# RRB Group D Official Paper (Held On: 02 Dec, 2025 Shift 2) (Previous Year Paper)

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

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## GENERAL SCIENCE

**Q1.** The working principle of a stethoscope is based on the _____.

**(a)** absorption of high-frequency sound
**(b)** conversion of sound into electric signals only
**(c)** conversion of sound into light for observation
**(d)** reflection of sound

**Q2.** Which of the following statements is true for a concave lens?

**(a)** Image is always virtual, erect, and on the same side as the object
**(b)** Image is always real
**(c)** Image is always virtual and on the opposite side
**(d)** Image is much larger than object

**Q3.** Which of the following statements about electric field lines is correct?

**(a)** They can form closed loops
**(b)** They never intersect
**(c)** They start on negative charges and end on positive charges
**(d)** They are always straight lines

**Q4.** Which of the following statements correctly describes a typical physical property of metals?

**(a)** Metals have low melting and boiling points.
**(b)** Metals are generally brittle and break easily when hammered.
**(c)** Metals are poor conductors of heat and electricity.
**(d)** Metals are sonorous and produce sound when struck.

**Q5.** When lead nitrate reacts with potassium iodide, a yellow precipitate of compound ‘X’ is formed. Identify compound X.

**(a)** Potassium nitrate (KNO3)
**(b)** Lead(II) nitrite [Pb(NO2)2]
**(c)** Lead(II) nitrate [Pb(NO3)2]
**(d)** Lead(II) iodide (PbI2)

**Q6.** A car starts to move from rest and attains a velocity of 20 m/s in 4 seconds. What is the acceleration of the car?

**(a)** 4 $m/s^2$
**(b)** 5 $m/s^2$
**(c)** 100 $m/s^2$
**(d)** 80 $m/s^2$

**Q7.** What happens to the density of a substance when the temperature of a substance increases?

**(a)** Density has no effect
**(b)** Density increases
**(c)** Density decreases

**(d)** Density doubles

**Q8.** How does fumigation help in the safe storage of food grains?

**(a)** It kills pests and insects that could otherwise damage stored grains.
**(b)** It increases the weight of the grains.
**(c)** It prevents moisture loss from grains.
**(d)** It adds nutrients to the grains.

**Q9.** The work required by an external force to bring a moving body to rest is equal to:

**(a)** its kinetic energy
**(b)** its weight
**(c)** its momentum
**(d)** its potential energy

**Q10.** Which of the following helps in maintaining reproductive health?

**(a)** Health education and medical care
**(b)** Ignoring hygiene
**(c)** Early marriage
**(d)** Junk food

**Q11.** Which of the following is a function of the Smooth Endoplasmic Reticulum (SER)?

**(a)** Synthesis of proteins
**(b)** Assembly of ribosomes
**(c)** Modification of sugars
**(d)** Manufacture of lipids

**Q12.** Electric current is expressed as:

**(a)** amount of charge per unit length
**(b)** energy consumed per unit time
**(c)** rate of flow of electric charge
**(d)** amount of charge per unit area

**Q13.** A body moves along a straight line with varying speed. Its displacement in 10 s is 50 m. What is the average velocity?

**(a)** 5 m/s
**(b)** 10 m/s
**(c)** 25 m/s
**(d)** 50 m/s

**Q14.** Which functional group present in aldehyde?

**(a)** -OH
**(b)** -CHO
**(c)** -COOH
**(d)** -CO

**Q15.** Which of the following alcohols is commonly used as a fuel or fuel additive?

**(a)** Ethanol
**(b)** Propanol
**(c)** Butanol
**(d)** Methanol

**Q16.** Which of the following correctly identifies a solution where the solute and solvent are both elements, and the solution is homogeneous?

**(a)** Iron filings mixed with Sulphur
**(b)** Sugar dissolved in water
**(c)** Oxygen mixed with Nitrogen in air

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**(d)** Carbon dissolved in water

**Q17.** The DNA in the cell nucleus is the information source for the making of which of the following substances?

**(a)** Lipid
**(b)** Fructose
**(c)** Glucose
**(d)** Protein

**Q18.** Which of the following quantities does NOT affect the buoyant force acting on a body immersed in a fluid?

**(a)** Density of object
**(b)** Density of fluid
**(c)** Gravitational acceleration
**(d)** Volume of displaced fluid

**Q19.** Which part of the neuron contains the nucleus and the cytoplasm?

**(a)** Dendrites
**(b)** Nerve endings
**(c)** Cell body
**(d)** Axon

**Q20.** A man undergoes a minor surgical procedure that prevents sperm from mixing with semen. Which structure was most likely altered?

**(a)** Vas deferens
**(b)** Testis
**(c)** Urethra
**(d)** Penis

**Q21.** For concave mirror, the height of an image above the principal axis _____.

**(a)** is considered zero
**(b)** depends on object position
**(c)** is considered positive
**(d)** is considered negative

**Q22.** Ethanol is miscible with water due to presence of which functional group?

**(a)** Carbon chain
**(b)** Double bond
**(c)** Hydroxyl group
**(d)** Carboxyl group

**Q23.** Which of the following is true about heterogeneous mixtures?

**(a)** It behaves like a compound
**(b)** The composition is the same throughout
**(c)** The individual substances retain their properties
**(d)** The components cannot be separated

**Q24.** Which of the following statements about adrenaline is INCORRECT?

**(a)** It reduces blood supply to the digestive system and directs it toward the skeletal muscles.
**(b)** It promotes digestion by increasing blood flow to the stomach.
**(c)** It increases heart rate and breathing rate to supply more oxygen to the muscles.
**(d)** It helps the body respond to stress or emergency by triggering the ‘fight or flight’ response.

**Q25.** Which of the following is a biological method of crop protection?

**(a)** Spraying DDT
**(b)** Burning crop residues
**(c)** Introducing pest predators

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**(d)** Ploughing

## MATHEMATICS

**Q26.** A shopkeeper marks the price of an article at Rs. 5,360. Find the cost price if after allowing a discount of 8% he still gains 34% on the cost price.

**(a)** Rs. 3,557
**(b)** Rs. 3,622
**(c)** Rs. 3,686
**(d)** Rs. 3,680

**Q27.** In quadrilateral PQRS, the bisectors of angle R and angle S meet at point T (inside the quadrilateral) and angle STR = 24°. If the ratio of angle P to angle Q is 3 : 5, then what is the difference between the measures of angle Q and angle P ?

**(a)** 15°
**(b)** 12°
**(c)** 17°
**(d)** 11°

**Q28.** A manufacturer sells a transistor for Rs. 840 at a gain of 20% to a shopkeeper. The shopkeeper then sells it to a customer at a profit of 10%. What is the difference between the cost price to the manufacturer and the cost price to the customer (in Rs. )?

**(a)** 224
**(b)** 250
**(c)** 345
**(d)** 200

**Q29.** The value of 999.99 + 99.99 + 9.99 is:

**(a)** 1999.9
**(b)** 1109.97
**(c)** 1119.99
**(d)** 1109.99

**Q30.** Simplify: $(2^4)^3 \times (2^5)^2 \div 2^7$

**(a)** 2^(10)
**(b)** $2^{12}$
**(c)** 2^7
**(d)** 2^(15)

**Q31.** Aakash, Suman and Raj invest Rs. 1,720, Rs. 1,690 and Rs. 1,240, respectively, to start a business. If the profit at the end of the year is Rs. 1,440, then what is the share of Raj in the profit?

**(a)** Rs. 381
**(b)** Rs. 385
**(c)** Rs. 384
**(d)** Rs. 382

**Q32.** A car travels from City A to City B, a distance of 150 km, at a speed of 60 km/hr. On the way back, due to heavy traffic, the car's speed decreases. If the total time for the round trip is 7 hours 30 min, what is the speed during the return trip?

**(a)** 30 km/hr
**(b)** 45 km/hr
**(c)** 36 km/hr
**(d)** 42 km/hr

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**Q33.** 1/20 is what percentage of 10/100

**(a)** 65%
**(b)** 50%
**(c)** 100%
**(d)** 60%

**Q34.** Prakhar and Riya together invested Rs. 33,500 in a business. At the end of the year, out of a total profit of Rs. 6,700, Prakhar's share was Rs. 2,000. What was Prakhar's investment?

**(a)** Rs. 11,210
**(b)** Rs. 10,370
**(c)** Rs. 10,000
**(d)** Rs. 8,540

**Q35.** Ravi's father is 4 times as old as Ravi. After 5 years, the father's age will be 3 times Ravi's age. What is Ravi's present age?

**(a)** 18 years
**(b)** 10 years
**(c)** 12 years
**(d)** 15 years

**Q36.** One pipe can fill a tank in 3 minutes, while another pipe can empty the completely filled tank in 12 minutes. If both the pipes are opened together when the tank is empty, how many minutes will it take to fill one-fourth of the tank?

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

**Q37.** The LCM of two numbers is four times their HCF. The sum of their LCM and HCF is 140. If one of the numbers is 112, find the other number.

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

**Q38.** Thomas is 38 years old. His nephew is 26 years younger than him. In how many years will Thomas's age be 14 years less than three times his nephew's age?

**(a)** 3
**(b)** 8
**(c)** 5
**(d)** 2

**Q39.** If 20% of a number is added to 84, then the result is the same number. 65% of the same number is:

**(a)** 68.25
**(b)** 88.25
**(c)** 98.25
**(d)** 78.25

**Q40.** If $a + 1/a = 12$, then find the value of $a^2 + 1/(a^2)$.

**(a)** 138
**(b)** 140
**(c)** 144
**(d)** 142

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**Q41.** If cos α = 5/13, where α is acute, find the value of sec α - tan α.

**(a)** 1/5
**(b)** 5/12
**(c)** 13/12
**(d)** 4/5

**Q42.** The curved surface area of a cylinder is 528 m² and its volume is 1848 m³. Find the total surface area (in m²) of the cylinder. (Take π = 22/7)

**(a)** 842
**(b)** 832
**(c)** 836
**(d)** 840

**Q43.** Arrange the following schemes in the ascending order of their discounts.

A. Buy 5 get 6 free.

B. A single discount of 82%.

C. Two successive discounts of 11% and 24%.

**(a)** B, C, A
**(b)** C, B, A
**(c)** C, A, B
**(d)** A, B, C

**Q44.** In a group of 150 players consisting of males and females, 58% are males. The average weight of the male players is 82 kg, while that of the female players is 72 kg. Find the average weight (in kg) of all the players in the group.

**(a)** 76.4
**(b)** 75.9
**(c)** 77.8
**(d)** 77.2

**Q45.** In an examination, the percentage of students who qualified from school X to the number of students who appeared from that school is 80%. In school Y, the number of students who appeared is 15% more than those from school X, and the number of students who qualified is 30% more than the number of students qualified from school X. What is the percentage of students qualified to the number of students who appeared from school Y (rounded off to one decimal place)?

**(a)** 88.8%
**(b)** 80.4%
**(c)** 90.4%
**(d)** 84.6%

**Q46.** Water flows through a cylindrical pipe of diameter 14 cm at a speed of 15 km/hr into a rectangular tank 50 m long and 44 m wide. How long will it take for the water level in the tank to rise by 21 cm?

**(a)** 1.5 hours
**(b)** 2.5 hours
**(c)** 2 hours
**(d)** 3 hours

**Q47.** X people were given a contract for doing a piece of work in 28 days. 5 people did not turn up to work due to sickness, and the rest of the people completed the work in 30 days. What is the value of X?

**(a)** 74
**(b)** 82
**(c)** 75
**(d)** 65

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**Q48.** A sum of money was invested at simple interest at a certain rate for 4 years. Had it been invested at a 3% per annum higher rate, it would have fetched Rs. 960 more. Find the principal.

**(a)** Rs. 7,500
**(b)** Rs. 7,800
**(c)** Rs. 8,300
**(d)** Rs. 8,000

**Q49.** The average age of 40 students of a class is 33 years. If the age of the teacher is also included, the average age of the whole group becomes 34 years. The age (in years) of the teacher is:

**(a)** 73
**(b)** 77
**(c)** 76
**(d)** 74

**Q50.** If a X m long train running at a speed of 59 m/sec crosses a railway platform in 9 sec. Find the value of X, if the length of the railway platform is 279 m.

**(a)** 253
**(b)** 252
**(c)** 262
**(d)** 256

## GENERAL INTELLIGENCE & REASONING

**Q51.** In a certain code language,

A + B means ‘A is the father of B’,

A - B means ‘A is the mother of B’,

A * B means ‘A is the sister of B’ and

A ÷ B means ‘A is the brother of B’.

Based on the above, how is P related to T if ‘P – Q * R + S ÷ T’?

**(a)** Mother’s mother
**(b)** Sister
**(c)** Father’s mother
**(d)** Mother’s sister

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

23 40 57 74 91 ?

**(a)** 105
**(b)** 108
**(c)** 107
**(d)** 106

**Q53.** Shantanu starts from Point A and drives 4 km towards the north. He then takes a right turn, drives 5 km, then turns right and drives 7 km. He then takes a right turn and drives 10 km. He takes a final right turn, drives 3 km, and then stops at Point P. How far (shortest distance) and towards which direction should he drive in order to reach Point A again? (All turns are 90-degree turns only, unless specified).

**(a)** 9 km towards south
**(b)** 5 km towards north
**(c)** 5 km towards east
**(d)** 4 km towards west

**Q54.** In a certain code language, ‘CLAW’ is coded as ‘3948’ and ‘FLAW’ is coded as ‘9748’. What is the code for ‘F’ in that language?

**(a)** 7
**(b)** 8

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**(c)** 4
**(d)** 9

**Q55.** A, B, C, D, E, F and G are sitting around a circular table facing the centre. B sits to the immediate left of F. C sits second to the right of F. E sits third to the left of B. D sits to the immediate right of A.

How many people sit between G and D when counted from the left of G?

**(a)** Four
**(b)** Five
**(c)** Two
**(d)** Three

**Q56.** Which letter cluster will replace the question mark (?) to complete the given series?

ILL LKN OJP RIR ?

**(a)** OLI
**(b)** JMK
**(c)** UHT
**(d)** MKP

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

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

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

**(a)** Five
**(b)** Two
**(c)** Four
**(d)** Three

**Q58.** D, E, F, G, L, M and N are sitting in a straight line facing north.

No one sits to the left of D. Only four people sit between D and G. Only three people sit to the right of M. L sits to the immediate left of E. N is not an immediate neighbour of M.

Who sits at the rightmost end of the line?

**(a)** N
**(b)** G
**(c)** F
**(d)** D

**Q59.** In the following triads, each group of letters is related to the subsequent one following a certain logic. Select from the given options, the one which follows the same logic.

MANY - YMNA - MYAN

WING - GWNI - WGIN

**(a)** LADY - YLDA - LAYD
**(b)** UNIT - TUIN - UTNI
**(c)** DUSK - KDUS - USKD
**(d)** ROSE - ORSE - EOSR

**Q60.** What will come in the place of '?' in the following equation, if '+' and '-' are interchanged and 'x' and '÷' are interchanged?

428 ÷ 2 + 183 × 3 - 127 = ?

**(a)** 942
**(b)** 821
**(c)** 811
**(d)** 922

**Q61.** What should come in place of the question mark (?) in the given series?

310 320 321 331 332 342 ?3526

**(a)** 341
**(b)** 343
**(c)** 344
**(d)** 342

**Q62.** In a certain code language, ‘FIRE’ is coded as ‘2739’ and ‘RISE’ is coded as ‘3978’. What is the code for ‘S’ in the given code language? 8996

**(a)** 3
**(b)** 8
**(c)** 9
**(d)** 7

**Q63.** Riddhima ranked 18^(th) from the top and 43^(rd) from the bottom in his class. How many students are there in the class?

**(a)** 61
**(b)** 43
**(c)** 60
**(d)** 50

**Q64.** Read the given statements and conclusions carefully. Assuming that the information given in the statements is true, even if it appears to be at variance with commonly known facts, decide which of the given conclusions logically follow(s) from the statements.

Statements:

All denims are trousers.

All trousers are shoes.

Conclusions:

(I): Some shoes are trousers.

(II): All denims are shoes.

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

**Q65.** Seven boxes B, C, D, I, J, K and L are kept one over the other but not necessarily in the same order. Only I is kept above C. Only L is kept between C and J. Only K is kept below D. How many boxes are kept between B and I?

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

**Q66.** Read the given statements and conclusions carefully. Assuming that the information given in the statements is true, even if it appears to be at variance with commonly known facts, decide which of the given conclusions logically follow(s) from the statements.

Statements:

All chalan are tax.

All chalan are rebate.

Conclusions:

(I): Some tax are rebate.

(II): All rebate are chalan.

**(a)** Both conclusions (I) and (II) follow.
**(b)** Only conclusion (II) follows.

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**(c)** Only conclusion (I) follows.
**(d)** Neither conclusion (I) nor (II) follows.

**Q67.** A, B, C, D, W, X and Y are sitting in a straight line, facing the north.

Only two people sit to the right of X. Only two people sit between X and C. Only two people sit between A and D. D sits to the immediate left of X. B sits to the immediate right of Y.

Who sits at the third position from the left end of the line?

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

**Q68.** This question is based on the following words.

(Left) TOK, THE, HAS, ALL, COW (Right)

If in each of the words, each letter is changed to the letter immediately following it in the English alphabetical order, how many words thus formed will have no vowel?6295

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

**Q69.** Based on the English alphabetical order, three of the following four letter-cluster pairs are alike in a certain way and thus form a group. Which letter-cluster pair DOES NOT belong to that group?

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

**(a)** DG-BE
**(b)** JM-HL
**(c)** HK-FJ
**(d)** FI-DH

**Q70.** Refer to the number series given below and answer the question that follows. Counting to be done from left to right only.

(NOTE: All numbers are single-digit numbers only.)

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

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

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

**Q71.** Select the triad which follows the same pattern as that followed by the two triads given below. Both triads follow the same pattern.

NG-LE-JL

KD-IB-GI

**(a)** RJ-OG-MP
**(b)** QJ-OH-MO
**(c)** QJ-OH-MP
**(d)** RJ-OH-MP

**Q72.** If ‘A’ stands for ‘÷’, ‘B’ stands for ‘x’, ‘C’ stands for ‘+’ and ‘D’ stands for ‘-‘, what will come in place of the question mark ‘?’ in the following equation?

10 B 2 C 7 D 8 A 2 = ?

**(a)** 22
**(b)** 21

**(c)** 23
**(d)** 24

**Q73.** Select the set in which the numbers are related in the same way as are the numbers of the following sets.

(Note: Operations should be performed on the whole numbers, without breaking down the numbers into their constituent digits.)

(46, 56, 10)

(22, 33, 11)

**(a)** (12, 29, 14)
**(b)** (35, 63, 25)
**(c)** (4, 17, 10)
**(d)** (15, 20, 5)

**Q74.** In the following triads, each group of letters is related to the subsequent one following a certain logic. Select from the given options, the one which follows the same logic.

BEST - TSBE - BSET

COWS - SWCO - CWOS

**(a)** SALT - SLAT - TLAS
**(b)** MADE - EDMA - MDAE
**(c)** URIC - RIUC - RICU
**(d)** PAGE - EGPA - AGPE

**Q75.** This question is based on the five, three-digit numbers given below.

(Left) 548 658 254 369 714 (Right)

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

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

What will be the resultant if the second digit of the second highest number is multiplied with the the third digit of the lowest number?

**(a)** 20
**(b)** 18
**(c)** 17
**(d)** 19

**Q76.** What should come in place of the question mark (?) in the given series?

312 310 306 300 292 282 ?4226

**(a)** 276
**(b)** 274
**(c)** 272
**(d)** 270

**Q77.** Each of the digits in the number 5628743 is arranged in ascending order from left to right. The position(s) of how many digits will remain unchanged as compared to that in the original number?

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

**Q78.** 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 is the letter-cluster that DOES NOT belong to that group?

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

**(a)** XTR
**(b)** FBZ
**(c)** CZW
**(d)** MIG

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**Q79.** Which of the following letter-number clusters will replace the question mark (?) in the given series to make it logically complete?

KM 17, NP 20, QS 23, TV 26, ?

**(a)** XY 29
**(b)** XY 30
**(c)** WY 30
**(d)** WY 29

**Q80.** Mr. Akai starts from Point A and drives 5 km towards south. He then takes a right turn, drives 15 km, turns right and drives 24 km. He then takes a right turn and drives 29 km. He takes a final right turn, drives 19 km and stops at Point P. How far (shortest distance) and towards which direction should he drive in order to reach Point A again? (All turns are 90 degrees turns only unless specified)

**(a)** 14 km to the east
**(b)** 10 km to the south
**(c)** 14 km to the west
**(d)** 10 km to the north

## GENERAL AWARENESS AND CURRENT AFFAIRS

**Q81.** In May 2025, what change did the Supreme Court make regarding environmental clearances (EC)?

**(a)** Rejected retrospective ECs as illegal
**(b)** Approved retrospective clearances
**(c)** Made ECs optional
**(d)** Allowed clearances without public hearings

**Q82.** What was the name of the military operation launched by the Indian Armed Forces in response to the Pahalgam terror attack in 2025?

**(a)** Operation MANGALSUTRA
**(b)** Operation SUHAGAN
**(c)** Operation SAUBHAGYA
**(d)** Operation SINDOOR

**Q83.** Which IIHF goaltender was named MVP of the 2025 World Championship?

**(a)** Nick Olesen
**(b)** David Pastrňák
**(c)** Zach Werenski
**(d)** Leonardo Genoni

**Q84.** As announced by Indian Space Research Organisation (ISRO) in February 2025, what is the weight of the world's largest vertical propellant mixer for solid rocket motors?

**(a)** 10 tonnes
**(b)** 5 tonnes
**(c)** 7 tonnes
**(d)** 13 tonnes

**Q85.** In a landmark judgment on 8 April 2025, the Supreme Court deemed which state governor's refusal to assent to 10 state bills as illegal and unconstitutional?

**(a)** Maharashtra
**(b)** Andhra Pradesh
**(c)** Tamil Nadu
**(d)** Telangana

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**Q86.** Which Indian state leads in mangrove afforestation under MISHTI scheme as of February 2025?

