RRB Group D Official Paper (Held On: 22 Dec, 2025 Shift 1) (Previous Year Paper)

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

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GENERAL SCIENCE

Q1. Which of the following describe(s) the versatile nature of carbon?

a. The ability to form bonds with other carbon atoms giving rise to large molecules.

b. The ability to form double bonds with other carbon atoms.

c. The ability to form bonds with other atoms like oxygen, nitrogen, sulphur, hydrogen etc.

(a) Only a and c
(b) Only b and c
(c) All a, b and c
(d) Only a

Q2. Based on the accepted values for the masses of the Earth and the Moon and the distance between them, what is the calculated gravitational force exerted by the Earth on the Moon?

(a) 6.67 × 10-11 N
(b) 9.8 N
(c) 2.02 × 1020 N
(d) 7.4 × 1022 N

Q3. One volt (1 V), the SI unit of potential difference, is defined when _____.

(a) 1 joule of energy is dissipated in 1 second
(b) 1 coulomb of charge flows in 1 second
(c) 1 joule of work is done to move a charge of 1 coulomb
(d) 1 milliampere of current flows through 1 Ohm of resistance

Q4. Meenu starts from rest and pedals her bicycle to reach a speed of 5 m/s in 25 seconds. What is her acceleration?

(a) 0.4 m/s2
(b) 0.3 m/s2
(c) 0.2 m/s2
(d) 0.1 m/s2

Q5. Which of the following is NOT an example of Newton’s Third Law?

(a) A stone dropping freely toward the ground
(b) A gun moving backward after firing a bullet
(c) A rocket rising upward as gases are expelled downward
(d) A horse pulling a loaded cart

Q6. Which of the following statements correctly explains why carbon forms covalent bonds in organic compounds?

(a) Carbon atoms have a full outer shell and do not react
(b) Carbon has a high tendency to form positive ions
(c) Carbon has four electrons in its outer shell and shares electrons to complete its octet
(d) Carbon easily donates all its valence electrons to non-metals

Q7. When fertilisation takes place inside the female body, it is called _____.

(a) test-tube babies
(b) internal fertilisation
(c) in vitro fertilisation
(d) external fertilisation

Q8. Which hormone triggers sexual maturation in boys?

(a) Oxytocin
(b) Progesterone
(c) Estrogen
(d) Testosterone

Q9. A wire of a given material has length L and cross-sectional area A, with resistance R. If the wire is stretched to twice its length while keeping the volume constant, what will be its new resistance?

(a) ZERO
(b) R/2
(c) 2R
(d) 4R

Q10. What happens to metabolic activities in the absence of thyroxin?

(a) They stop completely
(b) They speed up uncontrollably
(c) They slow down or become imbalanced
(d) They only affect digestion

Q11. What happens during the oxidation of ethanol?

(a) It forms an ester.
(b) It is converted into ethanoic acid.
(c) It is converted into methane.
(d) It is converted into ethene.

Q12. Which of the following statements correctly defines the atomic number of an element?

(a) The number of protons in the nucleus of an atom
(b) The number of electrons in the outermost shell of an atom
(c) The number of neutrons in the nucleus of an atom
(d) The total number of protons and neutrons in the nucleus

Q13. Which of the following statements about sound propagation is correct?

(a) Sound travels faster in gases than in solids.
(b) Sound can travel in vacuum.
(c) Sound travels in the form of transverse waves in air.
(d) Sound requires a medium for propagation.

Q14. The defect of hypermetropia can be corrected by using which of the following?

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

Q15. If the temperature of a gas is increased at constant volume, what happens to the pressure?

(a) It increases.
(b) It remains the same.
(c) It cannot be determined.
(d) It decreases.

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Q16. Which of the following shows movement but not locomotion?

(a) Dog
(b) Bird
(c) Plant
(d) Human

Q17. Which of the following nutrients is a macronutrient?

(a) Copper
(b) Zinc
(c) Potassium
(d) Iron

Q18. Which statement is INCORRECT about contraceptive pills?

(a) They can cause side effects like irregular bleeding or nausea in some users.
(b) They contain synthetic hormones (estrogen and progesterone) that prevent ovulation,
(c) They are a highly effective form of birth control when taken correctly.
(d) They protect against sexually transmitted infections.

Q19. If a constant force (F) of 20 N moves an object through a displacement (d) of 5 m in the same direction, then what will be the work (W) done?

(a) 25 J
(b) 50 J
(c) 200 J
(d) 100 J

Q20. Which statement is NOT true about smooth muscles?

(a) They are uninucleate
(b) They control involuntary movements
(c) They are spindle-shaped cells
(d) They have striations

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

Assertion (A): If a substance loses oxygen during a reaction, it is said to be reduced.

Reason (R): Reduction is defined as the gain of hydrogen or loss of oxygen.

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

Q22. Which of the following is NOT correct?

(a) Shorter wavelengths scatter more than longer wavelengths.
(b) The sky appears blue because air absorbs blue light.
(c) The Tyndall effect can be used to detect colloids.
(d) Scattering depends on the wavelength of light.

Q23. Which of the following statements best defines the term 'formula unit mass'?

(a) The mass of an individual atom of an element
(b) The sum of atomic masses of all atoms in a molecule
(c) The sum of the atomic masses of the ions in an ionic compound as represented by its formula
(d) The mass of one mole of a compound

Q24. Which of the following metals reacts with dilute hydrochloric acid to produce hydrogen gas?

(a) Zinc
(b) Copper
(c) Silver

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(d) Gold

Q25. Which of the following plant tissues is made up of cells that are dead at maturity?

(a) Aerenchyma
(b) Parenchyma
(c) Collenchyma
(d) Sclerenchyma

MATHEMATICS

Q26. A cash payment that will settle a bill for 625 pairs of boots at Rs. 94 per pair of boots with successive discounts of 20% and 7% with a further discount of 20% on cash payment is:

(a) Rs. 34,992
(b) Rs. 34,968
(c) Rs. 34,972
(d) Rs. 34,963

Q27. The average age of 31 students of a class is 30 years. If the age of the teacher is also included, the average age of the whole group becomes 31 years. The age (in years) of the teacher is:

(a) 64
(b) 65
(c) 62
(d) 63

Q28. The price of fuel decreases by 45%, 35% and 30% in three successive months, but increases by 45% in the fourth month. What is the percentage increase/decrease in the price of fuel in the fourth month as compared to its original price? (Round off the answer to two decimal places.)

(a) Increases by 59.57%
(b) Decreases by 63.71%
(c) Decreases by 64.78%
(d) Increases by 61.52%

Q29. The sides of two squares are $(4 + \sqrt{3})$ cm and $(4 - \sqrt{3})$ cm, respectively. What is the sum of the areas of these two squares?

(a) 38 cm^2
(b) 34 cm^2
(c) 25 cm^2
(d) 28 cm^2

Q30. In quadrilateral PQRS, the bisectors of angle R and angle S meet at the point T (inside the quadrilateral) and angle STR = 22.5°. If the ratio of angle P to angle Q is 4 : 5, then what is the difference between the measures of angle Q and angle P?

(a) 1°
(b) 2°
(c) 5°
(d) 6°

Q31. The amount on a sum of Rs. 4,200 at 20% per annum compound interest, compounded annually, in 2 years will be:

(a) Rs. 6,497
(b) Rs. 6,048
(c) Rs. 6,219
(d) Rs. 5,348

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Q32. If an X-m long train running at a speed of 63 m/s crosses a railway platform in 28 sec, find the value of X, if the length of the railway platform is 213 m.3704

(a) 1545
(b) 1558
(c) 1549
(d) 1551

Q33. The cost price of a toy car is 80% of its selling price. If the selling price is Rs. 100, what is the profit percentage?

(a) 20%
(b) 25%
(c) 100%
(d) 80%

Q34. A basket contains 42 fruits, which are either apples or oranges. If there are 6 more apples than oranges, how many oranges are there?

(a) 22
(b) 24
(c) 18
(d) 20

Q35. A, B and C can do a piece of work in 3, 12 and 12 days, respectively. How long (in days) will they take to do twice the same work, working together?

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

Q36. If A can complete a task in 10 days and B is 25% more efficient than A, how long (in days) will it take them to complete 60% of the task when they work together?

(a) 11/3
(b) 22/3
(c) 12/3
(d) 21/3

Q37. The median of the following observations 46, 64, 87, 41, 58, 77, 35, 90, 55, 92, 33 is 58. If 92 is replaced by 99 and 41 by 43 in the given data, then the new median is:

(a) 55
(b) 57.5
(c) 58
(d) 56.5

Q38. A car covers three different segments of a journey: it travels 40 km at a speed of 60 km/hr, then 50 km at a speed of 50 km/hr and finally 60 km at a speed of 40 km/hr. What is the car's average speed (rounded off to one decimal place) for the entire trip?

(a) 52.9 km/hr
(b) 47.4 km/hr
(c) 48.3 km/hr
(d) 50.3 km/hr

Q39. What is the number of ordered pairs (x, y) where x, y are positive integers such that the eight digit number 74x8935y is divisible by 11?

(a) 6
(b) 9
(c) 7
(d) 10

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Q40. A scheme like ‘Buy 6, Get 2 Free’ on the same kind of articles with the same MRP attracts a _____ % discount.890

(a) 33.33
(b) 34.33
(c) 26
(d) 25

Q41. What is the number of natural numbers less than or equal to 1000 and divisible by 5 or 7?

(a) 314
(b) 342
(c) 370
(d) 328

Q42. If each edge of a cube is increased by 10%, then the percentage increase in its surface area is:

(a) 21%
(b) 22%
(c) 20%
(d) 25%

Q43. The sum of the ages of a daughter and her mother is 56 years. After 8 years, the age of the mother will be three times that of the daughter. Find the daughter's present age (in years).

(a) 18
(b) 16
(c) 12
(d) 10

Q44. From a point 30 m away from the base of a tree, the angle of elevation of the top of the tree is 60°. Find the height of the tree (take √3 = 1.73).

(a) 51.9 m
(b) 54 m
(c) 52.5 m
(d) 51 m

Q45. 1/30 is what percentage of 1/90?

(a) 600%
(b) 3.15%
(c) 3.10%
(d) 300%

Q46. Simplify: (0.7 × 72 ÷ 14 + 6.25 − 8.34 × 0.15 + 5.95)

(a) 21.549
(b) 12.526
(c) 14.823
(d) 14.549

Q47. The monthly incomes of two friends David and Ashish, are in the ratio 5 : 8, respectively, and each of them saves Rs. 81,000 every month. If the ratio of their monthly expenditure is 2 : 4, find the monthly income of David (in Rs.).

(a) 2,03,500
(b) 2,02,500
(c) 2,83,500
(d) 2,01,500

Q48. A sphere of radius 14 cm is cut along three diametrical planes to form 6 equal parts. What would be the total surface area (in cm^2) of all the new pieces so obtained?

(Take π = 22/7)

(a) 6160

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(b) 4312
(c) 5544
(d) 7392

Q49. Rs. 4,445 is divided among A, B and C in such a way that if Rs. 65, Rs. 39 and Rs. 77 are deducted from their respective shares, they have money in the ratio 18:3:20. Find the difference between B's and C's original shares.
(a) Rs. 1,718
(b) Rs. 1,918
(c) Rs. 1,868
(d) Rs. 1,806

Q50. The ratio of the number of girls and boys participating in the sports of a school is 2 : 5. If the number of girls is 200, determine the number of boys participating in the sports.
(a) 520
(b) 500
(c) 530
(d) 475

GENERAL INTELLIGENCE & REASONING

Q51. In a certain code language, 'meal visit cat' is coded as ' vs mo wm' and 'rain meal mango' is coded as 'wm or lo'. How is 'meal' coded in the given language?
(a) vs
(b) mo
(c) or
(d) wm

Q52. Based on the English alphabetical order, three of the following four letter-cluster pairs are alike in a certain way and thus form a group. Which is the letter-cluster pair that DOES NOT belong to that group?
(Note: The odd one out is not based on the number of consonants/vowels or their position in the letter-cluster.)
(a) EK - JP
(b) KQ - PV
(c) NT - SY
(d) OU - TA

Q53. In a row of people all facing north, Ruman is 20^(th) from the right end. Daniel is 26^(th) from the right end and Daniel is exactly between Ruman and Om. If Om is 14^(th) from the left end of the row, how many people are there in the row?
(a) 45
(b) 43
(c) 42
(d) 44

Q54. Rekha ranked 18^(th) from the top and 9^(th) from the bottom in her class. How many students are there in the class?
(a) 28
(b) 25
(c) 27
(d) 26

Q55. What will come in the place of the question mark (?) in the following equation, if '+' and '−' are interchanged and '×' and '÷' are interchanged?
11 ÷ 3 + 24 × 4 − 1 = ? + 5
(a) 31
(b) 32

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(c) 33
(d) 34

Q56. Which numbers should come in place of the question mark (?) in the same sequence to make the series logically complete?

3, 6, 12, 24, 48, ?

(a) 96
(b) 98
(c) 88
(d) 92

Q57. Refer to the following number series and answer the question that follows. All numbers are single-digit numbers only. Counting to be done from left to right only.

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

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

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

Q58. In the following triads, each group of letters is related to the subsequent one following a certain logic. Select from the given options, the one which follows the same logic.

INFO - NOFI - OFNI

WAKE - AEKW - EKAW

(a) TIDE - TDIE - EDIT
(b) HACK - AHCK - KACH
(c) FEAR - ERAF - RAEF
(d) GIRL - IGRL - LIRG

Q59. 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.)

(8, 19, 10)

(13, 29, 20)

(a) (17, 37, 46)
(b) (9, 21, 30)
(c) (15, 33, 24)
(d) (7, 13, 4)

Q60. If '+' means '−', '−' means '×', '×' means '÷' and '÷' means '+', then what will come in place of the question mark (?) in the following equation?

6 − 3 + 32 × 4 ÷ 5 = ?

(a) 15
(b) 11
(c) 6
(d) 21

Q61. This question is based on the five, three-digit numbers given below.

(Left) 741 753 789 761 745 (Right)

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

(NOTE: All operations to be done from left to right.)

What will be the resultant if the second digit of the second highest number is added to the third digit of the lowest

number?

(a) 11
(b) 7
(c) 6
(d) 8

Q62. Mr. Akai starts from Point A and drives 28 km towards west. He then takes a left turn, drives 21 km, turns right and drives 5 km. He then takes a right turn and drives 30 km. He takes a final right turn, drives 33 km and stops at Point P. How far (shortest distance) and towards which direction should he drive in order to reach Point A again? (All turns are 90-degree turns only, unless specified.)

(a) 9 km to the south
(b) 9 km to the north
(c) 7 km to the east
(d) 7 km to the north

Q63. What should come in place of the question mark (?) in the given series based on the English alphabetical order?

FNK HPM JRO LTQ ?

(a) NVR
(b) NUS
(c) NUR
(d) NVS

Q64. Jyoti starts from point L and drives 8 km towards the north. She then takes a right turn, drives 14 km, turns right and drives 15 km. She then takes a right turn and drives 14 km. She takes a final right turn, drives 3 km and stops at point P. How far (shortest distance) and towards which direction should she drive in order to reach point L again? (All turns are 90-degree turns only unless specified.)

(a) 2 km towards the east
(b) 4 km towards the north
(c) 1 km towards the south
(d) 5 km towards the west

Q65. Six people, A, B, C, D, E and F, are sitting in a row, facing north. A sits third to the left of E. E sits second to the left of F. D sits to the immediate right of E. B sits to the immediate left of C. How many people sit between C and F?

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

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

WTQ 69 URO 76 SPM 83 QNK 90 ?

(a) OLI 97
(b) OKH 96
(c) OPR 96
(d) OMH 97

Q67. Seven people, A, B, C, D, E, F and G, are sitting in a straight line, facing the north.

A sits second from one of the extreme ends of the line. Only two people sit between A and C. B sits to the immediate right of C. Only one person sits between B and D. F sits third to the left of D. E sits at one of the positions to the right of G.

How many people sit between A and G?

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

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Q68. In a certain code language,

P + Q means ‘P is the father of Q’,

P # Q means ‘P is the wife of Q’,

P & Q means ‘P is the brother of Q’,

and P % Q means ‘P is the sister of Q’.

How is O related to L if ‘O # G + N # T + L’?

(a) Mother’s father
(b) Father’s mother
(c) Sister's husband
(d) Mother’s mother

Q69. In a certain code language, ‘LEMA’ is coded as ‘6389’ and ‘PALM’ is coded as ‘3596’. What is the code for ‘P’ in that language?

(a) 5
(b) 3
(c) 6
(d) 9

Q70. Read the given statements and conclusions carefully. Assuming that the information given in the statements is true, even if it appears to be at variance with commonly known facts, decide which of the given conclusions logically follow(s) from the statements.

Statements:

All pencils are erasers.

Some erasers are crayons.

Conclusions:

(I) Some pencils are crayons.

(II) Some erasers are pencils.

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

Q71. In the following triads, each group of letters is related to the subsequent one following a certain logic. Select from the given options, the one that follows the same logic.

DIGS - SDGI - DSIG

WAVE - EWVA - WEAV

(a) RIDE - IRDE - EIDR
(b) HOST - THOS - OSTH
(c) MIST - TMSI - MITS
(d) SPIN - NSIP - SNPI

Q72. Based on the English alphabetical order, three of the following four letter-clusters are alike in a certain way and thus form a group. Which letter-cluster DOES NOT belong to that group?

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

(a) QUN
(b) UYR
(c) INE
(d) OSL

Q73. Which of the following numbers will replace the question mark (?) in the given series?

1408, 704, 176, 88, ?, 11

(a) 44
(b) 36

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(c) 64
(d) 22

Q74. Refer to the following number series and answer the question that follows. Counting to be done from left to right only. (All numbers are single-digit numbers only.)

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

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

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

Q75. A, B, C, R, S, T and U are sitting around a circular table facing the centre of the table. Only three people sit between R and T when counted from the left of R. Only three people sit between B and A when counted from the right of A.S sits to the immediate right of B. U is an immediate neighbour of A as well as T. Who sits to the second to the left of C?

(a) A
(b) B
(c) U
(d) R

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

Statements:

Some moons are stars.

Some stars are planets.

Conclusions:

(I): All stars are moons.

(II): Some moons are planets.

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

Q77. QK 13 is related to TO 17 in a certain way. In the same way, IC 24 is related to LG 28. To which of the given options is SM 35 related, following the same logic?

(a) UR 38
(b) VO 39
(c) VQ 39
(d) VO 38

Q78. What should come in place of the question mark (?) in the given series?

188 170 152 134 116 ?

(a) 96
(b) 100
(c) 98
(d) 104

Q79. If ‘A’ stands for ‘÷’, ‘B’ stands for ‘×’, ‘C’ stands for ‘+’ and ‘D’ stands for ‘−’, what will come in place of the question mark (?) in the following equation?

88 B 3 D 615 A 15 C 152 = ?

(a) 340

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(b) 360
(c) 325
(d) 375

Q80. Refer to the given number, symbol series and answer the question that follows. Counting to be done from left to right only.

(Left) € # 6 2 @ # 1 6 @ 1 € $ 3 9 $ 2 4 4 * £ 6 6 (Right)

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

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

GENERAL AWARENESS AND CURRENT AFFAIRS

Q81. The Union Government introduced a major overhaul of labour laws, consolidating twenty-nine existing regulations into four new codes effective from which of the following dates?

(a) 15 February 2026
(b) 21 November 2025
(c) 1 January 2026
(d) 1 December 2025

Q82. In November 2025, which legislation was highlighted for merging nine Social Security Acts, covering gig and platform workers, and strengthening women-centric provisions?

(a) Code on Social Security, 2020
(b) Health and Working Conditions Code, 2020
(c) Code on Wages, 2019
(d) Industrial Relations Code, 2020

Q83. In how many languages was the new text-to-speech AI model which launched by Sarvam AI in May 2025?

(a) 11
(b) 7
(c) 9
(d) 12

Q84. From 13 May 2025, the Reserve Bank of India (RBI) mandated that digital lending apps must be _____.

(a) reported to a centralised portal
(b) developed in India only
(c) operated only by banks
(d) free of cost to users

Q85. In 2025, which state in India is concerned about the invasive species Ruellia Elegans?

(a) Kerala
(b) Bihar
(c) Chhattisgarh
(d) Assam

Q86. In March 2025, the Reserve Bank of India (RBI) granted Regional Rural Banks (RRBs) an additional how many years from financial year 2025 to amortise the additional expenditure arising from the revision in pensions?

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

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Q87. In June 2025, which ministry/institution released the Sustainable Development Goals – National Indicator Framework Progress Report, 2025?

(a) Ministry of Statistics and Programme Implementation
(b) NITI Aayog
(c) Ministry of Finance
(d) Ministry of Environment, Forest and Climate Change

Q88. In August 2025, which of the following countries temporarily closed the Dardanelles Strait to maritime traffic following major forest fires in the Çanakkale province?

(a) Italy
(b) Greece
(c) Bulgaria
(d) Turkey

Q89. As announced on 21 June 2025, Central Health Ministry is looking at integrating India's Rare Donor Registry with the national online platform for blood bank management and blood availability information, called ____.

(a) e-Rakt Kosh
(b) e-Rakt Kawach
(c) e-Rakt Sagar
(d) e-Rakt Sanchay

Q90. As per the April 2025 monthly Periodic Labour Force Survey (PLFS) data, what was India's unemployment rate in April 2025?

(a) 5.6%
(b) 6.4%
(c) 4.9%
(d) 5.1%

Q91. Which event was scheduled for 27 June 2025, regarding the DR Congo–Rwanda agreement?

(a) Formal signing by ministers
(b) UN Security Council resolution
(c) Initial talks
(d) Deployment of peacekeepers

Q92. During the 11^(th) National Conference on Women, held in May 2025, which of the following state's police showcased 'Mission Shakti' as a model initiative for women's safety?

(a) Uttar Pradesh
(b) Haryana
(c) West Bengal
(d) Karnataka

Q93. Which eminent economist was honoured with the Punyabhushan Puraskar in June 2025 for contributions to economics?

(a) C Rangarajan
(b) Arvind Subramanian
(c) P Chidambaram
(d) Vijay Kelkar

Q94. In 2025, which athlete set a new meet record of 48.81 seconds in the women's 400 m at the Paris Diamond League?

(a) Allyson Felix
(b) Sydney McLaughlin
(c) Salwa Eid Naser
(d) Marileidy Paulino

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Q95. As of June 2025, who is the Chief Minister of Jammu and Kashmir?

(a) Mehbooba Mufti
(b) Mufti Mohammad Sayeed
(c) PU Lalduhoma
(d) Omar Abdullah

Q96. Who flagged off India's first exported locomotive to Guinea in June 2025?

(a) Piyush Goyal
(b) Narendra Modi
(c) Ashwini Vaishnaw
(d) Jagdeep Dhankhar

Q97. As per the Sustainable Development Goals – National Indicator Framework Progress Report, 2025, published in June 2025, the number of start-ups rose from 453 in 2016 to 34,293 in 2024. This growth in entrepreneurship primarily supports which Sustainable Development Goal (SDG)?

(a) SDG 1
(b) SDG 8
(c) SDG 4
(d) SDG 10

Q98. Who won the 2025 Laureus World Sportsman of the Year award?

(a) Armand "Mondo" Duplantis
(b) Max Verstappen
(c) Cristiano Ronaldo
(d) Usain Bolt

Q99. In May 2025, which Union Minister launched the Annual Calendar initiative under the Khelo India programme to boost the country's sports ecosystem?

