RRB ALP CBT-I 2024 Official Paper (Held On: 25 Nov, 2024 Shift 3) (Previous Year Paper)

RRB Group D • 2024 • 75 questions • 60 minutes • Answer key and solutions

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STAGE I (CBT I)

Q1. Which biotic component of an ecosystem is present in the greatest number?

(a) Primary Consumers
(b) Producers
(c) Secondary Consumers
(d) Tertiary Consumers

Q2. Given below is a cause followed by three effects numbered I, II and III. Read the cause carefully and decide which of the three can be a/the possible effect(s).

Cause - City X has been lashed by lightning and heavy rains for the past two days. The Met Department has predicted more rain in the next 48 hours.

Effect I - The electricity board has decided to increase the tariff by 50 paise per unit in City X.

Effect II - Water-logging is being reported from many areas of City X.

Effect III - Several trees reportedly fell last night on MG Road injuring at least 12 people.

(a) Both I and II are possible effects.
(b) Only II is a possible effect.
(c) Both II and III are possible effects.
(d) Only I is a possible effect.

Q3. The phenomenon involved in the image formation by mirrors is _____.

(a) diffraction
(b) refraction
(c) reflection
(d) interference

Q4. If three numbers are in the ratio 5 : 6 : 8 and their sum is 3800, then the greatest number will be:

(a) 1200
(b) 2000
(c) 1000
(d) 1600

Q5. A, B, C, D, E and F are sitting around a circular table facing the centre. Only two people sit between F and C. D sits to an immediate right of F. A is an immediate neighbour of B and C. What is the position of E with respect to B?

(a) Immediate right
(b) Second to the left
(c) Immediate left
(d) Third to the right

Q6. Which of the following options should come in place of the question mark (?) in the given series to make it logically complete?

13, 24, 46, 79, 123,?

(a) 176
(b) 172
(c) 178
(d) 174

Q7. A man invested 1/3 of his income at 7% simple interest, 1/4 of his income at 8% simple interest, and the remainder of his income at 10% simple interest. If the total interest at the end of one year was Rs. 561, what was his initial income?

(a) Rs. 4,500
(b) Rs. 6,600
(c) Rs. 7,500
(d) Rs. 3,000

Q8. In a certain code language, 'ALSO' is coded as '8693' and 'SALE' is coded as '2836'. What is the code for 'E' in the given code language?

(a) 9
(b) 3
(c) 2
(d) 8

Q9. Express the expression below as a perfect square:

$a^2 + 9b^2 + c^2 - 6ab + 6bc - 2ac$

(a) $(a - 3b - 2c)^2$
(b) $(a + 3b + c)^2$
(c) $(a - 3b - c)^2$
(d) $(a - 3b + c)^2$

Q10. The sum of the ages of 5 children born at intervals of 2 years each is 40 years. What is the age of the eldest child?

(a) 10 years
(b) 14 years
(c) 16 years
(d) 12 years

Q11. Two successive discounts of 30% and 35% on a deal are equivalent to a single discount of:

(a) 60%
(b) 65%
(c) 54.5%
(d) 55.5%

Q12. Harmful metabolic wastes from our body are removed by the biological process called:

(a) defecation
(b) transportation
(c) secretion
(d) excretion

Q13. The Jivitputrika festival, which was in the news for an incident in September 2024, is primarily celebrated in which of the following states?

(a) West Bengal
(b) Odisha
(c) Bihar
(d) Gujarat

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Q14. Which of the following options should come in place of the question mark (?) in the given series based on the English alphabetical order?

ZTQ, XRO, VPM, TNK, ?

(a) RKL
(b) RML
(c) RLI
(d) SMK

Q15. Aruna borrowed a sum of Rs. 9,000 from Jayshree at 10% per annum on compound interest, compounded annually. Find the total amount paid by Aruna after 2 years to clear all the dues.

(a) Rs. 10,098
(b) Rs. 10,890
(c) Rs. 10,980
(d) Rs. 10,089

Q16. In the following number-pairs, the second number is obtained by applying certain mathematical operations to the first number. Which numbers should replace X and Y so that the pattern followed by the two numbers on the left side of :: is the same as that on the right side of ::?

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

X : 529 :: 21 : Y

(a) X = 14, Y = 529
(b) X = 12, Y = 729
(c) X = 11, Y = 625
(d) X = 18, Y = 676

Q17. There is a 10 m tall tower between two parallel roads. The angles of depression of the roads from the top of the tower are 30° and 45° respectively. Approximately, how far are the roads from each other?

(a) 30.82 m
(b) 27.32 m
(c) 29.56 m
(d) 26.44 m

Q18. The total count of prime numbers less than 50 is:

(a) 17
(b) 15
(c) 14
(d) 13

Q19. Town A lies to the north of Town B. Town C lies to the south of Town A. Town D lies to the northeast of Town C. Town E lies to the south of Town D. Town B lies to the northwest of Town E. Town B lies to the south of Town C. What is the position of Town E with respect to Town C?

(a) Northwest
(b) Northeast
(c) Southwest
(d) Southeast

Q20. Which of the following options should come in place of the question mark (?) in the given series based on the English alphabetical order?

CGM, EIO, GKQ, IMS, ?

(a) KOX
(b) KNY
(c) KOV
(d) KOU

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Q21. The kinetic energy of a body of mass 2 kg, which is moving with the constant velocity 5 m/sec, is _____.

(a) 100 joules
(b) 25 joules
(c) 10 joules
(d) 50 joules

Q22. Every trait in an organism is influenced by which of the following?

(a) Only maternal DNA
(b) By both maternal and paternal DNA equally
(c) More by paternal DNA than maternal DNA
(d) Only paternal DNA

Q23. Who among the following is India's youngest Olympic medallist as of August 2024?

(a) Manu Bhaker
(b) Lakshya Sen
(c) Aman Sherawat
(d) Neeraj Chopra

Q24. When an object is kept in front of a concave mirror of focal length 10 cm, a real image is formed at a distance of 20 cm in front of the mirror. Here, the object distance is _____.

(a) -5 cm
(b) -20 cm
(c) -10 cm
(d) -30 cm

Q25. The salaries of P and Q together amount to Rs. 2,000. P spends 95% of his salary and Q spends 85% of his salary. If now their savings are the same, then P's salary is:

(a) Rs. 1,500
(b) Rs. 500
(c) Rs. 1,250
(d) Rs. 750

Q26. Arpita buys 9 oranges and 8 bananas for Rs. 276. When the cost of an orange is decreased by 10% and that of a banana remains the same, then the cost of 5 oranges and 10 bananas is Rs. 210. What is the original cost of 3 oranges and 4 bananas?

(a) Rs. 108
(b) Rs. 120
(c) Rs. 116
(d) Rs. 123

Q27. Justice M Fathima Beevi was the first female Judge appointed to the Supreme Court of India in 1989. She passed away at the age of 96 on:

(a) 22 November 2023
(b) 23 November 2023
(c) 26 November 2023
(d) 25 November 2023

Q28. 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) VRU
(b) PKO
(c) FAE
(d) MHL

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Q29. Sameer has a solid metal ball having a diameter of 6 cm. He melts it and uses the material for making a solid cylinder. If the diameter of the base of the cylinder is same as that of the ball, what would the height of the cylinder be?

(a) 4.5 cm
(b) 4 cm
(c) 6 cm
(d) 8 cm

Q30. Select the correct statement.

(a) Pollination is visit of insects to the flower.
(b) Pollination is the growth of pollen tube in ovule.
(c) Pollination is germination of pollen grains.
(d) Pollination is transfer of pollen grains from stamen to stigma.

Q31. Which of the following is the symbol of the unit of atomic mass?

(a) u
(b) mg
(c) g
(d) ml

Q32. The first _____ transport aircraft was formally inducted into the Indian Air Force in 2023.

(a) C-225 MW
(b) C-275 MW
(c) C-295 MW
(d) C-250 MW

Q33. Which of the following is an example of emulsion?

(a) Foam
(b) Face Cream
(c) Sponge
(d) Rubber

Q34. Select the triad which follows the same pattern as that followed by the two triads given below. Both triads follow the same pattern.

PK-RM-TU

HC-JE-LM

(a) MH-OJ-PR
(b) MH-OJ-QR
(c) MG-OJ-QR
(d) MH-OJ-QS

Q35. A car travels 80 km at the speed of 20 km/h and the next 30 km at the speed of 30 km/h. What is its average speed?

(a) 30 km/h
(b) 20 km/h
(c) 40 km/h
(d) 22 km/h

Q36. Seven people, B, C, D, E, F, G, and K, are sitting in a straight line, facing north. No one sits to the right of G. Only three people sit between G and E. Only two people sit between E and F. C sits third to the left of D. K sits to the immediate right of D.

How many people sit between B and F?

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

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Q37. What is the function of xylem?

(a) Conduction of food
(b) Conduction of protein
(c) Conduction of water and minerals
(d) Conduction of lipid

Q38. Carbon, in all its allotropic forms, burns in oxygen to give _____.

(a) carbon monoxide
(b) carbon dioxide
(c) carbonic acid
(d) methane

Q39. If each vowel in the word TEACHING is changed to the letter following it in the English alphabetical order and each consonant is changed to the letter following it in the English alphabetical order and then arrange the letters in alphabetical order, then which of the following letters will be fourth from the right in the group of letters thus formed?

(a) J
(b) I
(c) F
(d) H

Q40. In a closed circuit, if 100 coulomb charges flow for a duration of 50 sec, then the current drawn in the circuit is _____.

(a) 5 A
(b) 0.2 A
(c) 0.5 A
(d) 2 A

Q41. JGLI is related to NKPM in a certain way based on the English alphabetical order. In the same way, OLQN is related to SPUR. To which of the following options is LINK related, following the same logic?

(a) PMRO
(b) PMOR
(c) MPRO
(d) MPOR

Q42. In the following number-pairs, the second number is obtained by applying certain mathematical operations to the first number. Which numbers should replace X and Y so that the pattern followed by the two numbers on the left side of :: is same as that on the right side of ::?

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

X : 243 :: 17 : Y

(a) X = 31, Y = 169
(b) X = 27, Y = 156
(c) X = 25, Y = 171
(d) X = 34, Y = 148

Q43. The Federation of International Hockey (FIH) Men's World Cup 2023 was conducted in _____.

(a) Amaravati, Andhra Pradesh
(b) Kochi, Kerala
(c) Rourkela, Odisha
(d) Patna, Bihar

Q44. If 'P' stands for '×', 'Q' stands for '÷', 'R' stands for '−' and 'S' stands for '+', what will come in place of question mark '?' in the following equation?

15P6R11P4S38R41S2P5=?