**(a)** West Bengal
**(b)** Odisha
**(c)** Andhra Pradesh
**(d)** Gujarat

**Q87.** How many Kirti Chakras were conferred during the Defence Investiture Ceremony 2025 (Phase-I)?

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

**Q88.** Vaidya Tara Chand Sharma, Vaidya Maya Ram Uniyal and Vaidya Sameer Govind Jamadagni were the recipients of which of the following awards in 2025?

**(a)** National Florence Nightingale Awards
**(b)** National Award to Teachers
**(c)** Nelson Mandela Award for Health Promotion
**(d)** National Dhanwantari Ayurveda Awards

**Q89.** In May 2025, which of the following two companies received Reserve Bank of India's (RBI) in-principle approval for cross-border payment aggregation?

**(a)** PhonePe and Razorpay
**(b)** PayPal and Worldline
**(c)** Amazon Pay and Instamojo
**(d)** Google Pay and Stripe

**Q90.** What was the distance Krishna Jayasankar achieved in her record-breaking indoor shot put performance in 2025?

**(a)** 17.5 m
**(b)** 16.03 m
**(c)** 12.7 m
**(d)** 14.2 m

**Q91.** Who among the following was elected as the President of South Korea in June 2025?

**(a)** Yoon Suk Yeol
**(b)** Lee Jae-myung
**(c)** Lee Jun-seok
**(d)** Kim Moon-soo

**Q92.** According to the Finland-based Centre for Research on Energy and Clean Air (CREA), which region was identified as the most polluted zone in India in October 2025?

**(a)** Western Ghats
**(b)** Indo-Gangetic Plain
**(c)** Deccan Plateau
**(d)** Eastern Himalayas

**Q93.** In which country was the FIG Apparatus World Cup 2025, where Pranati Nayak won bronze, held?

**(a)** Turkey
**(b)** Germany
**(c)** Japan
**(d)** India

**Q94.** According to the Reserve Bank of India's announcement in May 2025, which denomination of the Mahatma Gandhi (New) Series banknote, carrying the signature of the new RBI Governor, Sanjay Malhotra, is set to be released?

**(a)** Rs. 5
**(b)** Rs. 200

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**(c)** Rs. 100
**(d)** Rs. 20

**Q95.** Who among the following won the International Booker Prize in 2025 for 'Heart Lamp'?
**(a)** Kiran Desai
**(b)** Salman Rushdie
**(c)** Arundhati Roy
**(d)** Banu Mushtaq

**Q96.** Up to what depth will India's first manned deep ocean mission 'Samudrayaan' be launched, using the manned submersible vehicle 'Matsya,' by the end of 2026?
**(a)** 6,000 metres
**(b)** 8,000 metres
**(c)** 4,500 metres
**(d)** 9,500 metres

**Q97.** With which defense organisation has the Indian Navy jointly conducted successful combat trials of the indigenously developed Multi-Influence Ground Mine (MIGM) in May 2025?
**(a)** Hindustan Aeronautics
**(b)** Defense Research and Development Organisation
**(c)** Bharat Dynamics
**(d)** Armed Forces Tribunal

**Q98.** What was the theme of the 9^(th) International Maritime Security Conference (IMSC) organised by the Republic of Singapore in May 2025?
**(a)** Safe and Secure Seas
**(b)** Maritime Connectivity and Economic Growth
**(c)** Navigating New Horizons in Maritime Innovation
**(d)** Emerging Challenges in Undersea Technologies

**Q99.** What was the theme of National Doctor's Day in 2025?
**(a)** Healing Hands, Caring Hearts
**(b)** Family Doctors on the Front Line
**(c)** Behind the Mask: Who Heals the Healers?
**(d)** Celebrating Resilience and Healing Hands

**Q100.** In 2025, which Indian female athlete set a new national record in the 3000 m steeplechase event?
**(a)** Jyothi Yarraji
**(b)** Parul Chaudhary
**(c)** Hima Das
**(d)** Annu Rani

## ANSWER KEY

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

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| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 91 b | 92 b | 93 a | 94 d | 95 d | 96 a | 97 b | 98 a | 99 c | 100 b |

## SOLUTIONS

**Q1. Answer: (d) reflection of sound**

The correct answer is reflection of sound.

Key Points

• The working principle of a stethoscope is based on the reflection and amplification of sound waves. This enables the doctor to hear internal body sounds such as heartbeats or lung sounds clearly.

• The stethoscope consists of a chest piece, a tube, and earpieces. When the chest piece is placed on the body, the sound waves are reflected and transmitted through the tube to the doctor's ears.

• Sound waves from internal organs such as the heart and lungs reflect off the walls of the stethoscope’s diaphragm, enhancing the clarity of the sound.

• The stethoscope diaphragm vibrates in response to sound waves, and these vibrations are transmitted through the hollow tube to the earpieces.

• The reflection of sound is critical because it concentrates the sound waves and eliminates noise interference, allowing the physician to detect abnormalities effectively.

• This principle can detect sounds at low frequencies, which are crucial for diagnosing conditions like heart murmurs or respiratory issues.

Additional Information

• Reflection of Sound:

• Sound waves, like light waves, can reflect when they hit a surface. This phenomenon is used in many applications such as stethoscopes, sonar, and ultrasound devices.

• In stethoscopes, the curved diaphragm acts as a reflecting surface that collects and transmits sound waves efficiently.

• The reflection of sound allows the focusing of sound waves, making faint noises from internal organs more audible.

• Components of a Stethoscope:

• The chest piece contains a diaphragm (for high-frequency sounds) and a bell (for low-frequency sounds).

• The tubing transmits sound without significant loss, ensuring that the doctor hears clear and amplified internal body sounds.

• The earpieces are designed to fit snugly into the ear canal, eliminating external noise interference.

• Applications of Stethoscopes:

• Used to listen to heartbeats for diagnosing conditions like arrhythmias, valve abnormalities, and murmurs.

• Helps in monitoring respiratory sounds, aiding in the diagnosis of lung infections, asthma, or pneumonia.

• Used during blood pressure measurement to detect Korotkoff sounds.

• Important Characteristics of Sound Reflection:

• Reflection occurs when sound waves hit a surface and bounce back.

• It is influenced by the nature of the surface (smooth surfaces reflect sound more efficiently).

• This principle is used in both mechanical and electronic medical devices.

Important Points

• Option 1: Absorption of high-frequency sound – This is incorrect as stethoscopes primarily reflect and amplify sound waves rather than absorb them.

• Option 2: Conversion of sound into electric signals only – This is incorrect because traditional stethoscopes are mechanical devices and do not convert sound into electrical signals.

• Option 3: Conversion of sound into light for observation – This is incorrect as stethoscopes do not involve the use of light for sound detection.

• Option 4: Reflection of sound – Correct as stethoscopes work on the principle of sound reflection to amplify internal body sounds.

**Q2. Answer: (a) Image is always virtual, erect, and on the same side as the object**

The correct answer is Image is always virtual, erect, and on the same side as the object.

Key Points

• A concave lens always forms an image that is virtual, erect, and smaller than the object. The image is formed on the same side as the object, irrespective of the object's position.

• The focal length of a concave lens is negative, and it diverges light rays, making them appear to originate from a point on the same side as the object.

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• Virtual images are formed because the light rays diverge after passing through the lens and do not actually converge to form a real image.

• Concave lenses are used in devices like glasses for correcting myopia (nearsightedness), cameras, and telescopes, where the formation of a smaller virtual image is required.

• Real images cannot be formed by concave lenses as they only diverge light rays. Hence, statements about real images are incorrect.

Additional Information

• Concave Lens Characteristics:

• A concave lens is thinner at the center and thicker at the edges.

• It is also known as a diverging lens because it spreads out light rays that pass through it.

• The focal length of a concave lens is represented by a negative value, indicating the divergent nature.

• Applications of Concave Lens:

• Used in glasses for correcting myopia, where distant objects appear blurry.

• In binoculars, telescopes, and cameras, concave lenses help focus and adjust the light rays.

• Used in projectors to spread light uniformly.

• Comparison with Convex Lens:

• While concave lenses produce virtual images, convex lenses can produce both real and virtual images depending on the object's position.

• Convex lenses converge light rays, while concave lenses diverge them.

• Convex lenses are used in magnifying glasses and cameras to create real images.

• Important Facts:

• In physics, the study of lenses falls under the branch of optics, which explores how light interacts with different mediums.

• The behavior of concave lenses is explained using the principles of ray diagrams and geometrical optics.

• Concave lenses are often paired with convex lenses in optical instruments for corrective purposes.

Important Points

• Statement Analysis:

• Statement 1 (Image is always virtual, erect, and on the same side as the object): Correct. Concave lenses always produce virtual images on the same side as the object.

• Statement 2 (Image is always real): Incorrect. Concave lenses never produce real images as they diverge light rays.

• Statement 3 (Image is always virtual and on the opposite side): Incorrect. Virtual images formed by concave lenses are always on the same side as the object.

• Statement 4 (Image is much larger than the object): Incorrect. The image formed by concave lenses is smaller than the object.

• Use in Scientific Instruments:

• Concave lenses are integral to designing microscopes, telescopes, and other optical devices.

• They are often combined with convex lenses to achieve better focus and image clarity.

**Q3. Answer: (b) They never intersect**

The correct answer is They never intersect.

Key Points

• Electric field lines never intersect: This is because, at any given point in space, the electric field has a unique direction. If two field lines were to intersect, it would mean that the electric field has two directions at that point, which is not possible. Hence, this statement is correct.

• Electric field lines do not form closed loops: Electric field lines originate from positive charges and terminate on negative charges. They cannot form closed loops, as this would violate the principle that electric fields have sources (positive charges) and sinks (negative charges). Hence, this statement is incorrect.

• Electric field lines start on negative charges and end on positive charges: This is incorrect. Electric field lines originate from positive charges and terminate on negative charges. Hence, this statement is incorrect.

• Electric field lines are not always straight lines: The shape of electric field lines depends on the configuration of charges. For example, in the case of a single point charge, the lines are radial, but in the case of a dipole, the lines are curved. Hence, this statement is incorrect.

Additional Information

• Electric Field Lines:

• Electric field lines are an abstract representation of the electric field. They provide a visual way to understand the strength and direction of the field at various points in space.

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• The density of electric field lines represents the magnitude of the electric field. Closer lines indicate a stronger field, while lines farther apart indicate a weaker field.

• Properties of Electric Field Lines:

• They originate from positive charges and terminate on negative charges.

• They never intersect because the electric field at any point has a unique direction.

• They do not form closed loops because electric fields are conservative in nature.

• In a uniform electric field, the field lines are parallel and equidistant.

• Applications of Electric Field Lines:

• They help in visualizing electric fields around charge distributions.

• They are used in understanding the behavior of charges in electric fields, such as in capacitors and dipoles.

• They are crucial in designing devices like electric motors, generators, and capacitors.

• Examples of Electric Field Configurations:

• Single Charge: Electric field lines radiate outward for a positive charge and inward for a negative charge.

• Dipole: Electric field lines are curved and originate from the positive charge to terminate on the negative charge.

• Parallel Plates: The electric field is uniform, with straight, parallel lines between the plates.

Important Points

• Mathematical Representation: The electric field at a point is represented as E = F/q, where F is the force on a test charge q.

• Superposition Principle: The net electric field at a point due to multiple charges is the vector sum of the electric fields due to individual charges.

• Electric Dipole: It consists of two equal and opposite charges separated by a small distance. The electric field lines of a dipole are distinctive and curved.

• Conservative Nature: The work done in moving a charge in an electric field depends only on the initial and final positions, not on the path taken.

**Q4. Answer: (d) Metals are sonorous and produce sound when struck.**

The correct answer is Metals are sonorous and produce sound when struck..

Key Points

• Sonority of Metals: Metals are sonorous, meaning they produce a ringing sound when struck. This is due to their ability to vibrate uniformly, which is a distinctive physical property of metals.

• Low Melting and Boiling Points: The statement that metals have low melting and boiling points is incorrect. Most metals, such as iron and tungsten, have very high melting and boiling points, making them suitable for high-temperature applications.

• Brittleness: Metals are generally malleable and ductile, meaning they can be hammered or drawn into wires without breaking. The statement that metals are brittle is incorrect, as brittleness is a property of non-metals like sulfur or phosphorus.

• Conductivity: Metals are excellent conductors of heat and electricity due to the presence of free electrons. The statement that metals are poor conductors is incorrect.

• Practical Examples: The sonorous nature of metals is utilized in making bells, gongs, and musical instruments like cymbals, where the production of a clear sound is essential.

Additional Information

• Malleability and Ductility: Metals like gold and silver are highly malleable and ductile, allowing them to be shaped into thin sheets or drawn into wires. These properties are crucial for jewelry and electrical wiring.

• Electrical Conductivity: Metals like copper and aluminum are extensively used in electrical circuits due to their high conductivity. Their free electrons facilitate the easy flow of electricity.

• Thermal Conductivity: Metals like silver and copper are excellent thermal conductors, making them ideal for cookware and heat exchangers.

• High Density: Most metals have a high density, meaning they are heavy for their size. For example, iron and lead are significantly denser than non-metals like carbon.

• Melting Points: Metals generally have high melting points. For instance, tungsten has the highest melting point among metals, at approximately 3422°C, making it useful in light bulb filaments.

Important Points

• Applications of Sonorous Metals: The sonorous property of metals is utilized in making bells, church gongs, and tuning forks, where the production of a resonating sound is essential.

• Exceptions: While most metals are sonorous, some metals like mercury, which is in liquid form at room temperature, do not exhibit sonority.

• Industrial Usage: Sonorous metals like bronze and brass are widely used in musical instruments due to their ability to produce clear and resonating sounds.

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**Q5. Answer: (d) Lead(II) iodide (PbI2)**

The correct answer is Lead(II) iodide (PbI2).

Key Points

• Reaction Overview: When lead nitrate (Pb(NO3)2) reacts with potassium iodide (KI), a double displacement reaction occurs, forming a yellow precipitate of Lead(II) iodide (PbI2). This reaction is represented as: Pb(NO3)2 + 2KI → PbI2 (yellow precipitate) + 2KNO3.

• Formation of Precipitate: Lead(II) iodide (PbI2) is insoluble in water, which is why it forms a solid yellow precipitate during the reaction.

• Potassium nitrate: Potassium nitrate (KNO3) remains dissolved in the solution as it is highly soluble in water, and does not form a precipitate.

• Double Displacement Reaction: The reaction between lead nitrate and potassium iodide is classified as a double displacement reaction where ions exchange places to form new compounds.

• Color of PbI2: The distinct yellow color of Lead(II) iodide makes the identification of the precipitate straightforward and is a characteristic property of this compound.

Additional Information

• Lead(II) iodide (PbI2):

• PbI2 is a yellow crystalline solid that is sparingly soluble in water but soluble in hot water.

• It is commonly used in laboratory experiments to demonstrate precipitation reactions and is also used in applications like solar cells.

• PbI2 exhibits interesting optical properties and has been studied for its potential in optoelectronic devices.

• Potassium nitrate (KNO3):

• KNO3 is a soluble ionic compound and does not form a precipitate in the reaction.

• It is widely used in fertilizers, food preservation, and pyrotechnics.

• Its role in this reaction is as a by-product, remaining dissolved in the aqueous medium.

• Double Displacement Reactions:

• These reactions involve the exchange of ions between two reacting compounds to form two new compounds.

• One of the products is often a precipitate, gas, or water, making it easy to identify such reactions.

• Common examples include reactions between salts, acids, and bases.

• Solubility Rules:

• According to solubility rules, nitrates (NO3^-) are generally soluble in water, which explains why KNO3 remains in solution.

• Halides of lead, such as PbI2, tend to be insoluble, leading to the formation of a precipitate.

Important Points

• Laboratory Demonstrations: The reaction between lead nitrate and potassium iodide is often demonstrated in chemistry laboratories to teach concepts of precipitation and solubility.

• Environmental Concerns: Lead compounds, including PbI2, are toxic and must be handled with care. Disposal should follow proper guidelines to avoid environmental harm.

• Applications of PbI2: Due to its optical properties, PbI2 has been explored for use in perovskite solar cells and radiation detectors.

• Reaction Classification: The reaction is a clear example of a double displacement reaction and highlights the importance of solubility rules in predicting reaction outcomes.

• Precipitation Reactions: These reactions are crucial in analytical chemistry for the qualitative and quantitative determination of ions in solution.

**Q6. Answer: (b) 5 m/s²**

The correct answer is 5 m/s².

Key Points

• Acceleration is the rate of change of velocity of an object per unit time. The formula to calculate acceleration is:

a = (v - u) / t, where:

• a is acceleration,

• v is the final velocity,

• u is the initial velocity, and

• t is the time taken.

• Here, the car starts from rest, so the initial velocity (u) = 0 m/s.

• The final velocity (v) attained by the car is 20 m/s.

• The time taken (t) for this change is 4 seconds.

• Substituting these values into the formula:

$a = (20 - 0) / 4 = 20 / 4 = 5$ m/s².

• Hence, the acceleration of the car is 5 m/s², which matches the given option.

Additional Information

• Acceleration:

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

• If an object speeds up, the acceleration is positive; if it slows down, the acceleration is negative (also called deceleration).

• Units of acceleration are typically expressed as meters per second squared (m/s²).

• Types of Acceleration:

• Uniform Acceleration: When the rate of change of velocity remains constant over time (e.g., free fall under gravity).

• Non-uniform Acceleration: When the rate of change of velocity varies over time (e.g., a car accelerating unevenly).

• Real-life Applications of Acceleration:

• Used in designing vehicles to ensure optimal speed and safety during acceleration.

• Helps astronauts understand forces during rocket launches.

• Essential in physics experiments to study motion and forces.

• Newton's Second Law of Motion:

• The concept of acceleration is closely tied to Newton's Second Law, which states:

$F = ma$, where:

• F is the force applied,

• m is the mass of the object, and

• a is the acceleration produced.

• This law explains the relationship between force, mass, and acceleration.

Important Points

• SI Units: Always ensure the units are consistent when solving equations involving velocity, time, and acceleration. For instance, use seconds for time and meters/second for velocity.

• Motion Equations: Other equations used in motion analysis include:

• $v = u + at$

• $s = ut + 1/2\ at^2$

• $v^2 = u^2 + 2as$

• Practical Example: A rocket taking off from the ground or a car speeding up on a highway are examples of acceleration in real life.

**Q7. Answer: (c) Density decreases**

The correct answer is Density decreases.

Key Points

• Density is defined as the mass per unit volume of a substance, expressed mathematically as Density = Mass/Volume.

• When the temperature of a substance increases, its volume typically expands due to the increase in kinetic energy of the particles. This phenomenon is more pronounced in gases and liquids.

• Since density is inversely proportional to volume, an increase in volume leads to a decrease in density. Hence, option 3 is correct.

• This behavior is most commonly observed in liquids and gases, where particles move more freely compared to solids. In solids, the effect is minimal due to their rigid structure.

• For example, when water is heated, its molecules move faster, causing the liquid to expand, resulting in a lower density.

Additional Information

• Density and Temperature Relationship:

• Solids: The density of solids is minimally affected by temperature changes due to their rigid molecular structure.

• Liquids: Liquids expand more noticeably when heated, leading to a decrease in density. For example, hot water is less dense than cold water.

• Gases: Gases exhibit the greatest change in density with temperature. When heated, gases expand significantly, causing their density to drop. This is governed by the Ideal Gas Law ($PV = nRT$).

• Applications of Density Changes:

• Hot Air Balloons: Heated air inside the balloon becomes less dense than the cooler air outside, enabling the balloon to rise.

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• Ocean Currents: Temperature-induced density changes in seawater contribute to the formation of ocean currents.

• Expansion of Metals: In engineering, temperature-induced density changes are considered when designing structures like bridges and pipelines.

• Anomalous Behavior of Water:

• Unlike most substances, water exhibits an anomalous expansion where its density decreases as it is cooled below 4°C, leading to ice floating on water.

• This unique property plays a crucial role in maintaining aquatic ecosystems during winter.

• Thermal Expansion Coefficient:

• The rate at which a substance expands with temperature is quantified by its thermal expansion coefficient.

• Substances with a high thermal expansion coefficient experience greater density changes when heated.

Important Points

• Ideal Gas Law: The density (ρ) of a gas is given by the formula ρ = P/(RT), where P is pressure, R is the gas constant, and T is temperature.

• In engineering, temperature-induced density changes must be considered for materials exposed to heat, such as turbine blades and engine parts.

• Thermal Expansion in Liquids: This property is utilized in thermometers, where the liquid expands with rising temperature to indicate the reading.

• Environmental Implications: Density changes in air and water due to temperature variations are significant in weather patterns, climate dynamics, and ecological balance.

**Q8. Answer: (a) It kills pests and insects that could otherwise damage stored grains.**

The correct answer is It kills pests and insects that could otherwise damage stored grains..

Key Points

• Fumigation is a process used in the safe storage of food grains to eliminate pests, insects, and other biological threats that can damage the grains. This ensures the quality and longevity of the stored grains.

• The method involves the use of chemical fumigants, such as phosphine, methyl bromide, or sulfuryl fluoride, which are released in a controlled environment to destroy pests at all life stages, including eggs, larvae, pupae, and adults.

• Fumigation is particularly effective in protecting grains during long-term storage by preventing infestations that can lead to spoilage and economic losses.

• This practice is crucial for maintaining the food security of a nation, as it prevents wastage and ensures that grains remain fit for consumption.

• It is important to note that fumigation does not alter the nutritional value, weight, or moisture content of the grains, but solely targets pests and insects.

Additional Information

• Purpose of Fumigation:

• The primary purpose of fumigation is to eliminate infestations by killing pests such as weevils, beetles, moths, and mites in stored grains.

• It is a preventive measure to ensure that food grains remain free from contamination.

• Commonly Used Fumigants:

• Phosphine: This is one of the most widely used fumigants due to its high efficacy and low residue levels.

• Methyl Bromide: Although effective, its use is restricted in many countries due to its potential environmental and health hazards.

• Carbon Dioxide: Often used as a natural alternative for organic fumigation.

• Fumigation Process:

• The grains are stored in airtight containers or silos before the fumigant is introduced.

