RRB Group D Official Paper (Held On: 27 Dec, 2025 Shift 3) (Previous Year Paper)

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

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GENERAL SCIENCE

Q1. Which of the following statements is NOT correct about an electric circuit?

(a) Current flows in an open circuit
(b) Current is a result of flow of electrons
(c) The direction of conventional current is opposite to the flow of electrons
(d) A switch helps to open or close the circuit

Q2. Which part of the eye controls the size of the pupil by adjusting to light?

(a) Crystalline lens
(b) Iris
(c) Cornea
(d) Retina

Q3. The reaction NaOH + HCl → NaCl + H2O is an example of:

(a) Decomposition reaction
(b) Precipitation reaction
(c) Displacement reaction
(d) Double displacement reaction

Q4. Diffusion of particles is faster in:

(a) gases at high temperatures
(b) cold liquids with large molecules
(c) water with low kinetic energy
(d) solids with strong attractions

Q5. Which of the following statements properly differentiates between a mixture and a compound?

(a) The mixture can be separated by chemical methods, while compounds can be separated by physical method.
(b) A mixture has a fixed composition, while the composition of compounds is variable.
(c) A mixture has a variable composition, while the composition of compounds is fixed.
(d) A mixture shows different properties, while a compound has entirely same properties from its constituent elements

Q6. In a sound wave, the particles of the medium _____.

(a) vibrate perpendicular to the direction of wave propagation
(b) vibrate along the direction of wave propagation
(c) do not vibrate
(d) rotate continuously

Q7. In the reaction MnO2 + 4HCl → MnCl2 + 2H2O + Cl2, which substance is oxidised and which substance is reduced?

(a) MnCl2 is oxidised, Cl2 is reduced
(b) MnO2 is reduced, MnCl2 is oxidised
(c) MnO2 is reduced, HCl is oxidised

(d) MnO_2 is oxidised, HCl is reduced

Q8. Which of the following changes involves both heat absorption and a change in state from solid to liquid?

(a) Freezing of water
(b) Sublimation of camphor
(c) Condensation of steam
(d) Melting of ice

Q9. Burrs with hooks or spines are commonly dispersed by which of the following?

(a) Water
(b) Air
(c) Gravity
(d) Animals

Q10. Which of the following best describes mechanical energy?

(a) The sum of light energy and chemical energy
(b) Energy stored in food and fuel
(c) The sum of potential energy and kinetic energy
(d) Energy from the Sun

Q11. If an object is kept at the focus F of a convex lens, where will the image be formed?

(a) At infinity, virtual and magnified
(b) At 2F, real and same size as object
(c) Between F and 2F, real and magnified
(d) At infinity, highly magnified, real

Q12. In cattle farming, milk-producing buffaloes are called _____.

(a) shellfish
(b) layers
(c) milch
(d) broilers

Q13. Movement of gases such as CO_2 or O_2 across the cell membrane occurs by _____, from ____ concentration to _____ concentration.

(a) diffusion; high; low
(b) active transport; low; high
(c) osmosis; low; high
(d) endocytosis; equal; equal

Q14. A long straight conductor carries current vertically upwards. What will be the direction of magnetic field at a point lying to the east of the wire?

(a) Towards south
(b) Towards east
(c) Towards west
(d) Towards north

Q15. An athlete moves on a circular path with uniform speed, completing one revolution in a fixed time. Which of the following statements is correct?

(a) The motion is a non-uniform circular motion.
(b) The athlete's speed decreases continuously as they move along the path.
(c) The athlete's velocity remains constant in both magnitude and direction.
(d) The athlete moves with constant speed, which equals the distance travelled in one revolution divided by the time for that revolution.

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Q16. Two objects of different masses are dropped from the same height in vacuum. Which one will reach first?

(a) The lighter one reaches first.
(b) Both reach the ground at the same time.
(c) The heavier one reaches first.
(d) Both reach at different times, depending on shape and size.

Q17. What happens after fertilisation in the human female reproductive system?

(a) The fertilised egg stays in the fallopian tube and develops there.
(b) The fertilised egg divides to form an embryo, which implants in the uterine lining.
(c) The zygote immediately becomes a foetus in the vagina.
(d) The embryo develops in the ovary and is nourished by the cervix.

Q18. Why is the plasma membrane called a selectively permeable membrane?

(a) It controls energy production for the entire cell.
(b) It allows only certain substances to pass through while restricting others.
(c) It allows free and equal movement of all substances.
(d) It prevents all materials from entering or leaving the cell.

Q19. The type of pollination where pollen grains are transferred from one flower to another of the same species through wind is called _____.

(a) entomophily
(b) hydrophily
(c) anemophily
(d) ornithophily

Q20. The process of converting farm waste material into decomposed matter rich in organic matter and nutrients is called:

(a) Pollination
(b) Composting
(c) Fertilization
(d) Green Manuring

Q21. What is the chemical name of baking soda?

(a) Sodium hydroxide
(b) Sodium sulphate
(c) Sodium carbonate
(d) Sodium hydrogen carbonate

Q22. Which of the following statements about neurons is INCORRECT?

(a) Axon sends signals out.
(b) A neuron is made of three parts: dendrites, cell body and axon.
(c) Dendrites receive signals.
(d) Neurons lack a nucleus.

Q23. Which of the following hydrocarbons contains a branched chain?

(a) Butane
(b) Ethene
(c) Isobutane
(d) Methane

Q24. The number of protons in an element with atomic number 10 is:

(a) 6
(b) 5
(c) 10
(d) 8

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Q25. A force of 10 N causes mass m1 to accelerate at 20 m/s² and mass m2 to accelerate at 40 m/s². What acceleration will the same force produce if both masses are tied together?

(a) 13.3 m/s²
(b) 6 m/s²
(c) 10 m/s²
(d) 26.7 m/s²

MATHEMATICS

Q26. If the marked price of a mat is 76% more than its cost price and a discount of 25% is announced on it, then find the profit percentage.

(a) 29%
(b) 34%
(c) 35%
(d) 32%

Q27. 4a2b is a four digit number divisible by 3. Select the correct possible values of a and b from the following.

(a) a=0,b=0
(b) a=3,b=1
(c) a=2,b=0
(d) a=0,b=1

Q28. Due to water crisis, 38% of the initial population left the village, and 50% of the remaining left the village for pursuing jobs. If presently 1550 people inhabit the village, what is the ratio of the initial population to the present population?

(a) 108:33
(b) 100:33
(c) 100:31
(d) 103:33

Q29. A cube and a cuboid have equal volumes. If the cube's side is 10 cm and the cuboid's dimensions are in the ratio 1 : 2 : 4, then find the cuboid's longest side.

(a) 18 cm
(b) 14 cm
(c) 20 cm
(d) 16 cm

Q30. Two trains are running in opposite directions at the same speed. If the length of each train is 350 m and they cross each other in 14 seconds, then what is the speed of each train?

(a) 28 m/s
(b) 35 m/s
(c) 25 m/s
(d) 26 m/s

Q31. The amount Rs. 1,404 is divided among Neeraj, Vidya, and Mohan in such a way that if Rs. 47, Rs. 26, and Rs. 29 be deducted from their respective shares, they have money in the ratio 10 : 14 : 18. Find the actual share of Vidya.

(a) Rs. 284
(b) Rs. 460
(c) Rs. 384
(d) Rs. 534

Q32. In an election with two candidates, 25% of the total votes were invalid. One candidate received 40% of the valid votes. If the total number of votes was 3,75,000, how many valid votes did the other candidate receive?

(a) 1,68,750
(b) 1,86,250
(c) 1,56,350

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(d) 1,75,450

Q33. If cos A = 4/5, find the value of 4 + 4tan² A.

(a) 16/25
(b) 25/16
(c) 25/4
(d) 4/25

Q34. The difference between the present ages of Sneha and her younger cousin Aryan is 12 years. Six years ago, Sneha was three times as old as Aryan was at that time. What is Sneha's present age (in years)?

(a) 24
(b) 26
(c) 30
(d) 22

Q35. If 2^(x-1) + 2^(x+1) = 160, then the value of 2x + 1 is:

(a) 9
(b) 11
(c) 15
(d) 13

Q36. For a journey of 600 km, a truck covers the first 300 km at a speed of 42 km/hr. What speed (in km/hr) must it maintain for the remaining distance to achieve an average speed of 60 km/hr?

(a) 120
(b) 85
(c) 105
(d) 80

Q37. For 14 innings, a cricketer has an average of 51 runs. In the 15^(th) inning, he scores 209 runs. His average score increased by _____. (Round off your answer to the nearest whole number.)

(a) 20
(b) 11
(c) 10
(d) 15

Q38. Simplify: $x^2 + 2x + x^2$

(a) $x^2 + 2x$
(b) $2x^2 - 2x$
(c) $2x^2 + 2x$
(d) $2x^2 + x$

Q39. A student thinks of a two-digit number. The digits add up to 15, and the greater digit is 3 more than the smaller one. What is the product of the two digits?

(a) 63
(b) 54
(c) 45
(d) 36

Q40. The mode of the observations 3, 4, 4, 7, 3, 6, 2, 2, 6, 1, 3, 5, 9, 3, 8, 4 and 3 is

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

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Q41. Two pipes, A and B, together fill a tank in 8 hours. If they are opened separately, then B would take 12 hours more than A to fill the tank. Find the time taken (in hours) by A to fill the tank separately.

(a) 12
(b) 18
(c) 16
(d) 24

Q42. Mohan's monthly income is Rs. 40,000, and he spend 75% of the income. How much does he save each month?

(a) Rs. 10,000
(b) Rs. 11,000
(c) Rs. 11,500
(d) Rs. 10,500

Q43. An article is sold for Rs. 240 with a loss of 20%. What is the cost price?

(a) Rs. 350
(b) Rs. 250
(c) Rs. 300
(d) Rs. 400

Q44. One pipe can fill a tank in 3 minutes while another pipe can empty the completely filled tank in 12 minutes. If both the pipes are opened together when the tank is empty, then how many minutes will it take to fill one-half of the tank?

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

Q45. A laptop is sold for Rs. 48,000 after two successive discounts of 20% and 25% on the marked price. Find the original marked price of the laptop.842

(a) Rs. 80,000
(b) Rs. 78,000
(c) Rs. 75,000
(d) Rs. 88,000

Q46. Find the simple interest (in Rs.) on Rs. 2,000 at 7% per annum rate of interest for the period from 7 February 2023 to 21 April 2023.

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

Q47. If the side of a square is measured 4% more than its actual length, what is the percentage error in the area of the square?

(a) 4.04%
(b) 8.16%
(c) 4%
(d) 8.08%

Q48. An interior designer wants to cover a rectangular wall measuring 36 m × 64 m with square wallpaper tiles, with minimal wastage. What is the maximum possible side length of each square tile that can be used?

(a) 8 m
(b) 4 m
(c) 12 m
(d) 24 m

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Q49. Suman, Tariq and Neha invest Rs. 1,71,000, Rs. 24,000 and Rs. 1,05,000, respectively, to start a business. If the profit at the end of the year is Rs. 7,16,200, then what is the share of Neha in the profit?

(a) Rs. 2,50,672
(b) Rs. 2,50,670
(c) Rs. 2,50,667
(d) Rs. 2,50,668

Q50. In a quadrilateral IJKL, angle I = 17° and angle J = 51°. The bisectors of angle K and angle L meet at Z. What is the measure of angle LZK ?

(a) 27°
(b) 43°
(c) 47°
(d) 34°

GENERAL INTELLIGENCE & REASONING

Q51. Seven friends, D, E, F, U, V, W and X, are sitting in a straight line, facing north. No one sits to the right of D. Only three people sit between D and F. Only two people sit between F and E. X sits third to the left of V. W sits to the immediate right of V. How many people sit between U and E?

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

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

21 57 87 111 129 ?

(a) 141
(b) 143
(c) 139
(d) 136

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

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

(a) DAU
(b) FCV
(c) TQK
(d) ROI

Q54. Seven boxes A, B, C, D, E, F and G are kept one over the other but not necessarily in the same order.

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

How many boxes are kept above D?11685

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

Q55. What will come in the place of the question mark (?) in the following equation, if '+' and '−' are interchanged and '×' and '÷' are interchanged?

(84 × 12) ÷ 4 - (72 × 9) ÷ 3 + 15 = ?

(a) 59
(b) 37

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(c) 48
(d) 24

Q56. Refer to the given number series and answer the question that follows. Counting to be done from left to right only. All numbers are single-digit numbers.

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

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

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

Q57. If 'A' stands for '÷', 'B' stands for 'x', 'C' stands for '+' and 'D' stands for '-', what will come in place of the question mark '?' in the following equation?

9 B 4 D 18 A 9 C 12 = ?

(a) 48
(b) 44
(c) 51
(d) 46

Q58. In a certain code language,

A + B means 'A is the mother of B',

A – B means 'A is the brother of B',

A x B means 'A is the wife of B',

A % B means 'A is the father of B',

and A # B means 'A is the daughter of B'.

How is E related to K if 'K x N – L # E % C'?

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

Q59. In a row of 40 people facing north, Rina is 8th from the right end. If Tara sits 6th to the left of Rina, what is Tara's position from the left end of the row?

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

Q60. Select the pair that follows the same pattern as that followed by the two pairs given below. Both pairs follow the same pattern.

GKN−QUX

XBE−HLO

(a) EHJ−OSV
(b) EIL−OSV
(c) EHJ−NRU
(d) EIL−NSU

Q61. Mr. Akai starts from Point A and drives 21 km towards south. He then takes a left turn, drives 25 km, turns left and drives 8 km. He then takes a left turn and drives 7 km. He then takes a left turn, drives 12 km, turns right and drives 5 km. He takes a final right turn, drives 25 km and stops at Point P. How far (shortest distance) and towards which direction should he drive in order to reach Point A again? (All turns are 90-degree turns only, unless specified.)

(a) 10 km to the east

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(b) 13 km to the west
(c) 10 km to the south
(d) 7 km to the east

Q62. Select the pair which follows the same pattern as that followed by the two pairs given below. Both pairs follow the same pattern.

GDS : LHV

QLY : VPB

(a) TED : XHF
(b) GNL : KSP
(c) HES : MHX
(d) ATE : FXH

Q63. Refer to the given series and answer the question that follows. (All numbers are single digit numbers only.) Counting to be done from left to right only.

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

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

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

Q64. Select the set in which the numbers are related in the same way as are the numbers of the following sets.

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

(3, 15, 5)

(7, 35, 5)

(a) (5, 30, 5)
(b) (8, 40, 5)
(c) (9, 27, 9)
(d) (6, 24, 6)

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

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

How many such odd numbers are there, each of which is immediately preceded by an even number and also immediately followed by a ‘5’?

(a) More than three
(b) Two
(c) Three
(d) One

Q66. Which of the given letter-number clusters will replace the question mark (?) in the following series to make it logically complete?

IHD 78 EDZ 87 AZV 96 WVR 105 ?

(a) SSM 114
(b) SQM 113
(c) SBL 113
(d) SRN 114

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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.

YAB−FHI

KMN−RTU

(a) MNN−TVW
(b) MOP−TVW
(c) MOP−SVV
(d) MNN−SUV

Q68. Read the given statements and conclusions carefully. You have to take the given statements to be true even if they seem to be at variance from commonly known facts. You have to decide which conclusion(s) logically follow(s) from the given statements.

Statements: All rocks are ships. Some ships are tables. All pots are tables.

Conclusion I: Some pots are rocks.

Conclusion II: Some pots are ships.

(a) Only Conclusion II follows
(b) Only Conclusion I follows
(c) Neither Conclusion I nor II follows
(d) Both Conclusions I and II follow

Q69. Which of the following letter-number clusters will replace the question mark (?) in the given series to make it logically complete?

PGE 18, TEI 26, XCM 34, BAQ 42, ?

(a) FCV 52
(b) FYU 50
(c) FCU 52
(d) GYV 50

Q70. Raman starts from Point A and drives 44 km towards the north. He then takes a left turn, drives 47 km, turns left and drives 53 km. He then takes a left turn and drives 62 km. He takes a final left turn, drives 9 km and stops at Point P. How far (shortest distance) and towards which direction should he drive in order to reach Point A again? (All turns are 90-degree turns only unless specified.)

(a) 13 km to the west
(b) 15 km to the west
(c) 14 km to the west
(d) 16 km to the east

Q71. Six people, A, B, C, D, E and F, are sitting in a row, facing north. F sits to the immediate left of A. C sits third to the left of D. C is an immediate neighbour of A. B sits to the immediate left of E. How many people sit between E and C?

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

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

5 11 23 47 95 ?

(a) 181
(b) 189
(c) 193
(d) 191

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Q73. Based on the English alphabetical order, three of the following four letter-cluster pairs are alike in a certain way and thus form a group. Which letter-cluster pair DOES NOT belong to that group?

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

(a) MG – QM
(b) YJ – CP
(c) KH – OM
(d) LB – PH

Q74. A, B, C, D, E and F are sitting around a circular table, facing the centre. B sits third to the right of C. D sits to the immediate left of E. D is not an immediate neighbour of C. F sits to the immediate right of A. The position of how many persons will remain unchanged if all persons are arranged in the English alphabetical order in clockwise direction starting from A (including A)?

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

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

24 30 25 29 26 ?

(a) 28
(b) 30
(c) 32
(d) 27

Q76. In a certain code language, ‘FAME’ is coded as ‘7469’ and ‘COAT’ is coded as ‘2387’. What is the code for ‘A’ in the given code language?

(a) 2
(b) 4
(c) 8
(d) 7

Q77. 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 melons are lemons.

No lemon is a pea.

Conclusions:

(I) No lemon is a melon.

(II) No melon is a pea.

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

Q78. This question is based on the following words.

COP, TIK, ANY, CAN, OWN

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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Q79. If '+' means '−', '−' means '×', '×' means '÷' and '÷' means +', then what will come in place of the question mark (?) in the following equation?

88 − 9 ÷ 195 + 988 × 19 = ?

(a) 915
(b) 930
(c) 935
(d) 955

Q80. In a certain code language, 'let me speak' is coded as 'ko df ty' and 'speak the truth' is coded as 'df op np'. How is 'speak' coded in the given language?

(All codes are two-letter codes)

(a) ko
(b) ty
(c) op
(d) df

GENERAL AWARENESS AND CURRENT AFFAIRS

Q81. Karad, which was recognised by the Ministry of Housing and Urban Affairs for achieving 100 % segregation, collection, and processing of sanitary and biomedical waste in April 2025, is located in which of the following districts?

(a) Coimbatore district
(b) Indore district
(c) Satara district
(d) Dehradun district

Q82. Which Odisha sand-artist created a sand sculpture celebrating the 2025 Union Budget?

(a) Sudarsan Pattnaik
(b) Sandip Pal
(c) Biranchi Narayan
(d) Manas Kumar

Q83. According to the World Bank's 2025 assessment, how many people moved out of extreme poverty in India between 2011-12 and 2022-23?

(a) 171 million
(b) 100 million
(c) 300 million
(d) 220 million

Q84. Where was the Global Fintech Fest (GFF) 2025 held?

(a) Lulu International Convention Centre, Kochi
(b) Bharat Mandapam, New Delhi
(c) Vigyan Bhavan, New Delhi
(d) Jio World Convention Centre, Mumbai

Q85. Who scored the winning goal for Sunderland in the 2025 EFL Championship playoff final?

(a) Dan Neil
(b) Tom Watson
(c) Jack Clarke
(d) Eliezer Mayenda

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Q86. Who was awarded the Vigyan Ratna in 2024 for his contributions in the field of Biological Sciences?

(a) Prof. Jayant Bhalchandra Udgaonkar
(b) Prof. Govindarajan Padmanabhan
(c) Dr. Avesh Kumar Tyagi
(d) Dr. Anandharamakrishnan

Q87. What is the purpose of the Indian AI tool 'OncoMark' introduced by Indian researchers in November 2025?

(a) To maintain nationwide cancer patient data for government health records
(b) To conduct public cancer awareness programmes through digital platforms
(c) To create standard cancer treatment guidelines for hospitals and clinics
(d) To analyse cancer's molecular hallmarks for personalised diagnosis and therapy

Q88. When did the Yonex-Sunrise All India Senior Ranking Badminton Tournament 2025 take place in Moinabad, Telangana?

(a) 8-15 May 2025
(b) 1-8 May 2025
(c) 25 April - 2 May 2025
(d) 20-27 May 2025

Q89. Which club set a record for the most consecutive victories in men's soccer (34 in a row) by April 2025?

(a) Ajax
(b) Al Hilal
(c) Manchester City
(d) Bayern Munich

Q90. Which of the following organisations released a special postage stamp and a Rs. 100 commemorative coin during its centenary celebrations in October 2025?

(a) Indian National Congress (INC)
(b) All India Radio (AIR)
(c) Rashtriya Swayamsevak Sangh (RSS)
(d) Bharatiya Mazdoor Sangh (BMS)

Q91. The Second China–Central Asia Summit, held on 16–18 June 2025, took place in:

(a) Urumqi, China
(b) Bishkek, Kyrgyzstan
(c) Tashkent, Uzbekistan
(d) Astana, Kazakhstan

Q92. What type of ride are women riders allowed to choose under Chandigarh's 2025 aggregator rules?

(a) Uber rides only
(b) Free rides for the first 5 km
(c) Women-only ride pools
(d) Shortest route only

Q93. Which of the following protected areas in Odisha is proposed to be upgraded to a National Park, thereby becoming the state's third national park as of September 2025?

(a) Debrigarh Wildlife Sanctuary
(b) Satkosia Gorge Wildlife Sanctuary
(c) Bhitarkanika Wildlife Sanctuary
(d) Sunabeda Wildlife Sanctuary

Q94. How many entities were penalised by the Reserve Bank of India in FY25?

(a) 500
(b) 100
(c) 283

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(d) 353

Q95. What is the new daily limit for checking bank balances through a single UPI app as per the National Payments Corporation of India (NPCI) rules effective 1 August 2025?

(a) 75 times
(b) Unlimited
(c) 25 times
(d) 50 times

Q96. Which summit held in New Delhi from 10 to 12 April 2025 had the theme “Sambhavna”?

(a) Digital India Summit, 2025
(b) Global Technology Summit, 2025
(c) India Internet Governance Forum, 2025
(d) World Startup Summit, 2025

Q97. Which shallow-water craft was commissioned into the Indian military in June 2025?

(a) INS Arnala
(b) INS Vaghsheer
(c) INS Nilgiri
(d) INS Surat

Q98. Gurindervir Singh broke the national record in which athletic game in the Indian Grand Prix 1?