(a) 61

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(b) 41
(c) 49
(d) 53

Q45. Which cell has changing shapes?
(a) Smooth Muscle
(b) Ovum
(c) Amoeba
(d) Nerve cell

Q46. 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 pair does not belong to that group?
(Note: The odd one out is not based on the number of consonants/vowels or their position in the letter cluster.)
(a) PV-XR
(b) DJ-LF
(c) CH-MR
(d) GM-OI

Q47. Who among the following has received the Vigyan Ratna Award in Rashtriya Vigyan Puraskar 2024?
(a) Prof. Umesh Varshney
(b) Dr. Avesh Kumar Tyagi
(c) Dr. Anandharamakrishnan C
(d) Prof. Govindarajan Padmanabhan

Q48. A shopkeeper, on selling a pan for Rs. 10, loses 1/11 of what it cost him. The cost price of a pan is:
(a) 10
(b) 11
(c) 9
(d) 12

Q49. What is/are the product(s) of the reaction between an acid and a base?
(a) Both Salt And Hydrogen Gas
(b) Only water
(c) Only salt
(d) Both salt and water

Q50. The length, the breadth and the height of a closed cuboidal box are 2.5 m, 2 m and 90 cm, respectively. What would be the cost of a canvas needed to cover this box completely, if the cost of the canvas is Rs. 70 per m^2?
(a) 1507
(b) 1267
(c) 1448
(d) 1348

Q51. According to the latest NSSO consumer expenditure survey conducted in 2024, what is the reported poverty rate in India?
(a) 10%-15%
(b) Below 5%
(c) Below 10%
(d) Above 15%

Q52. In a quadrilateral PQRS, if the sum of measures of angles angle Q and angle S is 150° while the measures of angles angle P and angle R are in ratio 4 : 3, then the measure of angle R will be
(a) 120
(b) 90
(c) 210

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(d) 150

Q53. The average monthly salary of a person for the months of January, February, March and April is Rs. 8,000 and that for the months of February, March, April and May is Rs. 8,500. If his salary for the month of May is Rs. 6,500, find his salary for the month of January.

(a) 4500
(b) 5000
(c) 2500
(d) 3000

Q54. Which legendary musician, known for his work in films like 'Amar Akbar Anthony' and 'Bobby', was awarded the Padma Bhushan on Republic Day 2024?

(a) Pyarelal Sharma
(b) Laxmikant Shantaram Kudalkar
(c) RD Burman
(d) Ilaiyaraaja

Q55. In a certain code language, ‘towards the end’ is coded as ‘mb rh gp’ and ‘end it here’ is coded as ‘hk mb bl’. What is the code for ‘end’ in the given code language?

(a) gp
(b) hk
(c) mb
(d) bl

Q56. Which two numbers should be interchanged to make the given equation correct?

56 + 18 - 11 × 3 + 4 × (66 ÷ 2) + 22 = 151

((Note: Interchange should be done of entire number and not individual digits of a given number.): Interchange should be done of entire number and not individual digits of a given number.)

(a) 3 and 2
(b) 11 and 22
(c) 18 and 11
(d) 56 and 66

Q57. Study the given table and answer the question that follows.

The table depicts the number of tickets sold on Friday and Saturday by cash and online mode for a cricket match.

Days	Number of tickets sold (cash)	Number of tickets sold (online)
Friday	725	525
Saturday	1000	3000

How many tickets were sold in total on Friday by cash and online together?

(a) 1150
(b) 1250
(c) 1350
(d) 1050

Q58. How many water molecules are required to react with three molecules of the iron atom to form Fe3O4?

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

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Q59. Which of the following examples shows that particles of matter have enough space between them?

(a) Boiling of water
(b) Potassium permanganate got evenly distributed in water
(c) Breaking of iron nail
(d) Lighting incense stick

Q60. The HCF of 450, 1500, and 1650 is:

(a) 50
(b) 200
(c) 100
(d) 150

Q61. In the word DYNAMIC, each letter of the word is changed to the letter immediately succeeding it in the English alphabetical order and then the new group of letters thus formed is rearranged according to the English alphabetical order. Which letter is first to the right in the new rearranged group of letters?

(a) E
(b) D
(c) B
(d) Z

Q62. The average of the first five multiples of 3 is:

(a) 9
(b) 3
(c) 12
(d) 15

Q63. Evaluate the given expression.

12+18/3

(a) 22
(b) 12
(c) 18
(d) 10

Q64. A train travelling at a speed of 72 km/h crosses a pole in 24 sec. What is the length of the train?

(a) 300m
(b) 125m
(c) 150m
(d) 480m

Q65. In the address regarding the Union Budget 2024, the Finance Minister highlighted key areas of focus for the upcoming year.

Which of the following sectors was emphasised?

(a) Infrastructure, Technology, Tourism and Environment
(b) Education, Sports, Culture and Entertainment
(c) Agriculture, Defense, Space and Healthcare
(d) Employment, Skilling, MSMEs and the Middle Class

Q66. Which of the following statements is correct?

(a) The weight of a given object is 6 times higher on the moon as compared to its weight on the earth.
(b) The weight of a given object is the same when we measure it on the earth or moon.
(c) The weight of a given object is 6 times higher on the earth as compared to its weight on the moon.
(d) The weight of a given object is 2 times higher on the earth as compared to its weight on the moon.

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Q67. Seven boxes A, B, C, D, E, F and G are kept one over the other but not necessarily in the same order. A is kept second from the bottom. Only three boxes are kept between E and G. G is not kept at the top-most position. F is kept immediately above C. C is kept immediately above E. B is not kept fourth from the top.

How many boxes are kept between C and A?

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

Q68. Large number of impurities present in ore, such as sand, soil, etc., is called

(a) Gangue
(b) Wrought
(c) Spongy
(d) Hardness of ore

Q69. Which Indian city recorded the highest PM2.5 level in 2023, making it the most polluted metropolitan area globally?

(a) Greater Noida
(b) Guwahati
(c) New Delhi
(d) Begusarai

Q70. A + B means "A is the mother of B"

A - B means "A is the brother of B"

A × B means "A is the wife of B"

A ÷ B means "A is the father of B"

A # B means "A is the daughter of B"

How is P related to K if "Q - S + P - T # R ÷ K"?

(a) Brother
(b) Sister
(c) Father
(d) Mother

Q71. What determines the pattern of the magnetic field generated by a current through a conductor?

(a) Material of the conductor
(b) Direction of the current
(c) Shape of the conductor
(d) Colour of the conductor

Q72. According to the second law of motion, the rate of change of momentum is proportional to _____.

(a) force
(b) displacement
(c) inertia
(d) energy

Q73. Read the given statements and conclusions carefully. You have to take the given statements to be true even if they seem to be at variance from commonly known facts and decide which conclusion(s) logically follow(s) from the given statements.

Statements:

All doors are gates.

No door is a lock.

Conclusion:

(I) Some locks are gates.

(II) No lock is a door.

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

Q74. If each of the letters in the word CONAGE is arranged in the English alphabetical order, then how many letters are there in the English alphabetical series between the letter which is fourth from the left and the one which is fourth from the right in the new letter-cluster thus formed?

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

Q75. Read the given statements and conclusions carefully. You have to take the given statements to be true even if they seem to be at variance from commonly known facts and decide which conclusion(s) logically follow(s) from the given statements.

Statements:

Some microphones are speakers.

No speaker is a piano.

Conclusions:

(I) No microphone is a piano.

(II) Some speakers are microphones.

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

ANSWER KEY

1	b	2	c	3	c	4	d	5	d	6	c	7	b	8	c	9	c	10	d
11	c	12	d	13	c	14	c	15	b	16	d	17	b	18	b	19	d	20	d
21	b	22	b	23	c	24	b	25	a	26	a	27	b	28	a	29	b	30	d
31	a	32	c	33	b	34	b	35	d	36	a	37	c	38	b	39	b	40	d
41	a	42	c	43	c	44	d	45	c	46	c	47	d	48	b	49	d	50	b
51	b	52	b	53	a	54	a	55	c	56	b	57	b	58	a	59	b	60	d
61	d	62	a	63	c	64	d	65	d	66	c	67	d	68	a	69	d	70	a
71	c	72	a	73	b	74	d	75	d										

SOLUTIONS

Q1. Answer: (b) Producers

The correct answer is Producers.

Note: As per the official answer key, the correct answer is Tertiary Consumers but in actual the correct answer would be Producers because producers form the base of the ecological pyramid. As they are the primary source of energy for all other organisms in the ecosystem, producers are the most abundant biotic component.

Source: https://ncert.nic.in/textbook/pdf/lebo114.pdf

Key Points

• Producers are the organisms in an ecosystem that produce energy-rich compounds like glucose through photosynthesis.
• They form the base of the food chain and are critical for energy flow in an ecosystem.
• Examples of producers include plants, algae, and cyanobacteria.
• Producers convert sunlight into chemical energy, which is utilized by all other biotic components.

• Their large numbers are essential for supporting the energy needs of the entire ecosystem.

Additional Information

• Primary Consumers

• These organisms, also called herbivores, feed directly on producers.

• Examples include cows, deer, and caterpillars.

• Secondary Consumers

• These are carnivores or omnivores that feed on primary consumers.

• Examples include frogs, small birds, and some fish.

• Tertiary Consumers

• These are apex predators that consume secondary consumers.

• Examples include lions, eagles, and sharks.

Q2. Answer: (c) Both II and III are possible effects.

Cause: City X has been lashed by lightning and heavy rains for the past two days, with more rain expected.

Effect I This is unrelated to the heavy rains and lightning, as tariff hikes are usually based on financial factors, not weather conditions.

Effect II (Water-logging) is a valid effect, as heavy rainfall can easily cause water-logging, especially if drainage systems are overwhelmed, which is a common result of such weather.

Effect III (Trees falling) is also possible, as strong winds, heavy rains, and lightning can lead to trees being uprooted, potentially causing injuries and damage.

Hence, the correct answer is "Both II and III are possible effects."

Q3. Answer: (c) reflection

The correct answer is reflection.

Key Points

• Reflection is the phenomenon where light bounces off a surface, such as a mirror.

• It follows the law of reflection, which states that the angle of incidence is equal to the angle of reflection.

• Mirrors are designed to have a smooth, reflective surface to produce clear images.

• There are two types of reflection: specular reflection (from a smooth surface) and diffuse reflection (from a rough surface).

• Reflection is essential for various applications, including periscopes, telescopes, and everyday mirrors.

Additional Information

• Refraction

• It is the bending of light as it passes from one medium to another with a different density.

• Refraction is responsible for phenomena such as the bending of light in water and the focusing of light by lenses.

• Diffraction

• Diffraction occurs when light waves bend around obstacles or spread out after passing through narrow openings.

• It is significant in the study of wave optics and is observed in phenomena such as the spreading of light in shadows.

• Interference

• Interference is the phenomenon where two or more waves superimpose to form a resultant wave of greater, lower, or the same amplitude.

• It is observed in various scenarios, including the creation of patterns in thin films and sound waves.

Q4. Answer: (d) 1600

Shortcut Trick

Total ratio parts = 5 + 6 + 8 = 19 parts.

Given total sum of numbers = 3800.

19 units → 3800, so 1 unit = 3800 ÷ 19 = 200.

Greatest number corresponds to 8 units = 8 × 200 = 1600.

Therefore The correct answer is 1600.

Alternate Method

Given:

Ratio of three numbers = 5 : 6 : 8

Sum of the numbers = 3800

Let the three numbers be 5x, 6x, and 8x.
According to the question:
=> 5x + 6x + 8x = 3800
=> 19x = 3800
=> x = 3800 ÷ 19
=> x = 200
The three numbers are:
=> First number = 5 × 200 = 1000
=> Second number = 6 × 200 = 1200
=> Third (greatest) number = 8 × 200 = 1600
Therefore The correct answer is 1600.
Additional Information
Ratio and Proportion
If four quantities a, b, c, and d are in proportion, then a : b = c : d, which implies a × d = b × c.
Compounded Ratio
The compounded ratio of (a : b) and (c : d) is (ac : bd).
Mean Proportional
The mean proportional between two numbers a and b is given by √(a × b).
Duplicate Ratio
The duplicate ratio of (a : b) is (a^2 : b^2).

Q5. Answer: (d) Third to the right

Given: A, B, C, D, E and F are sitting around a circular table facing the centre.
Only two people sit between F and C.
D sits to an immediate right of F.
A is an immediate neighbour of B and C.
Thus, final arrangement:
So, 'Third to the right" is the position of E with respect to B.
Hence, the correct answer is "Third to the right".