• The fumigant is allowed to circulate for a specific period to ensure complete pest eradication.

• After fumigation, the storage area is ventilated to remove any remaining traces of the chemical.

• Legal and Safety Regulations:

• Fumigation is regulated by government guidelines to ensure safe and effective use of chemicals.

• For example, in India, the Insecticides Act, 1968 governs the use of fumigants to prevent misuse and safeguard public health.

• Importance in Agriculture:

• Fumigation plays a critical role in maintaining the quality of stored grains, especially in agricultural economies where grains are stored for extended periods.

• It helps reduce post-harvest losses, which account for a significant portion of food wastage globally.

Important Points

• Option 2: "It increases the weight of the grains" is incorrect as fumigation does not affect the physical weight or mass of the grains.

• Option 3: "It prevents moisture loss from grains" is incorrect because fumigation does not impact the moisture levels of the grains.

• Option 4: "It adds nutrients to the grains" is incorrect since fumigation is not intended to alter the nutritional composition of the grains.

• Fumigation is purely a pest control method, ensuring that the grains remain safe for human consumption and free from infestations.

**Q9. Answer: (a) its kinetic energy**

The correct answer is its kinetic energy.

Key Points

• The work-energy principle states that the work done by all forces acting on a body is equal to the change in its kinetic energy. This is a fundamental concept in physics.

• The moving body possesses kinetic energy, which is defined as KE = (1/2)mv², where m is the mass of the body, and v is its velocity.

• When an external force is applied to bring the moving body to rest, it does negative work on the body by reducing its velocity to zero.

• The amount of work required to stop the body is equal to the initial kinetic energy of the body because the kinetic energy is converted into work done by the external force.

• Other quantities like weight, momentum, or potential energy are not directly involved in the process of stopping a moving object unless specifically mentioned in the context.

• Hence, the work done by the external force to stop the moving body is equal to its kinetic energy.

Additional Information

• Kinetic Energy:

• Kinetic energy is the energy possessed by a body due to its motion.

• The formula is KE = (1/2)mv², where m is mass and v is velocity.

• It is a scalar quantity, meaning it has magnitude but no direction.

• Kinetic energy is measured in joules (J) in the SI system.

• Work-Energy Theorem:

• The work-energy theorem states that the work done by the net force acting on an object is equal to the change in its kinetic energy.

• Mathematically, W = ΔKE = KE_final - KE_initial.

• When a moving object is brought to rest, its final kinetic energy is zero, and the work done equals its initial kinetic energy.

• Weight:

• Weight is the force exerted by gravity on a body, calculated as W = mg, where m is the mass of the body and g is the acceleration due to gravity.

• Weight is unrelated to the kinetic energy unless the context involves motion against gravity.

• Momentum:

• Momentum is the product of the mass and velocity of an object, given by p = mv.

• While momentum is conserved in a closed system, it is not directly equal to the work done to stop a moving body.

• Potential Energy:

• Potential energy is the energy possessed by a body due to its position in a force field, such as gravity or elasticity.

• It is calculated as PE = mgh for gravitational potential energy.

• Potential energy is not relevant in the context of stopping a moving object unless the object is moving in a potential energy field.

Important Points

• The conversion of energy is fundamental in physics. In this case, the kinetic energy of the moving object is converted into work done by the external force to bring it to rest.

• The negative work done by the external force reduces the velocity of the object to zero.

• Understanding the distinction between kinetic energy, momentum, and potential energy is crucial for solving problems related to motion and forces.

• Real-world examples of this concept include applying brakes to a moving vehicle, where the brakes do work to reduce the car's kinetic energy to zero.

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**Q10. Answer: (a) Health education and medical care**

The correct answer is Health education and medical care.

Key Points

• Health education and medical care are crucial components in maintaining reproductive health. They provide awareness and preventive measures to avoid diseases and promote overall well-being.

• Health education ensures individuals have the knowledge to make informed decisions about contraception, family planning, sexually transmitted infections (STIs), and safe sexual practices.

• Access to medical care, such as routine health check-ups, vaccinations, and treatment for diseases, plays a vital role in reducing reproductive health issues.

• Proper health education empowers people to recognize the importance of hygiene, nutrition, and regular medical check-ups, which are essential for reproductive health.

• Government and non-governmental organizations often implement programs focusing on reproductive health awareness, particularly for adolescents and women in rural areas, to reduce maternal and infant mortality rates.

Additional Information

• Hygiene: Maintaining personal hygiene, particularly during menstruation, pregnancy, and post-pregnancy, is critical for avoiding infections and promoting reproductive health.

• Impact of Early Marriage: Early marriage can negatively affect reproductive health as it often leads to early pregnancies, which increase the risk of maternal and infant mortality. Hence, it should be avoided.

• Junk Food: Regular consumption of junk food can lead to malnutrition, obesity, and hormonal imbalances, adversely impacting reproductive health.

• Reproductive Health Programs in India: Initiatives such as the National Reproductive and Child Health (RCH) Program aim to improve maternal and child health by providing essential services like antenatal care, safe delivery, and contraception.

• Adolescent Health: Programs like the Rashtriya Kishor Swasthya Karyakram (RKSK) focus on improving adolescent health, which includes components of reproductive health education and services.

Important Points

• Government Schemes: In India, schemes like Janani Suraksha Yojana and Pradhan Mantri Matru Vandana Yojana aim to improve reproductive health by providing financial incentives for institutional deliveries and maternal nutrition.

• Data and Statistics: According to the National Family Health Survey (NFHS-5), maternal health indicators such as institutional delivery rates and antenatal care coverage have significantly improved in recent years.

• Role of NGOs: Non-governmental organizations such as Population Foundation of India and PATH work extensively in creating awareness and providing resources for reproductive health, especially in underserved communities.

• Global Perspective: According to the World Health Organization (WHO), comprehensive sexual and reproductive health services are integral to achieving the Sustainable Development Goals (SDG) 3, which target ensuring healthy lives and promoting well-being.

**Q11. Answer: (d) Manufacture of lipids**

The correct answer is Manufacture of lipids.

Key Points

• The Smooth Endoplasmic Reticulum (SER) is primarily responsible for the manufacture of lipids. Lipids are essential for cell membrane formation, energy storage, and signaling.

• Unlike the Rough Endoplasmic Reticulum (RER), the SER lacks ribosomes, which gives it a smooth appearance under the microscope.

• The SER is involved in the synthesis of steroid hormones in endocrine cells, such as those in the adrenal glands and gonads.

• It also plays a crucial role in the detoxification of drugs and harmful substances in liver cells.

• In muscle cells, the SER is referred to as the sarcoplasmic reticulum and is responsible for regulating calcium ion storage and release, which is vital for muscle contraction.

Additional Information

• Protein Synthesis (Option 1):

• Protein synthesis is a function of the Rough Endoplasmic Reticulum (RER), not the SER. The RER is studded with ribosomes, which facilitate the production of proteins.

• Proteins synthesized in the RER are often destined for secretion or incorporation into the cell membrane.

• Assembly of Ribosomes (Option 2):

• Ribosome assembly occurs in the nucleolus, a structure within the nucleus of the cell. This process is independent of both the RER and SER.

• Once assembled, ribosomes may either float freely in the cytoplasm or attach to the RER for protein synthesis.

• Modification of Sugars (Option 3):

• The modification of sugars is typically a function of the Golgi apparatus, not the SER. The Golgi apparatus processes and packages carbohydrates for incorporation into glycoproteins and glycolipids.

• This organelle plays a key role in the transport of macromolecules within the cell.

• Manufacture of Lipids (Correct Answer - Option 4):

• The SER synthesizes phospholipids, which are critical components of cellular membranes.

• It also produces cholesterol and steroid hormones, which are essential for various physiological functions.

Important Points

• The SER is abundant in cells specialized for lipid metabolism, such as liver cells and adipocytes.

• It also plays a role in the storage of ions, particularly calcium ions in muscle cells, which is critical for muscle function.

• The SER detoxifies substances like alcohol and drugs through enzymatic reactions, making it vital for maintaining cellular health.

• The balance of lipid production and metabolism in the SER is crucial for maintaining the structural integrity of membranes and proper cellular function.

**Q12. Answer: (c) rate of flow of electric charge**

The correct answer is rate of flow of electric charge.

Key Points

• Electric current is defined as the rate at which electric charge flows through a conductor or a circuit. It is typically measured in amperes (A).

• Current is expressed mathematically as I = Q / t, where Q represents the electric charge in coulombs, and t is the time in seconds during which the charge flows.

• The direction of current flow is conventionally taken to be from the positive terminal to the negative terminal, even though electrons flow in the opposite direction.

• Electric current arises due to the movement of electrons or charged particles, and it can be classified into direct current (DC), where the flow is unidirectional, or alternating current (AC), where the direction periodically reverses.

• In practical applications, current can be generated by various sources such as batteries, generators, or solar cells, depending on the requirement.

Additional Information

• Option 1: Amount of charge per unit length:

• This statement is incorrect because electric current is not defined in terms of charge per unit length. Instead, it is based on the rate of charge flow over time.

• Charge per unit length may be relevant in specific contexts like linear charge density in physics, but it does not define electric current.

• Option 2: Energy consumed per unit time:

• This statement is incorrect as it refers to power, not current. Power is defined as the rate at which energy is transferred or consumed, and it is given by P = IV, where I is current and V is voltage.

• While power is closely related to current, it does not define electric current itself.

• Option 3: Rate of flow of electric charge:

• This is the correct definition of electric current. It quantifies how much charge passes through a given point in a circuit over a specified time.

• Current is a fundamental concept in electrical and electronic systems, and it forms the basis of various applications, from powering devices to signal transmission.

• Option 4: Amount of charge per unit area:

• This statement is incorrect as it refers to surface charge density, which is used in electrostatics to describe the distribution of charge on surfaces.

• Electric current, however, is not described in terms of charge per unit area.

Important Points

• Types of Current:

• Direct Current (DC): The flow of charge is unidirectional and constant over time. Batteries are common sources of DC.

• Alternating Current (AC): The flow of charge periodically reverses direction. Household electricity is typically AC, delivered at a frequency of 50 Hz in countries like India.

• Measurement of Electric Current:

• Current is measured using an instrument called an ammeter, which is connected in series in a circuit.

• The unit of current is the ampere (A), named after the French scientist André-Marie Ampère.

• Sources of Current:

• Electric current can be generated from various sources, such as chemical reactions in batteries, electromagnetic induction in generators, or photovoltaic effects in solar cells.

• In industrial applications, large generators produce currents that are distributed through power grids.

• Applications of Electric Current:

• Current plays a crucial role in powering electronic devices, lighting systems, motors, and communication networks.

• In medical applications, controlled electric currents are used in devices like ECGs and defibrillators.

**Q13. Answer: (a) 5 m/s**

The correct answer is 5 m/s.

Key Points

• Displacement: The displacement of the body is given as 50 m. Displacement is the shortest distance between the initial and final positions of the body in a straight line.

• Time Taken: The total time taken by the body to cover the displacement is 10 seconds.

• Average Velocity Formula: The formula for average velocity is:

Average Velocity = Total Displacement / Total Time

• Calculation:

Substituting the given values:

Average Velocity = 50 m / 10 s = 5 m/s.

• Interpretation: The body moves along a straight line with varying speed, but average velocity depends only on the total displacement and total time, not the actual speed variations. Hence, the correct answer is 5 m/s.

Additional Information

• Difference Between Speed and Velocity:

• Speed is a scalar quantity and measures how fast an object is moving. It does not consider direction.

• Velocity is a vector quantity, meaning it includes both magnitude and direction. Average velocity is determined by dividing total displacement by total time.

• Uniform vs. Non-Uniform Motion:

• Uniform Motion: The object covers equal distances in equal intervals of time, and speed remains constant.

• Non-Uniform Motion: The speed of the object changes, leading to varying distances covered in equal intervals of time.

• Importance of Displacement:

• Displacement is a vector quantity that reflects the overall change in position.

• It is crucial for calculating average velocity, as opposed to average speed, which uses total distance.

• SI Units:

• The SI unit of displacement is meter (m).

• The SI unit of time is second (s).

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

Important Points

• Average Velocity:

• It depends only on total displacement and total time, irrespective of how the speed varies during motion.

• It can be positive, negative, or zero depending on the direction of displacement.

• Instantaneous Velocity: Unlike average velocity, it refers to the velocity of an object at a specific moment during its motion.

• Relation Between Velocity and Speed:

• For straight-line motion in one direction, average speed and average velocity are equal if the motion does not reverse direction.

• If the motion involves changes in direction, average speed will always be greater than or equal to the average velocity.

**Q14. Answer: (b) -CHO**

The correct answer is -CHO.

Key Points

• Aldehydes are organic compounds characterized by the presence of the -CHO functional group, also called the aldehyde group. This group is fundamental to their chemical properties.

• The -CHO group consists of a carbon atom double-bonded to an oxygen atom (C=O) and single-bonded to a hydrogen atom (H), making it a carbonyl group with a hydrogen attached.

• The -CHO group is always located at the end of the carbon chain because it requires a terminal carbon atom to attach the

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hydrogen and oxygen atoms.

• Aldehydes are distinct from other carbonyl-containing compounds like ketones because ketones have the carbonyl group bonded to two carbon atoms, while aldehydes have one hydrogen atom attached to the carbonyl group.

• The correct answer is -CHO because this functional group is unique to aldehydes and defines their chemical behavior. Hence, the correct option is -CHO.

Additional Information

• Explanation of Other Functional Groups:

• -OH (Hydroxyl Group): This is the functional group of alcohols. It consists of an oxygen atom bonded to a hydrogen atom. Alcohols do not contain a carbonyl group like aldehydes, and hence this option is incorrect.

• -COOH (Carboxylic Acid Group): This functional group is present in carboxylic acids. It consists of a carbon atom double-bonded to an oxygen atom (C=O) and single-bonded to a hydroxyl group (-OH). Aldehydes do not have this structure, so this option is incorrect.

• -CO (Carbonyl Group): While aldehydes do contain a carbonyl group, this option is too generic. The specific functional group for aldehydes is -CHO, which includes the carbonyl group bonded to a hydrogen atom. Hence, this option is not specific enough to be correct.

• Applications of Aldehydes:

• Aldehydes are widely used in the chemical industry for the production of resins, dyes, and perfumes.

• Formaldehyde (the simplest aldehyde) is used in the production of plastics and disinfectants.

• Acetaldehyde is used in the synthesis of acetic acid and as a precursor in the production of certain flavors and fragrances.

• Reactions of Aldehydes:

• Aldehydes undergo oxidation reactions to form carboxylic acids.

• They also participate in nucleophilic addition reactions, such as the addition of alcohols to form hemiacetals and acetals.

• Their reactivity is influenced by the electron-withdrawing nature of the carbonyl group, making the carbon atom electrophilic.

• Examples of Aldehydes:

• Formaldehyde (HCHO): Used in the production of polymers and as a disinfectant.

• Acetaldehyde (CH3CHO): Used as an intermediate in the synthesis of acetic acid and in the production of perfumes.

• Benzaldehyde (C6H5CHO): Found in almond oil and used in the food and fragrance industries.

Important Points

• Distinguishing Aldehydes:

• Aldehydes can be distinguished from ketones using Tollens' Test, where aldehydes reduce Tollens' reagent (ammoniacal silver nitrate) to form a silver mirror.

• The Fehling's Test also distinguishes aldehydes, as they reduce Fehling's solution to form a brick-red precipitate of cuprous oxide (Cu2O).

• Importance of Functional Groups: Functional groups like -CHO play a crucial role in determining the chemical reactivity, physical properties, and biological activity of organic compounds.

**Q15. Answer: (a) Ethanol**

The correct answer is Ethanol.

Key Points

• Ethanol is a widely used alcohol as a fuel or fuel additive because of its renewable and eco-friendly nature.

• It is primarily produced from the fermentation of crops like sugarcane, corn, and other biomass materials, making it a renewable energy source.

• When blended with gasoline, ethanol reduces harmful emissions such as carbon monoxide and particulate matter, thereby improving air quality and promoting cleaner combustion.

• Many countries, including India, the United States, and Brazil, have adopted ethanol-blended fuels to reduce reliance on fossil fuels and improve energy security. For example, India has set a target of achieving a 20% ethanol blend with petrol by 2025.

• Ethanol has a high octane number, enhancing engine performance and reducing knocking in internal combustion engines.

Additional Information

• Methanol:

• Also known as wood alcohol, methanol is sometimes used as a fuel but is less common than ethanol because it is toxic and corrosive.

• It is primarily used in industrial applications, such as in the production of formaldehyde, acetic acid, and as a solvent.

• Propanol:

• Propanol is not commonly used as a fuel due to its higher production costs and less favorable combustion properties compared to ethanol and methanol.

• It finds its use mainly in the pharmaceutical and cosmetics industries as a solvent.

• Butanol:

• Butanol can also be used as a fuel or fuel additive, but its production is less efficient compared to ethanol.

• However, it has some advantages, such as higher energy content and lower volatility, making it a potential alternative in the future.

• Advantages of Ethanol-Blended Fuel:

• It helps reduce greenhouse gas emissions, supporting global efforts to combat climate change.

• Using ethanol reduces dependency on imported crude oil, promoting energy independence in countries like India.

• It supports the agricultural sector by creating demand for crops like sugarcane and corn.

• Blending ethanol in fuels leads to cleaner air by reducing harmful pollutants.

Important Points

• Ethanol Production in India:

• In India, ethanol production is primarily derived from sugarcane molasses under the National Bio-Energy Mission.

• The Ethanol Blended Petrol (EBP) Programme was launched in India to promote the use of ethanol as an alternative fuel.

• Global Leaders in Ethanol Use:

• Brazil is one of the largest producers and consumers of ethanol, with its fuel market dominated by ethanol-blended gasoline.

• The United States also heavily uses ethanol, primarily sourced from corn, under its Renewable Fuel Standard (RFS) program.

• Challenges of Ethanol Use:

• Large-scale production of ethanol can lead to competition for agricultural resources, affecting food security.

• It requires substantial water resources for crop cultivation and ethanol processing.

**Q16. Answer: (c) Oxygen mixed with Nitrogen in air**

The correct answer is Oxygen mixed with Nitrogen in air.

Key Points

• Homogeneous Solution: A solution is homogeneous when its composition is uniform throughout. Gaseous mixtures like air, where oxygen (solute) is mixed with nitrogen (solvent), are classic examples of this. Air is a homogeneous mixture, and the gases are mixed uniformly, making it a solution.

• Solute and Solvent as Elements: Both oxygen (O2) and nitrogen (N2) are elements. In air, oxygen acts as the solute, while nitrogen, being the most abundant gas, is the solvent. This fits the requirement of a solution where both the solute and solvent are elements.

• Physical State: In this case, both the solute and solvent are in the gaseous state, making it easier to form a homogeneous mixture. The properties of gases allow them to mix thoroughly without any barriers.

• Incorrect Options: Other options involve either heterogeneous mixtures or solutions where the solute/solvent are not both elements. For example, sugar dissolved in water involves a compound (sugar) and a compound (water), not two elements.

• Relevance of Air: Air is a natural example of a homogeneous solution where gases like oxygen, nitrogen, argon, and carbon dioxide coexist in a single phase. Hence, this scenario aligns perfectly with the question's requirement.

Additional Information

• Iron Filings Mixed with Sulphur: This is a heterogeneous mixture because the components do not mix uniformly. Iron filings and sulfur retain their individual properties and can be separated easily by physical methods such as using a magnet. Hence, this is not a homogeneous solution.

• Sugar Dissolved in Water: Sugar (a compound) dissolves in water (another compound), forming a homogeneous solution. However, the solute and solvent are not both elements, which disqualifies this option based on the question's criteria.

• Carbon Dissolved in Water: Carbon in its solid form (e.g., graphite) does not dissolve in water to form a homogeneous solution. This makes it an incorrect example for the given question.

• Definition of Homogeneous Mixture: A homogeneous mixture has a uniform composition and phase throughout. Examples include salt dissolved in water, alcohol mixed with water, and gases like air. These solutions are stable and do not separate over time.

• Gaseous Mixtures: Gases mix freely and form homogeneous solutions due to their high kinetic energy and the lack of intermolecular forces. Air is a prime example, where oxygen and nitrogen are uniformly distributed.

Important Points

• Key Characteristics of Solutions:

• Homogeneous solutions have a single phase and uniform composition.

• Solutes and solvents can exist in various states (solid, liquid, or gas).

• In gaseous solutions, all components are gases, as seen in air.

• Air Composition:

• Air is approximately 78% nitrogen, 21% oxygen, and small amounts of other gases like carbon dioxide and argon.

• It is a prime example of a homogeneous mixture where individual gases retain their properties but are evenly mixed.

• Solutions in Different Phases:

• Solid in Liquid: Salt in water.

• Liquid in Liquid: Alcohol in water.

• Gas in Gas: Oxygen in nitrogen (air).

• Scientific Applications: Understanding homogeneous solutions is crucial in fields like chemistry, environmental science, and industrial processes where uniformity in composition is necessary.

**Q17. Answer: (d) Protein**

The correct answer is Protein.

Key Points

• The DNA in the cell nucleus contains the genetic instructions necessary for the synthesis of proteins. Proteins are crucial for the structure, function, and regulation of the body's tissues and organs.

• DNA is transcribed into mRNA (messenger RNA) in the cell nucleus. This mRNA serves as a template for protein synthesis during the process called translation.

• Proteins are composed of chains of amino acids, which are arranged in specific sequences as dictated by the genetic code in the DNA. This sequence determines the protein's structure and function.

• Unlike proteins, substances like lipids, glucose, and fructose are not directly synthesized using the instructions from DNA. Their production involves enzymatic pathways influenced by proteins.

• Thus, the DNA in the nucleus primarily directs the production of proteins, making it the central molecule in biological information transfer and cellular function.

Additional Information

• Protein Synthesis Process:

• The process begins with transcription, where the DNA sequence of a gene is copied into mRNA.

• The mRNA exits the nucleus and binds to a ribosome in the cytoplasm, initiating translation.

• During translation, tRNA (transfer RNA) molecules bring specific amino acids to the ribosome, where they are assembled into a protein chain based on the mRNA sequence.