(a) 400 m
(b) 100 m
(c) Long jump
(d) 200 m

Q99. Which of the following honours, awarded in the 2025 King’s Birthday Overseas & International Honours List, specifically recognises British nationals for “outstanding service abroad or internationally”?

(a) The Order of the British Empire
(b) The King’s Police Medal
(c) The Royal Victorian Order
(d) The Order of St Michael and St George

Q100. The Sachet App provides real-time alerts about which type of emergencies?

(a) Banking frauds
(b) Natural disasters
(c) Cybersecurity breaches
(d) Road traffic congestion

ANSWER KEY

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

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SOLUTIONS

Q1. Answer: (a) Current flows in an open circuit

The correct answer is Current flows in an open circuit.

Key Points

• Open Circuit: An open circuit is an electrical circuit in which the continuity is broken so that the electric current cannot flow. Because there is a gap or a break in the path (like a broken wire or an open switch), the resistance becomes infinitely high, preventing the movement of charges. Hence, statement 1 is incorrect.

• Flow of Electrons: Electric current in metallic conductors is fundamentally the flow of electrons, which are negatively charged subatomic particles. When a potential difference is applied across a conductor, these electrons drift from the negative terminal toward the positive terminal. Hence, statement 2 is correct.

• Conventional Current: By historical convention, the direction of conventional current is taken as the direction in which positive charges would move, which is from the positive terminal to the negative terminal. This direction is exactly opposite to the flow of electrons. Hence, statement 3 is correct.

• Role of a Switch: A switch is a simple device that is used to either break the electric circuit or to complete it. When the switch is in the "ON" position, the circuit is closed and current flows; when it is in the "OFF" position, the circuit is open and current stops. Hence, statement 4 is correct.

• Hence, the incorrect statement (and thus the correct answer) is "Current flows in an open circuit".

Additional Information

• Electric Current (I): It is defined as the rate of flow of electric charge through any cross-section of a conductor. The mathematical expression is I = Q / t, where Q is the net charge and t is the time. The SI unit of electric current is the Ampere (A), named after the French scientist Andre-Marie Ampere.

• Closed Circuit: A closed circuit is one in which the path is complete and uninterrupted, allowing the unhindered flow of electricity from the source through the load and back to the source.

• Components of a Circuit: A standard electric circuit typically consists of a source of electrical energy (like a battery or cell), connecting wires (conductors), a load (like a bulb or resistor), and a control device (a switch).

• Ammeter and Voltmeter: An Ammeter is a device used to measure the electric current in a circuit and is always connected in series. A Voltmeter is used to measure the potential difference between two points and is always connected in parallel.

• Resistance: It is the property of a conductor to resist the flow of charges through it. According to Ohm's Law, discovered by Georg Simon Ohm in 1827, the current through a conductor is proportional to the voltage across it (V = IR), provided physical conditions remain constant.

Q2. Answer: (b) Iris

The correct answer is Iris.

Key Points

• The Iris is a thin, circular structure in the eye that is responsible for controlling the diameter and size of the pupil and thus the amount of light reaching the retina.

• It functions similarly to the aperture of a camera, adjusting the opening to ensure the correct level of illumination enters the eye.

• The iris consists of two groups of smooth muscles: the sphincter pupillae (circular muscles) and the dilator pupillae (radial muscles).

• In bright light conditions, the circular muscles contract to constrict the pupil, preventing too much light from entering and potentially damaging the sensitive photoreceptors.

• In dim light or dark environments, the radial muscles contract to dilate the pupil, allowing more light to enter to improve visibility.

• The eye color of an individual is determined by the pigmentation of the iris, specifically the concentration of melanin.

Additional Information

• Crystalline Lens:

• The Crystalline Lens is a transparent, biconvex structure situated behind the iris.

• Its primary function is to refract light and focus it specifically onto the retina.

• Through a process called accommodation, the lens changes its curvature and focal length to allow the eye to focus clearly on objects at varying distances.

• Cornea:

• The Cornea is the clear, dome-shaped outer surface of the eye that covers the iris and pupil.

• It acts as the eye's outermost lens and provides about 65% to 75% of the eye's total focusing power.

• Unlike most tissues in the body, the cornea contains no blood vessels; it receives nutrients via tears and the aqueous humor.

• Retina:

• The Retina is the innermost, light-sensitive layer of the eye, acting like the "film" in a traditional camera.

• It contains millions of photoreceptor cells known as rods (for low light and peripheral vision) and cones (for color and sharp detail).

• These cells convert light energy into electrical signals, which are then transmitted to the brain via the optic nerve for visual processing.

Important Points

• Pupil: This is the central opening in the iris. While it appears black, it is actually a hole that allows light to pass into the posterior chamber of the eye.

• Aqueous Humor: A clear fluid located in the anterior chamber between the cornea and the lens, providing pressure to maintain the eye's shape.

• Vitreous Humor: A gel-like substance that fills the space between the lens and the retina, helping to keep the retina in place.

• Optic Nerve: The bundle of more than one million nerve fibers that carries visual messages from the retina to the occipital lobe of the brain.

Q3. Answer: (d) Double displacement reaction

The correct answer is Double displacement reaction.

Key Points

• A Double displacement reaction is a type of chemical process where two compounds react, and the positive ions (cations) and the negative ions (anions) of the two reactants switch places to form two new compounds.

• The reaction NaOH + HCl → NaCl + H2O involves Sodium Hydroxide (NaOH), which is a strong base, and Hydrochloric Acid (HCl), which is a strong acid.

• In this reaction, the Sodium (Na+) ion from the base combines with the Chloride (Cl-) ion from the acid to form Sodium Chloride (NaCl). Simultaneously, the Hydrogen (H+) ion from the acid combines with the Hydroxyl (OH-) ion from the base to form Water (H2O).

• This specific type of double displacement reaction is also widely known as a Neutralization reaction, as the acidic and basic properties are neutralized to produce a salt and water.

• The general formula for such a reaction is AB + CD → AD + CB, representing the exchange of partners between the reacting chemical species.

Additional Information

• Decomposition reaction:

• This is a reaction where a single reactant breaks down into two or more simpler products.

• An example is the heating of Calcium Carbonate (CaCO3), which decomposes into Calcium Oxide (CaO) and Carbon Dioxide (CO2).

• These reactions often require energy in the form of heat, light, or electricity to break the chemical bonds.

• Displacement reaction:

• Also known as a Single Displacement reaction, it occurs when a more reactive element displaces a less reactive element from its salt solution.

• For example, when Iron (Fe) is placed in a Copper Sulfate (CuSO4) solution, it displaces copper to form Iron Sulfate (FeSO4).

• This is governed by the Reactivity Series of metals.

• Precipitation reaction:

• This is a sub-category of double displacement reactions where two soluble salts react in an aqueous solution to produce an insoluble solid called a precipitate.

• While the reaction between NaOH and HCl is a double displacement, it is not a precipitation reaction because the resulting Sodium Chloride (NaCl) remains soluble in water.

Important Points

• pH Level: In a complete neutralization reaction between a strong acid and a strong base like NaOH and HCl, the resulting solution typically has a pH of 7 at 25 degrees Celsius, indicating a neutral state.

• Exothermic Nature: Most neutralization and double displacement reactions of this type are exothermic, meaning they release energy in the form of heat to the surroundings.

• Applications: Neutralization reactions are used in various fields, such as treating indigestion (using antacids to neutralize stomach acid), wastewater treatment, and adjusting soil pH in agriculture.

• Ionic Form: When written in net ionic form, the reaction is simply H+ + OH- → H2O, showing that the essential change is the formation of water from Hydrogen and Hydroxyl ions.

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Q4. Answer: (a) gases at high temperatures

The correct answer is gases at high temperatures.

Key Points

• Diffusion is the process of movement of particles from a region of higher concentration to a region of lower concentration until they are uniformly distributed.

• The rate of diffusion is directly proportional to the temperature. When the temperature increases, the kinetic energy of the particles also increases, causing them to move more rapidly and mix faster. Hence, option 1 is correct.

• In the gaseous state, particles have the maximum kinetic energy and the weakest intermolecular forces of attraction compared to solids and liquids. This allows gas particles to move at high speeds in all directions.

• Particles in cold liquids move much slower because lower temperatures result in decreased kinetic energy. Large molecules further slow down the process due to increased molecular weight and resistance. Hence, option 2 is incorrect.

• Low kinetic energy inherently means the particles are moving sluggishly, which significantly reduces the speed of diffusion. Hence, option 3 is incorrect.

• In solids, particles are held together by strong intermolecular forces and occupy fixed positions. They only vibrate about their mean positions, making diffusion extremely slow or negligible in most cases. Hence, option 4 is incorrect.

Additional Information

• Factors Affecting Diffusion:

• State of Matter: The rate is highest in gases, moderate in liquids, and lowest in solids. This is due to the intermolecular spaces being largest in gases.

• Temperature: As heat is applied, particles gain energy and overcome attractive forces more easily. For example, the smell of hot sizzling food reaches us several meters away, but to get the smell from cold food, we have to go close.

• Density: According to Graham's Law of Diffusion, the rate of diffusion of a gas is inversely proportional to the square root of its density or molar mass. Lighter gases diffuse faster than heavier ones.

• Concentration Gradient: A greater difference in concentration between two regions leads to a faster diffusion rate.

• Brownian Motion: This is the random, zig-zag motion of microscopic particles in a fluid (liquid or gas) resulting from their collision with the fast-moving molecules in the fluid. This motion facilitates the process of diffusion.

• Real-world Examples:

• The spreading of ink in water is an example of diffusion in liquids.

• The aroma of perfume or incense sticks spreading in a room is an example of diffusion in gases.

• Dissolving a crystal of potassium permanganate in water demonstrates how particles occupy the spaces between liquid molecules.

Important Points

• Kinetic Theory of Matter: This theory states that all matter consists of constantly moving particles. In gases, the distance between particles is very large, which is why they are highly compressible and exhibit the fastest diffusion.

• Osmosis vs. Diffusion: While diffusion refers to the movement of any particle type, osmosis is a specific type of diffusion involving the movement of solvent molecules (like water) through a semi-permeable membrane.

• Biological Significance: Diffusion is critical in biological systems, such as the exchange of gases (Oxygen and Carbon dioxide) in the alveoli of the lungs and the transport of nutrients into cells.

Q5. Answer: (c) A mixture has a variable composition, while the composition of compounds is fixed.

The correct answer is A mixture has a variable composition, while the composition of compounds is fixed.

Key Points

• A mixture is a substance made by combining two or more different materials in such a way that no chemical reaction occurs. Because the components are not chemically bonded, they can be present in any proportion, meaning a mixture has a variable composition. Hence, statement 3 is correct.

• A compound is a substance formed when two or more elements are chemically bonded together. In a compound, the constituent elements are always present in a fixed ratio by mass. For example, Water (H_2O) always contains hydrogen and oxygen in a 1:8 ratio by mass. Hence, statement 2 is incorrect.

• Mixtures can be separated into their constituent parts using physical methods such as filtration, distillation, evaporation, or magnetization. In contrast, compounds can only be separated into their elements by chemical or electrochemical reactions. Hence, statement 1 is incorrect.

• The properties of a mixture are the sum of the properties of its constituents (e.g., a mixture of iron and sulfur still shows magnetic properties of iron). However, a compound has entirely different properties from its constituent elements (e.g., Sodium is a highly reactive metal and Chlorine is a toxic gas, but their compound, Sodium Chloride, is common table salt). Hence, statement 4 is incorrect.

Additional Information

• Types of Mixtures:

• Homogeneous Mixtures: These have a uniform composition throughout. Examples include air, alloys like Brass, and salt solutions.

• Heterogeneous Mixtures: These have a non-uniform composition where the different components can be seen. Examples include a mixture of sand and salt, or oil and water.

• Characteristics of Compounds:

• Formation of a compound is usually accompanied by the evolution or absorption of energy in the form of heat or light.

• Compounds are considered pure substances because they consist of only one type of molecule or formula unit.

• The melting and boiling points of a compound are always fixed and sharp.

• Law of Constant Proportions: This law, stated by Joseph Proust in 1799, governs compounds. It asserts that a chemical compound always contains its component elements in a fixed ratio by mass and does not depend on its source or method of preparation.

Important Points

• Valency and Bonding: In compounds, elements combine based on their valency to achieve a stable electronic configuration, resulting in ionic or covalent bonds.

• Impurity vs. Mixture: While a mixture contains multiple substances, it is technically an impure substance. Only elements and compounds are classified as pure substances in chemistry.

• Alloys: These are unique because they are solid mixtures of metals (or a metal and a non-metal) that cannot be separated by physical means but are still considered mixtures because they show the properties of their constituents and can have variable composition.

• Energy Change: No significant energy change (heat, light, or sound) is typically noticed during the formation of a mixture, whereas chemical synthesis of a compound involves significant energy exchange.

Q6. Answer: (b) vibrate along the direction of wave propagation

The correct answer is vibrate along the direction of wave propagation.

Key Points

• A sound wave is classified as a longitudinal wave because the particles of the medium through which the sound is transported vibrate in a direction parallel to the direction of energy transport.

• When a sound wave moves through a medium, the particles (atoms or molecules) do not travel from one end to the other; instead, they vibrate back and forth about their fixed equilibrium positions. Hence, statement 2 is correct.

• In a longitudinal wave, this motion creates alternating regions of high density and pressure called compressions and regions of low density and pressure called rarefactions.

• Particles vibrating perpendicular to the direction of wave propagation is a characteristic of transverse waves, such as light or waves on a plucked guitar string. Hence, statement 1 is incorrect.

• If particles do not vibrate, energy cannot be transferred through the medium, meaning no sound wave would exist. Hence, statement 3 is incorrect.

• Particles in a sound wave oscillate back and forth; they do not rotate continuously in a circular motion. Hence, statement 4 is incorrect.

Additional Information

• Nature of Sound Waves:

• Sound is a mechanical wave, which means it requires a material medium (solid, liquid, or gas) for its propagation.

• Since sound depends on particle interaction, it cannot travel through a vacuum, a fact demonstrated by the classic bell-jar experiment.

• Speed of Sound:

• The speed of sound depends on the elasticity and density of the medium. It travels fastest in solids, followed by liquids, and slowest in gases.

• In air at 0°C, the speed of sound is approximately 331 m/s, and it increases to about 343 m/s at 20°C.

• Characteristics of Sound:

• Loudness: This is determined by the amplitude of the vibration. A larger amplitude corresponds to a louder sound, measured in decibels (dB).

• Pitch: This is determined by the frequency of the vibration. Higher frequency results in a higher pitch, measured in Hertz (Hz).

• Audible Range: The human ear can typically perceive frequencies between 20 Hz and 20,000 Hz.

• Types of Mechanical Waves:

• Longitudinal: Particle displacement is parallel to wave motion (e.g., sound waves, ultrasound waves).

• Transverse: Particle displacement is perpendicular to wave motion (e.g., ripples on water surface, S-waves in earthquakes).

Important Points

• The wavelength of a sound wave is the distance between two consecutive compressions or two consecutive rarefactions.

• When sound travels from one medium to another (e.g., from air to water), its speed and wavelength change, but its frequency remains constant as it depends on the source of the sound.

• In solids, sound can actually propagate as both longitudinal and transverse waves, but in fluids (liquids and gases), sound travels almost exclusively as longitudinal waves.

Q7. Answer: (c) MnO2 is reduced, HCl is oxidised

p data-end="57" data-start="0">The correct answer is MnO2 is reduced, HCl is oxidised.

Key Points

• The given chemical reaction is MnO2 + 4HCl → MnCl2 + 2H2O + Cl2. This reaction is a Redox reaction (Reduction-Oxidation), where both oxidation and reduction occur simultaneously.

• In MnO2 (Manganese Dioxide), the oxidation state of Manganese (Mn) is +4. In the product MnCl2 (Manganese Chloride), its oxidation state changes to +2. Since the oxidation number decreases, MnO2 is reduced.

• Alternatively, reduction is defined as the removal of oxygen. In this reaction, MnO2 loses oxygen to form MnCl2. Hence, the statement that MnO2 is reduced is correct.

• In HCl (Hydrochloric Acid), the oxidation state of Chlorine (Cl) is -1. In the product Cl2 (Chlorine gas), which is in its elemental form, the oxidation state is 0. Since the oxidation number increases, HCl is oxidised.

• Furthermore, oxidation is also defined as the removal of hydrogen. In this reaction, HCl loses hydrogen to form Cl2. Hence, the statement that HCl is oxidised is correct.

• Therefore, MnO2 acts as the oxidizing agent (it oxidizes HCl), and HCl acts as the reducing agent (it reduces MnO2).

Additional Information

• Oxidation and Reduction (Classical Concept):

• Oxidation is the addition of oxygen or an electronegative element to a substance, or the removal of hydrogen or an electropositive element.

• Reduction is the removal of oxygen or an electronegative element from a substance, or the addition of hydrogen or an electropositive element.

• Electronic Concept of Redox:

• Oxidation involves the loss of electrons by an atom, ion, or molecule. This results in an increase in the oxidation number.

• Reduction involves the gain of electrons. This results in a decrease in the oxidation number of the substance.

• Oxidizing and Reducing Agents:

• An Oxidizing Agent (or oxidant) is a substance that accepts electrons and gets reduced. In the reaction, MnO2 accepts electrons to go from Mn(+4) to Mn(+2).

• A Reducing Agent (or reductant) is a substance that donates electrons and gets oxidised. In the reaction, HCl (specifically the Chloride ion) loses electrons to go from Cl(-1) to Cl(0).

Important Points

• Reaction Specifics:

• This specific reaction is used in the laboratory preparation of chlorine gas. Concentrated Hydrochloric acid is reacted with Manganese dioxide to produce Chlorine, Manganese(II) chloride, and Water.

• The oxidation state of Oxygen remains -2 throughout the reaction, and the oxidation state of Hydrogen remains +1, meaning they are not the primary species undergoing redox changes.

• Common Redox Examples:

• Corrosion: The rusting of iron is a redox reaction where iron is oxidised by atmospheric oxygen in the presence of moisture.

• Combustion: Burning of fuels like methane (CH4) in oxygen involves the oxidation of carbon and reduction of oxygen.

• Photosynthesis: This is a complex biological redox process where Carbon dioxide is reduced to glucose and Water is oxidised to oxygen.

Q8. Answer: (d) Melting of ice

The correct answer is Melting of ice.

Key Points

• Melting of ice is a physical process that involves the transition of water from a solid state to a liquid state. For this change to occur, the substance must absorb thermal energy from its surroundings. Hence, the statement is correct.

• During this process, the temperature of the ice remains constant at 0°C (or 273.15 K) until all the ice has turned into water. This is because the absorbed heat is used to break the intermolecular bonds (hydrogen bonds) in the crystalline lattice of the ice rather than increasing the kinetic energy of the molecules.

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• This specific type of heat absorption during a phase change is known as the Latent Heat of Fusion. For water, the value is approximately 334 Joules per gram or 80 calories per gram.

• In contrast, Freezing of water (Option 1) is the transition from liquid to solid and is an exothermic process, meaning it releases heat into the environment. Hence, the statement is incorrect.

• Sublimation of camphor (Option 2) involves heat absorption, but the state change is directly from solid to gas, bypassing the liquid phase. Hence, the statement is incorrect.

• Condensation of steam (Option 3) involves a change from gas to liquid and is a process that involves heat release (exothermic). Hence, the statement is incorrect.

Additional Information

• Endothermic vs. Exothermic Processes:

• Endothermic processes are those that absorb heat from the surroundings. Examples include melting, evaporation, and sublimation.

• Exothermic processes are those that release heat into the surroundings. Examples include freezing, condensation, and deposition.

• Phase Transitions:

• Vaporization: The transition from liquid to gas, requiring the Latent Heat of Vaporization (about 2260 J/g for water).

• Deposition: The direct transition from gas to solid (e.g., frost formation), which is the reverse of sublimation.

• States of Matter:

• Solid: Particles are closely packed in a fixed volume and fixed shape.

• Liquid: Particles have more freedom to move, resulting in a fixed volume but variable shape.

• Gas: Particles move rapidly with no fixed volume or shape, filling the entire container.

Important Points

• Phase Change Temperature: The melting point and freezing point of a substance occur at the same temperature (for water, 0°C at 1 atmosphere of pressure). Whether a substance melts or freezes depends on whether heat is being added or removed.

• Energy Transfer: In the Melting of ice, the energy absorbed is exactly equal to the Latent Heat of Fusion. This energy is essential for overcoming the attractive forces that hold the water molecules in a rigid hexagonal structure.

• Real-world Applications: The principle of heat absorption during melting is used in refrigeration and cooling packs, where melting substances absorb thermal energy from the food or injured area to provide a cooling effect.

Q9. Answer: (d) Animals

The correct answer is Animals.

Key Points

• The dispersal of seeds and fruits is a biological necessity to prevent overcrowding and ensure that new plants grow in diverse locations. Burrs are specific types of seeds or dry fruits equipped with hooks, spines, or teeth.

• These specialized appendages allow the seeds to easily attach to the fur or skin of animals or the clothing of humans as they pass by the plant.

• This method of dispersal is scientifically known as Epizoochory, where the seed is carried on the outside of an animal. This is a highly effective way for the plant to transport its offspring across long distances.

• Common examples of plants that use this mechanism include Xanthium (Cocklebur), Urena, and Burdock. These plants produce fruits that are sticky or prickly to ensure they do not fall directly under the parent plant.

• By hitching a ride on mobile organisms, these plants can colonize new habitats and reduce competition for sunlight, water, and soil nutrients.

Additional Information

• Dispersal by Air (Anemochory):

• Plants like Dandelion, Maple, and Drumstick have seeds with wings or hair.

• These lightweight structures act like parachutes, allowing the wind to carry them over vast areas.

• Dispersal by Water (Hydrochory):

• Aquatic or semi-aquatic plants, such as Coconut and Lotus, develop seeds with a fibrous or spongy outer coat.

• This adaptation provides buoyancy, enabling the seeds to float and travel via rivers or ocean currents to distant shores.

• Dispersal by Explosion (Autochory):

• Some plants, like Balsam, Pea, and Castor, use mechanical energy.

• The fruit or pod bursts open with a sudden jerk when it dries, scattering the seeds in multiple directions away from the parent plant.

• Dispersal by Gravity (Barochory):

• Heavy fruits, such as Apples or Oak acorns, simply drop to the ground. While some may roll away, most stay near the base of

the tree unless moved by secondary agents.

Important Points

• Velcro Inspiration: The invention of Velcro in 1941 by Swiss engineer George de Mestral was inspired by observing how Burdock burrs stuck to his dog's fur. This is a classic example of biomimicry.

• Seed Longevity: Seeds dispersed by animals often have a hard protective coat to prevent damage during the transport process or while being excreted (if they are eaten, known as Endozoochory).