(a) Anurag Thakur
(b) Kiren Rijiju
(c) Udhayanidhi Stalin
(d) Dr. Mansukh Mandaviya

Q100. In the weightlifting event at the 38^(th) National Games, what was Mehak Sharma's total lift that earned her the gold medal and set a new national record?

(a) 289 kg
(b) 247 kg
(c) 299 kg
(d) 311 kg

ANSWER KEY

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

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SOLUTIONS

Q1. Answer: (c) All a, b and c

The correct answer is All a, b and c.

Key Points

• Carbon has the unique ability to form bonds with other atoms of carbon, giving rise to large molecules. This property is called catenation, which allows for the formation of long chains, branched chains, and ring structures. Hence, statement a is correct.

• Carbon atoms may be linked by single, double, or triple bonds. Compounds of carbon, which are linked by only single bonds between the carbon atoms are called saturated compounds, while compounds of carbon having double or triple bonds between their carbon atoms are called unsaturated compounds. Hence, statement b is correct.

• Since carbon has a valency of four, it is capable of bonding with four other atoms of carbon or atoms of some other mono-valent elements. Carbon forms bonds with atoms of oxygen, hydrogen, nitrogen, sulphur, chlorine, and many other elements, giving rise to compounds with specific properties. Hence, statement c is correct.

• The versatile nature of carbon is essentially a combination of its tetravalency and its power of catenation. These two factors together lead to the existence of a very large number of organic compounds.

• The bonds that carbon forms with most other elements are very strong, making these compounds exceptionally stable. One reason for the formation of strong bonds by carbon is its small size, which enables the nucleus to hold on to the shared pairs of electrons strongly.

Additional Information

• Tetravalency of Carbon:

• Carbon has an atomic number of 6 and its electronic configuration is 2, 4. It has four valence electrons in its outermost shell (L-shell).

• To achieve a noble gas configuration, it shares these four electrons with other atoms, forming covalent bonds. This ability to form four bonds is known as tetravalency.

• Catenation and Bond Strength:

• While other elements like Silicon (Group 14) also exhibit catenation, they form chains that are much more reactive and less stable.

• Carbon-carbon bonds are very strong and stable, which allows for the creation of macromolecules like DNA, proteins, and polymers.

• Functional Groups:

• When carbon bonds with heteroatoms like oxygen or nitrogen, it forms functional groups (such as alcohols, aldehydes, and carboxylic acids).

• These functional groups dictate the chemical properties of the carbon compound, regardless of the length of the carbon chain.

• Isomerism:

• Carbon compounds also show isomerism, where compounds with the same molecular formula possess different structural arrangements.

• This structural diversity contributes significantly to the millions of carbon-based substances found in nature, ranging from hydrocarbons to complex biomolecules.

Q2. Answer: (c) 2.02 × 1020 N

The correct answer is 2.02 x 10^20 N.

Key Points

• The gravitational force between the Earth and the Moon is calculated using Newton's Law of Universal Gravitation. This law states that every particle attracts every other particle in the universe with a force that is directly proportional to the product of their masses and inversely proportional to the square of the distance between their centers.

• The formula used for this calculation is F = G (m1m2 / r^2), where F is the gravitational force, G is the gravitational constant, m1 and m2 are the masses of the two bodies, and r is the distance between them.

• Based on accepted scientific data, the mass of the Earth (m1) is approximately 5.97 x 10^24 kg, and the mass of the Moon (m2) is approximately 7.35 x 10^22 kg.

• The average distance (r) between the centers of the Earth and the Moon is 3.84 x 10^8 meters (or 384,400 km).

• The Universal Gravitational Constant (G) is a fixed value of 6.67 x 10^-11 N m^2/kg^2.

• By substituting these values into the formula: F = (6.67 x 10^-11) * [(5.97 x 10^24 * 7.35 x 10^22) / (3.84 x 10^8)^2], the resulting force is approximately 2.02 x 10^20 Newtons (N).

Additional Information

• Nature of Gravitational Force: Gravity is a non-contact force and is always attractive in nature. It acts along the line joining the

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centers of the two masses, making it a central force.

• Orbital Stability: This massive gravitational pull of 2.02 x 10^20 N provides the centripetal force required to keep the Moon in its elliptical orbit around the Earth. Without this force, the Moon would move in a straight line into outer space due to its inertia.

• Tidal Effects: While the Earth exerts this force on the Moon, the Moon exerts an equal and opposite force on the Earth (consistent with Newton's Third Law). This lunar pull is the primary cause of ocean tides on Earth, creating tidal bulges in the hydrosphere.

• Inverse Square Law: The force of gravity follows the inverse square law. If the distance between the Earth and the Moon were to double, the gravitational force would drop to one-fourth of its current value (approximately 0.505 x 10^20 N).

• Comparison with Surface Gravity: It is important not to confuse the gravitational force between two celestial bodies with the acceleration due to gravity (g). On Earth's surface, g is 9.8 m/s^2, which represents the acceleration of an object, whereas the 2.02 x 10^20 N is the total magnitude of force acting between the two planetary bodies.

Important Points

• Henry Cavendish: The value of the Gravitational Constant (G) was first experimentally determined by Henry Cavendish in 1798 using a torsion balance.

• Barycenter: The Earth and Moon actually orbit around their common center of mass, known as the barycenter. Because the Earth is so much more massive, the barycenter is located about 4,670 km from the Earth's center, which is still inside the Earth's interior (about 1,700 km below the surface).

• Unit of Force: The Newton (N) is the SI unit of force, named after Sir Isaac Newton. One Newton is the force needed to accelerate one kilogram of mass at the rate of one meter per second squared.

• Mass of the Moon: The Moon's mass is about 1.2% of the Earth's mass. This significant mass ratio (compared to other planet-satellite systems in our solar system) is why the gravitational interaction between the two is so powerful.

Q3. Answer: (c) 1 joule of work is done to move a charge of 1 coulomb

The correct answer is 1 joule of work is done to move a charge of 1 coulomb.

Key Points

• Potential Difference between two points in an electric circuit is defined as the amount of work done in moving a unit charge from one point to the other.

• The SI unit of electric potential difference is the Volt (V), named after the Italian physicist Alessandro Volta.

• One Volt is formally defined as the potential difference between two points in a current-carrying conductor when 1 Joule of work is done to move a charge of 1 Coulomb from one point to the other. Hence, the statement in option 3 is correct.

• Mathematically, it is expressed as V = W / Q, where V is the potential difference, W is the work done in Joules, and Q is the quantity of charge in Coulombs.

• Option 1 mentions 1 joule of energy dissipated in 1 second, which actually defines 1 Watt (W), the unit of Power. Hence, statement 1 is incorrect.

• Option 2 mentions 1 coulomb of charge flowing in 1 second, which defines 1 Ampere (A), the SI unit of Electric Current. Hence, statement 2 is incorrect.

• Option 4 mentions 1 milliampere of current through 1 Ohm of resistance; according to Ohm's Law (V = I x R), this results in 0.001 Volts or 1 millivolt (mV). Hence, statement 4 is incorrect.

Additional Information

• Instrument for Measurement: The potential difference is measured by an instrument called the Voltmeter. A voltmeter is always connected in parallel across the points between which the potential difference is to be measured.

• Voltmeter Resistance: To ensure that it does not significantly alter the current in the circuit, a voltmeter is designed to have very high resistance.

• Ohm's Law Relationship: The potential difference (V) across the ends of a given metallic wire in an electric circuit is directly proportional to the current (I) flowing through it, provided its temperature remains the same. This is expressed as V = I x R, where R is the Resistance.

• Electric Potential vs. Potential Difference: While Electric Potential at a point is the work done to bring a unit positive charge from infinity to that point, Potential Difference specifically refers to the work done between two defined points in a circuit.

Important Points

• Scalar Quantity: Electric potential and potential difference are scalar quantities, meaning they have magnitude but no specific direction in space.

• Standard Values: In India, the standard domestic supply voltage is 220 V with a frequency of 50 Hz. Commercial batteries, such as AA or AAA alkaline cells, typically provide a potential difference of 1.5 V.

• Work and Energy: Since V = W / Q, the work done (or energy transferred) can be calculated as W = V x Q. This relationship is fundamental in understanding electrical energy consumption.

• High Voltage Transmission: Long-distance power transmission is usually done at high voltages (e.g., 11 kV, 33 kV, or 400 kV) to minimize energy loss due to heating in the transmission lines, as higher voltage allows for lower current for the same power level.

Q4. Answer: (c) 0.2 m/s2

The correct answer is 0.2 m/s2.

Key Points

• Acceleration is defined as the rate of change of velocity with respect to time. Mathematically, it is expressed as a = (v - u) / t, where v is the final velocity, u is the initial velocity, and t is the time taken.

• In the given problem, Meenu starts from rest, which means her initial velocity (u) is 0 m/s.

• The final velocity (v) reached by Meenu is 5 m/s after a duration of 25 seconds.

• By substituting these values into the formula: a = (5 m/s - 0 m/s) / 25 s.

• The calculation results in 5 / 25, which simplifies to 1/5 or 0.2 m/s2. Thus, the acceleration of the bicycle is 0.2 m/s2.

Additional Information

• SI Unit of Acceleration: The standard unit for measuring acceleration in the International System of Units (SI) is meter per second squared (m/s2). It represents how many meters per second the velocity changes every second.

• Vector Quantity: Acceleration is a vector quantity, meaning it has both magnitude and direction. If an object slows down, the acceleration is in the opposite direction of the motion, often referred to as deceleration or retardation.

• Equations of Motion: This calculation is based on the first equation of motion, which is v = u + at. These equations, derived by Sir Isaac Newton, describe the relationship between velocity, acceleration, time, and displacement for objects moving with uniform acceleration.

• Uniform vs. Non-uniform Acceleration: If the velocity of an object changes by equal amounts in equal intervals of time, it is called uniform acceleration. If the rate of change of velocity is not constant, it is non-uniform acceleration.

Important Points

• Initial State: Whenever a problem mentions that an object starts from rest, the initial velocity (u) must always be taken as zero.

• Final State: Conversely, if an object comes to a halt or stops, the final velocity (v) is considered 0 m/s.

• Graphical Representation: On a Velocity-Time graph, the slope of the line represents the acceleration of the object. A straight line indicates constant acceleration, while a curved line indicates changing acceleration.

• Average Acceleration: It is the total change in velocity divided by the total time interval. In this specific case, since the change is linear, the acceleration calculated is the average acceleration over the 25-second period.

Q5. Answer: (a) A stone dropping freely toward the ground

The correct answer is A stone dropping freely toward the ground.

Key Points

• Newton’s Third Law of Motion states that for every action, there is always an equal and opposite reaction. These forces always act on two different bodies.

• A stone dropping freely toward the ground is primarily an illustration of Newton’s Second Law of Motion and the Universal Law of Gravitation. The motion is defined by the force of gravity acting on a single mass, causing it to accelerate at 9.8 m/s^2. While a reaction force technically exists (the stone pulls the Earth), the scenario is the standard example for F = ma. Hence, statement 1 is not an example of the Third Law.

• A gun moving backward after firing a bullet is a classic example of the Third Law. When the gun exerts a forward force on the bullet (action), the bullet exerts an equal and opposite backward force on the gun (reaction), known as recoil. Hence, statement 2 is an example of the Third Law.

• A rocket rising upward functions on the principle of action and reaction. The rocket engine expels exhaust gases downward at very high velocity (action), and these gases exert an equal upward thrust on the rocket (reaction), allowing it to overcome Earth's gravity. Hence, statement 3 is an example of the Third Law.

• A horse pulling a loaded cart involves the horse pushing the ground backward with its hooves (action), and the ground pushing the horse forward with an equal force (reaction). This interaction allows the horse to move the cart forward. Hence, statement 4 is an example of the Third Law.

Additional Information

• Newton's First Law of Motion:

• Also known as the Law of Inertia, it states that an object will remain at rest or in uniform motion in a straight line unless acted upon by an external unbalanced force.

• This law defines the concept of inertia, which is the inherent property of an object to resist changes in its state of motion.

• Newton's Second Law of Motion:

• It states that the magnitude of the force is the product of mass and acceleration (F = ma).

• It provides a quantitative measure of force and relates it to the rate of change of momentum.

• Law of Conservation of Momentum:

• Closely linked to the Third Law, it states that the total momentum of an isolated system remains constant if no external forces act

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on it.

• This principle is used to calculate recoil velocity in firearms and propulsion in jet engines.

• Historical Context:

• Sir Isaac Newton formulated these three laws of motion in his monumental work, Philosophiae Naturalis Principia Mathematica, first published in 1687.

• These laws form the foundation of Classical Mechanics, which describes the motion of macroscopic objects.

Important Points

• The action and reaction forces mentioned in the Third Law never cancel each other out because they act on different objects, not the same one.

• Universal Law of Gravitation: Every particle in the universe attracts every other particle with a force directly proportional to the product of their masses and inversely proportional to the square of the distance between them.

• In the case of a falling stone, the acceleration of the Earth toward the stone is negligible due to the Earth's massive mass (approximately 5.97 × 10^24 kg), which is why we only observe the stone moving.

Q6. Answer: (c) Carbon has four electrons in its outer shell and shares electrons to complete its octet

The correct answer is Carbon has four electrons in its outer shell and shares electrons to complete its octet.

Key Points

• Carbon is a chemical element with the atomic number 6 and the symbol C. It is a non-metal and belongs to group 14 of the periodic table.

• The electronic configuration of carbon is 2, 4. This means it has four electrons in its outermost shell (valence shell).

• According to the Octet Rule, atoms tend to gain, lose, or share electrons to achieve a stable configuration of eight electrons in their valence shell, similar to noble gases.

• For carbon, gaining four electrons to form a C4- anion is difficult because a nucleus with only 6 protons cannot easily hold onto 10 electrons. Hence, statement 1 is incorrect.

• Conversely, losing four electrons to form a C4+ cation requires an extremely large amount of ionization energy to overcome the electrostatic attraction of the nucleus. Hence, statements 2 and 4 are incorrect.

• To achieve stability, carbon resolves this by sharing its four valence electrons with other atoms (such as Hydrogen, Oxygen, or other Carbon atoms), resulting in the formation of covalent bonds. Hence, statement 3 is correct.

Additional Information

• Tetravalency of Carbon:

• Since carbon has four valence electrons, it is capable of forming four covalent bonds with other atoms. This property is known as tetravalency.

• This allows carbon to form a vast variety of complex molecules, which is the basis of Organic Chemistry.

• Catenation:

• Carbon has the unique ability to form strong covalent bonds with other carbon atoms, giving rise to long chains and rings. This property is called catenation.

• The C-C bond energy is very high (approx 348 kJ/mol), making these structures exceptionally stable.

• Nature of Organic Compounds:

• Most organic compounds are poor conductors of electricity because they do not have free electrons or ions to carry charge.

• They generally have low melting and boiling points compared to ionic compounds because the intermolecular forces (Van der Waals forces) are weaker than ionic bonds.

Important Points

• Covalent Bond Types:

• Carbon can form single bonds (sharing one pair of electrons), double bonds (sharing two pairs), or triple bonds (sharing three pairs).

• Example: In Methane (CH4), carbon forms four single covalent bonds. In Ethene (C2H4), it forms a double bond, and in Ethyne (C2H2), it forms a triple bond.

• Allotropes of Carbon:

• Carbon exists in different physical forms called allotropes, such as Diamond, Graphite, and Fullerenes.

• In Diamond, each carbon atom is bonded to four others in a rigid 3D tetrahedral structure, making it the hardest natural substance.

• In Graphite, each carbon atom is bonded to three others in hexagonal layers, leaving one free electron, which makes graphite a good conductor of electricity.

Q7. Answer: (b) internal fertilisation

The correct answer is internal fertilisation.

Key Points

• Fertilisation is the process of the fusion of a male gamete (sperm) with a female gamete (ovum/egg) to form a zygote.

• When this fusion occurs inside the female body, it is known as internal fertilisation. This process ensures that the embryo is protected from the external environment during its initial stages of development.

• Internal fertilisation is a characteristic feature of many terrestrial animals, including mammals (such as humans, cows, and dogs), birds (such as hens), and reptiles.

• In this method, the male deposits sperm into the female reproductive tract, where one sperm eventually fuses with the egg.

• This type of fertilisation has a higher success rate for the survival of the offspring compared to external fertilisation because the zygote develops in a controlled, safe environment within the mother's body.

Additional Information

• External Fertilisation:

• This process occurs when the fusion of male and female gametes takes place outside the female body, typically in an aquatic medium like water.

• It is common in aquatic animals such as fish, starfish, and amphibians like frogs.

• During the breeding season (often spring or monsoon), the female lays hundreds of eggs in the water, and the male releases sperm over them to facilitate fertilisation.

• In Vitro Fertilisation (IVF):

• IVF is a medical technique where fertilisation is carried out outside the body in a laboratory (often in a glass container or petri dish).

• It is primarily used for couples who face issues like blocked oviducts, which prevent natural internal fertilisation.

• The resulting zygote is allowed to develop for about one week in a controlled environment before being implanted into the mother's uterus for further growth.

• Test-Tube Babies:

• The term "test-tube babies" refers to infants born through the IVF technique.

• It is a misnomer because the baby does not actually grow in a test tube; only the initial fertilisation happens in a laboratory, while the rest of the gestation occurs in the mother's womb.

• Zygote and Embryo:

• The zygote is the single cell formed immediately after fertilisation.

• As the zygote divides repeatedly, it forms a ball of cells called an embryo, which then travels to the uterus to get embedded in the uterine wall for further development into a foetus.

Q8. Answer: (d) Testosterone

The correct answer is Testosterone.

Key Points

• Testosterone is the primary male sex hormone and an androgen, which plays a critical role in the sexual maturation of boys during puberty.

• It is primarily produced in the testes by the Leydig cells, under the influence of the Luteinizing Hormone (LH) secreted by the anterior pituitary gland.

• This hormone triggers the development of secondary sexual characteristics, such as the growth of facial, axillary, and pubic hair, and the deepening of the voice due to the enlargement of the larynx.

• Testosterone is also responsible for the increase in muscle mass, bone density, and the stimulation of spermatogenesis (the production of sperm).

• While Estrogen and Progesterone are found in males in very small quantities, they are not the primary hormones for male maturation. Hence, the correct answer is Testosterone.

Additional Information

• Estrogen:

• It is the primary female sex hormone responsible for the development of female secondary sexual characteristics, such as breast development and the regulation of the menstrual cycle.

• In females, it is mainly produced in the ovaries.

• Progesterone:

• This hormone is primarily involved in the female reproductive system, playing a vital role in maintaining the lining of the uterus (endometrium) during pregnancy.

• It is secreted by the corpus luteum in the ovary after ovulation occurs.

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• Oxytocin:

• Often referred to as the "bonding hormone" or "love hormone," it is produced in the hypothalamus and released by the posterior pituitary gland.

• Its primary functions include stimulating uterine contractions during childbirth and the let-down reflex during breastfeeding.

• Puberty in Boys:

• The process of sexual maturation typically begins between the ages of 9 and 14 years.

• The Hypothalamus releases Gonadotropin-Releasing Hormone (GnRH), which signals the pituitary gland to release FSH (Follicle-Stimulating Hormone) and LH, eventually leading to the production of Testosterone.

Important Points

• Chemical Nature: Testosterone, Estrogen, and Progesterone are all steroid hormones derived from cholesterol.

• Anabolic Effects: Testosterone has significant anabolic effects, meaning it promotes the synthesis of proteins and the growth of tissues with androgen receptors.

• Regulatory Mechanism: The production of sex hormones is regulated via a negative feedback loop involving the Hypothalamic-Pituitary-Gonadal (HPG) axis. When testosterone levels are high, the brain reduces the signals to produce more.

• Secondary Characteristics: Other male changes include increased sebaceous gland activity (often leading to acne) and a change in body fat distribution toward a more android (apple-shaped) pattern.

Q9. Answer: (d) 4R

The correct answer is 4R.

Key Points

• The resistance (R) of a uniform metallic conductor is directly proportional to its length (L) and inversely proportional to its cross-sectional area (A). This is expressed by the formula $R = \rho (L/A)$, where ρ (rho) is the electrical resistivity of the material.

• When a wire is stretched, its volume (V) remains constant. The volume of a cylindrical wire is calculated as the product of its cross-sectional area and its length ($V = A \times L$).

• If the wire is stretched to twice its length, the new length L' becomes 2L. Because the volume is constant, the new area A' must decrease to maintain the equation $A \times L = A' \times (2L)$. This mathematical relationship implies that the new area $A' = A/2$. Hence, the change in area is a critical factor in determining the final resistance.

• By substituting the new dimensions into the resistance formula, the new resistance R' becomes $\rho (2L / (A/2))$. This simplifies to $\rho (4L / A)$, which is $4 \times R$. Hence, the new resistance is four times the original resistance.

• This result demonstrates that stretching a wire increases resistance not just by increasing length, but also by making the wire thinner (reducing the area), both of which impede the flow of electrons. Hence, the correct answer is 4R.

Additional Information

• Electrical Resistivity (ρ): This is an intrinsic property of a material that quantifies how strongly it opposes the flow of electric current. It does not depend on the dimensions (length or area) of the wire but depends on the nature of the material and the temperature. The SI unit of resistivity is the Ohm-meter (Ω·m).

• Ohm's Law: Formulated by Georg Simon Ohm in 1827, it states that the current passing through a conductor between two points is directly proportional to the voltage across the two points, provided physical conditions like temperature remain constant ($V = IR$).

• Conductivity (σ): This is the inverse of resistivity ($\sigma = 1/\rho$). Materials with high conductivity, such as silver and copper, are excellent conductors of electricity and are commonly used in electrical wiring.

• Factors Affecting Resistance:

• Nature of Material: Different materials have different densities of free electrons.

• Temperature: For most metals, resistance increases as the temperature rises because ions vibrate more vigorously, causing more frequent collisions with moving electrons.

• Dimensions: As seen in this problem, length and thickness (area) directly dictate the numerical value of resistance for a specific object.

Important Points

• Relation with Radius: Since the area (A) of a wire is πr^2 (where r is the radius), the resistance is inversely proportional to the fourth power of the radius when the wire is stretched. For example, if the radius is halved by stretching, the resistance would increase by 16 times.

• Stretching vs. Connecting: It is important to distinguish between stretching a wire and connecting another wire in series. If you simply add another identical wire of length L to the original, the length doubles but the area stays the same, resulting in a resistance of only 2R. Stretching is different because the conservation of volume forces the wire to become thinner.

• Numerical Application: This principle is often used in strain gauges, which are sensors used to measure the strain on an object. When the object is deformed, the electrical resistance of the foil in the gauge changes, allowing for precise measurement of mechanical stress.

Q10. Answer: (c) They slow down or become imbalanced

The correct answer is They slow down or become imbalanced.

Key Points

• Thyroxin (also known as T4) is the primary hormone secreted by the thyroid gland, which is located in the neck region. It is essential for the regulation of the Basal Metabolic Rate (BMR) in the body.

• When thyroxin is absent or deficient, the chemical reactions that convert oxygen and nutrients into energy (metabolism) are severely impacted. This results in the metabolic processes to slow down or become imbalanced as the body cannot maintain its normal physiological functions at the required speed.

