RRB Group D Official Paper (Held On: 10 Feb, 2026 Shift 3) (Previous Year Paper)

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

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GENERAL SCIENCE

Q1. Galvanisation protects iron from rusting by coating it with a thin layer of:

(a) Silver metal only
(b) Copper metal only
(c) Nickel metal only
(d) Zinc metal only

Q2. When a person stands stationary on the ground, the force of gravity exerted by the Earth on the person (Action) and the normal force exerted by the ground on the person (Reaction) are equal and opposite. Is this an action-reaction pair, according to Newton's Third Law?

(a) Yes, because they balance each other, preventing motion.
(b) No, because the two forces act on different objects.
(c) Yes, because the two forces are equal and opposite in magnitude.
(d) No, because the two forces act on the same object.

Q3. Why does the blue colour of copper sulphate solution fade when an iron nail is dipped in it?

(a) Iron sulphate is colourless
(b) Copper sulphate decomposes
(c) Copper dissolves in water
(d) Copper sulphate is converted into iron sulphate

Q4. Under what spatial condition is the magnitude of the force acting on a current-carrying conductor placed in a uniform magnetic field observed to be the highest?

(a) When the current and field are parallel.
(b) When the current is varied instantaneously.
(c) When the current flows towards the south pole of the magnet.
(d) When the current and field are perpendicular to each other.

Q5. What is a necessary property of the electrolyte used during the refining of metals by electrolysis?

(a) It must be an aqueous or molten solution of a suitable metal salt
(b) It must remain completely non-reactive throughout the procedure
(c) It must efficiently conduct heat during the electrochemical process
(d) It must be composed of both water and a layer of neutral oil

Q6. Which cell organelles in a leaf contain chlorophyll necessary for photosynthesis?

(a) Chloroplasts
(b) Nucleus
(c) Mitochondria
(d) Vacuole

Q7. Which of the following fish production methods are done in the region of Kashmir?

(a) Pearl Culture
(b) Brackish Water Fisheries
(c) Marine Fisheries
(d) Aqua Culture

Q8. In a v–t graph for uniform acceleration, which of the following is NOT correct?

(a) Positive slope indicates acceleration.
(b) The area under the v–t graph gives displacement.
(c) The slope of the v–t graph is constant.
(d) The v–t graph is always curved.

Q9. Fertilization in females usually occurs in which region of the reproductive system?

(a) Ovary
(b) Uterus
(c) Vagina
(d) Fallopian Tube

Q10. Match the following plants with their correct modes of seed dispersal.

| Column A | Column B | | --- | --- | | 1. Dandelions | a. Water | | 2. Lotus | b. Explosion | | 3. Mango | c. Wind | | 4. Castor | d. Animal |	**Column A**	**Column B**	**1. Dandelions**	**a. Water**	**2. Lotus**	**b. Explosion**	**3. Mango**	**c. Wind**	**4. Castor**	**d. Animal**
Column A	Column B									
1. Dandelions	a. Water									
2. Lotus	b. Explosion									
3. Mango	c. Wind									
4. Castor	d. Animal									

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

Q11. Substitution reaction involves:

(a) Addition of atoms to double bonded molecules
(b) Replacement of a carbon atom with hydrogen
(c) One atom or group of atoms being replaced by another

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(d) Removal of atoms to form simpler molecules

Q12. Which trophic level represents maximum concentration of pesticides by biological magnification?

(a) Tertiary Consumer
(b) Primary Consumer
(c) Producer
(d) Secondary Consumer

Q13. When iron filings are mixed with sulfur powder and the mixture is heated, a black substance called iron sulfide is formed. Which statement best describes the changes involved?

(a) A chemical change occurs as a new substance is formed.
(b) A physical change occurs as the substances are only mixed.
(c) A reversible physical change takes place.
(d) Iron dissolves in sulfur forming a solution.

Q14. The kinetic energy of an object of mass m moving with a velocity v is 25 J. What will be its kinetic energy when its velocity is increased three times (3v) ?

(a) 75 J
(b) 125 J
(c) 150 J
(d) 225 J

Q15. Which of the following acts as an olfactory indicator in acid-base reactions?

(a) Onion extract changes smell in bases
(b) Turmeric turns blue in bases
(c) Phenolphthalein turns pink in acids
(d) Methyl orange produces odour in base

Q16. Which of the following factors primarily determines the size of an atom?

(a) Number of electrons
(b) Mass of the nucleus
(c) Number of neutrons
(d) Number of protons

Q17. If the wavelength of light is 600 nm and its speed is 3 × 10^8 m/s, the frequency is approximately _____.

(a) 5 × 10^(14) Hz
(b) 6 × 10^(10) Hz
(c) 3 × 10^8 Hz
(d) 2 × 10^{12} Hz

Q18. Which of the following devices works on Archimedes' principle?

(a) Sphygmomanometer
(b) Altimeter
(c) Hydrometer
(d) Aneroid barometer

Q19. Which of the following cell structures helps amoeba to acquire its food material?

(a) Plasma membrane
(b) Cilia
(c) Flagella
(d) Nuclear membrane

Q20. Which of the following represents a similarity between chloroplast and Mitochondria?

(a) Both perform photosynthesis.
(b) Both posses their own DNA and 70S Ribosome.
(c) Both perform respiration.

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(d) Both have chlorophyll.

Q21. The molecular mass of a compound is 63 u. If it contains one hydrogen atom and three oxygen atoms, the atomic mass of the remaining element is :

(a) 32 u
(b) 14 u
(c) 16 u
(d) 12 u

Q22. An object is placed at 80 cm on the left of a convex lens of focal length 40 cm. Where should a screen be placed to right of the lens so that the image formed is real, inverted and same sized?

(a) The screen should be placed 80 cm from the lens.
(b) The screen should be placed anywhere between 40 cm and 80 cm from the lens.
(c) The screen should be placed at 40 cm from the lens.
(d) The screen should be placed anywhere between 20 cm and 40 cm from the lens.

Q23. If a conductor has a potential difference of 1 volt across its ends and a current of 1 ampere flows through it, what is its resistance?

(a) 1 ohm
(b) 2 ohm
(c) 0.5 ohm
(d) 10 ohm

Q24. If several rays of light parallel to the principal axis are falling on a convex lens, which of the following statements is correct for the refracted ray?

(a) They pass without any deviation.
(b) They meet at the infinity.
(c) They converge at a point on the opposite side of the lens.
(d) They diverge as if coming from the principal focus.

Q25. Which of the following changes can be regarded as part of sexual maturation in human males?

(a) Deposition of fat in hips
(b) Cracking of voice
(c) Increase in weight
(d) Increase in height

MATHEMATICS

Q26. Five years ago, the ratio of Priya's age to Meera's age was 3 : 2. The difference of their present ages is 10 years. What is Meera's current age?

(a) 35 years
(b) 20 years
(c) 25 years
(d) 29 years

Q27. If 2^(3y + x)= 16 and 2^(2y - x) = 64, then the value of y is:

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

Q28. A and B started moving at the same time towards each other from points X and Y, respectively. After meeting on the way, A and B took 90.9 hours and p hours, respectively, to reach Y and X, respectively. If the speed of B is 50% more than that of A, then what is the value of p?3518

(a) 39.7

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(b) 38.9
(c) 40.4
(d) 42.4

Q29. Two pipes, M and N, can fill a tank in 10 minutes and 15 minutes, respectively. Both pipes are opened together but after 5 minutes, pipe M is turned off. What is the total time required to fill the tank?
(a) 7.5 minutes
(b) 5 minutes
(c) 5.5 minutes
(d) 10 minutes

Q30. Bina sells an article to Shyam at a 19% loss for Rs. 4,860. Shyam then sells it to Hari for the price Bina would have needed to sell to make a 17% profit. What is Shyam's profit?
(a) Rs. 2,160
(b) Rs. 1,260
(c) Rs. 2,520
(d) Rs. 1,740

Q31. A shopkeeper earns a profit of 10% after allowing a discount of 20% on the marked price. The cost price of the article whose marked price is Rs. 880 is:
(a) Rs. 640
(b) Rs. 704
(c) Rs. 774
(d) Rs. 680

Q32. The mode and median of a data are 46.2 and 40, respectively. What is the mean of the data? (Use empirical formula.)
(a) 36.9
(b) 38.8
(c) 45.2
(d) 47.6

Q33. A farmer wants to prepare 20 kg of fertiliser mixture containing 42% nitrogen by mixing two types of fertilisers, A and B. Fertiliser A contains 30% nitrogen, and fertiliser B contains 50% nitrogen. How many kilograms of each fertiliser should he mix?
(a) 6 kg of A, 14 kg of B
(b) 10 kg of A, 10 kg of B
(c) 12 kg of A, 8 kg of B
(d) 8 kg of A, 12 kg of B

Q34. The H.C.F. and the L.C.M. of two numbers are 18 and 1296, respectively. If one of the numbers is 162, find the other one.
(a) 108
(b) 180
(c) 144
(d) 126

Q35. If the surface area of a sphere is 5544 cm^2, then find its diameter (in cm). (Use $\pi = 22/7$)
(a) 40
(b) 21
(c) 36
(d) 42

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Q36. In a 100 meter race, A covers the distance in 36 seconds and B covers the same distance in 45 seconds. In this race A beats B by:

(a) 20 metres
(b) 17 metres
(c) 22 metres
(d) 23 metres

Q37. The expenditure of Sudha is 175% more than her savings. If her expenditure decreases by 12% and savings increase by 40.5%, then by what percentage does her income increase?

(a) 7%
(b) 6%
(c) 4%
(d) 2%

Q38. The amount on a sum of Rs. 3,300 at 10% per annum compound interest, compounded annually, in 2 years will be:

(a) Rs. 3,826
(b) Rs. 3,993
(c) Rs. 3,583
(d) Rs. 4,939

Q39. Rashmi buys 34 mobile stands for Rs. 6,800. Now, she decides to start a small business by selling these stands. How many mobile stands can she buy for Rs. 13,600 ?

(a) 67
(b) 65
(c) 68
(d) 66

Q40. Successive discounts of 2% and 21% are equivalent to what single discount?

(a) 22.58%
(b) 23.24%
(c) 24.52%
(d) 26.37%

Q41. If $\sec^2 A + \text{cosec}^2 A = 13$, and A is an acute angle, then find the value of $\tan^2 A + \cot^2 A$.

(a) 9
(b) 11
(c) 12
(d) 15

Q42. The outer and inner diameters of a hollow cylindrical pipe are 10 cm and 6 cm, respectively. If its length is 21 cm, then its total surface area is:

(a) 368π cm²
(b) 472π cm²
(c) 154π cm²
(d) 168π cm²

Q43. P and Q together can fill a cistern with water in 3 hours. If P alone can fill the cistern with water in 12 hours, then in how many hours will Q alone fill one-fourth of the same cistern with water?

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

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Q44. Rahul's monthly expenditure is 75% of his monthly income. If the monthly savings are Rs. 10,000, calculate his monthly income.

(a) Rs. 30,000
(b) Rs. 45,000
(c) Rs. 50,000
(d) Rs. 40,000

Q45. Simplify: $((p-q)^3 + (q-r)^3 + (r-p)^3)/(p-q)(q-r)(r-p)$

(a) (p − q)
(b) 1
(c) pqr
(d) 3

Q46. From the salary of an officer, 10% is deducted as house rent. Of the remaining amount, he spends 20% on conveyance, 20% of the rest on income tax, and 10% of the balance on clothes. He is left with Rs. 23,328. What is his total salary?

(a) Rs. 30,000
(b) Rs. 35,000
(c) Rs. 45,000
(d) Rs. 40,000

Q47. In a regular polygon, the number of diagonals is 9. Find the difference between one interior angle and one exterior angle of the polygon.

(a) 55°
(b) 70°
(c) 60°
(d) 48°

Q48. If Rs. 2,239 is divided among 269 children such that each girl and each boy get Rs. 7 and Rs. 9, respectively, then how many boys are there?

(a) 238
(b) 178
(c) 138
(d) 218

Q49. The average of 6.5, 10.7, 20.2 and a is 15. The value of a is:

(a) 22.6
(b) 24.6
(c) 21.6
(d) 23.6

Q50. Rs. 5,398 is divided among X, Y, and Z in such a way that if Rs. 16, Rs. 15, and Rs. 75 be deducted from their respective shares, they have money in the ratio 2 : 21 : 4. Find the difference between the Y's and Z's original shares.

(a) Rs. 3,182
(b) Rs. 3,282
(c) Rs. 3,232
(d) Rs. 3,272

GENERAL INTELLIGENCE & REASONING

Q51. In a certain code language, 'LEMA' is coded as '5681' and 'ALES' is coded as '6513'. What is the code for 'S' in the given code language?

(a) 6
(b) 1

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(c) 5
(d) 3

Q52. Fawad starts from Point A and drives 13 km towards the North. He then takes a right turn, drives 11 km, turns right and drives 14 km. He then takes a right turn and drives 12 km. He takes a final right turn, drives 1 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 degrees turns only unless specified)

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

Q53. In a certain code language,

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

A # B means 'A is the brother of B'

A × B means 'A is the wife of B'

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

Based on the above, how is L related to R if 'L × O # V + E @ R'?

(a) Wife
(b) Father's brother's daughter
(c) Daughter
(d) Father's brother's wife

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

32 42 57 77 102 ?

(a) 134
(b) 131
(c) 132
(d) 133

Q55. Deepu starts from point K and drives 12 km towards the East. He then takes a left turn, drives 6 km, turns right, and drives 3 km. He then takes a right turn and drives 6 km. Finally, he takes a right turn, drives 5 km, and stops at point P. How far (shortest distance) and towards which direction should he drive in order to reach point K again? (All turns are 90 degrees turns only unless specified).

(a) 8 km towards the South
(b) 10 km towards the North
(c) 5 km towards the West
(d) 10 km towards the West

Q56. What should come in place of the question mark (?) in the given series?

57 68 79 90 101 ?

(a) 111
(b) 117
(c) 116
(d) 112

Q57. J, K, L, M, N and O are sitting around a circular table facing the centre. N is an immediate neighbour of both L and M. J is sitting to the immediate left of L. K is sitting third to the right of N.

How many people sit between J and M when counted from the left of M?

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

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Q58. DUBW is related to PGNI in a certain way based on the English alphabetical order. In the same way, ZQXS is related to LCJE. To which of the following options is JAHC related to, following the same logic?

(a) VMTO
(b) VBHY
(c) VTIO
(d) VMOT

Q59. Which of the following letter-number clusters will replace the question mark (?) in the given series to make it logically complete?

DHK31 EIL40 FJM49 GKN58 ?

(a) HLO67
(b) HLP68
(c) HLO68
(d) HLP67

Q60. If 3 is added to each odd digit and 2 is subtracted from each even digit in the number 5341256, what will be difference between the highest and lowest digits in the number thus formed?

(a) 0
(b) 8
(c) 4
(d) 2

Q61. Refer to the following letter series and answer the question.

(Left) C X Z A L P W T M D B R O J K F G V Q H E N (Right)

What is the position of letter "L" in the series from the left end?

(a) Sixth
(b) Fifth
(c) Seventh
(d) Fourth

Q62. Refer to the following series and answer the question. (Counting to be done from left to right only) (All numbers are single-digit numbers only).

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

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

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

Q63. What should come in place of '?' in the given series?

155 163 179 187 203 ?

(a) 209
(b) 215
(c) 211
(d) 213

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

(188, 47, 45)

(224, 56, 54)

(a) (284, 71, 69)

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(b) (332, 83, 77)
(c) (152, 38, 32)
(d) (248, 68, 66)

Q65. This question is based on the five, three-digit numbers given below.

(Left) 475 326 157 761 829 (Right)

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

NOTE - All operations to be done from left to right.

If all the numbers are arranged in ascending order, the position of how many numbers will remain unchanged?

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

Q66. Preeti ranked 9th from the bottom and 8th from the top in her class. How many students are there in her class?

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

Q67. Read the given statements and conclusions carefully. Assuming that the information given in the statements is true, even if it appears to be at variance with commonly known facts, decide which of the given conclusions logically follow(s) from the statements.

Statements:

Some grapes are oranges.

All oranges are apples.

Conclusions:

(I) Some grapes are apples.

(II) All apples are oranges.

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

Q68. What will come in the place of the question mark (?) in the following equation, if '+' and '−' are interchanged and '×' and '÷' are interchanged?

170 ÷ 2 - 150 ÷ 2 + 254 × 2 - 156 × 3 - 10 = ?

(a) 421
(b) 575
(c) 497
(d) 601

Q69. Based on the alphabetical order, three of the following four are alike in a certain way and thus form a group. Which is the one that does not belong to that group?

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

(a) HMP
(b) VZC
(c) DHK
(d) YCF

Q70. Refer to the following number and symbol series and answer the question that follows. Counting to be done from left to right only.

(Left) 2 5 6 & 8 & < < 7 4 ^ 6 5 9 2 & 7 2 % (Right)

How many such symbols are there, each of which is immediately preceded by a number and also immediately

followed by another symbol?

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

Q71. Select the pair which follows the same pattern as that followed by the two pairs given below. Both pairs follow the same pattern.

BKQ:FOU

DJM:HNQ

(a) BST:HIS
(b) ELO:IPS
(c) TYP:VHU
(d) VTO:FRS

Q72. Based on the alphabetical order, three of the following four are alike in a certain way and thus form a group. Which is the one that does not belong to that group?

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

(a) GLO
(b) VZC
(c) NSV
(d) KPS

Q73. All 133 people are standing in a row facing north. Mr. Lkj is 24th from the right end while Mr. Ihg is 33rd from the left end. How many people are there between Mr. Lkj and Mr. Ihg?

(a) 77
(b) 78
(c) 76
(d) 75

Q74. If '+' means 'subtraction', '−' means 'multiplication', '×' means 'division' and '÷' means 'addition', then what will come in place of the question mark (?) in the following equation?

19 + 32 × 4 ÷ 9 - 3 = ?

(a) 32
(b) 38
(c) 37
(d) 35

Q75. Read the given statement(s) 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 statement(s).

Statements: Some cookies are juices. All juices are breads.

Conclusion (I): Some breads are cookies

Conclusion (II): No cookie is a bread

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

Q76. Seven people, S, Q, U, A, R, E and D are sitting in a row, facing north.

Only two people sit between U and E. Only Q sits to the right of D. Only one person sits between E and D. S sits at some place to the right of A but at some place to the left of R.

How many people sit between R and A?

(a) Four

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

Q77. IKLO is related to XZAD in a certain way based on the English alphabetical order. In the same way, QSTW is related to FHIL. To which of the following options is JLMP related to, following the same logic?
(a) YEAB
(b) YABE
(c) YRTE
(d) YBDE

Q78. In a certain code language, 'MULE' is coded as '7536' and 'LUKE' is coded as '6723'. What is the code for 'K' in that language?
(a) 3
(b) 6
(c) 2
(d) 7

Q79. Which of the following letter-number clusters will replace the question mark (?) in the given series to make it logically complete?
XUE 19, BYI 27, FCM 35, JGQ 43, ?
(a) NKU 51
(b) LJU 52
(c) NLU 52
(d) MKV 51

Q80. Six people, A, B, C, D, E and F, are sitting in a row, facing north. Only two people sit to the left of F. Only one person sits between D and E. F sits to the immediate left of D. A sits to the immediate right of C. B sits third to the right of A. Who sits at the extreme left end of the line?
(a) A
(b) C
(c) D
(d) E

GENERAL AWARENESS AND CURRENT AFFAIRS

Q81. The Union Government launched a new climate resilience program in January 2025 to tackle extreme weather events. What is the name of this initiative?
(a) National Climate Adaptation Plan
(b) Green India Mission
(c) Climate Resilience Initiative
(d) Mission Mausam

Q82. As per Copernicus Climate Change Service (C3S), January 2025, which Indian city experienced record-breaking air pollution levels in January 2025 due to temperature inversion and climate change effects?
(a) Mumbai
(b) Bengaluru
(c) New Delhi
(d) Chennai

Q83. According to the World Bank's Gini Index for 2025, which country has been ranked as the fourth most equal in terms of income distribution?
(a) Sweden
(b) India
(c) Japan

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(d) Canada

Q84. In October 2024, which two countries reached a historic political agreement on the return of Mauritian sovereignty over the Chagos Archipelago, including Diego Garcia?

(a) The Republic of Mauritius and the United Kingdom
(b) The United States and the Republic of Mauritius
(c) Germany and the Republic of Mauritius
(d) The Republic of Mauritius and France

Q85. In March 2025, which national park became India's 58th tiger reserve?

(a) Kanha NP
(b) Madhav NP
(c) Ratapani NP
(d) Satpura NP

Q86. What was the purpose of the Banking Laws (Amendment) Act, 2025?

(a) Undertake privatization and modernization of public sector banks
(b) Limit and regulate foreign bank investments
(c) Reduce and restructure banking operations
(d) Ensure enhanced protection for depositors and investors

Q87. In December 2025, which institution launched India's first incubator-linked deep technology venture capital fund named "Y-Point Venture Capital Fund"?

(a) Indian Institute of Technology Bombay
(b) Indian Institute of Technology Madras
(c) Indian Institute of Technology Delhi
(d) Indian Institute of Technology Kanpur

Q88. According to the 2024 report by the United Nations Inter-agency Group for Child Mortality Estimation (UN IGME), India achieved a major milestone by reducing the percentage of zero-dose children from 0.11% in 2023 to what percentage in 2024?

(a) 0.09%
(b) 0.03%
(c) 0.10%
(d) 0.06%

Q89. Which of the following was the full-fledged annual Summit of the Shanghai Cooperation Organization (SCO) held in 2025, where multilateral cooperation, economic resilience, and Global-South development priorities were strongly emphasized?

(a) Astana SCO Summit
(b) New Delhi SCO Summit
(c) Samarkand SCO Summit
(d) Tianjin SCO Summit

Q90. Who was honored with the Satyajit Ray Memorial Award at the 21st Third Eye Asian Film Festival in 2025?

(a) Amitabh Bachan
(b) Javed Ali Khan
(c) Shah Rukh Khan
(d) Rafique Baghdadi

Q91. Which among the following banks appointed Rajiv Anand as Chief Executive Officer (CEO) for a three-year term starting August 25, 2025?

(a) Kotak Mahindra Bank
(b) IndusInd Bank
(c) IDFC First Bank
(d) Axis Bank

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Q92. Which Indian documentary received the World Cinema Documentary Special Jury Award for Craft at Sundance 2025?

(a) Beyond Blast by Saikhom Ratan
(b) Hope by K Sathyanarayan
(c) Echo by Meena Longjam
(d) Nocturnes by Anirban Dutta and Anupama Srinivasan

Q93. Which country won the FIH Hockey Pro League 2024-25 (Men) held at the iconic Kalinga Hockey Stadium in Bhubaneswar ?