• Importance of Proteins:

• Proteins serve as enzymes, which catalyze biochemical reactions essential for life.

• They act as structural components, like collagen in connective tissues and keratin in hair and nails.

• Proteins play a role in transport, such as hemoglobin carrying oxygen in blood, and in defense mechanisms, like antibodies in the immune system.

• Substances Not Synthesized Directly by DNA:

• Lipids: Lipids are synthesized through enzymatic pathways involving acetyl-CoA and are not directly encoded by DNA.

• Glucose and Fructose: These are carbohydrates metabolized via pathways such as glycolysis, gluconeogenesis, and the Calvin cycle in plants.

• Central Dogma of Molecular Biology:

• The central dogma describes the flow of genetic information: DNA → RNA → Protein.

• This principle highlights how genetic instructions in DNA are used to synthesize functional proteins that drive cellular activities.

Important Points

• Gene Expression:

• Gene expression is the process by which the information in a gene is used to produce a functional product, typically a protein.

• It involves two main steps: transcription (DNA to RNA) and translation (RNA to protein).

• Codons:

• A codon is a sequence of three nucleotides in mRNA that specifies a particular amino acid or a stop signal during protein synthesis.

• For example, the codon AUG codes for the amino acid methionine and also serves as the start codon for translation.

• Role of Ribosomes:

• Ribosomes are the cellular organelles where protein synthesis occurs. They consist of ribosomal RNA (rRNA) and proteins.

• They facilitate the binding of mRNA and tRNA, ensuring the correct sequence of amino acids in the protein.

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**Q18. Answer: (a) Density of object**

The correct answer is Density of object.

Key Points

• Buoyant Force is determined by Archimedes' Principle, which states that the upward buoyant force acting on an object submerged in a fluid is equal to the weight of the fluid displaced by the object.

• The density of the fluid is crucial because the buoyant force depends on the weight of the displaced fluid, which is directly proportional to the fluid's density. Hence, this affects buoyant force.

• Gravitational acceleration influences the buoyant force because it directly affects the weight of the displaced fluid. The formula for buoyant force involves gravitational acceleration (g), making it a significant factor. Hence, this affects buoyant force.

• Volume of displaced fluid is key in calculating buoyant force. The larger the volume displaced, the greater the buoyant force. Hence, this affects buoyant force.

• Density of the object, however, does not directly influence the buoyant force. The buoyant force depends only on the density of the fluid and the volume displaced, not on the object's density. Hence, this does NOT affect buoyant force.

Additional Information

• Archimedes' Principle:

• Formulated by ancient Greek scientist Archimedes, this principle explains the behavior of objects submerged in a fluid.

• The principle states that the buoyant force is equal to the weight of the displaced fluid, which can be calculated using the formula: Buoyant Force = ρ × V × g, where:

• ρ = density of fluid

• V = volume of displaced fluid

• g = gravitational acceleration

• This principle is used in applications such as ship design, submarines, and measuring densities.

• Factors Affecting Buoyant Force:

• Density of fluid: Higher fluid density results in a greater buoyant force.

• Volume of displaced fluid: A larger displaced volume increases the buoyant force.

• Gravitational acceleration: The buoyant force is proportional to the acceleration due to gravity.

• Applications of Buoyant Force:

• Ships and boats: Designed to displace sufficient water to counteract their weight.

• Submarines: Adjust buoyancy by controlling the volume of water in ballast tanks.

• Hot air balloons: Use the principle of buoyancy to rise by displacing cooler air.

• Density of Object:

• The object's density determines whether it will float or sink, but it does not affect the buoyant force directly.

• If the object's density is less than the fluid's density, it will float. If greater, it will sink.

• Example: A wooden block floats in water because its density is lower than water, while a metal block sinks.

Important Points

• Weight vs Buoyant Force:

• The buoyant force acts upward, opposing the weight of the object acting downward.

• When the buoyant force equals the object's weight, the object floats. If less, the object sinks.

• Neutral Buoyancy:

• Occurs when an object's weight is equal to the buoyant force, causing it to remain suspended in the fluid.

• Example: Scuba divers achieve neutral buoyancy by adjusting their buoyancy compensators.

• Real-life Examples:

• Icebergs float in water despite their massive size because ice has a lower density than water.

• Oil spills float on water due to the lower density of oil compared to water.

**Q19. Answer: (c) Cell body**

The correct answer is Cell body.

Key Points

• The cell body, also known as the soma, is a key structural part of the neuron that contains the nucleus and surrounding cytoplasm.

• The nucleus inside the cell body contains the genetic material (DNA), which directs the activities of the neuron, such as protein synthesis.

• The cytoplasm of the cell body is rich in organelles like mitochondria, ribosomes, and the endoplasmic reticulum, which are

essential for maintaining cellular functions and generating energy.

• The cell body is responsible for integrating signals received from the dendrites and generating an appropriate response that is transmitted to the axon.

• This part of the neuron also plays a critical role in the growth, repair, and survival of the neuron by coordinating various metabolic activities.

Additional Information

• Structure of a Neuron:

• Neurons are specialized cells that transmit electrical and chemical signals in the nervous system.

• They consist of three main parts: dendrites, cell body (soma), and axon.

• Dendrites: These are branched structures that receive signals from other neurons or sensory receptors.

• Axon: A long, slender projection that transmits signals away from the cell body to other neurons or effector cells.

• Functions of the Cell Body:

• Acts as the control center of the neuron, regulating vital activities.

• Processes incoming signals from dendrites and determines whether an action potential should be generated.

• Provides metabolic support and maintains the structural integrity of the neuron.

• Comparison of Other Options:

• Dendrites: They do not contain the nucleus but are responsible for receiving signals.

• Nerve endings: These are specialized structures for transmitting signals to other neurons, muscles, or glands.

• Axon: It transmits signals but does not house the nucleus or cytoplasm.

• Importance of Neurons:

• Neurons are critical for the functioning of the brain, spinal cord, and peripheral nervous system.

• They enable communication between different parts of the body and the brain, allowing processes like movement, sensation, and cognition.

Important Points

• Neurotransmission:

• Neurons communicate via electrical signals and chemical messengers known as neurotransmitters.

• Neurotransmitters are released at the synaptic cleft, enabling signal transmission between neurons.

• Types of Neurons:

• Sensory neurons: Transmit sensory information from receptors to the brain and spinal cord.

• Motor neurons: Send signals from the brain and spinal cord to muscles and glands.

• Interneurons: Connect sensory and motor neurons and facilitate communication within the central nervous system.

• Diseases Affecting Neurons:

• Diseases like Alzheimer's disease, Parkinson's disease, and multiple sclerosis impact neuron functionality.

• Understanding the structure and function of neurons is crucial for developing treatments for these conditions.

**Q20. Answer: (a) Vas deferens**

The correct answer is Vas deferens.

Key Points

• The vas deferens is the duct responsible for transporting sperm from the testicles to the urethra during ejaculation. Altering this structure prevents sperm from being included in semen.

• The surgical procedure commonly performed to block or cut the vas deferens is called a vasectomy. It is a minor operation used as a method of permanent contraception for males.

• During a vasectomy, the vas deferens is either tied, cut, or sealed to prevent sperm from entering the ejaculate. This ensures that the semen released during ejaculation does not contain sperm, effectively preventing fertilization.

• The vas deferens is located within the male reproductive system and connects the epididymis (where sperm mature and are stored) to the urethra.

• This procedure does not affect the production of sperm in the testicles or the volume of semen ejaculated, as sperm constitutes only a small portion of the semen. Hence, the man’s sexual function remains normal post-procedure.

Additional Information

• Testis:

• The testis is responsible for producing sperm and the male hormone testosterone. Alteration to the testis would impact sperm production, but this is not the structure modified during a vasectomy.

• The testis is located within the scrotum and serves as the primary site for spermatogenesis (sperm production).

• Damage or removal of the testes would lead to infertility and hormonal imbalance, unlike a vasectomy which preserves hormonal function.

• Urethra:

• The urethra is the tube that carries urine from the bladder and semen from the reproductive system out of the body. It is not altered during a vasectomy.

• It functions as a passageway for both urine and ejaculate in males, but it does not directly influence the composition of semen.

• Penis:

• The penis is the external male genital organ responsible for delivering semen and urine outside the body.

• It is not surgically altered during a vasectomy, as the procedure focuses on the internal vas deferens ducts.

• Any surgical alteration to the penis would impact sexual or urinary function, which is not the case with vasectomy.

• Additional Facts about Vasectomy:

• Vasectomy is considered a highly effective method of contraception, with a failure rate of less than 1%.

• The procedure is minimally invasive, typically performed under local anesthesia, and recovery is quick, often within a few days.

• It does not protect against sexually transmitted infections (STIs), and individuals are advised to use condoms for STI prevention.

• Vasectomy can be reversed in some cases through a procedure called vasovasostomy, although reversal is not always successful.

Important Points

• Vasectomy does not affect the production of testosterone, libido, or sexual ability in males. These functions remain intact post-procedure.

• The semen released during ejaculation after a vasectomy is visually and functionally normal, except it does not contain sperm.

• The vasectomy procedure is a safe and reliable form of permanent contraception, but individuals must be informed about its irreversible nature in most cases.

• In rare cases, the vas deferens can spontaneously reconnect, leading to the potential for pregnancy, though this is extremely uncommon.

• Vasectomy is widely practiced globally and is considered one of the simplest and safest methods of permanent male sterilization.

**Q21. Answer: (c) is considered positive**

The correct answer is is considered positive.

Key Points

• Height of an image in a concave mirror is considered positive when the image is formed above the principal axis. This is based on the standard sign convention used in optics.

• In the Cartesian sign convention, all distances measured above the principal axis are positive, while those below it are negative.

• When the object is placed within the focal length of a concave mirror, the image is virtual, erect, and formed above the principal axis, hence its height is considered positive.

• For example, if a ray diagram shows an image formed above the principal axis, the corresponding height value will be positive. This adheres to the general rules of image formation in concave mirrors.

• The height of an image depends on the position of the object, but the sign of the height (positive or negative) is determined by its orientation relative to the principal axis.

Additional Information

• Concave Mirror:

• A concave mirror is a spherical mirror with the reflecting surface curved inward, resembling the interior of a sphere.

• It is also known as a converging mirror because it converges light rays that are incident parallel to its principal axis to a single focal point.

• Applications include telescopes, shaving mirrors, and headlights due to their ability to focus light.

• Sign Convention in Optics:

• In the Cartesian sign convention:

• Distances measured in the direction of the incident light are considered positive.

• Distances measured against the direction of the incident light are considered negative.

• Heights above the principal axis are positive, and those below are negative.

• This convention ensures consistency in calculations and diagrams.

• Image Formation in Concave Mirrors:

• The nature, position, and size of the image depend on the object's position relative to the mirror's focal point (F) and center of curvature (C).

• When the object is placed:

• Beyond C: The image is real, inverted, and smaller.
• At C: The image is real, inverted, and of the same size.
• Between C and F: The image is real, inverted, and larger.
• At F: No image is formed as the reflected rays are parallel.
• Between F and the mirror: The image is virtual, erect, and larger.
• Applications of Concave Mirrors:
• In solar furnaces to focus sunlight and generate heat.
• In torches, searchlights, and car headlights for producing parallel beams of light.
• In shaving or makeup mirrors to provide a magnified view.
• In optical devices such as microscopes and telescopes for focusing light.

Important Points

• Position of Object and Image Properties:
• The position of the object significantly affects the image's size, orientation, and type (real or virtual).
• For example, moving the object closer to the mirror changes the image from real and inverted to virtual and erect.
• Magnification:
• The magnification (M) of a mirror is the ratio of the height of the image to the height of the object.
• A positive magnification indicates a virtual and erect image, while a negative magnification indicates a real and inverted image.
• Focal Length and Radius of Curvature:
• The focal length (f) of a concave mirror is half of its radius of curvature (R), i.e., f = R/2.
• The relationship between object distance (u), image distance (v), and focal length is given by the mirror formula: 1/f = 1/v + 1/u.

**Q22. Answer: (c) Hydroxyl group**

The correct answer is Hydroxyl group.

Key Points

• Ethanol is miscible with water due to the presence of a hydroxyl group (-OH), which can form hydrogen bonds with water molecules.
• The hydroxyl group is a polar functional group, meaning it has a partial positive charge on hydrogen and a partial negative charge on oxygen, enabling it to interact with the polar water molecules.
• This hydrogen bonding is responsible for the high solubility of ethanol in water, as the intermolecular forces between ethanol and water molecules are strong enough to overcome the forces within each substance.
• The carbon chain in ethanol is relatively short, which further facilitates its miscibility. Longer carbon chains tend to reduce solubility in water due to increased hydrophobic characteristics.
• Ethanol's chemical structure (C2H5OH) includes both a non-polar carbon chain and a polar hydroxyl group. The hydroxyl group dominates, making ethanol hydrophilic and miscible with water.

Additional Information

• Hydroxyl Group (-OH):
• It is a functional group consisting of an oxygen atom bonded to a hydrogen atom.
• The oxygen atom in the hydroxyl group is highly electronegative, which makes the bond polar.
• The polarity of the hydroxyl group allows it to form hydrogen bonds, which are critical for the solubility of alcohols like ethanol in water.
• Hydrogen Bonding:
• Hydrogen bonding occurs when a hydrogen atom covalently bonded to a highly electronegative atom (like oxygen, nitrogen, or fluorine) interacts with another electronegative atom.
• This bonding is responsible for the miscibility of ethanol in water, as the hydroxyl group in ethanol forms bonds with water molecules.
• Solubility of Alcohols:
• Alcohols with shorter carbon chains are more soluble in water due to the dominance of the hydroxyl group's hydrophilic nature.
• As the length of the carbon chain increases, the hydrophobic nature of the carbon chain begins to dominate, reducing solubility.
• Ethanol, with only two carbon atoms, is highly miscible with water.
• Other Functional Groups:
• Carbon chain: Non-polar and hydrophobic, does not contribute to ethanol's miscibility with water.
• Double bonds: Found in alkenes, they do not directly influence solubility in water as they are non-polar.
• Carboxyl group (-COOH): Found in carboxylic acids, it also contributes to solubility in water but is not present in ethanol.

Important Points

• Ethanol's Applications:

• Used as a solvent in industries due to its miscibility with both water and many organic compounds.

• Acts as a fuel or fuel additive in vehicles (e.g., ethanol-blended petrol).

• Used in alcoholic beverages due to its ability to dissolve in water and provide desired properties.

• Miscibility Principle:

• “Like dissolves like” is a fundamental principle of solubility. Polar substances like ethanol are miscible with polar solvents like water.

**Q23. Answer: (c) The individual substances retain their properties**

The correct answer is The individual substances retain their properties.

Key Points

• A heterogeneous mixture is a type of mixture in which the individual components are not uniformly distributed, and they retain their distinct properties. Hence, the statement is correct.

• The substances in a heterogeneous mixture can usually be identified visually, as the mixture consists of physically distinct components. For example, a salad or a mixture of sand and iron filings. This supports the correctness of the option.

• Unlike compounds, the components in a heterogeneous mixture do not combine chemically but rather remain physically separate. This means each component retains its individual characteristics, such as taste, color, and texture. This reinforces the correct answer.

• The components of a heterogeneous mixture can often be separated by simple physical methods, such as filtration, decantation, or sieving. Thus, the statement "components cannot be separated" is incorrect.

• The composition of a heterogeneous mixture is not uniform throughout. For instance, in a mixture of oil and water, the oil forms a distinct layer above the water due to differences in density. Hence, the statement "composition is the same throughout" is incorrect.

Additional Information

• Heterogeneous Mixture:

• A heterogeneous mixture consists of two or more substances that are not uniformly distributed. Examples include mixtures like sand and salt, oil and water, or granite.

• Heterogeneous mixtures are classified into two categories: suspensions (e.g., muddy water) and colloids (e.g., milk).

• The components of these mixtures can typically be separated by physical methods such as filtration, centrifugation, or magnetic separation.

• Unlike homogeneous mixtures (e.g., salt dissolved in water), the properties of heterogeneous mixtures vary throughout the mixture.

• Comparison with Compounds:

• In a compound, elements combine chemically in a fixed ratio, forming a substance with new properties. For example, water ($H_2O$) is a compound where hydrogen and oxygen chemically bond.

• In contrast, a heterogeneous mixture retains the original properties of its components, as there is no chemical bonding involved.

• Separation Techniques:

• Filtration: Used to separate insoluble solids from liquids (e.g., sand from water).

• Decantation: Employed to separate liquids of different densities, such as oil from water.

• Sieving: Used to separate particles of different sizes, such as sand from gravel.

• Examples of Heterogeneous Mixtures:

• Concrete: A mixture of cement, sand, gravel, and water, where the components are visibly distinct.

• Trail Mix: A combination of nuts, raisins, and chocolate chips, where each component is easily identifiable.

Important Points

• Homogeneous vs. Heterogeneous Mixtures:

• Homogeneous mixtures have a uniform composition throughout, such as saltwater or air.

• Heterogeneous mixtures have visibly distinct components, such as salad or a mixture of sand and iron filings.

• Properties of Heterogeneous Mixtures:

• They do not have a fixed composition.

• Each component retains its physical properties.

• The mixture can often be separated into its original components using physical methods.

**Q24. Answer: (b) It promotes digestion by increasing blood flow to the stomach.**

The correct answer is It promotes digestion by increasing blood flow to the stomach..

Key Points

• Adrenaline, also known as epinephrine, is a hormone secreted by the adrenal glands during stress or emergency situations. It plays a key role in the body's "fight or flight" response.

• Adrenaline reduces blood supply to the digestive system and redirects it to essential areas like the skeletal muscles, brain, and heart, preparing the body for action. Hence, statement 1 is correct.

• It does not promote digestion. Instead, it suppresses digestive activities by reducing blood flow to the stomach and intestines, conserving energy for more critical functions. Hence, statement 2 is incorrect.

• Adrenaline increases heart rate and breathing rate, ensuring a higher oxygen supply to muscles and other vital organs during stress. Hence, statement 3 is correct.

• It triggers the "fight or flight" response, enabling the body to respond swiftly to emergencies by increasing energy availability, sharpening focus, and enhancing physical performance. Hence, statement 4 is correct.

• This hormone's actions are crucial for responding to acute stress but can have detrimental effects if released excessively over long periods.

Additional Information

• Functions of Adrenaline:

• Adrenaline increases blood glucose levels by stimulating glycogen breakdown in the liver and muscles, providing energy for immediate use.

• It dilates the airways in the lungs, improving oxygen intake and making breathing easier during stress.

• It causes vasoconstriction in certain areas, such as the skin and digestive system, and vasodilation in others, such as the muscles, to optimize blood flow.

• Adrenal Glands:

• Adrenal glands are small, triangular organs located on top of each kidney.

• They are divided into two parts: the adrenal cortex (outer part) and the adrenal medulla (inner part).

• The adrenal medulla produces adrenaline and noradrenaline, which are crucial in stress responses.

• Fight or Flight Response:

• This is an automatic physiological reaction to a perceived threat or danger.

• It involves the release of adrenaline, which prepares the body to either confront the threat (fight) or escape from it (flight).

• Key effects include increased heart rate, pupil dilation, elevated glucose levels, and suppressed non-essential functions like digestion.

• Health Implications of Excess Adrenaline:

• Prolonged stress or excessive adrenaline release can lead to health issues like hypertension, anxiety, insomnia, and cardiovascular problems.

• Chronic stress can also suppress the immune system and impair digestion.

• Examples of Adrenaline Use in Medicine:

• Adrenaline is used in emergency treatments, such as anaphylaxis (severe allergic reactions) and cardiac arrest.

• It is administered via injection to rapidly counteract life-threatening conditions.

Important Points

• Adrenaline vs. Noradrenaline:

• Both are stress hormones, but their effects differ slightly.

• Adrenaline has a more significant impact on the "fight or flight" response, while noradrenaline primarily acts as a neurotransmitter and regulates blood pressure.

• Historical Discovery:

• Adrenaline was first isolated in 1901 by Jokichi Takamine, a Japanese chemist.

• Its discovery revolutionized the understanding of stress responses and led to the development of life-saving drugs.

• Applications in Sports:

• Adrenaline enhances physical performance by boosting energy and focus.

• However, excessive reliance on adrenaline during high-pressure situations can lead to burnout or stress-related injuries.

**Q25. Answer: (c) Introducing pest predators**

The correct answer is Introducing pest predators.

Key Points

• Biological method of crop protection involves the use of natural organisms or their products to control pests and diseases in

agriculture. Introducing pest predators is a key example of this approach.

• Predators such as ladybirds (Coccinellidae), spiders, and lacewings are used to control populations of pests like aphids and mites, which harm crops.

• This method is environmentally friendly as it reduces the reliance on chemical pesticides, which can cause soil and water pollution.

• Biological pest control is a part of Integrated Pest Management (IPM), which combines biological, cultural, and mechanical techniques for sustainable crop protection.

• Unlike chemical methods like spraying DDT or burning residues, the use of pest predators ensures a natural balance in the ecosystem, promoting biodiversity and long-term agricultural sustainability.

Additional Information

• Option 1: Spraying DDT

• DDT (Dichlorodiphenyltrichloroethane) is a synthetic chemical pesticide used to kill pests but has severe environmental and health impacts.

• Its excessive use leads to soil contamination, bioaccumulation in food chains, and harm to non-target organisms like birds and aquatic life.

• DDT is not a biological method and is discouraged due to its long-term adverse effects.

• Option 2: Burning crop residues

• This method is not biological and is primarily employed to clear fields of leftover plant material after harvest.

• Burning crop residues releases carbon dioxide ($CO_2$) and other harmful gases into the atmosphere, contributing to air pollution and global warming.

• Option 3: Introducing pest predators

• This is a biological control method that involves introducing natural enemies of pests, such as predators, parasitoids, or pathogens.

• Examples include releasing Trichogramma wasps to control caterpillar populations and using Bt (Bacillus thuringiensis) to target insect larvae.

• It is a sustainable and eco-friendly approach that minimizes environmental harm.

• Option 4: Ploughing

• Ploughing is a mechanical method used to prepare the soil for sowing and to bury weeds or crop residues. It is not considered a biological method.