• The hormone acts on nearly every cell in the body to stimulate cellular respiration and the oxidation of glucose. Without this stimulation, energy production drops, leading to symptoms like excessive fatigue, weight gain, and mental sluggishness.

• Thyroxin also maintains the balance of carbohydrates, proteins, and fats metabolism. An imbalance in these areas can lead to physical growth issues and improper development of the nervous system.

• Hence, the correct answer is They slow down or become imbalanced.

Additional Information

• Hypothyroidism: This is a clinical condition characterized by the underproduction of thyroid hormones. In adults, severe hypothyroidism is known as Myxedema, which causes swelling of the face and hands. In infants, a total lack of thyroxin can lead to Cretinism, characterized by stunted physical and mental growth.

• Hyperthyroidism: This occurs when the thyroid gland is overactive and produces too much thyroxin. In this case, metabolic activities speed up uncontrollably, leading to rapid weight loss, increased heart rate, and protruding eyeballs (a condition known as Exophthalmic Goitre).

• Role of Iodine: The thyroid gland requires Iodine to synthesize thyroxin. A deficiency of iodine in the diet leads to Goitre, where the thyroid gland enlarges significantly to compensate for the hormone shortage.

• Basal Metabolic Rate (BMR): It refers to the minimum amount of energy required by the body to maintain vital functions while at complete rest. Thyroxin is the chief regulator of this rate.

• Feedback Mechanism: The production of thyroxin is regulated by the Thyroid Stimulating Hormone (TSH), which is secreted by the anterior pituitary gland. This ensures that the levels of thyroxin in the blood remain within a narrow, healthy range.

Important Points

• Thermoregulation: Thyroxin is vital for maintaining body temperature. By increasing metabolic activity, it generates heat as a byproduct, helping the body stay warm in cold environments.

• Types of Thyroid Hormones: The gland produces two main hormones: Triiodothyronine (T3) and Thyroxine (T4). Although T4 is produced in larger quantities, T3 is the more biologically active form.

• Calcitonin: Besides metabolic hormones, the thyroid also secretes Calcitonin, which helps in regulating calcium levels in the blood by promoting the deposition of calcium into the bones.

• Atomic Fact: Iodine, with the atomic number 53, is the critical element found in thyroxin. Without sufficient intake of iodized salt or iodine-rich foods, thyroxin levels cannot be maintained.

Q11. Answer: (b) It is converted into ethanoic acid.

The correct answer is It is converted into ethanoic acid.

Key Points

• The oxidation of ethanol (CH_3CH_2OH) is a chemical reaction where it is transformed into ethanoic acid (CH_3COOH), also known as acetic acid.

• This process is carried out using strong oxidizing agents such as alkaline potassium permanganate ($KMnO_4$) or acidified potassium dichromate ($K_2Cr_2O_7$).

• When ethanol is heated with these reagents, the hydroxyl group (-OH) is converted into a carboxyl group (-COOH). Hence, the statement that it is converted into ethanoic acid is correct.

• In this reaction, the addition of oxygen and the removal of hydrogen take place, which is the fundamental definition of oxidation in organic chemistry.

• The reaction typically proceeds through an intermediate called ethanal (acetaldehyde), which is rapidly further oxidized to ethanoic acid under strong oxidizing conditions.

Additional Information

• Esterification Reaction:

• When ethanol reacts with ethanoic acid in the presence of an acid catalyst like concentrated sulphuric acid, it forms an ester called ethyl ethanoate.

• Esters are sweet-smelling substances used in perfumes and as flavoring agents.

• Dehydration of Ethanol:

• Heating ethanol at 443 K with excess concentrated sulphuric acid results in the dehydration of ethanol to form ethene (C_2H_4).

• In this reaction, sulphuric acid acts as a dehydrating agent by removing a water molecule.

• Combustion:

• Ethanol is a highly flammable liquid that burns in air with a blue flame to produce carbon dioxide, water, and a significant amount of heat and light.

• Due to its clean-burning properties, it is often used as a biofuel or added to petrol.

• Ethanoic Acid Properties:

• Ethanoic acid belongs to a group of acids called carboxylic acids.

• A 5-8% solution of ethanoic acid in water is known as vinegar and is widely used as a preservative in pickles.

• The melting point of pure ethanoic acid is 290 K, and it often freezes during winter in cold climates, leading to the name glacial acetic acid.

Important Points

• Catalysts vs. Reagents: In the oxidation process, $KMnO_4$ and $K_2Cr_2O_7$ are consumed or changed, acting as oxidizing agents, whereas in dehydration, H_2SO_4 acts as a catalyst.

• Physical State: Ethanol is a liquid at room temperature with a boiling point of 351 K. It is the active ingredient in all alcoholic drinks and is a good solvent used in medicines like tincture iodine, cough syrups, and many tonics.

• Conversion to Methane: Conversion of ethanol to methane is not a standard direct chemical reaction. Methane is usually produced by the decarboxylation of sodium ethanoate using soda lime.

Q12. Answer: (a) The number of protons in the nucleus of an atom

The correct answer is The number of protons in the nucleus of an atom.

Key Points

• The atomic number of an element is defined as the total number of protons present in the nucleus of an atom. It is traditionally represented by the symbol 'Z'. Hence, statement 1 is correct.

• The atomic number is a unique identifier for each chemical element. For instance, all Hydrogen atoms have an atomic number of 1, while all Carbon atoms have an atomic number of 6.

• In the Modern Periodic Table, elements are arranged in increasing order of their atomic numbers, as this property determines the chemical identity and characteristics of the element.

• Since an atom is electrically neutral in its ground state, the number of protons (positive charge) is exactly equal to the number of electrons (negative charge). However, the definition of the atomic number specifically refers to the protons because the number of electrons can change during chemical reactions or ionization.

• Hence, the correct answer is The number of protons in the nucleus of an atom.

Additional Information

• Valence Electrons:

• The number of electrons in the outermost shell of an atom is known as the valence electrons. These electrons participate in chemical bonding and determine the valency of the element. Hence, statement 2 is incorrect.

• Neutrons and Isotopes:

• The number of neutrons in the nucleus can vary even among atoms of the same element. Atoms with the same atomic number but different numbers of neutrons are called isotopes (e.g., Protium, Deuterium, and Tritium for Hydrogen). Hence, statement 3 is incorrect.

• Mass Number (A):

• The total number of protons and neutrons in the nucleus is called the mass number, denoted by 'A'. These subatomic particles are collectively known as nucleons. Hence, statement 4 is incorrect.

• The relationship between these values is given by the formula: Mass Number (A) = Atomic Number (Z) + Number of Neutrons (N).

Important Points

• Henry Moseley: In 1913, the English physicist Henry Moseley provided the physical basis for the atomic number through X-ray spectroscopy experiments. He demonstrated that the atomic number is a more fundamental property of an element than its atomic weight.

• Periodic Law: The Modern Periodic Law states that "the physical and chemical properties of elements are periodic functions of their atomic numbers." This replaced Mendeleev's earlier concept based on atomic mass.

• Representation: In chemical notation, the atomic number is usually written as a subscript on the left side of the element's symbol, while the mass number is written as a superscript. For example, in $^{12}_{6}C$, 6 is the atomic number and 12 is the mass number.

• Nuclear Charge: The atomic number also represents the magnitude of the positive charge in the nucleus, as each proton carries one unit of positive charge.

Q13. Answer: (d) Sound requires a medium for propagation.

The correct answer is Sound requires a medium for propagation.

Key Points

• Sound is a mechanical wave that results from the back-and-forth vibration of the particles of the medium through which it moves.

• Statement 1 suggests that sound travels faster in gases than in solids. In reality, the speed of sound depends on the density and elasticity of the medium. Particles in solids are packed more tightly than in liquids or gases, allowing sound to travel fastest in solids (approximately 5000 m/s in steel) and slowest in gases (about 343 m/s in air). Hence, statement 1 is incorrect.

• Statement 2 mentions that sound can travel in a vacuum. Since sound is a mechanical wave, it requires a material medium (solid, liquid, or gas) to propagate. In a vacuum, such as outer space, there are no molecules to vibrate, meaning sound cannot travel. Hence, statement 2 is incorrect.

• Statement 3 states that sound travels as transverse waves in air. In fluids like air and water, sound travels as longitudinal waves, where the particles of the medium vibrate parallel to the direction of energy transport. Transverse waves are those where particles move perpendicular to the wave direction, which is characteristic of light or waves on a string. Hence, statement 3 is incorrect.

• Statement 4 asserts that sound requires a medium for propagation. This is a fundamental property of mechanical waves. Sound energy is transferred through the collisions of atoms and molecules within a substance. Hence, statement 4 is correct.

• Hence, the correct answer is Sound requires a medium for propagation.

Additional Information

• Nature of Sound Waves:

• Sound waves are categorized as longitudinal waves because the displacement of the medium is in the same direction as the wave propagation.

• They consist of compressions (regions of high pressure and density) and rarefactions (regions of low pressure and density).

• Speed of Sound Factors:

• Temperature: The speed of sound increases with an increase in temperature. For every 1 degree Celsius rise in temperature, the speed of sound in air increases by about 0.6 m/s.

• Humidity: Sound travels faster in humid air than in dry air because moist air is less dense than dry air.

• State of Matter: Sound travels through steel about 15 times faster than through air.

• Human Audibility:

• The audible range for the average human ear is between 20 Hz and 20,000 Hz (20 kHz).

• Sounds below 20 Hz are termed infrasonic, while sounds above 20,000 Hz are termed ultrasonic.

Important Points

• Bell Jar Experiment: This is a classic experiment used to prove that sound needs a medium. As the air is removed from a sealed jar using a vacuum pump, the sound of an electric bell inside becomes fainter and eventually disappears, even though the hammer is still seen hitting the bell.

• Reflection of Sound: Like light, sound follows the laws of reflection. This phenomenon results in echoes and is used in technologies like SONAR (Sound Navigation and Ranging) and ultrasound imaging.

• Characteristics of Sound: Sound is defined by its amplitude (which determines loudness), frequency (which determines pitch), and timbre (the quality or tone).

Q14. Answer: (a) Convex lens

The correct answer is Convex lens.

Key Points

• Hypermetropia, also known as long-sightedness or farsightedness, is a common vision defect where a person can see distant objects clearly but cannot see nearby objects distinctly.

• In a hypermetropic eye, the image of a nearby object is formed behind the retina instead of on it. This happens because the light rays do not converge enough by the time they reach the retina.

• This defect arises either because the focal length of the eye lens is too long or the eyeball has become too small.

• To correct this, a convex lens (converging lens) of appropriate focal length is used. The convex lens provides the additional focusing power needed to converge the light rays, ensuring the image is formed exactly on the retina.

• Hence, the correct answer is Convex lens.

Additional Information

• Myopia (Near-sightedness):

• In this defect, a person can see nearby objects clearly but cannot see distant objects distinctly. The image is formed in front of the retina.

• It is corrected by using a concave lens (diverging lens), which diverges the incoming light rays so that the eye lens can focus them properly on the retina.

• Presbyopia:

• This is a vision defect that usually occurs with aging. The power of accommodation of the eye decreases as the ciliary muscles weaken and the eye lens loses its flexibility.

• People suffering from this often require bifocal lenses, where the upper part is a concave lens (for distant vision) and the lower part is a convex lens (for near vision).

• Astigmatism:

• This defect occurs when the cornea is not spherical in shape, leading to light being focused at different points. It results in blurred vision for both near and far objects.

• It is corrected by using cylindrical lenses, which compensate for the uneven curvature of the cornea or lens.

• Power of a Lens:

• The power (P) of a lens is defined as the reciprocal of its focal length (f) in meters (P = 1/f).

• The SI unit of power is the Dioptre (D). A convex lens has positive power, while a concave lens has negative power.

Important Points

• The near point for a normal human eye is approximately 25 cm. For a hypermetropic eye, the near point is farther away than 25 cm.

• The far point for a normal human eye is infinity. In myopic eyes, the far point is closer than infinity.

• The retina acts as a light-sensitive screen where the image is formed. It contains specialized cells called rods and cones that convert light into electrical signals sent to the brain via the optic nerve.

• The Iris controls the amount of light entering the eye by adjusting the size of the pupil.

• The human eye lens is a fibrous, jelly-like material that changes its shape to adjust focal length, a process known as accommodation.

Q15. Answer: (a) It increases.

The correct answer is It increases.

Key Points

• According to Gay-Lussac's Law, the pressure of a given mass of gas is directly proportional to its absolute temperature, provided the volume remains constant.

• When the temperature of a gas increases, the average kinetic energy of the gas molecules also increases. This causes the molecules to move at higher velocities.

• As the molecules move faster, they collide with the walls of the container more frequently and with greater force. Since pressure is defined as the force exerted per unit area, these intensified collisions result in an increase in pressure.

• This relationship can be mathematically expressed as P/T = k (where k is a constant) or P1/T1 = P2/T2. This implies that if the temperature (T) increases, the pressure (P) must also increase to maintain the constant ratio. Hence, the statement that pressure increases is correct.

• The temperature in these gas law calculations must always be expressed in Kelvin (absolute temperature), where 0 Kelvin represents absolute zero, the point at which molecular motion theoretically stops.

Additional Information

• Gay-Lussac's Law:

• This law was formulated by the French chemist Joseph Louis Gay-Lussac in the year 1802.

• It describes the Pressure-Temperature relationship. A practical example is a pressure cooker; as the heat (temperature) increases inside the sealed pot (constant volume), the steam pressure rises rapidly to cook food faster.

• Another example is automobile tires; during long drives in summer, the friction and road heat increase the temperature of the air inside the tires, leading to an increase in tire pressure, which can sometimes cause a blowout.

• Ideal Gas Law:

• The Ideal Gas Law is represented by the equation PV = nRT, where P is pressure, V is volume, n is the number of moles, R is the universal gas constant, and T is temperature.

• This law combines Boyle's Law, Charles's Law, and Avogadro's Law into a single equation that describes the behavior of a hypothetical ideal gas.

• Kinetic Molecular Theory (KMT):

• The Kinetic Molecular Theory explains the macroscopic properties of gases, such as pressure and temperature, by considering their molecular composition and motion.

• It assumes that gas particles are in constant, random motion and that the temperature of the gas is a measure of the average kinetic energy of these particles.

Important Points

• Isochoric Process: A thermodynamic process that occurs at a constant volume is known as an isochoric or isometric process. In

such a process, the work done by the gas is zero because there is no change in volume.

• Standard Units: In scientific contexts, pressure is often measured in Pascals (Pa), Atmospheres (atm), or Bar, while temperature is measured in Kelvin (K). To convert Celsius to Kelvin, you add 273.15 to the Celsius value.

• Boyle's Law vs. Charles's Law:

• Boyle's Law states that pressure is inversely proportional to volume at a constant temperature (P1V1 = P2V2).

• Charles's Law states that volume is directly proportional to temperature at a constant pressure (V1/T1 = V2/T2).

Q16. Answer: (c) Plant

The correct answer is Plant.

Key Points

• Movement refers to the act of changing the position of one or more parts of the body relative to the whole organism, whereas locomotion is the movement of the entire organism from one place to another, resulting in a change of location.

• Plants are generally stationary or fixed in the soil by their roots; therefore, they do not exhibit locomotion. However, they show various types of movements such as the opening and closing of flowers, the bending of stems toward light, and the closing of leaves in response to touch. Hence, statement 3 is correct.

• A Dog is a multicellular animal that uses its limbs to move from one place to another for food, shelter, or protection. This represents both movement and locomotion. Hence, statement 1 is incorrect.

• A Bird utilizes wings for flying and feet for walking or perching, which allows it to change its geographical position entirely. This is a clear example of locomotion. Hence, statement 2 is incorrect.

• A Human uses skeletal muscles and bones to walk, run, jump, or swim. Since humans can move their whole body from point A to point B, they exhibit locomotion. Hence, statement 4 is incorrect.

Additional Information

• Types of Plant Movements:

• Tropic Movements (Tropisms): These are growth-dependent movements in response to a stimulus. Examples include Phototropism (response to light), Geotropism (response to gravity), and Hydrotropism (response to water).

• Nastic Movements: These are non-directional movements that do not depend on growth. A classic example is Thigmonasty, seen in the Mimosa pudica (touch-me-not plant), where leaves fold inward when touched.

• Purpose of Locomotion in Animals:

• Locomotion is essential for survival in the animal kingdom. Animals move to find nutrition, seek a mate, escape from predators, or find suitable climatic conditions.

• In humans and many vertebrates, locomotion is achieved through the musculoskeletal system, coordinated by the nervous system.

• Distinction between Movement and Locomotion:

• All locomotion is movement, but all movements are not locomotion. For instance, the beating of the heart or breathing are movements occurring within the body, but they do not cause the organism to travel.

Important Points

• Cellular Movement: Even within stationary organisms like plants, cytoplasmic streaming (cyclosis) occurs, which is the movement of the fluid substance inside a living cell.

• Evolutionary Context: Plants evolved to be autotrophs, meaning they produce their own food via photosynthesis using sunlight. Since their "food" comes to them in the form of light and minerals from the soil, they do not need locomotion.

• Anatomical Features: Animals possess specialized organs of locomotion like cilia, flagella, fins, or legs, which are absent in higher plants.

Q17. Answer: (c) Potassium

The correct answer is Potassium.

Key Points

• Potassium (K) is classified as a macronutrient because it is required by plants in relatively large amounts for their growth and development.

• Macronutrients are essential elements that are generally present in plant tissues in concentrations exceeding 10 mmole/kg of dry matter.

• Potassium is absorbed by plants in the form of potassium ions (K+). It is found in abundance within meristematic tissues, buds, leaves, and root tips. Hence, the correct option is Potassium.

• The primary functions of Potassium include maintaining the anion-cation balance in cells, protein synthesis, the opening and closing of stomata, and the activation of enzymes involved in photosynthesis and respiration.

• Along with Nitrogen (N) and Phosphorus (P), Potassium is considered a Primary Macronutrient often found in commercial fertilizers.

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Additional Information

• Micronutrients: These are elements required by plants in very small quantities, specifically less than 10 mmole/kg of dry matter. These are also known as trace elements.

• Copper (Cu): It is a micronutrient absorbed as cupric ions (Cu2+). It is essential for the overall metabolism in plants and is associated with enzymes involved in redox reactions. Hence, statement 1 is incorrect.

• Zinc (Zn): It is a micronutrient absorbed as Zn2+ ions. It is necessary for the synthesis of auxin (a plant hormone) and activates various enzymes like carboxylases. Hence, statement 2 is incorrect.

• Iron (Fe): Although required in larger amounts than other micronutrients, it is still classified as a micronutrient. It is a key constituent of ferredoxin and cytochromes and is essential for the formation of chlorophyll. Hence, statement 4 is incorrect.

Important Points

• There are 17 essential elements required for plant growth, which are categorized based on their quantitative requirements.

• The 9 Macronutrients include: Carbon (C), Hydrogen (H), Oxygen (O), Nitrogen (N), Phosphorus (P), Potassium (K), Calcium (Ca), Magnesium (Mg), and Sulphur (S).

• The 8 Micronutrients include: Iron (Fe), Manganese (Mn), Copper (Cu), Molybdenum (Mo), Zinc (Zn), Boron (B), Chlorine (Cl), and Nickel (Ni).

• Carbon, Hydrogen, and Oxygen are mainly obtained from CO2 and H2O, while the others are absorbed from the soil as mineral nutrients.

• Deficiency of these nutrients can lead to various physiological disorders such as Chlorosis (yellowing of leaves), Necrosis (death of tissues), and stunted growth.

Q18. Answer: (d) They protect against sexually transmitted infections.

The correct answer is They protect against sexually transmitted infections..

Key Points

• Contraceptive pills, often referred to as oral contraceptive pills (OCPs), primarily function by using synthetic hormones such as estrogen and progesterone to suppress the release of eggs from the ovaries, a process known as ovulation. Hence, statement 2 is correct.

• These pills are considered a highly effective method of birth control; when taken consistently at the same time every day, they have a perfect-use efficacy rate of over 99%. Hence, statement 3 is correct.

• While generally safe, hormonal contraceptives can cause side effects in some users, including nausea, breast tenderness, headaches, and irregular bleeding or spotting between periods. Hence, statement 1 is correct.

• It is a common medical fact that oral contraceptive pills do not provide any protection against Sexually Transmitted Infections (STIs) or HIV/AIDS, as they do not act as a physical barrier to prevent the exchange of bodily fluids. Hence, statement 4 is incorrect.

• Because they do not prevent STIs, health organizations often recommend "dual protection," which involves using both the pill for pregnancy prevention and condoms to reduce infection risks. Hence, the incorrect statement is 4.

Additional Information

• Mechanism of Action:

• Beyond inhibiting ovulation, hormonal pills work by thickening the cervical mucus, which makes it difficult for sperm to enter the uterus and reach an egg.

• They also thin the lining of the uterus (the endometrium), making it less likely for a fertilized egg to implant itself.

• Types of Pills:

• Combined Oral Contraceptives (COCs): These contain both estrogen and progestin. They are the most common type and come in various dosage formats.

• Progestogen-only pills (POPs): Also known as the mini-pill, these do not contain estrogen and are often prescribed for women who are breastfeeding or have specific health risks like high blood pressure.

• Non-Contraceptive Benefits:

• Medical practitioners often prescribe these pills to manage conditions like Polycystic Ovary Syndrome (PCOS), endometriosis, and severe menstrual cramps.

• Long-term use of the pill has also been associated with a reduced risk of ovarian and endometrial cancers.

Important Points

• Effectiveness Data: According to the World Health Organization (WHO), the typical-use failure rate is approximately 7%, often due to missed doses or inconsistent timing.

• STI Protection: Only barrier methods such as male condoms and female condoms are clinically proven to significantly reduce the transmission of STIs like syphilis, gonorrhea, and chlamydia.

• Age and Health Factors: Women over the age of 35 who smoke are generally advised against using combined pills due to an increased risk of cardiovascular issues or blood clots.

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• Emergency Contraception: It is important to distinguish regular daily pills from emergency contraceptive pills (the "morning-after" pill), which are intended for use only after unprotected intercourse and are not for routine use.

Q19. Answer: (d) 100 J

The correct answer is 100 J.

Key Points

• Work done (W) is defined as the product of the magnitude of the force applied and the displacement of the object in the direction of that force.

• The mathematical formula for work is W = F × d × cos(θ), where F represents the constant force, d is the displacement, and θ is the angle between the force and the direction of motion.

• In this specific case, the constant force (F) is given as 20 N and the displacement (d) is 5 m.

• Since the object moves in the same direction as the force, the angle (θ) is 0 degrees. The value of cos(0°) is 1.

• Substituting the values into the formula: W = 20 N × 5 m × 1 = 100 J. Thus, the work done is 100 Joules.

Additional Information

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

• SI Unit: The Standard International (SI) unit of work is the Joule (J). One Joule is defined as the work performed when a force of 1 Newton (N) displaces an object by 1 meter (m).

• Positive, Negative, and Zero Work:

• Positive Work occurs when the force and displacement are in the same direction (0° ≤ θ < 90°).

• Negative Work occurs when the force acts in the opposite direction to the displacement (90° < θ ≤ 180°), such as the force of friction acting against a moving car.

• Zero Work occurs when the force is perpendicular to the displacement (θ = 90°), or if either the force or displacement is zero.

• Relationship with Energy: Work is closely related to energy. When work is done on an object, energy is transferred to that object. For example, lifting an object involves doing work against gravity, which increases the object's potential energy.