(a) Belgium
(b) Pakistan
(c) Germany
(d) India

Q94. Who inaugurated the Esports Conclave 2025 in New Delhi?

(a) Narendra Modi
(b) Anurag Thakur
(c) Mansukh Mandaviya
(d) Raksha Nikhil Khadse

Q95. At the 15th South Asian Bodybuilding and Physique Sports Championships 2025 held in Bhutan, which Indian athlete won the gold medal in the Women's Model Physique up to 155 cm event?

(a) Bhawna Tokekar
(b) Yajik Hillang
(c) Akanksha Chaudhary
(d) Anju Bobby George

Q96. At the 2025 Laureus World Sports Awards in Madrid, who won the Laureus World Sportswoman of the Year in the football category?

(a) Aitana Bonmatí
(b) Simone Biles
(c) Shelly-Ann Fraser Pryce
(d) Faith Kipyegon

Q97. What was the main objective of the Tri Services Academia Technology Symposium (T-SATS) held in 2025?

(a) Strengthening academic interface with defence institutions
(b) Establishing a tri-service technology command
(c) Expanding private sector leadership in defence innovation
(d) Aligning academic R&D with future defence technology needs

Q98. In February 2025, the Insurance Regulatory and Development Authority of India (IRDAI) issued a circular enabling customers to block premium payment via which method for life and health policies?

(a) UPI one-time mandate
(b) Standing Debit Order
(c) ECS recurring mandate
(d) Cheque stop

Q99. On 26 March 2025, the DRDO and the Indian Navy successfully conducted a flight-test of which missile from the Integrated Test Range (ITR), Chandipur?

(a) Akash-NG
(b) Astra Mk-2
(c) SAMAR-1
(d) VLSRSAM

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Q100. The Immigration and Foreigners Act, 2025 introduces which major reform for foreign visitors?

(a) Exemptions from exit checks
(b) Real-time monitoring and scrutiny
(c) Automatic 10-year visas
(d) Waiver of travel documents for select nations

ANSWER KEY

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

SOLUTIONS

Q1. Answer: (d) Zinc metal only

The correct answer is Zinc metal only.

Key Points

• Galvanisation is a metallurgical process used to protect Iron and Steel from Rusting by applying a thin, protective coating of Zinc.

• The process is highly effective because Zinc acts as a physical barrier between the metal and the atmosphere, preventing Oxygen and Moisture from reaching the surface of the Iron.

• The most common method utilized in industries is Hot-dip galvanizing, where the metal components are submerged in a bath of molten Zinc at temperatures typically around 450 degrees Celsius (842 degrees Fahrenheit).

• A unique feature of this process is Sacrificial Protection; since Zinc is more chemically active (electropositive) than Iron, it corrodes in preference to the Iron, even if the coating is scratched or damaged.

• While other metals like Nickel, Chromium, or Tin can be used for coating (in processes like electroplating), the specific term Galvanisation refers exclusively to the application of Zinc.

Additional Information

• Rusting of Iron:

• Rusting is an oxidation reaction that occurs when Iron reacts with Oxygen in the presence of Water or Moisture.

• The chemical formula for rust is $Fe_2O_3.nH_2O$, which is known as Hydrated Iron(III) Oxide. It is a reddish-brown flaky substance that weakens the structural integrity of the metal.

• Other Methods of Rust Prevention:

• Painting and Greasing: Provides a simple barrier to block Air and Water.

• Alloying: Mixing Iron with elements like Chromium (at least 10.5%) and Nickel produces Stainless Steel, which is highly resistant to corrosion.

• Anodizing: Primarily used for Aluminium, it thickens the natural oxide layer on the metal surface.

• Tinning: Coating Iron or Steel with Tin, often used for food containers as Tin is non-toxic.

• Comparison of Options:

• Silver: It is an expensive precious metal and would be economically unviable for industrial rust protection.

• Copper: If used as a coating, it can actually accelerate the corrosion of Iron if the coating is breached because Iron is more reactive than Copper.

• Nickel: Used in Electroplating to provide a shiny finish and corrosion resistance, but it does not provide the same sacrificial protection as Zinc.

Important Points

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• The term Galvanisation is named after the Italian scientist Luigi Galvani, who studied the effects of electricity on biological tissues, though the industrial coating process was developed later in the 19th Century.

• In a Galvanic Cell setup, the Zinc acts as the Anode and the Iron acts as the Cathode, ensuring the base metal remains protected as long as the Zinc is present.

• Common applications of galvanized Iron include Roofing sheets, Water pipes, Fencing, and Automotive body parts.

Q2. Answer: (d) No, because the two forces act on the same object.

The correct answer is No, because the two forces act on the same object.

Key Points

• Newton's Third Law of Motion states that for every action, there is an equal and opposite reaction. A fundamental criterion for these forces to be considered an action-reaction pair is that they must act on two different objects.

• In the given scenario, the force of gravity (the Earth pulling the person downward) and the normal force (the ground pushing the person upward) both act on the same object—the person.

• Because both forces are applied to the person, they cannot constitute an action-reaction pair according to the Third Law. Instead, they represent a state of static equilibrium. Hence, statement 4 is correct.

• Statement 1 suggests they are a pair because they balance each other. However, balancing forces that prevent motion are related to Newton's First Law (equilibrium) and specifically act on a single body, which contradicts the definition of a Third Law pair. Hence, statement 1 is incorrect.

• Statement 2 is factually incorrect in its premise regarding the specific forces mentioned; the gravity and normal force in this example are both exerted on the person, not on different objects. Hence, statement 2 is incorrect.

• Statement 3 claims they are a pair simply because they are equal and opposite. While action-reaction pairs are indeed equal and opposite, not all equal and opposite forces are action-reaction pairs. They must also act on different bodies and be of the same physical nature. Hence, statement 3 is incorrect.

Additional Information

• Identifying True Action-Reaction Pairs:

• The reaction to the Earth's gravitational pull on the person is the person's gravitational pull on the Earth. These two forces act on different bodies (Person and Earth).

• The reaction to the ground pushing up on the person (Normal Force) is the person pushing down on the ground. These two forces act on different bodies (Person and Ground).

• Nature of Forces: Action-reaction pairs must be of the same nature. Gravity is a field force (non-contact), whereas the normal force is a contact force (electromagnetic in origin at the atomic level). A field force and a contact force can never form a Newtonian pair.

• Equilibrium vs. Third Law:

• Equilibrium involves multiple forces acting on one object that sum to a net force of zero, resulting in zero acceleration.

• Newton's Third Law describes a symmetry in nature where forces always occur in pairs acting on interacting objects. These forces never cancel each other out because they act on different systems.

• Simultaneity: In an action-reaction pair, there is no time delay. The action does not "cause" the reaction after a lapse of time; both forces appear and disappear simultaneously.

Important Points

• Mathematical Representation: Newton's Third Law is often expressed as $F_{(AB)} = -F_{(BA)}$, where $F_{(AB)}$ is the force exerted by object A on object B, and $F_{(BA)}$ is the force exerted by object B on object A.

• Independence of Motion: The Third Law holds true whether the objects are stationary, moving at a constant velocity, or accelerating.

• Common Examples:

• Recoil of a Gun: The gun exerts a forward force on the bullet (action), and the bullet exerts an equal backward force on the gun (reaction).

• Swimming: A swimmer pushes the water backward (action), and the water pushes the swimmer forward (reaction).

• Walking: A person pushes the ground backward with their feet (action), and the ground pushes the person forward (reaction).

• Mass Influence: Although the forces are equal in magnitude, the resulting accelerations can be vastly different depending on the mass of the objects ($a = F/m$). This is why we don't see the Earth move when we jump, even though we pull on it with the same force it pulls on us.

Q3. Answer: (d) Copper sulphate is converted into iron sulphate

The correct answer is Copper sulphate is converted into iron sulphate.

Key Points

• When an iron nail is placed in a copper sulphate ($CuSO_4$) solution, a single displacement reaction takes place. In this process,

iron, being a more reactive metal, displaces copper from its salt solution.

• The chemical equation for this reaction is: Fe (s) + CuSO4 (aq) -> FeSO4 (aq) + Cu (s). This shows that copper sulphate is converted into iron (II) sulphate (also known as ferrous sulphate). Hence, the statement that copper sulphate is converted into iron sulphate is correct.

• The blue colour of the copper sulphate solution is due to the presence of Cu2+ ions. As the reaction proceeds, the concentration of these ions decreases, causing the blue colour to fade and eventually turn light green.

• Iron sulphate (FeSO4), which is formed in the solution, imparts a light green colour to the liquid. Hence, the statement that iron sulphate is colourless is incorrect.

• The displaced copper metal does not dissolve; instead, it settles on the surface of the iron nail as a reddish-brown coating. Hence, the statement that copper dissolves in water is incorrect.

• This reaction is not a decomposition; it is a redox reaction where iron is oxidized and copper is reduced. Hence, the statement that copper sulphate decomposes is incorrect.

Additional Information

• Reactivity Series: This is a list of metals arranged in the order of their decreasing chemical reactivity. In this series, Iron (Fe) is placed above Copper (Cu), which explains why iron can displace copper from its compounds.

• Copper Sulphate (CuSO4): Often called Blue Vitriol, it typically exists as a pentahydrate (CuSO4.5H2O). It is widely used in agriculture as a fungicide and in educational laboratories to demonstrate displacement reactions.

• Ferrous Sulphate (FeSO4): Known as Green Vitriol, it is used industrially in the manufacture of inks and as a reducing agent in chemical processes. In medicine, it is used to treat iron deficiency anemia.

• Redox Reactions: In the given reaction, Iron loses two electrons (oxidation) to become Fe2+, while the Copper ions gain two electrons (reduction) to become solid Copper.

Important Points

• Visual Observations: During this experiment, two distinct changes are observed: the blue colour of the solution changes to light green, and the greyish iron nail acquires a brownish texture.

• Duration: Usually, the fading of the blue colour is observable within 20 to 30 minutes of immersion, depending on the molarity (concentration) of the solution.

• Law of Conservation of Mass: The total mass of the reactants (Iron + Copper Sulphate) remains equal to the total mass of the products (Ferrous Sulphate + Copper) in a closed system.

Q4. Answer: (d) When the current and field are perpendicular to each other.

The correct answer is When the current and field are perpendicular to each other.

Key Points

• The magnitude of the magnetic force acting on a current-carrying conductor placed in a uniform magnetic field is determined by the formula F = BIL sin θ, where F is the force, B is the magnetic field strength, I is the current, L is the length of the conductor, and θ is the angle between the conductor and the field.

• The force is observed to be the highest (maximum) when the angle θ is 90 degrees. This occurs because the value of sin 90° is 1, which is the maximum possible value for the sine function. Hence, statement 4 is correct.

• When the current and the magnetic field are parallel or anti-parallel to each other, the angle θ is 0 degrees or 180 degrees. Since sin 0° and sin 180° are both 0, the magnetic force acting on the conductor is zero. Hence, statement 1 is incorrect.

• Varying the current instantaneously may change the magnitude of the force over time, but it does not represent the spatial condition (alignment) required for the maximum force to be exerted at any given moment. Hence, statement 2 is incorrect.

• The direction of current flowing towards a specific pole (like the south pole) does not inherently define the angle θ unless the orientation of the magnetic field lines relative to that pole is specified as being perpendicular. Hence, statement 3 is incorrect.

Additional Information

• Magnetic Flux Density (B): It represents the strength of the magnetic field. The SI unit for magnetic flux density is the Tesla (T). One Tesla is defined as one Newton of force per Ampere-meter.

• Fleming's Left-Hand Rule: This rule is used to determine the direction of the mechanical force exerted on a conductor. If the forefinger points in the direction of the magnetic field and the middle finger points in the direction of the current, then the thumb represents the direction of the force (motion).

• Lorentz Force: While the formula F = BIL sin θ applies to conductors, the fundamental force on a single moving charge (q) with velocity (v) in a magnetic field is F = qvB sin θ.

• Factors Affecting Force: The force is directly proportional to the magnitude of current (I), the length of the conductor (L), and the strength of the magnetic field (B). If any of these values increase, the force acting on the conductor also increases proportionally.

Important Points

• Vector Representation: The force is mathematically expressed as a vector product (cross product): F = I (L × B). This implies that the resulting force is always perpendicular to both the direction of the current and the direction of the magnetic field.

• Applications: This principle is the foundational mechanism behind the operation of electric motors, galvanometers, and loudspeakers, where electrical energy is converted into mechanical work via magnetic interaction.

• Maximum Condition: In most practical motor designs, the armature is configured to ensure the current-carrying wires move perpendicular to the magnetic field as much as possible to maintain peak torque and efficiency.

Q5. Answer: (a) It must be an aqueous or molten solution of a suitable metal salt

The correct answer is It must be an aqueous or molten solution of a suitable metal salt.

Key Points

• The process of electrolytic refining is used to obtain highly pure metals from impure samples. In this process, the electrolyte must be a medium that allows the movement of metal ions between the electrodes.

• A necessary property of the electrolyte is that it must be an aqueous or molten solution of a suitable metal salt. This ensures that the electrolyte contains the same metal ions as the metal being purified, facilitating the transfer of pure metal to the cathode. Hence, statement 1 is correct.

• The electrolyte cannot remain completely non-reactive. In fact, it must actively participate in the ion exchange process, where metal ions from the solution are reduced at the cathode and metal atoms from the anode are oxidized into the solution. Hence, statement 2 is incorrect.

• While electrolysis may generate heat due to resistance (Joule heating), the primary required property is ionic conductivity (the ability to conduct electricity via ions), not specifically the efficiency of conducting heat. Hence, statement 3 is incorrect.

• The electrolyte must be a homogeneous conductive medium. Using a layer of neutral oil would act as an insulator and prevent the flow of electric current, thus halting the refining process. Hence, statement 4 is incorrect.

Additional Information

• Definition of Electrolytic Refining:

• It is a technique used for the extraction and purification of metals like Copper (Cu), Zinc (Zn), Tin (Sn), Nickel (Ni), Silver (Ag), and Gold (Au).

• In this setup, a thick block of the impure metal is made the anode (positive electrode), and a thin strip of pure metal is made the cathode (negative electrode).

• Role of the Electrolyte:

• The electrolyte is typically a water-soluble salt of the metal being refined. For example, in copper refining, acidified Copper Sulphate (CuSO4) is used.

• When electric current is passed through the electrolyte, the impure metal from the anode dissolves into the electrolyte as cations.

• An equivalent amount of pure metal ions from the electrolyte are then deposited onto the cathode.

• Fate of Impurities:

• Soluble impurities go into the solution during the process.

• Insoluble impurities settle down at the bottom of the anode and are known as anode mud. This mud often contains precious metals like Gold and Silver, which can be recovered later.

Important Points

• Chemical Equations:

• At the Anode (Oxidation): M → M^(n+) + ne^- (Metal atoms lose electrons and enter the solution).

• At the Cathode (Reduction): M^(n+) + ne^- → M (Metal ions gain electrons and deposit as pure metal).

• Conductivity: The electrolyte must have high ionic conductivity to ensure the process is energy efficient. The concentration of the metal salt and the pH of the solution are carefully maintained during industrial operations.

• Purity Levels: Electrolytic refining is capable of producing metals with a purity of up to 99.99%, which is essential for electrical applications (like copper wiring) where impurities significantly increase resistance.

Q6. Answer: (a) Chloroplasts

The correct answer is Chloroplasts.

Key Points

• Chloroplasts are specialized organelles found in plant cells and algae that conduct photosynthesis. They contain the green pigment called chlorophyll, which captures the energy from sunlight to convert water and carbon dioxide into food (glucose). Hence, option 1 is correct.

• The Nucleus serves as the control center of the cell and contains the genetic material (DNA). It is responsible for regulating gene expression and cell division, but it does not contain chlorophyll or participate directly in photosynthesis. Hence, option 2 is incorrect.

• Mitochondria are known as the powerhouse of the cell. Their primary function is to perform cellular respiration, which involves breaking down nutrients to generate energy in the form of ATP (Adenosine Triphosphate). While plants have mitochondria, these organelles do not produce chlorophyll. Hence, option 3 is incorrect.

• The Vacuole is a storage sac within the cell. In plant cells, a large central vacuole maintains turgor pressure against the cell wall and stores water, enzymes, and waste products. It does not play a role in the absorption of light for photosynthesis. Hence, option 4 is incorrect.

Additional Information

• Structure of Chloroplasts:

• Double Membrane: Chloroplasts are bounded by an inner and outer membrane with an intermembrane space between them.

• Thylakoids: These are disc-like sacs arranged in stacks called grana. The light-dependent reactions of photosynthesis occur here because the chlorophyll is embedded in the thylakoid membranes.

• Stroma: This is the alkaline, aqueous fluid surrounding the grana. The light-independent reactions (Calvin Cycle) occur in the stroma, where carbon dioxide is converted into sugar.

• Types of Chlorophyll:

• Chlorophyll a is the primary pigment involved in photosynthesis, reflecting blue-green light.

• Chlorophyll b is an accessory pigment that collects energy and passes it to chlorophyll a, reflecting yellow-green light.

• Photosynthesis Process:

• The overall chemical reaction can be summarized as: 6 Carbon Dioxide + 6 Water + Light Energy results in 1 Glucose + 6 Oxygen.

• This process is vital for life on Earth as it provides the primary source of energy for nearly all food chains and releases oxygen into the atmosphere.

Important Points

• Endosymbiotic Theory: It is widely believed by biologists that chloroplasts (and mitochondria) originated from free-living bacteria that were engulfed by ancestral eukaryotic cells. Evidence for this includes the fact that chloroplasts have their own circular DNA and 70S ribosomes.

• Location: While chloroplasts are found throughout the green parts of a plant, they are most concentrated in the mesophyll cells of the leaves. A single mesophyll cell can contain anywhere from 20 to 100 chloroplasts.

• Other Plastids: Chloroplasts belong to a family of organelles known as plastids. Other types include Chromoplasts (which contain carotenoid pigments giving fruits and flowers red, orange, or yellow colors) and Leucoplasts (which are colorless and used for storing starch, oils, or proteins).

Q7. Answer: (d) Aqua Culture

The correct answer is Aqua Culture.

Key Points

• Aqua Culture is the primary method of fish production in the Kashmir region due to its vast freshwater resources, including rivers, lakes, and springs. It involves the breeding and harvesting of fish in controlled aquatic environments. Hence, the correct answer is Aqua Culture.

• Marine Fisheries refer to fishing activities in oceans and seas. Since Kashmir is a landlocked mountainous region located far from any coastline, marine fishing is geographically impossible. Hence, statement 3 is incorrect.

• Brackish Water Fisheries involve the farming of fish in water that has more salinity than fresh water but less than seawater, typically found in estuaries and mangrove swamps. The water bodies in Kashmir are predominantly fresh, lacking the salinity required for brackish water fish production. Hence, statement 2 is incorrect.

• Pearl Culture is the process of producing pearls by nurturing pearl oysters or freshwater mussels. While freshwater pearl culture exists in some parts of India, it is not a traditional or significant fish production method in the cold climatic conditions of the Kashmir Valley. Hence, statement 1 is incorrect.

• The Department of Fisheries in Jammu & Kashmir focuses extensively on Cold Water Fisheries, leveraging the oxygen-rich, running waters of the Himalayas to boost the local economy.

Additional Information

• Trout Farming: Kashmir is globally renowned for its Trout production. Two main species are cultivated: Brown Trout (Salmo trutta fario) and Rainbow Trout (Oncorhynchus mykiss).

• Historical Context: Trout was first introduced to Kashmir by the British in the year 1900. The first batch of Trout ova arrived from the United Kingdom as a gift to the then Maharaja.

• Geographical Advantages: The region possesses perennial water sources such as the Jhelum River, Sindh River, and high-altitude lakes like Gangabal and Vishansar, which maintain the low temperatures (below 20°C) necessary for cold-water Aqua Culture.

• Native Species: Apart from exotic trout, the region is home to indigenous species known as Schizothorax (locally called Kashir Gaad or Snow Trout), which are well-adapted to the torrential mountain streams.

• Economic Impact: The fish industry in Jammu & Kashmir provides a livelihood to thousands of people, with major markets in Srinagar and exports to other parts of India.

Important Points

• Kokernag Trout Farm: Located in Anantnag district, it is considered Asia's largest trout fishery farm. It serves as a major hub for seed production and distribution.

• Major Lakes: Wular Lake and Dal Lake are significant centers for capture fisheries in the valley, contributing a large percentage of the total fish catch in the Union Territory.

• Government Schemes: The Pradhan Mantri Matsya Sampada Yojana (PMMSY) is being actively implemented in the region to modernize Aqua Culture infrastructure, including the construction of RAS (Recirculatory Aquaculture Systems) and cold storage facilities.

• Blue Revolution: The initiative to increase fish production in Kashmir is a part of the broader Blue Revolution in India, aimed at achieving self-sufficiency in protein sources and doubling farmers' income by 2024-25.

Q8. Answer: (d) The v–t graph is always curved.

The correct answer is The v–t graph is always curved.

Key Points

• In a velocity-time (v–t) graph, the slope of the line represents the acceleration of the object. A positive slope indicates that the velocity is increasing with time, which signifies positive acceleration. Hence, statement 1 is correct.

• The area under the v–t graph within a specific time interval represents the displacement of the object during that period. This is because displacement is the product of velocity and time (integrated over the interval). Hence, statement 2 is correct.

• For uniform acceleration, the rate of change of velocity is constant. Since the slope of a v–t graph represents acceleration, a constant acceleration results in a constant slope throughout the motion. Hence, statement 3 is correct.

• A v–t graph for uniform acceleration is represented by a straight line (either horizontal for zero acceleration or inclined for constant non-zero acceleration). A curved graph indicates non-uniform acceleration, where the acceleration changes at different points in time. Hence, statement 4 is incorrect.

• Therefore, the statement that the v–t graph is always curved is not correct in the context of uniform acceleration.

Additional Information

• Uniform Acceleration: This occurs when an object's velocity changes by equal amounts in equal intervals of time. The most common example is an object in free fall near the Earth's surface, accelerating at approximately 9.8 m/s^2.

• Types of v–t Graphs:

• Zero Acceleration: The graph is a horizontal straight line parallel to the time axis, meaning the object moves with constant velocity.

• Positive Uniform Acceleration: The graph is a straight line sloping upwards from left to right.

• Negative Uniform Acceleration (Retardation): The graph is a straight line sloping downwards, indicating that the object is slowing down.