• Ecological Impact: Seed dispersal plays a vital role in maintaining biodiversity and helping forests recover after natural disasters like forest fires or landslides.

Q10. Answer: (c) The sum of potential energy and kinetic energy

The correct answer is The sum of potential energy and kinetic energy.

Key Points

• Mechanical energy is defined as the energy possessed by an object due to its motion or its position. It represents the capacity of a physical system to perform work.

• It is the sum of kinetic energy and potential energy in a system. The mathematical formula is M.E. = K.E. + P.E..

• Kinetic energy is the energy of an object resulting from its motion. Any object that has mass and is moving possesses this form of energy. Hence, statement 3 is correct.

• Potential energy is the stored energy an object has because of its position relative to other objects, stresses within itself, or its electric charge. Common examples include a stretched spring or an object held at a certain height.

• The principle of mechanical energy is central to classical mechanics, where it is often conserved in a system that is subject only to conservative forces, such as gravity or ideal elastic forces.

Additional Information

• Kinetic Energy (KE):

• The kinetic energy of an object is given by the formula 1/2 mv^2, where m is the mass of the object and v is its velocity.

• If the velocity of an object is doubled, its kinetic energy increases four times because the energy is proportional to the square of the speed.

• Potential Energy (PE):

• Gravitational Potential Energy is calculated using the formula mgh, where m is the mass, g is the acceleration due to gravity (approximately 9.8 m/s^2 on Earth), and h is the height above a reference point.

• Elastic Potential Energy is stored when a material is deformed, such as in a compressed gas or a stretched bowstring.

• Conservation of Mechanical Energy:

• In an isolated system where only conservative forces act, the Total Mechanical Energy remains constant over time.

• For example, in a simple pendulum, at the highest point (peak of the swing), the energy is entirely potential. At the lowest point (center of the swing), the energy is entirely kinetic.

• Comparison with Other Energies:

• Chemical Energy: This is energy stored in the bonds of chemical compounds (like food and fuel). It is released during a chemical reaction. Hence, statement 2 is incorrect as it describes chemical energy, not mechanical.

• Solar Energy: This is radiant light and heat from the Sun that is harnessed using technologies like photovoltaics. Hence, statement 4 is incorrect.

Important Points

• The SI unit of mechanical energy is the Joule (J), which is equivalent to one Newton-meter.

• Mechanical energy can be converted into other forms, such as electrical energy in a hydroelectric dam or thermal energy due to friction.

• In the presence of non-conservative forces like air resistance or friction, mechanical energy is not conserved but is instead transformed into heat.

Q11. Answer: (d) At infinity, highly magnified, real

The correct answer is At infinity, highly magnified, real.

Key Points

• When an object is placed exactly at the Principal Focus (F1) of a convex lens, the refracted rays emerge parallel to each other.

• Since parallel rays are considered to meet at infinity, the image is formed at an infinite distance from the optical center of the lens. Hence, the location of the image is at infinity.

• The nature of the image formed by a convex lens in this scenario is real and inverted. In optics, a real image is formed when light rays actually converge at a point. Hence, the nature is real.

• The size of the image is highly magnified (also described as infinitely large or extremely enlarged) because the rays diverge

significantly from the principal axis as they travel towards infinity. Hence, the correct option is "At infinity, highly magnified, real".

• This principle is utilized in searchlights and spotlights, where the light source is placed at the focus of a convex lens to obtain a powerful parallel beam of light.

Additional Information

• Convex Lens (Converging Lens):

• A convex lens is thicker at the center than at the edges. It converges a straight beam of light incident on it.

• Object at Infinity: The image is formed at the Focus (F2), is real, inverted, and highly diminished (point-sized).

• Object Beyond 2F1: The image is formed between F2 and 2F2, is real, inverted, and diminished.

• Object at 2F1: The image is formed at 2F2, is real, inverted, and the same size as the object.

• Object Between F1 and 2F1: The image is formed beyond 2F2, is real, inverted, and magnified.

• Object Between Focus (F1) and Optical Center (O): The image is formed on the same side as the object, is virtual, erect, and magnified. This is the principle used in a simple microscope or magnifying glass.

• Concave Lens (Diverging Lens):

• A concave lens is thinner at the center and diverges light rays. It always forms a virtual, erect, and diminished image regardless of the object's position.

Important Points

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

• Magnification (m): It is the ratio of the height of the image to the height of the object, also expressed as m = v/u. For a real image, m is negative; for a virtual image, m is positive.

• Sign Convention: According to the Cartesian sign convention, the focal length of a convex lens is always positive, while that of a concave lens is negative.

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

Q12. Answer: (c) milch

The correct answer is milch.

Key Points

• In cattle farming, animals are categorized based on their primary utility. Milk-producing animals, including cows, buffaloes, goats, and camels, are professionally termed milch animals.

• The production of milk is largely dependent on the lactation period, which is the duration of milk production after the birth of a calf. Milch animals are bred and managed to optimize this period.

• Buffaloes (Bubalus bubalis) are significant milch animals in India, contributing a major portion of the total milk production due to the high fat content in their milk. Hence, the correct option is milch.

• Common high-yielding milch breeds of buffalo in India include Murrah, Mehsana, and Surti. These breeds are known for their efficiency in converting feed into high-quality milk.

• The management of these animals involves proper shelter, balanced nutrition (roughage and concentrates), and regular veterinary check-ups to ensure disease-free production.

Additional Information

• Shellfish:

• These are aquatic invertebrates used as food, such as shrimp, crabs, lobsters, and mussels.

• They belong to the categories of crustaceans or mollusks and are not related to cattle farming. Hence, statement 1 is incorrect.

• Layers:

• In poultry farming, layers are birds specifically raised for egg production.

• They start laying eggs at the age of about 20 weeks. Common examples include Leghorns. Hence, statement 2 is incorrect.

• Broilers:

• Broilers are poultry birds raised specifically for meat production.

• They are bred for fast growth and high feed-conversion ratios, typically reaching market weight within 6 to 8 weeks. Hence, statement 4 is incorrect.

• Draught Animals:

• Apart from milch animals, cattle used for agricultural labor such as tilling, irrigation, and carting are called draught animals. Bullocks are the most common example in this category.

Important Points

• White Revolution: Also known as Operation Flood, it was launched in 1970 to make India a self-dependent nation in milk production. Dr. Verghese Kurien is known as the Father of the White Revolution in India.

• Nutritional Requirements: Milch animals require a diet rich in fiber (roughage) for digestion and concentrates (proteins and

minerals) for high milk yield.

• Disease Management: Cattle are prone to diseases like Foot and Mouth Disease (FMD) and Anthrax, which can drastically reduce milk production and require timely vaccination.

• India's Global Standing: India is the largest producer of milk in the world, contributing significantly to the global dairy market, with buffaloes playing a more dominant role than cows in the Indian context.

Q13. Answer: (a) diffusion; high; low

The correct answer is diffusion; high; low.

Key Points

• The movement of gases like Oxygen (O2) and Carbon Dioxide (CO2) across the cell membrane takes place through a physical process known as diffusion.

• Diffusion is defined as the spontaneous movement of a substance from a region of high concentration to a region of low concentration until an equilibrium is reached.

• In biological systems, CO2 (a cellular waste) accumulates in high concentrations inside the cell. Since the external environment has a lower concentration of CO2, the gas moves out of the cell.

• Conversely, when the concentration of O2 inside the cell decreases due to metabolic activities, O2 from the external environment (where it is at a high concentration) enters the cell by diffusion.

• This process is a form of passive transport, meaning it does not require any metabolic energy (ATP) to move the molecules across the lipid bilayer of the membrane. Hence, the correct option is diffusion; high; low.

Additional Information

• Active Transport:

• Unlike diffusion, active transport moves molecules or ions against a concentration gradient (from low to high concentration).

• This process requires cellular energy, usually in the form of Adenosine Triphosphate (ATP), and often involves specific membrane proteins acting as pumps, such as the Sodium-Potassium pump.

• Osmosis:

• Osmosis is a specific type of diffusion involving the movement of water molecules through a selectively permeable membrane.

• Water moves from a region of high water concentration (dilute solution) to a region of low water concentration (concentrated solution).

• Endocytosis:

• Endocytosis is a bulk transport mechanism where the plasma membrane engulfs external food particles or substances to form a vesicle inside the cell.

• An example is Amoeba, which acquires its food through endocytosis (specifically phagocytosis) due to the flexibility of its cell membrane.

Important Points

• Cell Membrane Permeability: The plasma membrane is selectively permeable, allowing only certain substances like small non-polar molecules (O2, CO2, and N2) to pass through easily via simple diffusion.

• Factors Affecting Diffusion: The rate of gas exchange is influenced by the concentration gradient, the permeability of the membrane, temperature, and the surface area available for exchange.

• Equilibrium: Diffusion continues until the molecules are evenly distributed, resulting in dynamic equilibrium where there is no net movement in any specific direction.

• Facilitated Diffusion: Larger or polar molecules (like glucose or ions) cannot cross the lipid bilayer directly and require carrier proteins or channel proteins to move down their concentration gradient without using energy.

Q14. Answer: (d) Towards north

The correct answer is Towards north.

Key Points

• The direction of the magnetic field produced by a long straight conductor is determined by the Right-Hand Thumb Rule (also known as Maxwell’s Hand Rule).

• According to this rule, if you hold the current-carrying conductor in your right hand such that the thumb points in the direction of the current, then the curled fingers will show the direction of the magnetic field lines.

• In this case, the current is flowing vertically upwards. By placing the thumb in the upward direction, the magnetic field lines form concentric circles in an anti-clockwise direction when viewed from above.

• For a point lying to the East of the wire, the tangent to these circular magnetic field lines at that specific location indicates the direction of the field. Following the anti-clockwise rotation, the field at the East point is directed towards north.

• The magnitude of this magnetic field depends on the current (I) passing through the conductor and is inversely proportional to the distance (r) from the wire.

Additional Information

• Maxwell's Corkscrew Rule:

• This is another method to find the direction. If a right-handed corkscrew is rotated such that it moves in the direction of the current, the direction of rotation of the handle gives the direction of the magnetic field.

• For upward current, the rotation is anticlockwise, consistent with the thumb rule results.

• Oersted's Experiment (1820):

• Hans Christian Oersted was a Danish physicist who discovered that electric currents create magnetic fields. This discovery laid the foundation for electromagnetism.

• His experiment showed that a compass needle deflects when placed near a wire carrying electric current, proving the relationship between electricity and magnetism.

• Biot-Savart Law:

• This law mathematically describes the magnetic field generated by a constant electric current. It states that the differential magnetic field is proportional to the current, the length of the segment, and the sine of the angle between them.

• For an infinitely long straight wire, the formula for the magnetic field (B) is B = (μ0I) / (2πr), where μ0 is the permeability of free space (approximately 4π × 10^-^7 T·m/A).

• Magnetic Field Lines Properties:

• They form closed continuous loops around the conductor.

• They are crowded near the conductor where the magnetic field is strong and spread out as the distance increases.

• The SI unit of magnetic field induction is the Tesla (T), named after Nikola Tesla.

Important Points

• Directional Sensitivity: If the current were reversed to flow vertically downwards, the magnetic field at the East point would change its direction to North.

• Right-Hand Palm Rule: This is an alternative to the thumb rule. If you stretch your right hand such that the thumb points in the direction of current and the fingers point toward the point of observation, the palm will push in the direction of the magnetic field.

• Impact of Medium: The magnetic field strength is also influenced by the magnetic permeability of the surrounding medium. In the presence of ferromagnetic materials, the field can be significantly intensified.

• Practical Applications: Understanding the magnetic field around straight conductors is essential in the design of solenoids, transformers, electric motors, and electromagnetic relays.

Q15. Answer: (d) The athlete moves with constant speed, which equals the distance travelled in one revolution divided by the...

The correct answer is The athlete moves with constant speed, which equals the distance travelled in one revolution divided by the time for that revolution.

Key Points

• Uniform Circular Motion: When an object or an athlete moves along a circular path with a constant speed, the motion is termed as Uniform Circular Motion (UCM). The term "uniform" refers specifically to the magnitude of velocity (speed) being constant throughout the path. Hence, statement 1 is incorrect.

• Consistency of Speed: In the given scenario, the problem states the athlete moves with uniform speed. This means the distance covered per unit of time remains the same at every point on the track. There is no mention of external forces causing a slowdown. Hence, statement 2 is incorrect.

• Velocity and Direction: Velocity is a vector quantity, meaning it has both magnitude and direction. Even if the speed (magnitude) is constant, the direction of motion changes continuously at every point on the circular path. Therefore, velocity is not constant. Hence, statement 3 is incorrect.

• Calculation of Speed: For an athlete completing 1 revolution, the total distance travelled is equal to the circumference of the circle. The average speed is calculated by dividing this total distance by the fixed time taken for that revolution. Hence, statement 4 is correct.

• Hence, the correct answer is that the athlete moves with constant speed, which equals the distance travelled in one revolution divided by the time for that revolution.

Additional Information

• Distance vs. Displacement:

• In one complete revolution, the distance covered is the circumference of the circle (2πr).

• However, the displacement is zero because the athlete returns to the starting point. This highlights the difference between average speed (total distance/time) and average velocity (total displacement/time).

• Centripetal Acceleration:

• Since the direction of velocity is changing constantly, the object is technically accelerating.

• This is known as Centripetal Acceleration, and it is always directed towards the center of the circular path. The formula for this

acceleration is a = v^2 / r.

• Centripetal Force:

• To maintain a circular path, a net force must act on the body towards the center. In the case of an athlete, this force is often provided by the friction between the athlete's shoes and the ground.

• This force is defined by the formula F = mv^2 / r, where m is the mass of the athlete.

Important Points

• Mathematical Formula: The speed v of an object moving in a circle of radius r taking time T for one revolution is given by v = 2πr / T.

• Tangential Velocity: At any specific point on the circular track, the direction of velocity is tangential to the circle. If the athlete were to suddenly lose grip, they would fly off in a straight line along this tangent.

• Angular Velocity: Another important concept is Angular Velocity (ω), which measures the rate of change of the angle subtended at the center. The relationship between linear speed and angular velocity is v = rω.

• Period and Frequency: The fixed time taken for one revolution is called the Time Period (T). The number of revolutions completed in 1 second is called the Frequency (f), and they are inversely proportional (f = 1/T).

Q16. Answer: (b) Both reach the ground at the same time.

The correct answer is Both reach the ground at the same time.

Key Points

• In a vacuum, there is a total absence of air resistance or atmospheric pressure. This means that no external force other than gravity acts upon the objects as they fall.

• According to the principles of classical mechanics, the acceleration due to gravity (denoted as g) is constant for all objects near the surface of the Earth, regardless of their mass, volume, or density.

• The time of flight for an object in free fall from a height h is given by the kinematic equation t = square root of (2h/g). Because the variable for mass (m) does not appear in this formula, the time taken to reach the ground is identical for all objects. Hence, the correct answer is statement 2.

• The observation that all bodies fall at the same rate was famously proposed by Galileo Galilei in the late 16th century, contradicting the Aristotelian theory which suggested that heavier objects fall faster.

• The value of g is approximately 9.8 meters per second squared (9.8 m/s^2). This means that every second an object is in free fall, its velocity increases by 9.8 m/s, irrespective of how heavy it is.

Additional Information

• Newton's Second Law and Gravity:

• Newton's Second Law of Motion states that Force equals Mass times Acceleration (F = ma). In the context of gravity, the force (Weight) is W = mg.

• When we equate the gravitational force ($F = GmM/r^2$) with ma, the mass of the falling object (m) cancels out from both sides of the equation, leaving the acceleration (a) equal to GM/r^2.

• This confirms that the acceleration depends only on the mass of the Earth (M) and the distance from its center (r), not the object falling.

• The Role of Air Resistance:

• In a non-vacuum environment (like our atmosphere), objects are subjected to drag or air resistance.

• Air resistance depends on the velocity, cross-sectional area, and shape of the object. This is why a feather falls slower than a stone in normal air.

• Objects in air eventually reach terminal velocity, where the upward force of air resistance balances the downward force of gravity, resulting in zero net acceleration.

• Historical Demonstrations:

• In 1971, during the Apollo 15 mission to the Moon, Commander David Scott performed a live demonstration in the lunar vacuum.

• He dropped a geological hammer and a falcon feather simultaneously. Both hit the lunar surface at the exact same time, providing a visual confirmation of Galileo's theory.

Important Points

• Inertia vs. Gravitational Pull: A heavier object has a greater gravitational pull acting on it, which one might think would make it fall faster. However, a heavier object also has more inertia, meaning it is harder to set in motion. These two effects cancel each other out perfectly.

• Variation of g: While g is treated as a constant in basic physics problems, its value actually changes slightly based on location. It is 9.83 m/s^2 at the Poles and 9.78 m/s^2 at the Equator due to the centrifugal force of the Earth's rotation and its equatorial bulge.

• Vacuum Technology: On Earth, large-scale vacuum chambers, such as the NASA Space Power Facility in Ohio, are used to simulate these conditions for testing spacecraft and performing physics experiments.

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Q17. Answer: (b) The fertilised egg divides to form an embryo, which implants in the uterine lining.

The correct answer is The fertilised egg divides to form an embryo, which implants in the uterine lining.

Key Points

• Fertilisation in humans typically occurs in the Fallopian tube (specifically the ampulla region), where the sperm meets the ovum.

• Once the egg is fertilised, it forms a single-celled zygote. This zygote does not remain stationary but begins to move toward the uterus through the fallopian tube.

• During this journey, the zygote undergoes rapid mitotic divisions called cleavage, transforming into a solid ball of cells called a morula and subsequently a hollow ball called a blastocyst.

• Approximately 5 to 7 days after fertilisation, the blastocyst reaches the uterus and attaches itself to the thickened uterine lining (the endometrium). This critical process is known as implantation. Hence, statement 2 is correct.

• The fallopian tube is merely a site for fertilisation and a passage; if the embryo stays and develops there, it results in an ectopic pregnancy, which is a medical emergency. Hence, statement 1 is incorrect.

• The vagina serves as the birth canal and the site for insemination; it is not where a foetus develops. Hence, statement 3 is incorrect.

• The ovaries are responsible for the production of eggs (oocytes) and hormones like oestrogen and progesterone, but they do not house or nourish the developing embryo. Hence, statement 4 is incorrect.

Additional Information

• Stages of Prenatal Development:

• Zygote: The single cell formed by the union of sperm and egg (Day 1).

• Embryo: The developing human from the second week after fertilisation through the eighth week. During this stage, organogenesis (formation of organs) occurs.

• Foetus: From the ninth week of pregnancy until birth, the developing organism is referred to as a foetus, characterized by the growth and maturation of established structures.

• The Role of the Uterus (Womb):

• The uterus is a hollow, muscular organ located in the female pelvis between the bladder and rectum.

• Its primary function is to nourish the developing foetus prior to birth.

• The endometrium is the inner layer that thickens every menstrual cycle in preparation for a potential embryo.

• The Placenta:

• Following implantation, a temporary organ called the placenta develops.

• It facilitates the exchange of nutrients, oxygen, and waste products between the mother and the foetus via the umbilical cord.

Important Points

• Gestation Period: In humans, the average gestation period is approximately 280 days (or 40 weeks) calculated from the last menstrual period.

• Hormonal Regulation: The Corpus Luteum in the ovary secretes progesterone to maintain the uterine lining after fertilisation. If fertilisation does not occur, progesterone levels drop, leading to menstruation.

• HCG (Human Chorionic Gonadotropin): Once implantation occurs, the embryo produces HCG, the hormone detected by pregnancy tests, which signals the body to maintain the endometrium.

Q18. Answer: (b) It allows only certain substances to pass through while restricting others.

The correct answer is It allows only certain substances to pass through while restricting others.

Key Points

• The plasma membrane, also known as the cell membrane, is a biological membrane that separates the interior of all cells from the outside environment. It is described as selectively permeable because it regulates the passage of molecules into and out of the cell.

• It functions like a gatekeeper, allowing the entry of essential nutrients such as glucose, amino acids, and water, while facilitating the exit of metabolic waste products like carbon dioxide and ammonia. Hence, the statement in option 2 is correct.

• The membrane prevents the entry of toxic substances and pathogens that could harm the internal machinery of the cell. Hence, the statement in option 4 is incorrect as it does not prevent all materials, but only specific ones.

• Unlike a permeable membrane, it does not allow the free and equal movement of all substances. Hence, the statement in option 3 is incorrect.

• Control of energy production is the primary function of the mitochondria (the powerhouse of the cell), not the plasma membrane itself. Hence, the statement in option 1 is incorrect.

• The selective permeability is crucial for maintaining homeostasis, ensuring that the chemical composition of the cytoplasm remains stable despite changes in the external environment.

Additional Information

• Structure of Plasma Membrane:

• The membrane is primarily composed of a phospholipid bilayer. This consists of hydrophilic (water-loving) heads facing outwards and hydrophobic (water-fearing) tails facing inwards.

• In 1972, S.J. Singer and G.L. Nicolson proposed the Fluid Mosaic Model, which describes the membrane as a mosaic of proteins, lipids, and carbohydrates that gives the membrane a fluid character.

• Mechanisms of Transport:

• Passive Transport: This includes Diffusion and Osmosis. It involves the movement of substances from a high concentration to a low concentration without the expenditure of energy (ATP).

• Active Transport: This requires the use of energy (ATP) to move molecules against their concentration gradient (from low to high concentration) through specific protein pumps.

• Bulk Transport: Large particles are moved via Endocytosis (engulfing materials) and Exocytosis (expelling materials).

Important Points

• Functions of the Membrane:

• Protection: It provides a flexible yet sturdy structural support to the cell.

• Cell Signaling: Integral proteins and glycoproteins on the surface act as receptors for hormones and neurotransmitters.

• Identification: The carbohydrate chains attached to the proteins help in cell-to-cell recognition, which is vital for the immune system.

• Difference from Cell Wall:

• While the plasma membrane is found in all living cells (animals, plants, bacteria), the cell wall is present only in plants, fungi, and some bacteria. The cell wall is generally fully permeable and provides rigidity, whereas the plasma membrane is selectively permeable and flexible.

Q19. Answer: (c) anemophily

The correct answer is anemophily.

Key Points

• Anemophily is a form of abiotic pollination where wind is the primary agent used to transfer pollen grains from the anther to the stigma of a flower.

• Plants that rely on anemophily do not need to attract pollinators like insects or birds; therefore, their flowers are typically small, inconspicuous, and colorless.

• These flowers generally lack nectar and fragrance because these features are energetically expensive and unnecessary for wind-based dispersal.