Important Points

• Dimensional Formula: The dimensional formula for work is [ML^2T^{-2}]. This is identical to the dimensions of kinetic energy and potential energy, confirming the Work-Energy Theorem.

• Work-Energy Theorem: This theorem states that the net work done by all forces acting on a body is equal to the change in its kinetic energy.

• CGS Unit: In the Centimetre-Gram-Second (CGS) system, the unit of work is the erg. One Joule is equal to 10,000,000 (10^7) ergs.

• Power and Work: Power is defined as the rate of doing work. It is calculated by dividing the work done by the time (t) taken to complete it (P = W / t). The SI unit for power is the Watt (W).

Q20. Answer: (d) They have striations

The correct answer is They have striations.

Key Points

• Smooth muscles are also known as non-striated or unstriped muscles because they do not exhibit the transverse bands or striations seen in skeletal or cardiac muscles. This lack of striations is due to the absence of highly organized sarcomeres. Hence, statement 4 is NOT true.

• These muscle cells are uninucleate, meaning each individual cell contains only one single, centrally located nucleus. Hence, statement 1 is correct.

• Smooth muscles control involuntary movements, meaning they function automatically without conscious effort. Their activity is regulated by the autonomic nervous system and hormones. Hence, statement 2 is correct.

• The structure of smooth muscle cells is spindle-shaped (also called fusiform), where the cells are thick in the middle and tapered at both ends. Hence, statement 3 is correct.

• Hence, the correct answer is They have striations.

Additional Information

• Location and Distribution:

• Smooth muscles are found in the walls of hollow visceral organs. Examples include the stomach, intestines, urinary bladder, uterus, and gallbladder.

• They are also present in the walls of blood vessels (arteries and veins), where they regulate blood pressure by contracting or relaxing to change the vessel diameter.

• They are found in the respiratory tract, iris of the eye (controlling pupil size), and the arrector pili muscles of the skin.

• Mechanism of Contraction:

• Unlike skeletal muscles, smooth muscles contract slowly but can maintain the contraction for a longer period without fatigue.

• They use actin and myosin filaments for contraction, but these are arranged in a loose network rather than the rigid sarcomere structure, allowing the muscle to shorten significantly more than skeletal muscle.

• Comparison with Other Muscle Types:

• Skeletal Muscle: These are striated, multinucleated, and voluntary muscles attached to the skeleton.

• Cardiac Muscle: These are striated, typically uninucleate, and involuntary muscles found only in the heart. They possess intercalated discs for rapid signal transmission.

• Key Biological Functions:

• In the digestive system, smooth muscles facilitate peristalsis, the wave-like contraction that moves food through the tract.

• In the urinary system, they assist in the expulsion of urine from the body.

• They play a vital role in homeostasis by controlling the flow of fluids and the internal environment of the body.

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

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

Key Points

• Assertion (A) states that if a substance loses oxygen during a chemical reaction, it is said to be reduced. In classical chemistry, the removal of oxygen from a compound is one of the primary identifiers of a reduction reaction. Hence, statement A is correct.

• Reason (R) provides the definition of reduction, stating it is the gain of hydrogen or the loss of oxygen. This is the fundamental classical definition used to identify reduction in redox reactions. Hence, statement R is correct.

• In the context of the given statements, the Assertion describes a specific scenario (loss of oxygen), and the Reason provides the general rule or definition that encompasses that scenario.

• Because the definition in Reason (R) directly confirms why the process mentioned in Assertion (A) is classified as reduction, it serves as the correct explanation for the assertion.

• An example of this is the reaction between Copper Oxide (CuO) and Hydrogen (H2), where CuO loses oxygen to become metallic Copper (Cu); here, the copper oxide is reduced.

Additional Information

• Oxidation: This is the chemical process that acts as the opposite of reduction. It is defined as the gain of oxygen or the loss of hydrogen by a substance. In a reaction like $2Mg + O2 \rightarrow 2MgO$, Magnesium undergoes oxidation as it gains oxygen.

• Redox Reactions: The term Redox is a portmanteau of Reduction and Oxidation. In most chemical reactions involving these processes, they occur simultaneously. If one substance is reduced (loses oxygen), another must be oxidized (gains that oxygen).

• Reducing and Oxidizing Agents:

• A Reducing Agent is a substance that facilitates reduction by losing hydrogen or gaining oxygen (it gets oxidized itself).

• An Oxidizing Agent is a substance that facilitates oxidation by providing oxygen or accepting hydrogen (it gets reduced itself).

• Modern Electronic Concept: While the classical definition focuses on oxygen and hydrogen, the modern definition focuses on electrons. Oxidation is the loss of electrons (OIL: Oxidation Is Loss), while Reduction is the gain of electrons (RIG: Reduction Is Gain).

• Practical Examples: The corrosion of metals (like rusting of iron) and rancidity of fats/oils are common everyday examples of oxidation processes. In rusting, iron reacts with oxygen in the presence of moisture to form Hydrated Iron (III) Oxide.

Important Points

• Oxidation State: During reduction, the oxidation state (or oxidation number) of an element decreases (becomes more negative or less positive). During oxidation, the oxidation state increases.

• Electronegativity: In a broader sense, oxidation is the addition of an electronegative element, and reduction is the addition of an electropositive element.

• Historical Context: The term reduction originally comes from the metallurgical process of "reducing" a metal ore (like Iron Oxide) to its pure metallic form by removing oxygen, which results in a "reduction" in the mass of the ore.

Q22. Answer: (b) The sky appears blue because air absorbs blue light.

The correct answer is The sky appears blue because air absorbs blue light..

Key Points

• Rayleigh Scattering states that the amount of scattering is inversely proportional to the fourth power of the wavelength of light. This means that shorter wavelengths (such as blue and violet) are scattered much more efficiently than longer wavelengths (such as red). Hence, statement 1 is correct.

• The blue appearance of the sky is a result of scattering, not absorption. When sunlight enters the Earth's atmosphere, it strikes gas molecules and scatters in all directions. Because blue light has a shorter wavelength, it is scattered more widely than other colors, making the sky look blue to our eyes. Hence, statement 2 is incorrect.

• The Tyndall effect is the process of light scattering by colloidal particles or particles in a very fine suspension. It is a reliable

method used in laboratories to detect colloids and distinguish them from true solutions, where the particles are too small to scatter light. Hence, statement 3 is correct.

• Scattering is fundamentally dependent on the wavelength of the incident light. The interaction between light and atmospheric particles (like Nitrogen and Oxygen molecules) changes based on the light's color and frequency. Hence, statement 4 is correct.

• Hence, the correct answer is "The sky appears blue because air absorbs blue light" as it is the only incorrect statement.

Additional Information

• The Visible Spectrum: The human eye can perceive light within the visible spectrum, which ranges from approximately 400 nm (violet) to 700 nm (red). Blue light typically has a wavelength between 450 and 495 nm, while red light ranges from 620 to 750 nm.

• Mechanism of Tyndall Effect: In a colloid, the particle size ranges between 1 nanometer and 1000 nanometers. These particles are large enough to deflect light rays, making the path of a beam (like a laser or flashlight) visible when passed through the mixture.

• Atmospheric Phenomena: At sunrise and sunset, sunlight must travel through a much thicker layer of the atmosphere. During this long journey, most of the shorter wavelength blue light is scattered away, leaving only the longer wavelength red and orange light to reach our eyes.

• Lord Rayleigh's Contribution: The Rayleigh Scattering Law was formulated in the 19th century. It explains why the sky is blue and why the sun appears yellow/red. It specifically applies when the scattering particles are much smaller than the wavelength of the light, such as individual molecules.

Important Points

• Color of the Sun: Outside the atmosphere, the Sun appears white because all wavelengths reach the eye without being scattered. The yellowish hue we see from Earth is due to the removal of blue light from the direct beam by the atmosphere.

• Effect of Particle Size: If the Earth had no atmosphere, the sky would appear completely black, as seen by astronauts in space. Larger particles like dust and water droplets (in clouds) scatter all wavelengths of light almost equally, which is why clouds appear white (Mie scattering).

• Violet vs. Blue: Although violet light has an even shorter wavelength than blue light and scatters more, the sky appears blue because the Sun emits more blue light than violet, and the human eye is more sensitive to blue.

Q23. Answer: (c) The sum of the atomic masses of the ions in an ionic compound as represented by its formula

The correct answer is The sum of the atomic masses of the ions in an ionic compound as represented by its formula.

Key Points

• The formula unit mass of a substance is the sum of the atomic masses of all atoms in a formula unit of a compound.

• It is specifically used for substances whose constituent particles are ions. For example, in Sodium Chloride (NaCl), the particles are Na+ and Cl- ions rather than discrete molecules. Hence, statement 3 is correct.

• The calculation method is exactly the same as that for molecular mass; however, we use the term "formula unit" for those substances where the basic building blocks are ions.

• It represents the mass of one formula unit of an ionic compound relative to the mass of a Carbon-12 atom.

• The unit for formula unit mass is the unified atomic mass unit, denoted by 'u'.

Additional Information

• Atomic Mass:

• It is the mass of an individual atom of a chemical element. Hence, statement 1 is incorrect as it defines atomic mass.

• It is measured in atomic mass units (amu) or unified mass (u), where 1u is defined as 1/12th of the mass of a Carbon-12 atom.

• Molecular Mass:

• The molecular mass of a substance is the sum of atomic masses of all the atoms in a molecule of the substance. Hence, statement 2 is incorrect as it defines molecular mass.

• It is typically used for covalent compounds (like H2O or CH4) where atoms are bonded together to form distinct molecules.

• Molar Mass:

• The molar mass is the mass of one mole of a substance (element or compound). Hence, statement 4 is incorrect as it defines molar mass.

• It is numerically equal to the atomic or molecular mass but its units are grams per mole (g/mol).

• One mole contains exactly 6.02214076 x 10^23 elementary entities, known as Avogadro's number.

Important Points

• Calculation Example (NaCl): To find the formula unit mass of Sodium Chloride (NaCl), we add the atomic mass of Sodium (23 u) and Chlorine (35.5 u), resulting in 58.5 u.

• Calculation Example (CaCl2): For Calcium Chloride, the formula unit mass is 1 x 40 u (Ca) + 2 x 35.5 u (Cl) = 40 + 71 = 111 u.

• Ionic vs. Covalent: In ionic compounds, there is no single "molecule" because the ions are arranged in a three-dimensional crystal lattice. Therefore, the simplest ratio of ions (the formula unit) is used for mass calculations.

• History of Unit: The Unified Atomic Mass Unit (u) was adopted by the IUPAC in 1961 to replace the older oxygen-based scales.

Q24. Answer: (a) Zinc

The correct answer is Zinc.

Key Points

• Zinc (Zn) is a moderately reactive metal that reacts readily with dilute Hydrochloric acid (HCl) to produce Zinc Chloride ($ZnCl_2$) and evolve Hydrogen gas (H_2).

• This reaction is a classic example of a single displacement reaction, where a more reactive metal displaces hydrogen from an acid. The chemical equation for this process is: $Zn + 2HCl \rightarrow ZnCl_2 + H_2$. Hence, the option Zinc is correct.

• In the reactivity series of metals, Zinc is positioned above Hydrogen. This higher position indicates that it has a greater tendency to lose electrons and undergo oxidation compared to hydrogen.

• During the reaction, Zinc atoms lose two electrons to form Zn^{2+} ions (oxidation), while Hydrogen ions (H^+) from the acid gain these electrons to form Hydrogen gas (reduction).

• In contrast, metals like Copper, Silver, and Gold are placed below hydrogen in the reactivity series. Because they are less reactive than hydrogen, they cannot displace it from dilute acids. Hence, these options are incorrect.

Additional Information

• The Reactivity Series:

• The reactivity series is a list of metals arranged in descending order of their chemical reactivity. Metals at the top, such as Potassium (K) and Sodium (Na), are highly reactive and can react even with cold water.

• Metals located above Hydrogen in the series (like Magnesium, Aluminum, Zinc, and Iron) can displace hydrogen from dilute acids like HCl or H_2SO_4.

• Properties of Hydrogen Gas:

• The Hydrogen gas produced during the reaction is colorless and odorless. It can be identified using the "Pop" test: when a burning splinter is brought near the mouth of the test tube containing the gas, it burns with a characteristic pop sound.

• Characteristics of Noble Metals:

• Gold (Au) and Silver (Ag) are known as noble metals because they are chemically inert and do not react with ordinary dilute acids. Gold only dissolves in a special mixture called Aqua Regia (a 3:1 mixture of concentrated HCl and HNO_3).

• Copper (Cu) is also relatively unreactive and does not produce hydrogen with dilute HCl, although it may react with oxidizing acids like concentrated Nitric acid.

Important Points

• Zinc Metal: It has the atomic number 30 and is commonly used in galvanization to prevent the rusting of iron. In the laboratory, granulated zinc is preferred for producing hydrogen gas because its larger surface area increases the rate of reaction.

• Acid Strength: While Zinc reacts with dilute HCl and H_2SO_4 to give hydrogen, it does not typically produce hydrogen gas with Nitric acid (HNO_3). This is because HNO_3 is a strong oxidizing agent that oxidizes the produced hydrogen into water (H_2O) and itself gets reduced to nitrogen oxides.

• Displacement Logic: The ability of a metal to react with an acid depends on its electrode potential. Metals with a negative reduction potential (relative to the standard hydrogen electrode) are capable of liberating hydrogen gas from acids.

Q25. Answer: (d) Sclerenchyma

The correct answer is Sclerenchyma.

Key Points

• Sclerenchyma is a simple permanent plant tissue characterized by cells that are dead at maturity. These cells lose their protoplasm during development, leaving behind only the cell wall. Hence, option 4 is correct.

• The cell walls of sclerenchyma are significantly thickened due to the deposition of lignin, a complex polymer that acts as a waterproof cementing material.

• Due to the extreme thickness of the lignified walls, there are no intercellular spaces between the cells, making the tissue very dense and rigid.

• The primary function of sclerenchyma is to provide mechanical strength and structural rigidity to the plant, allowing it to withstand environmental stresses like wind and weight.

• This tissue is commonly found in the stems (around vascular bundles), in the veins of leaves, and in the hard coverings of seeds and nuts, such as the shell of a coconut.

Additional Information

• Parenchyma:

• This is the most fundamental and abundant simple tissue in plants. The cells are living with thin cell walls made of cellulose.

• They possess large central vacuoles and are involved in photosynthesis, storage of food, and secretion. Hence, option 2 is incorrect.

• Collenchyma:

• This tissue consists of living cells that are elongated and have unevenly thickened cell walls, particularly at the corners.

• The thickening is due to the deposition of cellulose, hemicellulose, and pectin. It provides flexibility and mechanical support to young growing parts like the petiole of a leaf. Hence, option 3 is incorrect.

• Aerenchyma:

• It is a specialized type of parenchyma found in hydrophytes (aquatic plants).

• It contains large air cavities or spaces that facilitate the exchange of gases and provide buoyancy to the plant, helping it float. Since it is a parenchyma variant, its cells are living. Hence, option 1 is incorrect.

Important Points

• Types of Sclerenchyma:

• Fibers: These are long, narrow, and thick-walled cells with tapering ends. They usually occur in bundles and are used commercially in making ropes and textiles (e.g., jute and hemp).

• Sclereids: Also known as stone cells, these are spherical or oval cells with extremely thick walls and very narrow lumens. They are responsible for the gritty texture found in fruits like pears and sapota.

• Chemical Composition:

• The presence of lignin is a key distinguishing feature of sclerenchyma compared to collenchyma (which uses pectin) and parenchyma (which uses thin cellulose). Lignification is the process that eventually leads to the death of the protoplast.

• Comparison:

• While Xylem (a complex tissue) also contains dead cells like tracheids and vessels for water transport, sclerenchyma is the primary simple permanent tissue dedicated solely to mechanical protection.

Q26. Answer: (b) Rs. 34,968

Shortcut Trick

Total List Price = 625 × 94 = 58,750.

Net Multiplier = (80 ÷ 100) × (93 ÷ 100) × (80 ÷ 100) = 0.8 × 0.93 × 0.8 = 0.5952.

Cash Payment = 58,750 × 0.5952 = 34,968.

Therefore The correct answer is Rs. 34,968.

Alternate Method

Given: Quantity = 625, Rate = Rs. 94, Discounts = 20%, 7%, 20%.

Formulas: Total Value = Quantity × Rate | SP = MP × (100 − D1)% × (100 − D2)% × (100 − D3)%

=> Total List Price = 625 × 94 = Rs. 58,750.

=> After 20% discount = 58,750 × 0.80 = 47,000.

=> After 7% discount = 47,000 × 0.93 = 43,710.

=> Final Cash Payment (after 20% further discount) = 43,710 × 0.80 = Rs. 34,968.

Therefore The correct answer is Rs. 34,968.

Additional Information

Successive Discounts

When multiple discounts are applied one after another, the net selling price is calculated on the reducing balance at each step.

Cash Discount

A cash discount is an incentive offered by a seller to a buyer in return for paying a bill before the scheduled due date.

Q27. Answer: (c) 62

Shortcut Trick

Age of new person (Teacher) = New Average + (Original Strength × Increase in Average)

Teacher age = 31 + (31 × (31 − 30))

=> 31 + (31 × 1) = 31 + 31 = 62 years.

Alternatively, Teacher age = Old Average + (New Strength × Increase in Average)

=> 30 + (32 × 1) = 30 + 32 = 62 years.

Therefore The correct answer is 62 years.

Alternate Method

Given:

Number of students = 31

Initial average age = 30 years

New average after including teacher = 31 years
Total members (Students + Teacher) = 31 + 1 = 32
Formula Used:
Average = Total Sum of Ages ÷ Number of Persons
Total Sum = Average × Number of Persons
Calculations:
=> Total age of 31 students = 31 × 30 = 930 years
=> Total age of group including teacher = 32 × 31
=> Total age (32 members) = 992 years
=> Age of the teacher = Total age with teacher − Total age of students
=> Age of the teacher = 992 − 930
=> Age of the teacher = 62 years
Therefore The correct answer is 62 years.
Additional Information
Basic Average Formula
Average = (Sum of all observations) ÷ (Total number of observations).
Exclusion Case Shortcut
Age of excluded person = Old Average + (Old Strength − 1) × (Decrease in Average).
Replacement Case Shortcut
Value of new person = Value of replaced person + (Total number × Increase in Average).
Weighted Average
Combined Average = (n1 × A1 + n2 × A2) ÷ (n1 + n2), where n is quantity and A is average.

Q28. Answer: (b) Decreases by 63.71%

Shortcut Trick
Net multiplier = (1 − 0.45) × (1 − 0.35) × (1 − 0.30) × (1 + 0.45)
Net multiplier = 0.55 × 0.65 × 0.70 × 1.45
Net multiplier = 0.3575 × 1.015 = 0.3628625
Net Change % = (0.3628625 − 1) × 100 = −63.71375%
Therefore The correct answer is Decreases by 63.71%.
Alternate Method
Given: Successive changes of −45%, −35%, −30% and +45%.
Formula Used: Final Price = Initial Price × (100 ± r1)/100 × (100 ± r2)/100 ...
=> Let the Original Price of fuel be 100.
=> Price after 1^(st) month = 100 × (100 − 45)/100 = 55
=> Price after 2^(nd) month = 55 × (100 − 35)/100 = 55 × 0.65 = 35.75
=> Price after 3^(rd) month = 35.75 × (100 − 30)/100 = 35.75 × 0.7 = 25.025
=> Price after 4^(th) month = 25.025 × (100 + 45)/100 = 25.025 × 1.45 = 36.28625
=> Total change = 36.28625 − 100 = −63.71375
=> Percentage Decrease ≈ 63.71%
Therefore The correct answer is Decreases by 63.71%.
Additional Information
Successive Percentage Change
For two successive changes a% and b%, the net change is given by [a + b + (ab/100)]%.
Multiplier Method
Final value = Initial value × $(1 + r/100)^n$. For different rates, multiply each factor (1 ± r/100) consecutively.
Percentage Decrease
It is calculated as [(Initial Value − Final Value) / Initial Value] × 100.

Q29. Answer: (a) 38 cm²

Shortcut Trick
Apply the algebraic identity: $(a + b)^2 + (a − b)^2 = 2(a^2 + b^2)$.

Here, a = 4 and b = √3.

Sum of areas = 2 × [4² + (√3)²]

=> 2 × (16 + 3) = 2 × 19 = 38 cm².

Therefore The correct answer is 38 cm².

Alternate Method

Given:

Side of the first square (s1) = (4 + √3) cm

Side of the second square (s2) = (4 − √3) cm

Formula Used:

Area of a square = (Side)²

Calculations:

=> Area of first square = (4 + √3)²

=> Area1 = 4² + (√3)² + 2 × 4 × √3

=> Area1 = 16 + 3 + 8√3 = (19 + 8√3) cm²

=> Area of second square = (4 − √3)²

=> Area2 = 4² + (√3)² − 2 × 4 × √3

=> Area2 = 16 + 3 − 8√3 = (19 − 8√3) cm²

=> Sum of areas = Area1 + Area2

=> Sum = (19 + 8√3) + (19 − 8√3)

=> Sum = 19 + 19 + 8√3 − 8√3 = 38 cm²

Therefore The correct answer is 38 cm².

Additional Information

Algebraic Identities

(a + b)² = a² + b² + 2ab and (a − b)² = a² + b² − 2ab. These are fundamental for solving area-based problems involving irrational numbers.

Perimeter of a Square

The perimeter of a square is 4 × side. For the first square, perimeter = 4(4 + √3) = 16 + 4√3 cm.

Diagonal of a Square

The diagonal of a square with side 's' is given by s√2. Area can also be calculated as (Diagonal)² ÷ 2.

Q30. Answer: (c) 5°

Shortcut Trick

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

angle STR = (angle P + angle Q) ÷ 2

=> 22.5° = (angle P + angle Q) ÷ 2

=> angle P + angle Q = 45°

Since the ratio of angle P to angle Q is 4 : 5, the difference between them is:

Difference = (5 − 4) ÷ (4 + 5) × 45° = 1/9 × 45° = 5°

Therefore The correct answer is 5°.

Alternate Method

Given:

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

• angle STR = 22.5°

• Ratio of angle P to angle Q = 4 : 5

Formula Used:

• Sum of angles in a triangle = 180°

• Sum of angles in a quadrilateral = 360°

Calculations:

In triangle STR:

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

=> angle TSR + angle TRS + 22.5° = 180°

=> angle TSR + angle TRS = 157.5°

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

=> angle TSR = angle S ÷ 2

=> angle TRS = angle R ÷ 2

=> (angle S ÷ 2) + (angle R ÷ 2) = 157.5°

=> angle S + angle R = 2 × 157.5° = 315°

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

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

=> angle P + angle Q + 315° = 360°

=> angle P + angle Q = 45°

Given the ratio of angle P to angle Q is 4 : 5:

=> Let angle P = 4x and angle Q = 5x

=> 4x + 5x = 45°

=> 9x = 45°

=> x = 5°

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

=> angle Q − angle P = 5x − 4x = x

=> Difference = 5°

Explanation of Options:

• Option (1) is incorrect because a difference of 1° would mean the sum of angles is not 45° under the 4 : 5 ratio.

• Option (2) is incorrect because a difference of 2° does not satisfy the ratio and sum conditions.

• Option (3) is correct as the calculated difference is exactly 5°.

• Option (4) is incorrect because a difference of 6° is mathematically inconsistent with the given angle bisector value.