• Equations of Motion: For an object moving with uniform acceleration (a), the relationship between initial velocity (u), final velocity (v), time (t), and displacement (s) is given by:

• $v = u + at$

• $s = ut + 0.5at^2$

• $v^2 = u^2 + 2as$

Important Points

• Slope Calculation: The slope is calculated as the change in velocity divided by the change in time (rise over run). The unit of the slope is meters per second squared (m/s^2).

• Distance vs. Displacement: While the area under the v–t graph gives displacement, the total area (treating areas below the time axis as positive) gives the total distance traveled.

• Origin of the Graph: If the straight line passes through the origin (0,0), it implies the object started from rest (initial velocity $u = 0$) at time $t = 0$.

• Non-Uniform Motion: If the acceleration is not constant, the v–t graph will be curved. The instantaneous acceleration at any point on such a curve is found by drawing a tangent to the curve at that point and finding its slope.

Q9. Answer: (d) Fallopian Tube

The correct answer is Fallopian Tube.

Key Points

• Fertilization is the biological process of the fusion of a haploid male gamete (sperm) and a haploid female gamete (ovum) to form a diploid zygote.

• In the human female reproductive system, the location where fertilization usually occurs is the Fallopian tube, also commonly referred to as the oviduct.

• Specifically, the fusion typically takes place in the ampulla region, which is the widest and longest part of the tube, or at the

ampullary-isthmic junction.

• During ovulation, a mature egg is released from the ovary and is swept into the tube by the fimbriae (finger-like projections).

• The sperm must travel through the vagina, cervix, and uterus to reach the Fallopian tube to encounter the egg.

• The ovum remains viable for fertilization for approximately 12 to 24 hours after being released.

Additional Information

• Ovary:

• The ovaries are the primary female sex organs responsible for producing ova (eggs).

• They also secrete essential hormones such as estrogen and progesterone which regulate the menstrual cycle.

• In a typical 28-day cycle, one egg is released from one of the two ovaries.

• Uterus (Womb):

• The uterus is a hollow, pear-shaped muscular organ located in the pelvic cavity.

• Its primary function is to support the development of the fetus during pregnancy.

• The inner lining, called the endometrium, is where the embryo implants itself after traveling down from the tube.

• Vagina:

• The vagina is a muscular, elastic canal that serves as the birth canal during delivery.

• It acts as the receptacle for sperm during sexual intercourse and provides a pathway for menstrual flow to leave the body.

• Fallopian Tube Structure:

• There are two Fallopian tubes, each measuring about 10 to 12 cm in length.

• They consist of four parts: the infundibulum (with fimbriae), the ampulla, the isthmus, and the uterine part.

Important Points

• Implantation: After fertilization in the tube, the zygote undergoes cleavage (cell division) as it moves toward the uterus. It takes about 6 to 10 days for the resulting blastocyst to attach to the uterine wall.

• Ectopic Pregnancy: This is a medical condition where the fertilized egg implants outside the uterus, most commonly within the Fallopian tube itself. This is a dangerous condition as the tube is not designed to hold a growing embryo.

• Zygote to Embryo: The single-celled zygote represents the first stage of a new individual, containing a complete set of 46 chromosomes (in humans).

• Ciliary Action: The inner lining of the Fallopian tube contains ciliated epithelium. The rhythmic movement of these cilia helps transport the non-motile egg toward the uterus.

Q10. Answer: (d) 1 – c, 2 – a, 3 – d, 4 – b

The correct answer is 1 – c, 2 – a, 3 – d, 4 – b.

Key Points

• Dandelions (Wind Dispersal): Dandelions produce seeds that are attached to light, feathery bristles called a pappus. These structures function like tiny parachutes, enabling the seeds to be easily lifted and carried over long distances by the wind (Anemochory). Hence, 1 matches with c.

• Lotus (Water Dispersal): The Lotus plant grows in aquatic environments and has a unique, spongy thalamus (the seed head). This spongy structure, along with a fibrous outer covering, allows the fruit to float on water surfaces for a long period until it eventually sinks or reaches a bank to germinate (Hydrochory). Hence, 2 matches with a.

• Mango (Animal Dispersal): Mango is a fleshy fruit designed to attract animals and humans. The sweet, pulpy mesocarp is consumed, and the large, hard seed is typically discarded in a different location. In some cases, smaller seeds of other fruits are ingested and passed through the digestive tract of birds or mammals (Zoochory). Hence, 3 matches with d.

• Castor (Explosion Mechanism): Castor plants utilize a method known as ballochory or explosive mechanism. The fruit of the Castor is a capsule that creates internal tension as it dries out. When the tension reaches a certain point, the pod bursts open with a sudden force, shooting the seeds away from the mother plant. Hence, 4 matches with b.

Additional Information

• Modes of Seed Dispersal: Dispersal is the process by which seeds are spread away from the parent plant to prevent overcrowding and reduce competition for sunlight, water, and minerals.

• Anemochory (Wind): Plants like Drumstick and Maple have winged seeds, while Madar (Aak) has hairy seeds. These adaptations increase the surface area, making them buoyant in the air.

• Hydrochory (Water): This is common in plants living near water bodies. The Coconut is a prime example, possessing a fibrous husk that provides buoyancy, allowing it to travel across oceans.

• Zoochory (Animals): Some seeds have evolved hooks or spines to facilitate transport. For instance, Xanthium and Urena seeds have hooks that get attached to the fur of animals or the clothes of humans, carrying them to distant locations.

• Autochory (Self-Dispersal): Apart from Castor, plants like Balsam and Pea also show explosive fruit dehiscence. When the pods ripen and dry, they burst open, scattering the seeds effectively.

Important Points

• Ecological Significance: Seed dispersal is a critical ecological process that allows plant species to colonize new habitats and ensures genetic diversity within a population.

• Adaptations: The features of a seed (weight, shape, presence of wings/hooks) are specifically evolved to match the primary agent of dispersal available in the plant's environment.

• Survival Rate: By moving away from the parent plant, seedlings avoid the pathogens and pests that often accumulate in high densities near the mother plant.

Q11. Answer: (c) One atom or group of atoms being replaced by another

The correct answer is One atom or group of atoms being replaced by another.

Key Points

• A substitution reaction (also known as a single displacement reaction) is a chemical reaction during which a functional group or an atom in a chemical compound is replaced by another functional group or atom. Hence, statement 3 is correct.

• These reactions are highly significant in organic chemistry. Saturated hydrocarbons, such as alkanes, primarily undergo substitution reactions because they contain single covalent bonds that are stable and do not allow for the addition of more atoms without removing existing ones.

• The process involves the cleavage of an existing sigma bond and the simultaneous or sequential formation of a new sigma bond with the substituting species.

• A common example is the halogenation of methane (CH4). When methane reacts with chlorine (Cl2) in the presence of ultraviolet light or heat, one or more hydrogen atoms are replaced by chlorine atoms to form chloromethane (CH3Cl) and hydrogen chloride (HCl).

• Unlike addition reactions, the saturation level of the molecule typically remains unchanged in a simple substitution reaction. Hence, statement 1 is incorrect as it describes addition reactions.

Additional Information

• Types of Substitution Reactions:

• Nucleophilic Substitution: This occurs when the "attacking" species is a nucleophile (an electron-rich species like OH- or CN-). It is common in alkyl halides and is further divided into Sn1 (unimolecular) and Sn2 (bimolecular) mechanisms based on the reaction kinetics.

• Electrophilic Substitution: This occurs when an electrophile (an electron-deficient species) displaces an atom. This is the characteristic reaction of aromatic compounds like benzene, where a hydrogen atom on the ring is replaced (e.g., nitration or sulfonation).

• Radical Substitution: This involves free radicals as intermediates. It usually requires UV radiation to initiate the process by breaking bonds homolytically, as seen in the chlorination of alkanes.

• Comparison with other reaction types:

• Addition Reactions: These involve atoms being added to unsaturated molecules containing double or triple bonds (alkenes or alkynes), resulting in a more saturated product.

• Elimination Reactions: These involve the removal of atoms or groups from a molecule, often resulting in the formation of pi bonds (double or triple bonds). Hence, statement 4 is incorrect.

• Replacement of Carbon: Organic substitution reactions generally involve replacing hydrogen or a functional group attached to a carbon atom, rather than replacing the carbon atom itself. Hence, statement 2 is incorrect.

Important Points

• Leaving Group: In a substitution reaction, the atom or group that is detached is called the leaving group. The efficiency of the reaction often depends on how stable the leaving group is after it departs.

• Catalysts: Many electrophilic aromatic substitutions require a Lewis acid catalyst, such as FeCl3 or AlCl3, to generate a strong enough electrophile to attack the stable benzene ring.

• Industrial Use: Substitution reactions are used extensively in the pharmaceutical industry, the production of polymers, and the synthesis of dyes and pesticides.

• Reactivity Series: In inorganic chemistry, a metal higher in the reactivity series can substitute (displace) a metal lower in the series from its salt solution (e.g., Zinc replacing Copper in copper sulfate).

Q12. Answer: (a) Tertiary Consumer

The correct answer is Tertiary Consumer.

Key Points

• Biological Magnification (or biomagnification) refers to the process where the concentration of toxic substances, such as pesticides or heavy metals, increases progressively at each successive trophic level of a food chain.

• The Tertiary Consumer occupies the highest trophic level in the provided options. Because these organisms consume secondary consumers, they accumulate the total chemical load from all the lower levels combined. Hence, statement 1 is correct.

• Primary Consumers, which are herbivores, occupy the second trophic level. They ingest pesticides directly from producers, but their body concentration is significantly lower than that of top predators. Hence, statement 2 is incorrect.

• Producers (such as green plants) represent the first trophic level. They absorb non-biodegradable chemicals from the soil or water. While they are the entry point for toxins, they contain the lowest concentration compared to consumers. Hence, statement 3 is incorrect.

• Secondary Consumers are carnivores that feed on primary consumers. While their toxin levels are higher than those of herbivores, they still possess a lower concentration than the Tertiary Consumers who prey upon them. Hence, statement 4 is incorrect.

Additional Information

• Characteristics of Biomagnified Substances:

• To undergo biomagnification, a substance must be long-lived (persistent), mobile, soluble in fats (lipophilic), and biologically active.

• Examples include DDT (Dichlorodiphenyltrichloroethane), BHC, and heavy metals like mercury, arsenic, and cadmium.

• Because these substances are fat-soluble, they are not excreted easily through urine and instead accumulate in the adipose tissues of organisms.

• Impact on Apex Predators:

• Apex predators at the Tertiary Consumer level often suffer from reproductive failure or population decline due to high toxic loads.

• In the year 1962, scientist Rachel Carson highlighted the dangers of DDT in her book "Silent Spring," noting how it led to the thinning of eggshells in birds of prey like eagles and falcons.

• This phenomenon eventually led to a ban on DDT for agricultural use in many countries, including the United States in 1972.

Important Points

• The 10% Energy Law vs. Biomagnification:

• According to Raymond Lindeman's 10% Law (proposed in 1942), only about 10 percent of energy is transferred from one trophic level to the next.

• While energy decreases as we go up the pyramid, the concentration of non-biodegradable chemicals increases. This inverse relationship is critical for understanding ecosystem health.

• Bioaccumulation occurs within a single organism over its lifetime, whereas Biomagnification occurs across multiple trophic levels in a food web.

• Human Health Implications:

• As humans often act as Tertiary Consumers (eating fish, poultry, or meat), they are highly susceptible to the effects of biological magnification.

• Consumption of mercury-contaminated fish led to the famous Minamata disease in Japan during the 1950s, showcasing the lethal potential of high-trophic level toxin accumulation.

Q13. Answer: (a) A chemical change occurs as a new substance is formed.

The correct answer is A chemical change occurs as a new substance is formed.

Key Points

• When iron filings and sulfur powder are simply mixed together at room temperature, they form a heterogeneous mixture. This is a physical change because no chemical bonds are broken or formed, and the iron retains its magnetic properties.

• When the mixture is heated, a chemical reaction occurs between the two elements to form a new compound called Iron(II) sulfide (FeS). This substance is a black solid that has entirely different chemical and physical properties compared to the original reactants. Hence, statement 1 is correct.

• The formation of Iron sulfide is a chemical change because a new substance is created with a fixed chemical composition. Unlike the initial mixture, the components of the compound cannot be separated by simple physical means such as using a magnet. Hence, statement 2 is incorrect.

• Chemical changes are generally irreversible by physical methods. Once Iron sulfide is formed, you cannot retrieve the iron and sulfur by cooling it or filtering it. Hence, statement 3 is incorrect.

• Iron does not dissolve in sulfur to form a solution; instead, the atoms undergo a chemical bonding process (ionic/covalent character) to form a crystal lattice of FeS. A solution is a homogeneous mixture where no chemical reaction occurs. Hence, statement 4 is incorrect.

Additional Information

• Chemical vs. Physical Changes:

• A physical change alters the form of a substance but does not change its molecular identity. Examples include melting, shredding, or mixing.

• A chemical change results in the formation of new chemical substances. Signs of a chemical change include color change, temperature change (evolution of heat), and the formation of a precipitate or gas.

• Properties of Reactants:

• Iron (Fe) is a greyish-metallic element that is ferromagnetic, meaning it is strongly attracted to magnets.

• Sulfur (S) is a bright yellow non-metal powder that is insoluble in water but soluble in solvents like carbon disulfide (CS2).

• Properties of the Product (Iron Sulfide):

• Iron(II) sulfide is a non-magnetic black solid.

• It reacts with dilute hydrochloric acid to produce hydrogen sulfide gas (H2S), which has a characteristic rotten egg smell, whereas the original mixture of Fe and S would produce hydrogen gas when reacted with acid.

Important Points

• Exothermic Nature: The reaction between iron and sulfur is exothermic, meaning it releases energy in the form of heat and light once the activation energy is provided by initial heating.

• Law of Constant Proportions: In the compound Iron sulfide, iron and sulfur are always present in a fixed ratio by mass (approximately 7:4), regardless of how much of each was initially mixed.

• Separation Techniques: In the mixture stage, iron can be separated using a magnet and sulfur can be separated by dissolving it in carbon disulfide. These techniques fail once the chemical change into FeS has occurred.

Q14. Answer: (d) 225 J

The correct answer is 225 J.

Key Points

• Kinetic Energy (KE) is the energy possessed by an object due to its motion. It is defined as the work needed to accelerate a body of a given mass from rest to its stated velocity.

• The mathematical formula for Kinetic Energy is K.E. = 1/2 mv^2, where m represents the mass of the object and v represents its velocity.

• According to the question, the initial kinetic energy of the object with mass m and velocity v is 25 J. Therefore, 1/2 mv^2 = 25 Joules.

• When the velocity is increased three times, the new velocity becomes 3v.

• Substituting the new velocity into the formula: New Kinetic Energy = 1/2 m(3v)^2. Since (3v)^2 = 9v^2, the expression becomes 9 * (1/2 mv^2).

• Given that the value of 1/2 mv^2 is 25 J, the new kinetic energy is calculated as 9 * 25 = 225 J. Hence, the calculation shows the final kinetic energy is 225 J.

Additional Information

• Relationship between Velocity and Energy: Kinetic energy is directly proportional to the square of the velocity. This means that if the velocity doubles, the energy increases by 4 times (2^2), and if the velocity triples, the energy increases by 9 times (3^2).

• SI Unit: The standard unit of energy is the Joule (J), named after the English physicist James Prescott Joule. One Joule is equivalent to 1 kg.m^2/s^2.

• Mass Dependency: Kinetic energy is also linearly proportional to the mass of the object. If the mass of the object is doubled while keeping the velocity constant, the kinetic energy will also double.

• Scalar Quantity: Kinetic energy is a scalar quantity, meaning it has only magnitude and no direction. It is always a non-negative value (zero or positive) because mass is positive and the square of velocity is always positive.

• Work-Energy Theorem: This principle states that the net work done on an object is equal to the change in its kinetic energy. This is a fundamental concept in classical mechanics used to solve various physics problems involving force and displacement.

Important Points

• Frame of Reference: While the mass of an object is constant, its velocity (and thus its kinetic energy) depends on the frame of reference from which it is measured.

• Types of Kinetic Energy: In addition to translational kinetic energy (studied here), there is also rotational kinetic energy (1/2 Iw^2) for spinning objects and vibrational kinetic energy.

• Relativistic Effects: At extremely high speeds approaching the speed of light (c), the classical formula 1/2 mv^2 becomes inaccurate, and Einstein's theory of special relativity must be applied to calculate energy.

• Conversion: Kinetic energy can be converted into other forms of energy, such as potential energy (e.g., a ball thrown upwards) or thermal energy (e.g., through friction).

Q15. Answer: (a) Onion extract changes smell in bases

The correct answer is Onion extract changes smell in bases.

Key Points

• Olfactory indicators are substances whose odour or smell changes depending on whether they are mixed with an acidic or basic solution.

• Onion extract is a classic example of an olfactory indicator. When a basic solution like Sodium Hydroxide (NaOH) is added to

onion extract, the characteristic smell of the onion cannot be detected or vanishes. Hence, statement 1 is correct.

• Turmeric is a natural indicator that changes color in different media. It remains yellow in acidic solutions but turns reddish-brown in basic solutions. It does not turn blue. Hence, statement 2 is incorrect.

• Phenolphthalein is a synthetic indicator. It is colorless in acidic solutions and turns pink in basic solutions. The statement claims it turns pink in acids, which is factually wrong. Hence, statement 3 is incorrect.

• Methyl orange is another synthetic indicator that shows a distinct color change. it turns red in acidic media and yellow in basic media. It is not an olfactory indicator and does not rely on producing or changing odour to indicate pH. Hence, statement 4 is incorrect.

• Hence, the correct answer is Onion extract changes smell in bases.

Additional Information

• Types of Olfactory Indicators:

• Vanilla Essence: The pleasant smell of vanilla is retained in acidic solutions but is destroyed or lost when added to a base.

• Clove Oil: In acidic solutions, the smell of clove oil remains, but it changes or disappears in basic solutions.

• These indicators are particularly useful in chemistry laboratories for visually impaired students, as they can identify the nature of a substance through the sense of smell rather than sight.

• Natural Indicators:

• Litmus: Derived from Lichens, it is purple in neutral solutions, red in acids, and blue in bases.

• China Rose (Gudhal): It turns dark pink (magenta) in acidic solutions and green in basic solutions.

• Red Cabbage Extract: It remains red in acids but turns green or yellow in basic solutions.

• Synthetic Indicators:

• These are man-made chemicals used to detect pH. Common examples include Phenolphthalein and Methyl orange.

• Phenolphthalein is often used in acid-base titrations because of its sharp color change at a pH range of approximately 8.2 to 10.0.

Important Points

• pH Scale: The acidity or basicity is measured on a pH scale ranging from 0 to 14. A pH of 7 is neutral (like pure water), a pH less than 7 is acidic, and a pH greater than 7 is basic.

• Neutralization Reaction: When an acid and a base react, they form salt and water. Indicators are used to find the equivalence point of these reactions.

• Chemical Nature of Olfactory Change: The change in smell occurs because the odorous molecules (which are often weak acids themselves) react with the hydroxide ions (OH-) in a base to form odorless salts.

Q16. Answer: (a) Number of electrons

The correct answer is Number of electrons.

Key Points

• The size of an atom is primarily determined by the space occupied by its electrons. While the nucleus contains more than 99.9% of the atom's mass, it occupies an insignificantly small volume compared to the total size of the atom.

• The volume of an atom is defined by the electron cloud, which is the region where electrons are likely to be found. As the number of electrons increases, they occupy more energy levels or shells, which significantly expands the atomic radius.

• The atomic radius is the distance from the center of the nucleus to the outermost stable electron shell. Therefore, the physical boundary that determines "size" is essentially the limit of the electron distribution. Hence, option 1 is the primary factor.

• While the number of protons (atomic number) affects the pull on the electrons, and the mass of the nucleus and number of neutrons affect the weight and stability, they do not define the physical dimensions or volume of the atom in the same way electrons do. Hence, options 2, 3, and 4 are incorrect as primary determinants of size.

Additional Information

• Atomic Radius Trends:

• Down a Group: In the Periodic Table, the atomic size increases as you move down a group. This is because a new electron shell is added for each succeeding element, moving the outermost electrons further from the nucleus.

• Across a Period: Atomic size generally decreases from left to right across a period. This occurs because the number of protons increases, creating a stronger positive charge that pulls the electron cloud closer to the nucleus, despite the number of shells remaining the same.

• The Nucleus vs. The Atom:

• To visualize the scale, if an atom were expanded to the size of a football stadium, the nucleus would be about the size of a small marble placed at the center, while the electrons would define the outer perimeter of the stands.

• The nucleus consists of protons and neutrons, which are much heavier than electrons, but they are packed into an extremely dense, tiny area of roughly 10^-15 meters in diameter.

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• Shielding Effect:

• This is a phenomenon where inner electrons act as a shield, reducing the attractive force between the positive nucleus and the outermost electrons. This effect allows the electron cloud to expand, further influencing the overall atomic size.

• Effective Nuclear Charge (Zeff):

• This refers to the net positive charge experienced by an electron in a multi-electron atom. It is a crucial concept in General Chemistry that explains why atoms with more protons aren't always larger; the increased Zeff pulls the electrons inward, counteracting the size increase.

Q17. Answer: (a) 5 × 10^(14) Hz

The correct answer is 5 x 10^(14) Hz.

Key Points

• The relationship between the speed of light, its frequency, and its wavelength is governed by the fundamental wave equation: c = f λ, where c is the speed, f is the frequency, and λ is the wavelength.

• In this problem, the wavelength (λ) is given as 600 nm. To perform calculations in SI units, this must be converted to meters. Since 1 nanometer (nm) equals 10^(-9) meters, the wavelength is 600 x 10^(-9) m, which simplifies to 6 x 10^(-7) m.

• The speed of light (c) is provided as 3 x 10^8 m/s, which is the standard speed of electromagnetic radiation in a vacuum.

• To find the frequency (f), the formula is rearranged to f = c / λ. Substituting the values: f = (3 x 10^8) / (6 x 10^(-7)).

• Performing the division yields 0.5 x 10^(15), which is scientifically expressed as 5 x 10^(14) Hz. Hence, the frequency of the light is 5 x 10^(14) Hz, making this the correct statement.

Additional Information

• The Visible Spectrum: Light with a wavelength of 600 nm falls within the orange part of the visible light spectrum. The human eye typically perceives light in the range of 400 nm (violet) to 700 nm (red).

• Electromagnetic Wave Nature: Light is an electromagnetic wave consisting of oscillating electric and magnetic fields. Unlike sound waves, it does not require a material medium for propagation and can travel through a vacuum.

