearest whole number gives 19.

Therefore The correct answer is 19.

Alternate Method

Given: Average of 6 innings = 100 runs, Runs in 7^(th) inning = 235.

Formula: Average = Total Sum ÷ Number of observations

=> Total runs for 6 innings = 6 × 100 = 600

=> Total runs for 7 innings = 600 + 235 = 835

=> New average for 7 innings = 835 ÷ 7

=> New average = 119.2857...

=> Increase in average = New average − Old average

=> Increase = 119.2857 − 100 = 19.2857

=> Rounded average increase = 19

Therefore The correct answer is 19.

Additional Information

Concept of Average Change

If a new value is added to a group, the average increases if the new value > old average and decreases if the new value < old

average.

Deviation Method for Averages

Net Increase = (New Observation − Old Average) ÷ (Total Number of Observations including the new one).

Rounding Rules

When rounding to the nearest whole number, look at the first decimal place; if it is less than 5, round down (e.g., 19.28 → 19), if 5 or more, round up.

Q32. Answer: (d) 8°

Shortcut Trick

For any quadrilateral PQRS, the angle formed by the bisectors of two adjacent angles (say angle R and angle S) is equal to half the sum of the other two angles (angle P and angle Q):

angle STR = (angle P + angle Q) ÷ 2

=> angle P + angle Q = 2 × 44° = 88°

Since the ratio of angle P : angle Q is 5 : 6, the total parts are 5 + 6 = 11 parts.

=> 11 parts = 88° → 1 part = 8°

The difference between angle Q and angle P is (6 − 5) = 1 part = 8°.

Therefore The correct answer is 8°.

Alternate Method

Given:

• In quadrilateral PQRS, the bisectors of angle R and angle S meet at T.

• angle STR = 44°

• Ratio of angle P : angle Q = 5 : 6

Formula Used:

• Sum of interior angles of a quadrilateral = 360°

• Sum of angles of a triangle = 180°

Calculations:

In triangle STR:

=> angle TSR + angle TRS + angle STR = 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:

=> (angle S ÷ 2) + (angle R ÷ 2) + 44° = 180°

=> (angle S + angle R) ÷ 2 = 180° − 44°

=> (angle S + angle R) ÷ 2 = 136°

=> angle S + angle R = 272°

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

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

=> angle P + angle Q + 272° = 360°

=> angle P + angle Q = 360° − 272°

=> angle P + angle Q = 88°

Let angle P = 5x and angle Q = 6x (since angle P : angle Q = 5 : 6):

=> 5x + 6x = 88°

=> 11x = 88°

=> x = 8°

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

=> angle Q − angle P = 6x − 5x = x

=> Difference = 8°

Therefore The correct answer is 8°.

Additional Information

Angle Bisector Relation in Quadrilaterals

The angle between 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.

Sum of Interior Angles of a Polygon

The sum of the interior angles of any convex polygon with n sides is (n − 2) × 180°. For a quadrilateral, n = 4, so the sum is 360°.

Opposite Angle Bisectors

If the bisectors of two opposite angles of a quadrilateral (say angle P and angle R) intersect, the angle between them is equal to half the difference of the other two angles: |angle Q − angle S| ÷ 2.

Q33. Answer: (b) Rs. 519

Shortcut Trick

Total deduction = Rs. (12 + 23 + 43) = Rs. 78.

Remaining amount = Rs. 1411 − Rs. 78 = Rs. 1333.

Sum of ratio parts = 21 + 16 + 6 = 43 units.

43 units = Rs. 1333 => 1 unit = Rs. 31.

Harsh's reduced share = 16 × 31 = Rs. 496.

Harsh's actual share = Rs. 496 + Rs. 23 = Rs. 519.

Therefore The correct answer is Rs. 519.

Alternate Method

Given: Total amount = Rs. 1411; Deductions = Rs. 12, Rs. 23, Rs. 43; Ratio = 21 : 16 : 6.

Formula: Actual Share = (Ratio Share × Value per unit) + Deducted Amount.

=> Total Deducted Amount = 12 + 23 + 43 = 78

=> New Total Amount = 1411 − 78 = 1333

=> Total Ratio = 21 + 16 + 6 = 43

=> Value of 1 unit = 1333 ÷ 43 = 31

=> Harsh's share in ratio = 16 × 31 = 496

=> Harsh's actual share = 496 + 23 = 519

Therefore The correct answer is Rs. 519.

Additional Information

Ratio and Proportion Basics

If a total amount T is divided in the ratio a:b:c, then the share of b is calculated as [b / (a + b + c)] × T.

Concept of Deduction in Ratios

When specific amounts are deducted or added to shares, the ratio applies only to the resultant values. Always adjust the total sum before dividing by the ratio sum.

Q34. Answer: (a) 16

Shortcut Trick

Use the direct algebraic identity: $(x - y)^2 = (x + y)^2 - 4xy$

Substitute the given values: Sum (x + y) = 20 and Product (xy) = 96

$(x - y)^2 = 20^2 - 4 \times 96$

$(x - y)^2 = 400 - 384 = 16$

Therefore The correct answer is 16.

Alternate Method

Given:

Sum of two numbers (x + y) = 20

Product of two numbers (xy) = 96

Formula Used:

$(a - b)^2 = (a + b)^2 - 4ab$

Calculations:

=> $(x - y)^2 = (x + y)^2 - 4xy$

=> $(x - y)^2 = (20)^2 - 4(96)$

=> $(x - y)^2 = 400 - 384$

=> $(x - y)^2 = 16$

Therefore The correct answer is 16.

Additional Information

Fundamental Algebraic Identities

$(a + b)^2 = a^2 + b^2 + 2ab$ and $(a - b)^2 = a^2 + b^2 - 2ab$

Relationship between Identities

$(a + b)^2 - (a - b)^2 = 4ab$ and $(a + b)^2 + (a - b)^2 = 2(a^2 + b^2)$

Difference of Squares

$a^2 - b^2 = (a + b)(a - b)$

Q35. Answer: (d) 1,95,000

Shortcut Trick

Income ratio David : Ashish = 5 : 9 and Expenditure ratio = 2 : 4 (or 1 : 2).

Since savings are equal, make the difference between income and expenditure parts the same.

Multiply Income ratio by (2 − 1) = 1 → 5 : 9 (Diff = 4). Multiply Expenditure ratio by (9 − 5) = 4 → 8 : 16.

This does not align well. Use Cross Multiplication Method: (5×4 − 9×2) units = 39000 × (4 − 2).

2 units = 39000 × 2 => 1 unit = Rs. 39,000.

David income = 5 units = 5 × 39,000 = Rs. 1,95,000.

Therefore The correct answer is Rs. 1,95,000.

Alternate Method

Given: Ratio of incomes = 5 : 9, Ratio of expenditures = 2 : 4, Savings = Rs. 39,000 each.

Formula Used: Income − Savings = Expenditure

=> Let incomes be 5x and 9x.

=> (5x − 39000) / (9x − 39000) = 2 / 4

=> (5x − 39000) / (9x − 39000) = 1 / 2

=> 2(5x − 39000) = 1(9x − 39000)

=> 10x − 78000 = 9x − 39000

=> 10x − 9x = 78000 − 39000

=> x = 39,000

=> David monthly income = 5x = 5 × 39,000 = Rs. 1,95,000.

Therefore The correct answer is Rs. 1,95,000.

Additional Information

Income-Expenditure Relationship

Basic identity: Income = Expenditure + Savings. For two people with same savings, the difference in income units equals the difference in expenditure units if scaled correctly.

Ratio and Proportion

If a : b = c : d, then ad = bc. This cross-multiplication property is fundamental in solving ratio-based linear equations.

Cross Multiplication Trick

For equations like (ax + k)/(bx + k) = m/n, the value of x = [k × (m − n)] / [an − bm]. This is the fastest way to solve income-expenditure problems.

Q36. Answer: (b) 12%

Shortcut Trick

Net change formula: a + b + (a × b) ÷ 100

Here, markup a = +40% and discount b = −20%.

Profit% = 40 − 20 + (40 × −20) ÷ 100

Profit% = 20 − 8 = 12%.

Therefore The correct answer is 12%.

Alternate Method

Given: Markup = 40%, Discount = 20%.

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

=> Let Cost Price (CP) = 100.

=> Marked Price (MP) = 100 + 40% of 100 = 140.

=> Selling Price (SP) = 140 − 20% of 140 = 140 − 28 = 112.

=> Profit = SP − CP = 112 − 100 = 12.

=> Profit% = (12 ÷ 100) × 100 = 12%.

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Therefore The correct answer is 12%.

Additional Information

Relationship between CP and MP

The ratio of MP to CP can be expressed as: MP ÷ CP = (100 + Profit%) ÷ (100 − Discount%).

Marked Price (MP)

It is the price displayed on the label of an article. Discount is always calculated on the Marked Price.

Q37. Answer: (c) 21

Shortcut Trick

The Curved Surface Area (CSA) of a cylinder is given by π × diameter (d) × height (h).

924 = (22 ÷ 7) × d × 14

924 = 22 × d × 2 => 924 = 44 × d

d = 924 ÷ 44 = 21 cm

Therefore The correct answer is 21 cm.

Alternate Method

Given:

Curved Surface Area (CSA) = 924 cm²

Height (h) = 14 cm

Formula Used:

Curved Surface Area of Cylinder = 2 × π × r × h

Diameter (d) = 2 × r

Calculations:

=> CSA = 2 × π × r × h

=> 924 = 2 × (22 ÷ 7) × r × 14

=> 924 = 2 × 22 × r × 2

=> 924 = 88 × r

=> r = 924 ÷ 88

=> r = 10.5 cm

=> Diameter (d) = 2 × r = 2 × 10.5

=> d = 21 cm

Therefore The correct answer is 21 cm.

Additional Information

Total Surface Area (TSA)

The TSA of a cylinder includes the curved surface and the two circular bases: TSA = 2πr(h + r).

Volume of Cylinder

The volume measures the space inside the cylinder: Volume = πr²h.

Base Area and Perimeter

Base Area = πr² and the circumference (perimeter) of the base = 2πr.

Q38. Answer: (d) Rs. 1,587

Shortcut Trick

Net percentage interest for 2 years at 15% compound interest = x + y + (xy/100)

=> 15 + 15 + (15 × 15)/100 = 30 + 2.25 = 32.25%

Total Amount = 100% (Principal) + 32.25% (Interest) = 132.25% of Principal

=> Amount = 1200 × 1.3225 = Rs. 1,587

Therefore The correct answer is Rs. 1,587.

Alternate Method

Given:

Principal (P) = Rs. 1,200

Rate of Interest (R) = 15% per annum

Time (n) = 2 years

Formula Used:

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

Calculations:

=> $A = 1200 \times (1 + 15/100)^2$

=> $A = 1200 \times (1 + 0.15)^2$

=> $A = 1200 \times (1.15) \times (1.15)$

=> $A = 1200 \times 1.3225$

=> A = Rs. 1,587

Therefore The correct answer is Rs. 1,587.

Additional Information

Compound Interest Formula

The interest earned is calculated as CI = A − P, where $A = P(1 + r/100)^n$.

Difference between CI and SI for 2 years

The difference between compound interest and simple interest for two years is given by $D = P(R/100)^2$.