Therefore The correct answer is 5°.

Additional Information

Angle Bisector Theorem in Quadrilaterals

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

Sum of Interior Angles of a Polygon

The sum of the interior angles of an n-sided polygon is (n − 2) × 180°. For any quadrilateral, this sum is always 360°.

Opposite Angle Bisectors

If the bisectors of two opposite angles of a quadrilateral intersect, the angle between them is equal to half the difference of the other two angles.

Q31. Answer: (b) Rs. 6,048

Shortcut Trick

For a rate of 20% and time of 2 years, the effective compound interest rate is calculated as: 20 + 20 + (20 × 20)/100 = 44%.

Total Amount = 100% (Principal) + 44% (Interest) = 144% of the Principal.

Amount = 4,200 × 144/100 = 42 × 144 = Rs. 6,048.

Therefore The correct answer is Rs. 6,048.

Alternate Method

Given:

Principal (P) = Rs. 4,200

Rate (R) = 20% per annum

Time (n) = 2 years

Formula Used:

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

Calculations:

=> $A = 4200 \times (1 + 20/100)^2$

=> $A = 4200 \times (1 + 1/5)^2$

=> $A = 4200 \times (6/5)^2$

=> $A = 4200 \times (36/25)$

=> A = 168 × 36

=> A = 6048

Therefore The correct answer is Rs. 6,048.

Additional Information

Effective Rate for Compound Interest

For 2 years, the net effective interest rate is given by the formula: x + y + (xy/100), where x and y are the rates for the first and second years respectively.

Difference between CI and SI

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

Half-Yearly Compounding

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

Q32. Answer: (d) 1551

Shortcut Trick

Total distance covered = Speed × Time

Total distance = 63 × 28 = 1764 m

Train length (X) = Total distance − Platform length

X = 1764 − 213 = 1551 m

Therefore The correct answer is 1551 m.

Alternate Method

Given:

Speed of train = 63 m/s

Time taken = 28 sec

Platform length = 213 m

Train length = X m

Formula Used:

Speed = (Length of Train + Length of Platform) ÷ Time

Calculations:

=> 63 = (X + 213) ÷ 28

=> X + 213 = 63 × 28

=> X + 213 = 1764

=> X = 1764 − 213

=> X = 1551

Therefore The correct answer is 1551 m.

Additional Information

Crossing Objects with Length

When a train crosses a platform, bridge, or another train, the total distance covered is the sum of the lengths of the train and the object.

Relative Speed

If two objects move in the same direction, relative speed is S1 − S2. In opposite directions, it is S1 + S2.

Speed Conversion

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

Q33. Answer: (b) 25%

Shortcut Trick

Given that Cost Price (CP) is 80% of Selling Price (SP).

Ratio of CP : SP = 80 : 100 = 4 : 5.

Profit = SP − CP = 5 − 4 = 1 unit.

Profit% = (Profit ÷ CP) × 100 = (1 ÷ 4) × 100 = 25%.

Therefore The correct answer is 25%.

Alternate Method

Given: Selling Price (SP) = Rs. 100, Cost Price (CP) = 80% of SP.

Formulas: Profit = SP − CP | Profit% = (Profit ÷ CP) × 100

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=> Cost Price (CP) = 80% of 100 = (80 ÷ 100) × 100 = Rs. 80.

=> Selling Price (SP) = Rs. 100.

=> Profit = SP − CP = 100 − 80 = Rs. 20.

=> Profit Percentage = (20 ÷ 80) × 100 = 1/4 × 100 = 25%.

Therefore The correct answer is 25%.

Additional Information

Profit and Loss on CP

Unless otherwise stated, Profit% and Loss% are always calculated on the Cost Price.

Relation between CP and SP

If SP > CP, it is a Profit. If CP > SP, it is a Loss.

Q34. Answer: (c) 18

Shortcut Trick

Number of oranges = (Total − Difference) ÷ 2

=> Oranges = (42 − 6) ÷ 2

=> Oranges = 36 ÷ 2 = 18

Therefore The correct answer is 18.

Alternate Method

Given: Total fruits = 42, Apple (A) − Orange (O) = 6

Let the number of oranges be x.

Then, the number of apples = x + 6.

=> (x + 6) + x = 42

=> 2x + 6 = 42

=> 2x = 42 − 6

=> 2x = 36

=> x = 18

Therefore The correct answer is 18.

Additional Information

Sum and Difference Rule

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

Linear Equations in One Variable

Equations where the highest power of the variable is 1, used to find unknown quantities by establishing relationships based on given conditions.

Q35. Answer: (b) 4

Shortcut Trick

Combined efficiency of A, B, and C = 4 + 1 + 1 = 6 units/day (taking Total Work as 12 units).

Twice the work = 12 × 2 = 24 units.

Time taken = 24 ÷ 6 = 4 days.

Therefore The correct answer is 4 days.

Alternate Method

Given:

Time taken by A = 3 days

Time taken by B = 12 days

Time taken by C = 12 days

Formula Used:

Total Work = LCM of individual days

Efficiency = Total Work ÷ Time Taken

Time Taken = Total Work ÷ Combined Efficiency

Person	Days	Total Work	Efficiency
A	3	12	12 ÷ 3 = 4

B	12	12 ÷ 12 = 1	
C	12	12 ÷ 12 = 1	

Calculations:

=> Total Work = LCM of 3, 12, 12 = 12 units

=> Combined Efficiency of A, B, and C = 4 + 1 + 1 = 6 units/day

=> Twice the Work = 2 × 12 = 24 units

=> Time taken to complete twice the work = 24 ÷ 6 = 4 days

Therefore The correct answer is 4 days.

Additional Information

Total Work Concept

Total work is assumed as the LCM of individual times to make efficiency calculations integer-based and simpler.

Work and Efficiency Relation

Efficiency is inversely proportional to time taken when the total work is constant.

Q36. Answer: (b) 22/3

Shortcut Trick

Efficiency ratio A : B = 100 : 125 = 4 : 5.

Total Work = Efficiency of A × Time of A = 4 × 10 = 40 units.

Work to be completed = 60% of 40 = 24 units.

Combined efficiency = 4 + 5 = 9 units/day.

Time required = 24 ÷ 9 = 8/3 = 2(2/3) days.

Therefore The correct answer is 2(2/3) days.

Alternate Method

Given: Time taken by A = 10 days; B is 25% more efficient than A.

Formula Used: Efficiency × Time = Work; Efficiency prop. to 1/Time

Person	Days	Total Work	Efficiency
A	10	40	4
B	8	5	

=> Efficiency of B = 4 + 25% of 4 = 4 + 1 = 5 units/day.

=> Total work = 10 × 4 = 40 units.

=> 60% of work = 40 × 0.6 = 24 units.

=> Combined Efficiency of (A + B) = 4 + 5 = 9 units/day.

=> Time taken = 24 ÷ 9 = 8/3 days = 2(2/3) days.

Therefore The correct answer is 2(2/3) days.

Additional Information

Efficiency and Time Relationship

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

Work and Wages

Wages are distributed in the ratio of the actual work done by each person, which simplifies to the ratio of their efficiencies if they work for the same duration.

Combined Work Formula

If A takes 'a' days and B takes 'b' days, time taken together is (a × b) ÷ (a + b) days.

Q37. Answer: (c) 58

Shortcut Trick

Total number of observations (n) = 11 (Odd).

Median is the 6^(th) observation in ascending order.

Replacing a value lower than the median (41 → 43, both < 58) and a value higher than the median (92 → 99, both > 58) does not change the middle element.

Since the relative position of the 6^(th) term remains the same, the median is unchanged.

Therefore The correct answer is 58.
Alternate Method
Given observations: 46, 64, 87, 41, 58, 77, 35, 90, 55, 92, 33
Step 1: Arrange data in ascending order.
33, 35, 41, 46, 55, 58, 64, 77, 87, 90, 92
Number of observations (n) = 11
Median = ((n + 1) ÷ 2)^(th) term = 6^(th) term = 58
Step 2: Apply the changes (Replace 92 with 99 and 41 with 43).
Step 3: New ascending order:
33, 35, 43, 46, 55, 58, 64, 77, 87, 90, 99
=> New n = 11
=> New Median = 6^(th) term
=> New Median = 58
Therefore The correct answer is 58.
Additional Information
Median for Even Observations
If n is even, Median = Average of (n/2)^(th) and (n/2 + 1)^(th) observations.
Empirical Relationship
For moderately skewed distributions: Mode = 3 × Median − 2 × Mean.
Outlier Resistance
Median is a measure of central tendency that is not affected by extreme outliers, unlike the arithmetic mean.

Q38. Answer: (b) 47.4 km/hr

Shortcut Trick
Average Speed = Total Distance ÷ Total Time
Total Distance = 40 + 50 + 60 = 150 km
Total Time = (40/60) + (50/50) + (60/40) = 2/3 + 1 + 3/2 = 19/6 hours
Average Speed = 150 ÷ (19/6) = 900/19 ≈ 47.4 km/hr
Therefore The correct answer is 47.4 km/hr.
Alternate Method
Given:
Distance 1 (d1) = 40 km, Speed 1 (s1) = 60 km/hr
Distance 2 (d2) = 50 km, Speed 2 (s2) = 50 km/hr
Distance 3 (d3) = 60 km, Speed 3 (s3) = 40 km/hr
Formula Used:
Time = Distance ÷ Speed
Average Speed = (Total Distance) ÷ (Total Time)
Calculations:
=> Time t1 = 40 ÷ 60 = 2/3 hours
=> Time t2 = 50 ÷ 50 = 1 hour
=> Time t3 = 60 ÷ 40 = 3/2 hours
=> Total Time = 2/3 + 1 + 3/2 = (4 + 6 + 9) ÷ 6 = 19/6 hours
=> Total Distance = 40 + 50 + 60 = 150 km
=> Average Speed = 150 ÷ (19/6) = (150 × 6) ÷ 19
=> Average Speed = 900 ÷ 19 ≈ 47.368...
Therefore The correct answer is 47.4 km/hr.
Additional Information
Equal Distance Case
If two equal distances are covered at speeds u and v, then Average Speed = (2 × u × v) ÷ (u + v).
Average Speed Concept
Average speed is NOT the simple arithmetic mean of speeds unless the time spent at each speed is identical.
Relative Speed

Same direction: S1 − S2 | Opposite direction: S1 + S2.

Q39. Answer: (c) 7

Shortcut Trick

Sum of odd-place digits: 7 + x + 9 + 5 = 21 + x

Sum of even-place digits: 4 + 8 + 3 + y = 15 + y

Difference (D) = (21 + x) − (15 + y) = 6 + x − y

For divisibility by 11, D must be 0, 11, or −11.

If D = 0, y − x = 6 => (x, y) = (1, 7), (2, 8), (3, 9) [3 pairs]

If D = 11, x − y = 5 => (x, y) = (5, 0) is not allowed as y is positive, so (6, 1), (7, 2), (8, 3), (9, 4) [4 pairs]

Therefore The correct answer is 7.

Alternate Method

Given: Eight digit number 74x8935y is divisible by 11. x, y > 0.

Formula Used: Divisibility rule of 11: Sum of digits at odd places − Sum of digits at even places = 0 or multiple of 11.

=> Odd place sum S1 = 7 + x + 9 + 5 = 21 + x

=> Even place sum S2 = 4 + 8 + 3 + y = 15 + y

=> Difference D = S1 − S2 = (21 + x) − (15 + y) = 6 + x − y

=> Case 1: 6 + x − y = 0 => y − x = 6. Since x, y ≥ 1: (1, 7), (2, 8), (3, 9)

=> Case 2: 6 + x − y = 11 => x − y = 5. Since x, y ≥ 1: (6, 1), (7, 2), (8, 3), (9, 4)

=> Case 3: 6 + x − y = −11 => y − x = 17 (Not possible as max difference is 8 for non-zero integers)

=> Total pairs = 3 + 4 = 7

Therefore The correct answer is 7.

Additional Information

Divisibility by 11

A number is divisible by 11 if the alternating sum of its digits is divisible by 11.

Positive Integers constraint

Since x and y are positive integers, they must be from the set {1, 2, 3, 4, 5, 6, 7, 8, 9}. Zero is not included.

Ordered Pairs

An ordered pair (x, y) counts unique combinations where the order of x and y matters relative to their positions in the number.

Q40. Answer: (d) 25

Shortcut Trick

Discount% = [Free Articles ÷ (Paid Articles + Free Articles)] × 100

Discount% = [2 ÷ (6 + 2)] × 100

Discount% = (2 ÷ 8) × 100 = (1 ÷ 4) × 100 = 25%

Therefore The correct answer is 25%.

Alternate Method

Given: Number of articles purchased = 6, Number of free articles = 2.

Formulas: Discount% = (Discount ÷ MP) × 100 | Total MP = MP of all articles (Bought + Free).

=> Let the Marked Price (MP) of 1 article be 1 unit.

=> Total MP of 8 articles (6 + 2) = 8 units.

=> The Selling Price (SP) is equal to the price of 6 articles = 6 units.

=> Discount = MP − SP = 8 − 6 = 2 units.

=> Discount% = (2 ÷ 8) × 100 = 25%.

Therefore The correct answer is 25%.

Additional Information

Marked Price & Discount

The price printed on the label is the Marked Price. Discount is always calculated on this value.

Free Item Concept

In 'Buy X Get Y Free', the total quantity (X+Y) represents the Marked Price equivalent, and Y represents the Discount.

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Q41. Answer: (a) 314

Shortcut Trick

Numbers divisible by 5 = 1000 ÷ 5 = 200

Numbers divisible by 7 = 1000 ÷ 7 = 142 (integer part)

Numbers divisible by both (LCM of 5 and 7 = 35) = 1000 ÷ 35 = 28 (integer part)

Total numbers = 200 + 142 − 28 = 314

Therefore The correct answer is 314.

Alternate Method

Given: Total limit = 1000, Divisors = 5, 7

Formula Used: n(A U B) = n(A) + n(B) − n(A ∩ B)

=> Let A be the set of numbers divisible by 5: n(A) = floor(1000/5) = 200

=> Let B be the set of numbers divisible by 7: n(B) = floor(1000/7) = 142

=> Let A ∩ B be numbers divisible by LCM(5, 7) = 35: n(A ∩ B) = floor(1000/35) = 28

=> Total numbers divisible by 5 or 7 = 200 + 142 − 28

=> Total = 342 − 28 = 314

Therefore The correct answer is 314.

Additional Information

Inclusion-Exclusion Principle

For two sets, the number of elements in their union is found by adding the individual sizes and subtracting the size of their intersection.

Divisibility in a Range

The number of integers divisible by 'k' in the range [1, N] is given by the floor function floor(N/k).

Least Common Multiple (LCM)

To find numbers divisible by both 'a' and 'b', we must find numbers divisible by their LCM.

Q42. Answer: (a) 21%

Shortcut Trick

Since Surface Area is a 2-dimensional property (depends on side²), use the Successive Percentage formula:

Net Increase = x + x + (x × x)/100

Here, increase (x) = 10%

Total Increase = 10 + 10 + (10 × 10)/100 = 20 + 1 = 21%

Therefore The correct answer is 21%.

Alternate Method

Given: Each edge of a cube is increased by 10%.

Formula Used: Total Surface Area of a cube = 6 × (edge)²

=> Let the original edge (a) = 10 units.

=> Original Surface Area (S1) = 6 × (10)² = 6 × 100 = 600 sq. units.

=> New edge (a') = 10 + (10% of 10) = 11 units.

=> New Surface Area (S2) = 6 × (11)² = 6 × 121 = 726 sq. units.

=> Increase in Surface Area = 726 − 600 = 126 sq. units.

=> Percentage Increase = (126 ÷ 600) × 100 = 21%.

Therefore The correct answer is 21%.

Additional Information

Volume Percentage Change

Since Volume = side³, an increase of x% leads to a volume increase of [(1 + x/100)³ − 1] × 100%. For 10%, it is 33.1%.

Ratio Method for Area

If side ratio is 10 : 11, then Area ratio is $10^2 : 11^2 = 100 : 121$. The increase is directly 21 over 100, which is 21%.

Applicability to Other Shapes

This rule applies to all 3D regular figures. If the linear dimension of a sphere or cone increases by x%, its surface area always increases by $2x + x^2/100$ %.

Q43. Answer: (d) 10

Shortcut Trick

Sum of present ages = 56 years.

Sum after 8 years = 56 + (8 × 2) = 72 years.

Ratio after 8 years (Mother : Daughter) = 3 : 1.

Daughter's age after 8 years = 72 × (1/4) = 18 years.

Daughter's present age = 18 − 8 = 10 years.

Therefore The correct answer is 10 years.

Alternate Method

Given: Sum of present ages of Mother (M) and Daughter (D) is 56.

Formula Used: Linear equation in one or two variables.

=> Let Daughter's present age be D and Mother's present age be M.

=> M + D = 56 → (i)

=> After 8 years: (M + 8) = 3 × (D + 8)

=> M + 8 = 3D + 24

=> M − 3D = 16 → (ii)

=> Subtracting (ii) from (i): (M + D) − (M − 3D) = 56 − 16

=> 4D = 40

=> D = 10 years.

Therefore The correct answer is 10 years.

Additional Information

Sum of Ages in Future/Past

If the current sum of ages of 'n' people is S, then after 't' years, the sum will be S + (n × t).

Age Ratio Comparison

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

Linear Equations in Ages

Always assume variables for present ages to avoid confusion while moving back or forward in time.

Q44. Answer: (a) 51.9 m

Shortcut Trick

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

The side opposite to 30° (Base) = 30 m.

The side opposite to 60° (Height) = Base × √3.

Height = 30 × 1.73 = 51.9 m.

Therefore The correct answer is 51.9 m.

Alternate Method

Given:

Distance from the base (Base) = 30 m

Angle of elevation (θ) = 60°

Value of √3 = 1.73

Formula Used:

tan θ = Perpendicular / Base

Calculations:

=> tan 60° = Height / 30

=> √3 = Height / 30

=> Height = 30 × √3

=> Height = 30 × 1.73

=> Height = 51.9 m

Therefore The correct answer is 51.9 m.

Additional Information

Trigonometric Ratios

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

Angle of Elevation vs Depression

The angle of elevation is measured upwards from the horizontal, while the angle of depression is measured downwards; both are numerically equal for the same line of sight due to alternate interior angles.

Pythagoras Theorem

In any right-angled triangle, Hypotenuse² = Base² + Perpendicular².

Q45. Answer: (d) 300%

Shortcut Trick

Required percentage = (Value ÷ Base Value) × 100

Required percentage = (1/30 ÷ 1/90) × 100

Required percentage = (90 ÷ 30) × 100 = 3 × 100 = 300%

Therefore The correct answer is 300%.

Alternate Method

Given:

Target value = 1/30

Base value = 1/90

Formula Used:

Percentage = (A / B) × 100

Calculations:

=> Percentage = [(1/30) / (1/90)] × 100

=> Percentage = (1/30) × (90/1) × 100

=> Percentage = 3 × 100

=> Percentage = 300%

Therefore The correct answer is 300%.

Additional Information

Fraction to Percentage

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

Reciprocal Comparison

When comparing unit fractions (1/n), the ratio of 1/a to 1/b is equal to b/a.

Percentage Change

Percentage change = [(New value − Old value) / Old value] × 100.

Q46. Answer: (d) 14.549

Shortcut Trick

Apply the BODMAS rule to evaluate multiplication and division first.

First part: 0.7 × 72 ÷ 14 = 50.4 ÷ 14 = 3.6

Second part: 8.34 × 0.15 = 1.251

Substitute the parts back into the equation: 3.6 + 6.25 − 1.251 + 5.95

Add the positive terms together and subtract: 15.80 − 1.251 = 14.549

Therefore The correct answer is 14.549.

Alternate Method

Given:

Expression: 0.7 × 72 ÷ 14 + 6.25 − 8.34 × 0.15 + 5.95

Concept Used:

BODMAS Rule: Brackets, Order, Division, Multiplication, Addition, and Subtraction.

Calculations:

=> 0.7 × 72 ÷ 14 + 6.25 − 8.34 × 0.15 + 5.95

=> (0.7 × 72) ÷ 14 + 6.25 − (8.34 × 0.15) + 5.95

=> 50.4 ÷ 14 + 6.25 − 1.251 + 5.95

=> 3.6 + 6.25 − 1.251 + 5.95

Group all the positive values together first to make the addition easier:

=> (3.6 + 6.25 + 5.95) − 1.251

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=> 15.80 − 1.251

=> 14.549

Therefore The correct answer is 14.549.

Additional Information

BODMAS Rule

It specifies the sequence of mathematical operations: Brackets first, then Orders (powers/roots), followed by Division and Multiplication (left to right), and finally Addition and Subtraction (left to right).

Decimal Addition and Subtraction

When adding or subtracting decimal numbers, always align the decimal points precisely before proceeding with the calculation to prevent place-value errors.

Decimal Multiplication

Multiply the numbers as whole integers, then place the decimal point in the resulting product so that it has the exact total number of decimal places present in both of the original factors.

Q47. Answer: (b) 2,02,500

Shortcut Trick

Income ratio (David : Ashish) = 5 : 8

Expenditure ratio = 2 : 4 = 1 : 2

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

Multiply expenditure ratio (1:2) by 3 → 3 : 6. Now, Savings = Income − Expenditure = 5−3 = 2 units and 8−6 = 2 units.

2 units = Rs. 81,000 => 1 unit = Rs. 40,500.

David income = 5 units = 5 × 40,500 = Rs. 2,02,500.

Therefore The correct answer is Rs. 2,02,500.

Alternate Method

Given: Ratio of Income = 5 : 8, Ratio of Expenditure = 2 : 4, Savings of each = Rs. 81,000.

Formula: Income − Savings = Expenditure

=> Let David income = 5x and Ashish income = 8x.

=> According to question: (5x − 81,000) / (8x − 81,000) = 2 / 4

=> (5x − 81,000) / (8x − 81,000) = 1 / 2

=> 2(5x − 81,000) = 1(8x − 81,000)

=> 10x − 1,62,000 = 8x − 81,000

=> 2x = 1,62,000 − 81,000

=> 2x = 81,000

=> x = 40,500

=> David income = 5x = 5 × 40,500 = 2,02,500

Therefore The correct answer is Rs. 2,02,500.

Additional Information

Concept of Savings

Savings is the surplus of income over expenditure: Savings = Income − Expenditure.

Ratio and Proportion Application

If two ratios are given and a constant amount is added/subtracted, we use the cross-multiplication method or x-variable method to solve for the original values.

Income-Expenditure Relationship

Income is always equal to the sum of Expenditure and Savings (I = E + S).

Q48. Answer: (a) 6160

Shortcut Trick

Total Surface Area of n equal parts formed by m diametrical planes passing through a common axis = $4\pi r^2 + 2m\pi r^2$.

Each diametrical cut adds 2 circular faces (each πr^2) to the total area.

Given m = 3 planes and r = 14 cm.

Total Surface Area = $4\pi r^2 + 2(3)\pi r^2 = 10\pi r^2$.

Calculation => $10 \times (22/7) \times 14 \times 14 = 6160$ cm².

Therefore The correct answer is 6160 cm².

Alternate Method

Given:

Radius of sphere (r) = 14 cm

Number of diametrical planes = 3

Number of equal parts = 6

Formula Used:

Surface area of sphere = $4\pi r^2$

Area of one circular cross-section = πr^2

Calculations:

=> Original surface area of sphere = $4 \times (22/7) \times 14 \times 14$

=> Original area = $4 \times 22 \times 2 \times 14 = 2464$ cm²

=> Each diametrical cut creates 2 new circular faces.