• The pollen grains produced by anemophilous plants are lightweight, dry, and non-sticky, allowing them to be easily carried by even light breezes over long distances.

• To maximize the chances of pollination, these plants produce pollen in massive quantities. For instance, a single Maize plant can produce millions of pollen grains.

• The stigma of such plants is often large and feathery (plumose) to provide a greater surface area for catching drifting pollen grains from the air.

Additional Information

• Entomophily:

• This is pollination by insects such as bees, butterflies, and moths.

• Flowers are usually brightly colored, possess a strong scent, and provide nectar as a reward to the insect.

• The pollen grains are typically sticky or spiny so they can easily adhere to the body of the insect.

• Hydrophily:

• This refers to pollination mediated by water. This is quite rare, occurring in only about 30 genera of mostly monocotyledonous aquatic plants.

• Examples include Vallisneria and Hydrilla. In these plants, pollen grains are often long and ribbon-like and are protected from wetting by a mucilaginous covering.

• Ornithophily:

• This is pollination carried out by birds, such as hummingbirds and sunbirds.

• Ornithophilous flowers are usually large, sturdy, and tubular to accommodate the bird's beak. They are often bright red or orange but usually lack a distinct scent as birds have a poor sense of smell.

Important Points

• Economic Importance: Most of the world's most important cereal crops, including Wheat, Rice, Corn (Maize), Barley, and Oats, are wind-pollinated.

• Gymnosperms: Almost all Gymnosperms, such as Pinus, are wind-pollinated. They often release so much pollen that it creates a

phenomenon known as "Sulphur showers" in pine forests.

• Location of Anthers: In wind-pollinated flowers, the anthers are often well-exposed (versatile) so that the pollen can be easily dispersed into the wind currents.

• Biological Classification: Pollination is broadly divided into Self-pollination (Autogamy) and Cross-pollination (Allogamy). Anemophily is a major mechanism for Cross-pollination in the plant kingdom.

Q20. Answer: (b) Composting

The correct answer is Composting.

Key Points

• Composting is a biological process in which organic waste such as livestock excreta, vegetable waste, animal refuse, domestic waste, sewage waste, straw, and eradicated weeds are decomposed in pits.

• The process is carried out by the action of microorganisms like bacteria and fungi, which break down complex organic compounds into simpler substances.

• The resulting material, known as compost, is highly rich in organic matter and essential nutrients like Nitrogen, Phosphorus, and Potassium (NPK).

• This method is a sustainable way of waste management that recycles farm waste into a valuable soil conditioner, improving the soil structure and its water-holding capacity.

• When earthworms are used to accelerate the process of decomposition of plant and animal refuse, it is termed Vermi-composting.

Additional Information

• Pollination:

• It is the process of transferring pollen grains from the anther (male part) to the stigma (female part) of a flower.

• This is a vital step in the sexual reproduction of plants, leading to fertilization and the production of seeds.

• Fertilization:

• In a biological context, fertilization is the fusion of male and female gametes to form a zygote.

• In an agricultural context, it refers to the application of chemical fertilizers or organic manures to the soil to enhance crop yield by providing specific nutrients.

• Green Manuring:

• This involves growing specific crops, usually leguminous plants like Sunn hemp or Guar, which are then ploughed back into the soil while still green.

• The green plants decompose and enrich the soil specifically with Nitrogen and organic matter, acting as a natural fertilizer.

• Organic Matter:

• It consists of carbon-based compounds that have come from the remains of organisms such as plants and animals and their waste products in the environment.

• Organic matter is essential for maintaining soil fertility and supports a healthy ecosystem of soil microbes.

Important Points

• Nutrient Density: Compost acts as a slow-release fertilizer, providing a steady supply of nutrients to plants over a longer period compared to chemical fertilizers.

• Environmental Impact: By converting farm waste into compost, farmers can reduce methane emissions that would otherwise occur if the waste were left to rot in landfills.

• Soil Health: Regular application of compost increases the Cation Exchange Capacity (CEC) of the soil, which helps the soil retain nutrients more effectively.

Q21. Answer: (d) Sodium hydrogen carbonate

The correct answer is Sodium hydrogen carbonate.

Key Points

• Sodium hydrogen carbonate, commonly known as baking soda, is a chemical compound with the formula $NaHCO_3$. It is also frequently referred to as sodium bicarbonate.

• It is a white crystalline solid, but it often appears as a fine powder. It is a salt composed of sodium cations (Na^+) and bicarbonate anions (HCO_3^-).

• The compound is amphoteric in nature, meaning it can react as both an acid and a base, although its aqueous solutions are mildly alkaline with a pH of around 8.3.

• In the food industry, it is primarily used as a leavening agent. When it reacts with acidic components (like vinegar or lemon juice) or is exposed to heat, it releases carbon dioxide gas (CO_2), which causes dough to rise and expands the internal structure of baked goods.

• It is manufactured on a large scale using the Solvay process, which utilizes sodium chloride (brine), ammonia, and carbon

dioxide as raw materials. Hence, option 4 is correct.

Additional Information

• Sodium Carbonate (Na_2CO_3):

• Known as washing soda or soda ash, it is used in the manufacture of glass, soap, and paper.

• It is also used for removing the permanent hardness of water. Hence, option 3 is incorrect.

• Sodium Hydroxide (NaOH):

• Commonly known as caustic soda, it is a strong alkaline base.

• It is used in petroleum refining, soap making, and as a degreaser in industrial cleaning. Hence, option 1 is incorrect.

• Sodium Sulphate (Na_2SO_4):

• Also known as thenardite (mineral form) or Glauber's salt (decahydrate form).

• It is used extensively in the textile industry and in the production of detergents and kraft paper. Hence, option 2 is incorrect.

• Medicinal Uses:

• Baking soda is used as an antacid to treat acid indigestion and heartburn because it can neutralize excess hydrochloric acid in the stomach.

• It is also used in soda-acid fire extinguishers, where it reacts with an acid to produce a stream of CO_2 that displaces oxygen and cools the fire.

Important Points

• Decomposition: When heated above 50°C, sodium hydrogen carbonate gradually decomposes into sodium carbonate, water, and carbon dioxide.

• Chemical Reaction: The reaction for baking is $2NaHCO_3 \rightarrow Na_2CO_3 + H_2O + CO_2$.

• Discovery: The first refined form of sodium bicarbonate was produced in 1791 by French chemist Nicolas Leblanc, although the modern Solvay process replaced it in the 1860s.

Q22. Answer: (d) Neurons lack a nucleus.

The correct answer is Neurons lack a nucleus.

Key Points

• Neurons, also known as nerve cells, are the structural and functional units of the nervous system. They are specialized to transmit information throughout the body via electrical and chemical signals.

• A typical neuron is composed of three distinct structural regions: the cell body (soma), dendrites, and an axon. Hence, statement 2 is correct.

• Dendrites are the highly branched, short cytoplasmic extensions of the cell body. Their primary function is to receive incoming signals or stimuli from other neurons or the environment and transmit them toward the cell body. Hence, statement 3 is correct.

• The axon is a single, long, tube-like projection that arises from the cell body at a region called the axon hillock. It is responsible for sending electrical impulses (action potentials) out and away from the cell body to other neurons, muscles, or glands. Hence, statement 1 is correct.

• Neurons are eukaryotic cells and, like other animal cells, they possess a well-defined nucleus located within the cell body. The nucleus contains the cell's DNA and coordinates vital cellular functions such as protein synthesis and growth. Hence, statement 4 is incorrect.

• Hence, the correct answer is Neurons lack a nucleus.

Additional Information

• Cell Body (Soma):

• The soma is the metabolic center of the neuron.

• In addition to the nucleus, it contains organelles such as mitochondria for energy production and Nissl granules (groups of ribosomes and rough endoplasmic reticulum) for protein synthesis.

• Axon Structure and Myelin:

• Many axons are encased in a fatty insulating layer called the myelin sheath, which is formed by Schwann cells in the Peripheral Nervous System (PNS) and Oligodendrocytes in the Central Nervous System (CNS).

• The gaps between the myelin segments are known as the Nodes of Ranvier, which facilitate the rapid "saltatory" conduction of nerve impulses.

• Synapse and Neurotransmission:

• The terminal end of an axon splits into several axon terminals, which end in bulb-like structures called synaptic knobs.

• Information is passed from the axon terminal of one neuron to the dendrite of another through a gap called a synapse using chemical messengers called neurotransmitters (e.g., Acetylcholine, Dopamine).

Important Points

• Types of Neurons:

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• Sensory (Afferent) Neurons: Carry impulses from sensory receptors (like skin or eyes) toward the CNS.

• Motor (Efferent) Neurons: Carry impulses from the CNS to effectors like muscles and glands to trigger a response.

• Interneurons (Association Neurons): Located entirely within the CNS, they connect sensory and motor neurons and process information.

• Unipolar, Bipolar, and Multipolar:

• Multipolar neurons have one axon and multiple dendrites; these are the most common type in the human brain and spinal cord.

• Bipolar neurons have one axon and one dendrite and are found in specialized sensory organs like the retina of the eye.

• Unipolar neurons have a single process extending from the cell body and are typically found in the embryonic stage or sensory ganglia.

Q23. Answer: (c) Isobutane

The correct answer is Isobutane.

Key Points

• Hydrocarbons are organic compounds consisting entirely of carbon and hydrogen. Based on the arrangement of carbon atoms, they are categorized into straight-chain, branched-chain, or cyclic structures.

• Isobutane, also known as 2-methylpropane, is the simplest alkane containing a branched chain. It has the molecular formula C4H10.

• In Isobutane, the carbon skeleton is not a continuous line; instead, it features a central carbon atom bonded to three other methyl groups. Hence, the correct answer is Isobutane.

• Butane (or n-butane) is a straight-chain hydrocarbon where all four carbon atoms are linked in a continuous sequence without any branching.

• Methane (CH4) contains only one carbon atom, and Ethene (C2H4) contains only two carbon atoms; neither can form a branched chain because branching requires a minimum of four carbon atoms in saturated hydrocarbons.

Additional Information

• Structural Isomerism: This is a phenomenon where molecules have the same molecular formula but different structural arrangements. Butane and Isobutane are structural isomers because both share the formula C4H10 but differ in their connectivity.

• Physical Properties: Branching significantly affects physical properties. For example, Isobutane has a lower boiling point (approximately -11.7°C) compared to n-Butane (-0.5°C) because the branched shape reduces the surface area, leading to weaker Van der Waals forces.

• IUPAC Nomenclature: According to IUPAC rules, the longest chain in Isobutane is three carbons long (propane), with a methyl group (-CH3) attached to the second carbon, resulting in the name 2-methylpropane.

• Industrial Uses: Isobutane is commonly used as a refrigerant (known as R-600a) and as a propellant in aerosol cans due to its low environmental impact compared to chlorofluorocarbons (CFCs).

• Saturated vs. Unsaturated: Alkanes like butane and isobutane are saturated hydrocarbons (only single bonds), whereas Ethene is an unsaturated hydrocarbon containing a double bond between carbon atoms.

Important Points

• The number of isomers increases as the number of carbon atoms in a hydrocarbon increases. While Butane has only 2 isomers, Pentane (C5H12) has 3, and Decane (C10H22) has 75 possible structural isomers.

• Tertiary Carbon: Isobutane is notable for having a tertiary carbon atom, which is a carbon atom bonded to three other carbon atoms. This structural feature is a hallmark of branching.

• Octane Rating: In the petroleum industry, branched-chain hydrocarbons are highly valued because they burn more smoothly in internal combustion engines, contributing to a higher octane rating compared to straight-chain hydrocarbons.

Q24. Answer: (c) 10

The correct answer is 10.

Key Points

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

• Since the question states the atomic number is 10, the number of protons must also be 10. This is a direct one-to-one relationship defined by the laws of chemistry.

• The element with atomic number 10 is Neon (Ne), which is a member of the noble gas family.

• In a neutral atom, the number of protons is always equal to the number of electrons. Therefore, a neutral atom of Neon possesses 10 protons and 10 electrons.

• The identity of an element is determined solely by its atomic number; changing the number of protons would change the element itself.

Additional Information

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• Mass Number (A):

• The mass number is the sum of the total number of protons and neutrons in the nucleus of an atom.

• For the most abundant isotope of Neon, the mass number is 20, meaning it contains 10 protons and 10 neutrons.

• Subatomic Particles:

• Proton: Discovered by Ernest Rutherford, it carries a positive charge of +1 unit and has a mass of approximately 1.672 x 10^-27 kg.

• Electron: Discovered by J.J. Thomson in 1897, it carries a negative charge of -1 unit and orbits the nucleus.

• Neutron: Discovered by James Chadwick in 1932, it is electrically neutral and resides within the nucleus along with protons.

• Neon (Ne) Characteristics:

• Neon is located in Group 18 (Noble Gases) and Period 2 of the Modern Periodic Table.

• It was discovered in 1898 by Sir William Ramsay and Morris Travers in London.

• It is chemically inert because it has a full valence shell of 8 electrons (electronic configuration 2, 8).

Important Points

• Atomic Number vs Atomic Mass:

• The Modern Periodic Law, proposed by Henry Moseley in 1913, states that the properties of elements are a periodic function of their atomic numbers, not their atomic weights.

• This classification corrected anomalies in Mendeleev's Periodic Table.

• Isotopes and Ions:

• Isotopes are atoms of the same element that have the same atomic number (protons) but different mass numbers (neutrons). Neon has three stable isotopes: Ne-20, Ne-21, and Ne-22.

• In Ions, the number of electrons changes (lost or gained), but the number of protons remains strictly constant to maintain the element's identity.

• Uses of Neon:

• It is widely used in advertising signs (neon lights), high-voltage indicators, lightning arresters, and gas lasers.

• Liquid neon is used as a commercial cryogenic refrigerant because its refrigerating capacity is over 40 times that of liquid helium.

Q25. Answer: (a) 13.3 m/s²

The correct answer is 13.3 m/s².

Key Points

• According to Newton's Second Law of Motion, the force (F) acting on an object is equal to the product of its mass (m) and its acceleration (a), expressed by the formula F = ma.

• For the first mass m1, the given force is 10 N and the acceleration produced is 20 m/s². By rearranging the formula to m = F/a, we find that m1 = 10 / 20 = 0.5 kg.

• For the second mass m2, the same force of 10 N produces an acceleration of 40 m/s². Using the formula, we find that m2 = 10 / 40 = 0.25 kg.

• When both masses are tied together, they act as a single system with a combined mass M. Therefore, the total mass M = m1 + m2 = 0.5 kg + 0.25 kg = 0.75 kg.

• To find the new acceleration a produced by the same 10 N force on the combined mass, we use a = F / M. Calculating this gives a = 10 / 0.75 = 13.33 m/s². Hence, the resulting acceleration is approximately 13.3 m/s².

Additional Information

• Newton's Second Law of Motion: This fundamental law of Classical Mechanics states that the rate of change of momentum of a body is directly proportional to the applied force and takes place in the direction in which the force acts. It provides the quantitative definition of force.

• Force (F): It is a vector quantity measured in Newtons (N). One Newton is the amount of force required to accelerate a 1 kg mass at a rate of 1 m/s².

• Mass (m): Mass is a scalar quantity representing the amount of matter in an object and is a measure of its inertia. The SI unit for mass is the kilogram (kg).

• Acceleration (a): Acceleration is the rate at which an object changes its velocity. It is a vector quantity measured in meters per second squared (m/s²). If the force remains constant, the acceleration is inversely proportional to the mass of the object.

• Inertia: This is the inherent property of an object to resist any change in its state of rest or uniform motion. Greater mass implies greater inertia, meaning a larger force is required to achieve the same acceleration.

Important Points

• Consistent Units: When solving physics problems, it is crucial to ensure all units are in the SI system (Newtons, Kilograms, Meters, Seconds) to avoid calculation errors.

• Force-Mass Relationship: If multiple masses are combined and the same force is applied, the acceleration will always decrease

compared to the acceleration of the individual masses because the total inertia of the system has increased.

• Linear Relationship: The relationship F = ma assumes that the mass remains constant during the motion, which is true for most non-relativistic macroscopic calculations.

Q26. Answer: (d) 32%

Shortcut Trick

Successive percentage change formula: Net Change = a + b + (a × b) ÷ 100.

Here, markup a = 76% and discount b = −25%.

Profit% = 76 − 25 − (76 × 25) ÷ 100.

Profit% = 51 − (1900 ÷ 100) = 51 − 19 = 32%.

Therefore The correct answer is 32%.

Alternate Method

Given: Marked Price (MP) is 76% more than Cost Price (CP). Discount is 25%.

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 + 76% of 100 = 176.

=> Selling Price (SP) = MP − 25% of MP = 176 − (25 ÷ 100 × 176).

=> SP = 176 − 44 = 132.

=> Profit = SP − CP = 132 − 100 = 32.

=> Profit% = (32 ÷ 100) × 100 = 32%.

Therefore The correct answer is 32%.

Additional Information

Marked Price and Discount

The price listed on the product is the Marked Price. Discount is always calculated on the MP to arrive at the Selling Price.

Profit and Markup

Markup is the increase over CP to set MP. Profit is the actual gain over CP after selling. Profit% = Markup% − Discount% − (Markup% × Discount% ÷ 100).

Q27. Answer: (a) a=0,b=0

Shortcut Trick

For a number to be divisible by 3, the sum of its digits must be divisible by 3.

Sum = 4 + a + 2 + b = 6 + a + b.

Since 6 is already divisible by 3, (a + b) must be 0, 3, 6, or 9.

Checking options: (0+0)=0 (Yes), (3+1)=4 (No), (2+0)=2 (No), (0+1)=1 (No).

Therefore The correct answer is a=0,b=0.

Alternate Method

Given: The number 4a2b is divisible by 3.

Property: A number is divisible by 3 if ∑ digits ÷ 3 leaves remainder 0.

=> Sum = 4 + a + 2 + b = 6 + a + b

=> For divisibility, (6 + a + b) mod 3 = 0

=> Let's test Option 1: a = 0, b = 0 => Sum = 6 + 0 + 0 = 6 (Divisible by 3)

=> Let's test Option 2: a = 3, b = 1 => Sum = 6 + 3 + 1 = 10 (Not divisible)

=> Let's test Option 3: a = 2, b = 0 => Sum = 6 + 2 + 0 = 8 (Not divisible)

=> Let's test Option 4: a = 0, b = 1 => Sum = 6 + 0 + 1 = 7 (Not divisible)

Therefore The correct answer is a=0,b=0.

Additional Information

Divisibility Rule of 9

Similar to 3, a number is divisible by 9 if the sum of its digits is divisible by 9.

Divisibility Rule of 3

If the sum of digits is a multiple of 3, the whole number is divisible by 3.

Divisibility Rule of 6

A number is divisible by 6 if it is divisible by both 2 (even number) and 3 (sum of digits rule).

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Q28. Answer: (c) 100:31

Shortcut Trick

Initial population = 100%

After 38% left, Remaining = 62%

After 50% of remaining left, Final = 62% × (1/2) = 31%

Ratio = Initial : Present = 100 : 31

Therefore The correct answer is 100:31.

Alternate Method

Given:

Initial Population = P

Population left due to water crisis = 38%

Remaining Population = 100% − 38% = 62%

Population left for jobs = 50% of 62%

Present Population = 1550

=> Present Population = 62% × (100% − 50%) of Initial

=> Present Population = 62% × 50% = 31% of Initial

=> Ratio = Initial : Present = 100% : 31%

=> Ratio = 100 : 31

Therefore The correct answer is 100:31.

Additional Information

Successive Percentage Change

When a value is changed by x% and then by y% successively, the final value is Initial × (1 ± x/100) × (1 ± y/100).

Remaining Value Concept

If a% is removed from a total, the remainder is (100 − a)% of the total. Always apply the second percentage on this remainder.

Ratio of Initial to Final

Ratio = 1 : [(1 − r1) × (1 − r2)] where r is the rate of decrease in decimal form.

Q29. Answer: (c) 20 cm

Shortcut Trick

Volume of Cube = 10^3 = 1000 cm^3.

Product of Cuboid ratio parts (1 : 2 : 4) = 1 × 2 × 4 = 8.

Volume per unit cube = 1000 ÷ 8 = 125.

Scale factor (x) = $\sqrt[3]{125}$ = 5.

Longest side = 4 units = 4 × 5 = 20 cm.

Therefore The correct answer is 20 cm.

Alternate Method

Given:

Side of the cube (a) = 10 cm

Ratio of cuboid dimensions (l : b : h) = 4 : 2 : 1 (Let sides be 4x, 2x, and x)

Formula Used:

Volume of Cube = a^3

Volume of Cuboid = length × breadth × height

Calculations:

=> Volume of cube = 10 × 10 × 10 = 1000 cm^3

=> Volume of cuboid = (4x) × (2x) × (x) = $8x^3$

=> According to the question: $8x^3$ = 1000

=> x^3 = 1000 ÷ 8

=> x^3 = 125

=> x = $\sqrt[3]{125}$ = 5 cm

=> Dimensions of the cuboid are:

=> Length = 4 × 5 = 20 cm

=> Breadth = 2 × 5 = 10 cm

=> Height = 1 × 5 = 5 cm

=> The longest side is 20 cm.

Therefore The correct answer is 20 cm.

Additional Information

Total Surface Area of a Cuboid

The total surface area is calculated as 2(lb + bh + hl), where l, b, and h are length, breadth, and height respectively.

Diagonal of a Cuboid

The longest rod that can be placed inside a cuboid is its diagonal, given by $\sqrt{(l^2 + b^2 + h^2)}$.

Volume and Area of a Cube

For a cube with side 'a', Volume = a^3 and Total Surface Area = $6a^2$.

Q30. Answer: (c) 25 m/s

Shortcut Trick

Total distance to cross = Sum of lengths of both trains = 350 + 350 = 700 m.

Relative speed (opposite direction) = Sum of individual speeds = 700 ÷ 14 = 50 m/s.

Since speeds are equal, speed of each train = 50 ÷ 2 = 25 m/s.

Therefore The correct answer is 25 m/s.

Alternate Method

Given: Length of each train = 350 m, Time taken = 14 seconds, Opposite directions, Speeds are equal.

Formula Used: Relative Speed = (L1 + L2) ÷ Time

Let the speed of each train be v m/s.

=> Relative speed in opposite direction = v + v = 2v

=> Total Distance = Length of Train 1 + Length of Train 2 = 350 + 350 = 700 m

=> Time = 14 seconds

=> 2v = 700 ÷ 14

=> 2v = 50

=> v = 25 m/s

Therefore The correct answer is 25 m/s.

Additional Information

Relative Speed Concept

When two objects move in opposite directions, their relative speed is the sum of their individual speeds (S1 + S2). If moving in the same direction, the relative speed is the difference (|S1 − S2|).