Q6. Answer: (c) 178

The logic followed here is:
Hence, the correct answer is "178".

Q7. Answer: (b) Rs. 6,600

Shortcut Trick
Assume Total Income = 1200 units (LCM of 3 and 4 multiplied by 100 for easy calculation).
Part 1: 1/3 of 1200 = 400 units @ 7% interest = 28 units.
Part 2: 1/4 of 1200 = 300 units @ 8% interest = 24 units.
Part 3: Remaining (1200 − 700) = 500 units @ 10% interest = 50 units.
Total Interest = 28 + 24 + 50 = 102 units → Rs. 561.
1 unit = 561 ÷ 102 = 5.5. Therefore, 1200 units = 1200 × 5.5 = Rs. 6,600.
Therefore The correct answer is Rs. 6,600.
Alternate Method
Given: Total interest = Rs. 561, Time = 1 year, Rates = 7%, 8%, 10%.
Formula Used: Simple Interest (SI) = (P × R × T) ÷ 100
Let the total income be x.
=> Interest from Part 1 = (x ÷ 3) × (7 ÷ 100) = 7x ÷ 300
=> Interest from Part 2 = (x ÷ 4) × (8 ÷ 100) = 8x ÷ 400 = 2x ÷ 100
=> Remainder part = x − (x ÷ 3 + x ÷ 4) = x − (7x ÷ 12) = 5x ÷ 12
=> Interest from Part 3 = (5x ÷ 12) × (10 ÷ 100) = 50x ÷ 1200 = 5x ÷ 120
=> Total Interest = (7x ÷ 300) + (2x ÷ 100) + (5x ÷ 120) = 561
=> (28x + 24x + 50x) ÷ 1200 = 561

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=> 102x ÷ 1200 = 561

=> x = (561 × 1200) ÷ 102

=> x = 11 × 600 = 6600

Therefore The correct answer is Rs. 6,600.

Additional Information

Simple Interest on Different Parts

When a sum is divided into parts P1, P2, ..., P_n at rates R1, R2, ..., R_n, the total interest is the sum of interest from each part: Total I = Σ(P_i × R_i × T_i) ÷ 100.

Effective Rate of Interest

The combined or average rate for multiple investments can be calculated as R_(eff) = (Total Interest × 100) ÷ (Total Principal × Time).

Amount in Simple Interest

The total amount A after time T is given by A = P + SI = P(1 + RT/100).

Q8. Answer: (c) 2

The logic followed here is:

Thus, the code for 'E' = 2

Hence, the correct answer is "2".

Q9. Answer: (c) (a - 3b - c)²

Shortcut Trick

Identify the square roots of the squared terms: $a^2 \rightarrow a$, $9b^2 \rightarrow 3b$, and $c^2 \rightarrow c$.

Observe the signs of the cross-product terms: $-6ab$, $+6bc$, and $-2ac$.

Since $-6ab$ and $-2ac$ are negative, the term a must have a different sign than 3b and c.

Since $+6bc$ is positive, 3b and c must have the same sign.

Combining these, we get the expression $(a - 3b - c)^2$.

Therefore The correct answer is $(a - 3b - c)^2$.

Alternate Method

Given Expression: $a^2 + 9b^2 + c^2 - 6ab + 6bc - 2ac$

We use the standard algebraic identity for the square of a trinomial:

$(x + y + z)^2 = x^2 + y^2 + z^2 + 2xy + 2yz + 2zx$

=> Let us express each term of the given expression in the form of this identity:

=> $a^2 = (a)^2$

=> $9b^2 = (-3b)^2$

=> $c^2 = (-c)^2$

=> $-6ab = 2 \times (a) \times (-3b)$

=> $6bc = 2 \times (-3b) \times (-c)$

=> $-2ac = 2 \times (a) \times (-c)$

=> Substituting x = a, y = −3b, and z = −c into the identity:

=> $(a + (-3b) + (-c))^2$

=> $(a - 3b - c)^2$

Therefore The correct answer is $(a - 3b - c)^2$.

Additional Information

Trinomial Expansion Rule

The square of a trinomial $(a+b+c)^2$ is always the sum of the squares of the terms plus twice the product of every pair of terms: $a^2+b^2+c^2+2ab+2bc+2ca$.

Sign Management in Identities

If a product term like 2ab is negative, it implies that a and b have opposite signs. If it is positive, they have the same sign.

Perfect Square Nature

An expression is a perfect square if it can be written as the square of a simpler polynomial, which ensures the expression is non-negative for all real values of the variables.

Q10. Answer: (d) 12 years

Shortcut Trick

For an odd number of terms in an Arithmetic Progression, the average is always the middle term.

Average age = Total Sum ÷ Number of children = 40 ÷ 5 = 8 years.

Middle child (3^(rd)) = 8 years. Since the interval is 2 years, the ages are: 4, 6, 8, 10, 12.

The eldest child is the 5^(th) child → 8 + 2 + 2 = 12 years.

Therefore The correct answer is 12 years.

Alternate Method

Given:

Number of children = 5

Birth interval = 2 years

Sum of ages = 40 years

Formula Used:

Sum of ages = Sum of all individual age terms

Calculations:

=> Let the age of the youngest child be x years.

=> Ages of the 5 children are x, (x + 2), (x + 4), (x + 6), and (x + 8).

=> x + (x + 2) + (x + 4) + (x + 6) + (x + 8) = 40

=> 5x + 20 = 40

=> 5x = 40 − 20

=> 5x = 20

=> x = 20 ÷ 5 = 4 years

=> Age of the eldest child = x + 8

=> Age of the eldest child = 4 + 8 = 12 years

Therefore The correct answer is 12 years.

Additional Information

Arithmetic Progression (AP)

A sequence where the difference between consecutive terms is constant. Here, common difference d = 2.

Average of AP

For any AP, Average = (First term + Last term) ÷ 2. Also, for odd number of terms, Average = Middle term.

Sum of n terms

Sum = (n ÷ 2) × [2a + (n − 1)d], where a is the first term and n is the number of terms.

Q11. Answer: (c) 54.5%

Shortcut Trick

For two successive discounts of x% and y%, the effective single discount is given by the formula: x + y − (xy/100).

Given: x = 30% and y = 35%

Effective Discount = 30 + 35 − (30 × 35 / 100)

=> 65 − (1050 / 100) = 65 − 10.5 = 54.5%

Therefore The correct answer is 54.5%.

Alternate Method

Given: First discount = 30%, Second discount = 35%.

Formula: Let Marked Price (MP) be 100. Selling Price (SP) = MP × (100 − d1)/100 × (100 − d2)/100.

=> Let the Marked Price = 100

=> Value after 30% discount = 100 − (30% of 100) = 70

=> Value after 35% discount = 70 − (35% of 70)

=> 35% of 70 = (35 × 70) / 100 = 24.5

=> Final Selling Price = 70 − 24.5 = 45.5

=> Equivalent Discount = 100 − 45.5 = 54.5%

Therefore The correct answer is 54.5%.

Additional Information

Order of Discounts

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In successive discounts, the order in which the discounts are applied does not change the final Selling Price or the equivalent discount.

Three Successive Discounts

For three discounts x%, y%, and z%, first find the equivalent of x and y (say d12), then find the equivalent of d12 and z using the same formula.

Successive vs Flat Discount

A single flat discount of (x+y)% is always greater than two successive discounts of x% and y% because in the latter, the second discount is applied to a reduced amount.

Q12. Answer: (d) excretion

The correct answer is excretion.

Key Points

• Excretion is the biological process by which harmful metabolic wastes are removed from the body.
• This process is vital for maintaining homeostasis and preventing damage to the body from the accumulation of toxic substances.
• In humans, the major excretory organs include the kidneys, liver, lungs, and skin.
• The kidneys filter blood to produce urine, which carries waste products out of the body.
• The liver processes toxins and waste products, converting them into less harmful substances that can be excreted.

Additional Information

• Defecation
• This is the process of eliminating solid waste (feces) from the digestive tract through the anus.
• It is different from excretion, as it involves the removal of undigested food and other non-metabolic waste.
• Secretion
• This involves the production and release of substances such as enzymes, hormones, and mucus by glands and cells.
• Secretion plays a role in various bodily functions but is not primarily involved in waste removal.
• Transportation
• This refers to the movement of substances such as nutrients, gases, and wastes within the body.
• While essential for overall bodily function, transportation is not a process that directly removes metabolic waste.

Q13. Answer: (c) Bihar

The correct answer is Bihar

Key Points

• The Jivitputrika festival, also known as Jitiya Vrat, is celebrated in the state of Bihar.
• The Jivitputrika festival is a three-day Hindu festival that focuses on the well-being of children.
• It is celebrated during the seventh to ninth lunar days of Krishna-Paksha in the month of Ashwin.
• The festival is rooted in Hindu mythology, particularly the story of King Jimutavahana.
• The festival is also celebrated in Nepal.

Additional Information

State	Festivals
West Bengal	Durga Puja, Saraswati Puja, Poila Boishakh, Kali Puja
Odisha	Rath Yatra, Raja Parba, Durga Puja, Makar Sankranti, Kartik Purnima, Rath Yatra
Gujarat	Navratri, Uttarayan (Makar Sankranti), Rann Utsav, Janmashtami, Diwali

Q14. Answer: (c) RLI

The logic followed here is:

Hence, the correct answer is "RLI".

Q15. Answer: (b) Rs. 10,890

Shortcut Trick

Effective rate of interest for 2 years at 10% compounded annually = 10 + 10 + (10 × 10) ÷ 100 = 21%.

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

=> Amount = 121% × 9,000 = 1.21 × 9,000

=> Amount = Rs. 10,890.

Therefore The correct answer is Rs. 10,890.

Alternate Method

Given:

Principal (P) = Rs. 9,000

Rate of interest (R) = 10% per annum

Time (n) = 2 years

Formula Used:

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

Calculations:

=> $A = 9000 \times (1 + 10 \div 100)^2$

=> $A = 9000 \times (1 + 0.1)^2$

=> $A = 9000 \times (1.1)^2$

=> A = 9000 × 1.21

=> A = Rs. 10,890

Therefore The correct answer is Rs. 10,890.

Additional Information

Compound Interest (CI) Formula

CI = Amount − Principal = $P[(1 + R \div 100)^n - 1]$.

Effective Percentage Rate

For two successive growth rates of x% and y%, the total effective rate is $[x + y + (x \times y) \div 100]$%.

Difference between CI and SI

The difference between Compound Interest and Simple Interest for 2 years is given by $P(R \div 100)^2$.

Q16. Answer: (d) X = 18, Y = 676

The logic followed here is: √2nd number - 5 = 1st number

X : 529 → √529 - 5 = 125 → X = 23 - 5 = 18

Similarly,

21 : Y → √Y - 5 = 21 → √Y = 21 + 5 → $Y = 26^2 = 676$

Hence, the correct answer is "X = 18, Y = 676".

Q17. Answer: (b) 27.32 m

Shortcut Trick

For a tower of height 'h' between two points with angles of depression α and β, the distance between the points is given by:

Distance = h × (cot α + cot β)

Here, h = 10 m, α = 30°, β = 45°

Distance = 10 × (cot 30° + cot 45°) = 10 × (√3 + 1)

Distance = 10 × (1.732 + 1) = 10 × 2.732 = 27.32 m

Therefore The correct answer is 27.32 m.