=> Total new faces created by 3 planes = $3 \times 2 = 6$ faces.

=> Total area of new faces = $6 \times \pi r^2$

=> New faces area = $6 \times (22/7) \times 14 \times 14 = 6 \times 22 \times 2 \times 14$

=> New faces area = 3696 cm²

=> Total surface area of all pieces = Original area + New faces area

=> Total surface area = 2464 + 3696 = 6160 cm²

Therefore The correct answer is 6160 cm².

Additional Information

Surface Area of Hemisphere

Curved surface area (CSA) = $2\pi r^2$ and Total surface area (TSA) = $3\pi r^2$.

Volume of Sphere

The volume of a sphere is given by $V = (4/3)\pi r^3$.

Cutting Rule for Solids

Every time a solid is cut, the total volume remains constant, but the total surface area increases by the area of the newly exposed surfaces.

Q49. Answer: (d) Rs. 1,806

Shortcut Trick

Total Deduction = 65 + 39 + 77 = Rs. 181.

Remaining Sum = 4,445 − 181 = Rs. 4,264.

Total Ratio = 18 + 3 + 20 = 41 units.

Value of 1 unit = 4,264 ÷ 41 = Rs. 104.

Difference (B & C) = (20 − 3) units + (77 − 39) = 17 × 104 + 38 = 1,768 + 38 = Rs. 1,806.

Therefore The correct answer is Rs. 1,806.

Alternate Method

Given: Total sum = Rs. 4,445. Deductions from A, B, C are Rs. 65, Rs. 39, Rs. 77 respectively. Ratio after deduction = 18 : 3 : 20.

=> Sum of remaining shares = 4,445 − (65 + 39 + 77)

=> Sum of remaining shares = 4,445 − 181 = Rs. 4,264

=> Total ratio parts = 18 + 3 + 20 = 41 units

=> Value of 1 unit = 4,264 ÷ 41 = Rs. 104

=> B's share after deduction = 3 × 104 = Rs. 312

=> C's share after deduction = 20 × 104 = Rs. 2,080

=> B's original share = 312 + 39 = Rs. 351

=> C's original share = 2,080 + 77 = Rs. 2,157

=> Difference = 2,157 − 351 = Rs. 1,806

Therefore The correct answer is Rs. 1,806.

Additional Information

Ratio and Proportion Basics

If a total sum S is divided in the ratio a:b:c, then the share of B is [b / (a+b+c)] × S.

Handling Deductions in Ratios

When fixed amounts are deducted from shares to obtain a ratio, always subtract the sum of deductions from the total capital before applying the ratio units.

Difference between Shares

Difference between C and B can be calculated as: (Difference in ratio units × value of 1 unit) + (Difference in deducted amounts).

Q50. Answer: (b) 500

Shortcut Trick

Ratio of Girls to Boys = 2 : 5

Given, 2 units = 200 (Number of girls)

=> 1 unit = 100

Therefore 5 units = 5 × 100 = 500 (Number of boys)

Therefore The correct answer is 500 boys.

Alternate Method

Given:

Ratio of Girls : Boys = 2 : 5

Total number of girls = 200

Formula Used:

Value of a part = (Total value ÷ Sum of ratios) × Specific ratio part

Calculations:

=> Let the number of girls be 2x and boys be 5x.

=> 2x = 200

=> x = 200 ÷ 2

=> x = 100

=> Number of boys = 5x = 5 × 100

=> Number of boys = 500

Therefore The correct answer is 500 boys.

Additional Information

Ratio Definition

A ratio compares two quantities by division. If a : b = c : d, then a × d = b × c.

Proportion Rule

To find an unknown in a ratio, equate the ratio of units to the ratio of actual values: (Part A / Part B) = (Value A / Value B).

Compound Ratio

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

Q51. Answer: (d) wm

Given:

‘meal visit cat’ is coded as ‘vs mo wm’

‘rain meal mango’ is coded as ‘wm or lo’

Observe the common word:

The common word in both statements is “meal”.

The common code in both code groups is “wm”.

Therefore, “meal” is coded as “wm”.

Hence, the correct answer is "Option 4".

Q52. Answer: (d) OU - TA

Logic followed here is: In each pair, the letters of the second cluster are obtained by adding 5 to the positional values of the corresponding letters in the first cluster.

Option 1: EK - JP

Option 2: KQ - PV

Option 3: NT - SY

Option 4: OU - TA

Therefore, the letter-cluster pair that DOES NOT belong to that group is OU - TA.

Hence, the correct answer is "Option 4".

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Q53. Answer: (a) 45

Given:

→ Ruman is 20^(th) from the right end.

→ Daniel is 26^(th) from the right end.

→ Daniel is exactly between Ruman and Om.

→ Om is 14^(th) from the left end.

Step 1:

Difference between Daniel and Ruman:

26 - 20 = 6

So, Daniel is 6 places away from Ruman.

Step 2:

Since Daniel is exactly between Ruman and Om, Om will also be 6 places away from Daniel.

Om's position from the right end:

26 + 6 = 32

Step 3:

Om is 14^(th) from the left end and 32^(nd) from the right end.

Total people = Left position + Right position - 1

= 14 + 32 - 1

= 45

Therefore, there are 45 people in the row.

Hence, the correct answer is "Option 1".

Q54. Answer: (d) 26

Given:

Rekha ranked 18^(th) from the top and 9^(th) from the bottom.

Formula used:

Total students = Rank from top + Rank from bottom - 1

Calculation:

= 18 + 9 - 1

= 27 - 1

= 26

Therefore, there are 26 students in the class.

Hence, the correct answer is "Option 4".

Q55. Answer: (c) 33

Logic followed here is: Mathematical signs are interchanged as per the given instructions, and the equation is solved using the BODMAS rule (Brackets, Orders, Division, Multiplication, Addition, Subtraction).

Signs interchange:

•	−	×	÷
↓	↓	↓	↓
−	•	÷	×

Given equation:

11 ÷ 3 + 24 × 4 − 1 = ? + 5

After interchanging the signs:

11 × 3 − 24 ÷ 4 + 1 = ? − 5

=> 33 - 6 + 1 = ? - 5

=> 34 - 6 = ? - 5

=> 28 + 5 = ?

Therefore, the value in place of the question mark is 33.

Hence, the correct answer is "Option 3".

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Q56. Answer: (a) 96

Given: 3, 6, 12, 24, 48, ?

The pattern followed here is:

Therefore Following the pattern given above 96 will replace the (?) mark.

Hence, the correct answer is "Option 1".

Q57. Answer: (a) One

Given series:

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

Logic followed:

We need to find even numbers which are:

→ Immediately preceded by an even number

→ Immediately followed by an even number

Pattern: Even Number → Even Number → Even Number

Checking the series:

2 6 9 1 2 5 7 2 5 2 2 4 7 9 3 2 5 4 1 4 9 9 1 8 9

Only the middle digit 2 in the pattern 2 2 4 satisfies the condition.

Therefore, there is One such even number.

Hence, the correct answer is "Option 1".

Q58. Answer: (c) FEAR - ERAF - RAEF

Logic followed here is: The letters in the first word of the triad are rearranged in a specific positional pattern to form the second and third words.

Pattern:

If the letters of the first word are numbered as 1, 2, 3, 4:

1. The second word follows the sequence: 2 - 4 - 3 - 1

2. The third word follows the sequence: 4 - 3 - 2 - 1 (Reverse of the first word)

For INFO - NOFI - OFNI

Word	1	2	3	4
INFO	I	N	F	O
NOFI (2-4-3-1)	N	O	F	I
OFNI (4-3-2-1)	O	F	N	I

For WAKE - AEKW - EKAW

Word	1	2	3	4
WAKE	W	A	K	E
AEKW (2-4-3-1)	A	E	K	W
EKAW (4-3-2-1)	E	K	A	W

The pattern observed is: Word 1 (1234) → Word 2 (2431) → Word 3 (4321).

Similarly, let's check the options:

Option (3) FEAR - ERAF - RAEF:

Word	1	2	3	4
FEAR	F	E	A	R
ERAF (2-4-3-1)	E	R	A	F
RAEF (4-3-2-1)	R	A	E	F

Therefore, the triad 'FEAR - ERAF - RAEF' follows the same logic.

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Q59. Answer: (c) (15, 33, 24)

Logic followed here is:

Second number : (1st Number × 2) + 3

Third number : 2nd Number - 9

Set 1 (8, 19, 10) →

1st	2nd	3rd
8	19	10

2nd Number = (1st Number × 2) + 3 = (8 × 2) + 3 = 19

3rd Number = 2nd Number - 9 = 19 - 9 = 10

Set 2 (13, 29, 20) →

1st	2nd	3rd
13	29	20

2nd Number = (1st Number × 2) + 3 = (13 × 2) + 3 = 29

3rd Number = 2nd Number - 9 = 29 - 9 = 20

Similarly,

Option 3 (15, 33, 24):

1st	2nd	3rd
15	33	24

2nd Number = (15 × 2) + 3 = 33

3rd Number = 33 - 9 = 24

Therefore, the set related in the same way is (15, 33, 24).

Hence, the correct answer is "Option 3".

Q60. Answer: (a) 15

Logic followed here is: The value of the equation is determined by replacing the given symbols with their actual mathematical operators and then solving the expression using the BODMAS rule.

Symbol Replacement Table:

Given Symbol	•	–	×	÷
Actual Operator	−	×	÷	•

Given Equation:

6 − 3 + 32 × 4 ÷ 5 = ?

After replacing the signs as per the table above, the equation becomes:

6 × 3 − 32 ÷ 4 + 5

Applying BODMAS rule:

=> (6 × 3) - (32 ÷ 4) + 5 = ?

=> 18 - 8 + 5 = ?

=> 23 - 8 = ?

=> 15 = ?

Therefore, the value that will come in place of the question mark is 15.

Hence, the correct answer is "Option 1".

Q61. Answer: (b) 7

Given numbers:

741, 753, 789, 761, 745

Step 1:

Arrange the numbers in descending order: 789, 761, 753, 745, 741

Step 2:

The second highest number is 761.

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Second digit of 761 = 6
Step 3:
The lowest number is 741.
Third digit of 741 = 1
Step 4:
Required result: 6 + 1 = 7
Therefore, the result is 7.
Hence, the correct answer is "Option 2".

Q62. Answer: (a) 9 km to the south

Given:
→ Mr. Akai starts from Point A and drives 28 km towards west.
→ Takes a left turn and drives 21 km.
→ Turns right and drives 5 km.
→ Turns right again and drives 30 km.
→ Takes a final right turn and drives 33 km to reach Point P.
Step-by-step movement:
Final Position:
→ East-West movement cancels out.
→ North-South movement = 30 − 21 = 9 km north
So Point P is 9 km north of Point A.
To reach Point A again:
Mr. Akai must travel 9 km towards south.
Hence, the correct answer is "Option 1".

Q63. Answer: (d) NVS

Given Series: FNK HPM JRO LTQ ?
The pattern followed here is:
Therefore After following the pattern NVS will replace the (?) mark.
Hence, the correct answer is "Option 4".

Q64. Answer: (b) 4 km towards the north

Given:
→ Jyoti starts from Point L and drives 8 km towards north.
→ Takes a right turn and drives 14 km.
→ Turns right again and drives 15 km.
→ Takes another right turn and drives 14 km.
→ Takes a final right turn and drives 3 km to reach Point P.
Step-by-step movement:
Final Position:
→ East-West movement cancels out.
→ North-South movement = 8 + 3 − 15 = −4
So Point P is 4 km south of Point L.
To reach Point L again:
Jyoti must travel 4 km towards north.
Hence, the correct answer is "Option 2".

Q65. Answer: (d) Two

Given:
→ Six people A, B, C, D, E and F are sitting in a row facing north.
→ A sits third to the left of E.
→ E sits second to the left of F.
→ D sits to the immediate right of E.

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→ B sits to the immediate left of C.
C is at position 3 and F is at position 6.
People sitting between C and F:
→ E and D
So, 2 people sit between C and F.
Hence, the correct answer is "Option 4".

Q66. Answer: (a) OLI 97

Given Series: WTQ 69 URO 76 SPM 83 QNK 90 ?
The pattern followed here is:
Therefore After following the pattern OLI 97 will replace the (?) mark.
Hence, the correct answer is "Option 1".

Q67. Answer: (d) None

Given Conditions:
→ A sits second from one of the extreme ends.
→ Only two people sit between A and C.
→ B sits to the immediate right of C.
→ Only one person sits between B and D.
→ F sits third to the left of D.
→ E sits to the right of G.
A is at position 2 and G is at position 3.
No person sits between A and G.
Hence, the correct answer is "Option 4 - None".

Q68. Answer: (d) Mother’s mother

Given:
→ P + Q means P is the father of Q
→ P # Q means P is the wife of Q
→ P & Q means P is the brother of Q
→ P % Q means P is the sister of Q
Expression:
O # G + N # T + L
Step-by-step decoding:
→ O # G = O is the wife of G
→ G + N = G is the father of N
→ N # T = N is the wife of T
→ T + L = T is the father of L
Family Structure:
Therefore, O is the mother’s mother of L.
Hence, the correct answer is "Option 4".

Q69. Answer: (a) 5

Given:
→ ‘LEMA’ is coded as ‘6389’
→ ‘PALM’ is coded as ‘3596’
Therefore: P = 5
Hence, the correct answer is "Option 1".

Q70. Answer: (a) Only conclusion (II) follows.

Given Statements:
All pencils are erasers.
Some erasers are crayons.
Venn Diagram Representation:

Conclusions:

(I) Some pencils are crayons: Does not follows (becasuse, No direct relation is given between pencils and crayons.)

(II) Some erasers are pencils: Follows (because, All pencils are erasers.At least some erasers are pencils.)

Therefore Only conclusion (II) follows.

Hence, the correct answer is "Option 1".

Q71. Answer: (d) SPIN - NSIP - SNPI

Given Triads:

DIGS → SDGI → DSIG

WAVE → EWVA → WEAV

Observe the pattern:

Step 1: Move the last letter to the first position.

DIGS → SDGI

WAVE → EWVA

Step 2: From the new word, swap the 2nd and 3rd letters.

SDGI → DSIG

EWVA → WEAV

Check the options:

Option 4:

SPIN → NSIP

→ Last letter moved to first

NSIP → SNPI

→ Swap 2nd and 3rd letters

Hence, the correct answer is "Option 4".

Q72. Answer: (c) INE

Logic followed here is: The pattern followed here is based on the positional values of the letters in the English alphabetical order. In three of the options, the difference between the first and second letter is +4, and the difference between the second and third letter is -7.

Option (1): QUN →

Option (2): UYR →

Option (3): INE →

Option (4): OSL →

The observed pattern is (+4, -7) for all options except INE.

Hence, the correct answer is "Option 3".

Q73. Answer: (d) 22

Given Series: 1408, 704, 176, 88, ?, 11

The pattern followed here is:

Therefore According to the logic followed 22 will come in place of (?) mark.

Hence, the correct answer is "Option 4".

Q74. Answer: (c) 4

Given:

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

We need to find the even digits which are:

Immediately preceded by an odd digit and immediately followed by an odd digit.

Required pattern: Odd digit → Even digit → Odd digit

Checking the series:

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

The even digits satisfying the condition are:

2 in (5 2 7)

4 in (7 4 7)

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8 in (7 8 3)

6 in (5 6 7)

Therefore, there are 4 such even digits.

Hence, the correct answer is "Option 3".

Q75. Answer: (c) U

Given:

→ A, B, C, R, S, T and U are sitting around a circular table facing the centre.

→ Only three people sit between R and T when counted from the left of R.

→ Only three people sit between B and A when counted from the right of A.

→ S sits to the immediate right of B.

→ U is an immediate neighbour of both A and T.

From C, move two places left:

→ First left = T

→ Second left = U

Hence, the correct answer is "Option 3 - U".

Q76. Answer: (c) Neither follows

Given Statements:

Some moons are stars.

Some stars are planets.

Venn Diagram Representation:

Conclusions:

(I) All stars are moons: Does not follows(because, the statement says only some moons are stars and It does not mean all stars are moons.)

(II) Some moons are planets: Does not follows (because, Some moons are stars and some stars are planets.But there is no definite relation given between moons and planets.)

Therefore Neither conclusion (I) nor (II) follows.

Hence, the correct answer is "Neither conclusion (I) nor (II) follows."

Q77. Answer: (c) VQ 39

Logic followed here is: The first letter is shifted forward by 3, the second letter is shifted forward by 4, and the numerical value is increased by 4.

QK 13 is related to TO 17 →

IC 24 is related to LG 28 →

Similarly, let's find the relation for SM 35:

Therefore, the related term for 'SM 35' is VQ 39.

Hence, the correct answer is "Option 3".

Q78. Answer: (c) 98

Shortcut Trick

Observe the pattern of the series: it is a decreasing series.

The difference between consecutive terms is constant.

Common difference = 188 − 170 = 18.

Applying the same logic to the last term: 116 − 18 = 98.

Therefore The correct answer is 98.

Alternate Method

Given series: 188, 170, 152, 134, 116, ?

188

−18

→

170

−18

→

152
−18
→
134
−18
→
116
−18
→
98

The pattern follows a constant subtraction of 18 from each preceding number.

=> 188 − 18 = 170

=> 170 − 18 = 152

=> 152 − 18 = 134

=> 134 − 18 = 116

=> 116 − 18 = 98

Therefore The correct answer is 98.

Additional Information

Arithmetic Progression (AP) Series

A sequence where the difference between any two consecutive terms is constant, known as the common difference (d).

General Term of AP

The n^(th) term can be calculated using the formula: a_n = a1 + (n − 1)d, where a1 is the first term.

Decreasing Number Series

In a decreasing series, the common difference is negative (d < 0), meaning each subsequent term is smaller than the previous one.

Q79. Answer: (d) 375

Logic followed here is: Replace the letters in the expression with their respective mathematical signs and then solve the resulting equation using the BODMAS rule.

The signs are coded as follows:

A	B	C	D
÷	×	•	–

Given Expression: 88 B 3 D 615 A 15 C 152 = ?

After replacing the letters with their respective signs, the equation becomes:

88 × 3 - 615 ÷ 15 + 152

Applying the BODMAS rule (Bracket, Orders, Division, Multiplication, Addition, Subtraction):

=> 264 - 41 + 152 = ?

=> 416 - 41 = ?

=> 375 = ?

Therefore, the value that will come in place of the question mark is 375.

Hence, the correct answer is "Option 4".

Q80. Answer: (d) 2

Given Series:

(Left) € # 6 2 @ # 1 6 @ 1 € $ 3 9 $ 2 4 4 * £ 6 6 (Right)

Condition:

Find the symbols which are:

→ Immediately preceded by a number

→ Immediately followed by a number

Required pattern: Number → Symbol → Number

Checking the series:

€ # 6 2 @ # 1 6 @ 1 € $ 3 9 $ 2 4 4 * £ 6 6

The symbols satisfying the condition are:

@ in (6 @ 1)

$ in (9 $ 2)

Total valid symbols = 2

Hence, the correct answer is "Option 4".

Q81. Answer: (b) 21 November 2025

The correct answer is 21 November 2025.

Key Points

• The Union Government of India has consolidated 29 existing central labour laws into four comprehensive Labour Codes to simplify and modernize the regulatory framework for the workforce.

• These reforms are scheduled to be fully effective from 21 November 2025, establishing a unified commencement date for the new legal regime across the country.

• The overhaul aims to improve the Ease of Doing Business in India while ensuring better social security and working conditions for over 50 crore workers in both the organized and unorganized sectors.

• The Ministry of Labour and Employment spearheaded this initiative to replace archaic laws, some of which date back to the 1920s and 1940s, with a more contemporary legislative structure.

• As Labour is a subject under the Concurrent List (List III) of the Seventh Schedule of the Constitution of India, both the Central Government and State Governments have the authority to draft rules under these codes. Hence, the correct answer is 21 November 2025.

Additional Information

• The Four Labour Codes:

• Code on Wages, 2019: This was the first code to be passed by Parliament in August 2019. It replaces four major acts: the Minimum Wages Act, 1948, the Payment of Wages Act, 1936, the Payment of Bonus Act, 1965, and the Equal Remuneration Act, 1976. It introduces a National Floor Level Minimum Wage to be set by the Central Government.

• Industrial Relations Code, 2020: It consolidates laws relating to Trade Unions, conditions of employment, and settlement of industrial disputes. Notably, it increases the worker threshold for requiring government permission before retrenchment or closure from 100 to 300 workers.

• Social Security Code, 2020: This code integrates nine laws, including the Employees' Provident Fund Act and the Maternity Benefit Act. For the first time, it provides a legal framework for social security for gig workers and platform workers.

• Occupational Safety, Health and Working Conditions Code, 2020: It streamlines 13 laws related to the health and safety of workers. It mandates annual health check-ups for certain categories of employees and simplifies the registration process for establishments.

Important Points

• Impact on Wages: The new codes introduce a uniform definition of "wages" across all four legislations. This change is expected to impact take-home pay and provident fund (PF) contributions, as allowances are now capped at 50% of the total salary.

• Digitalization: The government has promoted the Shram Suvidha Portal to facilitate online registration, filing of returns, and transparent inspections, reducing the Inspector Raj system.

• Fixed-Term Employment: The codes provide for Fixed Term Employment (FTE), allowing companies to hire workers for a specific duration with the same statutory benefits as permanent employees, thereby increasing labor flexibility.

• Gender Equality: The codes mandate that women are entitled to work in all types of establishments, including at night (with their consent and safety measures), and prohibit gender-based discrimination in wages for the same work.

Q82. Answer: (a) Code on Social Security, 2020

The correct answer is Code on Social Security, 2020.

Key Points

• The Code on Social Security, 2020 is a landmark legislation that aims to extend social security to all employees and workers in both the organized and unorganized sectors.

• It consolidates and replaces nine central labor laws, including the Employees' Provident Funds and Miscellaneous Provisions Act, 1952, the Maternity Benefit Act, 1961, and the Payment of Gratuity Act, 1972.

• A significant feature of this Code is the inclusion of gig workers and platform workers under the ambit of social security schemes for the first time in India.

• The Code empowers the Central Government to set up a Social Security Fund to provide death and disability cover, health and maternity benefits, and old age protection for unorganized workers.

• It strengthens women-centric provisions by ensuring maternity benefits and allowing women to work in all establishments at night (between 7 PM and 6 AM) subject to their consent and safety conditions provided by the employer.

Additional Information

• Code on Wages, 2019:

• This Code was the first of the four labor codes to be passed. It amalgamates four acts: the Payment of Wages Act, Minimum Wages Act, Payment of Bonus Act, and Equal Remuneration Act.

• It aims to universalize the provisions of minimum wages and timely payment of wages to all employees, irrespective of the sector and wage ceiling.

• Industrial Relations Code, 2020:

• This Code merges three laws: the Trade Unions Act, 1926; the Industrial Employment (Standing Orders) Act, 1946; and the Industrial Disputes Act, 1947.

• It introduces the concept of fixed-term employment and seeks to streamline dispute resolution and labor relations in industrial establishments.

• Occupational Safety, Health and Working Conditions Code, 2020:

• It consolidates 13 central labor laws relating to the safety, health, and working conditions of workers.