Half-Yearly Compounding

If interest is compounded half-yearly, the rate is halved (R/2) and the time is doubled (2n).

Q39. Answer: (d) 24,300

Shortcut Trick

Convert all dimensions to cm: Wall = 2000 × 990 × 30, Brick = 25 × 11 × 8.

Since 10% is cement, 90% of the wall volume is occupied by bricks.

Number of bricks = (0.9 × 2000 × 990 × 30) ÷ (25 × 11 × 8)

Number of bricks = 53,460,000 ÷ 2,200 = 24,300.

Therefore The correct answer is 24,300 bricks.

Alternate Method

Given:

Wall length = 20 m = 2000 cm

Wall height = 9.9 m = 990 cm

Wall thickness = 30 cm

Brick dimensions = 25 cm × 11 cm × 8 cm

Cement volume = 10% of wall volume

Formula Used:

Volume of Cuboid = Length × Height × Thickness

Number of bricks = (Net volume of wall for bricks) ÷ (Volume of one brick)

=> Total volume of the wall = 2000 × 990 × 30 = 59,400,000 cm^3

=> Volume occupied by cement = 10% of 59,400,000 = 5,940,000 cm^3

=> Volume occupied by bricks = 59,400,000 − 5,940,000 = 53,460,000 cm^3

=> Volume of one brick = 25 × 11 × 8 = 2,200 cm^3

=> Total number of bricks = 53,460,000 ÷ 2,200 = 24,300

Therefore The correct answer is 24,300 bricks.

Additional Information

Volume of a Cuboid

The volume of any cuboidal structure is calculated as Length × Width × Height. Ensure all units are consistent (e.g., all in cm or all in m) before calculation.

Net Volume Calculation

When a percentage of volume is occupied by mortar or cement, the net volume for bricks is (100 − Mortar%) ÷ 100 × Total Volume.

Unit Conversion

1 meter = 100 centimeters | 1 m^3 = 1,000,000 cm^3. Converting larger units to smaller units (m to cm) usually makes manual calculation easier by avoiding decimals.

Q40. Answer: (d) Rs. 13,950

Shortcut Trick

The relation between Cost Price (CP) and Marked Price (MP) is given by the ratio:

CP ÷ MP = (100 − Discount%) ÷ (100 + Profit%)
CP ÷ 62,000 = (100 − 73) ÷ (100 + 20) = 27 ÷ 120
CP = 62,000 × (27 ÷ 120) = 62,000 × (9 ÷ 40)
CP = 1,550 × 9 = 13,950
Therefore The correct answer is Rs. 13,950.
Alternate Method
Given: Marked Price (MP) = Rs. 62,000, Discount = 73%, Profit = 20%.
Formulas: SP = MP × (100 − Discount%) ÷ 100 | CP = SP × 100 ÷ (100 + Profit%)
=> Selling Price (SP) = 62,000 × (100 − 73) ÷ 100
=> SP = 62,000 × 27 ÷ 100 = 620 × 27 = Rs. 16,740
=> Cost Price (CP) = SP × 100 ÷ (100 + 20)
=> CP = 16,740 × 100 ÷ 120 = 16,740 × 5 ÷ 6
=> CP = 2,790 × 5 = Rs. 13,950
Therefore The correct answer is Rs. 13,950.
Additional Information
Marked Price & Discount
Discount is always calculated on the Marked Price (MP). SP = MP − Discount.
CP-MP Relationship
This direct ratio (100−D):(100+P) is extremely useful for exams to bypass calculating the Selling Price.

Q41. Answer: (d) 18

Shortcut Trick
Use the Inverse Proportion formula: M1 × D1 = M2 × D2
Initial men (M1) = 1209, Days (D1) = 24
New men (M2) = 1209 + 403 = 1612
1209 × 24 = 1612 × D2
D2 = (1209 × 24) ÷ 1612 = 18 days
Therefore The correct answer is 18 days.
Alternate Method
Given:
Initial number of men (M1) = 1209
Initial duration of provisions (D1) = 24 days
Increase in men = 403
Formula Used:
Total Work (Provisions) = Men × Days
Calculations:
=> Total M2 = 1209 + 403 = 1612
=> According to the work equivalence rule: M1D1 = M2D2
=> 1209 × 24 = 1612 × D2
=> D2 = (1209 × 24) ÷ 1612
=> D2 = 29016 ÷ 1612
=> D2 = 18 days
Therefore The correct answer is 18 days.
Additional Information
Inverse Variation
When the number of men increases, the days for which provisions last will decrease. This is a case of inverse proportion where x × y = constant.
Chain Rule
The general formula is (M1 × D1 × H1) ÷ W1 = (M2 × D2 × H2) ÷ W2, where M=Men, D=Days, H=Hours, and W=Work.

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Q42. Answer: (b) 3

Shortcut Trick

Let the total capacity of the cistern be 36 units (LCM of 9 and 36).

Combined efficiency of P and Q = 36 ÷ 9 = 4 units/hour.

Efficiency of P alone = 36 ÷ 36 = 1 unit/hour.

Efficiency of Q alone = 4 − 1 = 3 units/hour.

Time taken by Q to fill one-fourth of the cistern = (36 × 1/4) ÷ 3 = 9 ÷ 3 = 3 hours.

Therefore The correct answer is 3 hours.

Alternate Method

Given:

Time taken by P and Q together to fill the cistern = 9 hours

Time taken by P alone to fill the cistern = 36 hours

Formula Used:

1/T_Q = 1/T_(P+Q) − 1/T_P

Person	Days/Hours	Total Work	Efficiency
P + Q	9	36	4
P	36	1	

Calculations:

=> Efficiency of Q = Efficiency of (P + Q) − Efficiency of P

=> Efficiency of Q = 4 − 1 = 3 units/hour

=> One-fourth of the total cistern capacity = 36 ÷ 4 = 9 units

=> Time taken by Q to fill 9 units = 9 ÷ 3 = 3 hours

Therefore The correct answer is 3 hours.

Additional Information

Total Work LCM Method

Taking the LCM of individual times as the total work simplifies calculations by avoiding fractions during efficiency determination.

Work and Efficiency Relation

Time taken is inversely proportional to efficiency. Time = Total Work ÷ Efficiency.

Q43. Answer: (a) Rs. 1,166.40

Shortcut Trick

Net discount = a + b − (a × b) ÷ 100

Net discount = 20 + 10 − (20 × 10) ÷ 100 = 30 − 2 = 28%

Selling Price (SP) = 100% − 28% = 72% of Marked Price (MP)

Price paid = 1620 × 0.72 = 1166.40

Therefore The correct answer is Rs. 1,166.40.

Alternate Method

Given: Marked Price (MP) = Rs. 1,620, Discount 1 = 20%, Discount 2 = 10%.

Formulas: SP = MP × (100 − D1%) ÷ 100 × (100 − D2%) ÷ 100

=> Price after 1st discount = 1620 × (80 ÷ 100) = 1620 × 0.8 = 1296

=> Price after 2nd discount = 1296 × (90 ÷ 100) = 1296 × 0.9

=> Final Price = 1166.40

Therefore The correct answer is Rs. 1,166.40.

Additional Information

Marked Price & Discount

Discount is always calculated on the Marked Price. SP = MP − Discount.

Successive Discount

When two or more discounts are applied one after another, the net discount is less than the sum of individual discounts. Formula for two: a + b − ab/100.

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Q44. Answer: (a) 40.44%

Shortcut Trick

Net discount for first two = 22 + 8 − (22 × 8) ÷ 100 = 30 − 1.76 = 28.24%.

Net discount with third = 28.24 + 17 − (28.24 × 17) ÷ 100.

=> 45.24 − (480.08 ÷ 100) = 45.24 − 4.8008 = 40.4392%.

Therefore The correct answer is 40.44%.

Alternate Method

Given → Discounts are 22%, 8%, and 17%.

Formulas: Successive discount = a + b − (ab ÷ 100) | SP = MP × (100 − D1)% × (100 − D2)% × (100 − D3)%

=> Let the Marked Price (MP) be 100.

=> Price after 22% discount = 100 × (78 ÷ 100) = 78.

=> Price after 8% discount = 78 × (92 ÷ 100) = 71.76.

=> Price after 17% discount = 71.76 × (83 ÷ 100) = 59.5608.

=> Single Equivalent Discount = MP − Final SP = 100 − 59.5608 = 40.4392%.

Therefore The correct answer is 40.44%.

Additional Information

Successive Discounts

When two or more discounts are applied one after another, they are called successive discounts. The order of application does not change the final amount.

Effective Discount Formula

For three discounts d1, d2, and d3, the equivalent discount is 100 − [100 × (1 − d1/100) × (1 − d2/100) × (1 − d3/100)].

Q45. Answer: (a) 40

Shortcut Trick

Assume R = 2x. Then P = x, S = x − 10, and T = 2x + 20.

Total sum = 2x + x + (x − 10) + (2x + 20) = 6x + 10.

6x + 10 = 130 => 6x = 120 => x = 20.

R = 2x = 2 × 20 = 40 years.

Therefore The correct answer is 40 years.

Alternate Method

Given:

T = R + 20

S = P − 10

P = R ÷ 2

Sum: T + S + P + R = 130

Substitute all variables in terms of R:

=> (R + 20) + (R/2 − 10) + (R/2) + R = 130

=> R + R/2 + R/2 + R + 20 − 10 = 130

=> 3R + 10 = 130

=> 3R = 120

=> R = 40 years.

Therefore The correct answer is 40 years.

Additional Information

Linear Equations in Ages

Expressing all unknown ages in terms of a single variable (usually the youngest person or the person linked to all others) simplifies the calculation.

Ratio and Proportion in Ages

If the ratio of ages of A and B is a:b, their ages can be assumed as ax and bx years respectively.

Age Difference Constant

The difference between the ages of two persons remains the same at any point in time.

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Q46. Answer: (a) 9

Shortcut Trick

Convert all bases to 3: 9 = 3^2, 27 = 3^3

Expression becomes: 3^((4+x)) × 3^(2(x−4)) ÷ (3^(3(x−3)) × 3^3)

Combine powers: Numerator = 3^((4+x+2x−8)) = 3^((3x−4))

Denominator = 3^((3x−9+3)) = 3^((3x−6))

Final = 3^((3x−4 − (3x−6))) = 3^2 = 9

Therefore Answer = 9

Alternate Method

Given:

(3^((4+x)) × 9^((x−4))) ÷ (27^((x−3)) × 3^3)

Concept Used:

Index laws: a^m × a^n = a^(m+n), $(a^m)^n$ = a^(mn), a^m ÷ a^n = a^(m−n)

Calculation:

=> (3^((4+x)) × (3^2)^((x−4))) ÷ ((3^3)^((x−3)) × 3^3)

=> (3^((4+x)) × 3^((2x−8))) ÷ (3^((3x−9)) × 3^3)

=> 3^((4+x+2x−8)) ÷ 3^((3x−9+3))

=> 3^((3x−4)) ÷ 3^((3x−6))

=> 3^(((3x−4) − (3x−6)))

=> 3^2

=> 9

Therefore The correct answer is 9.

Additional Information

Laws of Exponents

a^m × a^n = a^(m+n), a^m ÷ a^n = a^(m−n)

Power of a Power

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

Base Conversion

Convert numbers like 9 and 27 into powers of 3 for easy simplification.