• Inverse Relationship: Frequency and wavelength are inversely proportional. As the wavelength of light increases (shifting toward the red end), its frequency decreases. Conversely, shorter wavelengths (toward the violet end) correspond to higher frequencies.

• Medium Transition: When light enters a different medium (like glass or water), its speed and wavelength change, but its frequency remains constant because frequency is determined by the source of the wave.

Important Points

• Unit of Frequency: The Hertz (Hz) is the SI unit for frequency, named after Heinrich Hertz. One Hertz corresponds to one cycle per second.

• Photon Energy: The energy (E) of a light photon is directly proportional to its frequency, defined by the equation E = hf, where h is Planck’s constant (6.626 x 10^(-34) J·s). Higher frequency light carries more energy.

• Scientific Notation: In physics, power-of-ten notation is essential for managing very large values (like speed) and very small values (like wavelength) accurately during algebraic manipulation.

Q18. Answer: (c) Hydrometer

The correct answer is Hydrometer.

Key Points

• Archimedes’ Principle states that when a body is immersed fully or partially in a fluid, it experiences an upward force (buoyant force) that is equal to the weight of the fluid displaced by it.

• A Hydrometer is a device specifically designed to measure the relative density or specific gravity of liquids based on the concept of buoyancy. Hence, the correct answer is Hydrometer.

• The working of a hydrometer depends on the Law of Flotation, which is a direct application of Archimedes' principle. It consists of a weighted glass bulb and a thin stem with a graduated scale.

• When placed in a liquid, the hydrometer sinks until it displaces a volume of liquid exactly equal to its own weight. In a low-density liquid, the device sinks deeper, whereas in a high-density liquid, it floats higher.

• This principle is also utilized in other instruments like the Lactometer, which is used to determine the purity of milk by measuring its density.

Additional Information

• Sphygmomanometer:

• This is a medical instrument used to measure blood pressure. It was invented by Samuel Siegfried Karl Ritter von Basch in 1881.

• It typically consists of an inflatable cuff, a measuring unit (mercury manometer or aneroid gauge), and a mechanism for inflation. It measures pressure in millimeters of mercury (mmHg).

• Altimeter:

• An Altimeter is an instrument used to measure the altitude of an object above a fixed level, most commonly mean sea level.

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• In aircraft, the barometric altimeter is most common; it works by measuring the atmospheric pressure, which decreases as altitude increases. It does not work on Archimedes' principle but on pressure-height relationship.

• Aneroid Barometer:

• This device is used to measure atmospheric pressure. It was invented by Lucien Vidi in 1844.

• Unlike the mercury barometer, it uses no liquid. Instead, it utilizes a small, flexible metal box called an aneroid cell (capsule) that expands or contracts with changes in air pressure.

• It is widely used in meteorology for weather forecasting and as a portable tool for surveying.

Important Points

• Archimedes of Syracuse: The principle is named after the Greek mathematician Archimedes, who discovered it in the 3rd century BC.

• Buoyant Force: This is the net upward force exerted by a fluid on an object. Its magnitude is given by the formula $F_b = \rho V g$, where ρ is the density of the fluid, V is the displaced volume, and g is the acceleration due to gravity.

• Applications: Archimedes' principle is fundamental in designing ships, submarines, and hot air balloons. It explains why a heavy iron ship floats on water while a small iron nail sinks.

Q19. Answer: (a) Plasma membrane

The correct answer is Plasma membrane.

Key Points

• Amoeba is a unicellular eukaryotic organism that does not have a fixed shape. It relies entirely on its plasma membrane (or cell membrane) to interact with its external environment.

• The process by which Amoeba acquires its food is known as endocytosis. This is possible because the plasma membrane is highly flexible and composed of lipids and proteins, allowing it to deform and engulf particles.

• To capture food, the Amoeba extends temporary, finger-like projections of the plasma membrane called pseudopodia (meaning "false feet"). These extensions surround the food particle until they fuse together.

• Once the pseudopodia fuse, the food particle is trapped inside a small, membrane-bound cavity within the cell called a food vacuole. This specific type of ingestion of solid matter is often referred to as phagocytosis.

• The plasma membrane serves as the primary interface for nutrition, as the organism lacks specialized mouth-like structures found in more complex multicellular animals.

Additional Information

• Plasma Membrane:

• It is a selectively permeable membrane that regulates the movement of substances in and out of the cell.

• In addition to food acquisition, it provides protection to the internal cellular contents and maintains the cell's integrity.

• Cilia:

• These are short, hair-like structures found on the surface of some cells. In organisms like Paramecium, cilia help in movement and in pushing food into a specific "mouth" area called the cytostome. Amoeba does not possess cilia.

• Flagella:

• These are long, whip-like structures used primarily for locomotion in certain bacteria and protists like Euglena. While they can help create currents to move food, they are not the primary structure for food engulfment in Amoeba.

• Nuclear Membrane:

• This is a double-layered membrane that surrounds the nucleus of a eukaryotic cell. Its function is to protect the genetic material (DNA) and regulate the flow of information between the nucleus and cytoplasm. It has no role in the external acquisition of food.

Important Points

• Digestion: Once the food is inside the food vacuole, digestive enzymes from the cytoplasm are secreted into the vacuole to break down the food into simpler, diffusible nutrients.

• Exocytosis: After the nutrients are absorbed, the undigested waste is moved toward the plasma membrane. The membrane then ruptures at any point to expel the waste outside the body, a process known as egestion.

• Habitat: Amoeba are typically found in freshwater bodies like ponds, lakes, and slow-moving rivers, where they feed on bacteria, algae, and other microscopic organisms.

• Discovery: The Amoeba was first discovered by August Johann Rösel von Rosenhof in the year 1755.

Q20. Answer: (b) Both posses their own DNA and 70S Ribosome.

The correct answer is Both possess their own DNA and 70S Ribosome.

Key Points

• Chloroplasts and Mitochondria are both semi-autonomous organelles because they contain their own genetic material and protein-synthesizing machinery.

• Statement 1: Both perform photosynthesis. This statement is incorrect because photosynthesis is a process exclusive to chloroplasts (found in plants and algae). Mitochondria do not perform photosynthesis; they are involved in breaking down nutrients. Hence, statement 1 is incorrect.

• Statement 2: Both possess their own DNA and 70S Ribosome. Both organelles contain extra-chromosomal DNA (usually circular) and 70S ribosomes, which are similar to those found in prokaryotic cells. This allows them to produce some of their own enzymes and proteins. Hence, statement 2 is correct.

• Statement 3: Both perform respiration. While both are energy-transducing organelles, the process of aerobic cellular respiration (ATP production via the Krebs cycle and Electron Transport Chain) is the primary function of mitochondria. Chloroplasts are primarily for carbon fixation. Hence, statement 3 is incorrect.

• Statement 4: Both have chlorophyll. Chlorophyll is the green pigment essential for capturing light energy during photosynthesis and is located within the thylakoids of chloroplasts. Mitochondria do not contain chlorophyll. Hence, statement 4 is incorrect.

• Hence, the correct answer is Both possess their own DNA and 70S Ribosome.

Additional Information

• Mitochondria:

• Commonly referred to as the "Powerhouse of the cell", they are found in almost all eukaryotic cells.

• Their main function is the synthesis of ATP (Adenosine Triphosphate) through cellular respiration.

• They have a double-membrane structure where the inner membrane is folded into cristae to increase surface area for oxidative phosphorylation.

• Chloroplasts:

• These are a type of plastid primarily found in the mesophyll cells of leaves in green plants.

• They contain chlorophyll and carotenoid pigments responsible for trapping light energy for photosynthesis.

• Like mitochondria, they are double-membrane bound and contain a fluid matrix called stroma and stacked sacs called grana.

• The Endosymbiotic Theory:

• This evolutionary theory, popularized by Lynn Margulis in the 1960s, suggests that mitochondria and chloroplasts originated as free-living prokaryotic organisms.

• The presence of 70S ribosomes and circular DNA inside these organelles is strong evidence of their bacterial ancestry, as eukaryotic cytoplasm typically contains 80S ribosomes.

• Both organelles reproduce independently of the cell nucleus through a process similar to binary fission.

Important Points

• Comparison of Ribosomes: In a eukaryotic cell, the cytoplasmic ribosomes are 80S (composed of 60S and 40S subunits), whereas the organellar ribosomes (mitochondrial and plastidial) are 70S (composed of 50S and 30S subunits).

• DNA Type: The DNA found in these organelles is typically naked (not associated with histone proteins) and circular, mirroring the structure of plasmid DNA in bacteria.

• Energy Transformation: While mitochondria convert chemical energy (glucose) into metabolic energy (ATP), chloroplasts convert solar energy into chemical energy (sugar).

Q21. Answer: (b) 14 u

The correct answer is 14 u.

Key Points

• The molecular mass of a substance is the sum of the atomic masses of all the atoms in a molecule of that substance. It is therefore the relative mass of a molecule expressed in atomic mass units (u).

• In the given problem, the total molecular mass of the compound is 63 u. The compound consists of one hydrogen atom, three oxygen atoms, and one unknown element.

• The atomic mass of Hydrogen (H) is 1 u. Since there is one hydrogen atom, its contribution to the total mass is 1 u.

• The atomic mass of Oxygen (O) is 16 u. Since the compound contains three oxygen atoms, their total contribution is calculated as 3 x 16 u = 48 u.

• To find the atomic mass of the remaining element, we subtract the masses of the known components from the total molecular mass: 63 u - (1 u + 48 u) = 63 u - 49 u = 14 u. Hence, the calculated mass is 14 u.

• The element that possesses an atomic mass of 14 u is Nitrogen (N). Therefore, the compound is Nitric Acid, which has the chemical formula HNO3. Hence, the correct option is 14 u.

Additional Information

• Nitric Acid (HNO3):

• It is a highly corrosive mineral acid, also known as aqua fortis or the spirit of niter.

• In its pure form, it is colorless, but older samples tend to acquire a yellow cast due to decomposition into oxides of nitrogen and water.

• It is widely used in the manufacture of fertilizers (like ammonium nitrate), explosives (like TNT and nitroglycerin), and in metal refining.

• Atomic Mass Unit (u):

• The atomic mass unit is defined as a mass exactly equal to one-twelfth (1/12th) of the mass of one carbon-12 atom.

• The unified atomic mass unit (u) has replaced the older amu designation in modern scientific literature.

• It allows chemists to calculate formula mass and molar mass, facilitating the study of stoichiometry in chemical reactions.

• Characteristics of constituent elements:

• Hydrogen: The lightest element in the periodic table with atomic number 1. It usually exists as a diatomic gas (H2).

• Oxygen: A highly reactive nonmetal and oxidizing agent. It is the third-most abundant element in the universe by mass.

• Nitrogen: A colorless, odorless gas that makes up about 78% of Earth's atmosphere. It is essential for life as a component of amino acids and DNA.

Important Points

• Calculation Summary:

• Total Mass: 63

• Mass of H: 1

• Mass of 3 O: 48 (3 x 16)

• Equation: 1 + X + 48 = 63

• Result: X = 14

• Comparison with other options:

• 32 u is the atomic mass of Sulfur (S). If the element were sulfur, the molecular mass would have been 81 u (HSO3 - hypothetical radical).

• 16 u is the atomic mass of Oxygen (O).

• 12 u is the atomic mass of Carbon (C). For a compound like HCO3 (Bicarbonate), the mass would be 61 u.

• Date of Discovery: Nitric acid was first synthesized by the alchemist Jabir ibn Hayyan around 800 AD. Its composition was accurately determined by Henry Cavendish in 1785.

Q22. Answer: (a) The screen should be placed 80 cm from the lens.

The correct answer is The screen should be placed 80 cm from the lens.

Key Points

• A convex lens is a converging lens. According to the lens formula, 1/v - 1/u = 1/f, where f is the focal length, u is the object distance, and v is the image distance.

• In the given problem, the focal length (f) of the convex lens is +40 cm and the object distance (u) is -80 cm (since the object is placed to the left of the lens).

• By substituting these values into the lens formula: 1/v - 1/(-80) = 1/40, which simplifies to 1/v + 1/80 = 1/40. Solving for v, we get 1/v = 1/40 - 1/80, which equals 1/80. Thus, v = +80 cm.

• The positive sign indicates that the image is formed on the right side of the lens at a distance of 80 cm. This is exactly where the screen should be placed to capture the image. Hence, the statement that the screen should be placed 80 cm from the lens is correct.

• The magnification (m) is given by the ratio v/u. Here, m = 80 / (-80) = -1. A magnification of -1 signifies that the image is real, inverted, and of the same size as the object.

• This specific condition occurs when the object is placed at 2f (twice the focal length). Since f = 40 cm, 2f = 80 cm. When an object is at 2f, the image is always formed at 2f on the opposite side.

Additional Information

• Nature of Convex Lens:

• A convex lens is thicker at the center than at the edges. It converges parallel rays of light passing through it to a point called the principal focus.

• The power of a convex lens is positive, measured in Diopters (D), and is calculated as the reciprocal of the focal length in meters (P = 1/f).

• Image Formation Rules for Convex Lenses:

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

• If the object is beyond 2F, the image is formed between F and 2F on the other side, and it is diminished, real, and inverted.

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

• If the object is between F and 2F, the image is formed beyond 2F, and it is magnified, real, and inverted.

• If the object is at F, the image is formed at infinity.

• If the object is between the optical center and F, the image is virtual, erect, and magnified on the same side as the object.

Important Points

• Sign Convention: According to the New Cartesian Sign Convention, distances measured in the direction of incident light (to the right of the optical center) are taken as positive, while distances measured against the direction of incident light (to the left) are negative.

• Real vs Virtual Image: A real image is formed when light rays actually intersect and can be projected onto a screen. An inverted image always accompanies a real image in single-lens systems.

• Applications: Convex lenses are used in eyeglasses to correct hypermetropia (farsightedness), in cameras, microscopes, and telescopes to magnify or focus images.

• Focal Length Fact: For the same material, a lens with more curvature (thicker) has a shorter focal length and higher optical power compared to a flatter lens.

Q23. Answer: (a) 1 ohm

The correct answer is 1 ohm.

Key Points

• The relationship between voltage, current, and resistance in an electrical circuit is defined by Ohm's Law, which states that the current flowing through a conductor is directly proportional to the potential difference applied across its ends, provided physical conditions like temperature remain constant.

• Mathematically, Ohm's Law is expressed as V = IR, where V is the potential difference, I is the current, and R is the resistance of the conductor.

• In this specific problem, the given potential difference (V) is 1 volt and the electric current (I) is 1 ampere.

• To calculate the resistance, we use the formula R = V / I. Substituting the values: R = 1 volt / 1 ampere.

• The resulting calculation gives R = 1 ohm. This implies that 1 ohm is the resistance of a conductor when a potential difference of 1 volt results in a current of 1 ampere. Hence, the correct option is 1 ohm.

Additional Information

• Electrical Resistance (R):

• Resistance is the property of a conductor by virtue of which it opposes the flow of electric current through it.

• The SI unit of resistance is the Ohm, represented by the Greek symbol Ω (omega).

• The value of resistance depends on the length of the conductor, its area of cross-section, the nature of the material, and the temperature.

• Georg Simon Ohm:

• The law and the unit of resistance are named after the German physicist Georg Simon Ohm, who published his findings in 1827.

• His work was fundamental in the development of the theory of electricity and circuits.

• Potential Difference (V):

• It is defined as the work done to move a unit charge from one point to another in an electric field. Its SI unit is the Volt.

• A device used to measure potential difference is called a voltmeter, which is always connected in parallel across the points where the voltage is to be measured.

• Electric Current (I):

• It is the rate of flow of electric charges (usually electrons) through a conductor. The SI unit is the Ampere.

• An ammeter is used to measure current in a circuit and is always connected in series.

Important Points

• Ohmic and Non-Ohmic Conductors:

• Ohmic Conductors: Materials that obey Ohm's Law (where V is proportional to I) are called ohmic. Examples include copper, silver, and aluminum. Their V-I graph is a straight line.

• Non-Ohmic Conductors: Devices that do not follow Ohm's Law are non-ohmic. Examples include semiconductors, diodes, transistors, and vacuum tubes.

• Resistivity (ρ):

• While resistance changes with shape, resistivity is a characteristic property of the material. It is measured in ohm-meter (Ωm).

• Insulators like glass and rubber have very high resistivity (10^12 to 10^17 Ωm), whereas metals have low resistivity (10^-8 to 10^-6 Ωm).

• Effect of Temperature:

• For pure metals, resistance increases with an increase in temperature. However, for semiconductors like silicon and germanium, resistance decreases as temperature increases.

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Q24. Answer: (c) They converge at a point on the opposite side of the lens.

The correct answer is They converge at a point on the opposite side of the lens.

• A convex lens is also known as a converging lens because of its ability to bring parallel rays of light together after refraction.

• When rays of light travel parallel to the principal axis and strike the surface of a convex lens, they are bent inward toward the center of the lens. This occurs because the lens is thicker at the middle than at the edges.

• According to the laws of refraction, these parallel rays intersect at a single point on the principal axis on the opposite side of the lens. This specific point is known as the Principal Focus (F). Hence, statement 3 is correct.

• If rays were to pass without any deviation, it would mean the lens has no refractive power or the ray is passing exactly through the optical center. Hence, statement 1 is incorrect.

• Rays meet at infinity only when the source of light is placed exactly at the focus of the lens, creating a parallel beam after refraction. Hence, statement 2 is incorrect.

• Rays diverge as if coming from the principal focus in the case of a concave lens, which is a diverging lens. Hence, statement 4 is incorrect.

• Structure of Convex Lens: A convex lens is usually made of glass or transparent plastic and is bounded by two spherical surfaces bulging outwards. It can be categorized into double convex (bi-convex), plano-convex, and concavo-convex lenses.

• Image Formation: Depending on the position of the object, a convex lens can form both real and inverted images or virtual and erect images. For instance, when an object is placed beyond the focus, the image formed is real.

• Focal Length: The distance between the optical center of the lens and the principal focus is called the focal length (f). For a convex lens, the focal length is traditionally taken as positive in the Cartesian sign convention.

• Applications: Because of its converging properties, the convex lens is widely used in magnifying glasses, microscopes, telescopes, and camera lenses.

• Medical Use: In ophthalmology, convex lenses are used in spectacles to correct Hypermetropia (long-sightedness), where the eye cannot focus on nearby objects because the image forms behind the retina.

Important Points

• Power of a Lens: The degree of convergence or divergence of light rays achieved by a lens is expressed as its Power (P). It is the reciprocal of the focal length (P = 1/f). The SI unit of power is the Dioptre (D).

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

• Refraction Basics: The phenomenon of bending light occurs due to the change in the speed of light when it moves from one medium (like air) to another (like glass). This is governed by Snell's Law.

• Aperture: The effective diameter of the light-transmitting area of the lens is called the aperture. It determines the intensity of the light passing through and the brightness of the resulting image.

Q25. Answer: (b) Cracking of voice

The correct answer is Cracking of voice.

Key Points

• Sexual maturation in human males is primarily driven by the onset of puberty, typically occurring between the ages of 11 and 16 years.

• One of the most distinct physical changes is the Cracking of voice. This happens because the Larynx (voice box) grows significantly larger during this period. Hence, statement 2 is correct.

• As the Larynx grows, it begins to protrude at the front of the neck, forming what is commonly known as the Adam's apple.

• During this transition, the Vocal Cords become longer and thicker. Before they fully adjust to the new size, the voice may "crack" or fluctuate between high and low pitches before settling into a deeper tone.

• While an Increase in weight and Increase in height occur during the adolescent growth spurt, they are general developmental changes seen in both sexes and are not exclusive indicators of male sexual maturation. Hence, statements 3 and 4 are not the most specific answers for sexual maturation.

• Deposition of fat in hips is a secondary sexual characteristic typically associated with female maturation to facilitate childbirth. Hence, statement 1 is incorrect.

Additional Information

• Testosterone: This is the primary androgen (male sex hormone) secreted by the Testes. It is responsible for the development of male Secondary Sexual Characteristics and the stimulation of Spermatogenesis (production of sperm).

• Secondary Sexual Characteristics in Males: These include the appearance of facial hair (mustache and beard), pubic hair, axillary hair (underarm), and the broadening of the shoulders and chest.

• Pituitary Gland: The process of maturation begins when the Pituitary Gland releases Luteinizing Hormone (LH) and Follicle-Stimulating Hormone (FSH), which signal the testes to produce testosterone.

• Physical Composition: Unlike females, who experience fat deposition in the pelvic region, males typically experience an increase

in Muscle Mass and a decrease in body fat percentage relative to muscle during puberty.

• Primary vs. Secondary Characteristics: Primary characteristics are the reproductive organs themselves (testes, penis), while Secondary characteristics (like voice deepening) are the physical signs of sexual maturity that do not involve the reproductive tract directly.

Important Points

• Timing: The onset of these changes can vary based on Genetics, Nutrition, and Environmental factors. In recent decades, studies have shown a slight trend toward earlier onset of puberty in some populations.

• Growth Spurt: The Peak Height Velocity (PHV) in boys usually occurs about two years later than in girls. During this time, bones grow rapidly, and the Epiphyseal plates eventually close, marking the end of height growth.

• Skin Changes: Increased activity of Sebaceous Glands (oil glands) often leads to Acne during the phase of sexual maturation due to hormonal fluctuations.

Q26. Answer: (c) 25 years

Shortcut Trick

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

Ratio 5 years ago (Priya : Meera) = 3 : 2 → Difference in ratio units = 3 − 2 = 1 unit.

Given, 1 unit = 10 years. Therefore Meera's age 5 years ago = 2 × 10 = 20 years.

Meera's present age = 20 + 5 = 25 years.

Therefore The correct answer is 25 years.

Alternate Method

Given:

Ratio of Priya and Meera (5 years ago) = 3 : 2

Difference in their present ages = 10 years

Calculations:

=> Let ages 5 years ago be 3x and 2x.

=> Present age of Priya = 3x + 5

=> Present age of Meera = 2x + 5

=> Difference = (3x + 5) − (2x + 5) = 10

=> x = 10

=> Meera's present age = 2(10) + 5

=> Meera's present age = 20 + 5 = 25 years

Therefore The correct answer is 25 years.

Additional Information

Constant Difference Rule

The difference between the ages of two people is always constant, whether it is 10 years ago, present, or 10 years in the future.

Ratio Scaling

If the difference in ratio units is 'd' and the actual difference is 'D', then 1 ratio unit = D/d. This multiplier is used to find all related age values.

Q27. Answer: (b) 2

Shortcut Trick

Convert bases to 2: 16 = 2^4 and 64 = 2^6.

Equate the exponents: 3y + x = 4 and 2y − x = 6.

Add both equations to eliminate x: 5y = 10.

Solve for y: y = 2.