• It applies to establishments with 10 or more workers and includes specific provisions for inter-state migrant workers and audio-visual workers.

Important Points

• Gig Workers and Platform Workers: Under the 2020 Code, a gig worker is defined as a person who performs work or participates in a work arrangement and earns from such activities outside of the traditional employer-employee relationship.

• e-Shram Portal: The Ministry of Labour and Employment launched this portal in 2021 to create a national database of unorganized workers (including migrants and gig workers) to facilitate the delivery of social security benefits.

• Maternity Benefit Enhancements: While the core entitlement remains 26 weeks of paid leave (as per the 2017 amendment integrated into the Code), the new Code ensures broader compliance and easier access for women across various sectors.

• Gratuity Eligibility: The Code reduces the eligibility period for gratuity for certain classes of employees, particularly those in fixed-term employment, where it is paid on a pro-rata basis even if the five-year service requirement is not met.

Q83. Answer: (a) 11

The correct answer is 11.

Key Points

• The Indian AI startup Sarvam AI launched a sophisticated text-to-speech (TTS) model in May 2025 (as per recent industry roadmaps) that supports a total of 11 languages.

• This AI model is designed to provide high-quality, natural-sounding voice synthesis for the Indian population, focusing on the unique linguistic nuances of the subcontinent.

• The 11 languages covered by the model include English and 10 major Indian languages: Hindi, Bengali, Gujarati, Kannada, Malayalam, Marathi, Odia, Punjabi, Tamil, and Telugu.

• The primary goal of this launch is to enable voice-first applications, making technology more accessible to people who prefer or require audio-based interactions in their native tongue.

• By supporting 11 languages, Sarvam AI aims to bridge the digital divide and foster digital inclusion across various states in India.

• Hence, the correct answer is 11.

Additional Information

• Sarvam AI:

• It is a Bengaluru-based AI startup founded by Vivek Raghavan and Pratyush Kumar, who were instrumental in the AI4Bharat initiative.

• The company focuses on developing a "full-stack" for Generative AI tailored specifically for India's diverse needs.

• Sarvam AI has received significant backing, including a $41 million Series A funding round led by Lightspeed Venture Partners, Peak XV Partners, and Khosla Ventures.

• Model Characteristics:

• The TTS model is optimized for low latency and high-quality prosody, ensuring that the synthesized speech sounds human-like rather than robotic.

• It is part of a broader suite of models, including Large Language Models (LLMs) and speech-to-text tools, intended to build sovereign AI capabilities for India.

• Prior to the TTS model, the company released OpenHathi, which was the first Hindi-focused LLM built on top of Meta's Llama 2.

Important Points

• Indic AI Ecosystem:

• The development of models in 11 languages is a significant milestone for Indic AI, as most global models primarily focus on Western languages.

• Data Diversity: The training involves massive Indic datasets to capture regional accents and dialects accurately.

• Use Cases: These models are being applied in sectors like customer service (IVR), education (audiobooks), banking, and government service delivery.

• Strategic Importance: Strengthening domestic AI capabilities reduces reliance on foreign tech giants and ensures data privacy within national borders under the Digital Personal Data Protection (DPDP) Act framework.

Q84. Answer: (a) reported to a centralised portal

The correct answer is reported to a centralised portal.

Key Points

• The Reserve Bank of India (RBI) has issued a directive requiring all Regulated Entities (REs), which include Commercial Banks, Non-Banking Financial Companies (NBFCs), and Cooperative Banks, to report their Digital Lending Apps (DLAs) to a centralised portal.

• This regulation is mandated to be fully implemented by 13 May 2025, aiming to create a structured and transparent digital credit market in India.

• The primary objective of this portal is to serve as a verifiable repository where customers can confirm the legitimacy of a lending app before engaging in financial transactions. Hence, the option "reported to a centralised portal" is correct.

• By mandating this reporting, the RBI ensures that REs take full responsibility for the DLAs and Lending Service Providers (LSPs) they partner with, preventing the proliferation of unauthorized third-party apps.

• This move is a direct response to the rising number of illegal lending apps that have been involved in predatory pricing and unethical recovery practices.

Additional Information

• Digital Lending Guidelines (2022): The RBI introduced these guidelines to ensure that all loan repayments and disbursements are made directly between the bank account of the borrower and the RE, without any pass-through or pool accounts of LSPs.

• Key Fact Statement (KFS): Under the digital lending framework, every lender must provide a KFS to the borrower before the loan contract is signed. This document must include the Annual Percentage Rate (APR), which helps borrowers understand the total cost of credit.

• Lending Service Providers (LSPs): These are agents engaged by Regulated Entities to carry out functions such as customer acquisition, underwriting support, and recovery. The new portal will help link these LSPs clearly to their parent REs.

• Grievance Redressal Mechanism: Any DLA must have a clear mechanism for complaints. If a complaint is not resolved within 30 days by the RE, the borrower has the right to approach the Reserve Bank - Integrated Ombudsman Scheme (RB-IOS).

• Data Privacy and Consent: DLAs are prohibited from accessing mobile data such as contacts, media, or call logs. They can only collect data that is strictly necessary for the credit assessment, and only with the explicit prior consent of the borrower.

Important Points

• Combatting Fraud: The centralised portal acts as a "whitelist." If an app is not listed on the portal by 13 May 2025, it will be considered unauthorized, providing law enforcement agencies a clear basis for taking down fraudulent apps.

• Financial Stability: By bringing all Digital Lending Apps under a reporting framework, the RBI can better monitor the systemic risks associated with the rapid growth of FinTech and digital credit.

• Customer Awareness: The mandate empowers users to perform due diligence. It is recommended that borrowers always check the RBI-approved list before sharing personal information or accepting a loan offer.

• Role of DIGITA: The RBI has also proposed the creation of the Digital India Trust Agency (DIGITA) to further strengthen the verification process and curb the menace of "mule accounts" and illegal lending platforms.

Q85. Answer: (d) Assam

The correct answer is Assam.

Key Points

• Ruellia elegans, commonly known as the Brazilian Petunia or Red Ruellia, has emerged as a significant ecological concern in the state of Assam in 2025.

• It is classified as an Invasive Alien Species (IAS) that has begun to spread rapidly across the forest floors and protected areas of the state, competing with indigenous flora.

• While originally introduced to India as an ornamental plant due to its vibrant red flowers, it has escaped cultivation and established itself in the wild, particularly in the moist and fertile regions of North-East India.

• The concern in 2025 stems from observations by botanists and environmentalists that the plant is displacing native ground-cover species, which serves as a critical food source for local herbivores.

• The rapid proliferation of Ruellia elegans is particularly alarming for the biodiversity hotspots in Assam, where maintaining the balance of native ecosystems is vital for endangered wildlife.

Additional Information

• Origin and Characteristics:

• Ruellia elegans is native to Brazil (South America). It is a perennial herb known for its tubular, bright red blooms that attract pollinators like butterflies and hummingbirds in its native range.

• In India, it thrives in tropical and subtropical climates, reaching a height of about 1 to 2 feet. Its ability to grow in both full sun and partial shade allows it to invade diverse habitats ranging from open grasslands to dense forest understories.

• Invasive Mechanisms:

• The plant spreads through high seed production and can also propagate vegetatively. Once established, it forms dense mats that prevent the sunlight from reaching the seeds of native plants, effectively halting their germination.

• In Assam, the absence of natural biological predators that exist in its native Brazilian habitat allows the species to grow unchecked.

• Impact on Wildlife Sanctuaries:

• States like Assam host critical habitats like Kaziranga National Park and Manas National Park. Invasive species like Ruellia elegans, Lantana camara, and Chromolaena odorata threaten the grassland ecosystems required by the One-horned Rhinoceros and the Wild Water Buffalo.

• The Assam Forest Department and various NGOs have been working in 2025 to map the extent of this invasion to initiate restoration projects.

• Legal and Regulatory Framework:

• The National Biodiversity Authority (NBA) of India and the Ministry of Environment, Forest and Climate Change (MoEFCC) are the primary bodies responsible for identifying and managing Invasive Alien Species.

• Under the Biological Diversity Act, 2002, states are encouraged to form Biodiversity Management Committees (BMCs) to monitor and control the spread of non-native species that threaten local biological diversity.

Important Points

• The identification of Ruellia elegans as a threat in Assam highlights the growing challenge of "Green Invasions" where beautiful ornamental plants become ecological disasters.

• Management strategies discussed in 2025 include manual uprooting before the flowering season (to prevent seed dispersal) and conducting awareness programs for local nurseries to discourage the sale of invasive varieties.

• Other states in India, such as Kerala and Chhattisgarh, also face threats from different invasive species, but the specific concern regarding Ruellia elegans in 2025 is most prominent in the Assam region due to its unique climatic suitability for this South American species.

Q86. Answer: (d) Five

The correct answer is Five.

Key Points

• In March 2025, the Reserve Bank of India (RBI) issued a notification regarding the financial management of Regional Rural Banks (RRBs).

• The RBI granted an additional five years, starting from the financial year 2024-25, to amortise the additional expenditure arising from the revision in pensions.

• This decision was taken to mitigate the sudden financial burden on the Balance Sheets of RRBs, which could otherwise lead to a sharp decline in their profitability and capital adequacy.

• The amortisation provision allows these banks to spread the total pension liability cost over a period of five years in equal installments, rather than charging the entire amount to the Profit and Loss account in a single year.

• The move follows representations made by the RRB sector regarding the high cost of implementing pension parity with Nationalised Banks, a requirement mandated by legal and administrative rulings.

Additional Information

• Regional Rural Banks (RRBs):

• RRBs were established under the provisions of an Ordinance passed in September 1975 and the RRB Act, 1976.

• They were created based on the recommendations of the Narasimham Working Group to provide banking and credit facilities for agriculture and other rural sectors.

• The equity of an RRB is held by the Central Government (50%), the Sponsor Bank (35%), and the State Government (15%).

• Amortisation in Banking:

• In accounting, amortisation refers to the practice of spreading an intangible asset's cost or a large liability over its useful life or a specific period.

• For RRBs, amortising pension costs helps maintain a stable Capital to Risk-weighted Assets Ratio (CRAR), ensuring they meet regulatory requirements.

• Regulatory Framework:

• While the Reserve Bank of India (RBI) sets the monetary policy and broad prudential norms, NABARD (National Bank for

Agriculture and Rural Development) is responsible for the supervision and inspection of RRBs.

Important Points

• Pension Parity Issue: The demand for equal pension benefits for RRB employees compared to their counterparts in Public Sector Banks (PSBs) was a long-standing issue, eventually settled by the Supreme Court of India in 2018.

• Financial Impact: The total liability for pension revisions is substantial for many RRBs, especially those with a high number of retirees and limited operating profits.

• Disclosure Norms: Banks opting for this amortisation are required to make full disclosure of the unamortised amount in the 'Notes to Accounts' section of their Annual Financial Statements.

• FY 2025 Significance: The permission to start the five-year window from FY 2024-25 provides immediate relief to banks preparing their year-end audits for the March 2025 closing.

Q87. Answer: (a) Ministry of Statistics and Programme Implementation

The correct answer is Ministry of Statistics and Programme Implementation.

Key Points

• The Ministry of Statistics and Programme Implementation (MoSPI) released the Sustainable Development Goals – National Indicator Framework (NIF) Progress Report, 2025 in June 2025.

• The release of this report is traditionally scheduled to coincide with National Statistics Day, celebrated on June 29 every year to mark the birth anniversary of Prof. P.C. Mahalanobis.

• The National Indicator Framework (NIF) serves as the primary institutional tool for monitoring the progress of Sustainable Development Goals (SDGs) at the national level in India.

• MoSPI acts as the nodal ministry for the development and maintenance of the NIF, ensuring that data is collected from various line ministries to track India's journey toward the 2030 Agenda.

• The 2025 Progress Report provides a detailed statistical analysis of the 17 SDGs, highlighting achievements and identifying gaps in areas such as poverty reduction, health, education, and climate action.

Additional Information

• Sustainable Development Goals (SDGs): These consist of 17 goals and 169 targets adopted by all United Nations Member States in 2015, providing a shared blueprint for peace and prosperity for people and the planet.

• Prof. Prasanta Chandra Mahalanobis: Recognized as the father of modern statistics in India, his contributions include the Mahalanobis distance and the establishment of the Indian Statistical Institute (ISI).

• NITI Aayog's Role: While MoSPI is responsible for the statistical framework (NIF), NITI Aayog is responsible for the overall coordination of SDGs and publishes the SDG India Index, which ranks States and Union Territories.

• Data Sources: The NIF Progress Report relies on high-quality data from various sources, including the National Family Health Survey (NFHS), Periodic Labour Force Survey (PLFS), and administrative data from central ministries.

• Global Indicator Framework (GIF): The Indian NIF is developed in alignment with the Global Indicator Framework but is tailored to suit the national context and priorities of the Indian government.

Important Points

• Institutional Framework: The monitoring of SDGs in India is overseen by a High-Level Steering Committee (HLSC) chaired by the Chief Statistician of India, which periodically reviews and refines the indicators in the NIF.

• The 2030 Deadline: As the year 2025 represents a critical juncture, this report is vital for assessing whether India is on track to meet the 2030 targets set by the United Nations.

• SDG 1 to 17: The report covers a wide spectrum of development, ranging from No Poverty (Goal 1) and Zero Hunger (Goal 2) to Partnerships for the Goals (Goal 17).

• Statistics Day Theme: Each year, National Statistics Day is celebrated with a specific theme related to current statistical challenges; the 2025 theme typically focuses on data for sustainable development.

Q88. Answer: (d) Turkey

The correct answer is Turkey.

Key Points

• In August, the Government of Turkey suspended maritime traffic in the Dardanelles Strait due to intense forest fires raging in the Çanakkale province.

• The Ministry of Transport and Infrastructure of Turkey announced the temporary closure to facilitate firefighting aircraft and helicopters to safely scoop water from the strait to combat the blazes. Hence, the statement regarding Turkey's involvement is correct.

• The forest fires in Çanakkale were driven by high temperatures, low humidity, and strong winds, which are common during the summer season in the Mediterranean region.

• The Dardanelles, a vital waterway for global trade, connects the Aegean Sea to the Sea of Marmara and serves as a primary

route for oil and grain tankers coming from the Black Sea.

• Authorities evacuated several villages and universities in the vicinity of Çanakkale to ensure the safety of the residents as the fire spread toward the city center.

Additional Information

• Geography of the Dardanelles Strait:

• The Dardanelles, historically known as the Hellespont, is a narrow, natural strait located in northwestern Turkey.

• It forms part of the continental boundary between Europe and Asia, separating the Gallipoli peninsula in Europe from the Biga peninsula in Asia.

• The strait is approximately 61 kilometers (38 miles) long and varies in width from 1.2 to 6.5 kilometers.

• The Turkish Straits and International Law:

• The Turkish Straits comprise the Dardanelles, the Sea of Marmara, and the Bosphorus strait.

• Transit through these waters is governed by the Montreux Convention Regarding the Regime of the Straits, signed in 1936.

• This international agreement grants Turkey control over the straits and regulates the passage of naval warships while guaranteeing the free passage of civilian vessels in peacetime.

• Strategic and Economic Importance:

• It is one of the world's busiest maritime chokepoints, providing the only access for Black Sea nations (like Ukraine and Russia) to reach the Mediterranean Sea and world markets.

• Major commodities transported through the strait include crude oil, petroleum products, iron, steel, and agricultural products.

• Çanakkale Province:

• Çanakkale is a major port city and province in Turkey, famous for the Gallipoli Campaign of World War I and the ancient city of Troy.

• The province is susceptible to wildfires due to its dense pine forests and the prevailing meltem winds during the summer months.

Important Points

• Environmental Impact: Forest fires in this region lead to significant loss of biodiversity and contribute to carbon emissions, exacerbating climate change concerns in the Eastern Mediterranean.

• Infrastructure: The 1915 Çanakkale Bridge, which opened in 2022, spans the Dardanelles Strait and is the longest suspension bridge in the world, providing a land alternative to the ferry services.

• Emergency Response: Turkey utilizes a fleet of Be-200 amphibious aircraft and T-70 helicopters for aerial firefighting operations during such crises.

Q89. Answer: (a) e-Rakt Kosh

The correct answer is e-Rakt Kosh.

Key Points

• The Central Health Ministry of India announced on 21 June 2025 the integration of the Rare Donor Registry with the existing national online platform for blood management.

• The platform, known as e-Rakt Kosh, serves as a centralized Blood Bank Management System that provides real-time data on blood availability across various hospitals and blood banks in the country. Hence, the correct answer is e-Rakt Kosh.

• The primary objective of this integration is to ensure that patients requiring rare blood groups, such as the Bombay blood group or the Rh-null phenotype, can be matched with donors quickly through a unified digital interface.

• e-Rakt Kosh acts as a comprehensive portal that tracks the entire lifecycle of blood units, from donation to testing, storage, and final transfusion to the patient.

• By incorporating the Rare Donor Registry, the government aims to reduce the mortality rate associated with the unavailability of rare blood types during emergencies and surgeries.

Additional Information

• e-Rakt Kosh Platform:

• It was launched in April 2016 by the Ministry of Health and Family Welfare (MoHFW) to enforce a uniform standard across blood banks in India.

• The system is part of the Digital India initiative and is implemented by the Centre for Development of Advanced Computing (C-DAC).

• It helps in identifying the nearest blood bank and checks the real-time stock of various blood components like plasma, platelets, and packed red blood cells (PRBC).

• Rare Donor Registry in India:

• A Rare Donor is typically defined as someone who lacks an antigen that 99% or more of the general population possesses.

• In India, the National Institute of Immunohaematology (NIIH) under the ICMR has traditionally maintained records of rare blood groups.

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• Integrating this registry with e-Rakt Kosh allows for a Geographic Information System (GIS) based tracking of donors, making it easier for blood bank officers to contact them during a crisis.

• Regulatory Framework:

• Blood bank operations in India are regulated under the Drugs and Cosmetics Act, 1940, and its subsequent rules.

• The National Blood Transfusion Council (NBTC) is the apex body that formulates policy guidelines for blood transfusion services in the country.

Important Points

• Bombay Blood Group: This is an extremely rare blood phenotype (also known as Oh or hh) first discovered in Mumbai (then Bombay) in 1952 by Dr. Y.M. Bhende. People with this group can only receive blood from other hh phenotype individuals.

• Features of the Integration: The 2025 initiative ensures that once a rare donor is identified, they are flagged in the national system, and their privacy is maintained while allowing emergency medical access.

• Other Options: Terms like e-Rakt Kawach, e-Rakt Sagar, and e-Rakt Sanchay are incorrect as they do not represent the official national blood bank management portal recognized by the Indian Government.

• National Health Mission (NHM): The NHM supports the scale-up of e-Rakt Kosh to include district-level and private blood banks to create a seamless supply chain.

Q90. Answer: (d) 5.1%

The correct answer is 5.1%.

Key Points

• According to the monthly data released for April 2025 by the National Statistical Office (NSO), India’s unemployment rate stood at 5.1%.

• The Periodic Labour Force Survey (PLFS) is the primary source of these statistics, designed to estimate key employment and unemployment indicators at more frequent intervals.

• The rate of 5.1% represents the percentage of persons unemployed among the persons in the labour force during the specific reference period of April 2025.

• This data is collected under the Ministry of Statistics and Programme Implementation (MoSPI), which oversees the collection and dissemination of socio-economic data in India.

• The unemployment rate is calculated based on the Current Weekly Status (CWS), which provides a short-term snapshot of the labour market's performance.

Additional Information

• Periodic Labour Force Survey (PLFS):

• Launched in April 2017 by the NSO, the PLFS was established to provide more frequent data on the Indian labour market compared to the previous quinquennial surveys.

• It aims to estimate employment indicators in the short time interval of three months for urban areas only in the CWS and annually for both rural and urban areas.

• Labour Force Participation Rate (LFPR):

• LFPR is defined as the percentage of persons in the labour force (working or seeking work) in the total population. It helps in understanding the size of the workforce available in the economy.

• Worker Population Ratio (WPR):

• The WPR is the percentage of employed persons in the total population. This indicator is a direct measure of the level of employment in the country.

• Current Weekly Status (CWS):

• In this approach, the activity status of a person is determined based on a reference period of the last 7 days preceding the date of the survey. A person is considered employed if they worked for at least one hour on any day during the reference week.

Important Points

• Methodology: The NSO uses a rotational panel sampling design in urban areas to ensure that the data reflects changes in the labour market accurately over time.

• Significance: Monitoring the unemployment rate monthly or quarterly allows the Government of India to tailor economic policies and social security schemes to address job shortages or sectoral declines.

• Historical Context: Before the introduction of PLFS, the National Sample Survey Office (NSSO) conducted large-scale surveys every five years, which often resulted in a time lag for policy intervention.

• Economic Impact: An unemployment rate of 5.1% in April 2025 serves as a benchmark for comparing the growth of the industrial and service sectors against the increasing population and workforce entry.

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Q91. Answer: (d) Deployment of peacekeepers

The correct answer is Deployment of peacekeepers.

Key Points

• The scheduled event for 27 June 2025 is the Deployment of peacekeepers as part of the implementation phase of the DR Congo–Rwanda agreement.

• This deployment is intended to stabilize the volatile Eastern Democratic Republic of Congo, particularly in the North Kivu province, where fighting has been intense between the FARDC (Congolese army) and the M23 rebel group.

• The agreement represents a critical milestone in the Luanda Process, a diplomatic effort mediated by Angola to mend the fractured relationship between Kinshasa and Kigali.

• The peacekeepers are tasked with supervising the disengagement of forces and ensuring that a buffer zone is maintained to prevent direct military confrontations between the two nations' proxies or armies.

• This specific date was set during high-level diplomatic sessions held in 2024 and early 2025 to provide a concrete timeline for transitioning from a fragile ceasefire to a monitored security arrangement.

Additional Information

• Geopolitical Context:

• The Democratic Republic of the Congo (DRC) has long accused Rwanda of providing military support to the M23 (March 23 Movement), a claim supported by reports from the United Nations Group of Experts.

• Conversely, Rwanda has raised security concerns regarding the presence of the FDLR (Democratic Forces for the Liberation of Rwanda), an ethnic Hutu rebel group operating within the DRC territory.

• The Luanda and Nairobi Processes:

• The Luanda Process, led by Angolan President João Lourenço, focuses on the interstate relationship between DRC and Rwanda.

• The Nairobi Process, facilitated by the East African Community (EAC), primarily addresses the internal dialogue between the DRC government and various local armed groups.

• Regional Peacekeeping Forces:

• The Southern African Development Community (SADC) deployed a mission known as SAMIDRC in December 2023 to support the DRC government.

• The United Nations mission, MONUSCO, which has been in the country for over two decades, began its phased withdrawal in 2024, making the 2025 deployment of new regional peacekeepers vital for filling the security vacuum.

• Humanitarian Impact:

• The conflict in the Great Lakes region has resulted in one of the world's worst humanitarian crises, with over 7 million people internally displaced within the DRC as of 2024.

• The June 2025 deployment is seen as a prerequisite for the safe repatriation of refugees and the delivery of humanitarian aid to besieged towns like Sake and Goma.

Important Points

• Sovereignty and Borders: The agreement emphasizes the respect for the territorial integrity of the DRC and the sanctity of colonial-era borders established in the 19th century.

• Economic Significance: The Eastern DRC is rich in critical minerals such as cobalt, coltan, and gold. Stability in the region is essential for global supply chains, as the DRC produces approximately 70% of the world's cobalt.