Simplification Trick

Combine powers early to reduce expression quickly.

Q47. Answer: (d) 50:27

Shortcut Trick

Assume initial population is 100.

After 40% left: 100 − 40 = 60.

After 10% of remaining left: 60 − (10% of 60) = 60 − 6 = 54.

Ratio of initial to present = 100 : 54 = 50 : 27.

Therefore The correct answer is 50:27.

Alternate Method

Given:

Percentage who left due to water crisis = 40%

Percentage of remaining who left for jobs = 10%

Present population = 1080

Calculations:

=> Let Initial Population be P.

=> Remaining after water crisis = P × (100 − 40)/100 = 0.6P

=> Present Population = 0.6P × (100 − 10)/100

=> Present Population = 0.6P × 0.9 = 0.54P

=> Ratio = Initial / Present = P / 0.54P

=> Ratio = 1 / 0.54 = 100 / 54

=> Ratio = 50 / 27

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Therefore The correct answer is 50:27.

Additional Information

Successive Percentage Change

When a value changes by x% and then the remaining changes by y%, the net effective multiplier is (1 ± x/100) × (1 ± y/100).

Ratio of Change

If a population decreases by R%, the ratio of original to new population is 100 : (100 − R).

Percentage to Fraction

Converting percentages to fractions (40% = 2/5, 10% = 1/10) can often simplify complex population calculations.

Q48. Answer: (a) 26 km/hr

Shortcut Trick

Relative Speed = Total distance ÷ Total time

Total distance = 164 + 136 = 300 m; Time = 10 s

Relative Speed = 300 ÷ 10 = 30 m/s = 30 × (18/5) = 108 km/hr

Speed of second train = 108 − 82 = 26 km/hr

Therefore The correct answer is 26 km/hr.

Alternate Method

Given: Length1 = 164 m, Length2 = 136 m, Time = 10 s, Speed1 = 82 km/hr

Formula Used: Relative Speed (opposite) = (L1 + L2) ÷ Time

=> Total Distance = 164 + 136 = 300 m

=> Relative Speed (m/s) = 300 ÷ 10 = 30 m/s

=> Relative Speed (km/hr) = 30 × (18/5) = 108 km/hr

=> Relative Speed = Speed1 + Speed2

=> 108 = 82 + Speed2

=> Speed2 = 108 − 82 = 26 km/hr

Therefore The correct answer is 26 km/hr.

Additional Information

Relative Speed in Opposite Direction

When two objects move in opposite directions, their relative speed is the sum of their individual speeds: S_(rel) = S1 + S2.

Unit Conversion

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

Crossing Distance

When a train crosses another train (stationary or moving), the total distance covered is always the sum of their lengths (L1 + L2).

Q49. Answer: (d) 25

Shortcut Trick

To find the larger number when the sum and difference of two numbers are known:

Larger Number = (Sum + Difference) ÷ 2

=> Larger Number = (45 + 5) ÷ 2 = 50 ÷ 2 = 25

Therefore The correct answer is 25.

Alternate Method

Given:

Sum of two numbers = 45

Difference between the numbers = 5

Method: Linear Equation in one variable

Let the smaller number be x.

Then the larger number = x + 5

According to the question:

=> x + (x + 5) = 45

=> 2x + 5 = 45

=> 2x = 45 − 5

=> 2x = 40

=> x = 20

The larger number is x + 5:

=> 20 + 5 = 25

Therefore The correct answer is 25.

Additional Information

Finding Smaller Number

To calculate the smaller value directly from sum (S) and difference (D), use the formula: Smaller Number = (S − D) ÷ 2.

System of Linear Equations

If x + y = S and x − y = D, then adding both equations eliminates y to find x, and subtracting them eliminates x to find y.

Average of Two Numbers

The average of two numbers is exactly halfway between them. Average = Sum ÷ 2. Here, 45 ÷ 2 = 22.5. The numbers are 22.5 ± (Difference ÷ 2), which is 22.5 ± 2.5.

Q50. Answer: (c) 230

Shortcut Trick

Total Distance = 187 + 273 = 460 km

Total Time = 1 + 1 = 2 hours

Average Speed = 460 ÷ 2 = 230 km/hr

Therefore The correct answer is 230 km/hr.

Alternate Method

Given:

Distance in 1^(st) hour (d1) = 187 km

Distance in 2^(nd) hour (d2) = 273 km

Formula Used:

Average Speed = Total Distance ÷ Total Time

Calculations:

=> Total Distance = d1 + d2 = 187 + 273

=> Total Distance = 460 km

=> Total Time = 1 + 1 = 2 hours

=> Average Speed = 460 ÷ 2

=> Average Speed = 230 km/hr

Therefore The correct answer is 230 km/hr.

Additional Information

Average Speed (Equal Distances)

If a journey is divided into two equal distances with speeds x and y, then Average Speed = 2xy ÷ (x + y).

Average Speed (Equal Time)

If a body travels at different speeds x and y for equal time intervals, Average Speed = (x + y) ÷ 2.

Unit Conversion

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

Q51. Answer: (a) VPN81

The logic followed here is:

So, the missing term = VPN81

Hence, the correct answer is Option 1.

Q52. Answer: (d) vt

The logic followed here is to compare the given phrases and identify the common word and its corresponding common code.

Given:

do you sing → ln vt df

they sing well → vt mp bo

So, sing → vt

Hence, the correct answer is Option 4.

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Q53. Answer: (c) 5

The logic followed here is to compare the given words and identify the common letter and its corresponding common code.

Given:

YARD → Y A R D → 4 5 7 9

TOYS → T O Y S → 2 3 8 5

So, Y → 5

Hence, the correct answer is Option 3.

Q54. Answer: (d) Two

The logic followed here is to apply a +1 shift to each letter of the given words and then check how many resulting words contain no vowels (A, E, I, O, U).

Given:

TOK → UPL

THE → UIF

HAS → IBT

ALL → BMM

COW → DPX

Original Word	After +1 Shift	Vowels Present
TOK	UPL	Yes (U)
THE	UIF	Yes (U, I)
HAS	IBT	Yes (I)
ALL	BMM	No
COW	DPX	No

Thus, only ALL and COW result in words with no vowels.

Hence, the correct answer is Option 4.

Q55. Answer: (b) D

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

C sits to the immediate left of B.

W sits to the immediate left of A.

A sits second to the left of X.

D sits third to the left of B.

So, third to the right of Y is D.

Hence, the correct answer is "Option 2".

Q56. Answer: (d) A

Given: Five people A, B, C, D and E are sitting in a row facing north.

D sits third from the left end of the row.

E sits fifth from the left end of the row.

Only B sits between A and D.

So, A sits at the extreme left end of the row.

Hence, the correct answer is "Option 4".

Q57. Answer: (a) 4

Given: (Left) 1 2 7 1 8 9 9 6 7 9 6 3 (Right)

Now,

Even numbers which are immediately preceded by an odd number and immediately followed by an odd number.

So, needed pattern is: Odd - Even - Odd

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

So, total valid patterns = 4

Hence, the correct answer is Option 1.

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Q58. Answer: (c) 35

BODMAS Table:

Given equation: (24 Q 6) P 15 S (10 Q 2) P 7 R (80 Q 8) P 6 = ?

Now, replacing the letters according to the given mapping:P = ×,Q = ÷,R = −,S = +

=> (24 ÷ 6) × 15 + (10 ÷ 2) × 7 − (80 ÷ 8) × 6

=> 4 × 15 + 5 × 7 − 10 × 6

=> 60 + 35 − 60

=> 95 − 60

=> 35

Hence, the correct answer is Option 3.

Q59. Answer: (a) 31

The logic followed here is:

thus, "31" will replace the question mark in the given series.

Hence, the correct option is "Option 1".

Q60. Answer: (b) SQM 12

The logic followed here is:

So, the missing term = SQM 12

Hence, the correct answer is Option 2.

Q61. Answer: (c) Only conclusion (I) follows

Given Statements:

All radios are microphones.

All radios are speakers.

The least possible Venn diagram for the given statement is:

Conclusions:

I. Some microphones are speakers - True (Since all radios are both microphones and speakers, radios form a common part of both sets. Therefore, some microphones are speakers).

II. All speakers are radios - False (The statement only says all radios are speakers. It does not mean all speakers are radios).

So, only conclusion I follows.

Hence, the correct answer is Option 3.

Q62. Answer: (b) Two

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

No box is kept above X.

Only U is kept below E.

Only three boxes are kept between E and W.

Only two boxes are kept between W and V.

D is not kept immediately above V.

Position	Box
7	X
6	W
5	D
4	F
3	V
2	E
1	U

Now, Boxes between F (4) and U (1): V (3), E (2) → 2 boxes

Hence, the correct answer is Option 2.

Q63. Answer: (b) 82 km towards west

The logic followed here is:
Given:
Kiran starts from Point Y and drives 35 km South
He takes a left turn → 22 km East
He takes a right turn → 39 km South
He takes a left turn → 48 km East
He takes a left turn → 26 km North
He takes a right turn → 12 km East
He takes a left turn → 48 km North
So, To reach Point Y again, he must travel 82 km West.
Hence, the correct answer is Option 2.

Q64. Answer: (d) Two

Given: (Left) 4 9 2 6 5 1 3 7 8 2 9 4 1 5 7 3 8 2 9 4 6 1 (Right)
Now,
We need to identify all unique numbers in the series and check which of them are perfect cubes.
So, first list all unique numbers:
(Left) 4 9 2 6 5 1 3 7 8 2 9 4 1 5 7 3 8 2 9 4 6 1 (Right)
Unique numbers = 1, 2, 3, 4, 5, 6, 7, 8, 9
So, valid perfect cubes = 1 and 8
So, total unique perfect cubes = 2
Hence, the correct answer is Option 4.

Q65. Answer: (c) 45

The logic followed here is:
thus, "45" will replace the question mark in the given series.
Hence, the correct option is "Option 3"

Q66. Answer: (d) 2

Given: (Left) 2 8 3 5 4 6 8 3 2 6 9 7 1 3 8 9 8 2 7 8 5 7 6 9 7 4 4 (Right)
Now,
An odd number is counted if it is immediately preceded by an odd number and also immediately followed by an odd number.
So, needed pattern is: Odd - Odd - Odd
(Left) 2 8 3 5 4 6 8 3 2 6 9 7 1 3 8 9 8 2 7 8 5 7 6 9 7 4 4 (Right)
So, total valid odd numbers = 2
Hence, the correct answer is Option 4.

Q67. Answer: (b) QNN : PKJ

The logic followed here is:
For, JHK → IEG
For, JUM → IRI
Now, checking the options:
Option 1) EOP : DLK
Option 2) QNN : PKJ
Option 3) HIJ : GEF
Option 4) ETI : DQD
Hence, the correct answer is Option 2.

Q68. Answer: (b) IMK

The logic followed here is based on the alphabetical position pattern:
Option 1: EHA
Option 2: IMK

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Option 3: GJC

Option 4: SVO

Thus, Options 1, 3, and 4 follow a consistent “+3 then -7” pattern, while Option 2 follows a different pattern.

Hence, the odd one out is Option 2.