• While ploughing can disrupt pest habitats, it is not a direct method of biological pest control.

Important Points

• Advantages of biological pest control:

• Minimizes environmental pollution and reduces the use of harmful chemicals.

• Maintains ecological balance by promoting biodiversity.

• Cost-effective in the long term as natural predators multiply and sustain themselves.

• Challenges:

• Requires careful selection of predators to avoid harm to non-target species.

• May take longer to show results compared to chemical pesticides.

• Effectiveness can depend on environmental factors like temperature and habitat availability.

• Examples of biological pest control:

• Using beetles to control water hyacinth in aquatic systems.

• Releasing parasitic wasps to target crop-damaging pests in fields.

**Q26. Answer: (d) Rs. 3,680**

Shortcut Trick

Use the direct relation between Cost Price (CP) and Marked Price (MP):

CP ÷ MP = (100 − Discount%) ÷ (100 + Profit%)

CP ÷ 5360 = (100 − 8) ÷ (100 + 34) = 92 ÷ 134

CP = 5360 × (92 ÷ 134) = 40 × 92 = Rs. 3,680

Therefore The correct answer is Rs. 3,680.

Alternate Method

Given:

Marked Price (MP) = Rs. 5,360

Discount = 8%

Profit = 34%
Calculations:
=> Selling Price (SP) = MP × (100 − Discount%) ÷ 100
=> SP = 5360 × (92 ÷ 100) = Rs. 4,931.2
=> Cost Price (CP) = [SP ÷ (100 + Profit%)] × 100
=> CP = [4931.2 ÷ 134] × 100
=> CP = 36.8 × 100 = Rs. 3,680
Therefore The correct answer is Rs. 3,680.
Additional Information
Markup Percentage
It is the percentage by which the cost price is increased to set the marked price. Markup% = [(MP − CP) ÷ CP] × 100.
Successive Discounts
If two successive discounts of a% and b% are given, the effective discount is (a + b − ab/100)%.
Relation between CP and MP
The ratio CP : MP is always (100 − D%) : (100 + P%) where D is discount and P is profit percentage.

**Q27. Answer: (b) 12°**

Shortcut Trick
In any quadrilateral, the angle formed by the bisectors of two adjacent angles is equal to half the sum of the other two angles.
angle STR = (angle P + angle Q) ÷ 2
=> angle P + angle Q = 2 × angle STR = 2 × 24° = 48°
Given the ratio of angle P : angle Q = 3 : 5, the total parts = 3 + 5 = 8 parts.
The difference between angle Q and angle P = 5 − 3 = 2 parts.
=> Difference = (2 ÷ 8) × 48° = 12°.
Therefore The correct answer is 12°.
Alternate Method
Given:
=> In quadrilateral PQRS, the bisectors of angle R and angle S meet at point T.
=> angle STR = 24°
=> Ratio of angle P : angle Q = 3 : 5
Calculations:
In triangle STR, the sum of angles is 180°:
=> angle STR + angle TSR + angle TRS = 180°
Since ST and RT are the angle bisectors of angle S and angle R respectively:
=> angle TSR = angle S ÷ 2
=> angle TRS = angle R ÷ 2
Substitute these into the triangle angle sum equation:
=> 24° + (angle S ÷ 2) + (angle R ÷ 2) = 180°
=> (angle S + angle R) ÷ 2 = 180° − 24°
=> (angle S + angle R) ÷ 2 = 156°
=> angle S + angle R = 312°
In quadrilateral PQRS, the sum of all interior angles is 360°:
=> angle P + angle Q + angle R + angle S = 360°
=> angle P + angle Q + 312° = 360°
=> angle P + angle Q = 360° − 312°
=> angle P + angle Q = 48°
Given that the ratio of angle P to angle Q is 3 : 5:
Let angle P = 3x and angle Q = 5x
=> 3x + 5x = 48°
=> 8x = 48°
=> x = 6°
Now, find the difference between the measures of angle Q and angle P:

=> Difference = angle Q − angle P = 5x − 3x = 2x

=> Difference = 2 × 6° = 12°

Therefore The correct answer is 12°.

Additional Information

Angle Bisector Theorem in Quadrilaterals

The angle formed by the bisectors of two adjacent angles of a quadrilateral is equal to half the sum of the remaining two angles: angle STR = (angle P + angle Q) ÷ 2.

Sum of Interior Angles of a Polygon

The sum of the interior angles of any n-sided polygon is given by the formula (n − 2) × 180°. For a quadrilateral (n = 4), the sum is always 360°.

Opposite Angle Bisectors

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

**Q28. Answer: (a) 224**

Shortcut Trick

CP_(Manufacturer) = 840 × (100/120) = Rs. 700

CP_(Customer) = 840 × (110/100) = Rs. 924

Difference = 924 − 700 = Rs. 224

Therefore The correct answer is Rs. 224.

Alternate Method

Given:

Selling Price by Manufacturer = Rs. 840

Profit% of Manufacturer = 20%

Profit% of Shopkeeper = 10%

Calculations:

=> Cost Price to Manufacturer = 840 ÷ (1 + 20/100)

=> CP_M = 840 ÷ 1.2 = Rs. 700

=> Cost Price to Customer = Selling Price of Shopkeeper

=> CP_C = 840 × (1 + 10/100)

=> CP_C = 840 × 1.1 = Rs. 924

=> Required Difference = CP_C − CP_M

=> Difference = 924 − 700 = Rs. 224

Therefore The correct answer is Rs. 224.

Additional Information

Successive Percentage Formula

When there are successive changes of a% and b%, the effective change is (a + b + ab/100)%.

Cost Price from Selling Price

CP = [SP × 100] / [100 + Profit%] or [SP × 100] / [100 − Loss%].

Marked Price and Discount

SP = MP × (1 − Discount/100). Profit is always calculated on CP unless stated otherwise.

**Q29. Answer: (b) 1109.97**

Given:

999.99 + 99.99 + 9.99

Formula Used:

Direct addition of decimal numbers

Calculation:

=> 999.99 + 99.99 = 1099.98

=> 1099.98 + 9.99 = 1109.97

Therefore The correct answer is 1109.97.

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**Q30. Answer: (d) 2^(15)**

Given:

(2^4)³ × (2^5)² ÷ 2^7

Formula Used:

(a^m)ⁿ = a^(mn)

a^m × aⁿ = a^(m+n)

a^m ÷ aⁿ = a^(m-n)

Calculation:

(2^4)³ × (2^5)² ÷ 2^7

=> 2¹² × 2^(10) ÷ 2^7

=> 2^(12+10-7)

=> 2^(15)

Therefore The correct answer is 2^(15).

**Q31. Answer: (c) Rs. 384**

Shortcut Trick

Ratio of profit = Ratio of investments

Aakash : Suman : Raj = 1720 : 1690 : 1240 = 172 : 169 : 124

Total units = 172 + 169 + 124 = 465 units

Raj's share = (124 ÷ 465) × 1440 = 384

Therefore The correct answer is Rs. 384.

Alternate Method

Given:

Investment of Aakash (C_A) = Rs. 1720

Investment of Suman (C_S) = Rs. 1690

Investment of Raj (C_R) = Rs. 1240

Total Profit = Rs. 1440

Formula Used:

Profit Ratio = (Capital1 × Time1) : (Capital2 × Time2)

Calculations:

=> Since time is same for all, Profit Ratio = 1720 : 1690 : 1240

=> Profit Ratio = 172 : 169 : 124

=> Total Ratio sum = 172 + 169 + 124 = 465

=> Raj's Profit Share = (124 / 465) × 1440

=> Raj's Profit Share = 124 × (1440 / 465) = 124 × 3.0967... ≈ 384

=> Raj's Profit Share = Rs. 384

Therefore The correct answer is Rs. 384.

Additional Information

Partnership Profit Distribution

When investment periods are equal, the profit is divided in the ratio of the capitals invested by the partners.

Compound Partnership

If partners invest for different time periods, Profit Ratio = (C1 × T1) : (C2 × T2) : (C3 × T3).

Active vs Sleeping Partner

An active partner may receive an additional salary or percentage of profit before the remaining profit is shared among all partners.

**Q32. Answer: (a) 30 km/hr**

Shortcut Trick

Time from A to B = 150 ÷ 60 = 2.5 hours.

Total Time = 7.5 hours (7 hours 30 min).

Return Time = 7.5 − 2.5 = 5 hours.

Return Speed = 150 ÷ 5 = 30 km/hr.

Therefore The correct answer is 30 km/hr.

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Alternate Method
Given:
Distance (D) = 150 km
Forward Speed (S1) = 60 km/hr
Total Time (T_(total)) = 7 hours 30 min = 7.5 hours
Formula Used:
Time = Distance ÷ Speed
Calculations:
=> Time taken from A to B (T1) = 150 ÷ 60
=> T1 = 2.5 hours
=> Time taken for return trip (T2) = T_(total) − T1
=> T2 = 7.5 − 2.5 = 5 hours
=> Return Speed (S2) = Distance ÷ T2
=> S2 = 150 ÷ 5
=> S2 = 30 km/hr
Therefore The correct answer is 30 km/hr.
Additional Information
Average Speed for Round Trip
When distances are equal, Average Speed = (2 × S1 × S2) ÷ (S1 + S2).
Time-Speed Inversely Proportional
For a constant distance, the ratio of speeds is the inverse of the ratio of times (S1/S2 = T2/T1).
Unit Conversion
To convert km/hr to m/s, multiply by 5/18. To convert m/s to km/hr, multiply by 18/5.

**Q33. Answer: (b) 50%**

Shortcut Trick
Convert fractions to decimals for quick comparison.
1/20 = 0.05
10/100 = 1/10 = 0.1
Percentage = (0.05 ÷ 0.1) × 100 = 50%
Therefore The correct answer is 50%.
Alternate Method
Given: First value = 1/20, Second value = 10/100
Formula Used: Percentage = (Part ÷ Whole) × 100
=> Required % = [(1/20) ÷ (10/100)] × 100
=> Required % = [(1/20) ÷ (1/10)] × 100
=> Required % = (1/20 × 10/1) × 100
=> Required % = (10/20) × 100
=> Required % = (1/2) × 100
=> Required % = 50%
Therefore The correct answer is 50%.
Additional Information
Percentage Change
Percentage change is calculated as [(New Value − Old Value) ÷ Old Value] × 100.
Fraction to Percentage
To convert any fraction x/y into percentage, multiply it by 100 and add the % sign.
Decimal Conversion
Moving the decimal point two places to the right converts a decimal to a percentage (e.g., 0.5 → 50%).

**Q34. Answer: (c) Rs. 10,000**

Shortcut Trick
Investment ratio is equal to the profit ratio when time is constant.

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Total Profit = Rs. 6,700 | Prakhar's Profit = Rs. 2,000 | Riya's Profit = Rs. 4,700.
Prakhar's Investment = (Prakhar's Profit ÷ Total Profit) × Total Investment
Prakhar's Investment = (2,000 ÷ 6,700) × 33,500 = 20 ÷ 67 × 33,500 = 20 × 500 = Rs. 10,000.
Therefore The correct answer is Rs. 10,000.
Alternate Method
Given:
Total Investment = Rs. 33,500
Total Profit = Rs. 6,700
Prakhar's Profit Share = Rs. 2,000
Formula: Profit Ratio = Investment Ratio (for same time period)
=> Riya's Profit = Total Profit − Prakhar's Profit
=> Riya's Profit = 6,700 − 2,000 = Rs. 4,700
=> Ratio of Profits (Prakhar : Riya) = 2,000 : 4,700 = 20 : 47
=> Sum of ratio parts = 20 + 47 = 67 units
=> 67 units = Rs. 33,500
=> 1 unit = 33,500 ÷ 67 = Rs. 500
=> Prakhar's Investment = 20 units = 20 × 500 = Rs. 10,000
Therefore The correct answer is Rs. 10,000.
Additional Information
Partnership Basic Law
Profit is distributed in the ratio of the product of Capital and Time: P1:P2 = C1×T1 : C2×T2.
Active vs Sleeping Partner
An active partner may receive a salary or fixed percentage of profit before the remaining profit is divided based on investment ratios.
Constant Time Case
If all partners invest for the same duration, the Profit Ratio is directly proportional to the Investment Ratio (P1:P2 = C1:C2).

**Q35. Answer: (b) 10 years**

Shortcut Trick
Ratio of Father : Ravi presently is 4 : 1 (Difference = 3 units).
After 5 years, ratio becomes 3 : 1 (Difference = 2 units).
Equalize differences: Present (8 : 2) and After 5 years (9 : 3).
Ratio increase of 1 unit = 5 years.
Ravi present age = 2 units × 5 = 10 years.
Therefore The correct answer is 10 years.
Alternate Method
Given: Present age ratio 4:1, Age after 5 years ratio 3:1.
Formula Used: Age Equation Method.
=> Let Ravi’s present age be x years.
=> Father’s present age = 4x years.
=> According to the condition: (4x + 5) = 3(x + 5)
=> 4x + 5 = 3x + 15
=> 4x − 3x = 15 − 5
=> x = 10
Therefore The correct answer is 10 years.
Additional Information
Ratio Difference Constant
In age problems, the absolute difference between two people's ages remains constant over any number of years.
Linear Equations in Ages
Most age problems can be solved by setting up a linear equation: Age_(future) = Age_(present) + n years.

**Q36. Answer: (c) 1**

Shortcut Trick

Net efficiency of filling the tank = 4 − 1 = 3 units/minute.

Time to fill the whole tank = 12 ÷ 3 = 4 minutes.

Time to fill one-fourth of the tank = 4 × (1/4) = 1 minute.

Therefore The correct answer is 1 minute.

Alternate Method

Given:

Time taken by the first pipe to fill the tank = 3 minutes

Time taken by the second pipe to empty the tank = 12 minutes

Formula Used:

Total Work = LCM of individual times

Efficiency = Total Work ÷ Time

| Pipe | Time (mins) | Total Capacity (LCM) | Efficiency |
|---|---|---|---|
| Filling Pipe (A) | 3 | 12 units | +4 |
| Emptying Pipe (B) | 12 | −1 | |

Calculations:

=> Net efficiency of both pipes combined = 4 − 1 = 3 units/minute

=> One-fourth of the total capacity of the tank = 12 ÷ 4 = 3 units

=> Time required to fill one-fourth of the tank = 3 units ÷ 3 units/minute = 1 minute

Therefore The correct answer is 1 minute.

Additional Information

Inlet and Outlet Pipes

An inlet pipe fills a tank (positive work/efficiency), while an outlet pipe empties it (negative work/efficiency).

Combined Rate Formula

If an inlet pipe fills a tank in x hours and an outlet pipe empties it in y hours, the net rate of work when both are open is (1/x − 1/y) per hour.

**Q37. Answer: (d) 28**

Shortcut Trick

Ratio of LCM : HCF is given as 4 : 1.

Sum of ratios → 4 + 1 = 5 units.

5 units = 140 => 1 unit (HCF) = 28.

LCM = 4 × 28 = 112.

Since Product of numbers = LCM × HCF, and one number is 112, the other must be the HCF.

Therefore The correct answer is 28.

Alternate Method

Given:

LCM = 4 × HCF

LCM + HCF = 140

First number (a) = 112

Formula Used:

Product of two numbers = LCM × HCF

Calculations:

=> Let HCF be x, then LCM = 4x

=> x + 4x = 140

=> 5x = 140

=> x = 28

=> HCF = 28 and LCM = 4 × 28 = 112

=> Let the second number be b

=> a × b = LCM × HCF

=> 112 × b = 112 × 28

=> b = 28

Therefore The correct answer is 28.

Additional Information

Fundamental Property of HCF and LCM

For any two positive integers a and b, the product of the numbers is always equal to the product of their Greatest Common Divisor (HCF) and Least Common Multiple (LCM): a × b = HCF(a, b) × LCM(a, b).

HCF as a Factor

The HCF of two or more numbers is always a factor of their LCM. This means LCM ÷ HCF will always result in an integer.

Co-prime Numbers

If two numbers are co-prime, their HCF is 1 and their LCM is simply the product of the two numbers.

**Q38. Answer: (b) 8**

Shortcut Trick

Present ages: Thomas = 38, Nephew = 38 − 26 = 12 years.

Let n years pass. Condition: 38 + n = 3(12 + n) − 14.

Solve: 38 + n = 36 + 3n − 14 => 38 + n = 22 + 3n.

2n = 16 => n = 8 years.

Therefore The correct answer is 8 years.

Alternate Method

Given:

Thomas's age = 38 years.

Nephew's age = 38 − 26 = 12 years.

Calculations:

Let the required number of years be x.

=> Age of Thomas after x years = 38 + x.

=> Age of nephew after x years = 12 + x.

According to the question:

=> 38 + x = 3 × (12 + x) − 14

=> 38 + x = 36 + 3x − 14

=> 38 + x = 22 + 3x

=> 3x − x = 38 − 22

=> 2x = 16

=> x = 8 years.

Therefore The correct answer is 8 years.

Additional Information

Constant Age Difference

The difference between the ages of two persons remains constant regardless of how many years pass.

Linear Equations in Ages

Most age problems can be solved by representing unknown years as 'x' and forming a linear equation based on the given ratio or comparison.

Verification Method

In multiple-choice exams, plugging in options into the final condition is often faster than solving the algebraic equation.

**Q39. Answer: (a) 68.25**

Shortcut Trick

If 20% of a number is added to 84 to get the same number (100%), then 84 represents the remaining 80%.

80% → 84

1% → 84 ÷ 80 = 1.05

65% → 1.05 × 65 = 68.25

Therefore The correct answer is 68.25.

Alternate Method

Given: 20% of x + 84 = x

=> Let the number be x.
=> 0.20x + 84 = x
=> x − 0.20x = 84
=> 0.80x = 84
=> x = 84 ÷ 0.80 = 105
=> Required value = 65% of 105
=> Required value = (65 ÷ 100) × 105 = 0.65 × 105
=> Required value = 68.25
Therefore The correct answer is 68.25.
Additional Information
Percentage Base Change
When a part (P%) of a value is removed, the remaining part is (100 − P)%. Here, 100% − 20% = 80%.
Fraction Equivalents
20% = 1/5 and 80% = 4/5. Using fractions: 4/5 of x = 84 => x = 105.
Percentage to Decimal
To convert a percentage to a decimal, divide by 100. Example: 65% = 65/100 = 0.65.

**Q40. Answer: (d) 142**

Shortcut Trick
If the value of $a + 1/a = k$, then the value of $a^2 + 1/a^2 = k^2 - 2$.
Given: k = 12
Applying the trick: $12^2 - 2 = 144 - 2 = 142$.
Therefore The correct answer is 142.
Alternate Method
Given: $a + 1/a = 12$
Formula Used: $(x + y)^2 = x^2 + y^2 + 2xy$
=> $a + 1/a = 12$
Squaring both sides:
=> $(a + 1/a)^2 = (12)^2$
=> $a^2 + (1/a)^2 + 2 \times a \times (1/a) = 144$
=> $a^2 + 1/a^2 + 2 = 144$
=> $a^2 + 1/a^2 = 144 - 2$
=> $a^2 + 1/a^2 = 142$
Therefore The correct answer is 142.
Additional Information
Algebraic Identity for Squares
The square of a binomial sum is given by $(x + y)^2 = x^2 + y^2 + 2xy$.
Reciprocal Square Relation (Minus Sign)
If $a - 1/a = k$, then the value of $a^2 + 1/a^2 = k^2 + 2$.
Sum of Cubes Shortcut
If $a + 1/a = k$, then the value of $a^3 + 1/a^3 = k^3 - 3k$.
Product of Reciprocals
The product of a variable and its reciprocal ($a \times 1/a$) is always equal to 1.

**Q41. Answer: (a) 1/5**

Shortcut Trick
Given $\cos \alpha = 5/13$. In a Pythagorean triplet (5, 12, 13), Base = 5, Perpendicular = 12, Hypotenuse = 13.
$\sec \alpha$ = Hypotenuse / Base = 13/5.
$\tan \alpha$ = Perpendicular / Base = 12/5.
$\sec \alpha - \tan \alpha = 13/5 - 12/5 = 1/5$.
Therefore The correct answer is 1/5.
Alternate Method

Given: cos α = 5/13
Formula Used: $\sin^2\alpha + \cos^2\alpha = 1$ | sec α = 1/cos α | tan α = sin α / cos α
=> sin α = √(1 − cos²α)
=> sin α = √(1 − (5/13)²) = √(1 − 25/169) = √(144/169) = 12/13
=> sec α = 1 / (5/13) = 13/5
=> tan α = (12/13) / (5/13) = 12/5
=> sec α − tan α = 13/5 − 12/5 = 1/5
Therefore The correct answer is 1/5.
Additional Information
Trigonometric Identity
$\sec^2\alpha - \tan^2\alpha = 1$, which implies (sec α − tan α)(sec α + tan α) = 1.
Reciprocal Relationship
If sec α + tan α = x, then sec α − tan α = 1/x.
Pythagorean Triplets
Common triplets used in exams include (3, 4, 5), (5, 12, 13), (8, 15, 17), and (7, 24, 25).

**Q42. Answer: (c) 836**

Shortcut Trick
The ratio of Volume to Curved Surface Area of a cylinder is r/2.
r/2 = 1848 ÷ 528 = 3.5 => Radius (r) = 7 m.
Total Surface Area = Curved Surface Area + 2 × Base Area
TSA = 528 + 2 × (22/7 × 7 × 7) = 528 + 308 = 836 m².
Therefore The correct answer is 836 m².
Alternate Method
Given:
Curved Surface Area (CSA) = 528 m²
Volume (V) = 1848 m³
Formula Used:
CSA = 2 × π × r × h
Volume = π × r² × h
Total Surface Area (TSA) = 2 × π × r × (r + h) = CSA + 2 × π × r²
Calculations:
=> V / CSA = (π × r² × h) / (2 × π × r × h) = r / 2
=> 1848 / 528 = r / 2
=> 3.5 = r / 2
=> r = 7 m
=> Base Area (πr²) = 22/7 × 7 × 7 = 154 m²
=> TSA = CSA + 2 × (Base Area)
=> TSA = 528 + 2 × 154
=> TSA = 528 + 308
=> TSA = 836 m²
Therefore The correct answer is 836 m².
Additional Information
Curved Surface Area of Cylinder
It is the area of only the side surface, calculated as 2πrh.
Total Surface Area of Cylinder
It includes the curved surface and the areas of the two circular bases: 2πrh + 2πr².
Volume of Cylinder
The space occupied by the cylinder is given by the formula πr²h.
Relation between Volume and CSA
Volume = (CSA × r) ÷ 2, which allows finding the radius if V and CSA are known.