Alternate Method

Given:

Height of the tower (AD) = 10 m

Angle of depression to Road 1 = 30° => Angle of elevation at B = 30°

Angle of depression to Road 2 = 45° => Angle of elevation at C = 45°

Let BD = x and CD = y. In right-angled triangle ΔABD:

=> tan 30° = AD ÷ BD

=> 1 ÷ √3 = 10 ÷ x

=> x = 10√3 = 10 × 1.732 = 17.32 m

In right-angled triangle ΔACD:

=> tan 45° = AD ÷ CD

=> 1 = 10 ÷ y

=> y = 10 m

The total distance between the two roads:

=> Distance = x + y

=> Distance = 17.32 + 10 = 27.32 m

Therefore The correct answer is 27.32 m.

Additional Information

Angle of Depression

It is the angle formed between the horizontal line and the line of sight when looking down at an object. It is numerically equal to the angle of elevation from the object to the observer.

Trigonometric Ratios in Heights and Distances

The most commonly used ratio is tan θ = Perpendicular ÷ Base. For standard angles: tan 30° = 1/√3, tan 45° = 1, and tan 60° = √3.

Case of Objects on Opposite Sides

When two objects are on opposite sides of a tower, the total distance between them is the sum of their individual distances from the base (h cot α + h cot β).

Case of Objects on the Same Side

When two objects are on the same side of a tower, the distance between them is the difference of their individual distances from the base (|h cot α − h cot β|).

Q18. Answer: (b) 15

Shortcut Trick

To find prime numbers quickly, use the standard count in ranges of 10.

Numbers 1 to 10: 4 primes (2, 3, 5, 7)

Numbers 11 to 20: 4 primes (11, 13, 17, 19)

Numbers 21 to 30: 2 primes (23, 29)

Numbers 31 to 40: 2 primes (31, 37)

Numbers 41 to 50: 3 primes (41, 43, 47)

Total primes = 4 + 4 + 2 + 2 + 3 = 15

Therefore The correct answer is 15.

Alternate Method

Given: Find all prime numbers less than 50.

A prime number is a natural number greater than 1 that has no positive divisors other than 1 and itself.

=> Prime numbers between 1 and 10: 2, 3, 5, 7 (Total 4)

=> Prime numbers between 11 and 20: 11, 13, 17, 19 (Total 4)

=> Prime numbers between 21 and 30: 23, 29 (Total 2)

=> Prime numbers between 31 and 40: 31, 37 (Total 2)

=> Prime numbers between 41 and 50: 41, 43, 47 (Total 3)

=> Total count = 4 + 4 + 2 + 2 + 3 = 15

Therefore The correct answer is 15.

Additional Information

Definition of Prime Numbers

A number that is divisible only by 1 and itself. 1 is neither prime nor composite.

Smallest Prime Number

2 is the smallest prime number and the only even prime number.

Primes up to 100

There are a total of 25 prime numbers between 1 and 100 (15 primes up to 50 and 10 primes from 51 to 100).

Co-prime Numbers

Two numbers are co-prime if their Highest Common Factor (HCF) is 1.

Q19. Answer: (d) Southeast

As per the given information:

Town A lies to the north of Town B.

Town C lies to the south of Town A.

Town D lies to the northeast of Town C.

Town E lies to the south of Town D.

Town B lies to the northwest of Town E.

Town B lies to the south of Town C.

So, Southeast is the position of Town E with respect to Town C.

Hence, the correct answer is "Southeast".

Q20. Answer: (d) KOU

The logic followed here is:

Hence, the correct answer is "KOU".

Q21. Answer: (b) 25 joules

The Correct answer is 25 joules.

Key Points

• The formula to calculate kinetic energy is given by: K.E. = (1/2) * m * v^2, where m is the mass of the body and v is its velocity.

• In the given problem, the mass of the body (m) is 2 kg, and the velocity (v) is 5 m/sec.

• Substitute the values in the formula: K.E. = (1/2) * 2 * $(5)^2$.

• On solving: K.E. = (1) * 25 = 25 joules.

• Thus, the kinetic energy of the body is 25 joules.

• Kinetic energy is a form of energy possessed by an object due to its motion.

• It is directly proportional to the mass of the object and the square of its velocity.

Additional Information

• Kinetic Energy

• Kinetic energy is a scalar quantity and has no direction.

• It is measured in joules (J), which is the SI unit of energy.

• Applications of kinetic energy include power generation, vehicular motion, and industrial machinery.

• Mass

• Mass is a measure of the amount of matter in an object.

• It is measured in kilograms (kg) in the SI system.

• Mass is independent of gravity, unlike weight.

• Velocity

• Velocity is the rate of change of an object's position with respect to time, including its direction.

• It is measured in meters per second (m/s).

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

Q22. Answer: (b) By both maternal and paternal DNA equally

The correct answer is By both maternal and paternal DNA equally.

Note: As per the official answer key, the correct answer is Option 3 but in actual the correct answer would be Option 2. In sexually reproducing organisms, each trait is influenced by the DNA inherited from both parents. During fertilization, an organism receives half of its genetic material from its mother (maternal DNA) and the other half from its father (paternal DNA). Therefore, traits are influenced equally by both maternal and paternal DNA. This allows for a combination of genetic information that contributes to the unique characteristics of the offspring.

Source: https://web.iitd.ac.in/~sumeet/Genetics/CHAP%209.pdf

Key Points

• Traits in an organism are influenced by both maternal and paternal DNA equally.

• Each parent contributes one set of chromosomes, thus providing half of the genetic material to the offspring.

• Genetic traits and characteristics are determined by the combination of genes inherited from both parents.

• During sexual reproduction, the offspring receive a mix of genetic material, which contributes to genetic diversity.

• Understanding the inheritance patterns helps in studying genetic diseases and traits that run in families.

Additional Information

• Mendelian Inheritance

• Gregor Mendel's principles of inheritance describe how traits are passed from parents to offspring through dominant and recessive alleles.

• His experiments with pea plants laid the foundation for modern genetics.

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• Sex-linked Traits

• These are traits associated with genes located on the sex chromosomes (X and Y).

• Examples include hemophilia and color blindness, which are often more common in males due to their single X chromosome.

• Polygenic Inheritance

• Some traits are controlled by multiple genes, resulting in a range of phenotypes.

• Examples include skin color, height, and weight, which are influenced by the interaction of several genes.

Q23. Answer: (c) Aman Sherawat

The correct answer is Aman Sherawat

Key Points

• Aman Sherawat is India's youngest Olympic medallist as of August 2024.

• He is the youngest Indian to win an individual Olympic medal, having secured a bronze medal at the 2024 Summer Olympics in Paris.

• Sehrawat has also won gold at U17 Asian Championships, U17 World Championships, U23 Asian Championships, U23 World Championships, and the Asian Wrestling Championships.

• In January 2024, Aman won the gold medal in the men’s 57 kg category at the Zagreb Open wrestling tournament, where he defeated all his opponents with technical superiority

Additional Information

• Manu Bhaker

• Manu Bhaker is an Olympian from India who competes in airgun shooting.

• She has earned two gold medals for India at the 2018 ISSF World Cup.

• She is the youngest Indian to earn an ISSF World Cup gold medal.

• In her first Commonwealth Games debut, she won the gold medal in the women's 10 m air pistol event at the age of 16.

• She qualified for the finals after scoring 388/400 points in the women's 10m air pistol qualification round at the 2018 Commonwealth Games.

• She won the gold medal in the women's 10m air pistol event at the Gold Coast Commonwealth Games by establishing a new Commonwealth Games record of 240.9 points in the final round.

• Lakshya Sen

• He hails from Almora in Uttarakhand.

• He is an Indian badminton player.

• He won gold medals at the 2018 Asian Junior Championships in the boys' singles and at the Summer Youth Olympics in the mixed team event.

• He won the bronze medal at the 2021 World Championships.

• He also won the gold medal at the 2022 Commonwealth Games.

• He was bestowed with Arjuna Award for badminton in November 2022.

-

Q24. Answer: (b) -20 cm

The correct answer is option 2.

Key Points

• The object is kept in front of a concave mirror, which means the object distance (u) is negative according to the sign conventions of mirrors.

• The focal length (f) of the concave mirror is given as -10 cm (negative because it is a concave mirror).

• The image distance (v) is given as -20 cm (negative because the image is real and formed in front of the mirror).

• Using the mirror formula: 1/f = 1/v + 1/u, we substitute the given values to find the object distance (u).

• 1/(-10) = 1/(-20) + 1/u

• -1/10 = -1/20 + 1/u

• 1/u = -1/10 + 1/20

• 1/u = -1/20 => u = -20 cm.

Additional Information

• Concave Mirrors

• Concave mirrors can form both real and virtual images depending on the position of the object.

• They are often used in telescopes, headlights of vehicles, and shaving mirrors.

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• Mirror Formula

• The mirror formula relates the object distance (u), the image distance (v), and the focal length (f): 1/f = 1/v + 1/u.

• This formula is applicable for both concave and convex mirrors.

• Image Formation by Concave Mirrors

• When an object is placed beyond the center of curvature, a concave mirror forms a real, inverted, and smaller image between the focal point and the center of curvature.

• If the object is placed at the focal point, the image formed is at infinity.

Q25. Answer: (a) Rs. 1,500

Shortcut Trick

Ratio of savings percentage: P = (100 − 95)% = 5% and Q = (100 − 85)% = 15%.

Since savings are equal: 5% of P = 15% of Q → P : Q = 15 : 5 = 3 : 1.

Total units = 3 + 1 = 4 units → Rs. 2,000.

P's salary (3 units) = (2,000 ÷ 4) × 3 = Rs. 1,500.

Therefore The correct answer is Rs. 1,500.

Alternate Method

Given: Total salary = Rs. 2,000, P spends 95%, Q spends 85%, Savings are equal.

Formula: Savings = Income − Expenditure | Savings = Income × (100 − Expenditure%) / 100

Let P's salary be x and Q's salary be (2,000 − x).

=> Savings of P = 5% of x = 0.05x

=> Savings of Q = 15% of (2,000 − x) = 0.15(2,000 − x)

=> 0.05x = 0.15(2,000 − x)

=> 1x = 3(2,000 − x)

=> x = 6,000 − 3x

=> 4x = 6,000

=> x = 1,500

Therefore The correct answer is Rs. 1,500.

Additional Information

Income, Expenditure and Savings Relationship

Total Income is always the sum of Expenditure and Savings. Income = Expenditure + Savings.

Inverse Ratio Property

If a% of A = b% of B, then the ratio of the quantities is the inverse of their percentage coefficients: A : B = b : a.

Percentage to Ratio Conversion

To find a part of a total amount based on ratios, use: Part = (Ratio of Part / Total Ratio) × Total Amount.

Q26. Answer: (a) Rs. 108

Shortcut Trick

Equate orange counts: 5 oranges at 90% cost equals 4.5 original oranges.

Double the second set: 9 oranges + 20 bananas = Rs. 420 (210 × 2).

Difference from first set: (20 − 8) bananas = 420 − 276 = Rs. 144.

Cost of 1 banana = Rs. 12 and 1 orange = (276 − 96) ÷ 9 = Rs. 20.

Cost of 3 oranges and 4 bananas = (3 × 20) + (4 × 12) = Rs. 108.

Therefore The correct answer is Rs. 108.

Alternate Method

Given:

Cost of 9 oranges (O) and 8 bananas (B) = Rs. 276

New cost of 1 orange = 90% of O = 0.9O

Cost of 5 new oranges and 10 bananas = Rs. 210

Formula Used:

Total Cost = (Quantity1 × Price1) + (Quantity2 × Price2)

Calculations:

=> 9O + 8B = 276 → (Equation 1)

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=> 5(0.9O) + 10B = 210 => 4.5O + 10B = 210

=> Multiplying by 2: 9O + 20B = 420 → (Equation 2)

=> Subtracting (1) from (2): (9O + 20B) − (9O + 8B) = 420 − 276

=> 12B = 144 => B = Rs. 12

=> Substituting B in (1): 9O + 8(12) = 276 => 9O + 96 = 276

=> 9O = 180 => O = Rs. 20

=> Cost of 3 oranges and 4 bananas = 3(20) + 4(12)

=> 60 + 48 = 108

Therefore The correct answer is Rs. 108.