Q69. Answer: (d) North-west

The logic followed here is:

Given:

Pooja starts from Point A and drives 20 km North

She turns left → 15 km West

She turns left → 5 km South

Therefore, Point B lies in the North-West direction from Point A.

Hence, the correct answer is Option 4.

Q70. Answer: (c) 110

BODMAS Table:

Given equation: 15 − 8 ÷ 4 + 40 × 10 + 10 = ?

Now, interchanging Signs ‘+’ and ‘−’, and Signs ‘×’ and ‘÷’, then:

=> 15 × 8 + 4 − 40 ÷ 10 − 10

=> 15 × 8 + 4 − 4 − 10

=> 120 + 4 − 4 − 10

=> 124 − 4 − 10

=> 120 − 10

=> 110

Hence, the correct answer is Option 3.

Q71. Answer: (c) Neither conclusion (I) nor (II) follows.

Given Statements:

Some burgers are fries.

Some fries are tacos.

The least possible Venn diagram for the given statement is:

Conclusions:

I. Some burgers are tacos - False (No definite relationship is established between burgers and tacos. The overlap may or may not exist).

II. All tacos are fries - False (The statement only says some fries are tacos, not all tacos are fries).

So, neither conclusion I nor conclusion II follows.

Hence, the correct answer is Option 3.

Q72. Answer: (b) 16th

Given:

The position of a person from the left end is calculated by finding their position from the right end and then using the ranking formula:

Position from Left = (Total number of people + 1) - Position from Right end.

Mayank’s position from the right end = Gayatri’s position + Offset = 10 + 12 = 22nd.

Total number of people in the row = 37.

Position from Left = (Total + 1) - Position from Right = (37 + 1) - 22 = 38 - 22 = 16.

The pattern observed is: (Total + 1) - Position from right end = Position from left end.

So, Mayank’s position from the left end of the line is 16th.

Hence, the correct answer is Option 2.

Q73. Answer: (d) 27

BODMAS Table:

Given equation: (90 A 9) B 4 C (28 A 7) B 8 D 9 B 6 C 18 A 2 = ?

Now, replacing the letters according to the given mapping: A = ÷, B = ×, C = +, D = −

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=> (90 ÷ 9) × 4 + (28 ÷ 7) × 8 − 9 × 6 + 18 ÷ 2
=> 10 × 4 + 4 × 8 − 9 × 6 + 9
=> 40 + 32 − 54 + 9
=> 72 − 54 + 9
=> 18 + 9
=> 27
Hence, the correct answer is Option 4.

Q74. Answer: (d) YUM

The logic followed here is based on the alphabetical position pattern:
Option 1: LHA
Option 2: AWP
Option 3: GCV
Option 4: YUM
Thus, Options 1, 2, and 3 follow a consistent “-4 then -7” pattern, while Option 4 deviates from this rule.
Hence, the odd one out is Option 4.

Q75. Answer: (a) Mother’s father

Family Chart:
Decoding the Symbols:

Symbol	•	–	•	÷
Meaning	Father	Mother	Sister	Brother

Given: Q + R * S − T ÷ P
It means: Q is the father of R, R is the sister of S, S is the mother of T, and T is the brother of P.
Therefore, Q is the mother’s father of P.
Hence, the correct answer is Option 1.

Q76. Answer: (a) 10 - 5 - 50

The logic followed here is:
Logic: The third number in each set is the product of the first and the second numbers.
9 - 3 - 27
=> 9 × 3 = 27
5 - 4 - 20
=> 5 × 4 = 20
Now, checking the options:
Option 1) 10 - 5 - 50
=> 10 × 5 = 50
Option 2) 8 - 5 - 30
=> 8 × 5 = 40 (not 30)
Option 3) 3 - 12 - 46
=> 3 × 12 = 36 (not 46)
Option 4) 4 - 6 - 10
=> 4 × 6 = 24 (not 10)
Hence, the correct answer is Option 1.

Q77. Answer: (b) WSAE

The logic followed here is:
For, GCKO → VRZD
For, OKSW → DZHL
Now, applying the same logic for HDLP
So, HDLP → WSAE
Hence, the correct answer is "Option 2".

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Q78. Answer: (d) CFE-ILK

The logic followed here is:

For, ILK → ORQ

For, QTS → WZY

Now, checking the options:

Option 1) CEC-HKJ

Option 2) CEC-ILK

Option 3) CFE-HLJ

Option 4) CFE-ILK

Hence, the correct answer is Option 4.

Q79. Answer: (c) 32

The logic followed here is:

thus, "32" will replace the question mark in the given series.

Hence, the correct option is "Option 3".

Q80. Answer: (a) 5

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

Only two people sit between G and B.

Only D sits to the right of E.

Only one person sits between B and E.

F sits at some place to the right of C but at some place to the left of A.

So, five people sit to the right of C.

Hence, the correct answer is "Option 1".

Q81. Answer: (b) Switzerland

The correct answer is Switzerland.

Key Points

• Switzerland has secured the 1st rank in the Global Innovation Index (GII) 2025, continuing its long-standing dominance as the world's most innovative economy.

• The index is published annually by the World Intellectual Property Organization (WIPO), a specialized agency of the United Nations.

• This ranking marks the 15th consecutive year that Switzerland has been named the global leader in innovation, showcasing its robust Research and Development (R&D) ecosystem and high-quality academic institutions.

• Following Switzerland, other top-performing nations in the 2025 index include Sweden, the United States of America, and Singapore, which consistently lead in technological advancements and patent filings.

• The GII 2025 report highlights the state of global innovation trends, focusing on how geopolitical tensions and economic shifts influence the ability of nations to foster new ideas and industries.

Additional Information

• Structure of the Global Innovation Index (GII):

• The GII relies on two sub-indices: the Innovation Input Sub-Index and the Innovation Output Sub-Index.

• The Input Sub-Index is built on five pillars: Institutions, Human capital and research, Infrastructure, Market sophistication, and Business sophistication.

• The Output Sub-Index is based on two pillars: Knowledge and technology outputs and Creative outputs.

• The overall score is the average of these two sub-indices, providing a balanced view of a country's innovation enablers and results.

• World Intellectual Property Organization (WIPO):

• Established in 1967 and headquartered in Geneva, Switzerland, WIPO is the global forum for intellectual property (IP) services, policy, and cooperation.

• It currently has 193 member states and manages over 26 international treaties related to patents, trademarks, and industrial designs.

• India's Performance:

• India has shown significant growth in the GII over the last decade, consistently ranking as the top innovative economy in the Central and Southern Asia region.

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• In recent editions like 2024, India was ranked 39th globally, driven by its leadership in Information and Communication Technology (ICT) services exports and venture capital receipt.

Important Points

• Top 5 Global Innovators (2025): The top five positions are generally occupied by Switzerland, Sweden, the United States, Singapore, and the United Kingdom.

• Science and Technology (S&T) Clusters: The GII also ranks the world's top 100 Science and Technology clusters, with the Tokyo-Yokohama cluster in Japan and the Shenzhen-Hong Kong-Guangzhou cluster in China often leading the list.

• Impact of AI: The 2025 report emphasizes the role of Artificial Intelligence (AI) and Green Technologies as the primary drivers of innovation growth for the current decade.

• Global Innovation Tracker: This component of the GII monitors key metrics like scientific publications, venture capital deals, and international patent applications (via the Patent Cooperation Treaty - PCT).

Q82. Answer: (c) Gold

The correct answer is Gold.

Key Points

• India secured the Gold medal in the women’s 10m air pistol event at the ISSF Junior World Cup 2025, continuing its legacy of dominance in international shooting competitions.

• The victory highlights the exceptional talent pool within the Indian shooting contingent, particularly in the pistol discipline, which has consistently yielded high scores on the global stage.

• The ISSF Junior World Cup is a premier tournament organized by the International Shooting Sport Federation, designed specifically for athletes in the junior category (typically under the age of 21).

• The women’s 10m air pistol event requires athletes to fire at a target placed 10 meters away using a 4.5 mm (0.177 in) caliber air pistol, emphasizing extreme concentration and precision.

• Winning the Gold medal at this level is a significant milestone for young Indian shooters, as it serves as a stepping stone toward major senior events like the World Championships and the Olympic Games.

Additional Information

• International Shooting Sport Federation (ISSF):

• The ISSF is the governing body for Olympic shooting events and several non-Olympic shooting sport disciplines, headquartered in Munich, Germany.

• It was founded in 1907 and currently oversees the rules and regulations for Rifle, Pistol, and Shotgun events globally.

• 10m Air Pistol Event Characteristics:

• In this event, shooters fire from a standing position and use only one hand to hold the pistol.

• The target's 10-ring (the center) has a diameter of only 11.5 millimeters, making it one of the most challenging precision sports in the world.

• In the final round, the scores of the qualification round are usually reset, and the top eight shooters compete in an elimination-style format to determine the medal winners.

• India's Performance in Shooting:

• India has emerged as a global powerhouse in junior shooting, frequently topping the medal tallies at Junior World Cups and World Championships in recent years.

• The National Rifle Association of India (NRAI), founded in 1951, is the organization responsible for promoting and governing the sport within the country.

• Prominent Indian shooters like Manu Bhaker and Saurabh Chaudhary also rose to fame through the ISSF Junior circuit before achieving success at the Senior level.

• Significance of 2025 Competitions:

• The 2025 shooting calendar is crucial for developing the next generation of shooters for the 2028 Los Angeles Olympics.

• The ISSF Junior World Cup provides a competitive environment that mimics the pressure of senior-level international finals, helping athletes build mental resilience and technical consistency.

Important Points

• Medal Categorization: In ISSF events, the Gold medal is awarded for first place, Silver for second, and Bronze for third. India’s Gold medal in 2025 signifies outperforming top competitors from countries like China, Germany, and the USA.

• Technological Advancement: Modern shooting events utilize electronic scoring targets (EST), which provide instant feedback and high numerical accuracy up to decimal points in the final rounds.

• Age Eligibility: Athletes are eligible to compete in the junior category until the 31st of December of the year in which they turn 21 years old.

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Q83. Answer: (d) Margaret McDonald

The correct answer is Margaret McDonald.

Key Points

• Margaret McDonald has made literary history by being named the youngest-ever winner of the Carnegie Medal for Writing in 2025.

• She received this prestigious honor for her debut novel titled ‘Glasgow Boys’, which has been widely acclaimed for its emotional depth and authentic portrayal of youth.

• At just 25 years of age, McDonald surpassed previous records to become the youngest recipient since the award's inception in 1936.

• The novel ‘Glasgow Boys’ follows the lives of two young men, Finlay and Banjo, navigating the complexities of the foster care system, masculinity, and working-class life in Scotland.

• The Yoto Carnegie Medal is judged by children’s librarians, making it one of the most respected awards in the United Kingdom for children’s and young adult literature.

Additional Information

• The Carnegie Medal:

• Established in 1936, it was created in memory of the Scottish-born philanthropist Andrew Carnegie.

• It is awarded annually by CILIP (the Chartered Institute of Library and Information Professionals).

• The award recognizes an outstanding new book written in English for children or young adults.

• ‘Glasgow Boys’ by Margaret McDonald:

• The book is noted for its dual-perspective narrative, focusing on the foster care experiences of its protagonists.

• It deals with heavy themes such as trauma, social class, and the redemptive power of friendship and education.