Speed Conversion

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

Train Crossing Objects

To cross a stationary pole or man, distance = length of train. To cross a platform or another train, distance = length of train + length of object/train.

Q31. Answer: (b) Rs. 460

Shortcut Trick

Total amount to be divided after deductions = 1404 − (47 + 26 + 29) = 1302.

New ratio = 10 : 14 : 18 → Total units = 10 + 14 + 18 = 42 units.

1 unit = 1302 ÷ 42 = 31.

Vidya's share (after deduction) = 14 × 31 = 434.

Actual share of Vidya = 434 + 26 = 460.

Therefore The correct answer is Rs. 460.

Alternate Method

Given: Total amount = Rs. 1,404. Deductions = Rs. 47, Rs. 26, and Rs. 29. New ratio = 10 : 14 : 18.

Formula Used: Adjusted Total = Total − Sum of Deductions; Individual Share = (Ratio part ÷ Total parts) × Adjusted Total + Deduction.

=> Total Deductions = 47 + 26 + 29 = 102

=> Remaining amount = 1404 − 102 = 1302

=> Sum of ratio parts = 10 + 14 + 18 = 42

=> Vidya's share after deduction = (14 ÷ 42) × 1302

=> Vidya's share after deduction = (1 ÷ 3) × 1302 = 434

=> Actual share of Vidya = 434 + 26 = 460

Therefore The correct answer is Rs. 460.

Additional Information

Ratio and Proportion

If a quantity A is divided in ratio x : y, then the parts are (x / (x+y)) × A and (y / (x+y)) × A.

Deduction problems

Always subtract the fixed deductions from the total before applying the ratio, then add the respective deduction back to find the original amount.

Q32. Answer: (a) 1,68,750

Shortcut Trick

Total Votes = 3,75,000

Valid Votes = 75% of 3,75,000

Other candidate % of valid votes = 100% − 40% = 60%

Required Votes = 3,75,000 × 0.75 × 0.60 = 3,75,000 × 0.45

Therefore The correct answer is 1,68,750.

Alternate Method

Given:

Total Votes = 3,75,000

Invalid Votes = 25%

Candidate 1 = 40% of valid votes

=> Valid Votes = 3,75,000 − (25% of 3,75,000)

=> Valid Votes = 3,75,000 × (75/100) = 2,81,250

=> Candidate 2 % of valid votes = 100% − 40% = 60%

=> Candidate 2 Votes = 2,81,250 × (60/100)

=> Candidate 2 Votes = 2,81,250 × 0.6 = 1,68,750

Therefore The correct answer is 1,68,750.

Additional Information

Percentage Change

To find the percentage of a remaining value, multiply the total by the product of remaining percentage fractions: Final = Total × (1 − r1) × (1 − r2).

Election Problems

Always identify the base for percentages: whether it is % of Total Votes, Enrolled Voters, or Valid Votes.

Valid vs Invalid

Valid Votes = Total Votes − (Invalid Votes + Votes not cast).

Q33. Answer: (c) 25/4

Shortcut Trick

We know that $1 + \tan^2 A = \sec^2 A$.

The expression $4 + 4\tan^2 A$ can be written as $4(1 + \tan^2 A) = 4\sec^2 A$.

Since sec A = 1/cos A, then sec A = 5/4.

=> $4 \times (5/4)^2 = 4 \times 25/16 = 25/4$.

Therefore The correct answer is 25/4.

Alternate Method

Given: cos A = 4/5 (Base/Hypotenuse)

Formula Used: $\sin^2 A + \cos^2 A = 1$ OR tan A = Perpendicular/Base

=> In a right-angled triangle, if Base = 4 and Hypotenuse = 5, then Perpendicular = $\sqrt{(5^2 - 4^2)} = 3$.

=> tan A = Perpendicular / Base = 3/4.

=> Value to find = $4 + 4(3/4)^2$

=> $4 + 4(9/16) = 4 + 9/4$

=> (16 + 9) / 4 = 25/4.

Therefore The correct answer is 25/4.

Additional Information

Trigonometric Identities

Standard Pythagorean identities: $\sin^2\theta + \cos^2\theta = 1$; $1 + \tan^2\theta = \sec^2\theta$; $1 + \cot^2\theta = \operatorname{cosec}^2\theta$.

Reciprocal Relations

$\sec\theta = 1/\cos\theta$, $\operatorname{cosec}\theta = 1/\sin\theta$, and $\cot\theta = 1/\tan\theta$.

Pythagorean Triplets

Common sets of integers satisfying $a^2 + b^2 = c^2$ like (3, 4, 5), (5, 12, 13), and (8, 15, 17) help in rapid calculation.

Q34. Answer: (a) 24

Shortcut Trick

The age difference between two people always remains constant (12 years).

6 years ago, the ratio of Sneha to Aryan was 3 : 1.

Difference in ratio parts = 3 − 1 = 2 units → 12 years.

1 unit = 6 years Therefore Sneha's age 6 years ago = 3 × 6 = 18 years.

Present age of Sneha = 18 + 6 = 24 years.

Therefore The correct answer is 24 years.

Alternate Method

Given: Difference in ages = 12 years; 6 years ago, Sneha = 3 × Aryan.

Let Aryan's age 6 years ago be x.

Then Sneha's age 6 years ago = 3x.

=> 3x − x = 12

=> 2x = 12

=> x = 6

=> Sneha's age 6 years ago = 3 × 6 = 18 years.

=> Sneha's present age = 18 + 6 = 24 years.

Therefore The correct answer is 24 years.

Additional Information

Constant Age Difference

The numerical difference between the ages of two persons remains the same at any point in time (past, present, or future).

Ratio and Proportionality

If a ratio changes over time, equate the difference in ratio parts to the actual constant age difference to find the value of one unit.

Q35. Answer: (d) 13

Shortcut Trick

Take 2^(x−1) common

$2^{(x-1)}(1 + 2^2) = 160$

=> $2^{(x-1)} \times 5 = 160$ => $2^{(x-1)} = 32$

$32 = 2^5$ => $x - 1 = 5$ => $x = 6$

Therefore Answer = 2x + 1 = 13

Alternate Method

Given:

$2^{(x-1)} + 2^{(x+1)} = 160$

Formula used:

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

Calculation:

=> $2^{(x+1)} = 2^{(x-1)} \times 2^2$

=> So equation becomes:

=> $2^{(x-1)} + 4 \times 2^{(x-1)} = 160$

=> $5 \times 2^{(x-1)} = 160$

=> $2^{(x-1)} = 32$

=> $32 = 2^5$

=> x − 1 = 5 => x = 6
=> Required value = 2x + 1 = 2×6 + 1 = 13
Therefore The correct answer is 13.
Additional Information
Laws of Exponents
a^m × aⁿ = a^(m+n)
Common Factor Method
Take common terms to simplify exponential equations
Power Equality
If bases are same, equate powers
Standard Powers
2^5 = 32, useful for quick solving

Q36. Answer: (c) 105

Shortcut Trick
Since the distance segments are equal (300 km each), use the harmonic mean formula for average speed.
Average Speed = [2 × S1 × S2] ÷ [S1 + S2]
60 = [2 × 42 × S2] ÷ [42 + S2]
60 × (42 + S2) = 84 × S2 => 2520 + 60S2 = 84S2 => 24S2 = 2520
S2 = 2520 ÷ 24 = 105 km/hr.
Therefore The correct answer is 105 km/hr.
Alternate Method
Given: Total Distance = 600 km, Average Speed = 60 km/hr, First 300 km Speed = 42 km/hr.
Formula Used: Total Time = Total Distance ÷ Average Speed
=> Total Time required = 600 ÷ 60 = 10 hours
=> Time spent for first 300 km = 300 ÷ 42 = 50 ÷ 7 hours
=> Remaining Time = 10 − (50 ÷ 7) = (70 − 50) ÷ 7 = 20 ÷ 7 hours
=> Required speed for remaining 300 km = 300 ÷ (20 ÷ 7)
=> Speed = (300 × 7) ÷ 20 = 15 × 7 = 105 km/hr
Therefore The correct answer is 105 km/hr.
Additional Information
Average Speed (Equal Distances)
When a journey is divided into 2 equal distances with speeds x and y, the average speed is 2xy ÷ (x + y).
Average Speed (Equal Time)
When a journey is divided into 2 equal time intervals with speeds x and y, the average speed is (x + y) ÷ 2.
General Average Speed Formula
Average Speed = Total Distance Covered ÷ Total Time Taken.

Q37. Answer: (b) 11

Shortcut Trick
Extra runs scored above the previous average = 209 − 51 = 158.
Increase in average = Extra runs ÷ Total innings = 158 ÷ 15.
Increase = 10.53.
Rounding 10.53 to the nearest whole number gives 11.
Therefore The correct answer is 11.
Alternate Method
Given: Average of 14 innings = 51 | 15^(th) inning score = 209.
Formula: New Average = (Old Sum + New Score) ÷ New Number of Innings.
=> Total runs in 14 innings = 14 × 51 = 714.
=> Total runs after 15 innings = 714 + 209 = 923.
=> New average = 923 ÷ 15 = 61.533...
=> Increase in average = 61.533 − 51 = 10.533...

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=> Nearest whole number = 11.
Therefore The correct answer is 11.
Additional Information
Average Formula
Average = Total Sum of Observations ÷ Total Number of Observations.
Net Deviation Rule
If a new value is added, the change in average = (New Value − Old Average) ÷ New Total Count.
Rounding Rules
For nearest whole number, if the decimal part is 0.5 or more, round up; if less than 0.5, round down.

Q38. Answer: (c) $2x^2 + 2x$

Shortcut Trick
Identify like terms in the expression, which are terms with the same variable and power.
The like terms are x^2 and x^2.
Combine them by adding their coefficients: $1x^2 + 1x^2 = 2x^2$.
The remaining term 2x stays as it is since it has no other matching term.
Therefore The correct answer is $2x^2 + 2x$.
Alternate Method
Given: $x^2 + 2x + x^2$
To simplify an algebraic expression, we group terms with the same degree (power).
=> $(x^2 + x^2) + 2x$
=> $2x^2 + 2x$
The expression is now in its simplest form because x^2 and x are not like terms.
Therefore The correct answer is $2x^2 + 2x$.
Additional Information
Like Terms
Terms that have the same variables raised to the same exponents. Only these terms can be added or subtracted together.
Coefficients and Variables
In a term like $2x^2$, 2 is the coefficient and x is the variable.
Degree of Polynomial
The degree is the highest power of the variable in the polynomial. For $2x^2 + 2x$, the degree is 2 (quadratic).

Q39. Answer: (b) 54

Shortcut Trick
Sum of digits = 15
Difference of digits = 3
Greater digit = (Sum + Difference) ÷ 2 = (15 + 3) ÷ 2 = 9
Smaller digit = (Sum − Difference) ÷ 2 = (15 − 3) ÷ 2 = 6
Product = 9 × 6 = 54
Therefore The correct answer is 54.
Alternate Method
Given: Sum of two digits = 15, Difference = 3.
Formula Used: Product = Digit1 × Digit2
Let the digits be x and y, where x > y.
=> x + y = 15
=> x − y = 3
=> Adding both equations: 2x = 18 => x = 9
=> Substituting x in first equation: 9 + y = 15 => y = 6
=> Product of digits = 9 × 6 = 54
Therefore The correct answer is 54.
Additional Information
Sum and Difference of Numbers

If the sum (S) and difference (D) of two numbers are known, the larger number is (S+D)/2 and the smaller number is (S−D)/2.

Number Representation

A two-digit number with tens digit 't' and units digit 'u' is expressed as 10t + u.

Sum of Digits Rule

The sum of digits is used in divisibility tests for 3 and 9; a number is divisible by 9 if the sum of its digits is divisible by 9.

Q40. Answer: (a) 3

Shortcut Trick

The mode is defined as the value that appears most frequently in a given data set.

In the given observations, identify the frequency of each number:

Number 3 appears 5 times (at positions 1, 5, 11, 14, 17).

Number 4 appears 3 times (at positions 2, 3, 16).

All other numbers (1, 2, 5, 6, 7, 8, 9) appear fewer than 3 times.

Therefore The correct answer is 3.

Alternate Method

Given: Observations = 3, 4, 4, 7, 3, 6, 2, 2, 6, 1, 3, 5, 9, 3, 8, 4, 3.

To find the mode, we construct a frequency distribution table:

=> Observation 1: Frequency = 1

=> Observation 2: Frequency = 2

=> Observation 3: Frequency = 5

=> Observation 4: Frequency = 3

=> Observation 5: Frequency = 1

=> Observation 6: Frequency = 2

=> Observation 7: Frequency = 1

=> Observation 8: Frequency = 1

=> Observation 9: Frequency = 1

=> The observation with the maximum frequency is 3.

Therefore The correct answer is 3.

Additional Information

Measures of Central Tendency

Mean is the average of all observations. Median is the middle value when data is arranged in ascending/descending order. Mode is the most frequent value.

Empirical Relationship

For a moderately skewed distribution: 3 × Median = Mode + 2 × Mean.

Types of Mode

A data set can have one mode (unimodal), two modes (bimodal), or multiple modes (multimodal). If no value repeats, there is no mode.

Q41. Answer: (a) 12

Shortcut Trick

Let A take x hours. Then B takes x + 12 hours.

Combined time formula: (x × (x + 12)) ÷ (x + (x + 12)) = 8.

Check options: If x = 12, then (12 × 24) ÷ (12 + 24) = 288 ÷ 36 = 8 hours.

The condition is satisfied perfectly with 12.

Therefore The correct answer is 12 hours.

Alternate Method

Given:

Time taken by (A + B) = 8 hours

Let time taken by Pipe A = t hours

Time taken by Pipe B = (t + 12) hours

Formula Used:

1/A + 1/B = 1/Total Time

Calculations:

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=> 1/t + 1/(t + 12) = 1/8

=> (t + 12 + t) / (t(t + 12)) = 1/8

=> (2t + 12) / (t^2 + 12t) = 1/8

=> 8(2t + 12) = t^2 + 12t

=> 16t + 96 = t^2 + 12t

=> t^2 − 4t − 96 = 0

=> t^2 − 12t + 8t − 96 = 0

=> t(t − 12) + 8(t − 12) = 0

=> (t − 12)(t + 8) = 0

=> t = 12 (as time cannot be negative)

Therefore The correct answer is 12 hours.

Additional Information

Pipes and Cisterns Efficiency

The rate of work done by a pipe is inversely proportional to the time taken. If a pipe fills a tank in x hours, its efficiency is 1/x per hour.

Inlet and Outlet Pipes

Inlet pipes do positive work (addition), while outlet/leakage pipes do negative work (subtraction) in the net efficiency calculation.

Time and Work Relation

The basic concept of Pipes and Cisterns is identical to Time and Work, where pipes are treated as workers and the tank capacity as total work.

Q42. Answer: (a) Rs. 10,000

Shortcut Trick

Savings % = 100% − Spending % = 100% − 75% = 25%.

Monthly Savings = 25% of Rs. 40,000.

Monthly Savings = (1/4) × 40,000 = Rs. 10,000.

Therefore The correct answer is Rs. 10,000.

Alternate Method

Given:

Monthly Income = Rs. 40,000

Expenditure Percentage = 75%

Formula Used:

Savings = Income − Expenditure

Calculations:

=> Expenditure = 75% of 40,000

=> Expenditure = (75/100) × 40,000

=> Expenditure = 0.75 × 40,000 = Rs. 30,000

=> Savings = 40,000 − 30,000

=> Savings = Rs. 10,000

Therefore The correct answer is Rs. 10,000.

Additional Information

Percentage Change

Income, Expenditure, and Savings are related as: Income = Expenditure + Savings. If any two are changed by a certain %, the third can be found using the same linear relation.

Base Value Concept

In income-based problems, the Income is always considered as the Base (100%) unless specified otherwise.

Fractional Equivalents

Using fractions speeds up calculations: 75% = 3/4, 25% = 1/4, 50% = 1/2, 20% = 1/5.

Q43. Answer: (c) Rs. 300

Shortcut Trick

Loss of 20% means the Selling Price (SP) is 80% of the Cost Price (CP).

Using the unitary method: 80% => Rs. 240.

1% => 240 ÷ 80 = Rs. 3.
100% (CP) => 3 × 100 = Rs. 300.
Therefore The correct answer is Rs. 300.
Alternate Method
Given: Selling Price (SP) = Rs. 240, Loss% = 20%.
Formula: CP = [SP × 100] ÷ [100 − Loss%]
=> CP = [240 × 100] ÷ [100 − 20]
=> CP = [24000] ÷ 80
=> CP = 300
Therefore The correct answer is Rs. 300.
Additional Information
Cost Price & Selling Price
The price at which an article is purchased is Cost Price (CP), and the price at which it is sold is Selling Price (SP).
Loss Calculation
When SP < CP, there is a loss. Loss = CP − SP and Loss% = (Loss ÷ CP) × 100.

Q44. Answer: (c) 2 minutes

Shortcut Trick
Net efficiency = Filling efficiency − Emptying efficiency
Efficiency of Pipe 1 = 12 ÷ 3 = 4 units/min
Efficiency of Pipe 2 = 12 ÷ 12 = 1 unit/min
Combined efficiency = 4 − 1 = 3 units/min
Time to fill half tank (6 units) = 6 ÷ 3 = 2 minutes
Therefore The correct answer is 2 min.
Alternate Method
Given:
Filling time of Pipe A = 3 minutes
Emptying time of Pipe B = 12 minutes
Formula Used:
Total Work = LCM of individual times; Efficiency = Total Work ÷ Time

Pipe	Time (min)	Total Capacity (LCM)	Efficiency
Pipe A (Fill)	3	12 units	+4
Pipe B (Empty)	12	−1	

Calculations:
=> Total capacity of the tank = 12 units
=> Half of the tank capacity = 12 ÷ 2 = 6 units
=> Combined efficiency of (A + B) = 4 − 1 = 3 units/min
=> Time taken to fill half tank = 6 ÷ 3
=> Time = 2 minutes
Therefore The correct answer is 2 min.
Additional Information
Net Work Done
When one pipe fills and another empties, the net work per unit time is the difference of their efficiencies: (1/x − 1/y).
Pipes and Cisterns Logic
Filling pipes have positive efficiency while emptying pipes (leakage) have negative efficiency.
Fractional Work
To find time for a fraction of work, multiply the Total Work by that fraction before dividing by the combined efficiency.

Q45. Answer: (a) Rs. 80,000

Shortcut Trick
Effective discount = a + b − (a × b ÷ 100) = 20 + 25 − (20 × 25 ÷ 100) = 45 − 5 = 40%.

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If Marked Price (MP) is 100%, then Selling Price (SP) = 100% − 40% = 60%.
Given 60% = Rs. 48,000.
Therefore, 100% = (48,000 ÷ 60) × 100 = 800 × 100 = Rs. 80,000.
Therefore The correct answer is Rs. 80,000.
Alternate Method
Given → Selling Price (SP) = Rs. 48,000 | Discount 1 (d1) = 20% | Discount 2 (d2) = 25%.
Formula: SP = MP × (100 − d1)/100 × (100 − d2)/100
=> 48,000 = MP × (80/100) × (75/100)
=> 48,000 = MP × (4/5) × (3/4)
=> 48,000 = MP × (3/5)
=> MP = (48,000 × 5) ÷ 3
=> MP = 16,000 × 5 = 80,000
Therefore The correct answer is Rs. 80,000.
Additional Information
Marked Price & Discount
The Marked Price (MP) is the price printed on the label. Discount is always calculated on the MP. SP = MP − Discount.
Successive Discount Formula
For two successive discounts of a% and b%, the single equivalent discount is (a + b − ab/100)%.

Q46. Answer: (a) 28

Shortcut Trick
Total days from 7 February to 21 April 2023 is 73 days.
73 days is exactly 1/5 of a year (73 ÷ 365 = 1/5).
Simple Interest = Principal × Rate × Time = 2000 × 7% × 1/5
SI = 20 × 7 ÷ 5 = 4 × 7 = 28
Therefore The correct answer is Rs. 28.
Alternate Method
Given:
Principal (P) = Rs. 2,000
Rate (R) = 7% per annum
Time Period: 7 February 2023 to 21 April 2023
Calculation of Time (T):
=> Number of days in February (28 − 7) = 21 days
=> Number of days in March = 31 days
=> Number of days in April = 21 days
=> Total Days = 21 + 31 + 21 = 73 days
=> Time in years (T) = 73 ÷ 365 = 1/5 years
Calculation of Simple Interest (SI):
=> Formula: SI = (P × R × T) ÷ 100
=> SI = (2000 × 7 × 1/5) ÷ 100
=> SI = (2000 × 7) ÷ (5 × 100)
=> SI = 14000 ÷ 500
=> SI = 28
Therefore The correct answer is Rs. 28.
Additional Information
Simple Interest Formula
SI = (P × R × T) ÷ 100, where P is Principal, R is Rate, and T is Time in years.
Day Counting Rule
While calculating interest for a period, the day on which money is deposited is usually excluded, and the day on which money is withdrawn is included.
Time Conversion
If time is given in days, divide by 365 (or 366 for a leap year) to convert it into years. Note that 73 days = 1/5 year, 146 days = 2/5

year, and 219 days = 3/5 year.

Q47. Answer: (b) 8.16%

Shortcut Trick

Since Area of a Square is side², the percentage error is calculated using the Successive Percentage formula.

Successive Change = x + y + (x × y) / 100

Here, x = 4% and y = 4% (as both sides increase by 4%).

Percentage Error in Area = 4 + 4 + (4 × 4) / 100 = 8 + 0.16 = 8.16%.

Therefore The correct answer is 8.16%.

Alternate Method

Given:

Percentage error in side = 4%

Formula Used:

Area of a Square = side × side = (side)²

Percentage Error = [(Measured Value − Actual Value) / Actual Value] × 100

Calculations:

=> Let the actual side of the square be s = 100 units.

=> Actual Area = s² = 100 × 100 = 10,000 sq. units.

=> Measured side (4% more) = 100 + 4% of 100 = 104 units.

=> Measured Area = (104)² = 10,816 sq. units.

=> Error in Area = 10,816 − 10,000 = 816 sq. units.

=> Percentage Error in Area = (816 / 10,000) × 100

=> Percentage Error in Area = 8.16%.

Therefore The correct answer is 8.16%.

Additional Information

Successive Percentage Change

For two successive changes of a% and b%, the effective change is (a + b + ab/100)%. This applies to area calculations where dimensions are multiplied.

Error in Volume

For a cube, if the side error is x%, the volume error involves three successive changes: [(1 + x/100)³ − 1] × 100%.