Additional Information

Linear Equations in Two Variables

Equations of the form ax + by = c can be solved using the elimination method by making the coefficients of one variable equal.

Percentage Decrease

A decrease of x% in value V results in a new value of V × (100 − x)/100. Here, 10% decrease = 0.9 × original cost.

Unitary Method

Finding the cost of a single unit first makes it easier to calculate the total cost for any desired quantity.

Q27. Answer: (b) 23 November 2023

The correct answer is Fatima Beevi.

Key Points

• M. Fathima Beevi is the first female judge of the Supreme Court of India.

• She was appointed to Supreme Court as a Judge on 6 October 1989 where she retired on 29 April 1992.

• She becomes the 11th Governor of Tamil Nadu on 25 January 1997.

• She passed away on 23 November 2023, at a private hospital in Kollam

Additional Information

• So far, no woman has been appointed as the Chief Justice of India.

• As per seniority, B. V. Nagarathna is assumed to become the first female Chief Justice of India in 2027.

• Leila Seth was an Indian judge who served as the first woman judge on the Delhi High Court and later, she became the first woman Chief Justice of a state High Court, Himachal Pradesh High Court, on 5 August 1991.

• Recently on 24th January 2022, Ayesha A. Malik took the oath to become the first female judge of the Supreme Court of Pakistan.

Q28. Answer: (a) VRU

The logic followed here is:

1) VRU

2) PKO

3) FAE

4) MHL

Hence, the correct answer is "VRU".

Q29. Answer: (b) 4 cm

Shortcut Trick

When a sphere is melted into a cylinder of the same radius (r), their volumes are equal.

$(4/3) \times \pi \times r^3 = \pi \times r^2 \times h$

This simplifies to: $h = (4/3) \times r$

Given diameter = 6 cm => radius (r) = 3 cm.

Height (h) = (4/3) × 3 = 4 cm.

Therefore The correct answer is 4 cm.

Alternate Method

Given:

Diameter of the metal ball (sphere) = 6 cm

Diameter of the cylinder base = 6 cm

Formula Used:

Volume of Sphere = (4/3) π r³

Volume of Cylinder = π r² h

Calculations:

=> Radius of sphere (r) = 6 ÷ 2 = 3 cm

=> Radius of cylinder base (R) = 6 ÷ 2 = 3 cm

=> Volume of Sphere = (4 ÷ 3) × π × (3)³

=> Volume of Sphere = (4 ÷ 3) × π × 27 = 36π cm³

=> Volume of Cylinder = π × (3)² × h = 9πh

=> Since Volume of Sphere = Volume of Cylinder:

=> 36π = 9πh

=> h = 36 ÷ 9

=> h = 4 cm

Therefore The correct answer is 4 cm.

Additional Information

Volume Conservation

When a solid object is melted and recast into another shape, the total volume remains the same, provided there is no wastage of material.

Sphere Formulas

Volume = (4/3)πr³ | Total Surface Area = 4πr².

Cylinder Formulas

Volume = πr²h | Curved Surface Area = 2πrh | Total Surface Area = 2πr(r + h).

Hemisphere Formulas

Volume = (2/3)πr³ | Curved Surface Area = 2πr² | Total Surface Area = 3πr².

Q30. Answer: (d) Pollination is transfer of pollen grains from stamen to stigma.

The correct answer is option 4.

Key Points

• Pollination is the transfer of pollen grains from the stamen (male reproductive part) to the stigma (female reproductive part) of a flower.

• This process is essential for the fertilization and formation of seeds in flowering plants.

• Pollination can occur through various agents, including wind, water, animals, and insects.

• Self-pollination occurs when pollen from the same flower or another flower on the same plant fertilizes the ovule.

• Cross-pollination occurs when pollen is transferred from the flower of one plant to the flower of another plant, promoting genetic diversity.

Additional Information

• Fertilization

• Fertilization is the process where the male gamete (sperm cell) fuses with the female gamete (egg cell) to form a zygote.

• This process usually follows successful pollination and germination of the pollen tube.

• Seed Formation

• After fertilization, the zygote develops into an embryo, and the ovule matures into a seed.

• The seed contains the embryo and a food reserve, enclosed within a protective seed coat.

• Fruit Development

• Following fertilization, the ovary of the flower develops into a fruit.

• The fruit helps in the dispersal of seeds, ensuring the spread of the plant species.

Q31. Answer: (a) u

The correct answer is u.

Key Points

• The atomic mass unit (amu) is denoted by the symbol u.

• It is a standard unit of mass that quantifies mass on an atomic or molecular scale.

• One atomic mass unit is defined as one-twelfth the mass of a carbon-12 atom.

• This unit is used to express the relative masses of atoms and molecules.

• The use of the atomic mass unit simplifies the comparison and calculation of atomic and molecular masses.

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Additional Information

• Mole

• A mole is a unit in chemistry that denotes an amount of substance containing Avogadro's number (approximately 6.022 x 10^{23}) of particles, such as atoms, molecules, or ions.

• The mole is a fundamental unit in the International System of Units (SI).

• Avogadro's Number

• Avogadro's number is the number of particles in one mole of a substance, which is approximately 6.022 x 10^{23}.

• This constant allows chemists to count particles by weighing macroscopic amounts of material.

• Molar Mass

• The molar mass of a substance is the mass of one mole of that substance, typically expressed in grams per mole (g/mol).

• Molar mass is used to convert between the mass of a substance and the amount in moles.

Q32. Answer: (c) C-295 MW

The correct answer is C-295 MV

Key Points

• The first C-295 transport aircraft was formally inducted into the Indian Air Force in 2023.

• The C-295 is a medium-lift tactical transport aircraft jointly developed by Airbus and CASA of Spain.

• It was formally inducted into the Indian Air Force (IAF) on September 25, 2023, during a ceremony in Vadodara, Gujarat

• It can carry up to 71 troops or 50 paratroopers.

• The C-295 will replace the aging fleet of Avro HS-748 aircraft that have been in service with the IAF since the 1960s.

Additional Information Indian Airforce:

• It was established in October 1932.

• It is one of the parts of the Indian Armed forces, the others being the Indian Army and Indian Navy.

• The President of India is the Supreme Commander of the IAF.

• The Indian Airforce is the Fourth largest Airforce in the world in terms of both personnel and aircraft.

• Arjan Singh was the first five-star rank-holding officer in IAF.

• Subroto Mukherjee was the first Chief of the Air Staff of the Indian Airforce.

• Subroto Mukherjee is also known as the Father of the Indian Air Force.

Q33. Answer: (b) Face Cream

The correct answer is Face Cream.

Key Points

• Emulsions are mixtures of two immiscible liquids where one liquid contains a dispersion of the other liquid.

• Face creams are common examples of emulsions, typically consisting of oil and water phases.

• Emulsions can be stabilized with the help of emulsifying agents that prevent the two phases from separating.

• Common types of emulsions include oil-in-water (O/W) and water-in-oil (W/O), with face creams usually being O/W emulsions.

• Emulsions are widely used in cosmetics, pharmaceuticals, and food products due to their ability to combine beneficial properties of both phases.

Additional Information

• Foam

• Foam is a dispersion of gas bubbles in a liquid or solid matrix, commonly found in products like shaving cream and whipped cream.

• Sponge

• A sponge is a porous material that can absorb liquids, but it is not an example of an emulsion.

• Rubber

• Rubber is a polymeric material with elastic properties, used in various applications, but it is not an emulsion.

Q34. Answer: (b) MH-OJ-QR

The logic followed here is:

PK-RM-TU

HC-JE-LM

Similarly, MH-OJ-QR

Hence, the correct answer is "MH-OJ-QR".

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Q35. Answer: (d) 22 km/h

Shortcut Trick

Average Speed = Total Distance ÷ Total Time

Total Distance = 80 + 30 = 110 km

Total Time = (80 ÷ 20) + (30 ÷ 30) = 4 + 1 = 5 hours

Average Speed = 110 ÷ 5 = 22 km/h

Therefore The correct answer is 22 km/h.

Alternate Method

Given:

Distance 1 (d1) = 80 km, Speed 1 (s1) = 20 km/h

Distance 2 (d2) = 30 km, Speed 2 (s2) = 30 km/h

Formula Used:

Average Speed = (Total Distance) ÷ (Total Time)

Time = Distance ÷ Speed

Calculations:

=> Time taken for first 80 km (t1) = 80 ÷ 20 = 4 hours

=> Time taken for next 30 km (t2) = 30 ÷ 30 = 1 hour

=> Total Distance = 80 + 30 = 110 km

=> Total Time = 4 + 1 = 5 hours

=> Average Speed = 110 ÷ 5 = 22 km/h

Therefore The correct answer is 22 km/h.

Additional Information

Average Speed for Equal Distances

If a journey is divided into two equal distances traveled at speeds x and y, then Average Speed = (2 × x × y) ÷ (x + y).

Average Speed for Equal Time Intervals

If a person travels at different speeds x and y for equal time intervals, then Average Speed = (x + y) ÷ 2.

Unit Conversion

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

Q36. Answer: (a) Three

Given: Seven people, B, C, D, E, F, G, and K, are sitting in a straight line, facing north.

1. No one sits to the right of G.

2. Only three people sit between G and E.

3. Only two people sit between E and F.

4. K sits to the immediate right of D.

5. C sits third to the left of D.

So, Three people sit between B and F.

Hence, the correct answer is "Three".

Q37. Answer: (c) Conduction of water and minerals

The correct answer is Conduction of water and minerals.

Key Points

• The primary function of xylem is the conduction of water and minerals from the roots to the rest of the plant.

• Xylem is made up of various types of cells, including tracheids and vessel elements, which are specialized for water transport.

• The structure of xylem allows it to support the plant mechanically while conducting water.

• Xylem tissues are typically found in vascular plants, forming a continuous network from the roots to the leaves.

• In addition to water and mineral transport, xylem also plays a role in storing nutrients and providing structural support to the plant.

Additional Information

• Phloem

• Phloem is responsible for transporting organic nutrients, particularly sucrose, from the leaves to other parts of the plant.

• It consists of different cell types, including sieve tube elements and companion cells.

• Root Hairs
• Root hairs are extensions of root epidermal cells that increase the surface area for water and mineral absorption.
• They play a crucial role in anchoring the plant and facilitating nutrient uptake from the soil.
• Transpiration
• Transpiration is the process by which water evaporates from the aerial parts of the plant, primarily through stomata in the leaves.
• This process helps in the upward movement of water through the xylem and also in cooling the plant.

Q38. Answer: (b) carbon dioxide

The correct answer is carbon dioxide.

Key Points

• Carbon burns in oxygen to form carbon dioxide, which is a common chemical reaction.
• Carbon dioxide is a colorless and odorless gas at room temperature.
• This reaction is exothermic, meaning it releases heat.
• Carbon dioxide is a greenhouse gas and plays a significant role in global warming.
• The chemical equation for the combustion of carbon in oxygen is $C + O2 \rightarrow CO2$.

Additional Information

• Carbon Monoxide
• Carbon monoxide (CO) is a colorless, odorless gas that can be produced by the incomplete combustion of carbon.
• It is highly toxic and can cause harmful health effects when inhaled.
• Carbonic Acid
• Carbonic acid ($H2CO3$) forms when carbon dioxide dissolves in water.
• It is a weak acid and plays a role in the carbon cycle and acid-base balance in the environment.
• Methane
• Methane ($CH4$) is a simple hydrocarbon and the main component of natural gas.
• It is a potent greenhouse gas and contributes to global warming.