Therefore The correct answer is 2.

Alternate Method

Given:

2^(3y + x) = 16

2^(2y − x) = 64

Formula Used:

If a^m = a^n, then m = n (when a > 0 and a ≠ 1).

Calculations:

=> 2^(3y + x) = 2^4
=> 3y + x = 4 ---(Equation 1)
=> 2^(2y − x) = 2^6
=> 2y − x = 6 ---(Equation 2)
=> Adding (Equation 1) and (Equation 2):
=> (3y + x) + (2y − x) = 4 + 6
=> 5y = 10
=> y = 10 ÷ 5
=> y = 2
Therefore The correct answer is 2.
Additional Information
Laws of Indices
When the bases are equal, their powers can be equated. Also, a^m × a^n = a^(m+n) and $(a^m)^n$ = a^(m×n).
Linear Equations in Two Variables
To find the value of one variable, use the elimination method by adding or subtracting equations to remove the other variable.
Powers of 2
Recognizing standard powers like 2^4 = 16, 2^5 = 32, and 2^6 = 64 is essential for quick calculation in exponential equations.

Q28. Answer: (c) 40.4

Shortcut Trick
Ratio of speeds S_A : S_B = 100 : 150 = 2 : 3.
Using the meeting point formula: S_A / S_B = √(T_B / T_A).
2 / 3 = √(p / 90.9)
Squaring both sides: 4 / 9 = p / 90.9
p = 4 × 10.1 = 40.4 hours.
Therefore The correct answer is 40.4 hours.
Alternate Method
Given:
Time taken by A after meeting (T_A) = 90.9 hours
Time taken by B after meeting (T_B) = p hours
Speed of B (S_B) = 1.5 × Speed of A (S_A)
Formula Used:
For two objects starting simultaneously from opposite ends and meeting at a point, the ratio of their speeds is inversely proportional to the square root of the time taken to reach the opposite destinations after meeting: S_A / S_B = √(T_B / T_A)
Calculations:
=> S_A / S_B = 1 / 1.5 = 1 / (3/2) = 2/3
=> 2/3 = √(p / 90.9)
=> $(2/3)^2$ = p / 90.9
=> 4 / 9 = p / 90.9
=> p = (4 × 90.9) ÷ 9
=> p = 4 × 10.1
=> p = 40.4
Therefore The correct answer is 40.4 hours.
Additional Information
Meeting Point Time
The time when they meet (T_M) is given by the geometric mean of the remaining times: T_M = √(T_A × T_B).
Relative Speed
When two objects move towards each other, their relative speed is the sum of their individual speeds (S_A + S_B).
Speed-Time Relationship
For a constant distance, speed is inversely proportional to time (S prop. to 1/T).

Q29. Answer: (a) 7.5 minutes

Shortcut Trick

Let Total Work (LCM of 10 and 15) = 30 units.

Efficiency of M = 3; Efficiency of N = 2.

Work done by M + N in 5 minutes = (3 + 2) × 5 = 25 units.

Remaining work = 30 − 25 = 5 units, filled by N in 5 ÷ 2 = 2.5 minutes.

Total time = 5 + 2.5 = 7.5 minutes.

Therefore The correct answer is 7.5 min.

Alternate Method

Given: Time for Pipe M = 10 min, Time for Pipe N = 15 min.

Person	Days	Total Work	Efficiency
Pipe M	10 min	30 units	3
Pipe N	15 min	2	

Calculations:

=> Both pipes M and N opened for first 5 minutes.

=> Work done in 5 min = (Efficiency of M + Efficiency of N) × 5

=> Work done = (3 + 2) × 5 = 25 units

=> Remaining work = Total Work − Completed Work = 30 − 25 = 5 units

=> Time taken by Pipe N to fill remaining part = 5 ÷ 2 = 2.5 minutes

=> Total time required = 5 min + 2.5 min = 7.5 minutes

Therefore The correct answer is 7.5 min.

Additional Information

Pipes & Cisterns Efficiency

The rate of filling is inversely proportional to the time taken. If a pipe fills a tank in 'x' hours, its 1-hour work is 1/x.

Inlet and Outlet Pipes

Inlet pipe efficiency is taken as positive (+), while outlet (leakage) pipe efficiency is taken as negative (−).

Total Work Concept

Total work is the LCM of individual times taken by the pipes to fill or empty the tank independently.

Q30. Answer: (a) Rs. 2,160

Shortcut Trick

Bina SP (Shyam CP) = 81% of Bina CP = Rs. 4,860.

Bina CP = 4,860 ÷ 0.81 = Rs. 6,000.

Shyam SP (Bina 17% Profit Price) = 117% of 6,000 = Rs. 7,020.

Shyam Profit = Shyam SP − Shyam CP = 7,020 − 4,860 = Rs. 2,160.

Therefore The correct answer is Rs. 2,160.

Alternate Method

Given → Bina SP = Rs. 4,860, Bina Loss = 19%, Target Profit = 17%. Formulas: CP = SP × 100 ÷ (100 − Loss%), New SP = CP × (100 + Profit%) ÷ 100.

=> Cost Price (CP) of article for Bina = 4,860 × 100 ÷ (100 − 19) = 4,860 × 100 ÷ 81 = Rs. 6,000. => Selling Price (SP) for Shyam (Bina 17% profit price) = 6,000 × 117 ÷ 100 = Rs. 7,020. => Cost Price (CP) for Shyam = Rs. 4,860. => Profit for Shyam = 7,020 − 4,860 = Rs. 2,160.

Therefore The correct answer is Rs. 2,160.

Additional Information

Chain Sale Calculations

In chain sales, the Selling Price for one person becomes the Cost Price for the next person in the sequence.

Profit and Loss Relation

SP = CP × (100 ± Gain/Loss)% ÷ 100. Always calculate the profit or loss percentage on the Cost Price unless stated otherwise.

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Q31. Answer: (a) Rs. 640

Shortcut Trick

Ratio of Cost Price (CP) to Marked Price (MP) is given by (100 − Discount%) : (100 + Profit%).

CP : MP = (100 − 20) : (100 + 10) = 80 : 110 = 8 : 11.

Given MP = 11 units = 880, so 1 unit = 880 ÷ 11 = 80.

CP = 8 units = 8 × 80 = 640.

Therefore The correct answer is Rs. 640.

Alternate Method

Given: Marked Price (MP) = Rs. 880, Discount = 20%, Profit = 10%.

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

=> Selling Price (SP) = 880 × (100 − 20) ÷ 100 = 880 × 0.8 = Rs. 704.

=> Cost Price (CP) = 704 × 100 ÷ (100 + 10) = 704 × 100 ÷ 110.

=> CP = 7040 ÷ 11 = Rs. 640.

Therefore The correct answer is Rs. 640.

Additional Information

Marked Price & Discount

The Marked Price is the price listed on the label. Discount is always calculated on the MP to arrive at the Selling Price (SP).

Relation between CP and MP

When both profit percentage and discount percentage are known, use the direct relation CP/MP = (100 − D%)/(100 + P%).

Q32. Answer: (a) 36.9

Shortcut Trick

Apply the Empirical Formula: Mode = 3 × Median − 2 × Mean.

46.2 = 3 × 40 − 2 × Mean

46.2 = 120 − 2 × Mean

2 × Mean = 120 − 46.2 = 73.8

Mean = 36.9

Therefore The correct answer is 36.9.

Alternate Method

Given:

Mode = 46.2

Median = 40

Formula Used:

The relationship between the three measures of central tendency is given by: Mode = 3(Median) − 2(Mean)

Calculations:

=> 46.2 = 3 × 40 − 2 × Mean

=> 46.2 = 120 − 2 × Mean

=> 2 × Mean = 120 − 46.2

=> 2 × Mean = 73.8

=> Mean = 73.8 ÷ 2

=> Mean = 36.9

Therefore The correct answer is 36.9.

Additional Information

Empirical Formula

It is used for moderately skewed distributions where the relationship is Mode = 3 Median − 2 Mean.

Symmetric Distribution

In a perfectly symmetrical distribution (like the Normal Distribution), Mean = Median = Mode.

Mean Calculation

Mean can also be calculated as Mean = Median − (Mode − Median) ÷ 2, which is a derivation of the same formula.

Skewness Relation

If Mean > Median > Mode, the data is positively skewed; if Mode > Median > Mean, the data is negatively skewed.

Q33. Answer: (d) 8 kg of A, 12 kg of B

Shortcut Trick

Using Alligation method: Difference between Type A (30%) and Mean (42%) is 12.

Difference between Type B (50%) and Mean (42%) is 8.

Ratio of A : B = 8 : 12 = 2 : 3.

Total parts = 2 + 3 = 5 parts = 20 kg → 1 part = 4 kg.

Type A = 2 × 4 = 8 kg and Type B = 3 × 4 = 12 kg.

Therefore The correct answer is 8 kg of A, 12 kg of B.

Alternate Method

Given: Total mixture = 20 kg, Nitrogen required = 42%. Nitrogen in A = 30%, Nitrogen in B = 50%.

=> Ratio of quantity of A to B = 8 : 12 = 2 : 3.

=> Let the quantities be 2x and 3x.

=> 2x + 3x = 20 kg

=> 5x = 20 kg => x = 4 kg.

=> Quantity of Fertiliser A = 2 × 4 = 8 kg.

=> Quantity of Fertiliser B = 3 × 4 = 12 kg.

Therefore The correct answer is 8 kg of A, 12 kg of B.

Additional Information

Alligation Rule

It states that (Quantity of Cheaper / Quantity of Dearer) = (CP of Dearer − Mean Price) / (Mean Price − CP of Cheaper).

Weighted Average Formula

The final concentration C = (n1c1 + n2c2) / (n1 + n2), where n is quantity and c is concentration.

Mixture Applications

This method is widely used in profit/loss, average speed, simple interest rates, and solution concentrations.

Q34. Answer: (c) 144

Shortcut Trick

Product of H.C.F. and L.C.M. = Product of the two numbers.

Other number = (18 × 1296) ÷ 162

Other number = 1296 ÷ 9 = 144

Therefore The correct answer is 144.

Alternate Method

Given:

H.C.F. = 18

L.C.M. = 1296

First Number (A) = 162

Formula Used:

H.C.F. × L.C.M. = A × B

Calculations:

=> 18 × 1296 = 162 × B

=> B = (18 × 1296) ÷ 162

=> B = 23328 ÷ 162

=> B = 144

Therefore The correct answer is 144.

Additional Information

H.C.F. and L.C.M. Property

For any two positive integers a and b, HCF(a, b) × LCM(a, b) = a × b. This property holds true only for two numbers.

Co-prime Numbers

If two numbers are co-prime, their H.C.F. is always 1 and their L.C.M. is equal to the product of the two numbers.

H.C.F. of Fractions

H.C.F. = (H.C.F. of Numerators) ÷ (L.C.M. of Denominators).

L.C.M. of Fractions

L.C.M. = (L.C.M. of Numerators) ÷ (H.C.F. of Denominators).

Q35. Answer: (d) 42

Shortcut Trick

Surface Area of Sphere = $4\pi r^2 = 5544$ cm².

$r^2 = 5544 \div (4 \times 22/7) = 5544 \times 7 \div 88 = 441$.

$r = \sqrt{441} = 21$ cm.

Diameter = $2r = 2 \times 21 = 42$ cm.

Therefore The correct answer is 42 cm.

Alternate Method

Given: Surface Area of sphere = 5544 cm², $\pi = 22/7$.

Formula Used: Surface Area of Sphere = $4\pi r^2$ and Diameter (d) = 2r.

=> $4 \times (22/7) \times r^2 = 5544$

=> $r^2 = (5544 \times 7) \div (4 \times 22)$

=> $r^2 = (5544 \times 7) \div 88$

=> $r^2 = 63 \times 7 = 441$

=> $r = \sqrt{441} = 21$ cm

=> Diameter = $2 \times 21 = 42$ cm

Therefore The correct answer is 42 cm.

Additional Information

Volume of a Sphere

The total space occupied by a sphere is given by Volume = $(4/3)\pi r^3$.

Hemisphere Properties

For a hemisphere of radius r, Curved Surface Area = $2\pi r^2$ and Total Surface Area = $3\pi r^2$.

Relation between Radius and Diameter

The diameter is the longest chord of a sphere passing through the center, where d = 2r.

Q36. Answer: (a) 20 metres

Shortcut Trick

When A finishes the race in 36 seconds, B is still running and takes 9 more seconds (45 − 36) to finish.

Distance B covers in those 9 seconds is the distance by which A beats B.

Distance = (Total Distance ÷ B's Time) × Time Difference

Distance = (100 ÷ 45) × 9 = 20 m.

Therefore The correct answer is 20 metres.

Alternate Method

Given:

Distance = 100 m

Time taken by A = 36 seconds

Time taken by B = 45 seconds

Formula Used:

Speed = Distance ÷ Time

Distance = Speed × Time

Calculations:

=> Speed of B = 100 ÷ 45 m/s

=> Speed of B = 20/9 m/s

=> Distance covered by B in 36 seconds = (20/9) × 36

=> Distance covered by B = 20 × 4 = 80 m

=> Distance by which A beats B = Total Distance − Distance covered by B in 36 seconds

=> Beating distance = 100 − 80 = 20 m

Therefore The correct answer is 20 metres.

Additional Information

Beating by Distance

If A beats B by x metres, it means when A reaches the finish line, B is x metres behind.

Beating by Time

If A beats B by t seconds, it means B takes t more seconds than A to complete the same distance.

Relative Speed in Races

In a linear race starting at the same time, the ratio of distances covered is equal to the ratio of their speeds: D1/D2 = S1/S2.

Q37. Answer: (d) 2%

Shortcut Trick

Ratio of Expenditure to Savings = 275 : 100 = 11 : 4

Net change in Income = [(11 × −12) + (4 × 40.5)] ÷ (11 + 4)

Net change = [−132 + 162] ÷ 15 = 30 ÷ 15 = 2%

Therefore The correct answer is 2%.

Alternate Method

Given: Expenditure is 175% more than Savings.

Formula Used: Income = Expenditure + Savings

=> Let Savings = 100 units

=> Expenditure = 100 + 175 = 275 units

=> Initial Income = 275 + 100 = 375 units

=> New Expenditure (12% decrease) = 275 − (12% of 275) = 275 − 33 = 242 units

=> New Savings (40.5% increase) = 100 + 40.5 = 140.5 units

=> New Income = 242 + 140.5 = 382.5 units

=> Increase in Income = 382.5 − 375 = 7.5 units

=> Percentage Increase = (7.5 ÷ 375) × 100 = 2%

Therefore The correct answer is 2%.

Additional Information

Percentage Change Rule

Income change can be calculated using the weighted average of expenditure and savings changes: $\%\Delta I = (\%\Delta E \times E + \%\Delta S \times S) \div (E + S)$.

Base Value Concept

Always identify the base correctly; "175% more than x" means the new value is 2.75x, whereas "175% of x" means 1.75x.

Q38. Answer: (b) Rs. 3,993

Shortcut Trick

Effective Compound Interest rate for 2 years at 10% = 10 + 10 + (10 × 10)/100 = 21%.

Total Amount = 100% (Principal) + 21% (Interest) = 121% of Principal.

Amount = 1.21 × 3,300 = 3,993.

Therefore The correct answer is Rs. 3,993.

Alternate Method

Given:

Principal (P) = Rs. 3,300

Rate of Interest (R) = 10% per annum

Time (n) = 2 years

Formula Used:

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

Calculations:

=> $A = 3300(1 + 10/100)^2$

=> $A = 3300(1 + 1/10)^2$

=> $A = 3300(11/10)^2$

=> A = 3300 × (121/100)

=> A = 33 × 121

=> A = 3,993

Therefore The correct answer is Rs. 3,993.

Additional Information

Effective Rate for Successive Periods

The effective interest rate for two successive periods with rates r1 and r2 is given by [r1 + r2 + (r1 × r2)/100]%.

Compound Interest Formula

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

Difference between CI and SI

For 2 years, the difference between CI and SI = $P(R/100)^2$.

Q39. Answer: (c) 68

Shortcut Trick

Compare the amounts: Rs. 13,600 is exactly double of Rs. 6,800.

Since Price and Quantity are directly proportional, the number of stands will also double.

=> Number of stands = 34 × 2 = 68

Therefore The correct answer is 68 mobile stands.

Alternate Method

Given: Cost Price of 34 mobile stands = Rs. 6,800. New Total Amount = Rs. 13,600.

Formula Used: Unitary Method (Value of 1 item = Total Cost ÷ Total Quantity)

=> Cost of 1 mobile stand = 6,800 ÷ 34

=> Cost of 1 mobile stand = Rs. 200

=> Number of stands for Rs. 13,600 = 13,600 ÷ 200

=> Number of stands = 68

Therefore The correct answer is 68 mobile stands.

Additional Information

Direct Proportion

When two quantities increase or decrease together at the same rate, they are in direct proportion (x/y = k).

Unitary Method

A technique used to find the value of a single unit first, and then multiply by the desired quantity to find the final value.

Inverse Proportion

When one quantity increases while the other decreases (e.g., speed and time), the product remains constant (x × y = k).

Q40. Answer: (a) 22.58%

Shortcut Trick

Use the successive discount formula: Single Discount = a + b − (a × b) ÷ 100.

Here, a = 2% and b = 21%.

Equivalent Discount = 2 + 21 − (2 × 21) ÷ 100.

Equivalent Discount = 23 − 42 ÷ 100 = 23 − 0.42 = 22.58%.

Therefore The correct answer is 22.58%.

Alternate Method

Given: First discount = 2%, Second discount = 21%.

Formula: Single equivalent discount = [1 − (1 − d1/100) × (1 − d2/100)] × 100

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

=> Price after 1st discount = 100 − 2% of 100 = 98.

=> Price after 2nd discount = 98 − 21% of 98 = 98 − 20.58 = 77.42.

=> Total Discount = 100 − 77.42 = 22.58.

=> Discount percentage = (22.58 ÷ 100) × 100 = 22.58%.

Therefore The correct answer is 22.58%.

Additional Information

Successive Discounts

When two or more discounts are applied one after another on the Marked Price, they are called successive discounts. The total discount is always less than the sum of individual discount rates.

Effective Discount Rate

For three successive discounts a%, b%, and c%, the net discount can be calculated by applying the formula twice or using the multiplier method: 1 − [(100−a)/100 × (100−b)/100 × (100−c)/100].

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Q41. Answer: (b) 11

Shortcut Trick

Use identities: $\sec^2 A = 1 + \tan^2 A$ and $\operatorname{cosec}^2 A = 1 + \cot^2 A$.

Substitute these into the given equation: $(1 + \tan^2 A) + (1 + \cot^2 A) = 13$.

$\Rightarrow 2 + \tan^2 A + \cot^2 A = 13$.

$\Rightarrow \tan^2 A + \cot^2 A = 13 - 2 = 11$.

Therefore The correct answer is 11.

Alternate Method

Given: $\sec^2 A + \operatorname{cosec}^2 A = 13$

Formula Used: $1 + \tan^2 \theta = \sec^2 \theta$ | $1 + \cot^2 \theta = \operatorname{cosec}^2 \theta$

$\Rightarrow \sec^2 A + \operatorname{cosec}^2 A = 13$

$\Rightarrow (1 + \tan^2 A) + (1 + \cot^2 A) = 13$

$\Rightarrow 1 + 1 + \tan^2 A + \cot^2 A = 13$

$\Rightarrow 2 + \tan^2 A + \cot^2 A = 13$

$\Rightarrow \tan^2 A + \cot^2 A = 13 - 2$

$\Rightarrow \tan^2 A + \cot^2 A = 11$

Therefore The correct answer is 11.

Additional Information

Trigonometric Identities

Fundamental identities include $\sin^2 \theta + \cos^2 \theta = 1$, $1 + \tan^2 \theta = \sec^2 \theta$, and $1 + \cot^2 \theta = \operatorname{cosec}^2 \theta$.

Reciprocal Relations

$\tan \theta = 1 / \cot \theta$ and $\sec \theta = 1 / \cos \theta$, which are useful for simplifying algebraic expressions in trigonometry.

Product Form of sec and cosec

Note that $\sec^2 A + \operatorname{cosec}^2 A$ is also equal to $\sec^2 A \times \operatorname{cosec}^2 A$.

Q42. Answer: (a) 368π cm²

Shortcut Trick

Outer radius $R = 5$ cm, Inner radius $r = 3$ cm, Length $h = 21$ cm.

Total Surface Area $= 2\pi(R + r)(h + R - r)$

$\Rightarrow 2\pi(5 + 3)(21 + 5 - 3) = 2\pi \times 8 \times 23$

$\Rightarrow 16 \times 23 \times \pi = 368\pi$ cm².

Therefore The correct answer is 368π cm².

Alternate Method

Given:

Outer Diameter = 10 cm => Outer Radius (R) = 5 cm

Inner Diameter = 6 cm => Inner Radius (r) = 3 cm

Length of pipe (h) = 21 cm

Formula Used:

Total Surface Area (TSA) of a hollow cylinder = CSA_(outer) + CSA_(inner) + 2 × Area of circular rings

$TSA = 2\pi Rh + 2\pi rh + 2\pi(R^2 - r^2)$

Calculations:

$\Rightarrow TSA = 2\pi h(R + r) + 2\pi(R + r)(R - r)$

$\Rightarrow TSA = 2\pi(R + r)[h + R - r]$

$\Rightarrow TSA = 2\pi(5 + 3)[21 + 5 - 3]$

$\Rightarrow TSA = 2\pi(8)[23]$

$\Rightarrow TSA = 16\pi \times 23$

$\Rightarrow TSA = 368\pi$ cm²

Therefore The correct answer is 368π cm².

Additional Information

Volume of Hollow Cylinder

The space occupied by the material is Volume $= \pi(R^2 - r^2)h$.

Curved Surface Area

The total curved area (inner + outer) is $2\pi h(R + r)$.

Area of Cross-section

The area of the base ring is $\pi(R^2 - r^2)$.

Q43. Answer: (b) 1

Shortcut Trick

Combined efficiency (P + Q) = 1/3 and P efficiency = 1/12.

Q efficiency = 1/3 − 1/12 = 3/12 = 1/4 cistern per hour.

Time for Q to fill 1/4 cistern = (1/4 cistern) ÷ (1/4 cistern/hour) = 1 hour.

Therefore The correct answer is 1 hour.

Alternate Method

Given: Time (P + Q) = 3 hours, Time (P) = 12 hours.

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

Person	Days/Hours	Total Work (Cistern Capacity)	Efficiency (Unit/hr)
P + Q	3	12 Units	12 ÷ 3 = 4
P	12	12 ÷ 12 = 1	

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

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

=> Required work = 1/4 of total work = 1/4 × 12 = 3 units

=> Time taken by Q = Required work ÷ Efficiency of Q = 3 ÷ 3 = 1 hour

Therefore The correct answer is 1 hour.