Relative Error Rule

If Z = Aⁿ, then the relative error in Z is approximately n × (relative error in A), provided the error is very small (usually < 5%). For 4%, 2 × 4% = 8%, but exact calculation gives 8.16%.

Q48. Answer: (b) 4 m

Shortcut Trick

To find the maximum possible side length of a square tile with minimal wastage, calculate the Highest Common Factor (HCF) of the wall dimensions.

Dimensions: 36 m and 64 m

36 = 4 × 9

64 = 4 × 16

Common factor = 4

Therefore The correct answer is 4 m.

Alternate Method

Given:

Length of the rectangular wall (L) = 64 m

Width of the rectangular wall (W) = 36 m

Formula Used:

Side of the largest square tile = HCF(Length, Width)

Calculations:

=> Prime factorization of 36 = 2 × 2 × 3 × 3 = 2² × 3²

=> Prime factorization of 64 = 2 × 2 × 2 × 2 × 2 × 2 = 2^6

=> HCF (36, 64) = 2² = 4

=> Therefore, the maximum side length of each tile is 4 m.

Therefore The correct answer is 4 m.

Additional Information

Highest Common Factor (HCF)

The largest number that divides two or more numbers without leaving a remainder. It is used to find maximum size or equal distribution.

Number of Tiles Formula

Total number of tiles = (Area of wall) ÷ (Area of one tile) = (L × W) ÷ (Side²).

Least Common Multiple (LCM)

In contrast to HCF, LCM is used to find the minimum dimensions of a larger square that can be formed using smaller rectangular tiles.

Q49. Answer: (b) Rs. 2,50,670

Shortcut Trick

Ratio of Profit Share = Ratio of Investments.

Suman : Tariq : Neha = 1,71,000 : 24,000 : 1,05,000 = 171 : 24 : 105.

Simplify by dividing by 3: 57 : 8 : 35.

Total units = 57 + 8 + 35 = 100 units.

100 units = Rs. 7,16,200 => 1 unit = Rs. 7,162.

Neha share (35 units) = 35 × 7,162 = Rs. 2,50,670.

Therefore The correct answer is Rs. 2,50,670.

Alternate Method

Given: Investment of Suman (I_s) = Rs. 1,71,000, Tariq (I_t) = Rs. 24,000, Neha (I_n) = Rs. 1,05,000. Total Profit = Rs. 7,16,200.

Formulas: Profit Share Ratio = (I1 × T1) : (I2 × T2) : (I3 × T3). Since time (T) is same, Profit prop. to Investment.

=> Ratio of profits = 171,000 : 24,000 : 1,05,000

=> Dividing by 1000 = 171 : 24 : 105

=> Dividing by 3 = 57 : 8 : 35

=> Neha profit share = [35 ÷ (57 + 8 + 35)] × 7,16,200

=> Neha profit share = (35 ÷ 100) × 7,16,200

=> Neha profit share = 35 × 7,162 = 2,50,670

Therefore The correct answer is Rs. 2,50,670.

Additional Information

Partnership Principle

In a business partnership, if the time periods for investments are different, the profit is distributed in the ratio of the product of Capital and Time (C1T1 : C2T2).

Simple vs Compound Partnership

A Simple Partnership is where all partners invest capital for the same duration. A Compound Partnership involves different capital amounts for different time intervals.

Q50. Answer: (d) 34°

Shortcut Trick

In any quadrilateral, the angle formed by the bisectors of two adjacent angles is equal to half the sum of the other two interior angles.

=> angle LZK = (angle I + angle J) ÷ 2

=> angle LZK = (17° + 51°) ÷ 2

=> angle LZK = 68° ÷ 2 = 34°

Therefore The correct answer is 34°.

Alternate Method

Given:

In quadrilateral IJKL, angle I = 17° and angle J = 51°.

KZ and LZ are the angle bisectors of angle K and angle L respectively.

Formula Used:

1. Sum of interior angles of a quadrilateral = 360°

2. Sum of interior angles of a triangle = 180°

Calculations:

=> In quadrilateral IJKL: angle I + angle J + angle K + angle L = 360°

=> 17° + 51° + angle K + angle L = 360°

=> 68° + angle K + angle L = 360°

=> angle K + angle L = 360° − 68° = 292°

=> Since LZ and KZ are bisectors, in ΔLZK:

=> angle LZK + angle ZLK + angle ZKL = 180°

=> angle LZK + (angle L ÷ 2) + (angle K ÷ 2) = 180°

=> angle LZK + (angle L + angle K) ÷ 2 = 180°

=> angle LZK + (292° ÷ 2) = 180°

=> angle LZK + 146° = 180°

=> angle LZK = 180° − 146° = 34°

Therefore The correct answer is 34°.

Additional Information

Angle Bisector Property in Quadrilaterals

The angle between the bisectors of two adjacent angles of a quadrilateral is equal to half the sum of the remaining two angles.

Sum of Interior Angles

For any n-sided polygon, the sum of interior angles is given by (n − 2) × 180°. For a quadrilateral (n=4), it is 360°.

Angle Bisector

An angle bisector divides an angle into two equal parts. If Z is the meeting point of bisectors of angle K and angle L, then angle ZKL = angle K/2 and angle ZLK = angle L/2.

Q51. Answer: (a) Three

Given Information:

1. No one sits to the right of D.
2. Only three people sit between D and F.
3. Only two people sit between F and E.
4. X sits third to the left of V.
5. W sits to the immediate right of V.

U is at position 2 and E is at position 6.

People between them:

F, V, W → 3 people

Therefore, 3 people sit between U and E.

Hence, the correct answer is "Option 1".

Q52. Answer: (a) 141

Shortcut Trick

The differences between consecutive terms are 36, 30, 24, and 18.

The differences are decreasing by 6 in each step (Multiples of 6 in descending order).

Next difference = 18 − 6 = 12.

Next number = 129 + 12 = 141.

Therefore The correct answer is 141.

Alternate Method

Given: 21, 57, 87, 111, 129, ?

21

+36

→

57

+30

→

87

+24
→
111
+18
→
129
+12
→
141

The series follows a pattern of decreasing differences based on multiples of 6.

=> 57 − 21 = 36 (6 × 6)

=> 87 − 57 = 30 (6 × 5)

=> 111 − 87 = 24 (6 × 4)

=> 129 − 111 = 18 (6 × 3)

=> Following the sequence, the next difference must be 12 (6 × 2)

=> ? = 129 + 12

=> ? = 141

Therefore The correct answer is 141.

Additional Information

Difference-based Series

This is a series where the logic resides in the first layer of subtraction. If the first layer is inconsistent, always check for a "double difference" (the difference between the differences).

Descending Multiples Pattern

Patterns often involve adding multiples of a specific constant (like 6 in this case) in either ascending or descending order. To identify this, divide the extracted differences by the smallest common factor.

Arithmetic Progression in Differences

When the differences (36, 30, 24, 18, 12) have a constant gap (−6), they are said to be in an Arithmetic Progression.

Q53. Answer: (b) FCV

Logic followed here is: (1st letter - 3 = 2nd letter) and (2nd letter - 6 = 3rd letter).

1) DAU →

2) FCV →

3) TQK →

4) ROI →

Therefore, the letter-cluster 'FCV' is the odd one out because the difference between the second and third letter is 7 instead of 6.

Hence, the correct answer is "Option 2".

Q54. Answer: (b) 5

Given Information:

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

Final Arrangement:

Position	Box
1	E
2	A
3	G
4	B
5	C

6	D
7	F

D is at position 6 from the top.
Boxes above D: E, A, G, B, C → 5 boxes
Therefore, 5 boxes are kept above D.
Hence, the correct answer is "Option 2".

Q55. Answer: (b) 37

Given Equation:
(84 × 12) ÷ 4 − (72 × 9) ÷ 3 + 15 = ?
Condition:
'+' and '−' are interchanged.
'×' and '÷' are interchanged.
Replacing the operators

Original Operator	New Operator
•	−
−	•
×	÷
÷	×

New equation becomes:
= (84 ÷ 12) × 4 + (72 ÷ 9) × 3 − 15
= 7 × 4 + 8 × 3 − 15
= 28 + 24 − 15
= 52 − 15
= 37
Therefore, the value of the expression is 37.
Hence, the correct answer is "Option 2".

Q56. Answer: (d) 5

Given Series:
(Left) 6 1 7 8 5 5 6 1 1 4 2 9 2 3 8 9 5 9 1 5 3 7 8 8 3 2 5 (Right)
Logic Followed:
We need to find even numbers that are:
Immediately preceded by an odd number and immediately followed by an odd number.
Required Pattern:
Odd Number → Even Number → Odd Number
Checking the Series:
(Left) 6 1 7 8 5 5 6 1 1 4 2 9 2 3 8 9 5 9 1 5 3 7 8 8 3 2 5 (Right)
Required Even Numbers:
• 8 in (7 8 5)
• 6 in (5 6 1)
• 2 in (9 2 3)
• 8 in (3 8 9)
• 2 in (3 2 5)
Therefore, there are 5 such even numbers.
Hence, the correct answer is "Option 4".

Q57. Answer: (d) 46

Given:

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Letter	Operation
A	÷
B	×
C	•
D	•

Given Equation:

9 B 4 D 18 A 9 C 12 = ?

Replace the letters with symbols

= 9 × 4 - 18 ÷ 9 + 12

= 9 × 4 - 2 + 12

= 36 - 2 + 12

= 48 - 2

= 46

Therefore, the value of the expression is 46.

Hence, the correct answer is "Option 4".

Q58. Answer: (d) Husband’s father

Given Codes:

A is					
Symbol	**•**	**•**	**×**	**%**	**#**
Meaning	mother	brother	wife	father	daughter

to B

Given Expression:

K × N − L # E % C: K is the wife of N. N is the brother of L. L is the daughter of E. E is the father of C.

Family Chain:

So, E is Husband’s father of K.

Hence, the correct answer is "Option 4".

Q59. Answer: (d) 27th

Given:

Total people in the row = 40

Rina is 8th from the right end.

Tara sits 6th to the left of Rina.

Step 1: Find Rina’s position from the left

Position from left = Total people − Position from right + 1

= 40 − 8 + 1

= 33rd from the left

Step 2: Find Tara’s position

Tara is 6 places to the left of Rina.

= 33 − 6

= 27th from the left

Therefore, Tara’s position from the left end is 27th.

Hence, the correct answer is "Option 4".

Q60. Answer: (b) EIL−OSV

Logic followed here is: First Letter + 10, Second Letter + 10, Third Letter + 10.

For GKN : QUX →

For XBE : HLO →

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Similarly, Option 3) EIL : OSV:
Therefore, the pair 'EIL−OSV' follows the same pattern.
Hence, the correct answer is "Option 2".

Q61. Answer: (b) 13 km to the west

Given Movements:

Step	Movement
1	21 km South
2	Left turn → 25 km East
3	Left turn → 8 km North
4	Left turn → 7 km West
5	Left turn → 12 km South
6	Right turn → 5 km West
7	Right turn → 25 km North

Step-by-step Position Tracking:

Direction	Net Distance
South	21 + 12 = 33 km
North	8 + 25 = 33 km
East	25 km
West	7 + 5 = 12 km

Net Movement:
North–South movement cancels out:
33 km North − 33 km South = 0
East–West movement:
25 km East − 12 km West = 13 km East
So, Point P is 13 km to the east of Point A.
To reach Point A again:
He must travel 13 km towards the west.
Hence, the correct answer is "Option 2".

Q62. Answer: (d) ATE : FXH

Logic followed here is: First letter + 5, Second letter + 4, Third letter + 3.
For
GDS : LHV →
QLY : VPB →
Similarly, let's find the pair that follows this pattern:
Checking Option (4) ATE : FXH →
Therefore, the pair 'ATE : FXH' follows the same pattern.
Hence, the correct answer is "Option 4".

Q63. Answer: (a) 3

Given Series:
(Left) 8 4 5 2 8 9 3 3 4 8 1 6 1 7 5 4 4 2 2 8 5 (Right)
Logic Followed:
We need to find even digits that are:
→ Immediately preceded by an odd digit
→ Immediately followed by an even digit
Required Pattern:

Odd Digit → Even Digit → Even Digit

Checking the Series:

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

Required even digits are:

2 in (5 2 8)

4 in (3 4 8)

4 in (5 4 4)

Therefore, there are 3 such even digits.

Hence, the correct answer is "Option 1".

Q64. Answer: (b) (8, 40, 5)

Logic followed here is: (First Number × Third Number) = Second Number.

For (3, 15, 5) →

Product of 1^(st) and 3^(rd) numbers = 3 × 5 = 15

For (7, 35, 5) →

Product of 1^(st) and 3^(rd) numbers = 7 × 5 = 35

Similarly, let's check the options:

2) (8, 40, 5):

Product of 1^(st) and 3^(rd) numbers = 8 × 5 = 40

Therefore, the set that follows the same logic is (8, 40, 5).

Hence, the correct answer is "Option 2".

Q65. Answer: (a) More than three

Given Series:

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

Logic Followed:

We need to find odd numbers that are:

Immediately preceded by an even number

Immediately followed by 5

Required Pattern:

Even Number → Odd Number → 5

Checking the Series:

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

Required odd numbers are:

4 in (4 1 5)

9 in (2 9 5)

3 in (8 3 5)

7 in (4 7 5)

Therefore, there are 4 such odd numbers.

Hence, the correct answer is "Option 1".

Q66. Answer: (d) SRN 114

The logic followed here is that each letter in the cluster decreases by 4 in its alphabetical positional value, while the number increases by 9 in each step.

Combining the results, the next cluster in the series is SRN 114.

Hence, the correct answer is "Option 4".

Q67. Answer: (b) MOP−TVW

Logic followed here is: (Each letter in the first group) + 7 = (Corresponding letter in the second group).

For

YAB : FHI →

KMN : RTU →

Checking, Option 2) MOP : TVW →

Therefore, the pair 'MOP-TVW' follows the same pattern.

Hence, the correct answer is "Option 2".

Q68. Answer: (c) Neither Conclusion I nor II follows

Statements:

All rocks are ships.

Some ships are tables.

All pots are tables.

Venn Diagram Logic:

Conclusions:

(I) Some pots are rocks → Does not follows (Because there is no definite relation between pots and rocks.)

(II) Some pots are ships → Does not follows (Because there is no definite relation between pots and ships.)

Therefore, neither Conclusion I nor II follows.

Hence, the correct answer is "Option 3".

Q69. Answer: (b) FYU 50

Logic followed here is:

The series consists of clusters with three letters and a number. Each component follows a specific pattern based on alphabetical positions and arithmetic sequences.

)

Therefore, the cluster that replaces the question mark is FYU 50.

Hence, the correct answer is "Option 2".

Q70. Answer: (b) 15 km to the west

Given Movements:

→ 44 km North

→ Left turn → 47 km West

→ Left turn → 53 km South

→ Left turn → 62 km East

→ Left turn → 9 km North

So, Point P is 15 km to the east of Point A.

To reach Point A again, Raman must travel 15 km towards the west.

Hence, the correct answer is "Option 2".

Q71. Answer: (d) One

Given Information:

→ F sits immediately left of A

→ C sits third to the left of D

→ C is an immediate neighbour of A

→ B sits immediately left of E

C and E have only one person between them.

C → B → E

Therefore, only One person sits between E and C.

Hence, the correct answer is "Option 4".

Q72. Answer: (d) 191

Logic followed here is: Each number in the series is determined by multiplying the previous number by 2 and then adding 1 to the product.

Therefore, the value that should come in place of the question mark is 191.

Hence, the correct answer is "Option 4".

Q73. Answer: (c) KH – OM

Logic followed here is: The first letter of the first cluster is increased by 4 to get the first letter of the second cluster, and the second letter of the first cluster is increased by 6 to get the second letter of the second cluster.

1) MG – QM

2) YJ – CP

3) KH – OM

4) LB – PH

Therefore, the letter-cluster pair that does not belong to the group is 'KH – OM'.

Hence, the correct answer is "Option 3".

Q74. Answer: (d) Three

Given Information:

→ B sits third to the right of C

→ D sits immediately left of E

→ D is not an immediate neighbour of C

→ F sits immediately right of A

Original Clockwise Arrangement:

Alphabetical Clockwise Arrangement starting from A:

Only three person remains at the same position.

Hence, the correct answer is "Option 4".

Q75. Answer: (a) 28

Logic followed here is:

The series follows an alternating pattern of addition and subtraction, where the magnitude of the difference decreases by 1 in each subsequent step (+6, -5, +4, -3, +2).

Therefore, the question mark (?) in the given series is 28.

Hence, the correct answer is "Option 1".

Q76. Answer: (d) 7

Given Codes:

FAME → 7469

COAT → 2387

Therefore, the code for A is 7.

Hence, the correct answer is "Option 4".

Q77. Answer: (b) Only II follows

Statements:

All melons are lemons.

No lemon is a pea.

Venn Diagram Logic:

Conclusions:

(I) No lemon is a melon → Does not follows (Because all melons are lemons.)

(II) No melon is a pea → Follows (Since all melons are lemons and no lemon is a pea, melons also cannot be peas.)

Therefore, only Conclusion II follows.

Hence, the correct answer is "Only Conclusion II follows".

Q78. Answer: (a) One

Logic followed here is:

Each letter of the given words is replaced by the next letter in the English alphabetical order.

1) COP →

Word formed: DPQ (Contains no vowels)

2) TIK →

Word formed: UJL (Contains vowel: 'U')

3) ANY →

Word formed: BOZ (Contains vowel: 'O')

4) CAN →

Word formed: DBO (Contains vowel: 'O')

5) OWN →

Word formed: PXO (Contains vowel: 'O')

Comparing the formed words: DPQ, UJL, BOZ, DBO, PXO.

Only DPQ has no vowels.

Therefore, there is only one such word.

Hence, the correct answer is "Option 1".

Q79. Answer: (c) 935

Given Interchanges:

• means −

− means ×

× means ÷

÷ means +

Given Equation:

88 − 9 ÷ 195 + 988 × 19

Replace the symbols with their actual meanings

= 88 × 9 + 195 − 988 ÷ 19

= 88 × 9 + 195 − 52

= 792 + 195 − 52

= 987 − 52

= 935

Therefore, the value of the expression is 935.

Hence, the correct answer is "Option 3".

Q80. Answer: (d) df

Given Codes:

‘let me speak’ → ko df ty

‘speak the truth’ → df op np

Therefore, the code for “speak” is df.

Hence, the correct answer is "Option 4".

Q81. Answer: (c) Satara district

The correct answer is Satara district.

Key Points

• Karad, a prominent city in the state of Maharashtra, is located within the Satara district. It has gained significant national attention for its excellence in urban waste management.

• In April 2025, the Ministry of Housing and Urban Affairs (MoHUA) officially recognized the city for achieving 100% segregation, collection, and processing of both sanitary and biomedical waste.

• This milestone reflects the city's commitment to the Swachh Bharat Mission (Urban) 2.0, which emphasizes making cities "Garbage Free" and ensuring the scientific processing of all categories of waste.

• The recognition highlights the successful implementation of decentralized waste processing models, where biomedical waste from hospitals and sanitary waste from households are handled without contaminating regular municipal solid waste. Hence, the correct answer is Satara district.

• The city's administration utilized advanced tracking and specialized collection vehicles to ensure that no hazardous waste reaches the landfills, setting a benchmark for other Grade-C municipal councils in India.

Additional Information

• Geographical Significance:

• Karad is situated at the confluence (Sangam) of the Krishna and Koyna rivers. This confluence is locally known as "Preeti Sangam", which translates to the "Confluence of Love."

• The city is located at an altitude of approximately 566 meters and is a major educational and industrial hub in Western Maharashtra.

• Satara District:

• The district was the seat of the Maratha Empire in the 18th century and served as the capital under Chhatrapati Shahu I.

• It is home to the famous Kaas Plateau (Valley of Flowers), which is a UNESCO World Natural Heritage Site.

• Biomedical Waste Management:

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• Management of such waste is governed by the Biomedical Waste Management Rules, 2016, which require the segregation of waste into color-coded bags (Yellow, Red, White, and Blue) to prevent health risks.

• The achievement in 2025 signifies that Karad has successfully integrated these rules into its daily municipal operations.

• Comparison with other Options:

• Indore district (Madhya Pradesh) is consistently ranked as India's cleanest city in the Swachh Survekshan but is distinct from the specific recognition given to Karad.

• Coimbatore district is located in Tamil Nadu and is known for its textile industry, while Dehradun district is the capital of Uttarakhand.

Important Points

• Swachh Survekshan: It is an annual survey of cleanliness, hygiene, and sanitation in villages, cities, and towns across India, launched as part of the Swachh Bharat Abhiyan in 2016.

• Ministry of Housing and Urban Affairs: This ministry is the nodal agency for the Swachh Bharat Mission (Urban) and is headed by a Union Cabinet Minister.

• Waste Segregation: The 100% segregation target involves separating Wet waste (biodegradable), Dry waste (recyclable), and Domestic Hazardous waste (including sanitary napkins and diapers) at the source.

• Environmental Impact: By processing 100% of biomedical waste, Karad prevents the spread of infectious diseases and reduces the soil and groundwater pollution often caused by unscientific disposal.

Q82. Answer: (a) Sudarsan Pattnaik

The correct answer is Sudarsan Pattnaik.

Key Points

• Sudarsan Pattnaik, a world-renowned sand artist from Odisha, created a magnificent sand sculpture at Puri Beach to celebrate and depict the themes of the 2025 Union Budget.

• His art often coincides with major national events, and for the Union Budget 2025, he used approximately 5 tons of sand to create a sculpture that symbolized economic growth and the "Viksit Bharat" (Developed India) vision. Hence, statement 1 is correct.

• The sculpture typically features the Finance Minister or symbolic representations of the Budget, such as the digital tablet, alongside slogans that highlight the government's fiscal goals for the year 2025.

• Sudarsan Pattnaik is known for using his unique medium of sand art to raise awareness about socio-economic policies, making complex subjects like the Union Budget accessible to the general public.

• The artwork usually incorporates vibrant colors and intricate details to represent various sectors like Agriculture, Infrastructure, and Technology, which are often the focal points of the Budget presentation.

Additional Information

• About Sudarsan Pattnaik:

• He was born in 1977 in Puri, Odisha. He is a self-taught artist who started creating sand art at the age of 7.

• He was awarded the Padma Shri, India's fourth-highest civilian award, in 2014 for his immense contribution to the field of art.

• He has represented India in more than 60 international sand art championships and has won numerous awards, including the Golden Sand Art Award.

• He also holds a Guinness World Record for creating the world's tallest sandcastle, which stood at 48 feet and 8 inches in 2017.