Q39. Answer: (b) I

The logic followed here is:

If each vowel in the word TEACHING is changed to the letter following it in the English alphabetical order and each consonant is changed to the letter following it in the English alphabetical order and then arrange the letters in alphabetical order,

Then, I will be fourth from the right in the group of letters thus formed.

Hence, the correct answer is "I".

Q40. Answer: (d) 2 A

The correct answer is 2 A.

Key Points

• Current (I) is defined as the amount of charge (Q) flowing per unit time (t).
• The formula to calculate current is $I = Q/t$.
• In this problem, Q = 100 coulombs and t = 50 seconds.
• Using the formula, I = 100 coulombs / 50 seconds.
• Simplifying this, I = 2 A, which means the current drawn in the circuit is 2 Amperes.

Additional Information

• Ohm's Law
• Ohm's Law states that the current through a conductor between two points is directly proportional to the voltage across the two points.
• The formula is $V = IR$, where V is voltage, I is current, and R is resistance.
• Resistance
• Resistance is a measure of the opposition to the flow of current in an electrical circuit.
• It is measured in ohms (Ω).
• Power
• Electrical power is the rate at which electrical energy is transferred by an electric circuit.
• The formula for power is $P = VI$, where P is power, V is voltage, and I is current.

Q41. Answer: (a) PMRO

The logic followed here is:

JGLI is related to NKPM

OLQN is related to SPUR

Similarly, LINK will be related:

Hence, the correct answer is "PMRO".

Q42. Answer: (c) X = 25, Y = 171

The logic followed here is: 1st number × 9 + 18 = 2nd number.

X : 243 → X × 9 + 18 = 243 → X × 9 = 225 → X = 225 / 9 = 25

Similarly,

17 : Y → 17 × 9 + 18 = 153 + 18 = 171

Hence, the correct answer is "X = 25, Y = 171".

Q43. Answer: (c) Rourkela, Odisha

The correct answer is India.

Key Points

• The 2023 Men's FIH Hockey World Cup was hosted the 15th edition of the Men's FIH Hockey World Cup.

• It was held from 13th January to 29th January 2023 at the Kalinga Stadium in Bhubaneswar and Rourkela in India.

• The quadrennial world championship for men's national field hockey teams is organized by the International Hockey Federation.

• The sixteen national teams were required to register a playing squad of eighteen players and two reserve players.

Additional Information

• International Hockey Federation commonly known by the acronym FIH.

• Its headquarter is in Lausanne, Switzerland.

• Mohammad Tayyab Ikram of Macau was elected as the new president of the International Hockey Federation.

Q44. Answer: (d) 53

Given Equation: 15P6R11P4S38R41S2P5 = ?

BODMAS Rule:

Decoding the given information:

Alphabet	P	Q	R	S
Meaning	×	÷	•	•

Now replacing the sign from left to right using BODMAS Rule, we get:

=> 15 × 6 - 11 × 4 + 38 - 41 + 2 × 5 = ?

=> 90 - 44 + 38 - 41 + 10 = ?

=> 138 - 44 - 41 = 53.

Hence, the correct option is "Option 4".

Q45. Answer: (c) Amoeba

The correct answer is Amoeba.

Key Points

• An Amoeba is a type of unicellular organism that constantly changes its shape.

• This shape-shifting ability is due to the extension and retraction of pseudopodia, which are temporary projections of its cytoplasm.

• Pseudopodia are used for movement and capturing food, making the Amoeba highly adaptable in its environment.

• The flexibility of its shape allows the Amoeba to navigate through various environments, including water and soil.

• Unlike other cells, such as muscle cells or nerve cells, the Amoeba does not have a fixed structure, which is essential for its survival and function.

Additional Information

• Smooth Muscle

• Smooth muscle cells have a spindle-shaped structure and are found in the walls of internal organs like the intestines and blood vessels.

• They are responsible for involuntary movements and do not change shape like an Amoeba.

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• Ovum
• The ovum is a female reproductive cell and has a fixed, spherical shape.
• It does not exhibit shape-changing behavior like an Amoeba.
• Nerve Cell
• Nerve cells, or neurons, have a unique structure with long extensions called axons and dendrites to transmit nerve impulses.
• They have a stable shape that is crucial for their function in signal transmission, unlike the shape-changing Amoeba.

Q46. Answer: (c) CH-MR

The logic followed here is:
1) PV-XR
2) DJ-LF
3) CH-MR
4) GM-OI
Hence, the correct answer is "CH-MR".

Q47. Answer: (d) Prof. Govindarajan Padmanabhan

The correct answer is Prof. Govindarajan Padmanabhan
Key Points
• Prof. Govindarajan Padmanabhan received the Vigyan Ratna Award in the 2024 Rashtriya Vigyan Puraskar
• He is known for being a Pioneer of molecular biology and biotechnology research in India
• He is NASI Honorary Scientist and Professor at the Indian Institute of Science, Bangalore
• The Rashtriya Vigyan Puraskar is India's most prestigious science award, and it recognises individual and team achievements in science and technology.
Additional Information
• Key Awardees of the Rashtriya Vigyan Puraskar 2024
• The key awardees of the Rashtriya Vigyan Puraskar 2024 include the following:
• Vigyan Ratna: G. Padmanabhan was honored with the Vigyan Ratna for pioneering research in malaria parasites besides general contributions to biological sciences. The retired director of the Indian Institute of Science also won Padma Shri and Padma Bhushan for his work.
• Vigyan Team: The Team of Chandrayaan-3 was awarded the Vigyan Team award for the mission's success in marking the first ever landing of an Indian spacecraft on the moon in the year 2023, a milestone indeed in the space exploration history of the nation.
• Vigyan Shri: This was awarded to three senior scientists, namely; Annapurni Subramaniam, for research in the field of star cluster and galaxy formation and evolution; Jayant Bhalchandra Udgaonkar, for physics in biology; and Naba Kumar Mondal for his contributions to particle physics.
• Vigyan Yuva: The three young scientists who have been honored with Vigyan Yuva are Vivek Polshettiwar for his significant contribution towards carbon capture technologies, Urbasi Sinha for her quantum research, and Roxy Mathew Koll for his contribution towards climate science.

Q48. Answer: (b) 11

Shortcut Trick
According to the question, Loss = 1/11 of Cost Price (CP).
This implies the ratio CP : Loss = 11 : 1.
Therefore, Selling Price (SP) = CP − Loss = 11 − 1 = 10 units.
Given Selling Price = Rs. 10. => 10 units = Rs. 10 => 1 unit = Rs. 1.
Cost Price = 11 units = 11 × Rs. 1 = Rs. 11.
Therefore The correct answer is Rs. 11.
Alternate Method
Given:
Selling Price (SP) of the pan = Rs. 10
Loss = 1/11 of Cost Price (CP)
Formula Used:
Cost Price (CP) = Selling Price (SP) + Loss
Calculations:

=> Let the Cost Price of the pan be Rs. x.

=> Loss = x/11

=> Selling Price (SP) = Cost Price − Loss

=> 10 = x − (x / 11)

=> 10 = (11x − x) / 11

=> 10 = 10x / 11

=> 1 = x / 11

=> x = 11

Therefore The correct answer is Rs. 11.

Additional Information

Loss Percentage Formula

Loss% = (Loss ÷ Cost Price) × 100. In this case, Loss% = (1/11) × 100 ≈ 9.09%.

Relation between SP and CP during Loss

Selling Price (SP) = Cost Price (CP) × (100 − Loss%) ÷ 100.

Calculating CP from Loss Fraction

If Loss is 1/n of CP, then CP = SP × [n ÷ (n − 1)]. Here, n = 11, so CP = 10 × (11/10) = 11.

Q49. Answer: (d) Both salt and water

The correct answer is Both salt and water.

Key Points

• The reaction between an acid and a base is a type of chemical reaction known as a neutralization reaction.

• In a neutralization reaction, an acid reacts with a base to produce a salt and water.

• The general equation for a neutralization reaction is: Acid + Base → Salt + Water.

• For example, when hydrochloric acid (HCl) reacts with sodium hydroxide (NaOH), the products are sodium chloride (NaCl) and water (H2O).

• Neutralization reactions are exothermic, releasing heat as the reaction proceeds.

Additional Information

• Acids

• Acids are substances that release hydrogen ions (H+) when dissolved in water.

• They have a sour taste and turn blue litmus paper red.

• Bases

• Bases are substances that release hydroxide ions (OH-) when dissolved in water.

• They have a bitter taste, slippery feel, and turn red litmus paper blue.

• Salts

• Salts are ionic compounds formed from the neutralization reaction between an acid and a base.

• They consist of positive ions (cations) from the base and negative ions (anions) from the acid.

Q50. Answer: (b) 1267

Shortcut Trick

Total Surface Area (TSA) = 2 × (lb + bh + hl)

TSA = 2 × (2.5 × 2 + 2 × 0.9 + 0.9 × 2.5) = 2 × (5 + 1.8 + 2.25) = 18.1 m²

Total Cost = Total Area × Rate per m²

Total Cost = 18.1 × 70 = 1267

Therefore The correct answer is Rs. 1267.

Alternate Method

Given:

Length (l) of the box = 2.5 m

Breadth (b) of the box = 2 m

Height (h) of the box = 90 cm = 0.9 m

Cost of the canvas = Rs. 70 per m²

l = 2.5 m

h = 0.9 m

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b = 2 m

Closed Cuboidal Box

Formula Used:

Total Surface Area of Cuboid (TSA) = 2 × (lb + bh + hl)

Total Cost = TSA × Rate per unit area

Calculation:

=> TSA = 2 × (2.5 × 2 + 2 × 0.9 + 0.9 × 2.5)

=> TSA = 2 × (5 + 1.8 + 2.25)

=> TSA = 2 × 9.05 = 18.1 m²

Now, finding the cost of the canvas required to completely cover the cuboidal box:

=> Total Cost = Total Area × Cost per m²

=> Total Cost = 18.1 × 70

=> Total Cost = 1267

Therefore The correct answer is Rs. 1267.

Additional Information

Total Surface Area of Cuboid

It includes the combined area of all 6 rectangular faces of the solid. Formula: TSA = 2 × (lb + bh + hl)

Lateral Surface Area of Cuboid

It is the area of the 4 vertical walls excluding the top and bottom faces. Formula: LSA = 2h × (l + b)

Volume of Cuboid

It defines the three-dimensional space enclosed by the cuboid boundaries. Formula: Volume = l × b × h

Length of Diagonal of Cuboid

It represents the longest rod that can be placed perfectly inside the room/box. Formula: Diagonal = √(l² + b² + h²)

Q51. Answer: (b) Below 5%

The correct answer is Below 5%

Key Points

• According to the National Sample Survey Organisation (NSSO) consumer expenditure survey conducted in 2024, India's poverty rate is below 5%

• The per capita monthly expenditure has increased to INR 3,773 in rural areas and INR 6,459 in urban areas, reflecting improved living standards.

• With sustained efforts in poverty alleviation, people in both rural and urban areas are becoming more prosperous, showcasing the success of developmental initiatives.

• The decline in poverty highlights India's strides toward achieving greater economic equity and enhancing the quality of life for its citizens.

Additional Information

• The NSSO is an organization under the Ministry of Statistics of the Government of India that conducts a survey every five years to estimate poverty in India.

• The NSSO was established in 1950.

• The survey uses a stratified multistage random sampling technique to select households from different strata, such as rural and urban.