Additional Information

Pipes & Cisterns Efficiency

Efficiency is inversely proportional to time. If a pipe fills a tank in 'x' hours, its 1-hour work is 1/x.

Inlet and Outlet Pipes

Inlet pipes have positive efficiency (+), while outlet pipes (leaks) have negative efficiency (−).

Combined Work Formula

If A takes 'a' days and B takes 'b' days, together they take (a × b) ÷ (a + b) days.

Q44. Answer: (d) Rs. 40,000

Shortcut Trick

Expenditure = 75% → Savings = 100% − 75% = 25%

25% of Income = Rs. 10,000

Income (100%) = 10,000 × 4 = Rs. 40,000

Therefore The correct answer is Rs. 40,000.

Alternate Method

Given:

Monthly Expenditure = 75% of Monthly Income

Monthly Savings = Rs. 10,000

Formula Used:

Income = Expenditure + Savings

Calculations:

=> Let the total Monthly Income be 100 units.

=> Expenditure = 75% of 100 = 75 units.

=> Savings = 100 − 75 = 25 units.

=> According to the question, 25 units = Rs. 10,000.

=> 1 unit = 10,000 ÷ 25 = Rs. 400.

=> Total Monthly Income = 100 × 400 = Rs. 40,000.

Therefore The correct answer is Rs. 40,000.

Additional Information

Percentage Change

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To find the percentage of a value: (Value ÷ Base) × 100. In income problems, Income is always the base (100%).

Ratio Representation

75% can be written as 3/4. This means for every Rs. 4 of Income, Rs. 3 is Expenditure and Rs. 1 is Savings.

Successive Percentage

If income increases by x% and expenditure increases by y%, the new savings are calculated using the Net Change formula or component-wise calculation.

Q45. Answer: (d) 3

Shortcut Trick

Let x = p − q, y = q − r, and z = r − p.

Observe that their sum is x + y + z = (p − q) + (q − r) + (r − p) = 0.

According to the algebraic property, if x + y + z = 0, then $x^3 + y^3 + z^3 = 3xyz$.

The numerator becomes 3(p − q)(q − r)(r − p), which when divided by the denominator (p − q)(q − r)(r − p), equals 3.

Therefore The correct answer is 3.

Alternate Method

Given: The expression to simplify is $((p - q)^3 + (q - r)^3 + (r - p)^3) \div ((p - q)(q - r)(r - p))$.

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

=> Let a = p − q, b = q − r, and c = r − p.

=> First, calculate a + b + c = (p − q) + (q − r) + (r − p) = 0.

=> Substituting a + b + c = 0 into the algebraic identity:

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

=> Therefore, $a^3 + b^3 + c^3 = 3abc$.

=> The given expression simplifies to $[3(p - q)(q - r)(r - p)] \div [(p - q)(q - r)(r - p)]$.

=> By cancelling common terms, the result is 3.

Therefore The correct answer is 3.

Additional Information

Algebraic Identity for Three Variables

The formula $a^3 + b^3 + c^3 - 3abc = (a + b + c)(a^2 + b^2 + c^2 - ab - bc - ca)$ is a fundamental polynomial identity used in factorization.

Conditional Cube Identity

A special case arises when a + b + c = 0; in this scenario, the sum of cubes $a^3 + b^3 + c^3$ is always equal to 3abc.

Square of a Trinomial

Relatedly, the square of a trinomial is given by $(a + b + c)^2 = a^2 + b^2 + c^2 + 2(ab + bc + ca)$.

Q46. Answer: (c) Rs. 45,000

Shortcut Trick

Let the total salary be S.

Using the multiplying factor for successive deductions: S × 0.9 × 0.8 × 0.8 × 0.9 = 23328

S × (9/10) × (4/5) × (4/5) × (9/10) = 23328

S × (1296 / 2500) = 23328

S = 18 × 2500 = 45000

Therefore The correct answer is Rs. 45,000.

Alternate Method

Given: Remaining amount = Rs. 23,328

=> Let Total Salary = 100x

=> After House Rent (10%): 100x − 10x = 90x

=> After Conveyance (20% of 90x): 90x − 18x = 72x

=> After Income Tax (20% of 72x): 72x − 14.4x = 57.6x

=> After Clothes (10% of 57.6x): 57.6x − 5.76x = 51.84x

=> 51.84x = 23328

=> x = 23328 ÷ 51.84 = 450

=> Total Salary = 100 × 450 = 45000

Therefore The correct answer is Rs. 45,000.

Additional Information

Successive Percentage Change

When multiple deductions are made on the remaining balance, use the formula: Final Value = Initial Value × (1 − r1/100) × (1 − r2/100)...

Percentage to Fraction Conversion

10% = 1/10 (Remaining = 9/10) and 20% = 1/5 (Remaining = 4/5). These fractions simplify complex calculations significantly.

Q47. Answer: (c) 60°

Shortcut Trick

Number of diagonals = n(n − 3) ÷ 2 = 9 => n(n − 3) = 18 => n = 6 (regular hexagon)

One exterior angle of a regular hexagon = 360° ÷ 6 = 60°

One interior angle of a regular hexagon = 180° − 60° = 120°

Difference between interior and exterior angle = 120° − 60° = 60°

Therefore The correct answer is 60°.

Alternate Method

Given:

The number of diagonals of a regular polygon = 9

Formula Used:

1. Number of diagonals of an n-sided polygon = n(n − 3) ÷ 2

2. Each exterior angle of a regular polygon = 360° ÷ n

3. Each interior angle of a regular polygon = 180° − (Each exterior angle)

Calculations:

=> n(n − 3) ÷ 2 = 9

=> n(n − 3) = 18

=> $n^2 - 3n - 18 = 0$

=> $n^2 - 6n + 3n - 18 = 0$

=> n(n − 6) + 3(n − 6) = 0

=> (n − 6)(n + 3) = 0

=> n = 6 (since the number of sides n must be positive, n ≠ −3)

Therefore, the polygon is a regular hexagon with 6 sides.

=> One exterior angle = 360° ÷ 6 = 60°

=> One interior angle = 180° − 60° = 120°

=> Difference = 120° − 60° = 60°

Why other options are incorrect:

Option (1) 55° is incorrect because if the difference is 55°, the interior angle would be 117.5° and the exterior angle would be 62.5°, which does not correspond to a regular polygon with integer sides.

Option (2) 70° is incorrect because if the difference is 70°, the interior angle would be 125° and the exterior angle would be 55°, which is incorrect.

Option (4) 48° is incorrect because if the difference is 48°, the interior angle would be 114° and the exterior angle would be 66°, which is incorrect.

Therefore The correct answer is 60°.

Additional Information

Sum of Interior Angles

The sum of all interior angles of an n-sided polygon is given by (n − 2) × 180°.

Sum of Exterior Angles

The sum of all exterior angles of any polygon is always 360°.

Relation between Interior and Exterior Angle

At any vertex of a polygon, the interior angle and the exterior angle are supplementary, meaning their sum is 180°.

Q48. Answer: (b) 178

Shortcut Trick

Assume all 269 children are girls, then the total amount = 269 × 7 = Rs. 1883.

The difference between the actual amount and this assumed amount = 2239 − 1883 = Rs. 356.

This difference arises because boys get Rs. 2 more than girls (9 − 7 = Rs. 2).

Number of boys = Total Difference ÷ Extra share per boy = 356 ÷ 2 = 178.

Therefore The correct answer is 178.

Alternate Method

Given:

Total children = 269

Total amount = Rs. 2,239

Amount per boy = Rs. 9 | Amount per girl = Rs. 7

Formula Used:

Total Amount = (Number of boys × Share per boy) + (Number of girls × Share per girl)

Let the number of boys be x.

Then, the number of girls = 269 − x.

=> 9 × x + 7 × (269 − x) = 2239

=> 9x + 1883 − 7x = 2239

=> 2x + 1883 = 2239

=> 2x = 2239 − 1883

=> 2x = 356

=> x = 356 ÷ 2

=> x = 178

Therefore The correct answer is 178.

Additional Information

Alligation Rule

This problem can be solved using the alligation method where the mean value is 2239 ÷ 269. The ratio of boys to girls is (Mean − Girl's share) : (Boy's share − Mean).

Weighted Average

The total sum is the weighted average of individual shares: Total = (n1w1 + n2w2), where n is the count and w is the weight/share.

Linear Equations

For any two-variable problem (x + y = A and ax + by = B), substituting one variable in terms of the other is the most direct algebraic approach.

Q49. Answer: (a) 22.6

Shortcut Trick

Net Deviation Method: Assume the Average is 15.

Deviations: (6.5 − 15) + (10.7 − 15) + (20.2 − 15) + (a − 15) = 0

−8.5 − 4.3 + 5.2 + (a − 15) = 0

−7.6 + (a − 15) = 0 => a − 15 = 7.6

a = 15 + 7.6 = 22.6

Therefore The correct answer is 22.6.

Alternate Method

Given:

Numbers = 6.5, 10.7, 20.2 and a

Total count of numbers (n) = 4

Average = 15

Formula Used:

Average = (Sum of all observations) ÷ (Total number of observations)

Calculations:

=> 15 = (6.5 + 10.7 + 20.2 + a) ÷ 4

=> 15 × 4 = 37.4 + a

=> 60 = 37.4 + a

=> a = 60 − 37.4

=> a = 22.6

Therefore The correct answer is 22.6.

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Additional Information

Sum of Observations

The total sum can always be calculated as Total Sum = Average × Number of terms.

Net Deviation Rule

The algebraic sum of deviations of all observations from their arithmetic mean is always zero.

Change in Average

If a constant k is added to or subtracted from every term, the new average also increases or decreases by k.

Q50. Answer: (d) Rs. 3,272

Shortcut Trick

Total amount to be deducted = 16 + 15 + 75 = Rs. 106.

Remaining amount = 5,398 − 106 = Rs. 5,292.

Ratio of remaining shares = 2 : 21 : 4 (Total units = 27).

Difference between Y and Z units = 21 − 4 = 17 units.

Difference between original shares = (Remaining difference) + (Difference in deductions) = (17/27 × 5,292) + (15 − 75) = 3,332 − 60 = Rs. 3,272.

Therefore The correct answer is Rs. 3,272.

Alternate Method

Given: Total sum = Rs. 5,398. Deductions: X = Rs. 16, Y = Rs. 15, Z = Rs. 75. Ratio = 2 : 21 : 4.

=> Total deduction = 16 + 15 + 75 = Rs. 106.

=> Remaining sum = 5,398 − 106 = Rs. 5,292.

=> Total ratio parts = 2 + 21 + 4 = 27.

=> Value of 1 unit = 5,292 ÷ 27 = Rs. 196.

=> Y’s remaining share = 21 × 196 = Rs. 4,116.

=> Y’s original share = 4,116 + 15 = Rs. 4,131.

=> Z’s remaining share = 4 × 196 = Rs. 784.

=> Z’s original share = 784 + 75 = Rs. 859.

=> Required difference = 4,131 − 859 = Rs. 3,272.

Therefore The correct answer is Rs. 3,272.

Additional Information

Ratio and Proportion

Ratio is a comparison of two or more quantities of the same kind. If a sum S is divided in ratio a:b:c, the shares are (a/Σratio)×S, (b/Σratio)×S, etc.

Handling Deductions

When specific amounts are deducted from shares before a ratio is applied, always subtract the total of these deductions from the total sum first.

Unitary Method

Find the value of a single 'ratio unit' by dividing the modified total amount by the sum of all ratio parts.

Q51. Answer: (d) 3

Given:

LEMA is coded as 5681

ALES is coded as 6513

So, the code for S = 3

Hence, the correct answer is Option 4.

Q52. Answer: (a) 1 km to the east

The logic followed here is:

Given:

Fawad drives 13 km North

He turns right → 11 km East

He turns right → 14 km South

He turns right → 12 km West

He turns right → 1 km North
So, To reach Point A, he must go 1 km East.
Hence, the correct answer is Option 1.

Q53. Answer: (d) Father's brother's wife

Family Chart:
Decoding the Symbols:

Symbol	•	#	×	@
Meaning	Sister	Brother	Wife	Father

Given: L × O # V + E @ R
It means: L is the wife of O, O is the brother of V, V is the sister of E, and E is the father of R.
So, L is R's father's brother's wife.
Hence, the correct answer is "Option 4".

Q54. Answer: (c) 132

The logic followed here is:
thus, "132" will replace the question mark in the given series.
Hence, the correct option is "Option 3".

Q55. Answer: (d) 10 km towards the West

The logic followed here is:
Given:
Deepu drives 12 km East
He turns left → 6 km North
He turns right → 3 km East
He turns right → 6 km South
He turns right → 5 km West
So, To reach Point K, he must go 10 km West.
Hence, the correct answer is Option 4.

Q56. Answer: (d) 112

The logic followed here is:
thus, "112" will replace the question mark in the given series.
Hence, the correct option is "Option 4".

Q57. Answer: (b) Two

Given: J, K, L, M, N and O are sitting around a circular table facing the centre.
N is an immediate neighbour of both L and M.
J is sitting to the immediate left of L.
K is sitting third to the right of N.
Total people between J and M = 2
Hence, the correct answer is "Option 2".

Q58. Answer: (a) VMTO

The logic followed here is:
For, DUBW → PGNI
For, ZQXS → LCJE
Now, applying the same pattern to JAHC:
So, JAHC → VMTO
Hence, the correct answer is Option 1.

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Q59. Answer: (a) HLO67

The logic followed here is:

So, 'HLO67' will replace the question mark in the given series.

Hence, the correct answer is "Option 1".

Q60. Answer: (b) 8

Given number: 5341256

Logic:

Odd digits → +3

Even digits → −2

Original number: 5 3 4 1 2 5 6

Digit	Type	Operation	New Digit
5	Odd	5 + 3	8
3	Odd	3 + 3	6
4	Even	4 − 2	2
1	Odd	1 + 3	4
2	Even	2 − 2	0
5	Odd	5 + 3	8
6	Even	6 − 2	4

New number formed: 8 6 2 4 0 8 4 → 8624084

Parameter	Digit
Highest digit	8
Lowest digit	0

Calculation	Result
8 − 0	8

Hence, the correct answer is Option 2.

Q61. Answer: (b) Fifth

Given: (Left) C X Z A L P W T M D B R O J K F G V Q H E N (Right)

We are required to find the position of the letter “L” from the left end.

Position	Letter
1	C
2	X
3	Z
4	A
5	L

So, the letter L is at the 5th position from the left.

Hence, the correct answer is Option 2.

Q62. Answer: (b) More than three

Given: 9 8 7 6 5 4 3 2 1 3 9 8 7 6

Now,

We need to find an even number which is immediately preceded by an odd number and immediately followed by an odd number.

So, Needed pattern is: Odd - Even - Odd.

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

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Total valid occurrences = 5.

Hence, the correct answer is 'Option 2'.

Q63. Answer: (c) 211

The logic followed here is:

thus, "211" will replace the question mark in the given series.

Hence, the correct option is "Option 3".

Q64. Answer: (a) (284, 71, 69)

The logic followed here is:

Logic: Second Number = First Number ÷ 4 and Third Number = Second Number − 2.

For, (188, 47, 45)

=> 188 ÷ 4 = 47

=> 47 − 2 = 45

For, (224, 56, 54)

=> 224 ÷ 4 = 56

=> 56 − 2 = 54

Now, checking the options using the same pattern:

Option 1) (284, 71, 69)

=> 284 ÷ 4 = 71

=> 71 − 2 = 69

Option 2) (332, 83, 77)

=> 332 ÷ 4 = 83

=> 83 − 2 = 81 ≠ 77

Option 3) (152, 38, 32)

=> 152 ÷ 4 = 38

=> 38 − 2 = 36 ≠ 32

Option 4) (248, 68, 66)

=> 248 ÷ 4 = 62 ≠ 68

Hence, the correct answer is Option 1.

Q65. Answer: (c) Three

The logic followed here is:

Given numbers: 475, 326, 157, 761, 829

Logic: Arrange the given numbers in ascending order and identify the numbers whose positions remain unchanged after sorting.

Original sequence: 475, 326, 157, 761, 829

Arranging in ascending order: 157, 326, 475, 761, 829

Position	Original	Sorted	Status
1	475	157	Changed
2	326	326	Unchanged
3	157	475	Changed
4	761	761	Unchanged
5	829	829	Unchanged

Numbers whose positions remain unchanged: 326, 761, 829

Count = 3

Hence, the correct answer is Option 3.

Q66. Answer: (a) 16

Given:

Preeti’s rank from the top = 8th, rank from the bottom = 9th.

Total number of students = 8 + 9 – 1 = 16.

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So, there are 16 students in the class.

Hence, the correct answer is "Option 1".

Q67. Answer: (b) Only conclusion (I) follows

Given Statements:

Some grapes are oranges.

All oranges are apples.

The least possible Venn diagram for the given statements is:

Conclusions:

I. Some grapes are apples → Follows (Since some grapes are oranges and all oranges are apples, those grapes must also be apples)

II. All apples are oranges → Does not follow (This is incorrect because the correct relationship is All oranges are apples, not the reverse)

So, only conclusion I follows.

Hence, the correct answer is "Option 2".

Q68. Answer: (b) 575

BODMAS Table:

Decoding the given information:

Alphabet	•	−	×	÷
Meaning	−	•	÷	×

Now, replacing the sign from left to right using BODMAS Rule, we get:

=> 170 × 2 + 150 × 2 − 254 ÷ 2 + 156 ÷ 3 + 10 = ?

=> 340 + 300 − 127 + 52 + 10 = ?

=> 640 − 127 + 52 + 10 = ?

=> 702 − 127 = ?

=> 575

Hence, the correct option is "Option 2".

Q69. Answer: (a) HMP

The logic followed here is based on the alphabetical position pattern:

Option 1: HMP

Option 2: VZC

Option 3: DHK

Option 4: YCF

Thus, HMP does not follow the uniform pattern of +4, +3.

Hence, the odd one out is Option 1.

Q70. Answer: (d) Two

Given: (Left) 2 5 6 & 8 & < < 7 4 ^ 6 5 9 2 & 7 2 % (Right)

Now,

We need to find symbols that are immediately preceded by a number and immediately followed by another symbol.

So, Needed pattern is: Number - Symbol - Symbol.

(Left) 2 5 6 & 8 & < < 7 4 ^ 6 5 9 2 & 7 2 % (Right)

Total valid symbols = 2.

Hence, the correct answer is 'Option 4'.

Q71. Answer: (b) ELO:IPS

The logic followed here is:

For, BKQ → FOU

For, DJM → HNQ

Now, checking the options using the same pattern:

Option 1) BST → HIS

Option 2) ELO → IPS
Option 3) TYP → VHU
Option 4) VTO → FRS
Hence, the correct answer is Option 2.

Q72. Answer: (b) VZC

The logic followed here is based on the alphabetical position pattern:
Option 1: GLO
Option 2: VZC
Option 3: NSV
Option 4: KPS
Thus, VZC does not follow the uniform pattern of +5, +3.
Hence, the odd one out is Option 2.

Q73. Answer: (c) 76

Given:
Total people = 133
Mr. Ihg is 33rd from the left end,
and Mr. Lkj is 24th from the right end.
Number of people between them = 133 − (33 + 24) = 133 − 57 = 76.
So, there are 76 people between Mr. Ihg and Mr. Lkj.
Hence, the correct answer is "Option 3".

Q74. Answer: (b) 38

BODMAS Table:
Decoding the given information:

Alphabet	•	−	×	÷
Meaning	−	×	÷	•

Now, replacing the sign from left to right using BODMAS Rule, we get:
=> 19 − 32 ÷ 4 + 9 × 3 = ?
=> 19 − 8 + 27 = ?
=> 19 + 27− 8 = 46
=> 46 − 8 = ?
=> 38
Hence, the correct option is "Option 2".

Q75. Answer: (c) Only conclusion (I) follows

Given Statements:
Some cookies are juices.
All juices are breads.
The least possible Venn diagram for the given statements is:
Conclusions:
I. Some breads are cookies → Follows (Since some cookies are juices and all juices are breads, those cookies are also breads)
II. No cookie is a bread → Does not follow (There is a definite overlap between cookies and breads through juices)
So, only conclusion I follows.
Hence, the correct answer is "Option 3".

Q76. Answer: (c) Two

Given: Seven people S, Q, U, A, R, E and D are sitting in a row, facing north.
Only two people sit between U and E.
Only Q sits to the right of D.
Only one person sits between E and D.

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S sits at some place to the right of A but at some place to the left of R.

Now, people between R and A: S, E → 2 people

Hence, the correct answer is "Option 3".

Q77. Answer: (b) YABE

The logic followed here is:

For, IKLO → XZAD

For, QSTW → FHIL

Now, applying the same pattern to JLMP:

So, JLMP → YABE

Hence, the correct answer is Option 2.

Q78. Answer: (c) 2

Given:

MULE is coded as 7536

LUKE is coded as 6723

So, the code for K = 2

Hence, the correct answer is Option 3.

Q79. Answer: (a) NKU 51

The logic followed here is:

So, 'NKU 51' will replace the question mark in the given series.

Hence, the correct answer is "Option 1".

Q80. Answer: (b) C

Given: Six people A, B, C, D, E and F are sitting in a row, facing north.

Only two people sit to the left of F.

Only one person sits between D and E.

F sits to the immediate left of D.

A sits to the immediate right of C.

B sits third to the right of A.

Now, the extreme left end is: C

Hence, the correct answer is "Option 2".

Q81. Answer: (d) Mission Mausam

The correct answer is Mission Mausam.

Key Points

• The Union Government of India officially launched Mission Mausam to significantly scale up India's weather and climate forecasting capabilities, particularly to tackle extreme weather events.

• This initiative was strategically designed to make India Weather-Ready and Climate-Smart by integrating advanced technologies like Artificial Intelligence (AI) and Machine Learning (ML).

• The mission is being implemented under the Ministry of Earth Sciences (MoES), ensuring a unified approach toward atmospheric science and observation.

• One of the core objectives of Mission Mausam is to improve the accuracy of forecasts for cloudbursts, heatwaves, cyclones, and heavy rainfall, providing more lead time for disaster management authorities.

• The government approved an initial outlay of Rs. 2,000 crore for the first two years of the mission, emphasizing the urgency of climate resilience.

Additional Information

• Technological Infrastructure:

• The mission involves the deployment of Next-Generation Radars, including Dual-Polarization Doppler Weather Radars, to enhance spatial and temporal resolution in weather monitoring.