**Q43. Answer: (c) C, A, B**

Shortcut Trick

Scheme A: Discount % = (Free ÷ Total) × 100 => (6 ÷ 11) × 100 ≈ 54.54%.

Scheme B: Single discount = 82%.

Scheme C: Successive discounts 11% and 24% ≈ 11 + 24 − (11 × 24)/100 ≈ 32.36%.

Comparing the values: 32.36% (C) < 54.54% (A) < 82% (B).

Therefore The correct answer is C, A, B.

Alternate Method

Given:

Scheme A: Buy 5 get 6 free. Scheme B: 82% discount. Scheme C: Successive 11% and 24%.

Calculations:

=> Discount A = (Free items / Total items) × 100

=> Discount A = (6 / (5 + 6)) × 100 = 600 / 11 = 54.54%

=> Discount B = 82%

=> Discount C = [x + y − (xy/100)]%

=> Discount C = 11 + 24 − (11 × 24 / 100) = 35 − 2.64 = 32.36%

=> Arranging in Ascending Order: 32.36% < 54.54% < 82%

Therefore The correct answer is C, A, B.

Additional Information

Buy X Get Y Free

The effective discount percentage is calculated as [Y / (X + Y)] × 100. Always use the total quantity in the denominator.

Successive Discounts

For two successive discounts a% and b%, the equivalent single discount is given by the formula (a + b − ab/100)%.

Marked Price and Selling Price

Selling Price (SP) = Marked Price (MP) × (100 − Discount%)/100. Discount is always calculated on the Marked Price.

**Q44. Answer: (c) 77.8**

Shortcut Trick

Ratio of Males to Females = 58% : 42% = 29 : 21.

Assume base average = 72 kg.

Net deviation for males = 29 × (82 − 72) = +290.

Average increase = 290 ÷ (29 + 21) = 290 ÷ 50 = 5.8 kg.

Final Average Weight = 72 + 5.8 = 77.8 kg.

Therefore The correct answer is 77.8 kg.

Alternate Method

Given: Total players = 150, Male percentage = 58%, Male avg weight = 82 kg, Female avg weight = 72 kg.

=> Number of male players = 58% of 150 = 0.58 × 150 = 87

=> Number of female players = 150 − 87 = 63

=> Total weight of males = 87 × 82 = 7134 kg

=> Total weight of females = 63 × 72 = 4536 kg

=> Total weight of all players = 7134 + 4536 = 11670 kg

=> Average weight of the group = 11670 ÷ 150 = 77.8 kg

Therefore The correct answer is 77.8 kg.

Additional Information

Weighted Average Formula

The weighted average is calculated as (n1w1 + n2w2) ÷ (n1 + n2), where n represents the quantity and w represents the weight/value.

Deviation Method

To simplify calculations, assume a base value (usually the smaller average) and distribute the total excess or deficit over the entire group size.

Ratio Principle in Averages

When calculating average weights or scores, the actual number of people is not required if the percentage distribution or ratio is

known.

**Q45. Answer: (c) 90.4%**

Shortcut Trick

Let Appeared students from School X be 100.

Qualified from X = 80% of 100 = 80.

Appeared from Y = 100 + 15% = 115.

Qualified from Y = 80 + 30% of 80 = 80 + 24 = 104.

Required % for Y = (104 ÷ 115) × 100 ≈ 90.4%.

Therefore The correct answer is 90.4%.

Alternate Method

Given:

=> Qualified % X = 80%

=> Appeared Y = Appeared X × (115/100)

=> Qualified Y = Qualified X × (130/100)

Calculations:

=> Let Appeared X = 100

=> Qualified X = 0.80 × 100 = 80

=> Appeared Y = 100 × 1.15 = 115

=> Qualified Y = 80 × 1.30 = 104

=> Required % = (Qualified Y ÷ Appeared Y) × 100

=> Required % = (104 ÷ 115) × 100

=> Required % = 90.434...

Therefore The correct answer is 90.4%.

Additional Information

Percentage Increase

To increase a value by x%, multiply the original value by (1 + x/100).

Successive Percentage

When a value changes by a% and then b%, the net change is [a + b + (ab/100)]%.

Rounding Off Rules

If the digit after the decimal is 5 or more, round up; otherwise, keep the digit as is.

**Q46. Answer: (c) 2 hours**

Shortcut Trick

Time = (Volume of Rectangular Tank) ÷ (Volume flow per hour through Cylindrical Pipe)

Volume of Tank = 50 × 44 × 0.21 = 462 $m^3$

Volume flow per hour = (22/7) × $(0.07)^2$ × 15000 = 231 $m^3$

Time = 462 ÷ 231 = 2 hr

Therefore The correct answer is 2 hr.

Alternate Method

Given:

Diameter of pipe = 14 cm => Radius (r) = 7 cm = 0.07 m

Speed of water (v) = 15 km/hr = 15,000 m/hr

Dimensions of tank: Length (L) = 50 m, Width (W) = 44 m

Required rise in Water Level (h) = 21 cm = 0.21 m

Calculations:

=> Volume of water needed in the tank = L × W × h

=> Volume = 50 × 44 × 0.21 = 462 $m^3$

=> Area of cross-section of the pipe = $\pi r^2$ = (22/7) × 0.07 × 0.07

=> Area = (22/7) × 0.0049 = 0.0154 $m^2$

=> Volume of water flowing through the pipe in 1 hour = Area × Speed

=> Volume per hr = 0.0154 × 15,000 = 231 $m^3$/hr

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=> Time required = (Total Volume needed) ÷ (Volume per hr)

=> Time = 462 ÷ 231 = 2 hours

Therefore The correct answer is 2 hr.

Additional Information

Volume of Cylinder

The volume of a cylindrical pipe is calculated as $V = \pi r^2 h$, where r is the radius and h is the length of water column (distance covered by speed).

Volume of Cuboid

The volume of a rectangular tank is V = length × width × height.

Unit Conversion

Always ensure all units are consistent: 1 km = 1000 m and 1 m = 100 cm.

Rate of Flow

Rate of flow = Area of cross-section × velocity of fluid flow.

**Q47. Answer: (c) 75**

Shortcut Trick

Apply the Man-Days formula: M1D1 = M2D2.

Initial men = X, Initial days = 28.

Final men = X − 5, Final days = 30.

28X = 30(X − 5) => 28X = 30X − 150 => 2X = 150.

X = 75.

Therefore The correct answer is 75 people.

Alternate Method

Given: Initial people = X, Initial time = 28 days, Absent people = 5, Final time = 30 days.

Formula Used: Total Work = Number of People × Number of Days.

=> Total Work = X × 28

=> Total Work = (X − 5) × 30

=> 28X = 30X − 150

=> 30X − 28X = 150

=> 2X = 150

=> X = 150 ÷ 2

=> X = 75

Therefore The correct answer is 75 people.

Additional Information

Chain Rule Formula

The general formula for work is (M1×D1×H1)/W1 = (M2×D2×H2)/W2 where M is men, D is days, H is hours, and W is work.

Inverse Proportion

When work is constant, the number of people is inversely proportional to the time taken (M prop. to 1/D).

Efficiency and Time

If efficiency increases, the time required to complete the same work decreases proportionally.

**Q48. Answer: (d) Rs. 8,000**

Shortcut Trick

The increase in interest is due to the 3% higher rate per annum for 4 years.

Total percentage increase in interest = 3% × 4 = 12%

According to the question, this 12% increase is equal to Rs. 960.

=> 12% of Principal = Rs. 960

=> 100% of Principal = (960 ÷ 12) × 100 = Rs. 8,000

Therefore The correct answer is Rs. 8,000.

Alternate Method

Given:

Time (T) = 4 years

Increase in rate of interest (R_(diff)) = 3% per annum

Increase in Simple Interest (I_(diff)) = Rs. 960

Formula Used:

Simple Interest (SI) = (P × R × T) ÷ 100

Difference in Simple Interest (I_(diff)) = (P × R_(diff) × T) ÷ 100

Calculations:

=> 960 = (P × 3 × 4) ÷ 100

=> 960 = (P × 12) ÷ 100

=> P × 12 = 960 × 100

=> P = 96000 ÷ 12

=> P = 8,000

Thus, the principal sum is Rs. 8,000.

Verification of Options:

Option (1) Rs. 7,500: Extra interest = (7500 × 3 × 4) ÷ 100 = Rs. 900 (Incorrect)

Option (2) Rs. 7,800: Extra interest = (7800 × 3 × 4) ÷ 100 = Rs. 936 (Incorrect)

Option (3) Rs. 8,300: Extra interest = (8300 × 3 × 4) ÷ 100 = Rs. 996 (Incorrect)

Option (4) Rs. 8,000: Extra interest = (8000 × 3 × 4) ÷ 100 = Rs. 960 (Correct)

Therefore The correct answer is Rs. 8,000.

Additional Information

Simple Interest Formula

SI = (P × R × T) ÷ 100, where P is the principal, R is the rate of interest per annum, and T is the time in years.

Direct Proportionality of Interest

Simple Interest is directly proportional to the rate of interest and time. Thus, any change in rate (ΔR) leads to a direct change in interest (ΔI) given by ΔI = (P × ΔR × T) ÷ 100.

Compound Interest vs Simple Interest

For the first year, Simple Interest and Compound Interest are equal (when compounded annually). From the second year onwards, Compound Interest is higher due to interest being earned on interest.

**Q49. Answer: (d) 74**

Shortcut Trick

Teacher age = New Average + (Initial Count × Increase in Average)

Given: Initial students = 40, Initial average = 33, New average = 34

Increase in average = 34 − 33 = 1 year

Teacher age = 34 + (40 × 1) = 34 + 40 = 74 years

Therefore The correct answer is 74 years.

Alternate Method

Given:

Number of students (n1) = 40

Average age of students (A1) = 33 years

Total number of people including teacher (n2) = 40 + 1 = 41

New average age (A2) = 34 years

Formula Used:

Total Age = Average × Number of persons

Calculations:

=> Total age of 40 students = 40 × 33 = 1320 years

=> Total age of 41 persons (including teacher) = 41 × 34

=> Total age of 41 persons = 1394 years

=> Teacher age = Total age (41) − Total age (40)

=> Teacher age = 1394 − 1320

=> Teacher age = 74 years

Therefore The correct answer is 74 years.

Additional Information

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Average Concept

The average is the sum of observations divided by the total number of observations: Average = Sum ÷ Number.

Inclusion/Exclusion Rule

When a new person joins, their value = (New Number of People × Change in Average) + Old Average.

Net Deviation Method

The sum of deviations from the average is always zero. If the average increases, the new entry must be higher than the previous average by (Count × Increase).

**Q50. Answer: (b) 252**

Shortcut Trick

Total distance = Speed × Time

Total distance = 59 m/sec × 9 sec = 531 m

X (Train length) = Total distance − Platform length

X = 531 − 279 = 252 m

Therefore The correct answer is 252 m.

Alternate Method

Given:

Speed of train = 59 m/sec

Time taken to cross = 9 sec

Length of platform = 279 m

Length of train = X m

Formula Used:

Distance = Speed × Time

When a train crosses a platform, Total Distance = Length of Train + Length of Platform

Calculations:

=> Total Distance = (X + 279) m

=> Total Distance = Speed × Time

=> X + 279 = 59 × 9

=> X + 279 = 531

=> X = 531 − 279

=> X = 252 m

Therefore The correct answer is 252 m.

Additional Information

Unit Conversion

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

Crossing Stationary Objects

When crossing a point object (pole, man), distance = length of train. When crossing a platform/bridge, distance = length of train + length of object.

Relative Speed

In same direction, Relative Speed = S1 − S2. In opposite direction, Relative Speed = S1 + S2.

**Q51. Answer: (c) Father’s mother**

Preparing the family tree using the following symbols:

According to the given information,

| **A is** | | | | |
|---|---|---|---|---|
| Symbol | • | – | • | ÷ |
| Meaning | Father | Mother | Sister | Brother |
| of B | | | | |

The given expression is :

'P – Q * R + S ÷ T' → P is mother of Q, Q is sister of R, R is father of S and S is brother of T.

P is T's father's mother.

Hence, the correct answer is “Option 3”.

**Q52. Answer: (b) 108**

Series: 23, 40, 57, 74, 91, ?

Step 1: Difference check karo

40 − 23 = 17

57 − 40 = 17

74 − 57 = 17

91 − 74 = 17

Pattern: +17

Step 2: Next number

91 + 17 = 108

Hence, the correct answer is 108

**Q53. Answer: (c) 5 km towards east**

Given:

Shantanu starts from Point A and drives 4 km towards the north.

He then takes a right turn and drives 5 km.

He then turns right and drives 7 km.

He then takes a right turn and drives 10 km.

He takes a final right turn, drives 3 km, and stops at Point P.

Hence, the correct answer is option 3

**Q54. Answer: (a) 7**

CLAW → 3948

FLAW → 9748

Common letters in both words: LAW

Common codes in both numbers: 948

So mapping:

L → 9

A → 4

W → 8

In FLAW = 9748, remaining number 7 corresponds to F.

Hence, the correct answer is 7.

**Q55. Answer: (c) Two**

Given:

B sits to the immediate left of F.

C sits second to the right of F.

E sits third to the left of B.

D sits to the immediate right of A.

Hence, the correct answer is option 3

**Q56. Answer: (c) UHT**

ILL → LKN → OJP → RIR

Pattern:

First letters: I → L → O → R → U (+3 each time)

Second letters: L → K → J → I → H (−1 each time)

Third letters: L → N → P → R → T (+2 each time)

So the ne×t cluster is UHT.

Hence, the correct answer is UHT.

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**Q57. Answer: (d) Three**

Series:

4 8 2 7 3 9 8 5 3 9 4 1 4 8 9 8 3 8 5 6 4 8 4 5 8 4 6

Condition: Odd – Even – Even

Valid cases:

1 4 8

5 6 4

5 8 4

Total such even numbers = 3

Hence, the correct answer is 3.

**Q58. Answer: (a) N**

Given:

No one sits to the left of D → D is at the leftmost end

Only four people sit between D and G → G is 5th from D

Only three people sit to the right of M → 7 seats total → M = 4.

L sits immediate left of E → L–E are consecutive with L on the left.

N is not an immediate neighbour of M → N

D — L — E — M — F — G — N

Hence, the correct answer is N

**Q59. Answer: (b) UNIT - TUIN - UTNI**

Logic:

1st word → last, first, third, second

2nd word → swap 1↔2 and 3↔4

Example check:

MANY → YMNA → MYAN

WING → GWNI → WGIN

Now check options:

UNIT

UNIT → TUIN (last, first, third, second)

TUIN → UTNI (swap 1↔2 and 3↔4)

Hence, the correct answer is Option 2: UNIT – TUIN – UTNI.

**Q60. Answer: (d) 922**

Operators interchange:

• ↔ −

× ↔ ÷

Equation becomes:

428 × 2 − 183 ÷ 3 + 127

Now solve (BODMAS):

428 × 2 = 856

183 ÷ 3 = 61

856 − 61 + 127 = 795 + 127 = 922

Hence, the correct answer is 922.

**Q61. Answer: (b) 343**

Series:

310, 320, 321, 331, 332, 342, ?

Pattern: +10, +1, +10, +1, +10

310 → 320 (+10)

320 → 321 (+1)

321 → 331 (+10)

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331 → 332 (+1)
332 → 342 (+10)
Next:
342 → 343 (+1)
Hence, the correct answer is 343.

**Q62. Answer: (b) 8**

FIRE → 2739
RISE → 3978
Common letters: R, I, E
Common digits: 3, 7, 9
Matching positions:
R → 3
I → 7
E → 9
In RISE = 3978, remaining digit 8 corresponds to S.
Hence, the correct answer is 8.

**Q63. Answer: (c) 60**

Riddhima's rank from top = 18
Riddhima's rank from bottom = 43
Total students = 18 + 43 − 1 = 60
Hence, the correct answer is 60.

**Q64. Answer: (d) Both conclusions (I) and (II) follow**

Statements:
All denims are trousers.
All trousers are shoes.
From this: Denims subset of Trousers subset of Shoes
Conclusion I: Some shoes are trousers
Since all trousers are shoes, at least some shoes must be trousers. Yes Follows
Conclusion II: All denims are shoes
Denims → Trousers → Shoes, so all denims are shoes. Yes Follows
Hence, both conclusions I and II follow.

**Q65. Answer: (a) Three**

Given:
Only I above C → I is directly above C
Only L between C and J → C–L–J sequence
Only K below D → D–K sequence
B and I positions: B = 3, I = 7 → boxes between them = 3
Top
7. I
6. C
5. L
4. J
3. B
2. D
1. K
Bottom
Hence, the correct answer is 3

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**Q66. Answer: (c) Only conclusion (I) follows.**

Statements:
All chalan are tax.
All chalan are rebate.
So, Chalan subset of Tax and Chalan subset of Rebate
Conclusion I: Some tax are rebate
Since all chalan are both tax and rebate, some tax must be rebate. Yes Follows
Conclusion II: All rebate are chalan
This cannot be concluded because rebate may contain elements other than chalan. ? Does not follow
Hence, only conclusion I follows.

**Q67. Answer: (d) W**

Given:
Only two people sit to the right of X.
Only two people sit between X and C.
Only two people sit between A and D.
D sits to the immediate left of X.
B sits to the immediate right of Y.
A — C — W — D — X — Y — B
Hence, the correct answer is W

**Q68. Answer: (d) Two**

Given words:
TOK, THE, HAS, ALL, COW
Each letter is replaced by the next alphabet letter.
TOK → UPL (U is vowel)
THE → UIF (U, I are vowels)
HAS → IBT (I is vowel)
ALL → BMM (no vowel)
COW → DPX (no vowel)
Words with no vowel: BMM, DPX
Total = 2
Hence, the correct answer is 2.

**Q69. Answer: (a) DG-BE**

Pairs:
DG–BE
JM–HL
HK–FJ
FI–DH
Pattern (alphabet position shift):
DG → BE
D → B (−2)
G → E (−2)
JM → HL
J → H (−2)
M → L (−1) ?
HK → FJ
H → F (−2)
K → J (−1) ?
FI → DH
F → D (−2)
I → H (−1) ?

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Group pattern: both letters decrease by 2.
Only DG → BE follows −2, −2 rule.
Hence, the correct answer is Option 1 (DG–BE).

**Q70. Answer: (d) Two**

Series:
7 4 5 5 4 7 9 8 4 3 9 2 1 5 7 9 7 8 3 3 8 2 1 9 6 9 7
Condition: Even – Even – Odd
Valid cases:
8 4 3 Yes
8 2 1 Yes
Total such even digits = 2
Hence, the correct answer is 2.

**Q71. Answer: (b) QJ-OH-MO**

Given:
NG → LE → JL
KD → IB → GI
NG → LE
N → L (−2)
G → E (−2)
LE → JL
L → J (−2)
E → L (+7)
KD → IB
K → I (−2)
D → B (−2)
IB → GI
I → G (−2)
B → I (+7)
Pattern:
First letter: −2, −2
Second letter: −2, +7
Options check
Option 3: QJ → OH → MP
Q → O (−2)
J → H (−2)
O → M (−2)
H → P (+8) ?
Option 2: QJ → OH → MO
Q → O (−2)
J → H (−2)
O → M (−2)
H → O (+7) Yes
Pattern exactly match.
Hence, the correct answer is Option 2 (QJ – OH – MO).

**Q72. Answer: (c) 23**

Given:
A = ÷
B = ×
C = +
D = −

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Expression:
10 B 2 C 7 D 8 A 2
Replace operators:
10 × 2 + 7 − 8 ÷ 2
Now solve (BODMAS):
10 × 2 = 20
8 ÷ 2 = 4
20 + 7 − 4 = 23
Hence, the correct answer is 23.

**Q73. Answer: (d) (15, 20, 5)**

Given pattern:
(46, 56, 10) → 56 − 46 = 10
(22, 33, 11) → 33 − 22 = 11
Pattern: Second number − First number = Third number
Check options:
(12, 29, 14) → 29 − 12 = 17 ≠ 14 ?
(35, 63, 25) → 63 − 35 = 28 ≠ 25 ?
(4, 17, 10) → 17 − 4 = 13 ≠ 10 ?
(15, 20, 5) → 20 − 15 = 5 Yes
Hence, the correct answer is Option 4 (15, 20, 5).

**Q74. Answer: (b) MADE - EDMA - MDAE**

Pattern from given examples:
BEST → TSBE → BSET
Step 1: Last letter comes to first position.
Step 2: Middle two letters interchange.
COWS → SWCO → CWOS
Step 1: Last letter comes to first position.
Step 2: Middle two letters interchange.
Check options:
Option 2:
MADE → EDMA (last letter E comes first) Yes
EDMA → MDAE (middle letters interchange) Yes
This follows the same pattern.
Hence, the correct answer is Option 2 (MADE – EDMA – MDAE).

**Q75. Answer: (a) 20**

Numbers: 548, 658, 254, 369, 714
Order them:
Highest → 714
Second highest → 658
Lowest → 254
Second digit of 658 = 5
Third digit of 254 = 4
Result:
5 × 4 = 20
Hence, the correct answer is 20.

**Q76. Answer: (d) 270**

Series:
312, 310, 306, 300, 292, 282, ?
Differences:

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312 → 310 = −2
310 → 306 = −4
306 → 300 = −6
300 → 292 = −8
292 → 282 = −10
Pattern: subtracting 2, 4, 6, 8, 10
Next subtraction = 12
282 − 12 = 270
Hence, the correct answer is 270.

**Q77. Answer: (b) None**

Number: 5628743
Arrange digits in ascending order:
2345678
Compare positions:
Original → 5 6 2 8 7 4 3
Ascending → 2 3 4 5 6 7 8
No digit remains in the same position.
Hence, the correct answer is 0.