• The setting of Glasgow serves as a vivid backdrop, highlighting the socio-economic realities of the city.

• Yoto Carnegie Medal for Illustration:

• Formerly known as the Kate Greenaway Medal, this sister award recognizes excellence in illustration for children's books.

• Both medals are presented during the same ceremony and are considered the "gold standard" of children's book prizes in the UK.

Important Points

• Significance of the 2025 Win: Margaret McDonald's victory is significant because the Carnegie Medal rarely goes to debut authors, let alone those in their mid-twenties.

• Selection Process: Books are nominated by CILIP members and then shortlisted by a panel of expert librarians who evaluate the quality of the writing and the reading experience for the target age group.

• Impact: Winning this medal often leads to a massive surge in book sales and international translation rights, cementing the author's place in the literary canon.

• Shadowing Scheme: The Carnegie Medals also feature a unique Shadowing Scheme where thousands of school children across the UK read the shortlisted books and vote for their own favorite, known as the Shadowers’ Choice Award.

Q84. Answer: (a) 353

The correct answer is 353.

Key Points

• The Reserve Bank of India (RBI), as the primary regulatory authority for the financial sector, undertook a total of 353 enforcement actions during the month of June 2025 to ensure strict adherence to banking norms.

• These 353 actions were distributed across various categories of financial entities, including Public Sector Banks (PSBs), Private Sector Banks, Foreign Banks, and Cooperative Banks.

• The enforcement measures were primarily triggered by non-compliance with regulatory guidelines, specifically concerning Know Your Customer (KYC) requirements, Anti-Money Laundering (AML) standards, and the Fair Practices Code.

• The Enforcement Department of the RBI, which was centralized in 2017 to handle the imposition of penalties, oversaw the identification of these lapses and the subsequent execution of the 353 actions. Hence, the statement regarding the count of 353 actions is correct.

• The nature of these actions varied from monetary penalties to administrative censures and operational restrictions, aimed at safeguarding the integrity of the Indian financial ecosystem.

Additional Information

• Reserve Bank of India (RBI):

• The RBI was established on April 1, 1935, in accordance with the provisions of the Reserve Bank of India Act, 1934. It serves as India's Central Bank and is responsible for Monetary Policy and the supervision of banking and non-banking financial companies.

• The Governor of the RBI leads the institution, which is headquartered in Mumbai, Maharashtra.

• Legal Framework for Enforcement:

• The RBI derives its power to take enforcement actions and impose penalties from the Banking Regulation Act, 1949, particularly under Section 47A, and the Payment and Settlement Systems Act, 2007.

• For Non-Banking Financial Companies (NBFCs), the RBI exercises authority under the RBI Act, 1934.

• Types of Financial Entities Regulated:

• Public Sector Banks: These are banks where the Government of India holds a majority stake (more than 50%). There are currently 12 such banks in India.

• Cooperative Banks: These institutions are governed by both the Banking Regulations Act and Cooperative Societies Acts of the respective states. They play a vital role in financial inclusion in rural and semi-urban areas.

• NBFCs: These are entities registered under the Companies Act that provide banking services without meeting the legal definition of a bank.

• Purpose of Enforcement Actions:

• The primary objective is to maintain Financial Stability and protect the interests of depositors. By penalizing 353 entities in a single month, the RBI signals its zero-tolerance policy toward systemic risks and fraudulent activities.

• These actions also ensure that the credit discipline is maintained and that institutions do not engage in evergreening of loans or misreporting of Non-Performing Assets (NPAs).

Important Points

• Enforcement Process: The process begins with an Annual Financial Inspection (AFI). If deficiencies are found, a Show Cause Notice (SCN) is issued. The final decision on the penalty, such as the 353 instances in June 2025, is taken after considering the institution's response.

• Digital Lending Guidelines: In recent years, a significant number of enforcement actions have been directed toward Digital Lending Apps (DLAs) and their Lending Service Providers (LSPs) for violating consumer privacy and unethical recovery practices.

• Monetary Penalties: The quantum of penalty is determined based on the size of the entity and the severity of the violation, ensuring the punishment is proportionate to the lapse.

Q85. Answer: (a) Indian Space Research Organisation (ISRO)

The correct answer is Indian Space Research Organisation (ISRO).

Key Points

• The Indian Space Research Organisation (ISRO) has successfully developed and operationalized a 10-ton vertical planetary mixer, which is currently the world’s largest facility for mixing solid propellants.

• The facility was commissioned at the Satish Dhawan Space Centre (SDSC) SHAR, located in Sriharikota, Andhra Pradesh, specifically to enhance the production capacity of heavy-lift launch vehicles.

• This massive mixer is designed to process the solid propellant required for the S200 boosters, which power the Launch Vehicle Mark 3 (LVM3), India's heaviest rocket used for missions like Chandrayaan and Gaganyaan.

• The development of this 10-ton capacity mixer represents a major technological leap from the previously used 4.5-ton and 5-ton mixers, significantly reducing the time required for propellant casting.

• The project is a significant milestone under the Atmanirbhar Bharat and Make in India initiatives, as the design and realization were achieved through indigenous efforts and collaboration with Indian industries.

Additional Information

• Vertical Planetary Mixer (VPM) Technology:

• A vertical planetary mixer uses a unique mechanism where the mixing blades rotate on their own axes while simultaneously orbiting around the center of the mixing bowl.

• This "planetary" motion ensures thorough and uniform mixing of highly viscous materials, which is critical for the stability and performance of rocket propellants.

• The 10-ton capacity refers to the amount of propellant slurry that can be processed in a single batch, ensuring consistency across large motor segments.

• Solid Propellant Composition:

• The solid propellant used by ISRO typically consists of Ammonium Perchlorate (oxidizer), Aluminium powder (fuel), and Hydroxyl-terminated polybutadiene (HTPB) (binder).

• The precision of the 10-ton mixer ensures that these components are blended without air bubbles or inconsistencies, which could lead to catastrophic failure during flight.

• Satish Dhawan Space Centre (SDSC) SHAR:

• Established in 1971, it is India’s primary spaceport located in Nellore district, Andhra Pradesh.

• It houses the Solid Propellant Plant (SPP) and the Second Solid Propellant Plant (SSPP), where the new 10-ton mixer is integrated into the production line.

Important Points

• Safety and Automation: The 10-ton mixer facility is equipped with advanced remote-control systems and automated safety protocols to handle hazardous chemical processes, minimizing human intervention in the mixing zone.

• Impact on Future Missions: By doubling the mixing capacity per batch, ISRO can now accelerate the launch frequency of the LVM3 rocket, supporting commercial satellite launches and the upcoming Gaganyaan (human spaceflight) missions scheduled for 2025 and beyond.

• Global Standing: Prior to this achievement, such high-capacity mixers were limited to a few spacefaring nations. With this 2025 operational report, India solidifies its position as a leader in solid propulsion technology.

• Strategic Autonomy: Developing this hardware indigenously eliminates dependence on foreign suppliers for critical aerospace manufacturing infrastructure, ensuring long-term sustainability for the Indian Space Program.

Q86. Answer: (b) Rithvik Bollipalli and Nicolás Barrientos

The correct answer is Rithvik Bollipalli and Nicolás Barrientos.

Key Points

• The Indian tennis player Rithvik Bollipalli and his Colombian partner Nicolás Barrientos won the men’s doubles title at the 2025 Chile Open.

• The Chile Open, also known as the Movistar Chile Open, is a prestigious professional men's tennis tournament played on outdoor clay courts.

• The 2025 edition of the tournament was held in Santiago, the capital city of Chile, and is categorized as an ATP 250 event on the ATP Tour.

• This victory marks a significant achievement for Rithvik Bollipalli, who has been steadily climbing the ATP Doubles Rankings and establishing himself as a prominent figure in Indian tennis.

• The duo showcased exceptional coordination throughout the tournament to defeat their opponents in the final, contributing to the growing success of Indo-Colombian partnerships in international tennis.

Additional Information

• Rithvik Bollipalli:

• He is an Indian professional tennis player who specializes in the doubles format.

• In recent years, he has won multiple ATP Challenger titles, which provided the momentum to transition into ATP 250 and higher-level tournaments.

• His playing style is often characterized by strong net play and quick reflexes, making him a formidable doubles specialist.

• Nicolás Barrientos:

• He is an experienced tennis player from Colombia who has represented his country in the Davis Cup.

• Barrientos has a career-high doubles ranking that reflects his consistency on the professional circuit, particularly on clay surfaces.

• The Chile Open (Santiago):

• The tournament is part of the "Golden Swing" of the Latin American tennis circuit, which includes events in Argentina, Brazil, and Mexico.

• It is typically held in February or March each year, attracting several top-tier clay-court specialists from around the world.

• Indian Tennis in Doubles:

• India has a rich history in doubles tennis, with icons like Leander Paes, Mahesh Bhupathi, and Rohan Bopanna winning multiple Grand Slams.

• The success of players like Bollipalli, Yuki Bhambri, and N. Sriram Balaji indicates a new generation of Indian athletes maintaining the nation's dominance in the doubles category.

Important Points

• ATP 250 Category: This is the fourth tier of men's tennis tournaments after the Grand Slams, the ATP Finals, and the ATP Masters 1000. Winning this title grants the players 250 ranking points.

• Surface Characteristics: The red clay in Santiago is known for being slower than hard courts, requiring high physical endurance and strategic point construction, which makes the victory of the Bollipalli-Barrientos pair even more commendable.

• Historical Context: The Chile Open has seen legendary winners in the past, and the inclusion of an Indian winner in the doubles category adds to the diverse history of the event.

Q87. Answer: (b) Intermediate Range Agni-Prime Missile

The correct answer is Intermediate Range Agni-Prime Missile.

Key Points

• The Defence Research and Development Organisation (DRDO) successfully flight-tested the Intermediate Range Agni-Prime Missile (also known as Agni-P) on 24 September 2025.

• The test was conducted from a rail-mounted mobile launcher, demonstrating the capability for rapid deployment and high

mobility across the Indian railway network.

• This successful mission was carried out in close coordination with the Strategic Forces Command (SFC), which is responsible for the management and administration of the country's tactical and strategic nuclear weapons stockpile.

• The Agni-Prime is a two-stage canisterised solid-propellant ballistic missile. Being canisterised allows for the missile to be stored for long periods and launched with very short preparation time.

• The missile has a strike range capability between 1,000 and 2,000 kilometres, making it a critical asset for regional deterrence.

• The test validated the reliability and efficiency of the advanced propulsion systems, navigation, and control mechanisms integrated into the Agni-P platform.

Additional Information

• Agni Series Evolution:

• The Agni-P is a next-generation follow-on to the Agni-I and Agni-II missiles, incorporating technologies used in the longer-range Agni-IV and Agni-V.

• Agni-I: Range of 700-800 km.

• Agni-V: India's first Intercontinental Ballistic Missile (ICBM) with a range exceeding 5,000 km.

• Defence Research and Development Organisation (DRDO):

• It was established in 1958 by merging the Technical Development Establishment of the Indian Army and the Directorate of Technical Development and Production.

• It works under the administrative control of the Ministry of Defence, Government of India, with headquarters in New Delhi.

• Its primary objective is to achieve self-reliance in critical defence technologies and systems.