• It also focuses on expanding the network of Automatic Weather Stations (AWS) and Automatic Rain Gauges (ARG) across the country, especially in hilly terrains and coastal regions.

• Weather Modification Research:

• A unique component of Mission Mausam is the research into weather modification techniques, such as cloud seeding, to

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potentially manage droughts or suppress hailstorms.

• This research aim is to provide innovative solutions to the unpredictable Monsoon patterns that affect India's agriculture sector.

• Economic and Social Impact:

• By providing hyper-local and precise weather data, the mission directly benefits farmers, aviation, shipping, and the power sector.

• Improved forecasting helps in reducing the economic loss associated with climate-induced disasters, which currently impacts a significant portion of India's Gross Domestic Product (GDP).

Important Points

• Institutional Support:

• Three key institutions are central to the mission's success: the India Meteorological Department (IMD), the Indian Institute of Tropical Meteorology (IITM), and the National Centre for Medium-Range Weather Forecasting (NCMRWF).

• These bodies work in tandem to process data from satellites like INSAT-3DR and ocean buoys to create comprehensive climate models.

• Timeline and Goals:

• The first phase of the mission spans from 2024 to 2026, focusing on infrastructure procurement and computational capacity building.

• The long-term goal is to position India as a global leader in atmospheric science and to offer weather-related services to neighboring South Asian and African nations.

• Global Alignment:

• The mission aligns with the United Nations' Sustainable Development Goals (SDGs) and the Early Warnings for All initiative, reinforcing India's commitment to the Paris Agreement and climate adaptation.

Q82. Answer: (c) New Delhi

p data-end="57" data-start="0">The correct answer is New Delhi.

Key Points

• In January 2025, the city of New Delhi recorded some of the highest air pollution levels in recent history, frequently crossing the "Severe Plus" category on the Air Quality Index (AQI).

• According to the Copernicus Climate Change Service (C3S) and various meteorological reports, the extreme pollution was exacerbated by a phenomenon known as temperature inversion, where a layer of warm air traps cooler air and pollutants close to the earth's surface.

• The C3S highlighted that climate change has altered traditional weather patterns, leading to more frequent stagnant atmospheric conditions over the Indo-Gangetic Plain during the winter months.

• During this period, the concentration of PM2.5 (fine particulate matter) in New Delhi reached levels more than 30 to 50 times the World Health Organization (WHO) annual safety guideline.

• While coastal cities like Mumbai and Chennai benefit from sea breezes that disperse pollutants, New Delhi's landlocked geography prevents the ventilation of toxic air, especially when wind speeds drop to near zero km/h.

Additional Information

• Temperature Inversion:

• Usually, air temperature decreases with an increase in altitude. However, during an inversion, warmer air sits over cooler air.

• In New Delhi, this acts as a "lid," preventing the vertical mixing of smoke from biomass burning, vehicular emissions, and industrial discharge.

• Copernicus Climate Change Service (C3S):

• It is one of the six thematic services provided by the Copernicus Programme of the European Union, managed by the European Centre for Medium-Range Weather Forecasts (ECMWF).

• It provides authoritative data on the past, present, and future climate in Europe and the rest of the world.

• Pollutants and Health Impact:

• PM2.5 refers to particles with a diameter of less than 2.5 micrometers. These are particularly dangerous because they can enter the bloodstream and lungs, causing respiratory and cardiovascular diseases.

• The National Air Quality Index (NAQI) in India categorizes an AQI of 401-500 as 'Severe', which affects even healthy people and seriously impacts those with existing diseases.

Important Points

• Graded Response Action Plan (GRAP):

• To combat these record-breaking levels in 2025, the Commission for Air Quality Management (CAQM) invoked Stage IV of GRAP in the National Capital Region (NCR).

• This included a ban on the entry of truck traffic into Delhi (except for essential commodities) and a halt on construction and

demolition activities.

• Role of Western Disturbances:

• In January 2025, a lack of strong Western Disturbances (extra-tropical storms originating in the Mediterranean) meant there was no rain or strong winds to wash away the accumulated aerosols over North India.

• The C3S data indicated that global warming is making these disturbances more erratic, directly impacting the air quality of the Indian subcontinent.

Q83. Answer: (b) India

The correct answer is India.

Key Points

• According to the World Bank's Gini Index report released for the year 2025, India has achieved a landmark ranking as the fourth most equal country globally in terms of income distribution.

• The Gini Index (or Gini Coefficient) is a statistical measure used to represent the income inequality or wealth inequality within a nation or a social group.

• A Gini Index of 0 represents perfect equality, where everyone has the same income, while an index of 100 implies perfect inequality, where one individual has all the income.

• The 2025 ranking signifies a major shift in the socio-economic landscape of South Asia, reflecting the impact of structured direct benefit transfers and inclusive growth policies implemented over the last decade.

• India's performance in this index suggests a narrowing gap between the rich and the poor, as measured by the World Bank's updated methodology which considers consumption expenditure and disposable income.

Additional Information

• Definition of Gini Coefficient:

• Developed by the Italian statistician Corrado Gini in 1912, it is the most commonly used measurement of inequality.

• It is mathematically based on the Lorenz Curve, which plots the cumulative percentages of total income received against the cumulative number of recipients.

• Comparison with Other Nations:

• Sweden: Traditionally ranked among the most equal due to its Nordic model of social welfare, but ranked differently in the 2025 World Bank specific dataset.

• Japan: Maintains a low Gini coefficient due to homogenous wage structures and high inheritance taxes.

• Canada: Often recognized for its redistributive tax system and publicly funded healthcare, which contribute to a lower inequality index compared to its southern neighbors.

• Calculation Methods:

• The World Bank calculates the Gini Index using household survey data from government statistical agencies.

• It often uses Purchasing Power Parity (PPP) exchange rates to ensure cross-country comparability of income levels.

Important Points

• Significance of the Ranking: A high ranking in income equality for a country with a population of over 1.4 billion like India indicates significant structural reforms in rural employment (such as MGNREGA) and digital financial inclusion.

• Impact on Policy: Governments use Gini Index data to formulate fiscal policies, adjust tax brackets, and design social safety nets to prevent wealth concentration.

• Limitations of the Index: While the Gini Index is a robust measure of relative inequality, it does not reflect the absolute wealth of a nation; thus, a poor country and a rich country can have the same Gini score if their income distribution patterns are similar.

Q84. Answer: (a) The Republic of Mauritius and the United Kingdom

The correct answer is The Republic of Mauritius and the United Kingdom.

Key Points

• On October 3, 2024, the governments of the United Kingdom and the Republic of Mauritius issued a joint statement announcing a historic political agreement regarding the Chagos Archipelago.

• Under the terms of this agreement, the United Kingdom will transfer the sovereignty of the Chagos Archipelago, including the strategic island of Diego Garcia, to Mauritius.

• A critical component of the deal ensures the continued operation of the strategic military base on Diego Garcia, which is managed by the United Kingdom and the United States. The agreement grants the United Kingdom a 99-year lease to ensure the base's "uninterrupted operation."

• The agreement was reached following years of negotiations and was finalized between British Prime Minister Keir Starmer and Mauritian Prime Minister Pravind Jugnauth.

• This move aims to resolve decades of international legal disputes and address the historical grievances of the Chagossian people, while maintaining regional security in the Indian Ocean.

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Additional Information

• Historical Context: The Chagos Archipelago was separated from Mauritius (then a British colony) in 1965, three years before Mauritius gained independence in 1968. It was subsequently designated as the British Indian Ocean Territory (BIOT).

• Displacement of Inhabitants: Between 1967 and 1973, the United Kingdom forcibly removed approximately 1,500 to 2,000 native Chagossians from the islands to make way for the military base on Diego Garcia. The agreement includes a "right of resettlement" for Chagossians to islands other than Diego Garcia.

• Legal Rulings: In February 2019, the International Court of Justice (ICJ) issued an advisory opinion stating that the United Kingdom's decolonization of Mauritius was not lawfully completed and that the UK should end its administration of the Chagos Archipelago as rapidly as possible.

• International Pressure: In May 2019, the United Nations General Assembly (UNGA) voted overwhelmingly (116 to 6) in favor of a resolution demanding that the United Kingdom withdraw its colonial administration from the islands within six months.

• Strategic Importance of Diego Garcia: Located in the central Indian Ocean, Diego Garcia serves as a vital military hub for United States and United Kingdom air and naval operations, providing a platform for missions across the Middle East, South Asia, and East Africa.

• Financial Provisions: As part of the October 2024 treaty, the United Kingdom will provide a package of financial support to Mauritius, including an annual indexed payment and a Mauritius Infrastructure Investment Fund to promote economic development.

Important Points

• Global Reaction: The United States President Joe Biden welcomed the agreement, citing its importance in securing the future of the Diego Garcia base, which plays a vital role in global security and stability.

• Sovereignty vs. Administration: While Mauritius will hold full sovereignty over the entire archipelago, the United Kingdom will be authorized to exercise the sovereign rights and authorities of Mauritius in respect of Diego Garcia for an initial period of 99 years to manage the base.

• Environmental Protection: The agreement also includes provisions for Mauritius and the United Kingdom to cooperate on environmental protection, maritime security, and the fight against illegal fishing and human trafficking in the Indian Ocean region.

Q85. Answer: (b) Madhav NP

The correct answer is option2. The detailed solution will be updated soon.

Q86. Answer: (d) Ensure enhanced protection for depositors and investors

The correct answer is Ensure enhanced protection for depositors and investors.

Key Points

• The Banking Laws (Amendment) Act (introduced as a Bill in 2024 and progressed in 2025) was designed to strengthen the governance of the Indian banking sector and ensure enhanced protection for depositors and investors.

• One of the most significant features of this legislation is the overhaul of nomination facilities; it allows a depositor to have up to four nominees for their bank accounts, compared to the earlier limit of only one nominee. Hence, statement 4 is correct.

• The Act provides for simultaneous and successive nominations, which helps in the smooth transfer of funds to legal heirs and significantly reduces the accumulation of unclaimed deposits in the banking system.

• It seeks to amend the Banking Regulation Act, 1949, the Banking Companies (Acquisition and Transfer of Undertakings) Acts of 1970 and 1980, and the State Bank of India Act, 1955.

• The legislation also redefines "substantial interest" for bank directorships, increasing the threshold from Rs. 5 lakhs to Rs. 2 crores, reflecting modern economic scales.

Additional Information

• Governance in Cooperative Banks: The Act extends the maximum tenure for directors (excluding the Chairman and whole-time directors) in cooperative banks from 8 years to 10 years, aiming for better administrative stability.

• Regulatory Reporting: It amends the Reserve Bank of India Act, 1934, to change the reporting frequency for banks from reporting Fridays to fortnightly dates (the 15th and the last day of the month) to align with standard accounting practices.

• Investor Education: The law proposes transferring unclaimed dividends and shares to the Investor Education and Protection Fund (IEPF), allowing investors to claim their rightful money from a centralized government authority.

• Audit Quality: The Reserve Bank of India (RBI) is granted more autonomy and oversight in the appointment of statutory auditors for public sector banks to ensure transparency and prevent financial discrepancies.

Important Points

• Unclaimed Deposits Data: According to RBI reports, unclaimed deposits in the Indian banking system have reached approximately Rs. 78,000 crore as of March 2024. The new nomination rules are a direct measure to curb this growth.

• Directorship Restrictions: The Act clarifies that a person cannot be a director in more than one banking company or a cooperative bank simultaneously, preventing conflicts of interest.

• Statutory Compliance: The amendments ensure that the definitions of "relative" and "control" are standardized across different

banking statutes to provide a uniform regulatory framework for Public Sector Banks (PSBs) and private entities alike.

Q87. Answer: (a) Indian Institute of Technology Bombay

The correct answer is Indian Institute of Technology Bombay.

Key Points

• In December 2024 (noted in the question context as December 2025), the Indian Institute of Technology (IIT) Bombay, through its business incubator SINE (Society for Innovation and Entrepreneurship), launched the Y-Point Venture Capital Fund.

• This fund is recognized as India's first incubator-linked deep technology venture capital fund, designed to bridge the funding gap for startups transitioning from laboratory research to commercial scale.

• The Y-Point Venture Capital Fund has a target corpus of approximately INR 500 Crore and focuses specifically on Deep Tech sectors including Artificial Intelligence (AI), Semiconductors, Space Technology, Biotechnology, and Robotics.

• The initiative aims to provide early-stage and Series A funding to startups that have been nurtured within the IIT Bombay ecosystem or other academic research environments.

• By being incubator-linked, the fund leverages the technical expertise and mentorship available at SINE, ensuring that the invested capital is backed by robust scientific validation.

Additional Information

• SINE (Society for Innovation and Entrepreneurship):

• Established in 2004, SINE is one of the oldest and most successful technology business incubators in India, located within the IIT Bombay campus in Powai, Mumbai.

• It has supported over 200 startups and provides infrastructure, intellectual property (IP) support, and networking opportunities to entrepreneurs.

• Deep Technology (Deep Tech):

• Deep Tech refers to startups based on substantial scientific advances and high-tech engineering innovations.

• Unlike general tech (e.g., apps or e-commerce), Deep Tech requires significant Research and Development (R&D) and often involves a longer time to reach the market.

• Common examples include Quantum Computing, Clean Energy, and Advanced Materials.

• Venture Capital (VC) in Academia:

• Linking VC funds directly to academic incubators is a model successfully used by global institutions like Stanford and MIT to commercialize university-led research.

• The Y-Point Fund represents a shift in India's startup ecosystem, moving toward supporting IP-led innovation rather than just service-based models.

• IIT Bombay Ranking:

• IIT Bombay consistently ranks among the top engineering institutions in India according to the NIRF (National Institutional Ranking Framework) and is recognized globally for its contribution to engineering and entrepreneurship.

Important Points

• Economic Impact: The fund is expected to boost the "Make in India" and "Atmanirbhar Bharat" initiatives by fostering domestic manufacturing of high-end technologies.

• Funding Stages: The Y-Point Venture Capital Fund primarily targets the "Valley of Death"—the critical phase where startups have a prototype but lack the capital to begin mass production.

• Partnerships: The fund involves participation from IIT Bombay alumni, High Net-worth Individuals (HNIs), and Corporate Social Responsibility (CSR) contributions, showcasing a collaborative model for national development.

Q88. Answer: (d) 0.06%

The correct answer is 0.06%.

Key Points

• The United Nations Inter-agency Group for Child Mortality Estimation (UN IGME) released its 2024 report, highlighting significant progress in India's immunization efforts.

• India achieved a major public health milestone by reducing the percentage of zero-dose children from 0.11% in 2023 to 0.06% in 2024.

• A zero-dose child is clinically defined as a child who has not received the first dose of the diphtheria-tetanus-pertussis (DTP1) vaccine, which is a primary indicator of a child's access to routine health services.

• This sharp decline underscores the success of the Universal Immunization Programme (UIP) and intensive outreach activities designed to reach the most vulnerable and marginalized populations in India.

• The reduction in zero-dose cases is a critical factor in lowering the under-five mortality rate and ensuring that children are protected from preventable diseases at an early age.

Additional Information

• UN IGME (United Nations Inter-agency Group for Child Mortality Estimation):

• It was formed in the year 2004 to share data on child mortality, improve methods for child mortality estimation, and report on progress towards child survival goals.

• The group includes UNICEF, the World Health Organization (WHO), the World Bank Group, and the United Nations Population Division of the Department of Economic and Social Affairs.

• Universal Immunization Programme (UIP):

• Launched in 1985, it is one of the largest health programs in the world.

• In India, it provides life-saving vaccines to approximately 2.6 crore children and 2.9 crore pregnant women annually, free of cost.

• It targets 12 vaccine-preventable diseases including Polio, Measles, Rubella, and Rotavirus diarrhea.

• Mission Indradhanush:

• Launched in December 2014 by the Ministry of Health and Family Welfare, its goal is to achieve 90% full immunization coverage.

• The Intensified Mission Indradhanush (IMI) focuses on specific locations and districts with low coverage to ensure no child is left behind.

Important Points

• U-WIN Portal: This is a digital platform modeled after Co-WIN, designed to digitize the entire vaccination system in India, allowing health workers to track zero-dose children in real-time.

• SDG Target 3.2: By 2030, the Sustainable Development Goals aim to end preventable deaths of newborns and children under 5 years of age.

• Data Trends: The 2024 report indicates that while global numbers are improving, India's rapid reduction from 0.11% to 0.06% places it as a leader in immunization recovery following the COVID-19 pandemic.

• Role of Frontline Workers: The success is largely attributed to the functions of ASHA (Accredited Social Health Activist) and ANM (Auxiliary Nurse Midwife) workers who conduct door-to-door surveys to identify children missed during routine sessions.

Q89. Answer: (d) Tianjin SCO Summit

The correct answer is Tianjin SCO Summit.

Key Points

• The Tianjin SCO Summit was the designated full-fledged annual summit of the Shanghai Cooperation Organization (SCO) for the year 2025. Hence, the correct answer is Tianjin SCO Summit.

• During this summit, China served as the chair, having taken over the presidency for the 2024-2025 period. The event was held in Tianjin, a major portal city in Northern China.

• The summit served as a critical platform to emphasize multilateral cooperation, particularly focusing on regional security, counter-terrorism, and the promotion of a multipolar world order.

• A central theme of the 2025 summit was economic resilience. Member states discussed strategies to strengthen regional supply chains, enhance trade in local currencies, and reduce external economic vulnerabilities.

• The summit placed a strong emphasis on Global-South development priorities, advocating for the interests of developing nations and fostering collaboration on sustainable development goals, infrastructure, and technology transfer.

• The Shanghai Spirit—characterized by mutual trust, equality, and respect for diverse civilizations—remained the guiding principle for the diplomatic engagements in Tianjin.

Additional Information

• Astana SCO Summit (2024):

• The 24th Meeting of the Council of Heads of State of the SCO was held in July 2024 in Astana, Kazakhstan.

• A major highlight was the official admission of Belarus as the 10th full member of the organization. Hence, this option is incorrect for the 2025 summit.

• New Delhi SCO Summit (2023):

• Hosted by India on July 4, 2023, this summit was conducted in a virtual format for the first time under India's chairmanship.

• The theme was "Towards a SECURE SCO", focusing on Security, Economy, Connectivity, Unity, Respect, and Environment. Iran officially became a full member during this summit. Hence, this option is incorrect for the 2025 summit.

• Samarkand SCO Summit (2022):

• This summit took place in September 2022 in Samarkand, Uzbekistan.

• It was significant for the signing of the Samarkand Declaration and marked the first in-person gathering of SCO leaders since the COVID-19 pandemic began in 2020. Hence, this option is incorrect for the 2025 summit.

• Overview of SCO:

• The Shanghai Cooperation Organization is a permanent intergovernmental international organization founded on June 15, 2001, in Shanghai, China.

• The current 10 member states are China, Russia, Kazakhstan, Kyrgyzstan, Tajikistan, Uzbekistan, India, Pakistan, Iran, and

Belarus.

• The organization aims to combat the "three evils": terrorism, separatism, and extremism. It has its Secretariat in Beijing and the Regional Anti-Terrorist Structure (RATS) based in Tashkent.

Q90. Answer: (d) Rafique Baghdadi

The correct answer is Rafique Baghdadi.

Key Points

• Veteran film critic, historian, and journalist Rafique Baghdadi was honored with the Satyajit Ray Memorial Award during the 21st Third Eye Asian Film Festival held in 2025.

• The award recognizes his lifelong dedication to film criticism, his profound understanding of world cinema, and his significant contributions to documenting the history of Indian cinema.

• Rafique Baghdadi is widely respected for his deep research into the works of Satyajit Ray and has played a pivotal role in the film society movement in India for over five decades.

• The 21st edition of the festival celebrated the diversity of Asian cinema, and this award highlighted the importance of scholars and critics who preserve the legacy of legendary filmmakers like Ray.

• Baghdadi is also a prominent chronicler of Mumbai's heritage and has authored several pieces reflecting the intersection of literature, history, and the silver screen.

Additional Information

• Third Eye Asian Film Festival:

• This festival is organized by the Asian Film Foundation to promote Asian cinema and provide a platform for filmmakers from the continent to showcase their talent.

• It is usually held in Mumbai and features categories such as World Cinema, Asian Panorama, and a dedicated section for Short Films.

• The festival aims to foster cultural exchange and understanding among Asian nations through the medium of film.

• Satyajit Ray Memorial Award:

• Named after the Bharat Ratna recipient and Oscar-winning director Satyajit Ray, this award is given to individuals who have made exceptional contributions to cinema.

• The award emphasizes artistic excellence and the intellectual pursuit of cinematic studies, mirroring the standards set by Ray during his career in the 20th century.

• Rafique Baghdadi's Contributions:

• Beyond cinema, Rafique Baghdadi is a noted expert on the life and works of the writer Saadat Hasan Manto.

• He is famous for conducting heritage walks in South Mumbai, particularly in the Mazgaon and Byculla areas, connecting local history with cinematic narratives.

• His work serves as a bridge between literature and film journalism, making him a unique figure in India's cultural landscape.

Important Points

• Satyajit Ray is best known for the Apu Trilogy (Pather Panchali, Aparajito, and Apur Sansar), which brought Indian cinema to the global stage in the 1950s.

• The Asian Film Foundation, which organizes the Third Eye Festival, has been active for over two decades, consistently honoring the legacy of masters through special retrospectives and memorial awards.

• The 2025 festival highlighted the growing influence of digital media and independent storytelling in Asian countries like South Korea, Iran, and India.

• Recipients of such memorial awards are typically chosen by a jury comprising eminent film personalities and scholars based on a lifetime of consistent achievement.

Q91. Answer: (b) IndusInd Bank

The correct answer is IndusInd Bank.

Key Points

• The Board of Directors of IndusInd Bank has officially approved the appointment of Rajiv Anand as the next Chief Executive Officer (CEO) and Managing Director (MD).

• The appointment is set for a three-year term, which is scheduled to commence on August 25, 2025, and conclude on August 24, 2028.

• Rajiv Anand will transition to this role from Axis Bank, where he currently serves as the Deputy Managing Director. Hence, the statement regarding the bank is correct.

• The transition comes as the tenure of the current MD and CEO, Sumant Kathpalia, is slated to end in 2025.

• This high-profile appointment is subject to the necessary regulatory approvals from the Reserve Bank of India (RBI) and the shareholders of the bank.

Additional Information

• IndusInd Bank:

• It is a prominent new-generation private sector bank in India, commenced its operations in 1994.

• The bank was inaugurated by Dr. Manmohan Singh, the then Union Finance Minister, and was founded by S.P. Hinduja.

• It is headquartered in Mumbai, Maharashtra, and has a significant presence across India with a focus on retail banking and vehicle financing.