• • The data collected is then processed and analyzed to ensure reliability and precision.

• The final data is published in reports that are used for policy formulation and academic research

Q52. Answer: (b) 90

Shortcut Trick

Sum of all internal angles in a quadrilateral = 360°.

Given angle Q + angle S = 150°, then angle P + angle R = 360° − 150° = 210°.

The ratio of angle P : angle R = 4 : 3. Sum of ratio parts = 4 + 3 = 7 units.

7 units = 210° => 1 unit = 30°.

Therefore angle R = 3 units = 3 × 30° = 90°.

Therefore The correct answer is 90.

Alternate Method

Given:
Sum of angles angle Q and angle S = 150°
Ratio of angle P and angle R = 4 : 3
Formula Used:
Sum of interior angles of a quadrilateral = 360°
Calculations:
=> angle P + angle Q + angle R + angle S = 360°
=> (angle P + angle R) + (angle Q + angle S) = 360°
=> angle P + angle R + 150° = 360°
=> angle P + angle R = 360° − 150° = 210°
Let angle P = 4x and angle R = 3x
=> 4x + 3x = 210°
=> 7x = 210°
=> x = 210° ÷ 7 = 30°
=> angle R = 3x = 3 × 30° = 90°
Therefore The correct answer is 90.
Additional Information
Sum of interior angles of a Polygon
The sum of interior angles of any polygon with n sides is given by the formula (n − 2) × 180°.
Cyclic Quadrilateral
In a cyclic quadrilateral, the sum of opposite angles is always 180°. (angle P + angle R = 180° and angle Q + angle S = 180°).
Angle Sum Property of Triangle
The sum of all three interior angles of a triangle is always 180°.

Q53. Answer: (a) 4500

Shortcut Trick
Difference in Totals = Number of Months × Difference in Average
=> May − January = 4 × (8,500 − 8,000) = 4 × 500 = Rs. 2,000
=> 6,500 − January = 2,000
=> January = 6,500 − 2,000 = Rs. 4,500
Therefore The correct answer is Rs. 4500.
Alternate Method
Given:
Average salary (Jan + Feb + Mar + Apr) = Rs. 8,000
Average salary (Feb + Mar + Apr + May) = Rs. 8,500
Salary for the month of May = Rs. 6,500
Formula Used:
Sum of observations = Average × Number of observations
Calculations:
=> Total salary (Jan + Feb + Mar + Apr) = 8,000 × 4 = Rs. 32,000 --- (1)
=> Total salary (Feb + Mar + Apr + May) = 8,500 × 4 = Rs. 34,000 --- (2)
=> Subtracting equation (1) from equation (2):
=> (Feb + Mar + Apr + May) − (Jan + Feb + Mar + Apr) = 34,000 − 32,000
=> May − Jan = 2,000
=> 6,500 − Jan = 2,000
=> Jan = 6,500 − 2,000
=> Jan = Rs. 4,500
Therefore The correct answer is Rs. 4500.
Additional Information
Arithmetic Mean Formula
The Average of a set of data is the sum of all observations divided by the total number of observations.
Replacement Property

When one value in a group is replaced by another, the change in the total is given by: (New Value − Old Value) = Number of items × Change in Average.

Weighted Average

The combined average of two groups is (n1 × x1 + n2 × x2) ÷ (n1 + n2), where n is the count and x is the individual average.

Q54. Answer: (a) Pyarelal Sharma

The correct answer is Pyarelal Sharma.

Key Points

• Pyarelal Sharma is part of the famous music director duo Laxmikant-Pyarelal, known for their iconic music in Indian cinema.

• He has worked in numerous films including 'Amar Akbar Anthony' and 'Bobby'.

• On Republic Day 2024, he was awarded the prestigious Padma Bhushan for his contribution to Indian music.

• The Laxmikant-Pyarelal duo has composed music for over 500 films, earning a legendary status in the Indian music industry.

Additional Information

• Padma Bhushan

• The Padma Bhushan is the third-highest civilian award in India.

• It is awarded to recognize distinguished service of a high order to the nation, in any field.

• The award was instituted on 2 January 1954 by the Government of India.

• Recipients of the Padma Bhushan are announced every year on Republic Day.

• Laxmikant-Pyarelal

• Laxmikant-Pyarelal were a popular Indian composer duo, consisting of Laxmikant Shantaram Kudalkar and Pyarelal Ramprasad Sharma.

• They composed music for over 500 Hindi films from 1963 to 1998.

• They were known for their versatility in creating music that ranged from classical to modern tunes.

• Some of their most famous works include music for the films 'Bobby', 'Amar Akbar Anthony', 'Karz', and 'Ram Lakhan'.

Q55. Answer: (c) mb

The logic followed here is:

Thus, the code for ‘end’ = 'mb'

Hence, the correct answer is "mb".

Q56. Answer: (b) 11 and 22

Given equation: 56 + 18 - 11 × 3 + 4 × (66 ÷ 2) + 22 = 151

Option 1) 3 and 2

Two numbers need to be interchanged then:

=> 56 + 18 - 11 × 2 + 4 × (66 ÷ 3) + 22 = 151

=> 56 + 18 - 11 × 2 + 4 × 22 + 22 = 151

=> 56 + 18 - 22 + 88 + 22 = 151

=> 184 - 22 = 151

=> 162 ≠ 151

Option 2) 11 and 22

Two numbers need to be interchanged then:

=> 56 + 18 - 22 × 3 + 4 × (66 ÷ 2) + 11 = 151

=> 56 + 18 - 22 × 3 + 4 × 33 + 11 = 151

=> 56 + 18 - 66 + 132 + 11 = 151

=> 217 - 66 = 151

=> 151 = 151

Option 3) 18 and 11

Two numbers need to be interchanged then:

=> 56 + 11 - 18 × 3 + 4 × (66 ÷ 2) + 22 = 151

=> 56 + 11 - 18 × 3 + 4 × 33 + 22 = 151

=> 56 + 11 - 54 + 132 + 22 = 151

=> 221 - 54 = 151

=> 167 ≠ 151

Option 4) 56 and 66

Two numbers need to be interchanged then:

=> 66 + 18 - 11 × 3 + 4 × (56 ÷ 2) + 22 = 151

=> 66 + 18 - 11 × 3 + 4 × 28 + 22 = 151

=> 66 + 18 - 33 + 112 + 22 = 151

=> 218 - 33 = 151

=> 185 ≠ 151

Hence, the correct answer is "11 and 22".

Q57. Answer: (b) 1250

Given:

Tickets sold on Friday by cash = 725

Tickets sold on Friday online = 525

Formula used:

Total tickets sold = Tickets sold by cash + Tickets sold online

Calculations:

Total tickets sold on Friday = 725 + 525

=> Total tickets sold on Friday = 1250

Therefore Total tickets sold on Friday by cash and online together = 1250

Q58. Answer: (a) 4

The correct answer is 4.

Key Points

• To determine the number of water molecules required, we need to consider the balanced chemical equation for the formation of Fe_3O_4 from iron and water.

• The balanced chemical equation is: $3Fe + 4H_2O \rightarrow Fe_3O_4 + 4H_2$.

• From the equation, it is clear that 4 water molecules (H_2O) are needed to react with 3 iron atoms (Fe) to produce Fe_3O_4.

• This reaction also produces hydrogen gas (H_2) as a byproduct.

• Understanding the stoichiometry of the reaction helps in determining the exact number of molecules required for the reaction.

Additional Information

• Stoichiometry

• It is the calculation of reactants and products in chemical reactions.

• Stoichiometry helps in determining the proportions of elements and compounds involved in a chemical reaction.

• Iron Oxides

• Iron oxides are chemical compounds composed of iron and oxygen.

• Examples include Fe_2O_3 (hematite) and Fe_3O_4 (magnetite).

• Chemical Reactions

• Chemical reactions involve the transformation of reactants into products.

• Balancing chemical equations ensures the law of conservation of mass is followed.

Q59. Answer: (b) Potassium permanganate got evenly distributed in water

The correct answer is Potassium permanganate got evenly distributed in water.

Key Points

• Potassium permanganate dissolving in water demonstrates that particles of matter have spaces between them.

• When potassium permanganate is added to water, its particles spread out and occupy the spaces between water molecules.

• This process is called diffusion, where particles move from a region of higher concentration to a region of lower concentration.

• The even distribution of potassium permanganate in water shows that water molecules have sufficient space to allow other particles to mix.

• This phenomenon highlights the concept that matter is made up of small particles with gaps in between them, allowing for such diffusion processes.

Additional Information

• Boiling of Water

• Boiling of water involves the transition of water from a liquid to a gas phase, which does not directly illustrate the space between

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particles in the liquid state.

• Breaking of Iron Nail

• Breaking an iron nail is a physical change and does not demonstrate the spaces between particles in a solid state.

• Lighting Incense Stick

• Lighting an incense stick involves combustion and the release of aromatic compounds, which does not illustrate the concept of spaces between particles in matter.

Q60. Answer: (d) 150

Shortcut Trick

The HCF of numbers is always equal to or a factor of the difference between any two of the numbers.

Difference between 1650 and 1500 = 1650 − 1500 = 150.

Check if 150 divides all numbers: 450 ÷ 150 = 3, 1500 ÷ 150 = 10, 1650 ÷ 150 = 11.

Since 150 divides all three numbers, it is the Highest Common Factor.

Therefore The correct answer is 150.

Alternate Method

Given: Numbers are 450, 1500, and 1650.

Method: Prime Factorization method.

Step-by-step Prime Factorization:

=> 450 = 2 × 3 × 3 × 5 × 5 = $2^1 \times 3^2 \times 5^2$

=> 1500 = 2 × 2 × 3 × 5 × 5 × 5 = $2^2 \times 3^1 \times 5^3$

=> 1650 = 2 × 3 × 5 × 5 × 11 = $2^1 \times 3^1 \times 5^2 \times 11^1$

=> Common factors are 2^1, 3^1, and 5^2.

=> HCF = 2 × 3 × 25 = 150.

Therefore The correct answer is 150.

Additional Information

HCF (Highest Common Factor)

The greatest number that divides two or more numbers without leaving a remainder. It is also known as Greatest Common Divisor (GCD).

HCF Difference Property

The HCF of a set of numbers is always a factor of the difference between any two numbers in the set. If HCF(a, b) = k, then k also divides |a − b|.

Relationship between LCM and HCF

For any two numbers 'a' and 'b', the product of the numbers is equal to the product of their HCF and LCM: a × b = HCF(a, b) × LCM(a, b).

Successive Division Method

To find the HCF of large numbers, divide the larger number by the smaller one, then divide the previous divisor by the remainder, until the remainder becomes zero.

Q61. Answer: (d) Z

The logic follows here is :-

Given sequence : DYNAMIC

First, we change each letter of the word to the letter immediately succeeding it in the English alphabetical order:

Word	D	Y	N	A	M	I	C
Immediately Succeed letter	E	Z	O	B	N	J	D
Alphabetical Order	B	D	E	J	N	O	Z

Thus, the new sequence is: EZONBJD

Next, we rearrange these letters according to the English alphabetical order:

B, D, E, J, N, O, Z

Now, The first letter from the right in the sequence is: Z.

Thus, the correct answer is "Option 4".

Q62. Answer: (a) 9

Shortcut Trick

The multiples of any number form an Arithmetic Progression (A.P.).

For an A.P. with an odd number of terms, the average is exactly the middle term.

The middle term of the first 5 multiples is the 3rd multiple.

=> Average = 3 × 3 = 9

Therefore The correct answer is 9.

Alternate Method

Given:

The sequence consists of the first five multiples of 3.