• Strategic Forces Command (SFC):

• Created in January 2003, the SFC is a part of India's Nuclear Command Authority (NCA).

• It is responsible for operationalising the directives of the NCA under the leadership of a Commander-in-Chief of the rank of Air Marshal or equivalent.

Important Points

• Advanced Navigation: The Agni-Prime missile features a Ring Laser Gyro-based Inertial Navigation System (RINS) and a redundant Micro Navigation System (MINS) to ensure high-degree accuracy during terminal phases.

• Weight and Maneuverability: Compared to earlier versions, the Agni-P is significantly lighter due to the use of composite materials, making it easier to transport via road or rail.

• Strategic Significance: The development of the Intermediate Range Agni-Prime strengthens India's No First Use (NFU) nuclear doctrine by ensuring a credible and survivable second-strike capability.

• BrahMos (Option 1): This is a Supersonic Cruise Missile developed jointly by India (DRDO) and Russia (NPOM), with a range of approximately 290-450 km, fundamentally different from the ballistic Agni series.

• Akash (Option 3): This is a short-range Surface-to-Air Missile (SAM) system designed to protect vulnerable areas from air attacks.

• Prithvi-II (Option 4): A short-range surface-to-surface ballistic missile with a range of approximately 250-350 km, first tested in 1996.

Q88. Answer: (b) Bharat Mandapam, New Delhi

The correct answer is Bharat Mandapam, New Delhi.

Key Points

• The 11th National Handloom Day was celebrated with great fervor on 7 August 2025. The primary event took place at the Bharat Mandapam, located at Pragati Maidan, New Delhi.

• During this significant occasion, the President of India, Smt. Droupadi Murmu, graced the event and presented the prestigious Sant Kabir Handloom Awards and National Handloom Awards to exceptional weavers for their contribution to the craft.

• The celebration of this day serves to honor the weaving community and acknowledge their contribution to the socio-economic development of the country, particularly in rural areas.

• The date August 7 carries deep historical significance as it commemorates the Swadeshi Movement, which was officially launched on this day in 1905 at the Calcutta Town Hall.

• The primary objective of the event at Bharat Mandapam was to promote indigenous textiles and encourage the public to adopt sustainable handloom products. Hence, the correct answer is Bharat Mandapam, New Delhi.

Additional Information

• History of National Handloom Day:

• The Government of India declared August 7 as National Handloom Day in 2015. The first-ever celebration was inaugurated by Prime Minister Narendra Modi in Chennai, Tamil Nadu.

• The goal was to bring the handloom sector into the mainstream and provide weavers with the recognition and financial stability

they deserve.

• Economic Significance:

• The handloom sector is the second-largest employer in India after agriculture, providing livelihoods to over 35 lakh people directly and indirectly.

• India accounts for approximately 95% of the world's hand-woven fabrics, making it a global leader in this traditional craft.

• Government Initiatives:

• The Ministry of Textiles has introduced various schemes such as the National Handloom Development Programme (NHDP) and the Raw Material Supply Scheme to support artisans.

• The India Handloom Brand was launched to ensure the quality, authenticity, and zero-defect nature of handloom products for international and domestic markets.

Important Points

• Sant Kabir Handloom Awards: These awards are conferred upon outstanding handloom weavers who have made valuable contributions in keeping the traditional handloom heritage alive through innovation and skill.

• Swadeshi Movement Connection: The 1905 movement focused on boycotting foreign-made goods and reviving domestic products and production processes, which is the core essence of modern-day Atmanirbhar Bharat.

• Women Empowerment: More than 70% of the weavers and allied workers in India are women, making the handloom sector a vital tool for gender-based economic empowerment and financial independence.

• Bharat Mandapam: This International Exhibition-cum-Convention Centre (IECC) is one of the largest convention complexes in India, famously known for hosting the G20 Summit in 2023.

Q89. Answer: (d) Chandrayaan-3

The correct answer is Chandrayaan-3.

Key Points

• Chandrayaan-3 is the third lunar exploration mission by the Indian Space Research Organisation (ISRO), which successfully landed near the Moon's south pole on August 23, 2023.

• The mission's Vikram lander was equipped with the Instrument for Lunar Seismic Activity (ILSA), which became the first instrument to detect over 250 seismic signals from the polar region.

• The ILSA payload is designed to characterize the seismicity of the lunar surface by measuring ground vibrations caused by moonquakes, meteorite impacts, and artificial activities like the movement of the Pragyan rover.

• This marks a significant scientific leap because seismic data from the Moon had not been collected since the Apollo missions of the 1970s, which were primarily located around the lunar equator.

• By detecting these signals at the south pole, Chandrayaan-3 has provided researchers with a new dataset to understand the lunar crust and mantle structure in a previously unexplored geographical context.

Additional Information

• ILSA Technology: The instrument is built using Micro-Electro-Mechanical Systems (MEMS) technology. This allowed the seismometer to be compact and highly sensitive, capable of detecting vibrations as small as a few nanometers.

• The Pragyan Rover: During its mission life of 14 Earth days (one lunar day), the Pragyan rover traveled over 100 meters. Interestingly, the ILSA was sensitive enough to record the vibrations generated by the rover's wheels as it navigated the lunar terrain.

• Mission Components: Chandrayaan-3 consisted of a Lander Module (Vikram), a Rover (Pragyan), and a Propulsion Module. The Propulsion Module carried the SHAPE (Spectro-polarimetry of Habitable Planet Earth) payload to study Earth from lunar orbit.

• Other Missions:

• Chang'e 5: A Chinese mission launched in 2020 that successfully returned lunar soil samples to Earth but did not focus on long-term seismic monitoring at the south pole.

• Luna 1: The first spacecraft to reach the vicinity of the Moon, launched by the Soviet Union in 1959.

• Artemis I: An uncrewed NASA mission launched in 2022 as a flight test for the Orion spacecraft and the Space Launch System (SLS), orbiting the Moon without landing.

Important Points

• Shiv Shakti Point: The landing site of Chandrayaan-3 was officially named Shiv Shakti Point by the Government of India to commemorate the success of the mission.

• LVM3-M4: The heavy-lift launch vehicle, also known as the Launch Vehicle Mark-III, was used to propel the spacecraft into space from the Satish Dhawan Space Centre in Sriharikota.

• Global Achievement: With this mission, India became the fourth country to achieve a soft landing on the Moon and the first to do so in the lunar south pole region.

• Scientific Payloads: Apart from ILSA, the mission included ChaSTE to measure thermal properties and APXS and LIBS on the rover to determine the elemental composition of lunar soil, which confirmed the presence of Sulphur.

Q90. Answer: (a) Jayant Vishnu Narlikar

The correct answer is Jayant Vishnu Narlikar.

Key Points

• Jayant Vishnu Narlikar is a world-renowned Astrophysicist and cosmologist who has been recognized with the Vigyan Ratna, the highest honour in the Rashtriya Vigyan Puraskar series for the year 2025.

• The Vigyan Ratna award is specifically designed to recognize lifetime achievements and contributions that have made a significant impact in any field of Science and Technology.

• Jayant Vishnu Narlikar is famous for his work on the Steady State theory of the universe and the Hoyle-Narlikar theory of gravitation, which he developed alongside Fred Hoyle.

• The Rashtriya Vigyan Puraskar was instituted by the Government of India in 2023 to unify various science awards under one umbrella, ensuring transparency and prestige in recognizing scientific excellence.

• The announcement of these awards typically takes place on May 11 (National Technology Day), and they are presented on August 23, celebrated as National Space Day to mark the success of the Chandrayaan-3 mission.

Additional Information

• Rashtriya Vigyan Puraskar (RVP) Categories:

• Vigyan Ratna: Recognizes lifetime achievement in any domain of science. A maximum of 3 awards are given annually in this category.

• Vigyan Shri: Awarded for distinguished contributions to science and technology. Up to 25 awards are presented.

• Vigyan Yuva–Shanti Swarup Bhatnagar: Aimed at young scientists under the age of 45 years who have made exceptional contributions. Up to 25 awards are available.

• Vigyan Team: Given to a team of 3 or more scientists/researchers for groundbreaking collaborative work. Up to 3 awards are granted.

• Career of Jayant Vishnu Narlikar:

• Born on July 19, 1938, in Kolhapur, Maharashtra, he pursued his higher education at Banaras Hindu University (BHU) and the University of Cambridge.

• He served as the founder-director of the Inter-University Centre for Astronomy and Astrophysics (IUCAA) in Pune, established in 1988.

• He is also a celebrated science communicator, having written numerous books in Marathi, Hindi, and English to popularize complex scientific concepts among the general public.

Important Points

• Other Options Overview:

• Prakash Kumar: Recognized in the Vigyan Shri category for Biological Sciences during the inaugural 2024 awards. Hence, this statement is not the correct category for the question.

• Pavannan: Awarded the Vigyan Shri for his contributions to Science Communication and Popularization in 2024. Hence, this statement is incorrect for the Ratna category.

• Vidya Subramanian: Recipient of the Vigyan Yuva–Shanti Swarup Bhatnagar award in 2024 for her work in Agricultural Science. Hence, this statement is incorrect.

• Narlikar's Past Honours: He was previously awarded the Padma Vibhushan (India's second-highest civilian award) in 2004 and the Padma Bhushan in 1965, making the Vigyan Ratna a further testament to his monumental legacy in Astrophysics.

• Selection Process: The winners are selected by the Rashtriya Vigyan Puraskar Committee (RVPC), which is headed by the Principal Scientific Adviser to the Government of India.

Q91. Answer: (c) To bring back samples of moon rocks to Earth

The correct answer is To bring back samples of moon rocks to Earth.

Key Points

• Chandrayaan-4 is a planned lunar sample return mission by the Indian Space Research Organisation (ISRO), serving as the successor to the highly successful Chandrayaan-3 mission.

• The primary objective of the mission is to land on the Lunar surface, collect samples of lunar soil (regolith) and rocks, and safely transport them back to Earth for detailed scientific study. Hence, option 3 is correct.

• Scheduled for launch around 2027 or 2028, the mission will demonstrate critical technologies such as docking and undocking in lunar orbit, lunar lift-off, and atmospheric re-entry.

• Unlike its predecessors, Chandrayaan-4 will involve a multi-module architecture, requiring at least two separate launches of the LVM3 (Launch Vehicle Mark-3) to carry the heavy payload into space.

• The mission is a crucial stepping stone towards India's long-term goal of sending a manned mission to the Moon by the year 2040.

Additional Information

• Legacy of Chandrayaan Missions:

• Chandrayaan-1 (2008): India's first lunar probe which played a pivotal role in the discovery of water molecules on the Lunar surface.

• Chandrayaan-2 (2019): Comprised an Orbiter, Lander (Vikram), and Rover (Pragyan). While the lander crashed, the Orbiter continues to provide valuable data.

• Chandrayaan-3 (2023): Made India the first country to achieve a soft landing near the Lunar South Pole on August 23, 2023.

• Future Lunar Exploration:

• LUPEX (Chandrayaan-5): The Lunar Polar Exploration Mission is a joint collaboration between ISRO and Japan's JAXA, focused on exploring the permanently shadowed regions of the moon for potential water ice.

• Bharatiya Antariksha Station: As part of the expanded space program, India aims to establish its own space station by 2035.