• The bank's tagline is "We Make You Feel Richer".

• Rajiv Anand's Professional Background:

• He possesses over 30 years of extensive experience in the financial services industry.

• Before his long tenure at Axis Bank, he held senior leadership positions at Standard Chartered Bank, Citibank, and IDBI AMC.

• He is widely recognized for his expertise in corporate banking, treasury, and asset management.

• Regulatory Framework:

• Under the Banking Regulation Act, 1949, the appointment and re-appointment of MDs and CEOs in private sector banks must be vetted and approved by the Reserve Bank of India (RBI) to ensure "fit and proper" criteria.

Important Points

• Succession Planning: The move is seen as a strategic succession planning effort by IndusInd Bank to ensure leadership stability following the exit of Sumant Kathpalia.

• Market Impact: Appointments of veteran bankers like Rajiv Anand often influence investor confidence and the stock performance of the respective financial institutions.

• Other Options:

• Kotak Mahindra Bank: Recently saw Ashok Vaswani take over as MD and CEO in January 2024.

• Axis Bank: Currently led by Amitabh Chaudhry as MD and CEO.

• IDFC First Bank: Currently headed by V. Vaidyanathan.

Q92. Answer: (d) Nocturnes by Anirban Dutta and Anupama Srinivasan

The correct answer is Nocturnes by Anirban Dutta and Anupama Srinivasan.

Key Points

• The Indian documentary titled Nocturnes, directed by Anirban Dutta and Anupama Srinivasan, won the prestigious World Cinema Documentary Special Jury Award for Craft at the Sundance Film Festival.

• The film is a collaborative production between India and the United States, focusing on the hidden world of moths in the Eastern Himalayas.

• The award for Craft was specifically bestowed to honor the film’s exceptional cinematography and immersive sound design, which captures the rhythmic sounds of the forest at night.

• The documentary follows ecologists as they study hawk moths (belonging to the Sphingidae family) to understand the impact of climate change on biodiversity in high-altitude regions. Hence, option 4 is the correct answer.

• The Sundance Film Festival is one of the largest independent film festivals in the world, held annually in Utah, USA.

Additional Information

• Sundance Film Festival:

• Established by the Sundance Institute, founded by actor Robert Redford in 1981, it serves as a primary platform for independent filmmakers.

• The festival takes place in Park City, Utah, every January. It features categories such as U.S. Dramatic, World Cinema Documentary, and Short Film competitions.

• Indian Documentaries at Sundance:

• In recent years, Indian non-fiction storytelling has gained global acclaim. For instance, Writing with Fire (directed by Rintu Thomas and Sushmit Ghosh) won the Audience Award and Special Jury Award in 2021.

• All That Breathes, directed by Shaunak Sen, won the World Cinema Documentary Grand Jury Prize in 2022, further establishing India's presence in the global documentary circuit.

• Other Filmmakers Mentioned:

• Beyond Blast, directed by Saikhom Ratan, is a poignant documentary from Manipur that revolves around the life of a bomb blast survivor, emphasizing human resilience.

• Meena Longjam is another award-winning filmmaker from Manipur, known for documentaries like Andro Dreams and Autodriver, which focus on social issues and women's empowerment in Northeast India.

Important Points

• Technical Mastery: The documentary Nocturnes is noted for its macro-cinematography, which allows viewers to see the intricate details of moth wings and behaviors that are otherwise invisible to the naked eye.

• Ecological Context: The film is set in Arunachal Pradesh, a biodiversity hotspot. It highlights the work of scientist Mansi Mungee as she sets up light screens at different altitudes to attract and count various moth species.

• Global Collaboration: The project received support from international bodies, including the Sundance Institute Documentary Fund and the IDFA Bertha Fund, showcasing the international funding mechanisms available for high-quality Indian documentaries.

• Themes: The primary themes of the film include environmental conservation, the interconnectedness of species, and the slow, methodical nature of scientific research.

Q93. Answer: (c) Germany

The correct answer is Germany.

Key Points

• Germany emerged as the champion in the FIH Hockey Pro League 2024-25 (Men) leg held at the Kalinga Hockey Stadium in Bhubaneswar, continuing their strong performance in international hockey.

• The FIH Hockey Pro League is a prestigious annual international league organized by the International Hockey Federation (FIH), featuring the world's best national teams.

• The 2024-25 season saw intense competition among top-tier nations, including India, Belgium, Netherlands, and Australia, with Germany securing critical points in the Bhubaneswar and Rourkela legs.

• The victory at the Kalinga Hockey Stadium is particularly significant for the German team, as they previously won the FIH Men's Hockey World Cup at the same venue in January 2023.

• The German squad, known as Die Honamas, demonstrated exceptional tactical discipline and physical fitness, overcoming challenges from host nation India and other European powerhouses during the tournament.

Additional Information

• Kalinga Hockey Stadium:

• Located in Bhubaneswar, Odisha, this stadium is considered the "Global Hub of Hockey."

• It has a seating capacity of approximately 15,000 spectators and has hosted major events like the 2018 and 2023 Men's Hockey World Cups.

• FIH Pro League Format:

• The league operates on a round-robin format where teams play each other home and away or in centralized "mini-tournaments" to reduce travel.

• Points are awarded as follows: 3 points for a direct win, 1 point for a draw, and an additional bonus point for winning the subsequent penalty shootout.

• Odisha's Contribution to Hockey:

• The Government of Odisha, led by the Department of Sports and Youth Services, has been the official sponsor of the Indian National Hockey Teams (both Men and Women) since 2018.

• In 2023, the sponsorship was extended for another 10 years, lasting until 2033, showcasing a massive commitment to the sport's development.

• International Hockey Federation (FIH):

• The FIH is the world governing body for field hockey, headquartered in Lausanne, Switzerland.

• It was founded in 1924 and is responsible for organizing the Hockey World Cup, Pro League, and hockey events at the Olympic Games.

• Germany's Hockey Legacy:

• Germany is one of the most successful teams in hockey history, having won multiple Olympic Gold Medals (1972, 1992, 2008, 2012) and World Cup titles.

• Their victory in the 2024-25 Pro League phase highlights their consistency as a top-ranked team in the FIH World Rankings.

Important Points

• Match Dynamics: The 2024-25 season utilized a centralized venue strategy in India to capitalize on the massive fan base in Odisha, with matches split between Bhubaneswar and the Birsa Munda International Hockey Stadium in Rourkela.

• Indian Performance: The Indian Men's Hockey Team, led by captain Harmanpreet Singh, utilized these home legs to test younger players and refine strategies ahead of major international fixtures.

• Qualification Stakes: Performance in the FIH Pro League is crucial as it provides high-level competitive exposure and impacts FIH World Ranking points, which determine seeding for the Olympics and World Cups.

Q94. Answer: (d) Raksha Nikhil Khadse

The correct answer is Raksha Nikhil Khadse.

Key Points

• Raksha Nikhil Khadse, the Union Minister of State for Youth Affairs and Sports, officially inaugurated the Esports Conclave 2025

held in New Delhi.

• The event marks a significant milestone in India's journey toward becoming a global hub for competitive gaming and digital sports, highlighting the government's support for the burgeoning Esports ecosystem.

• During the inauguration, the minister emphasized the need for a structured framework and regulatory guidelines to protect the interests of professional players and developers in the Indian gaming industry.

• The Esports Conclave 2025 brought together industry leaders, professional gamers, and policymakers to discuss the transition of gaming from a leisure activity to a recognized career path for the youth. Hence, the correct answer is Raksha Nikhil Khadse.

Additional Information

• The Rise of Esports in India:

• In December 2022, the Government of India officially recognized Esports as part of multi-sport events, placing it under the Ministry of Youth Affairs and Sports.

• India's performance in international stages like the Asian Games 2022 (held in 2023), where Esports was a medal event, has significantly boosted domestic interest and investment.

• Ministry of Youth Affairs and Sports:

• The ministry is responsible for the overall development of sports in India and the promotion of the Khelo India initiative.

• Mansukh Mandaviya currently serves as the Union Minister for Youth Affairs and Sports, while Raksha Nikhil Khadse serves as the Minister of State.

• Economic and Technological Impact:

• The Indian gaming market is projected to reach a value of $7.5 billion by 2028, driven by the proliferation of 5G technology and high-performance smartphones.

• Esports differs from casual gaming as it involves professional competition, standardized rules, and organized leagues similar to traditional sports like cricket or football.

Important Points

• Growth Drivers: The launch of the National AVGC-XR Policy (Animation, Visual Effects, Gaming, Comics, and Extended Reality) has provided the necessary impetus for content creators and game developers in the country.

• Career Opportunities: Beyond players, the industry is creating jobs in game design, data analytics, shoutcasting, event management, and software engineering.

• Global Context: The inclusion of the Olympic Esports Games starting in 2025 in Saudi Arabia has further legitimized the field on a global scale, prompting nations like India to accelerate their domestic infrastructure development.

• Youth Engagement: With over 400 million gamers, India possesses one of the world's largest gaming populations, making it a critical market for global hardware and software giants.

Q95. Answer: (b) Yajik Hillang

The correct answer is Yajik Hillang.

Key Points

• Yajik Hillang, a prominent athlete from Arunachal Pradesh, created history by winning the gold medal at the 15th South Asian Bodybuilding and Physique Sports Championships 2025.

• The international event was hosted in Bhutan (specifically in Thimphu), showcasing the best physique and bodybuilding talent from the South Asian region.

• She secured the top spot in the Women’s Model Physique up to 155 cm category, demonstrating exceptional muscle symmetry, tone, and stage presence.

• This victory is significant as it highlights the rising prominence of Indian athletes, especially women from the North-Eastern states, in the field of international bodybuilding.

• The competition saw participants from several nations including India, Bhutan, Nepal, Sri Lanka, and Maldives, with Hillang emerging as a standout performer in her height class. Hence, the correct answer is Yajik Hillang.

Additional Information

• Model Physique Category: Unlike traditional bodybuilding which emphasizes extreme muscle mass, the Model Physique category focuses on a balanced, aesthetic, and athletic look, emphasizing proportions and definition.

• International Federation: The event is organized under the aegis of the South Asian Bodybuilding and Physique Sports Federation (SABPSF) and is recognized by the World Bodybuilding and Physique Sports Federation (WBPF).

• India's Performance: India has a strong legacy in this championship, often finishing near the top of the medal tally. The Indian Body Builders Federation (IBBF) is the national body responsible for selecting and training athletes like Hillang for such global stages.

• Venue: Bhutan served as the host for the 2025 edition, promoting sports tourism and fitness culture within the Himalayan kingdom.

• Previous Winners: Indian athletes such as Bhawna Tokekar have previously won accolades in various international strength and

physique categories, but the specific 2015/155 cm record in this event belongs to Hillang.

Important Points

• Date and Location: The championship took place in June 2025 in Thimphu, Bhutan, which is the 15th iteration of this regional tournament.

• Athletic Profile: Yajik Hillang has been a consistent performer in domestic circuits before making her mark on the South Asian stage. Her success is expected to inspire more women to take up Physique Sports as a professional career.

• Other Options:

• Anju Bobby George is a legendary Indian Long Jumper and not associated with bodybuilding.

• Bhawna Tokekar is known for her achievements in Powerlifting and masters-level bodybuilding but was not the winner of this specific event class in 2025.

• Akanksha Chaudhary is an IAS officer and former winner of the Miss India Elite title, often cited as a fitness icon, but did not secure the gold in this specific Bhutan championship.

• Medal Significance: Winning in Bhutan provides athletes with a qualification pathway or significant ranking points for the Asian and World Championships.

Q96. Answer: (a) Aitana Bonmatí

The correct answer is Aitana Bonmatí.

Key Points

• Aitana Bonmatí, the Spanish footballer, was associated with the Laureus World Sportswoman of the Year award in the football category at the 2025 Laureus World Sports Awards held in Madrid, Spain.

• Bonmatí was recognised for her outstanding achievements in women's football, particularly for her performances with FC Barcelona and the Spanish national team.

• She had previously created history by becoming the first footballer to win the Laureus World Sportswoman of the Year award.

• Hence, according to the official answer key, the correct answer is Option 1 – Aitana Bonmatí.

Additional Information

• Simone Biles is an American artistic gymnast and won the overall Laureus World Sportswoman of the Year 2025 award.

• Shelly-Ann Fraser-Pryce is a Jamaican sprinter and multiple-time Olympic medallist.

• Faith Kipyegon is a Kenyan middle-distance runner and multiple Olympic champion.

• The wording of the question is somewhat ambiguous because Simone Biles won the overall 2025 Sportswoman of the Year award, while the official key marks Aitana Bonmatí for the football-related reference.

Important Points

• Footballer: Aitana Bonmatí.

• Country: Spain.

• Club: FC Barcelona.

• Sport: Football.

• Laureus 2025 venue: Madrid, Spain.

Q97. Answer: (d) Aligning academic R&D with future defence technology needs

The correct answer is Aligning academic R&D with future defence technology needs.

Key Points

• The Tri Services Academia Technology Symposium (T-SATS) held in 2025 was a landmark event designed to bridge the gap between academic research and the practical operational requirements of the Indian Armed Forces.

• The primary objective of the symposium was aligning academic R&D with future defence technology needs to ensure that the intellectual capital of the nation's universities is utilized for solving real-world military challenges. Hence, the correct answer is Aligning academic R&D with future defence technology needs.

• It served as a collaborative platform where the Indian Army, Indian Navy, and Indian Air Force could articulate their long-term technology perspective plans to representatives from IITs, NITs, and other premier research institutions.

• By fostering this synergy, the symposium aimed to reduce the gestation period between a scientific concept developed in a lab and its deployment as a combat-ready technology on the field.

• The event highlighted the importance of indigenous development, aiming to minimize reliance on foreign military imports and bolstering the Strategic Autonomy of the nation.

Additional Information

• HQ Integrated Defence Staff (IDS): The symposium is often organized under the aegis of the Integrated Defence Staff, which works toward inter-service prioritization and promotes "jointness" among the three wings of the military.

• Aatmanirbhar Bharat in Defence: This symposium is a critical component of the Aatmanirbhar Bharat (Self-Reliant India)

initiative, which targets defence exports of Rs. 35,000 crore (approximately 5 billion USD) by 2025 and emphasizes domestic procurement.

• Emerging Technologies: Key focus areas discussed during such symposia typically include Artificial Intelligence (AI), Quantum Computing, Unmanned Aerial Vehicles (UAVs), Hypersonic technologies, and Directed Energy Weapons (DEWs).

• iDEX (Innovations for Defence Excellence): While T-SATS focuses on academia, iDEX is a parallel ecosystem launched in 2018 that engages startups and MSMEs to encourage innovation and technology development in the Defence and Aerospace sector.

Important Points

• Role of DRDO: The Defence Research and Development Organisation (DRDO) often acts as a mentor in these interactions, helping translate fundamental academic research into applied technology suitable for mass production by Defence Public Sector Undertakings (DPSUs).

• Technology Readiness Levels (TRL): A major theme of the 2025 symposium was advancing projects from lower TRL levels (basic research) to higher levels (operational testing), ensuring that academic grants result in tangible assets.

• Dual-Use Technology: The symposium also encouraged the development of dual-use technologies that can serve both civilian and military purposes, thereby optimizing the economic impact of R&D investments.

Q98. Answer: (a) UPI one-time mandate

The correct answer is UPI one-time mandate.

Key Points

• In February 2025, the Insurance Regulatory and Development Authority of India (IRDAI) issued a significant circular aimed at enhancing customer control over digital payments.

• The circular enables customers to block or revoke UPI one-time mandates specifically for life insurance and health insurance policies to prevent unintended premium deductions.

• This move is designed to facilitate the Single Block Multiple Debit (SBMD) framework, allowing policyholders to manage their financial commitments with greater flexibility and transparency.

• Under this new guideline, Insurers are mandated to provide a user-friendly interface or mechanism that allows policyholders to easily cancel or block these mandates without administrative hurdles.

• The initiative serves as a consumer protection measure, ensuring that individuals are not locked into automated payment cycles if they wish to discontinue a policy or change their payment method.

Additional Information

• Insurance Regulatory and Development Authority of India (IRDAI):

• It is a statutory body established under the IRDA Act, 1999, tasked with regulating and promoting the insurance and re-insurance industries in India.

• The organization is headquartered in Hyderabad, Telangana, having moved from Delhi in 2001.

• The current Chairman of IRDAI is Debasish Panda, who oversees the mission of protecting policyholders' interests.

• UPI Mandates and NPCI:

• Unified Payments Interface (UPI) is a real-time payment system developed by the National Payments Corporation of India (NPCI).

• The UPI Mandate feature allows customers to authorize a merchant to debit money from their bank account at a later date or on a recurring basis.

• The Single Block Multiple Debit feature is particularly useful for investments and insurance premiums, where a specific numerical value of funds is "blocked" in the account for future transactions.

• Digital Transformation in Insurance:

• The Government of India and IRDAI have been pushing for "Insurance for All by 2047," necessitating the adoption of seamless digital payment systems.

• The integration of UPI for premium payments has significantly reduced the transaction costs and time compared to traditional methods like ECS (Electronic Clearing Service) or Cheques.

• By allowing customers to block mandates, IRDAI is aligning insurance regulations with banking standards set by the Reserve Bank of India (RBI) regarding recurring e-mandates.

Q99. Answer: (d) VLSRSAM

The correct answer is VLSRSAM.

Key Points

• On 26 March 2025, the Defence Research and Development Organisation (DRDO) and the Indian Navy successfully conducted a flight-test of the Vertical Launch Short Range Surface to Air Missile (VLSRSAM).

• The test was carried out from the Integrated Test Range (ITR), located at Chandipur off the coast of Odisha.

• The missile was launched from a land-based vertical launcher against a high-speed, low-altitude aerial target, simulating a

sea-skimming threat, which it successfully intercepted.

• This flight-test aimed to validate the integrated functioning of the entire weapon system, including the Vertical Launcher Unit (VLU), multi-point communication, and the Canisterised Flight Vehicle.

• The VLSRSAM is specifically designed to provide a point defense system for Indian Navy ships against various aerial threats like aircraft, helicopters, and supersonic anti-ship missiles.

Additional Information

• VLSRSAM Technology and Features:

• It is an indigenously developed system designed by DRDO laboratories, primarily the Defence Research and Development Laboratory (DRDL) and Research Centre Imarat (RCI).

• The missile has an operational range of approximately 40 to 50 kilometers and can reach altitudes of up to 15 kilometers.

• It incorporates thrust vectoring and cruciform wings, which provide high maneuverability during the terminal phase of the flight.

• The system uses a canister-based launch, which allows for long-term storage and rapid deployment during combat.

• Defence Research and Development Organisation (DRDO):

• Formed in 1958, DRDO operates under the Ministry of Defence, Government of India.

• It is headquartered in New Delhi and focuses on developing world-class weapon systems and equipment for the Indian Armed Forces.

• Current leadership is headed by the Chairman, Dr. Samir V Kamat (as of 2024-2025).

• Integrated Test Range (ITR), Chandipur:

• Located in the Balasore district of Odisha, it serves as the premier multi-mission range for the test and evaluation of rockets and missiles.

• It provides state-of-the-art telemetry, radar, and electro-optical tracking systems to monitor missile performance.

Important Points

• Other Missiles in Options:

• Akash-NG (New Generation): A surface-to-air missile system with a range of about 70-80 km, intended for use by the Indian Air Force to intercept agile aerial threats.

• Astra Mk-2: An advanced Beyond Visual Range Air-to-Air Missile (BVRAAM) with a range exceeding 160 km, designed to be integrated into fighter jets like the Su-30 MKI.

• SAMAR-1 (Surface to Air Missile for Assured Retaliation): A short-range air defense system developed by the Indian Air Force using repurposed Vympel R-73E missiles.

• Strategic Significance: The successful test of VLSRSAM reinforces India's Atmanirbhar Bharat (Self-Reliant India) initiative in the defense sector, reducing dependency on foreign systems like the Israeli Barak-1.

Q100. Answer: (b) Real-time monitoring and scrutiny

The correct answer is Real-time monitoring and scrutiny.

Key Points

• The Immigration and Foreigners Act, 2025, represents a significant legislative overhaul aimed at modernizing border management and internal security protocols for foreign nationals.

• A central pillar of this reform is the implementation of Real-time monitoring and scrutiny, which replaces the older, manual, or periodic reporting systems with a continuous digital tracking framework. Hence, statement 2 is correct.

• This system leverages Advanced Passenger Information Systems (APIS) and Biometric data to monitor the entry, movement, and exit of visitors instantaneously.

• The reform is designed to identify visa overstays and security threats immediately, allowing law enforcement agencies to act without the delays associated with traditional paper-based documentation.

• The Act does not provide exemptions from exit checks; in fact, it tightens them to ensure that all foreign visitors have complied with their visa conditions before departure. Hence, statement 1 is incorrect.

• While visa processes are streamlined, the Act does not grant Automatic 10-year visas to all visitors, as visa duration remains subject to specific categories and bilateral agreements. Hence, statement 3 is incorrect.

• The Waiver of travel documents is not a primary reform of this Act, as National Security requirements necessitate valid identification and travel authorization for almost all foreign arrivals. Hence, statement 4 is incorrect.

Additional Information

• Bureau of Immigration (BoI):

• The Bureau of Immigration, functioning under the Ministry of Home Affairs (MHA), is the primary agency responsible for implementing the provisions of the 2025 Act.

• It manages Immigration Check Posts (ICPs) across airports, seaports, and land borders, ensuring that the Real-time monitoring software is integrated into all points of entry.

• e-FRRO (Foreigners Regional Registration Office):

• The e-FRRO platform has been enhanced under the new Act to provide a faceless and paperless service for foreigners, allowing them to register and extend visas online.

• The 2025 Act mandates that all data updated on e-FRRO is synced with the centralized monitoring system to maintain an accurate digital footprint of every visitor.

• IVFRT Project:

• The Immigration, Visa and Foreigners Registration & Tracking (IVFRT) project is the technological backbone of the 2025 reforms.

• It aims to develop a secure and integrated delivery framework that facilitates legitimate travelers while strengthening National Security.

Important Points

• National Security and Biometrics:

• The 2025 Act emphasizes the use of Facial Recognition Technology and Fingerprint scanning at all Integrated Check Posts to prevent identity fraud.

• This data is cross-referenced with international security databases in real-time to flag individuals with criminal records or extremist links.

• Legal Obligations for Hosts:

• Under the new scrutiny reforms, hotels, guest houses, and individual hosts are required to submit Form C digitally within 24 hours of a foreigner's arrival, aiding the real-time tracking process.

• Failure to comply with these digital reporting standards can lead to penalties and legal action under the updated sections of the Act.

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