**Q78. Answer: (c) CZW**

Alphabet positions:
XTR → X(24), T(20), R(18)
Differences: −4, −2
FBZ → F(6), B(2), Z(26)
Differences: −4, −2 (cyclic order)
CZW → C(3), Z(26), W(23)
Differences: −3, −3 ?
MIG → M(13), I(9), G(7)
Differences: −4, −2
Three clusters follow −4, −2 pattern:
XTR, FBZ, MIG
CZW does not follow this pattern.
Hence, the correct answer is Option 3 (CZW).

**Q79. Answer: (d) WY 29**

Series:
KM 17, NP 20, QS 23, TV 26, ?
Letters pattern:
K → N → Q → T → W (+3 each)
M → P → S → V → Y (+3 each)
So next letters = WY
Numbers pattern:
17 → 20 → 23 → 26 → 29 (+3)
Hence, the correct answer is WY 29.

**Q80. Answer: (c) 14 km to the west**

Given:
Mr. Akai starts from Point A and drives 5 km towards south.
He then takes a right turn and drives 15 km.
He turns right and drives 24 km.
He takes a right turn and drives 29 km.
He takes a final right turn, drives 19 km and stops at Point P.

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Hence, the correct answer is option 3

**Q81. Answer: (a) Rejected retrospective ECs as illegal**

The correct answer is Rejected retrospective ECs as illegal.

Key Points

• The Supreme Court of India in May 2025 ruled that granting retrospective environmental clearances (ECs) was illegal and violative of established environmental laws.

• Retrospective ECs refer to environmental clearances issued after the commencement of a project, effectively legalizing activities that were undertaken without prior approval.

• The court emphasized that projects must secure environmental clearances before their initiation, as mandated under the Environmental Impact Assessment (EIA) Notification, 2006.

• This ruling was a significant step to ensure that industries and projects comply with environmental regulations and do not bypass mandatory procedural requirements.

• The decision aimed to protect the environment by ensuring that public hearings and impact assessments are conducted before the project approval process, thereby strengthening transparency and accountability in environmental governance.

Additional Information

• Environmental Impact Assessment (EIA) Notification, 2006:

• The EIA Notification requires projects to undergo an environmental clearance process before any physical activity begins.

• The process includes the preparation of an EIA report, public consultation, and appraisal by an expert committee.

• This notification applies to various sectors, including industry, mining, infrastructure, and energy projects.

• Public Hearing Process:

• A public hearing is conducted as part of the EIA process to ensure community participation in decision-making.

• Stakeholders, including local residents, environmental activists, and government representatives, can voice their concerns about the project.

• This process ensures that the social and environmental impacts of the project are adequately addressed.

• Supreme Court's Role in Environmental Governance:

• The Supreme Court has played a pivotal role in enforcing environmental laws and ensuring compliance with constitutional provisions like Article 21, which guarantees the right to a clean and healthy environment.

• Several landmark rulings, such as the Vellore Citizens Welfare Forum vs. Union of India, have strengthened environmental jurisprudence in India.

• Illegal Retrospective Clearances:

• Retrospective ECs allow projects to bypass mandatory processes, undermining environmental protection frameworks.

• Such clearances have often led to environmental degradation due to lack of proper planning and mitigation measures.

• The Supreme Court's ruling in May 2025 reinforces adherence to prior approval mechanisms.

Important Points

• Environmental Protection Act, 1986:

• This act forms the legal basis for environmental clearances in India.

• It empowers the government to take measures for protecting and improving the quality of the environment.

• It also provides the framework for regulating activities that impact the environment.

• Key Case Studies:

• Sterlite Copper Plant Case: The Supreme Court highlighted the importance of prior ECs when the plant was shut down due to environmental violations.

• Western Ghats Mining Case: Retrospective clearances were challenged, emphasizing the need for impact assessments before project approval.

• Impact of Ruling:

• The decision ensures stricter compliance with environmental regulations, promoting sustainable development.

• It prevents industries from bypassing legal procedures, thereby safeguarding environmental integrity.

**Q82. Answer: (d) Operation SINDOOR**

The correct answer is Operation SINDOOR.

Key Points

• Operation SINDOOR was launched by the Indian Armed Forces in response to the Pahalgam terror attack, which occurred in 2025.

• The operation was aimed at neutralizing terror threats and ensuring the safety and security of the region, especially in areas

impacted by militant activities.

• This military operation was conducted under the guidance of the Ministry of Defence and involved joint efforts from the Indian Army, Air Force, and intelligence agencies.

• Operation SINDOOR focused on targeted strikes, intelligence-led operations, and securing strategic locations to prevent further attacks.

• The operation demonstrated India's commitment to combating terrorism and protecting its citizens, particularly in regions prone to insurgency.

Additional Information

• Pahalgam Terror Attack (2025):

• The attack occurred in the southern region of Kashmir, a region that has historically seen militant insurgency and terrorist activities.

• The targeted area was Pahalgam, a popular tourist destination and pilgrimage route for the Amarnath Yatra.

• The attack resulted in significant casualties, including civilians and security personnel, prompting a swift response from the Indian Armed Forces.

• Indian Counter-Terrorism Operations:

• India has conducted several anti-terror operations, including Operation Vijay, Operation Meghdoot, and Operation All-Out, to curb militant activities in Jammu & Kashmir.

• These operations often rely on intelligence gathering, precision strikes, and the use of advanced technology to neutralize threats.

• Impact of Counter-Terror Operations:

• Such operations aim to restore peace and stability in regions affected by terrorism and insurgency.

• They also showcase India's military capabilities and commitment to safeguarding its sovereignty and citizens.

• International Cooperation on Counter-Terrorism:

• India actively participates in global counter-terrorism forums such as the United Nations Counter-Terrorism Committee and BRICS initiatives.

• Collaborations with countries like USA, Russia, and Israel have strengthened India's technological and intelligence capabilities in combating terrorism.

Important Points

• Operation SINDOOR:

• Named symbolically to represent protection and sanctity, indicating the importance of safeguarding the region and its citizens.

• The operation showcased India's use of modern warfare techniques, including drone surveillance, satellite imagery, and special forces deployment.

• It marked a significant step in India's ongoing efforts to eradicate terrorism and maintain regional stability.

• Significance of Pahalgam:

• Pahalgam is not only a tourist destination but also a key point for religious pilgrimages, making its security critical for national integration.

• The attack on Pahalgam underscored the need for enhanced security measures in sensitive areas.

• India's Defence Strategy:

• India follows a proactive defence strategy involving preemptive strikes and intelligence-led operations to counter terrorism.

• Strengthening border security and enhancing regional cooperation are integral to India's approach to combating terrorism.

**Q83. Answer: (d) Leonardo Genoni**

The correct answer is Leonardo Genoni.

Key Points

• Leonardo Genoni is a professional ice hockey goaltender from Switzerland, known for his exceptional performances in major tournaments.

• Genoni was named the MVP (Most Valuable Player) of the 2025 IIHF World Championship, a prestigious tournament organized by the International Ice Hockey Federation (IIHF).

• His phenomenal goalkeeping played a crucial role in Switzerland's journey during the championship, which included several match-winning saves and consistent performances.

• Genoni's ability to stay calm under pressure and his outstanding reflexes earned him recognition as one of the top goaltenders globally.

• Winning the MVP award highlights Genoni's contribution to his team and his impact on the overall tournament, further solidifying his status as a key player in international hockey.

Additional Information

• IIHF World Championship:

• The IIHF World Championship is an annual event organized by the International Ice Hockey Federation, featuring teams from around the world competing at the highest level.

• The tournament includes multiple stages, such as group matches, quarterfinals, semifinals, and the final, attracting global attention and showcasing top-tier hockey talent.

• Players are evaluated on their individual performances and team contributions, with awards like MVP and All-Star selections given to outstanding players.

• Leonardo Genoni's Career:

• Genoni has played for several top-tier clubs in the Swiss National League, including SC Bern and EV Zug.

• He is renowned for his quick reflexes, strategic positioning, and ability to read the game, making him a formidable presence in goal.

• Genoni has won multiple championships at the club level and has represented Switzerland in international tournaments, proving his consistency and skill.

• Other Nominees:

• Nick Olesen: A Danish forward known for his offensive skills but not recognized for goalkeeping.

• David Pastrňák: A Czech forward famous for his scoring ability, but his role as a skater excludes him from consideration as a goaltender MVP.

• Zach Werenski: An American defenseman whose contributions are defensive rather than goalkeeping.

• Switzerland's Ice Hockey Success:

• Switzerland has emerged as a strong contender in international ice hockey, with players like Genoni contributing to the team's success.

• Swiss teams are known for their disciplined gameplay and strategic defensive tactics, which complement Genoni's goalkeeping prowess.

Important Points

• Criteria for MVP Selection:

• The MVP award is given to the player who has the most significant impact on their team's performance throughout the tournament.

• Performance metrics such as saves, save percentage, and crucial game-turning moments are considered for goaltenders.

• Swiss Hockey Development:

• Switzerland's ice hockey infrastructure and training programs have produced world-class players like Genoni.

• Government and private institutions support the growth of the sport, ensuring competitive teams at international levels.

**Q84. Answer: (a) 10 tonnes**

The correct answer is 10 tonnes.

Key Points

• The Indian Space Research Organisation (ISRO) announced in February 2025 the successful development of the world's largest vertical propellant mixer for solid rocket motors.

• The vertical propellant mixer has a weight of 10 tonnes, making it the heaviest and largest of its kind globally.

• This mixer is a crucial component for producing solid propellant rocket motors, widely used in space missions for their reliability and efficiency.

• The mixer was designed and built with cutting-edge technology to handle the precise mixing requirements of solid propellant ingredients critical for rocket propulsion.

• This achievement highlights India's growing capability in developing advanced space technologies to support its ambitious space exploration programs.

Additional Information

• Solid Rocket Motors:

• Solid rocket motors are propulsion systems that use solid propellants composed of fuel and oxidizer mixed together in a polymer binder.

• They are used in space missions due to their simplicity, reliability, and high thrust generation.

• Examples of ISRO rockets using solid motors include the PSLV (Polar Satellite Launch Vehicle) and GSLV Mk III (Geosynchronous Satellite Launch Vehicle).

• Vertical Propellant Mixers:

• These mixers are specialized equipment used to blend solid propellant ingredients uniformly to ensure consistent performance.

• The vertical configuration helps in handling large quantities of material, ensuring homogeneous mixing.

• Such mixers are vital for producing propellants with precise chemical properties required for specific rocket missions.

• ISRO's Technological Advancements:

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• ISRO has been consistently innovating to develop advanced technologies for space exploration and satellite launches.

• Recent achievements include the successful launch of Chandrayaan-3, Aditya-L1, and the Gaganyaan mission preparations.

• The development of the 10-tonne vertical propellant mixer further cements India's position as a leading player in the global space industry.

• Applications of Solid Rocket Motors:

• Used in the first stages of launch vehicles for providing the initial thrust required to escape Earth's gravity.

• Widely utilized in defense applications, including missiles such as the Agni series developed by DRDO.

• Essential for scientific research missions, planetary explorations, and satellite launches.

Important Points

• ISRO's Legacy:

• Founded in 1969, ISRO has grown to become a global leader in space technology.

• Landmark missions include Mangalyaan (Mars Orbiter Mission), Chandrayaan series, and PSLV-C37, which launched 104 satellites in a single mission.

• Global Comparisons:

• Other space agencies, such as NASA and ESA, also use advanced mixers for solid propellant production, but ISRO's 10-tonne mixer sets a new benchmark in size and capability.

**Q85. Answer: (c) Tamil Nadu**

The correct answer is Tamil Nadu.

Key Points

• On 8 April 2025, the Supreme Court of India delivered a landmark judgment deeming the refusal of the Tamil Nadu Governor to assent to 10 state bills as illegal and unconstitutional.

• The judgment emphasized the Governor's role as a constitutional functionary and clarified that the Governor cannot act arbitrarily or delay assent without valid reasons.

• The court ruled that withholding assent for extended periods or rejecting bills passed by the state legislature violates the federal structure and the democratic principles enshrined in the Constitution of India.

• This decision set a precedent for addressing disputes related to the Governor's discretionary powers, reaffirming the importance of accountability and timely decision-making in constitutional governance.

• The judgment also underscored the principle that the Governor is bound by the advice of the Council of Ministers in most circumstances, as per Article 163 of the Constitution.

Additional Information

• Role of the Governor in India:

• The Governor is the constitutional head of the state, appointed by the President of India, and acts on the advice of the Council of Ministers.

• Under Article 200, the Governor can give assent, withhold assent, or reserve a bill for the consideration of the President.

• The Governor's discretion is limited, and decisions must align with the constitutional framework.

• Article 200 of the Constitution:

• Article 200 governs the process of assent to bills passed by the state legislature.

• The Governor can:

• Give assent to the bill,

• Withhold assent, or

• Reserve the bill for the President's consideration.

• The refusal to act on bills for extended periods is considered a violation of the constitutional duty.

• Federal Structure of India:

• India's governance system is based on a quasi-federal structure, where powers are divided between the Union and the States.

• Governors play a crucial role in preserving this balance but must adhere to the principles of democracy and accountability.

• Supreme Court as the Guardian of the Constitution:

• The Supreme Court has the authority to interpret the Constitution and adjudicate disputes between the Union and State governments.

• It ensures that the actions of constitutional authorities like Governors comply with the principles of justice, equality, and democracy.

• Key Precedents:

• The Supreme Court has previously ruled on cases involving the discretionary powers of Governors, emphasizing their role as a neutral constitutional authority.

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• Judgments like the SR Bommai Case (1994) have clarified the limitations on the Governor's powers.

Important Points

• Governors and State Bills:

• The Governor's role is primarily ceremonial, and decisions regarding state bills must reflect the advice of the elected government.

• Unnecessary delays or refusal to act on bills disrupt the legislative process and undermine the authority of state legislatures.

• Judicial Intervention:

• Judicial review serves as a safeguard against arbitrary actions by constitutional functionaries.

• The Supreme Court's rulings ensure that the Governor's powers are exercised responsibly and in accordance with the Constitution.

• Constitutional Provisions:

• Relevant articles include Article 163 (Governor's discretion), Article 200 (assent to bills), and Article 201 (President's consideration).

• These provisions collectively define the framework for legislative processes at the state level.

• Impact of the Judgment:

• This judgment reinforces the principles of democratic governance and accountability.

• It ensures that Governors act within their constitutional limits, respecting the authority of elected governments.

**Q86. Answer: (d) Gujarat**

The correct answer is Gujarat.

Key Points

• Gujarat leads in mangrove afforestation under the Mangrove Initiative for Shoreline Habitats & Tangible Incomes (MISHTI) scheme as of February 2025. The state has implemented extensive programs to restore and expand mangrove ecosystems along its coastline.

• The MISHTI scheme, announced in the Union Budget 2023-24, aims to promote mangrove conservation and restoration in collaboration with local communities and other stakeholders.

• Gujarat's success in afforestation is attributed to its vast coastal area of about 1,600 km, which includes regions like the Gulf of Kutch and the Gulf of Khambhat, known for their suitable conditions for mangrove growth.

• Mangroves play a critical role in mitigating climate change by acting as carbon sinks, protecting shorelines from erosion, and supporting biodiversity. Gujarat has prioritized these aspects through its targeted afforestation efforts.

• Local communities in Gujarat are actively involved in the afforestation process under the MISHTI initiative, ensuring the sustainability of the restored mangrove ecosystems while also generating livelihood opportunities.

Additional Information

• About the MISHTI Scheme:

• The Mangrove Initiative for Shoreline Habitats & Tangible Incomes (MISHTI) was introduced in the Union Budget 2023-24 to restore mangrove ecosystems.

• It is implemented through convergence of schemes such as the Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS) and Compensatory Afforestation Fund Management and Planning Authority (CAMPA).

• The scheme focuses on mangrove plantation along India’s coastline and on saltpan lands, aiming to enhance biodiversity and climate resilience.

• Significance of Mangroves:

• Mangroves are salt-tolerant plants that thrive in intertidal zones, serving as critical habitats for marine biodiversity.

• They act as effective carbon sinks, sequestering large amounts of carbon dioxide from the atmosphere, thus mitigating climate change.

• Mangroves protect coastlines from storm surges, erosion, and rising sea levels, ensuring the safety of coastal communities.

• Gujarat's Mangrove Restoration Efforts:

• Gujarat has a significant mangrove cover, with the Gulf of Kutch being one of the largest mangrove ecosystems in the state.

• The state’s mangrove area has seen consistent growth due to focused afforestation initiatives and community participation.

• Gujarat has implemented various projects to restore degraded mangrove areas and expand mangrove cover along its coastline.

• Other Leading States in Mangrove Conservation:

• West Bengal: Home to the Sundarbans, the largest mangrove forest in the world, with significant biodiversity.

• Odisha: Known for its mangrove ecosystems in the Bhitarkanika region, which supports rich wildlife.

• Andhra Pradesh: Focuses on mangrove restoration in areas like the Godavari and Krishna delta regions.

Important Points

• India accounts for approximately 3% of the world's mangrove cover, with significant areas in states like Gujarat, West Bengal, and Odisha.

• The State of Forest Report 2021 highlights that India's mangrove cover has increased by 17 sq. km compared to the previous assessment.

• Mangrove conservation is essential for achieving the Sustainable Development Goals (SDGs), particularly in combating climate change and promoting sustainable livelihoods.

• The Indian government has emphasized community participation in mangrove restoration, recognizing their importance in coastal ecosystem resilience.

**Q87. Answer: (d) 6**

The correct answer is 6.

Key Points

• During the Defence Investiture Ceremony 2025 (Phase-I), a total of 6 Kirti Chakras were conferred.

• The Kirti Chakra is India's second-highest peacetime gallantry award. It is awarded for exceptional acts of courage, bravery, and self-sacrifice in situations other than actual combat.

• The ceremony recognised the exceptional bravery and distinguished contributions of personnel of the Indian Armed Forces.

• The Defence Investiture Ceremony is an important military ceremony during which prestigious gallantry and distinguished-service awards are formally presented.

• Hence, the correct answer is 6.

Additional Information

• Kirti Chakra:

• It is the second-highest peacetime gallantry award in India.

• The award recognises acts of conspicuous gallantry performed away from the battlefield.

• It can be awarded to personnel of the Armed Forces and certain civilians who display exceptional courage.

• Peacetime Gallantry Awards:

• Ashoka Chakra – Highest peacetime gallantry award.

• Kirti Chakra – Second-highest peacetime gallantry award.

• Shaurya Chakra – Third-highest peacetime gallantry award.

• Historical Background:

• The Kirti Chakra was originally instituted in 1952 as the Ashoka Chakra, Class II.

• It was renamed the Kirti Chakra in 1967.

• Defence Investiture Ceremony:

• The ceremony is associated with the formal presentation of military decorations by the President of India, who is the Supreme Commander of the Armed Forces.

• The awards recognise gallantry, distinguished service, leadership, and devotion to duty.

Important Points

• Defence Investiture Ceremony 2025 (Phase-I): 6 Kirti Chakras were conferred.

• Kirti Chakra: Second-highest peacetime gallantry award.

• Ashoka Chakra: Highest peacetime gallantry award.

• Shaurya Chakra: Third-highest peacetime gallantry award.

**Q88. Answer: (d) National Dhanwantari Ayurveda Awards**

The correct answer is National Dhanwantari Ayurveda Awards.

Key Points

• The National Dhanwantari Ayurveda Awards are prestigious awards given to individuals who have made significant contributions to the field of Ayurveda in India.

• Recipients of these awards are recognized for their dedication to promoting and preserving the ancient system of Ayurveda, which is a key component of India's traditional medical heritage.

• In the year 2025, Vaidya Tara Chand Sharma, Vaidya Maya Ram Uniyal, and Vaidya Sameer Govind Jamadagni were honored with this award for their exceptional work in the field.

• The award is usually conferred by the Ministry of AYUSH, Government of India, which is responsible for promoting Ayurveda, Yoga, Naturopathy, Unani, Siddha, and Homoeopathy.

• The recipients are often individuals who have contributed to research, clinical practice, teaching, or the promotion of Ayurveda at a national or international level.

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Additional Information

• Ayurveda:

• Ayurveda is an ancient system of medicine that originated in India over 5,000 years ago.

• It is based on the principles of maintaining balance in the body through diet, lifestyle, and natural remedies.

• Ayurveda focuses on holistic healing and emphasizes the mind-body connection.

• Ministry of AYUSH:

• The Ministry of AYUSH (Ayurveda, Yoga & Naturopathy, Unani, Siddha, and Homoeopathy) was established in 2014 to promote traditional systems of medicine.

• It is responsible for the development, research, and education related to these systems of medicine.

• National Dhanwantari Ayurveda Awards:

• The award is named after Dhanwantari, the Hindu god of medicine and an avatar of Lord Vishnu, who is considered the father of Ayurveda.

• The award recognizes individuals who have made outstanding contributions to the research, innovation, and promotion of Ayurveda.

• Other Awards in the Field of Medicine:

• National Florence Nightingale Awards: These awards are conferred to outstanding nurses and healthcare professionals.

• Nelson Mandela Award for Health Promotion: This award recognizes contributions to public health and health promotion globally.

• National Award to Teachers: This award is given to educators for their exceptional contributions to the field of education.

Important Points

• Eligibility for National Dhanwantari Ayurveda Awards:

• Nominees must have demonstrated excellence in the practice, teaching, or research of Ayurveda.

• Their work should have a significant impact on public health or contribute to the advancement of Ayurveda.

• Role of Ayurveda in Modern Healthcare:

• Ayurveda is increasingly being integrated into modern healthcare systems, especially for chronic diseases and preventive care.

• Its emphasis on lifestyle and dietary practices aligns with modern concepts of wellness and preventive medicine.

**Q89. Answer: (b) PayPal and Worldline**

The correct answer is PayPal and Worldline.

Key Points

• Reserve Bank of India (RBI) granted in-principle approval for cross-border payment aggregation to PayPal and Worldline in May 2025, allowing these companies to facilitate payment processing for international transactions.