• Comparison with Other Options:

• Launching the first Indian astronaut is the objective of the Gaganyaan mission, not Chandrayaan-4.

• Establishing a permanent lunar base is a long-term international goal (like the Artemis Accords), but not the primary aim of this specific 2027 mission.

• Studying the Mars atmosphere was the goal of the Mars Orbiter Mission (Mangalyaan) launched in 2013.

Important Points

• Mission Modules: Chandrayaan-4 will consist of five specific modules: the Ascender Module, Descender Module, Propulsion Module, Transfer Module, and Re-entry Module.

• Sample Collection: The mission aims to collect roughly 2-3 kilograms of samples from the Shiv Shakti Point or a similar region in the South Pole.

• Complex Operations: This will be the first time ISRO attempts to launch a vehicle from the surface of another celestial body and perform a space docking maneuver to transfer samples between modules.

• Technical Significance: Successful sample return will place India in an elite group of nations (USA, Russia, and China) that have successfully brought back lunar soil to Earth.

Q92. Answer: (b) 3

The correct answer is 3.

Key Points

• Khel Mahakumbh is a major sports initiative of the Government of Gujarat aimed at encouraging participation in sports at the grassroots level.

• In January 2025, Gujarat Chief Minister Bhupendra Patel inaugurated the 3rd edition of the event in Rajkot, Gujarat. Hence, the correct answer is 3.

• The event provides a platform for athletes from different age groups to participate in a wide range of sporting disciplines and promotes a culture of sports throughout the state.

• The initiative focuses on identifying and encouraging sporting talent at the grassroots level and providing opportunities for participants to compete at various levels.

• Therefore, the event inaugurated in January 2025 was the 3rd edition of Khel Mahakumbh.

Additional Information

• Khel Mahakumbh:

• The term Mahakumbh refers to a large-scale sporting festival designed to bring athletes and sports enthusiasts together.

• The Gujarat initiative promotes mass participation, sports awareness, physical fitness, and talent identification.

• Competitions are organised across different sporting disciplines, providing opportunities to athletes from different parts of the state.

• Gujarat and Sports Promotion:

• The state government has undertaken several initiatives to develop sports infrastructure and grassroots sporting talent.

• Large sporting events such as Khel Mahakumbh encourage young people to participate in organised sports and develop competitive skills.

• Rajkot:

• Rajkot is a major city in the Saurashtra region of Gujarat.

• The city has important sporting infrastructure and has hosted various national and international sporting events.

• Bhupendra Patel:

• Bhupendra Patel is the Chief Minister of Gujarat.

• He has been associated with several state initiatives aimed at strengthening sports, youth development, and public infrastructure.

Important Points

• Event: Khel Mahakumbh

• Edition: 3rd

• Inauguration: January 2025

• Venue: Rajkot, Gujarat

• Inaugurated by: Bhupendra Patel, Chief Minister of Gujarat

Q93. Answer: (b) To enhance global monitoring of climate change and natural disasters

The correct answer is To enhance global monitoring of climate change and natural disasters.

Key Points

• The NASA–ISRO Synthetic Aperture Radar (NISAR) is a joint Earth-observing mission between the National Aeronautics and Space Administration (NASA) and the Indian Space Research Organisation (ISRO).

• The primary objective of this mission is to track subtle changes in the Earth's surface, providing essential data for understanding climate change, deforestation, glacier melt, and natural hazards such as earthquakes, tsunamis, volcanoes, and landslides. Hence, the correct answer is To enhance global monitoring of climate change and natural disasters.

• The satellite is scheduled to be launched from the Satish Dhawan Space Centre in Sriharikota, India, using the GSLV Mark II (or LVM3) launch vehicle in July 2025.

• NISAR will be the first satellite mission to use two different radar frequencies, the L-band and the S-band, to measure changes in our planet's surface less than a centimeter across.

• The mission is designed to observe the entire land and ice masses of the Earth every 12 days, providing a consistent and detailed time-lapse view of planetary changes over its three-year primary mission life.

Additional Information

• Technological Contribution:

• NASA is providing the L-band Synthetic Aperture Radar, a high-rate communication subsystem for science data, GPS receivers, a solid-state recorder, and the payload data subsystem.

• ISRO is providing the S-band radar, the spacecraft bus, the GSLV launch system, and associated launch services.

• Synthetic Aperture Radar (SAR): Unlike optical sensors, SAR can penetrate clouds, smoke, and forest canopies, and can operate during both day and night, making it an invaluable tool for disaster management and environmental monitoring.

• Global Ecosystems: The mission will measure changes in vegetation biomass, which is crucial for understanding the carbon cycle and the impact of human activities on forests and wetlands.

• Cryosphere Monitoring: NISAR will monitor the flow rates of glaciers and ice sheets in Antarctica and Greenland, helping scientists predict future sea-level rise more accurately.

Important Points

• Data Accessibility: One of the most significant aspects of the NISAR mission is that the data collected will be free and open to the public, facilitating global research and scientific collaboration.

• Disaster Response: In the event of large-scale natural disasters, NISAR data will be used to assess the extent of damage and help in relief operations by providing high-resolution maps of the affected regions.

• Solid Earth: The mission will study crustal deformation, providing insights into the processes occurring deep within the Earth that lead to tectonic shifts and volcanic eruptions.

• Indo-US Cooperation: This project represents one of the largest and most complex space collaborations between India and the United States, strengthening bilateral ties in science and technology.

Q94. Answer: (a) 6.5%

The correct answer is 6.5%.

Key Points

• In June 2025, the global credit rating agency S&P Global Ratings (Standard & Poor's) updated its economic outlook for India, specifically revising the Gross Domestic Product (GDP) growth forecast for the fiscal year 2025-26 (FY26).

• The agency settled on a growth projection of 6.5% for FY26, indicating a steady but moderated growth trajectory compared to previous high-growth years.

• The revision by S&P typically takes into account various macroeconomic indicators such as inflation trends, interest rate trajectories set by the Reserve Bank of India (RBI), and the overall global economic environment.

• Growth in FY26 is expected to be supported by a gradual recovery in rural demand and continued government capital expenditure on infrastructure projects, which acts as a catalyst for private investment.

• The forecast of 6.5% reflects the agency's view on the balance between domestic consumption and external challenges, such as volatile commodity prices and shifts in global supply chains.

• S&P Global Ratings often aligns its forecasts with the expected performance of the services sector and the manufacturing sector, which remain the primary drivers of the Indian economy.

Additional Information

• S&P Global Ratings:

• It is one of the "Big Three" credit rating agencies globally, alongside Moody's Investors Service and Fitch Ratings.

• Headquartered in the United States, it provides essential intelligence, including credit ratings, benchmarks, and economic research to investors and market participants worldwide.

• Gross Domestic Product (GDP):

• GDP measures the total market value of all final goods and services produced within a country's geographical boundaries during a specific financial year.

• It is the most common indicator used to track the health and size of a national economy.

• Fiscal Year (FY) in India:

• In India, the Fiscal Year runs from April 1st to March 31st.

• The term FY26 refers to the period starting from April 1, 2025, and ending on March 31, 2026.

• Other Forecasting Entities:

• Besides S&P, other institutions like the International Monetary Fund (IMF), the World Bank, and the Reserve Bank of India (RBI) regularly release GDP growth estimates.

• These projections are crucial for policymakers to formulate the Union Budget and for foreign investors to make decisions regarding Foreign Direct Investment (FDI).

• Factors Influencing GDP Growth:

• Key components influencing these percentages include Private Final Consumption Expenditure (PFCE), Gross Fixed Capital Formation (GFCF), and the Net Export status of the country.

• A growth rate of 6.5% generally positions India as one of the fastest-growing major economies in the world.

Important Points

• Economic revisions are dynamic; for instance, if monetary easing (lowering of repo rates) occurs faster than expected in 2025, the growth might exceed the 6.5% mark.

• Inflation management remains a core focus for the RBI, as maintaining CPI inflation within the target band of 4% (+/- 2%) is essential for sustainable GDP growth.

• The June 2025 report by S&P serves as a mid-year benchmark for tracking the Indian economy's resilience against global headwinds like geopolitical tensions.

Q95. Answer: (b) Feeding Profit: How Food Environments Are Failing Children

The correct answer is Feeding Profit: How Food Environments Are Failing Children.

Key Points

• The 2025 flagship report released by UNICEF is titled Feeding Profit: How Food Environments Are Failing Children, which focuses on the systemic failures of the global food system.

• The report highlights a critical shift where commercial interests and the drive for profit often outweigh the nutritional well-being and health of infants, children, and adolescents.

• It reveals that nearly one in three children globally are not growing well due to malnutrition, which is increasingly driven by the high availability of ultra-processed foods and sugary drinks.

• The UNICEF findings underscore that poor food environments—characterized by aggressive marketing and low affordability of fresh produce—are the primary drivers of the childhood obesity epidemic.

• The report calls for national governments to implement stricter regulations on the food industry to protect children from unhealthy food exposures and ensure access to diverse and nutritious diets.

Additional Information

• UNICEF (United Nations Children's Fund):

• Established in 1946 and headquartered in New York City, UNICEF is a United Nations agency responsible for providing humanitarian and developmental aid to children worldwide.

• Its nutrition programs aim to prevent stunting, wasting, and micronutrient deficiencies in more than 190 countries.

• Malnutrition Trends:

• The Triple Burden of Malnutrition refers to the coexistence of undernutrition (stunting and wasting), micronutrient deficiencies, and overweight/obesity within the same community or household.

• Data from 2023-2024 indicates that approximately 148 million children under 5 years of age suffer from stunting globally.

• Food Environments:

• This term refers to the physical, economic, and policy conditions that shape food accessibility, affordability, and promotional messaging.

• Healthy food environments are essential for achieving Sustainable Development Goal (SDG) 2, which targets Zero Hunger and

improved nutrition by 2030.

• Ultra-Processed Foods (UPFs):

• These are industrial formulations typically high in sodium, free sugars, and saturated fats, but low in protein and fiber.

• The 2025 report identifies UPFs as a major contributor to non-communicable diseases (NCDs) such as Type 2 diabetes and hypertension starting in early childhood.

Important Points

• Regulatory Measures:

• To combat malnutrition, experts suggest front-of-package labeling, taxes on sugar-sweetened beverages, and bans on marketing unhealthy foods to minor children.

• Several Latin American countries, such as Chile and Mexico, have already pioneered black-label warning systems to inform consumers about high levels of sugar and fat.

• Economic Impact:

• The World Bank estimates that malnutrition can cost the global economy billions of dollars in lost productivity and healthcare expenses.

• Investing in child nutrition yields high returns, often estimated at $16 for every $1 spent on interventions.

Q96. Answer: (b) Kheer Ganga River

The correct answer is Kheer Ganga River.

Key Points

• In August 2025, the Kheer Ganga River was severely affected by flash floods following intense torrential rain and suspected cloudbursts in its upper catchment areas.

• The disaster occurred in the Uttarkashi district of Uttarakhand, a region highly susceptible to extreme weather events during the monsoon season.

• The sudden increase in the water level of the Kheer Ganga, which is a tributary of the Bhagirathi River, led to the destruction of local bridges and temporary settlements.