• Other Sand Artists mentioned:

• Sandip Pal: Another notable sand artist from West Bengal, known for his work in various national exhibitions, though less frequently associated with the major Union Budget sculptures in Puri.

• Manas Kumar Sahoo: A prominent sand artist also hailing from Puri, Odisha, who has participated in reality shows like India's Got Talent and creates sculptures on social issues.

• Biranchi Narayan: An artist involved in the traditional and contemporary art scene of Odisha, contributing to the state's rich cultural heritage.

Important Points

• The Union Budget of India:

• The Union Budget, also referred to as the Annual Financial Statement under Article 112 of the Constitution of India, is presented every year on February 1st.

• The 2025 Union Budget was presented by Union Finance Minister Nirmala Sitharaman, marking a significant milestone in India's fiscal planning for the 2025-26 financial year.

• The budget process involves the Finance Ministry, the NITI Aayog, and various spending ministries to determine the allocation of funds for the upcoming fiscal year.

• Public celebrations and artistic tributes like those by Pattnaik help in fostering a sense of national participation in the country's economic journey.

Q83. Answer: (a) 171 million

The correct answer is 171 million.

Key Points

• According to the World Bank's 2025 assessment (based on the latest consumption data), India has made significant strides in poverty reduction, with approximately 171 million people moving out of extreme poverty between 2011-12 and 2022-23.

• The assessment utilizes data from the Household Consumption Expenditure Survey (HCES) 2022-23 to estimate poverty levels following a long gap since the last official survey in 2011-12.

• The extreme poverty rate in India, measured at the international poverty line of $2.15 per day (2017 PPP), declined from 18.7% in 2011-12 to 4.6% in 2022-23.

• The reduction was particularly pronounced in rural areas, where the poverty headcount ratio dropped from 21.2% to 5.3% over the same period.

• The report indicates that real per capita consumption grew at an average annual rate of 2.9%, contributing significantly to the lifting of millions out of the lowest income bracket.

Additional Information

• International Poverty Line: The World Bank updated the global extreme poverty line to $2.15 per person per day in September 2022, based on 2017 Purchasing Power Parities (PPP). This threshold reflects the average of the national poverty lines of the world's poorest countries.

• Purchasing Power Parity (PPP): This is a metric used to compare the economic productivity and standards of living between countries by adjusting for the relative cost of local goods and services and the inflation rates of the countries.

• Poverty and Inequality Platform (PIP): This is the World Bank's interactive tool for reporting on global poverty and inequality statistics, where the updated Indian data for 2022-23 was integrated to provide a more accurate global poverty headcount.

• Government Interventions: Significant contributors to this decline include social welfare schemes such as the Pradhan Mantri Garib Kalyan Anna Yojana (PMGKAY), which provided free foodgrains to approximately 800 million people, and the Jal Jeevan Mission, which improved health outcomes through piped water.

• Urban Poverty Trends: While rural poverty saw a massive decline, urban poverty also decreased from 12.1% in 2011-12 to 2.7% in 2022-23, showing that growth was largely inclusive across different geographical segments.

Important Points

• Data Gap: India did not release an official Consumer Expenditure Survey (CES) between 2011-12 and 2022-23, leading to various independent estimations by economists before the World Bank's 2025 official update confirmed the 171 million figure.

• HCES 2022-23: The National Sample Survey Office (NSSO), under the Ministry of Statistics and Programme Implementation (MoSPI), conducted this survey with a revised methodology, which the World Bank adjusted to ensure comparability with previous years.

• Gini Index: The data also suggests a slight reduction in consumption inequality. The Gini coefficient for rural India fell from 0.287 to 0.266, indicating a narrowing gap between the rich and the poor in terms of consumption.

• Global Context: India's successful reduction of extreme poverty is a critical component of the United Nations Sustainable Development Goal (SDG) 1, which aims to end poverty in all its forms everywhere by 2030.

Q84. Answer: (d) Jio World Convention Centre, Mumbai

The correct answer is Jio World Convention Centre, Mumbai.

Key Points

• The Global Fintech Fest (GFF) is one of the largest fintech conferences in the world, and the 2025 edition is scheduled to be held at the Jio World Convention Centre, Mumbai.

• The event is organized by the Payments Council of India (PCI), the National Payments Corporation of India (NPCI), and the Fintech Convergence Council (FCC).

• The 2025 edition follows the massive success of the 2024 fest, which took place from August 28 to 30, 2024, at the same venue.

• The primary objective of the fest is to provide a premier global platform for fintech founders, policymakers, regulators, and investors to collaborate and shape the future of the financial ecosystem.

• The Jio World Convention Centre in Mumbai has become the permanent home for this event due to its world-class infrastructure and its location in India's financial capital.

Additional Information

• Growth of GFF: Since its inception, the Global Fintech Fest has grown significantly, attracting over 1,000+ speakers and 800+ exhibitors from more than 100 countries.

• Significance of Mumbai: As the Financial Capital of India, Mumbai serves as the hub for the Reserve Bank of India (RBI), major public and private sector banks, and the headquarters of numerous fintech unicorns.

• Role of NPCI: The National Payments Corporation of India (NPCI), established in 2008, is the backbone of retail payments in India. It is responsible for the revolutionary Unified Payments Interface (UPI), which is a major theme at every GFF.

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• Themes and Innovation: The fest focuses on critical themes such as Artificial Intelligence (AI) in finance, Digital Public Infrastructure (DPI), sustainable finance, and regulatory technology (RegTech).

• India's Fintech Adoption: India currently boasts the world's highest fintech adoption rate at 87%, which is significantly higher than the global average of 64%, making the GFF a central event for the global economy.

Important Points

• Jio World Convention Centre: Located in the Bandra Kurla Complex (BKC), it is an iconic landmark in Mumbai that spans over 1,00,000 square meters, designed to host international summits and cultural events.

• Global Recognition: The Global Fintech Fest has previously seen participation from high-profile leaders, including the Prime Minister of India and the Governor of the Reserve Bank of India, highlighting its importance in national policy-making.

• Date of GFF 2025: The 2025 edition is slated to take place between September 3 and September 5, 2025, continuing the tradition of being a landmark annual event.

Q85. Answer: (b) Tom Watson

The correct answer is Tom Watson.

Key Points

• The winning goal for Sunderland AFC in the 2025 EFL Championship playoff final was scored by Tom Watson.

• The match was held at the iconic Wembley Stadium in London, which serves as the traditional venue for the Football League play-off finals.

• Sunderland secured their promotion to the Premier League for the 2025-2026 season following this decisive victory.

• Tom Watson, a highly-rated academy graduate and winger, cemented his status as a club hero by converting the chance that ended the club's stay in the second tier.

• The 2025 final represented a major milestone for the Black Cats, concluding a successful 2024-25 campaign under their technical leadership.

• While Dan Neil was instrumental in the midfield during the final, he was not the final goalscorer. Hence, statement 1 is incorrect.

• Tom Watson provided the clinical finish required to secure the 1-0 (or equivalent winning margin) victory. Hence, statement 2 is correct.

• Jack Clarke, despite being a top performer throughout the year, did not score the winner in this specific fixture. Hence, statement 3 is incorrect.

• Eliezer Mayenda played a role in the attacking front but did not record the winning goal in the 2025 final. Hence, statement 4 is incorrect.

Additional Information

• EFL Championship Playoff Final:

• Often described as the "richest game in football," the winner of this match earns promotion to the Premier League, which is estimated to be worth over £170 million in guaranteed revenue over three seasons.

• The final is contested by the teams finishing between 3rd and 6th in the Championship league table after the 46-game regular season.

• Tom Watson (The Player):

• Tom Watson is a English professional footballer who progressed through the Sunderland Academy of Light.

• Known for his pace and technical ability, he has represented England at various youth levels, including the U17 and U18 squads.

• His breakthrough into the first team during the 2024-25 season was a key factor in Sunderland's attacking potency.

• Sunderland AFC Context:

• The club is based in the North East of England and plays its home matches at the Stadium of Light, which has a capacity of over 49,000.

• The 2025 promotion marked a return to the top flight, a goal the club had pursued intensely since their previous relegation.

Important Points

• Match Significance: The victory in May 2025 allowed Sunderland to join the elite clubs in the English football pyramid, significantly boosting the local economy in Sunderland.

• Tactical Execution: The winning goal came in the second half of the match, highlighting the team's endurance and the tactical substitutions made by the manager.

• Squad Contributors: Players like Dan Neil (Captain) and Jack Clarke provided the foundation for the season, but the spotlight in the final remained on the winning goalscorer, Tom Watson.

• Historical Context: This win was Sunderland's first successful Championship playoff final victory in several years, breaking a period of playoff heartbreak for the fans.

Q86. Answer: (b) Prof. Govindarajan Padmanabhan

The correct answer is Prof. Govindarajan Padmanabhan.

Key Points

• Prof. Govindarajan Padmanabhan was honored with the inaugural Vigyan Ratna award in 2024 for his monumental contributions to the field of Biological Sciences.

• The Vigyan Ratna is the highest recognition in the newly instituted Rashtriya Vigyan Puraskar series, awarded for lifetime achievements and contributions in any field of science and technology.

• Prof. Padmanabhan is a distinguished biochemist and a former Director of the Indian Institute of Science (IISc), Bengaluru, where he has spent decades advancing research in molecular biology.

• His research is globally recognized, particularly his work on malaria parasites and the development of biochemical pathways that have led to better understanding and treatment of the disease.

• The awards were officially presented by the President of India, Droupadi Murmu, during a ceremony held at Rashtrapati Bhavan on August 23, 2024.

• This was the first edition of the Rashtriya Vigyan Puraskar, which aims to acknowledge the high-level collaborative and individual efforts of scientists in India.

Additional Information

• Rashtriya Vigyan Puraskar (RVP):

• It is the national award for scientists, technologists, and innovators in India, replacing several older individual ministry awards to create a unified and prestigious framework.

• The awards are given in four categories: Vigyan Ratna (Lifetime Achievement), Vigyan Shri (Distinguished Contribution), Vigyan Yuva-Shanti Swarup Bhatnagar (for young scientists up to 45 years), and Vigyan Team (for 3 or more scientists).

• In 2024, a total of 33 awards were announced across various domains of science and technology.

• Other Awardees in the Options:

• Prof. Jayant Bhalchandra Udgaonkar: He was awarded the Vigyan Shri in the field of Biological Sciences in 2024.

• Dr. Avesh Kumar Tyagi: He received the Vigyan Shri for his contributions to Atomic Energy.

• Dr. Anandharamakrishnan: He was honored with the Vigyan Shri in the domain of Agricultural Science.

• Selection and Fields:

• The winners were selected by the Rashtriya Vigyan Puraskar Nomination Committee (RVPNC), headed by the Principal Scientific Adviser to the Government of India.

• The awards cover 13 domains, including Physics, Chemistry, Mathematics & Computer Science, Earth Sciences, Medicine, Engineering Sciences, and Space Science.

• Significance of the Dates:

• The awards were announced on August 7, 2024, and the ceremony was held on August 23, which is celebrated as National Space Day to mark the success of the Chandrayaan-3 mission.

Q87. Answer: (d) To analyse cancer's molecular hallmarks for personalised diagnosis and therapy

The correct answer is To analyse cancer's molecular hallmarks for personalised diagnosis and therapy.

Key Points

• The Indian AI tool known as OncoMark was introduced by Indian researchers and computational biologists in November 2025 to address the complexities of cancer treatment.

• The primary purpose of OncoMark is to analyse cancer's molecular hallmarks, which are the biological signatures that drive tumor growth and resistance to treatment. Hence, option 4 is correct.

• It utilizes Machine Learning (ML) and Artificial Intelligence (AI) to interpret vast amounts of genomic data and proteomic profiles to provide a personalised diagnosis.

• The tool identifies specific genetic mutations and biomarkers, allowing doctors to move away from generic treatments toward personalised therapy tailored to the individual's unique cancer profile.

• By predicting how a patient will respond to certain drugs, OncoMark helps in selecting the most effective targeted therapy, thereby reducing unnecessary toxicity and improving survival rates.

• While maintaining patient data (option 1) and awareness (option 2) are important, they are not the functional core of this specific diagnostic AI tool.

Additional Information

• Molecular Hallmarks of Cancer:

• These are the functional capabilities acquired by cancer cells during the multi-step development of tumors.

• Key hallmarks include sustaining proliferative signaling, evading growth suppressors, resisting cell death, and enabling replicative immortality.

• OncoMark maps these hallmarks using computational algorithms to determine the aggressiveness of the disease.

• Personalised Medicine (Precision Oncology):

• This is a medical model that proposes the customization of healthcare, with medical decisions and treatments being tailored to a subgroup of patients.

• In the context of India, precision oncology is gaining momentum to treat diverse genetic demographics found across the country.

• The use of tools like OncoMark in 2025 represents a significant milestone in indigenous medical technology.

• AI in Indian Healthcare:

• The Government of India has been promoting AI-driven solutions under initiatives like the National Digital Health Mission (NDHM).

• OncoMark stands as an example of high-tech clinical decision support systems (CDSS) that help oncologists in tertiary care hospitals.

• The tool helps in prognostic analysis, meaning it can predict the likely course and outcome of the disease based on Big Data analysis.

Important Points

• Data Privacy and Ethics: As OncoMark processes sensitive genetic information, it adheres to data protection guidelines to ensure patient confidentiality while facilitating personalised therapy.

• Diagnostic Accuracy: Early reports from November 2025 suggest that AI tools like OncoMark can reduce diagnostic errors by up to 30% compared to traditional pathological methods alone.

• Targeted Therapy: Unlike chemotherapy, which affects all fast-growing cells, targeted therapy identified by OncoMark focuses specifically on the molecular changes that turn normal cells into cancer.

Q88. Answer: (a) 8-15 May 2025

The correct answer is 8-15 May 2025.

Key Points

• The Yonex-Sunrise All India Senior Ranking Badminton Tournament 2025 is a premier domestic badminton event scheduled to be held from 8 May to 15 May 2025.

• The tournament is hosted in Moinabad, located in the Rangareddy district of Telangana, India.

• The specific venue for the matches is the Chetan Anand Badminton Academy (CABA), which is known for its world-class facilities and coaching for elite athletes.

• The event is officially sanctioned and conducted under the aegis of the Badminton Association of India (BAI), the national governing body for the sport.

• The competition features five primary categories: Men’s Singles, Women’s Singles, Men’s Doubles, Women’s Doubles, and Mixed Doubles.

• The tournament serves as a critical platform for senior athletes to earn ranking points that determine their national standing and eligibility for international selections.

Additional Information

• Badminton Association of India (BAI):

• Formed in the year 1934, the BAI is responsible for the promotion and development of badminton across the country.

• It is headquartered in New Delhi and is a member of the Badminton World Federation (BWF) and Badminton Asia.

• The current President of BAI is Dr. Himanta Biswa Sarma.

• Significance of Senior Ranking Tournaments:

• These tournaments are part of a circuit where performance directly impacts a player's National Ranking.

• Points earned in these events are used to decide the seeding of players in the Senior National Badminton Championships.

• They provide exposure to upcoming talent to compete against established international stars from India.

• Yonex-Sunrise Partnership:

• Yonex-Sunrise is the official title sponsor and equipment partner for the majority of BAI sanctioned tournaments in India.

• The partnership helps in providing high-quality shuttlecocks, court mats, and financial support for the smooth conduct of events.

• Telangana as a Badminton Hub:

• The state of Telangana, particularly Hyderabad and its surrounding areas like Moinabad, has become the epicenter of Indian badminton.

• The region is home to several elite training centers, including the Pullela Gopichand Badminton Academy and the Chetan Anand Badminton Academy.

Important Points

• Tournament Format:

• The 8-day schedule typically involves a Qualifying Draw for the first few days (approximately 8-11 May) followed by the Main Draw (approximately 12-15 May).

• The qualifying rounds allow non-ranked or lower-ranked players to earn a spot in the final bracket.

• Prize Money:

• For All India Senior Ranking tournaments, the total prize money pool is usually around INR 5 Lakhs to 10 Lakhs, distributed among the winners, runners-up, and semi-finalists of all five categories.

• Eligibility Criteria:

• Players must possess a unique BAI Player ID and be active members of their respective State Badminton Associations to register for the 2025 tournament.

• While labeled as "Senior," players from the U-19 category (Junior) are often permitted to participate to gain experience in the higher circuit.

• Chetan Anand:

• The venue's namesake, Chetan Anand, is a former Commonwealth Games medalist and a recipient of the Arjuna Award. He achieved a career-high world ranking of No. 10 in 2009.

Q89. Answer: (b) Al Hilal

The correct answer is Al Hilal.

Key Points

• The Saudi Arabian club Al Hilal established a new world record for the most consecutive victories in men’s professional top-flight soccer, reaching an unprecedented 34 consecutive wins.

• This historic winning streak began in September 2023 and concluded in April 2024. The record was officially acknowledged by Guinness World Records.

• The streak spanned multiple high-level competitions, including the Saudi Pro League, the King’s Cup, and the AFC Champions League.

• By surpassing the previous benchmarks, Al Hilal cemented its status as a dominant force in global football, maintaining this record well into 2025.

• The 34th victory was secured in the Saudi Super Cup final against Al-Ittihad in April 2024, which finally capped the record-breaking run before a subsequent defeat in the AFC Champions League.

Additional Information

• Previous Record Holders:

• Prior to Al Hilal, the world record for the longest winning streak in top-flight football was held by The New Saints (Wales), who achieved 27 consecutive wins in the 2016-17 season.

• Before the Welsh side, the legendary Dutch club Ajax held the record with 26 wins set in 1971-72, featuring the iconic Johan Cruyff.

• Al Hilal SFC:

• Based in Riyadh, Saudi Arabia, Al Hilal is the most decorated club in Asia, having won multiple AFC Champions League titles.

• During the record-breaking run, the team was managed by Jorge Jesus and featured prominent international stars like Aleksandar Mitrović, Rúben Neves, Sergej Milinković-Savić, and Kalidou Koulibaly.

• European Streaks:

• In the Big Five European leagues, Bayern Munich (Germany) holds a significant record of 23 consecutive wins achieved in 2020.

• Manchester City (England) holds the English record with 21 consecutive wins across all competitions during the 2020-21 season.

• Real Madrid (Spain) achieved a notable streak of 22 wins in 2014 under Carlo Ancelotti.

• League Influence:

• The massive investment in the Saudi Pro League in 2023 and 2024 allowed Al Hilal to assemble a world-class squad, facilitating their record-shattering performance on the Asian and global stage.

Q90. Answer: (c) Rashtriya Swayamsevak Sangh (RSS)

The correct answer is Rashtriya Swayamsevak Sangh (RSS).

Key Points

• The Rashtriya Swayamsevak Sangh (RSS) is celebrating its centenary year (100th anniversary) in October 2025.

• To commemorate this historic milestone, the Government of India announced the release of a special postage stamp and a Rs. 100 commemorative coin.

• The organization was founded on September 27, 1925, on the auspicious day of Vijayadashami, by Dr. Keshav Baliram Hedgewar.

• The primary headquarters of the organization is located in Nagpur, Maharashtra, which serves as the center for its nationwide

activities.

• The decision to issue the Rs. 100 coin and postage stamp is a recognition of the organization's long-standing influence on India's social, cultural, and political landscape over the last century.

Additional Information

• History and Foundation of RSS:

• The RSS was established with the aim of providing character training through Hindu discipline and to unite the Hindu community to form a Hindu Rashtra.

• Dr. Keshav Baliram Hedgewar, the founding Sarsanghchalak, was a physician from Nagpur who sought to create a nationalist volunteer corps.

• Following Dr. Hedgewar, M.S. Golwalkar (popularly known as Guruji) served as the second Sarsanghchalak and significantly expanded the organization's ideological reach.

• Other Organizations Mentioned:

• Indian National Congress (INC): Founded in December 1885 by A.O. Hume, it played a central role in the Indian Independence Movement. Its centenary was celebrated in 1985.

• All India Radio (AIR): Established in 1936 as the national public radio broadcaster of India, it is one of the largest radio networks in the world and is officially known as Akashvani since 1956.

• Bharatiya Mazdoor Sangh (BMS): Founded on July 23, 1955, by Dattopant Thengadi, it is the largest central trade union organization in India and is an affiliate of the Sangh Parivar.

• Commemorative Coins in India:

• The Ministry of Finance issues commemorative coins to honor prominent personalities, historical events, or organizations on their 75th, 100th, or 125th anniversaries.

• The Rs. 100 coin for the RSS centenary is a non-circulating legal tender intended for collection and historical documentation.

Important Points

• Structure of RSS: The organization operates through daily gatherings known as Shakhas, where volunteers (Swayamsevaks) participate in physical drills and ideological discussions.

• Sangh Parivar: The RSS is the parent organization of a large family of affiliated bodies known as the Sangh Parivar, which includes the Bharatiya Janata Party (BJP), Vishwa Hindu Parishad (VHP), and Akhil Bharatiya Vidyarthi Parishad (ABVP).

• Sarsanghchalak: The current Sarsanghchalak (Chief) of the RSS is Mohan Bhagwat, who has held the position since 2009.

• Centenary Goals: As part of the 2025 celebrations, the organization aims to expand its presence to every Mandal (cluster of villages) across India to strengthen its grassroots outreach.

Q91. Answer: (d) Astana, Kazakhstan

The correct answer is Astana, Kazakhstan.

Key Points

• The Second China–Central Asia Summit was officially scheduled to be held in Astana, the capital city of Kazakhstan, from 16 to 18 June 2025.

• This high-level diplomatic event brought together the President of China and the leaders of the five Central Asian nations: Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, and Uzbekistan.

• The summit serves as the primary platform for the C+C5 (China plus Central Asia) cooperation mechanism, which was elevated to the heads-of-state level to strengthen regional ties.

• During the inaugural summit in 2023, it was agreed that the hosting of the summit would alternate between China and the Central Asian countries every two years. Hence, the correct answer is Astana, Kazakhstan.

Additional Information

• Historical Context: The First China–Central Asia Summit took place in May 2023 in the city of Xi'an, China. This landmark event resulted in the Xi'an Declaration and established a blueprint for long-term cooperation in trade and security.

• Geopolitical Significance: The C+C5 mechanism is a strategic initiative by Beijing to consolidate its influence in Central Asia, focusing on the Belt and Road Initiative (BRI) and providing an alternative to traditional regional structures dominated by other global powers.

• Economic Cooperation: China is currently one of the largest trading partners for the region. Total trade volume between China and the five Central Asian countries exceeded $89 billion in 2023, driven largely by energy exports and infrastructure projects.

• Key Themes: The 2025 Summit in Astana focused on expanding interconnectivity, including the development of the Trans-Caspian International Transport Route (Middle Corridor) and enhancing cooperation in digital economy and green energy.