• Monitoring Mechanisms: The deployment scheduled for 27 June 2025 includes the use of Ad Hoc Verification Mechanisms led by Angolan military officers to investigate border violations and ceasefire breaches.

Q92. Answer: (a) Uttar Pradesh

The correct answer is Uttar Pradesh.

Key Points

• The 11th National Conference on Women, organized in May 2025, highlighted groundbreaking strategies for gender-based security, where Uttar Pradesh emerged as a leader with its flagship Mission Shakti initiative.

• The Uttar Pradesh Police showcased Mission Shakti as a successful model initiative, emphasizing its three core pillars: Suraksha (Safety), Samman (Dignity), and Swavalamban (Self-reliance).

• The presentation at the conference detailed how the mission has transitioned from a periodic campaign to a permanent institutional framework within the state's policing and administrative structure.

• Key highlights of the presentation included the successful deployment of Beat Power (women police beats) and the establishment of dedicated Women Help Desks in all 1,584 police stations of the state.

• The initiative was lauded for its ability to reduce response times for women-related emergencies and for creating a Safe City environment through technological integration. Hence, the correct answer is Uttar Pradesh.

Additional Information

• Origin and Launch of Mission Shakti:

• The mission was originally launched by Chief Minister Yogi Adityanath in October 2020 during the Shardiya Navratri festival to curb crimes against women and children.

• Since its inception, it has undergone multiple phases (Phase 1 to Phase 5), with each phase expanding its scope to include rural outreach and economic empowerment.

• Institutional Framework:

• Pink Booths: Specialized booths have been set up in crowded market areas and outside educational institutions to provide a safe space for women to report issues.

• Pink Patrols: Specialized police units equipped with two-wheelers and four-wheelers dedicated to 24/7 patrolling in sensitive areas to prevent harassment.

• 1090 Women Power Line: A digital platform and toll-free number that allows women to complain about harassment without having to visit a police station.

• Safe City Project Integration:

• Under the Safe City Project, the Uttar Pradesh government has installed thousands of CCTV cameras integrated with AI-based facial recognition and analytics to monitor public spaces.

• It also involves the implementation of "smart" street lighting and the "Safety App" for real-time tracking during emergencies.

Important Points

• Multi-Departmental Coordination: Mission Shakti is not limited to the police; it involves the Department of Women and Child Development, Education, and Social Welfare to promote legal awareness and vocational training.

• Legal Awareness: A significant portion of the mission involves Shakti Pathshala (Shakti Schools), where women are educated about their legal rights, cyber safety, and self-defense techniques.

• Impact Metrics: As of 2024-25, the mission has reached millions of women through grassroots level meetings (Gram Panchayats), significantly increasing the reporting of domestic and public crimes, which indicates a rise in public trust.

Q93. Answer: (d) Vijay Kelkar

The correct answer is Vijay Kelkar.

Key Points

• Dr. Vijay Kelkar, a distinguished economist and former civil servant, was honored with the prestigious Punyabhushan Puraskar in June 2025 for his monumental contributions to the field of economics and public policy in India.

• The Punyabhushan Puraskar, which translates to "Jewel of Pune," is an award established by the Punyabhushan Foundation (Tridal) to recognize eminent personalities who have brought glory to the city of Pune and the nation through their exceptional work.

• The selection for this honor was conducted by a high-level committee, which has historically been chaired by eminent scientists like Dr. Raghunath Mashelkar.

• Dr. Vijay Kelkar is widely acclaimed for his visionary leadership as the Chairman of the 13th Finance Commission, where he played a crucial role in shaping the fiscal federalism of India.

• He is also celebrated as one of the primary architects of the Goods and Services Tax (GST) framework, having headed the Kelkar Task Force that laid the conceptual foundation for indirect tax reforms in the country.

Additional Information

• Career and Designations:

• Dr. Kelkar has held several key positions in the Government of India, including Union Finance Secretary (1998–1999) and Advisor to the Minister of Finance.

• On the international stage, he served as the Executive Director for India, Bangladesh, Bhutan, and Sri Lanka at the International Monetary Fund (IMF) in Washington, D.C.

• He also served as the Director of the United Nations Conference on Trade and Development (UNCTAD).

• Honors and Awards:

• In recognition of his exemplary service to the nation in the field of public affairs, he was conferred with the Padma Vibhushan, India’s second-highest civilian award, in the year 2011.

• Other Distinguished Personalities in the Options:

• C Rangarajan: A former Governor of the Reserve Bank of India (RBI) and Chairman of the 12th Finance Commission. He was awarded the Padma Vibhushan in 2002.

• Arvind Subramanian: An eminent economist who served as the Chief Economic Adviser (CEA) to the Government of India from 2014 to 2018.

• P Chidambaram: A senior politician and lawyer who served as the Union Minister of Finance multiple times, notably during the 2008 global financial crisis.

Important Points

• The Punyabhushan Award Legacy: Instituted in 1989, the award has been previously bestowed upon legendary figures such as Lata Mangeshkar, Pt. Bhimsen Joshi, and Dr. Jayant Narlikar.

• Policy Contributions: Dr. Kelkar chaired the Committee on Revisiting and Revitalizing the Public Private Partnership (PPP) Model of Infrastructure Development in 2015, which provided a roadmap for modernizing India's infrastructure sector.

• Current Roles: He remains active in the intellectual circle of Pune, serving as the President of the Pune International Centre (PIC), a think tank dedicated to policy research and national development.

Q94. Answer: (d) Marileidy Paulino

The correct answer is Marileidy Paulino.

Key Points

• The Dominican Republic sprinter Marileidy Paulino set a new meet record in the women’s 400 m race at the Paris Diamond League (Meeting de Paris).

• She clocked an impressive time of 48.81 seconds, which shattered the previous meet record at the Stade Charléty.

• The event took place on July 7, 2024 (often referenced in competitive cycles for 2024-2025), serving as a crucial precursor to her performance at the Paris Olympic Games.

• By finishing with 48.81 seconds, she finished ahead of elite competitors such as Natalia Kaczmarek of Poland and Salwa Eid Naser of Bahrain.

• This victory solidified her ranking as the World No. 1 in the women's 400 m category heading into the championship season.

Additional Information

• Marileidy Paulino’s Career Highlights:

• Born on October 25, 1996, in Don Gregorio, Dominican Republic, Paulino has become one of the most dominant forces in track and field.

• She won the Gold Medal at the 2024 Paris Olympics with a time of 48.17 seconds, which set a new Olympic Record, breaking the previous mark held since 1996.

• She is a World Champion, having secured the gold at the 2023 World Athletics Championships in Budapest.

• Paulino originally started her athletic career in handball before transitioning to track and field at the age of 18.

• Diamond League Overview:

• The Wanda Diamond League is an elite series of track and field competitions organized by World Athletics.

• It was founded in 2010 to replace the IAAF Golden League and currently consists of 15 meetings held across Europe, Asia, and North America.

• Athletes compete for Diamond Race points throughout the season to qualify for the Diamond League Final.

Important Points

• Technical Stats:

• The 48.81 seconds mark was the fastest time recorded in the Diamond League circuit for that specific leg of the season.

• In the 400 m sprint, any sub-49 second timing is considered world-class, and Paulino consistently maintains this pace.

• Global Impact:

• Paulino's success has inspired a massive surge in athletics participation in the Dominican Republic, making her a national icon.

• She became the first woman from her country to win an individual Olympic gold medal in any sport.

• The women's 400 m world record remains 47.60 seconds, set by Marita Koch in 1985, a target many experts believe Paulino could approach in the 2025 season.

Q95. Answer: (d) Omar Abdullah

The correct answer is Omar Abdullah.

Key Points

• Omar Abdullah was sworn in as the first Chief Minister of the Union Territory of Jammu and Kashmir on October 16, 2024, following the first assembly elections held in the region in a decade.

• He represents the Jammu and Kashmir National Conference (JKNC), which secured a significant victory in the 2024 Legislative Assembly elections held in three phases across September and October 2024.

• As of June 2025, he continues to serve as the head of the government, leading a cabinet that aims to address administrative challenges and advocate for the restoration of statehood for Jammu and Kashmir.

• This election was historic as it was the first since the abrogation of Article 370 and the reorganization of the state into a Union Territory in August 2019.

• The National Conference-Congress alliance formed the government, with Omar Abdullah leading the executive branch after the revocation of President’s Rule, which had been in place since 2018.

Additional Information

• Jammu and Kashmir Reorganisation Act, 2019:

• This landmark legislation passed by the Parliament of India reconstituted the state of Jammu and Kashmir into two separate Union Territories: Jammu and Kashmir (with a legislative assembly) and Ladakh (without a legislative assembly).

• The Act came into effect on October 31, 2019, coinciding with the birth anniversary of Sardar Vallabhbhai Patel.

• Mehbooba Mufti:

• She served as the last Chief Minister of the erstwhile state of Jammu and Kashmir from April 2016 to June 2018.

• She is the president of the Jammu and Kashmir Peoples Democratic Party (JKPDP) and was the first woman to hold the office of Chief Minister in the region.

• Mufti Mohammad Sayeed:

• A veteran politician and founder of the PDP, he served as the Chief Minister of Jammu and Kashmir twice, from 2002 to 2005 and from March 2015 until his death in January 2016.

• He also served as the Union Home Minister of India from 1989 to 1990, becoming the first Muslim to hold that specific portfolio.

• PU Lalduhoma:

• He is a prominent politician from Northeast India, currently serving as the Chief Minister of Mizoram since December 2023.

• He leads the Zoram People's Movement (ZPM) and is a former IPS officer who served in the security detail of Prime Minister Indira Gandhi.

Important Points

• Role of the Lieutenant Governor: In the Union Territory setup of Jammu and Kashmir, the Lieutenant Governor (LG) acts as the constitutional head representing the President of India. The LG maintains control over key subjects such as Public Order and Police.

• Legislative Assembly: The current assembly of the Union Territory has a five-year term. The number of seats was increased following a delimitation exercise completed in 2022, which allocated 43 seats to Jammu and 47 seats to the Kashmir Valley.

• Historical Context: Omar Abdullah previously served as the Chief Minister of the state of Jammu and Kashmir from 2009 to 2014, making him one of the youngest individuals to hold the post at age 38.

Q96. Answer: (b) Narendra Modi

The correct answer is Narendra Modi.

Key Points

• In June 2025, Prime Minister Narendra Modi flagged off India’s first exported locomotive specifically destined for Guinea, marking a historic achievement in the nation's railway sector.

• This locomotive was manufactured under the Make in India initiative, demonstrating the country’s growing prowess in heavy engineering and the production of high-performance railway rolling stock for the global market.

• The export to the West African nation of Guinea is part of a strategic vision to enhance India’s footprint in the Global South and strengthen bilateral trade relations through infrastructure support.

• The flagging-off ceremony highlights the successful implementation of the Atmanirbhar Bharat (Self-Reliant India) mission, where domestic manufacturing units are now capable of meeting international technical standards and specifications.

• The locomotive is designed to support Guinea's logistics and mining operations, particularly for the transport of Bauxite, which is a primary export of the country. Hence, the correct answer is Narendra Modi.

Additional Information

• RITES Limited:

• The export of locomotives and other rolling stock is typically facilitated by RITES Ltd (Rail India Technical and Economic Service), which is a Miniratna (Category-I) Schedule 'A' Public Sector Enterprise under the Ministry of Railways.

• RITES acts as the export arm and provides consultancy services for transport, infrastructure, and related technologies in over 55 countries across Africa, Asia, and Latin America.

• India-Guinea Relations:

• Guinea is a vital partner for India in West Africa, especially concerning energy security and mineral resources. India is one of the largest trading partners of Guinea.

• The provision of Indian railway technology helps Guinea modernize its transport network, which is essential for its economic development and the mining sector.

• Manufacturing Hubs:

• Major production units of Indian Railways, such as the Banaras Locomotive Works (BLW) in Varanasi and the Chittaranjan Locomotive Works (CLW), play a crucial role in manufacturing these export-quality engines.

• The shift toward exporting Diesel and Electric locomotives reflects India's transition from being an importer of railway technology to a net exporter.

• Global Reach of Indian Railways:

• Apart from Guinea, India has successfully exported locomotives, coaches, and wagons to countries like Sri Lanka, Bangladesh, Myanmar, Vietnam, and Mozambique.

• The Ministry of Railways, currently headed by Ashwini Vaishnaw (as of 2024-2025), has been instrumental in modernizing the rail network and promoting the Vande Bharat technology for future international markets.

Important Points

• Technical Customization: Exported locomotives are often customized to match the track gauge (such as Cape Gauge or Standard Gauge) and the specific environmental conditions of the destination country.

• Economic Impact: Such exports contribute significantly to India's Gross Domestic Product (GDP) and help in narrowing the trade deficit by earning valuable foreign exchange.

• Geopolitical Significance: Strengthening infrastructure in African nations through the India-Africa Forum Summit framework fosters long-term diplomatic and strategic partnerships.

Q97. Answer: (b) SDG 8

The correct answer is SDG 8.

Key Points

• SDG 8 aims to "Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all."

• As per the Sustainable Development Goals – National Indicator Framework (NIF) Progress Report, 2025, released in June 2025, the number of recognized start-ups in India saw an exponential rise from 453 in the year 2016 to 34,293 by 2024.

• The growth in entrepreneurship is a direct indicator of Target 8.3 under SDG 8, which focuses on promoting development-oriented policies that support productive activities, job creation, innovation, and the growth of MSMEs.

• This increase in start-ups reflects India's robust innovation ecosystem, which fosters self-employment and contributes significantly to the Gross Domestic Product (GDP) growth of the nation.

• The Ministry of Statistics and Programme Implementation (MoSPI) tracks these indicators to monitor India’s progress toward the 2030 Global Agenda.

Additional Information

• SDG 1 (No Poverty): This goal focuses on ending poverty in all its forms. It includes targets for social protection, access to basic services, and supporting those affected by economic, social, and environmental shocks.

• SDG 4 (Quality Education): This objective ensures inclusive and equitable quality education and promotes lifelong learning opportunities. It tracks literacy rates, school enrollment, and vocational training availability.

• SDG 10 (Reduced Inequalities): This goal aims to reduce inequality within and among countries by improving the regulation of financial markets, encouraging development assistance, and empowering lower-income earners.

• Startup India Initiative: Launched on January 16, 2016, by the Government of India, this flagship initiative was designed to build a strong ecosystem for nurturing innovation and driving sustainable economic growth.

• NITI Aayog: In India, NITI Aayog is the nodal agency responsible for the SDG India Index, which evaluates the progress of States and Union Territories in achieving the Global Goals.

Important Points

• Economic Impact: The rise to over 34,000 start-ups underscores India's position as one of the largest startup hubs globally, providing a foundation for Target 8.2 (achieving higher levels of economic productivity).

• National Indicator Framework (NIF): The NIF is the largest monitoring framework for SDGs in India, consisting of 300+ indicators that align with the Global Indicator Framework.

• Employment Generation: Start-ups play a crucial role in providing decent work for the youth, reducing the unemployment rate, which is a key component of SDG 8 metrics.

Q98. Answer: (a) Armand “Mondo” Duplantis

The correct answer is Armand “Mondo” Duplantis.

Key Points

• Armand “Mondo” Duplantis, the legendary Swedish-American pole vaulter, has been honored as the 2025 Laureus World Sportsman of the Year. This prestigious award recognizes his unparalleled dominance and extraordinary achievements in the sport of Athletics throughout the preceding year.

• During the 2024 season, which served as the qualifying period for this award, Duplantis broke the Pole Vault world record on three separate occasions. He ended the year with a staggering height of 6.26 meters, achieved at the Silesia Diamond League in August 2024.

• One of his most significant highlights was winning the Gold Medal at the Paris 2024 Olympic Games. In front of a capacity crowd at the Stade de France, he not only secured the Olympic title but also set a new Olympic Record and World Record of 6.25 meters during the final. Hence, the statement regarding his victory is correct.

• This victory marks the first time a track and field athlete specializing in a field event has taken home the top honor since the

inception of the awards, highlighting the global impact of his "Mondo-mania" performances.

• The Laureus World Sports Academy, composed of 71 sporting legends, voted for Duplantis over other high-profile nominees, including Formula 1 star Max Verstappen and Real Madrid footballer Jude Bellingham.

Additional Information

• The Laureus World Sports Awards:

• Often referred to as the “Oscars of Sport,” these awards were established in 1999 by founding patrons Daimler and Richemont.

• The first ceremony took place on May 25, 2000, in Monte Carlo, with Nelson Mandela delivering a famous speech about how "sport has the power to change the world."

• The awards celebrate the most remarkable sporting achievements of the calendar year across multiple categories, including World Sportswoman of the Year, World Team of the Year, and World Breakthrough of the Year.

• Profile of Armand Duplantis:

• Born in Lafayette, Louisiana, in November 1999, Duplantis represents Sweden internationally, the home country of his mother.

• He has dominated the Diamond League circuit and holds multiple World Championship titles (2022 and 2023) in addition to his two Olympic Gold medals (Tokyo 2020 and Paris 2024).

• By the age of 25, he has broken the world record ten times, establishing himself as one of the greatest athletes in history.

• Other Notable Nominees:

• Max Verstappen: A three-time Laureus nominee and 2022 winner, who continued his dominance in Formula 1.

• Cristiano Ronaldo: Though a legend of Football, he was not the winner of the 2025 Sportsman category, despite his ongoing record-breaking career in Saudi Arabia.

• Usain Bolt: A four-time winner of the Laureus World Sportsman of the Year (2009, 2010, 2013, 2017), he remains the most decorated athlete in the history of this specific award.

Important Points

• Selection Process: The shortlist is created by a panel of over 1,000 sports journalists from more than 70 countries. The final winner is then selected by a secret ballot of the Laureus World Sports Academy.

• Social Impact: The awards also support the Laureus Sport for Good Foundation, which funds over 250 programs in 40 countries, using sport to tackle social issues such as violence, discrimination, and disadvantage.

Q99. Answer: (d) Dr. Mansukh Mandaviya

The correct answer is Dr. Mansukh Mandaviya.

Key Points

• In May 2025, the Union Minister of Youth Affairs and Sports, Dr. Mansukh Mandaviya, officially launched the Annual Calendar for the Khelo India programme to streamline the nation's sporting events.

• The primary objective of this initiative is to ensure a synchronized schedule for various sports competitions, preventing overlaps between national-level events and international tournaments.

• This structured calendar allows athletes, coaches, and sports federations to plan their training cycles, recovery periods, and peak performance strategies with greater precision.

• The launch is part of a broader strategy to strengthen the sports ecosystem in India, providing a clear roadmap for talent identification and development at the grassroots level.

• By providing an advance timeline for the Khelo India Youth Games, University Games, and Winter Games, the ministry aims to increase participation and professionalize the administrative aspects of Indian sports.

• Dr. Mansukh Mandaviya emphasized that this move is a step toward the vision of Viksit Bharat 2047, where India aims to be among the top sporting nations globally.

Additional Information

• Khelo India Programme:

• The Khelo India (Play India) initiative was launched in 2018 by the Ministry of Youth Affairs and Sports.

• It was designed to revive the sports culture in India by integrating the sporting spirit with the education system and developing high-quality infrastructure.

• The programme identifies talented players in priority sports disciplines and provides them with annual financial assistance of Rs. 5 lakh per annum for 8 years.

• Union Ministry of Youth Affairs and Sports:

• This ministry is the nodal agency for implementing policies related to youth development and sports in India.

• Dr. Mansukh Mandaviya took charge of this ministry (alongside Labour and Employment) in the third term of the NDA government.

• Previous ministers who held this portfolio include Anurag Thakur, Kiren Rijiju, and Rajyavardhan Singh Rathore.

• Components of Khelo India:

• Khelo India Youth Games (KIYG): Aimed at school-level athletes (under-17 and under-21). The first edition was held in New Delhi in 2018.

• Khelo India University Games (KIUG): Aimed at identifying talent in higher education institutions. The inaugural edition took place in Odisha in 2020.

• Khelo India Winter Games: Focused on promoting winter sports in regions like Ladakh and Jammu & Kashmir (Gulmarg).

• Other Options Context:

• Anurag Thakur: Served as the Union Sports Minister prior to the 2024 General Elections.

• Kiren Rijiju: A former Sports Minister known for launching the Fit India Movement in 2019.

• Udhayanidhi Stalin: Currently serves as the Minister for Youth Welfare and Sports Development for the state of Tamil Nadu.

Important Points

• The Annual Calendar initiative is expected to reduce the administrative burden on State Sports Bodies and National Sports Federations (NSFs).

• It facilitates better budgetary allocation and utilization of resources by the Sports Authority of India (SAI).

• By 2025, the government has integrated digital platforms for athlete registration and real-time tracking of the calendar updates, ensuring transparency.

• The initiative also includes specialized slots for the Khelo India Para Games, ensuring inclusivity for divyang athletes within the main sports framework.

Q100. Answer: (b) 247 kg

The correct answer is 247 kg.

Key Points

• Mehak Sharma, representing the host state of Uttarakhand, secured the gold medal in the women's +87 kg weightlifting category during the 38th National Games.

• She achieved a total lift of 247 kg, which not only earned her the top spot on the podium but also established a new national record in this weight class.

• The record-breaking performance included a successful lift of 107 kg in the Snatch segment and a powerful 140 kg lift in the Clean and Jerk segment.

• Her total of 247 kg surpassed previous benchmarks, highlighting the rising standards of Indian weightlifting at the domestic level.

• This feat was achieved in the presence of sports enthusiasts and officials, marking a significant milestone for Uttarakhand sports history. Hence, the correct answer is 247 kg.

Additional Information

• 38th National Games:

• The 38th edition of the National Games of India was hosted by Uttarakhand, featuring over 30 sporting disciplines across various venues in the state.

• The event aims to provide a platform for athletes from all states and Union Territories, as well as the Services Sports Control Board (SSCB), to showcase their prowess.

• Weightlifting Mechanics:

• The sport consists of two main lifts: the Snatch and the Clean and Jerk. The Snatch is a wide-grip lift where the bar is moved from the floor to overhead in one continuous motion.

• The Clean and Jerk is a two-stage lift where the bar is first "cleaned" to the chest and then "jerked" overhead. The total lift is the sum of the best successful attempt in each of these two lifts.

• Weightlifting Categories:

• Athletes compete in specific weight classes to ensure fair competition. The +87 kg category is the highest weight division for women in international and national competitions.

• Prominent Indian weightlifters like Mirabai Chanu (Silver medalist at the Tokyo 2020 Olympics) have brought international acclaim to the sport in India.

• Governing Bodies:

• The Indian Weightlifting Federation (IWLF) is the national governing body for the sport in India, while the International Weightlifting Federation (IWF) oversees rules and global competitions.

• The National Games are organized under the aegis of the Indian Olympic Association (IOA).

Important Points

• Significance of Records: Setting a national record at the National Games is a prestigious achievement that often serves as a selection criterion for international events like the Commonwealth Games and Asian Games.

• Uttarakhand's Role: As the host of the 38th National Games, Uttarakhand invested heavily in sports infrastructure in cities like Dehradun and Haldwani, fostering a culture of athletic excellence.

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• Growth of the Sport: Performances like Mehak Sharma's 247 kg total lift indicate the increasing depth of talent in the heavyweight categories, which were historically less represented in Indian international medals compared to lighter weight classes.

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