Formula Used:

Average = Sum of all observations ÷ Total number of observations

3

6

9

Average

12

15

Calculations:

=> The first five multiples of 3 are: 3, 6, 9, 12, 15.

=> Sum of these multiples = 3 + 6 + 9 + 12 + 15

=> Sum = 45

=> Total number of multiples = 5

=> Average = 45 ÷ 5

=> Average = 9

Therefore The correct answer is 9.

Additional Information

Average of an Arithmetic Progression (A.P.)

For any sequence in A.P., the average can also be calculated directly using the formula: (First Term + Last Term) ÷ 2. Here, it is (3 + 15) ÷ 2 = 9.

Average of first n multiples of a number k

The direct shortcut formula to find the average of the first n multiples of a number k is k × (n + 1) ÷ 2. Here, it is 3 × (5 + 1) ÷ 2 = 9.

Average of first n natural numbers

The average of the first n consecutive natural numbers is given by the formula (n + 1) ÷ 2.

Q63. Answer: (c) 18

Given:

Expression to evaluate: 12 + 18 / 3

Formula Used:

Order of operations (BODMAS/BIDMAS): Evaluate division before addition.

Calculation:

Evaluate 18 / 3 first:

18 / 3 = 6

Now add 12 to the result:

12 + 6

=> 18

The correct answer is option 3.

Q64. Answer: (d) 480m

Shortcut Trick

Convert speed from km/h to m/s: 72 × (5/18) = 20 m/s.

When a train crosses a pole, the distance covered is equal to the length of the train.

Length = Speed × Time = 20 × 24 = 480 m.

Therefore The correct answer is 480 m.

Alternate Method

Given:

Speed of the train = 72 km/h

Time taken to cross the pole = 24 sec

Formula Used:

Distance = Speed × Time

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

Calculations:

=> Speed in m/s = 72 × (5/18)

=> Speed = 4 × 5 = 20 m/s

=> Length of the train = Speed × Time

=> Length = 20 × 24

=> Length = 480 m

Therefore The correct answer is 480 m.

Additional Information

Unit Conversion

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

Train Crossing a Stationary Object with Length

When a train of length L1 crosses a platform or bridge of length L2, the total distance covered is (L1 + L2).

Relative Speed

When two objects move in the opposite direction, relative speed = S1 + S2. In the same direction, relative speed = S1 − S2.

Q65. Answer: (d) Employment, Skilling, MSMEs and the Middle Class

The correct answer is Employment, Skilling, MSMEs and the Middle Class

Key Points

• In the Union Budget 2024, Finance Minister Nirmala Sitharaman emphasized sectors including employment, skilling, Micro, Small, and Medium Enterprises (MSMEs), and the middle class.

• This focus aligns with the government's commitment to fostering economic growth and ensuring inclusive development.

• The government introduced three schemes under the Prime Minister's package to promote employment, focusing on EPFO enrollments, recognition of first-time employees, and support for both employees and employers.

• Additionally, a new centrally sponsored scheme aims to skill 20 lakh youth over five years, with 1,000 Industrial Training Institutes being upgraded in a hub-and-spoke model.

Additional Information

• The major terms related to the Union Budget include the following:

• Revenue Budget: Details the government's revenue receipts (tax and non-tax) and revenue expenditure. It focuses on the regular operating costs of the government.

• Capital Budget: Involves government expenditure on the acquisition of assets like land, buildings, machinery, and includes receipts from loans, investments, etc.

• Fiscal Deficit: The difference between the total expenditure and total revenue (excluding borrowings) of the government. It indicates the borrowing requirement for the government.

• Revenue Deficit: The excess of revenue expenditure over revenue receipts. It highlights the shortfall in day-to-day government operations funding.

• Primary Deficit: The fiscal deficit minus interest payments on previous borrowings. It shows the borrowing requirement of the government, excluding debt interest payments.

• Gross Domestic Product (GDP): The total value of all goods and services produced within the country. It's used to gauge the health of the economy.

• Direct Taxes: Taxes directly levied on individuals and corporations, such as income tax and corporate tax.

• Indirect Taxes: Taxes levied on goods and services rather than on income or profits, like Goods and Services Tax (GST).

• Non-Tax Revenue: Government revenue from sources other than taxes, such as profits from public sector enterprises and fees from services.

• Plan vs. Non-Plan Expenditure: Plan expenditure refers to spending on the implementation of economic plans. Non-plan expenditure includes costs related to routine government operations and obligations.

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Q66. Answer: (c) The weight of a given object is 6 times higher on the earth as compared to its weight on the moon.

The correct answer is option 3.

Key Points

• The weight of an object is a measure of the gravitational force acting on it.
• On the moon, gravity is about 1/6th as strong as on Earth.
• Therefore, an object will weigh less on the moon compared to its weight on Earth.
• The correct statement is that the weight of a given object is 6 times higher on the Earth as compared to its weight on the moon.
• This difference in weight is due to the variation in gravitational acceleration between the Earth and the moon.

Additional Information

• Gravitational Force
• This force is responsible for the weight of an object on a planetary body.
• It varies depending on the mass and radius of the planetary body.
• Mass vs. Weight
• Mass is a measure of the amount of matter in an object and remains constant regardless of location.
• Weight depends on the gravitational force and can change with location.
• Gravitational Acceleration
• On Earth, it is approximately 9.81 m/s^2.
• On the moon, it is about 1.63 m/s^2, which is approximately 1/6th of Earth's gravitational acceleration.

Q67. Answer: (d) 3

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

A is kept second from the bottom.

Only three boxes are kept between E and G.

C is kept immediately above E.

S.No.	Boxes Case 1	Boxes Case 2
7	G	
6		C
5		E
4	C	
3	E	
2	A	A
1		G

F is kept immediately above C.

G is not kept at the top-most position. Here case 1 gets eliminated.

S.No.	Boxes Case 2
7	F
6	C
5	E
4	
3	
2	A
1	G

B is not kept fourth from the top.

Thus, final arrangement:

S.No.	Boxes Case 2

7	F
6	C
5	E
4	D
3	B
2	A
1	G

So, 3 boxes are kept between C and A.

Hence, the correct answer is "3".

Q68. Answer: (a) Gangue

The correct answer is Gangue.

Key Points

• Gangue refers to the unwanted materials or impurities such as sand, soil, or rocks present in an ore.

• It is an essential concept in the mining and mineral processing industry, where the primary goal is to separate valuable minerals from gangue.

• Efficient removal of gangue is crucial for the economic extraction of metals and for minimizing waste.

• The process of separating gangue from ore is known as beneficiation, which may involve techniques like crushing, grinding, and various separation methods.

• Understanding the nature of gangue is important for developing effective ore processing strategies and for improving the overall yield of the target mineral.

Additional Information

• Ore

• An ore is a naturally occurring solid material from which a metal or valuable mineral can be extracted profitably.

• Ores typically contain both the target mineral and gangue materials.

• Beneficiation

• This is the process of concentrating the valuable minerals in the ore and removing the gangue.

• Common beneficiation methods include gravity separation, flotation, and magnetic separation.

• Smelting

• Smelting is a metallurgical process involving the heating and melting of ore to extract a base metal.

• It is often used after beneficiation to further purify the metal extracted from the ore.

Q69. Answer: (d) Begusarai

The correct answer is Begusarai

Key Points

• Begusarai, Bihar was the most polluted city in India in 2023, with an average PM2.5 concentration of 118.9 micrograms per cubic meter of air (μg/m³).

• This made it the most polluted metropolitan area in the world.

• India was the third-most polluted country in the world in 2023, after Bangladesh and Pakistan.

• The main sources of particulate air pollution in India are vehicle exhaust, wood burning, soil, road, and construction dust

Additional Information

• Guwahati ranked as the second most polluted city in India in 2023, with a PM2.5 concentration of 105.4 μg/m³. Delhi followed as the third most polluted city, with a PM2.5 concentration of 102.1 μg/m³, while Mullanpur secured the fourth position with a PM2.5 concentration of 100.4 μg/m³.

Q70. Answer: (a) Brother

Family Chart:

Decoding the Symbols:

Symbol	•	•	×	÷	#
Meaning	Mother	Brother	Wife	Father	Daughter

Given: Q - S + P - T # R ÷ K

It means: Q is the brother of S, S is the mother of P, P is the brother of T, T is the daughter of R and R is the father of K.

So, P is the Brother of K.

Hence, the correct answer is "Brother".

Q71. Answer: (c) Shape of the conductor

The correct answer is Shape of the conductor.

Key Points

• The pattern of the magnetic field generated by a current through a conductor is determined by the shape of the conductor.

• A straight conductor generates a magnetic field in the form of concentric circles around it.

• A coiled conductor, such as a solenoid, produces a magnetic field similar to that of a bar magnet with distinct north and south poles.

• The direction of the current affects the direction of the magnetic field but not its pattern, which is why the shape of the conductor is crucial.

• The material or color of the conductor does not influence the magnetic field pattern generated by the current passing through it.

Additional Information

• Electromagnets

• These are created by coiling a wire around a magnetic core and passing a current through the wire.

• The magnetic field strength of an electromagnet can be increased by increasing the number of coils or the current.

• Magnetic Field Lines

• These are imaginary lines used to represent the strength and direction of a magnetic field.

• The density of the lines indicates the strength of the magnetic field; closer lines mean a stronger field.

• Right-Hand Rule

• This is a mnemonic used to determine the direction of the magnetic field relative to the direction of the current.

• If you point the thumb of your right hand in the direction of the current, your fingers will curl in the direction of the magnetic field lines.

Q72. Answer: (a) force

The correct answer is force.

Key Points

• According to Newton's second law of motion, the rate of change of momentum of an object is directly proportional to the force applied.

• This law is often stated as F = ma, where F is the force, m is the mass, and a is the acceleration.

• Momentum is defined as the product of mass and velocity of an object.

• When a force is applied to an object, it changes the object's velocity, thereby changing its momentum.

• The second law of motion helps us understand the relationship between force, mass, and acceleration in various physical situations.

Additional Information

• First Law of Motion (Law of Inertia)

• States that an object will remain at rest or in uniform motion unless acted upon by an external force.

• This law explains the concept of inertia, which is the resistance of an object to change its state of motion.

• Third Law of Motion

• States that for every action, there is an equal and opposite reaction.

• This law is crucial in understanding the interactions between two objects.

• Conservation of Momentum

• In a closed system, the total momentum before and after an event remains constant.

• This principle is often used in collision and explosion problems to predict the outcome of such events.

Q73. Answer: (b) Only conclusion (II) follows.

Statements:

All doors are gates.

No door is a lock.

The least possible Venn diagram is as follows:

Conclusion:

(I) Some locks are gates.- False (because because there is no direct relation given between lock and gates, so it can be possible but not definite)

(II) No lock is a door. - True (because No door is a lock given. So, No lock is a door too)

Hence, the correct answer is "Only conclusion (II) follows".

Q74. Answer: (d) One

The logic followed here is:

If each of the letters in the word CONAGE is arranged in the English alphabetical order,

The fourth letter from the left end = G

And, the fourth from the right = E

Then One letter (E, F, G) is there in the English alphabetical series between the letter which is fourth from the left and the one which is fourth from the right in the new letter-cluster thus formed.

Hence, the correct answer is "One".

Q75. Answer: (d) Only conclusion (II) follows

Statements:

Some microphones are speakers.

No speaker is a piano.

The least possible Venn diagram is as follows:

Conclusions:

(I) No microphone is a piano. - False (because there is no direct relation between microphone and piano so it can be possible but not definite)

(II) Some speakers are microphones. - True (because Some microphones are speakers so, Some speakers are microphones too)

Hence, the correct answer is "Only conclusion (II) follows".

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