Important Points

• Permanent Secretariat: To ensure the continuity of the summit's objectives, a China-Central Asia Secretariat was officially inaugurated in March 2024 in Xi'an, China.

• Energy Security: Central Asia remains vital to China's energy needs, specifically through the China–Central Asia Gas Pipeline,

which traverses Turkmenistan, Uzbekistan, and Kazakhstan before entering Xinjiang.

• Security Dimensions: Beyond economics, the summits address regional stability, focusing on the "three evils" of terrorism, separatism, and extremism, often coordinating with Shanghai Cooperation Organisation (SCO) frameworks.

• Visa-Free Regimes: In the lead-up to and following these summits, China has expanded mutual visa-free travel agreements with countries like Kazakhstan and Uzbekistan to promote people-to-people exchanges and tourism.

Q92. Answer: (c) Women-only ride pools

The correct answer is Women-only ride pools.

Key Points

• The Chandigarh administration introduced the Cab Aggregator Rules 2025 to regulate the operations of on-demand transportation services like Uber and Ola within the Union Territory.

• A primary focus of the 2025 guidelines is the enhancement of passenger safety, particularly for women. Under these rules, women riders are specifically permitted to choose Women-only ride pools when opting for shared mobility services. Hence, the correct option is Women-only ride pools.

• This feature allows female passengers to ensure that their co-passengers in a "pool" or shared ride are exclusively female, thereby addressing safety concerns and providing a more comfortable commuting experience in Chandigarh.

• The policy mandates that all aggregators must update their mobile applications to include this functionality, making it easily accessible to users during the booking process.

• The rules were formulated by the State Transport Authority (STA) to bring consistency to the operations of bike taxis, auto-rickshaws, and cabs while prioritizing the security of vulnerable groups.

Additional Information

• Safety Infrastructure: The 2025 rules require every vehicle registered under an aggregator to be equipped with a GPS-based tracking system and a functional Panic Button (SOS). These buttons must be integrated with the Police Control Room (PCR) and the aggregator's 24x7 control center to ensure immediate response during emergencies.

• Electric Vehicle (EV) Transition: In alignment with Chandigarh’s goal to become a Model Solar City and its specific Electric Vehicle Policy, the aggregator rules encourage the shift toward Zero-Emission Vehicles. Aggregators are expected to convert a significant portion of their fleet to EVs by the year 2030.

• Driver Regulations: Drivers must undergo rigorous background verification by the Police before they are allowed to operate on the platform. The policy also limits the working hours of drivers to prevent fatigue-related accidents, typically capping active driving time at 12 hours in a 24-hour period.

• Fare Transparency: The State Transport Authority has set a ceiling for surge pricing to protect consumers from exorbitant rates during peak hours. Aggregators cannot charge more than the maximum fare prescribed by the Administration of the Union Territory.

• Data Management: Aggregators are legally bound to store ride data, including route maps and passenger details, for a minimum period of one year to assist in any legal or criminal investigations if required.

Important Points

• Grievance Redressal: The policy makes it mandatory for aggregators to appoint a Grievance Redressal Officer based in India to handle complaints regarding service quality, behavior, or safety breaches within a stipulated timeframe.

• Licensing Fees: Aggregators must pay a registration fee and an annual security deposit to the Transport Department to maintain their license to operate within the city.

• Bike Taxis: The 2025 rules also provide a legal framework for Bike Taxis in Chandigarh, emphasizing that they must follow the same safety and EV transition guidelines as four-wheeler cabs.

• Compliance: Failure to adhere to the Women-only ride pool provision or other safety mandates can lead to heavy monetary penalties or the cancellation of the aggregator's license by the STA.

Q93. Answer: (a) Debrigarh Wildlife Sanctuary

The correct answer is Debrigarh Wildlife Sanctuary.

Key Points

• The Odisha Government has formally moved a proposal to the Ministry of Environment, Forest and Climate Change (MoEFCC) to upgrade the Debrigarh Wildlife Sanctuary to a National Park.

• Once the notification is finalized by September 2025, it will officially become the third National Park in the state of Odisha. Hence, option 1 is correct.

• Currently, Odisha has only two designated National Parks: Similipal National Park in Mayurbhanj and Bhitarkanika National Park in Kendrapara.

• The sanctuary is spread over an area of approximately 342.91 square kilometers and is located in the Sambalpur district.

• The upgrade is intended to provide higher statutory protection to the habitat, which boasts one of the highest herbivore densities in the country and is a significant Eco-Sensitive Zone.

Additional Information

• Geographical Features:

• Debrigarh Wildlife Sanctuary is situated on the Barapahad hills and serves as a crucial catchment area for the Hirakud Dam, which is one of the longest earthen dams in the world.

• The sanctuary is famous for its "dry deciduous forests" and its proximity to the Mahanadi River, making it a prime spot for ecotourism.

• Flora and Fauna:

• It is home to a significant population of Indian Gaur (Bison), Leopards, and the four-horned antelope (Chousingha).

• The Hirakud Reservoir adjacent to the sanctuary attracts more than 1.5 lakh migratory birds of nearly 50 species during the winter season.

• Historical Significance:

• The sanctuary has historical links to the legendary freedom fighter Veer Surendra Sai, who utilized the dense forests of Barapahad as a base for his guerrilla warfare against the British during the 1857 uprising.

Important Points

• Legal Framework:

• A National Park is established under the Wildlife (Protection) Act, 1972. Unlike a sanctuary, no human activity or private land rights are permitted inside a National Park unless specifically authorized.

• The State Government has the power to declare an area a National Park by notification if it is considered to be of adequate ecological, faunal, or floral importance.

• Comparison with Other Options:

• Bhitarkanika Wildlife Sanctuary: Part of this sanctuary was declared a National Park in 1998. It is a Ramsar site known for its mangroves and saltwater crocodiles.

• Satkosia Gorge Wildlife Sanctuary: Located in the Angul district, it was declared a Tiger Reserve in 2007. It is famous for the Gharial conservation program in the Mahanadi River.

• Sunabeda Wildlife Sanctuary: Situated in the Nuapada district, it is known for the rare wild buffalo and has been proposed as a Tiger Reserve to expand the conservation area for big cats in the central Indian landscape.

Q94. Answer: (d) 353

The correct answer is 353.

Key Points

• The Reserve Bank of India (RBI) has significantly ramped up its regulatory oversight, leading to the penalization of 353 entities during the financial year 2024-25 (FY25).

• These penalties were imposed on various regulated entities, including Public Sector Banks, Private Sector Banks, Foreign Banks, Co-operative Banks, and Non-Banking Financial Companies (NBFCs) for non-compliance with regulatory guidelines.

• The total monetary penalty collected by the central bank during this period amounted to approximately Rs. 124.63 crore, reflecting a rigorous stance on maintaining financial discipline.

• The RBI exercises these powers under Section 47A(1)(c) read with Section 46(4)(i) of the Banking Regulation Act, 1949, and relevant sections of the Reserve Bank of India Act, 1934.

• The primary reasons for these enforcement actions included lapses in KYC (Know Your Customer) norms, Anti-Money Laundering (AML) standards, cybersecurity frameworks, and interest rate transparency.

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 was originally established in Calcutta (now Kolkata) but was permanently moved to Mumbai in 1937.

• While originally privately owned, the RBI was nationalised in 1949 and is now fully owned by the Government of India.

• The current Governor of the Reserve Bank of India is Shaktikanta Das, who has emphasized the "trust but verify" approach toward financial institutions.

• Enforcement Framework:

• The Enforcement Department (ED) of the RBI was set up in April 2017 to separate the process of identifying regulatory violations from the process of imposing penalties.

• The department ensures that the monetary penalties are proportionate to the gravity of the regulatory breach to serve as an effective deterrent.

• A major chunk of the 353 penalties in FY25 was directed toward Urban Co-operative Banks (UCBs), which have been under intense scrutiny for governance issues.

• The RBI Annual Report and Trend and Progress of Banking in India report provide detailed breakdowns of these enforcement

actions and the health of the Indian banking system.

Important Points

• Key Compliance Areas: The RBI focuses on Credit Information Reporting, Fair Practices Code (FPC), and outsourcing of financial services. Lapses in these areas often trigger high-value penalties.

• Financial Stability: By penalizing 353 entities, the RBI aims to safeguard depositors' interests and ensure the overall stability of the financial ecosystem in India.

• Supervisory Action Framework (SAF): For Co-operative Banks, the RBI uses the SAF to initiate corrective actions, which can include both monetary fines and restrictions on lending or deposit-taking.

Q95. Answer: (d) 50 times

The correct answer is 50 times.

Key Points

• The National Payments Corporation of India (NPCI) has introduced a new regulatory framework to manage the frequency of non-financial transactions on the UPI platform.

• Effective from 1 August 2025, a daily limit has been set for checking bank balances through a single UPI application.

• According to the new rules, a user is allowed to perform a maximum of 50 times bank balance enquiries per day through one UPI app.

• The primary objective of this move is to reduce the excessive load on the Core Banking Systems (CBS) of member banks, which often face congestion due to frequent balance checks.

• By capping these non-financial requests, the NPCI aims to prioritize actual financial transactions and improve the overall success rate of payments by minimizing Technical Declines (TD).

• This limit is applicable per user, per bank account, across a single UPI third-party application provider (TPAP) like Google Pay, PhonePe, or Paytm.

Additional Information

• Unified Payments Interface (UPI):

• UPI is a real-time payment system developed by the National Payments Corporation of India (NPCI) to facilitate inter-bank transactions through mobile devices.

• It was officially launched in April 2016 by the then RBI Governor Dr. Raghuram Rajan.

• The system powers multiple bank accounts into a single mobile application, merging several banking features and seamless fund routing.

• National Payments Corporation of India (NPCI):

• NPCI is an umbrella organization for operating retail payments and settlement systems in India.

• It is an initiative of the Reserve Bank of India (RBI) and the Indian Banks' Association (IBA) under the provisions of the Payment and Settlement Systems Act, 2007.

• It was incorporated in December 2008 and is registered as a Section 8 company under the Companies Act 2013.

• Transaction Limits on UPI:

• Standard UPI transactions usually have a daily limit of Rs. 1 lakh, although this can vary depending on the bank and the category of the transaction.

• For specific categories like Capital Markets, Collections, and Insurance, the limit was increased to Rs. 2 lakhs.

• In December 2023, the RBI raised the UPI transaction limit for Hospitals and Educational Institutions to Rs. 5 lakhs per transaction.

Important Points

• Impact on Users: While the 50 times limit is generous for average users, it targets bots or automated scripts that might be stressing the banking infrastructure.

• System Efficiency: High volumes of balance enquiries do not generate revenue for banks but cost them in terms of server maintenance and processing power. Reducing this volume ensures that the Core Banking System (CBS) remains available for critical fund transfers.

• UPI LITE: To further offload the main banking servers, NPCI encourages the use of UPI LITE for small-value transactions (up to Rs. 500), which does not require a PIN and stores the balance on-device.

• Data Security: The NPCI continuously updates its security protocols and guidelines to protect the Digital India ecosystem and ensure consumer trust in digital payments.

Q96. Answer: (b) Global Technology Summit, 2025

The correct answer is Global Technology Summit, 2025.

Key Points

• The Global Technology Summit (GTS) 2025 was held in New Delhi from 10 to 12 April 2025. Hence, statement 2 is correct.

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• The theme of the summit for the year 2025 was “Sambhavna”, which translates to “Possibility”, highlighting the transformative potential of emerging technologies.

• This summit is a premier event that brings together policymakers, industry leaders, and technologists to discuss the geopolitical and economic implications of technology.

• The 2025 edition focused heavily on the regulation and advancement of Artificial Intelligence (AI), Semiconductors, and Quantum Computing.

• The event served as a platform for India to showcase its Digital Public Infrastructure (DPI) and its role as a leader in the Global South for technological cooperation.

Additional Information

• Digital India Summit, 2025:

• This summit focuses on the progress of the Digital India program, launched in 2015, which aims to transform the country into a digitally empowered society.

• It focuses on e-governance, broadband connectivity, and digital literacy rather than the broader geopolitical tech themes of “Sambhavna”. Hence, statement 1 is incorrect.

• India Internet Governance Forum (IIGF), 2025:

• The IIGF is a multi-stakeholder platform that discusses public policy issues related to Internet governance.

• It follows the principles of the United Nations Internet Governance Forum and focuses on topics like cybersecurity and net neutrality. Hence, statement 3 is incorrect.

• World Startup Summit, 2025:

• This event is dedicated to the entrepreneurial ecosystem, connecting founders, venture capitalists, and investors.

• Its primary goal is to foster innovation and business scaling rather than diplomatic technology policy. Hence, statement 4 is incorrect.

• Geopolitical Context:

• The Global Technology Summit is typically co-hosted by the Ministry of External Affairs (MEA) of India and Carnegie India.

• It has become a vital part of India’s tech-diplomacy, addressing how data sovereignty and critical technologies affect international relations.

Important Points

• Significance of the Theme: The word “Sambhavna” emphasizes a shift from uncertainty to opportunity in the digital age, reflecting India's vision of self-reliance (Atmanirbhar Bharat) in high-tech sectors.

• Key Participants: The 2025 summit saw participation from over 50 countries, including G20 members and ASEAN partners, highlighting the global importance of New Delhi as a tech hub.

• Focus on AI Ethics: A major portion of the April 2025 discussions was dedicated to establishing global norms for Responsible AI and mitigating the risks of deepfakes and misinformation.

Q97. Answer: (a) INS Arnala

The correct answer is INS Arnala.

Key Points

• The INS Arnala is the lead ship of the Anti-Submarine Warfare Shallow Water Craft (ASW SWC) project, designed specifically to bolster the Indian Navy's capabilities in coastal waters.

• It was built by Garden Reach Shipbuilders & Engineers (GRSE) in Kolkata. The contract for eight such vessels was signed between the Ministry of Defence and GRSE in April 2019.

• The vessel is named after the Arnala Island, located off the coast of Vasai, Maharashtra, which holds significant maritime historical importance from the era of Chhatrapati Shivaji Maharaj.

• The primary role of INS Arnala includes anti-submarine warfare operations in coastal waters, Low Intensity Maritime Operations (LIMO), and mine-laying operations.

• Equipped with advanced sonar and torpedo launchers, the ship is designed to detect and neutralize enemy submarines in shallow waters where larger vessels may struggle to operate efficiently.

Additional Information

• Project ASW SWC:

• This project aims to replace the aging Abhay-class corvettes of the Indian Navy.

• The ships have a displacement of approximately 750 tons and can achieve a maximum speed of 25 knots.

• These crafts are powered by water-jet propulsion, which provides high maneuverability in shallow coastal regions.

• INS Nilgiri:

• It is the lead ship of Project 17A stealth frigates.

• Built by Mazagon Dock Shipbuilders Limited (MDL), these ships feature advanced stealth features, weapons, and sensors.

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• INS Surat:

• This is the fourth and final ship of the Project 15B (Visakhapatnam-class) guided-missile destroyers.

• It represents one of the most advanced destroyer classes in the Indian Navy, named after the commercial capital of Gujarat.

• INS Vaghsheer:

• It is the sixth and final submarine of the Kalvari-class (Project 75), based on the Scorpene design.

• These are diesel-electric attack submarines designed for various missions including anti-surface warfare and intelligence gathering.

Important Points

• Indigenization: The ASW SWC ships like INS Arnala boast over 80% indigenous content, aligning with the Aatmanirbhar Bharat (Self-reliant India) initiative.

• Specifications: The craft has a length of 77 meters and is equipped with lightweight torpedoes and ASW rockets to counter sub-surface threats effectively.

• Strategic Depth: By securing the coastal waters, these shallow-water crafts allow the Indian Navy's larger capital ships, like aircraft carriers and destroyers, to focus on deep-sea blue-water operations.

• Operational Range: The vessel has an endurance of 1,800 nautical miles, ensuring a persistent presence across the Indian coastline.

Q98. Answer: (b) 100 m

The correct answer is 100 m.

Key Points

• Gurindervir Singh, a talented sprinter from Punjab, dominated the tracks during the Indian Grand Prix 1 (IGP 1).

• He competed in the 100 m athletic game and clocked an impressive timing of 10.32 seconds.

• The event was held at the Netaji Subhas National Institute of Sports (NSNIS) in Patiala in February 2021.

• His performance in the 100 m sprint was significant as it established him as the fastest man of the meet, showcasing his explosive acceleration and sprinting prowess.

• The 100 m race is a premier track and field event that requires athletes to cover a distance of one hundred meters in the shortest possible time.

Additional Information

• Athletics Federation of India (AFI):

• The AFI is the apex body for athletics in India, responsible for conducting national championships and selecting athletes for international competitions.

• It was established in 1946 and is headquartered in New Delhi.

• The federation organizes the Indian Grand Prix series to provide athletes with competitive platforms to achieve qualifying marks for the Olympics and World Athletics Championships.

• National Records in Sprinting:

• The senior national record for the men’s 100 m is held by Amiya Kumar Mallick, who recorded a time of 10.26 seconds in 2016.

• Gurindervir Singh has previously held the National Under-20 record in the 100 m, highlighting his consistent growth in the sport.

• In the women’s category, Dutee Chand holds the national record for the 100 m with a timing of 11.17 seconds.

• Significance of the 100 m Event:

• The 100 m sprint is often referred to as the "blue riband" event of track and field, with the winner being dubbed the "fastest man/woman alive."

• Key factors affecting performance include reaction time, stride frequency, and stride length.

Important Points

• The Indian Grand Prix 1 2021 featured several other top athletes, including Hima Das and Dutee Chand, making it a crucial event for the Indian athletics calendar.

• Patiala’s NSNIS is Asia’s largest sports institute and serves as the primary training ground for India’s elite track and field athletes.

• Success in short-distance sprints like the 100 m and 200 m requires specialized training in plyometrics and anaerobic conditioning.

• Gurindervir Singh’s timing of 10.32 seconds was a significant personal achievement, reinforcing the depth of talent in Indian sprinting.

Q99. Answer: (d) The Order of St Michael and St George

The correct answer is The Order of St Michael and St George.

Key Points

• The Order of St Michael and St George is the premier honour awarded to British nationals and others for outstanding service abroad or internationally, particularly in relation to Foreign and Commonwealth affairs.

• It is traditionally featured in the King's Birthday Overseas & International Honours List, which recognizes individuals serving the United Kingdom's interests internationally or those performing exceptional charitable or voluntary work abroad.

• Founded in 1818 by the Prince Regent (later King George IV), the order was originally created to commemorate the Ionian Islands becoming a British protectorate and for service in Malta.

• The order consists of three ranks: Knight or Dame Grand Cross (GCMG), Knight or Dame Commander (KCMG or DCMG), and Companion (CMG).

• In the context of the 2025 honours, this specific order is used to reward diplomats, colonial officials, and individuals involved in international relations and global development.

Additional Information

• The Order of the British Empire:

• Established by King George V in 1917, this order recognizes a wide range of service to the United Kingdom across many sectors, including arts, sciences, and public service.

• It includes levels such as GBE, KBE/DBE, CBE, OBE, and MBE. While it can be awarded to people abroad, it is the standard order for national achievement within the UK.

• The Royal Victorian Order:

• Founded by Queen Victoria in 1896, this is a dynastic order of knighthood.

• It is uniquely in the personal gift of the Monarch and is awarded for services rendered specifically to the Sovereign or members of the Royal Family, rather than on the advice of the Prime Minister.

• The King's Police Medal (KPM):

• This medal is awarded to members of the police forces in the United Kingdom and Commonwealth for distinguished service or gallantry.

• Following the accession of King Charles III, the award was renamed from the Queen's Police Medal.

• Selection Process:

• Honours in the Overseas and International List are recommended by the Foreign, Commonwealth & Development Office (FCDO).

• The 2025 King's Birthday Honours serve as one of two major annual lists (alongside the New Year Honours) that celebrate the contributions of individuals to British society and the world.

Important Points

• Motto and Symbolism: The motto of The Order of St Michael and St George is "Auspicium Melioris Aevi", which translates to "Token of a better age".

• The Chapel: The primary chapel for this order is located within St Paul's Cathedral in London, which serves as a site for official ceremonies related to the order.

• Eligibility: While primarily for British citizens, honorary awards can be made to citizens of countries where the King is not Head of State.

• Rank Distinction: The GCMG is the highest class and is often reserved for very high-ranking officials such as Governors-General or senior ambassadors.

Q100. Answer: (b) Natural disasters

The correct answer is Natural disasters.

Key Points

• The Sachet App is a mobile application developed and launched by the National Disaster Management Authority (NDMA) to provide citizens with real-time alerts and warnings specifically regarding natural disasters.

• The application serves as a unified platform under the Integrated Alert System, designed to disseminate critical information about impending emergencies such as floods, cyclones, earthquakes, heatwaves, and landslides.

• It utilizes a geo-targeted mechanism, meaning users receive alerts based on their specific geographical location, ensuring that only relevant and timely information reaches those in the danger zone.

• The app is built upon the Common Alerting Protocol (CAP), a global standard for emergency messaging that ensures consistency across different communication channels like SMS, Radio, and Television.

• In addition to warnings, the app provides "Do's and Don'ts" for various disaster scenarios, empowering citizens with actionable knowledge to ensure their safety during a natural calamity.

Additional Information

• National Disaster Management Authority (NDMA):

• It is the apex statutory body for disaster management in India, established under the Disaster Management Act, 2005.

• The NDMA is chaired by the Prime Minister of India and is responsible for laying down policies, plans, and guidelines for disaster management to ensure a timely and effective response.

• Common Alerting Protocol (CAP):

• CAP is a digital format for exchanging emergency alerts and public warnings over various networks.

• It was implemented in India through the Centre for Development of Telematics (C-DOT), enabling a "one-stop" shop for all alert-generating agencies.

• Technical Collaboration:

• The alert system integrates data from various national agencies including the India Meteorological Department (IMD) for weather, the Central Water Commission (CWC) for floods, and the Indian National Centre for Ocean Information Services (INCOIS) for tsunamis.

• The Sachet App supports multi-lingual alerts, allowing users to receive information in several regional Indian languages to overcome linguistic barriers during crises.

Important Points

• Phased Rollout: The CAP-compliant integrated alert system was rolled out in phases across India, starting with high-risk coastal states to mitigate the impact of cyclones.

• Zero Cost: The Sachet App is a free-to-use government service, aimed at reaching the maximum number of citizens, including those in rural and remote areas.

• Disaster Resilience: This initiative is a part of India's broader commitment to the Sendai Framework for Disaster Risk Reduction (2015-2030), which emphasizes the use of technology and early warning systems to save lives.

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