• Rescue operations were promptly initiated by the State Disaster Response Force (SDRF) to assist residents and pilgrims stranded in the affected zones near Ghattu Gad and surrounding valleys.

• The surge in the Kheer Ganga also caused a temporary rise in the silt levels and water volume of the main Bhagirathi River, prompting alerts in downstream towns.

Additional Information

• Geographical Context of Uttarkashi:

• Uttarkashi is a border district in Uttarakhand, housing the origins of two of India's holiest rivers: the Ganga (as Bhagirathi) and the Yamuna.

• The district is part of the Garhwal Himalayas and is characterized by steep slopes and narrow valleys, making it prone to landslides and flash floods.

• Bhagirathi River:

• The Bhagirathi is considered the source stream of the Ganga, originating from the Gaumukh at the foot of the Gangotri Glacier.

• It flows for about 205 kilometers before meeting the Alaknanda River at Devprayag.

• Mandakini River:

• The Mandakini originates from the Chorabari Glacier near Kedarnath in the Rudraprayag district.

• It was the primary river involved in the catastrophic 2013 North India floods, but it is not the river affected in this specific 2025 Uttarkashi event.

• Alaknanda River:

• The Alaknanda rises in the Satopanth Glacier and Bhagirath Kharak Glacier in Chamoli district.

• It is one of the major tributaries of the Ganga and has several confluences known as the Panch Prayag.

Important Points

• Meteorological Factors: The August 2025 floods were triggered by a low-pressure system that caused localized heavy downpours, often exceeding 100 mm of rain within a few hours.

• Ecological Sensitivity: The Himalayan region is an Eco-Sensitive Zone where unplanned construction and climate change have increased the frequency of GLOFs (Glacial Lake Outburst Floods) and flash floods.

• Disaster Management: The National Disaster Management Authority (NDMA) and the India Meteorological Department (IMD) emphasize the use of Early Warning Systems (EWS) to mitigate such risks in the high-altitude districts of Uttarakhand.

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Q97. Answer: (b) Rekha Gupta

The correct answer is Rekha Gupta.

Key Points

• Rekha Gupta was appointed as the Chief Minister of Delhi following the results of the 2025 Delhi Legislative Assembly elections.

• She represents the Bharatiya Janata Party (BJP), which emerged as the majority party by securing a significant number of seats in the 70-member assembly.

• The appointment was formalized after the Lieutenant Governor of Delhi invited the leader of the single largest party to form the government, leading to her swearing-in ceremony in February 2025.

• As the Chief Minister, she heads the Council of Ministers of the National Capital Territory (NCT) of Delhi, overseeing administrative and executive functions within the state's jurisdiction.

• Her victory marked a major political transition in the capital, shifting the governance from the Aam Aadmi Party (AAP) to the BJP after a decade.

Additional Information

• Delhi Legislative Assembly:

• The Legislative Assembly of Delhi consists of 70 members elected directly by the people.

• The term of the assembly is five years, as mandated by the Constitution of India, unless it is dissolved earlier.

• The majority mark required to form a government in the 70-member house is 36 seats.

• Article 239AA:

• This article of the Indian Constitution provides special status to Delhi as the National Capital Territory.

• It stipulates that there shall be a Legislative Assembly and a Council of Ministers headed by the Chief Minister to aid and advise the Lieutenant Governor.

• The Parliament of India retains control over specific subjects like Public Order, Police, and Land in Delhi.

• Role of the Lieutenant Governor (LG):

• The LG is the Constitutional Head of the NCT of Delhi and is appointed by the President of India.

• In the 2025 political context, the LG administered the Oath of Office and Secrecy to the new Chief Minister and the cabinet members at Raj Niwas.

Important Points

• Atishi Marlena: Prior to the 2025 elections, she served as the Chief Minister of Delhi, having taken office in September 2024 following the resignation of Arvind Kejriwal.

• Arvind Kejriwal: He served as the Chief Minister for three consecutive terms (2013, 2015-2020, and 2020-2024) before stepping down in 2024; he led the AAP campaign during the 2025 polls.

• Election Commission of India (ECI): The ECI was responsible for conducting the 2025 Delhi Assembly elections, ensuring a free and fair voting process for millions of registered voters in the capital.

• Governance Structure: Unlike other Union Territories, Delhi has a unique dual-governance model where the elected government and the Central Government (through the LG) share administrative responsibilities.

Q98. Answer: (c) Cash assistance and employment opportunities

The correct answer is Cash assistance and employment opportunities.

Key Points

• The Poverty-Free Village Scheme was launched by the Government of Rajasthan in July 2025 to uplift the socio-economic status of rural inhabitants.

• The scheme specifically focuses on providing Cash assistance to help families meet their immediate financial needs and manage daily subsistence costs.

• Along with financial aid, the initiative emphasizes Employment opportunities by integrating rural workers into local developmental projects and infrastructure maintenance. Hence, the correct answer is Cash assistance and employment opportunities.

• The primary objective of this project is to ensure that no household in the selected Gram Panchayats falls below the Poverty Line by the end of the implementation cycle.

• Implementation is carried out through the Department of Rural Development and Panchayati Raj, ensuring that the benefits reach the grassroots level effectively.

Additional Information

• Target Groups: The scheme is designed for rural families who are identified through the SECC (Socio-Economic and Caste Census) data and those currently lacking stable income sources.

• Mechanism of Cash Assistance: The funds are disbursed through Direct Benefit Transfer (DBT) to the bank accounts of the beneficiaries, ensuring transparency and reducing leakage. The estimated monthly support varies based on family size and economic distress levels.

• Employment Generation:

• The Employment opportunities component includes a 150-day guaranteed work clause, which is an extension beyond the standard provisions of MGNREGA.

• It also includes Skill Development training programs to make the youth in these villages employable in nearby Industrial Clusters.

• Geographical Coverage: While the pilot phase started in specific districts like Jaipur and Jodhpur, the state aims to cover over 10,000 villages across Rajasthan by the year 2027.

• Monitoring and Evaluation: A specialized Digital Dashboard has been created to track the poverty status of every enrolled family in real-time, involving Social Audits conducted by local community groups.

Important Points

• Eligibility Criteria: Families must be residents of Rajasthan for at least 10 years and should not have a member employed in a Government Job or paying Income Tax.

• Sustainable Goals: This scheme aligns with the United Nations Sustainable Development Goal 1 (No Poverty) and Goal 8 (Decent Work and Economic Growth).

• Integration: It works in tandem with other state welfare programs such as the Chiranjeevi Health Insurance Scheme to provide a holistic safety net, although health insurance is not the core component of this specific "Poverty-Free" grant.

Q99. Answer: (b) Chennai

The correct answer is Chennai.

Key Points

• The 23rd edition of the National Para Athletics Championships, 2025, was organized in the city of Chennai, Tamil Nadu.

• The championship was held from January 9 to January 13, 2025, at the iconic Jawaharlal Nehru Stadium.

• The event was organized by the Paralympic Committee of India (PCI) in collaboration with the Sports Development Authority of Tamil Nadu (SDAT) and the Tamil Nadu Para Sports Association.

• The 2025 edition saw the participation of approximately 2,500 athletes representing 28 states and 8 Union Territories across various sporting categories.

• This national meet serves as a crucial selection trial for identifying and grooming athletes for upcoming international competitions, including the World Para Athletics Championships and the Asian Para Games.

Additional Information

• Paralympic Committee of India (PCI):

• The PCI was founded in 1992 and is the national governing body for para-sports in the country.

• It is recognized by the Ministry of Youth Affairs and Sports, Government of India, and is affiliated with the International Paralympic Committee (IPC).

• The current President of the PCI is Devendra Jhajharia, who is a two-time Paralympic gold medalist in javelin throw.

• Classification in Para Athletics:

• Athletes are grouped into classes based on their physical, visual, or intellectual impairments to ensure fair competition.

• Prefix "T" stands for Track and Jumping events, while "F" stands for Field events (like shot put or discus).

• The numeric values indicate the type and severity of the impairment; for example, classes 11-13 are for visually impaired athletes, while classes 51-57 are for athletes competing in wheelchairs.

• Tamil Nadu as a Sports Hub:

• The state of Tamil Nadu has been proactive in promoting sports through the SDAT, having recently hosted the Khelo India Youth Games in 2024.

• The Jawaharlal Nehru Stadium in Chennai, built in 1993, has a seating capacity of 40,000 and is a premier venue for national and international athletic meets.

Important Points

• Significance of the National Championships:

• The National Para Athletics Championship is the highest level of domestic competition for para-athletes in India.

• Performance in this event is the primary criterion for the Target Olympic Podium Scheme (TOPS), which provides financial and technical assistance to top athletes.

• The 23rd edition featured a wide range of events including 100m, 200m, 400m, 1500m sprints, Long Jump, High Jump, Shot Put, Discus Throw, and Club Throw.

• India’s recent success at the Paris 2024 Paralympics, where the country won a record 29 medals, has significantly boosted the profile and funding for these national meets.

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Q100. Answer: (a) 99.62%

The correct answer is 99.62%.

Key Points

• The Sustainable Development Goals — National Indicator Framework (NIF) Progress Report, 2025, was released in June 2025 by the Ministry of Statistics and Programme Implementation (MoSPI).

• According to the report, during the assessment year 2024–2025, the percentage of the rural population using improved sources of drinking water reached 99.62%. Hence, the correct option is 99.62%.

• This indicator is a vital metric under SDG Goal 6, which specifically targets Clean Water and Sanitation for all citizens.

• The data indicates a significant upward trajectory in rural infrastructure development, ensuring that nearly the entire rural landscape has access to safe and improved water sources.

• The report serves as a monitoring tool for the United Nations' 2030 Agenda, tracking India's specific progress through the National Indicator Framework (NIF), which currently consists of over 300 indicators.

Additional Information

• SDG 6 (Clean Water and Sanitation):

• This goal aims to ensure the availability and sustainable management of water and sanitation for all by the year 2030.

• India's commitment to this goal is reflected in large-scale schemes designed to eliminate the disparity between urban and rural access.

• Jal Jeevan Mission (JJM):

• Launched on 15th August 2019, this mission is a primary driver for the high percentage recorded in the 2025 report.

• The mission aims to provide Functional Household Tap Connections (FHTC) to every rural household, often referred to as "Har Ghar Jal," by 2024-25.

• It emphasizes community-based management and greywater treatment to ensure long-term sustainability.

• Improved Sources of Drinking Water:

• This category includes piped water into dwellings, public taps or standpipes, tube wells or boreholes, protected dug wells, and rainwater harvesting systems.

• The use of improved sources is critical in reducing water-borne diseases such as cholera, dysentery, and typhoid in rural India.

Important Points

• Ministry of Statistics and Programme Implementation (MoSPI):

• MoSPI is the nodal agency in India responsible for the development of the National Indicator Framework (NIF).

• It coordinates with various Central Ministries and State Governments to collect authenticated data for the SDG Progress Reports.

• National Indicator Framework (NIF):

• The NIF is the backbone of SDG monitoring in India, localized to suit the Indian context while remaining aligned with Global Indicators.

• The 2025 Progress Report highlights that India has made "substantial progress" in Goal 6, with the rural drinking water target being one of the most successful outcomes.

• Data for this specific indicator is often sourced from the Department of Drinking Water and Sanitation under the Ministry of Jal Shakti.

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