• PayPal, a global leader in digital payments headquartered in the United States, specializes in providing secure and efficient cross-border payment services for individuals and businesses worldwide.

• Worldline, a European company based in France, is a prominent payment service provider offering solutions for e-commerce, international payment processing, and financial services.

• Cross-border payment aggregation services are crucial for businesses engaged in international trade, as they allow for seamless multi-currency processing, compliance with global regulations, and enhanced security measures.

• By granting this approval, RBI aims to strengthen India's digital payment ecosystem and support the growing demand for international payment solutions in a rapidly globalizing economy.

Additional Information

• PayPal:

• Founded in 1998, PayPal is an American multinational financial technology company headquartered in San Jose, California.

• It offers services including online money transfers, currency exchange, and payment processing for e-commerce platforms.

• PayPal supports over 200 markets globally and allows transactions in 25 currencies.

• The company focuses on providing secure and user-friendly payment solutions for businesses and individuals.

• Worldline:

• Worldline is a French payment and transactional services company, founded in 1974 and headquartered in Bezons, France.

• It is a leading provider of international payment solutions, offering services such as merchant acquiring, digital payments, and terminal services.

• The company operates in over 50 countries and processes billions of transactions annually.

• Worldline specializes in secure, scalable, and efficient payment systems for enterprises and governments.

• Cross-Border Payments:

• Cross-border payments refer to transactions where the payer and the payee are located in different countries.

• These payments are vital for international trade, e-commerce, remittances, and global supply chains.

• They involve currency exchange, compliance with international regulations, and anti-money laundering (AML) measures.

• Technological advancements such as blockchain and real-time payment systems are driving innovation in the cross-border payment sector.

• RBI's Role in Payment Aggregation:

• The Reserve Bank of India regulates payment aggregators to ensure security, transparency, and compliance in digital payment systems.

• RBI issues licenses to companies meeting stringent requirements, including capital adequacy, technology infrastructure, and risk management.

• It aims to promote financial inclusion and enhance the efficiency of India's payment ecosystem.

Important Points

• Other Options in the Question:

• PhonePe and Razorpay: These companies are leading payment service providers in India but have not been granted in-principle approval for cross-border payment aggregation by RBI as of May 2025.

• Amazon Pay and Instamojo: While Amazon Pay is a significant player in digital payments, and Instamojo specializes in online payment solutions for small businesses, they do not hold RBI's approval for cross-border payment aggregation.

• Google Pay and Stripe: Both companies are influential in the global payment ecosystem, but they have not received specific in-principle approval from RBI for cross-border payment aggregation.

**Q90. Answer: (b) 16.03 m**

The correct answer is 16.03 m.

Key Points

• Krishna Jayasankar achieved a record-breaking indoor shot put performance in 2025, setting a distance of 16.03 meters.

• Shot put is an athletic event where the participant pushes a heavy spherical object (shot) as far as possible within specified rules.

• The distance of 16.03 meters is significant as it set a new benchmark in indoor shot put competitions, showcasing the athlete's immense strength and technique.

• Indoor competitions differ from outdoor events due to factors like controlled environments, absence of wind, and specific flooring conditions that can impact performance.

• Such achievements underline the importance of rigorous training, enhanced physical conditioning, and mastery of technique required for elite performances.

Additional Information

• Shot Put Event:

• Shot put is a part of track and field events, where the athlete must "put" (not throw) the shot using one hand while adhering to a defined technique.

• The shot is generally made of solid iron or brass, weighing 7.26 kg for men and 4 kg for women.

• Competitors use techniques like the glide or the spin to maximize their throwing distance.

• Indoor Shot Put Competitions:

• Indoor events are conducted in closed venues, eliminating external factors like weather that can impact performance.

• The flooring is designed to provide traction and stability for the athlete during their throw.

• Measurements are taken precisely from the circle's edge to where the shot lands.

• Krishna Jayasankar's Contribution to Athletics:

• Krishna Jayasankar is a renowned athlete in the field of shot put, known for breaking records and inspiring upcoming athletes.

• Her performance in 2025 highlights the growing prominence of Indian athletes in international sporting events.

• This record-breaking achievement reflects the increasing standards of competitive athletics in India.

• Physical and Mental Conditioning:

• Shot put requires exceptional strength, explosive power, and precision to achieve long distances.

• Athletes undergo rigorous training, focusing on both physical attributes like muscle endurance and mental aspects such as focus and strategy.

Important Points

• Record-Breaking Performances:

• Achievements like Krishna Jayasankar's 16.03 m shot put are milestones that push the boundaries of what athletes can accomplish.

• They set benchmarks for future competitors and inspire advancements in training methodologies and sports science.

• India’s Growing Presence in Athletics:

• Indian athletes are increasingly making their mark in global sports competitions, showcasing their talent and dedication.

• Support from government schemes and private organizations has played a key role in nurturing talent.

• Technical Aspects of Shot Put:

• The shot must land within a sector marked at 34.92 degrees, and athletes must not step outside the circle during the attempt.

• Judges ensure adherence to rules, and precise measurements are taken for fairness.

**Q91. Answer: (b) Lee Jae-myung**

The correct answer is Lee Jae-myung.

Key Points

• Lee Jae-myung was elected as the President of South Korea in June 2025, succeeding his predecessor Yoon Suk Yeol.

• Lee Jae-myung is a member of the Democratic Party of Korea, which has traditionally focused on progressive economic policies, social welfare, and peace initiatives.

• He gained popularity for his strong stance on economic reforms and policies aimed at tackling income inequality and supporting the middle class.

• During his campaign, Lee Jae-myung emphasized policies such as universal basic income, affordable housing, and measures to address South Korea’s declining birth rate and aging population.

• His political career includes serving as the Governor of Gyeonggi Province, where he implemented successful welfare programs and economic policies that boosted his public image.

Additional Information

• Yoon Suk Yeol:

• Yoon Suk Yeol was the President of South Korea before Lee Jae-myung, serving from 2022 to 2025.

• He is a member of the People Power Party and is known for his conservative policies and focus on national security and economic growth.

• Yoon’s presidency was marked by efforts to strengthen South Korea’s alliances with the United States and Japan amidst growing regional tensions with North Korea and China.

• Lee Jae-myung’s Key Policies:

• He introduced the concept of universal basic income during his tenure as Governor of Gyeonggi Province and proposed expanding it nationally as President.

• His administration aims to tackle South Korea’s housing crisis by increasing the supply of affordable housing and regulating real estate speculation.

• Lee Jae-myung has advocated for reforms in the labor market to protect workers’ rights and promote job stability.

• He has also emphasized addressing climate change by promoting investments in green energy and sustainable development projects.

• South Korea’s Political System:

• South Korea is a democratic republic with a President serving as both the head of state and government.

• The President is elected for a single five-year term and cannot be re-elected for a consecutive term.

• The country operates under a multi-party system, with the People Power Party and the Democratic Party being the two leading political parties.

• Challenges Facing South Korea:

• Economic Inequality: South Korea has one of the highest levels of income inequality among OECD countries, which remains a critical issue for policymakers.

• Demographic Crisis: The country faces a declining birth rate and an aging population, posing challenges for its labor market and social welfare systems.

• Relations with North Korea: Inter-Korean relations and the denuclearization of the Korean Peninsula are key foreign policy challenges.

• Global Competition: South Korea continues to navigate its position in the global economy amidst trade tensions and geopolitical shifts.

Important Points

• Election Process:

• South Korea’s presidential elections are held every five years, and the candidate with the majority of votes is declared the winner.

• The elections are conducted by the National Election Commission under a transparent and democratic process.

• Role of the President:

• The President of South Korea holds significant powers, including the authority to appoint key officials, propose legislation, and

manage foreign relations.

• The President also serves as the commander-in-chief of the armed forces.

• Geopolitical Importance of South Korea:

• South Korea is a key player in East Asia, with strategic importance due to its proximity to China, Japan, and North Korea.

• The country is a leading global economy, known for its technological advancements and export-driven industries.

**Q92. Answer: (b) Indo-Gangetic Plain**

The correct answer is Indo-Gangetic Plain.

Key Points

• The Indo-Gangetic Plain was identified as the most polluted region in India in October 2025, according to a report by the Finland-based Centre for Research on Energy and Clean Air (CREA).

• This region is one of the most densely populated areas in the world and spans across northern and eastern India, including states like Uttar Pradesh, Bihar, Punjab, Haryana, and West Bengal.

• The high pollution levels in the Indo-Gangetic Plain are primarily attributed to stubble burning during the harvest season, vehicular emissions, industrial activities, and domestic fuel usage.

• Seasonal factors like winter smog and low wind speeds exacerbate the problem, leading to a significant deterioration in air quality, often reaching hazardous levels.

• The region frequently records extremely high levels of PM2.5 (fine particulate matter), which poses severe health risks, including respiratory and cardiovascular diseases.

Additional Information

• Indo-Gangetic Plain:

• This plain stretches from the Indus River in the west to the Brahmaputra River in the east.

• It is known for its fertile alluvial soil, making it a prominent agricultural hub in India.

• The plain is home to major cities such as Delhi, Lucknow, Patna, and Kolkata, which further contribute to the pollution due to urbanization and industrialization.

• Population density in this region is one of the highest globally, putting immense pressure on natural resources and air quality.

• Factors Contributing to Pollution:

• Stubble Burning: Farmers in Punjab, Haryana, and Uttar Pradesh burn agricultural residues after harvesting, releasing large amounts of pollutants.

• Vehicular Emissions: High vehicle density, especially in urban areas, leads to increased levels of nitrogen oxides (NOx) and particulate matter.

• Industrial Emissions: Industries in the region, including thermal power plants, contribute significantly to air pollution.

• Domestic Factors: The use of solid fuels like wood and coal for cooking and heating in rural areas adds to pollution levels.

• Health Impact of Pollution:

• High levels of PM2.5 and PM10 particles can penetrate deep into the lungs and even enter the bloodstream, causing respiratory and cardiovascular diseases.

• Long-term exposure can lead to chronic diseases, reduced lung function, and premature deaths.

• Children and the elderly are particularly vulnerable to the health effects of air pollution.

• Initiatives to Combat Pollution:

• The Indian government has launched initiatives like the National Clean Air Programme (NCAP) to reduce particulate pollution by 20-30% by 2024.

• Programs like Ujjwala Yojana aim to reduce dependence on solid fuels by providing LPG connections to rural households.

• Efforts are also being made to promote cleaner technologies and stricter industrial emission norms.

Important Points

• PM2.5 and PM10:

• PM2.5: Particulate matter with a diameter of less than 2.5 micrometers. These particles are small enough to enter the lungs and bloodstream, posing severe health risks.

• PM10: Particulate matter with a diameter of less than 10 micrometers, which can cause respiratory issues but does not penetrate as deeply as PM2.5.

• Centre for Research on Energy and Clean Air (CREA):

• An independent research organization focused on analyzing the trends, causes, and solutions to air pollution and its impact on human health.

• CREA provides data-driven insights to support effective policymaking for cleaner air.

• National Clean Air Programme (NCAP):

• Launched in 2019 by the Ministry of Environment, Forest and Climate Change.

• Aims to reduce PM2.5 and PM10 levels in non-attainment cities by 20-30% by 2024 (compared to 2017 levels).

• Focuses on comprehensive planning, monitoring, and implementation of air quality improvement measures.

**Q93. Answer: (a) Turkey**

The correct answer is Turkey.

Key Points

• The FIG Apparatus World Cup 2025 is an international gymnastics tournament organized by the International Gymnastics Federation (FIG).

• In this competition, Indian gymnast Pranati Nayak secured a bronze medal, showcasing her exceptional talent and dedication in gymnastics.

• The event was held in Turkey, a country with a growing reputation for hosting international sporting events, particularly in gymnastics and athletics.

• This achievement marks an important milestone for Indian gymnastics on the global stage, highlighting the country's progress in developing this sport.

• Pranati Nayak's performance at the FIG Apparatus World Cup is a testament to her skill and perseverance, inspiring many young athletes in India.

Additional Information

• Pranati Nayak:

• Pranati Nayak is an Indian artistic gymnast and one of the top gymnasts representing India internationally.

• She won a bronze medal at the 2019 Asian Artistic Gymnastics Championships, further establishing her as a leading gymnast in the country.

• Pranati hails from the state of West Bengal, and her career has been supported by rigorous training and national-level coaching programs.

• FIG Apparatus World Cup:

• The FIG Apparatus World Cup is an annual gymnastics competition organized by the International Gymnastics Federation (FIG).

• It is a prestigious event where gymnasts from around the world compete in different apparatus categories such as vault, uneven bars, balance beam, and floor exercises.

• The World Cup serves as a platform for gymnasts to earn valuable international rankings and prepare for other major tournaments like the Olympics and World Championships.

• Turkey's Role in Hosting Sports Events:

• Turkey has emerged as a popular destination for hosting international sports events due to its world-class infrastructure and strategic location at the crossroads of Europe and Asia.

• It has previously hosted major events such as the UEFA Champions League Final, international tennis tournaments, and athletics championships.

• The country's focus on promoting sports has enhanced its reputation in the global sports community.

• Gymnastics in India:

• Gymnastics is gaining popularity in India, with several young athletes making their mark on the international stage.

• Programs like the Khelo India initiative are promoting the development of gymnastics at the grassroots level.

• Indian gymnasts such as Dipa Karmakar and Pranati Nayak have played a significant role in bringing attention to the sport in the country.

Important Points

• International Gymnastics Federation (FIG):

• The FIG is the governing body for gymnastics worldwide, established in 1881.

• It oversees various gymnastics disciplines, including artistic gymnastics, rhythmic gymnastics, and trampoline gymnastics.

• Headquartered in Lausanne, Switzerland, the FIG is responsible for organizing events like the World Gymnastics Championships and FIG Apparatus World Cups.

• Gymnastics Disciplines:

• Artistic Gymnastics: Includes events like vault, uneven bars, balance beam, and floor exercises.

• Rhythmic Gymnastics: Combines dance, ballet, and gymnastics, often performed with apparatus like ribbons and hoops.

• Trampoline Gymnastics: Involves acrobatic movements performed on a trampoline.

• Other Indian Achievements in Gymnastics:

• Dipa Karmakar made history by becoming the first Indian gymnast to qualify for the Olympics in 2016 and performing the Produnova Vault.

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• India is gradually gaining recognition in gymnastics due to the efforts of athletes like Pranati Nayak and Dipa Karmakar.

**Q94. Answer: (d) Rs. 20**

The correct answer is Rs. 20.

Key Points

• Reserve Bank of India (RBI) announced the introduction of a new Rs. 20 denomination banknote in the Mahatma Gandhi (New) Series, which is set to carry the signature of the new RBI Governor, Sanjay Malhotra, in May 2025.

• The Rs. 20 banknote features a design that aligns with the aesthetic of the Mahatma Gandhi (New) Series, which emphasizes enhanced security features, durability, and ease of identification.

• The Mahatma Gandhi (New) Series was first introduced in 2016 to replace the older notes and improve security against counterfeiting. The Rs. 20 denomination continues to be an essential component of this series.

• The banknote is expected to showcase the iconic image of Mahatma Gandhi on the front, along with features such as a watermark, color-shifting ink, and tactile markings for visually impaired individuals.

• The reverse side of the Rs. 20 banknote typically features motifs representing India's cultural heritage. It is likely to retain such elements to highlight the country's diversity and traditions.

Additional Information

• Evolution of Mahatma Gandhi (New) Series:

• The series was introduced in November 2016 after demonetization, starting with Rs. 500 and Rs. 2000 notes.

• It focuses on enhancing security features such as micro-lettering, latent images, and color-changing ink to reduce the risk of counterfeiting.

• The notes are designed with tactile markings to aid visually impaired individuals in identifying denominations.

• Features of Rs. 20 Banknote:

• Dimensions: The new Rs. 20 note measures 63 mm x 129 mm, making it smaller and easier to handle.

• Color Scheme: The dominant color is greenish-yellow, providing contrast with other denominations.

• Security Elements: Includes features like a security thread, watermark of Mahatma Gandhi, and electrotype numeral 20.

• Design: The reverse side of the note typically features motifs showcasing India's cultural and natural heritage, such as the Ellora caves.

• Role of RBI Governor:

• The signature of the RBI Governor is a mandatory feature on Indian banknotes, signifying authenticity and legal tender status.

• Sanjay Malhotra, as the new Governor appointed in 2025, will oversee all aspects of monetary policy and currency issuance.

• Governors play a crucial role in ensuring financial stability and introducing innovative reforms, such as updated currency designs.

• Importance of Rs. 20 Denomination:

• The Rs. 20 note is widely used for everyday transactions, making it an essential medium for cash-based payments in India.

• Its size and value make it suitable for small purchases, such as groceries, transportation, and street food.

• The introduction of updated Rs. 20 notes ensures greater security and accessibility for citizens.

Important Points

• Historical Significance of Banknote Series:

• The Mahatma Gandhi Series was first introduced in 1996, featuring Gandhi's image on the front.

• The Mahatma Gandhi (New) Series replaced the older series, incorporating modern security features and design changes.

• RBI's Currency Management:

• The Reserve Bank of India is responsible for currency issuance and management under the Reserve Bank of India Act, 1934.

• It ensures the availability of adequate currency notes and coins across the country while maintaining security and efficiency.

• Security Features in Modern Banknotes:

• Indian banknotes include advanced security features like color-changing ink, micro-lettering, and tactile markings.

• These features are designed to prevent counterfeiting and ensure the authenticity of currency.

**Q95. Answer: (d) Banu Mushtaq**

The correct answer is Banu Mushtaq.

Key Points

• Banu Mushtaq won the International Booker Prize in the year 2025 for her celebrated novel, 'Heart Lamp.' The novel gained widespread acclaim for its deep exploration of human emotions and cultural nuances.

• The International Booker Prize recognizes outstanding works of fiction translated into English. The prize is awarded annually, acknowledging both the author and translator of the winning book.

• 'Heart Lamp' is a poignant literary work that delves into themes of resilience, identity, and interpersonal relationships, resonating with readers globally.

• The novel's unique narrative style and cultural depth were pivotal in securing the prestigious award for Banu Mushtaq, marking a significant milestone in her literary career.

• The International Booker Prize aims to promote global literary diversity, and the recognition of 'Heart Lamp' further underscores the importance of showcasing stories from diverse cultural backgrounds.

Additional Information

• Banu Mushtaq:

• Banu Mushtaq is an acclaimed author known for her ability to weave stories that reflect societal and personal struggles. Her writing is often rooted in cultural and emotional authenticity.

• She hails from a region with rich literary traditions, which deeply influence her storytelling and thematic choices.

• 'Heart Lamp' is considered her magnum opus, earning her critical acclaim and international recognition.

• International Booker Prize:

• The prize was established in 2005 and focuses on works of fiction translated into English, emphasizing the collaboration between authors and translators.

• The award is distinct from the Man Booker Prize, which is limited to English-language novels written by authors from the Commonwealth, Ireland, or Zimbabwe.

• Winners of the International Booker Prize receive a monetary award shared between the author and translator, fostering the importance of literary translation.

• 'Heart Lamp':

• The novel's central theme revolves around the metaphor of a heart as a lamp, illuminating the paths of life, love, and loss.

• Its narrative style employs a blend of poetic prose and vivid imagery, making it a masterpiece of literary art.

• The book's universal appeal lies in its exploration of emotional resilience and cultural identity, resonating with audiences across the globe.

• Other notable winners of the International Booker Prize:

• In 2022, Geetanjali Shree won for her novel 'Tomb of Sand', translated by Daisy Rockwell.

• Authors like David Grossman, Han Kang, and Olga Tokarczuk have previously received the award, showcasing the diversity of global literary talent.

• The prize continues to celebrate translations, promoting cultural exchange and understanding through literature.

Important Points

• Promoting Diversity: The International Booker Prize plays a crucial role in promoting literary diversity by recognizing works from different cultures and languages.

• Role of Translators: Translators are integral to the prize, ensuring that non-English works reach a global audience while maintaining the essence of the original text.

• Global Influence: Winning the International Booker Prize significantly boosts an author's international profile and contributes to the promotion of translated literature.

• Impact of 'Heart Lamp': The book's recognition highlights the importance of storytelling in bridging cultural gaps and fostering empathy across diverse communities.

**Q96. Answer: (a) 6,000 metres**

The correct answer is 6,000 metres.

Key Points

• Samudrayaan Mission: India’s first manned deep ocean mission, Samudrayaan, is part of the Deep Ocean Mission launched by the Ministry of Earth Sciences in 2021.

• The mission aims to explore the deep ocean using a manned submersible vehicle named 'Matsya', which will be capable of carrying three people and conduct deep-sea exploration.

• The target depth for the mission is to reach 6,000 metres below the ocean surface by the end of 2026.

• The primary objective of this mission is to explore the vast marine biodiversity, study deep-sea minerals, and assess the potential for underwater resources, such as polymetallic nodules.

• The Matsya submersible is being developed by the National Institute of Ocean Technology (NIOT) in Chennai and is equipped with advanced safety features to withstand the extreme conditions of the deep ocean.

Additional Information

• Deep Ocean Mission:

• Launched in 2021, the Deep Ocean Mission aims to explore the deep sea, harness marine resources, and develop advanced technologies for ocean exploration.

• It is a multi-ministerial and multi-disciplinary initiative under the Ministry of Earth Sciences.

• The mission focuses on areas like deep-sea mining, ocean climate change advisory services, and marine biodiversity exploration.

• Polymetallic Nodules:

• These are potato-shaped mineral deposits found on the deep ocean floor, containing valuable metals like nickel, cobalt, copper, and manganese.

• India is among the few countries granted exclusive rights by the International Seabed Authority (ISA) to explore polymetallic nodules in the Central Indian Ocean Basin (CIOB).

• Matsya Submersible:

• The submersible is being designed to carry three humans to a depth of 6,000 metres while withstanding extreme pressure and low temperatures.

• It will feature a titanium hull and advanced life-support systems to ensure the safety of its crew.

• Global Context:

• Countries like USA, Japan, China, and Russia have already developed manned submersibles for deep-sea exploration.

• India's Samudrayaan mission places it among the few nations actively pursuing deep-sea manned exploration capabilities.

• Significance of the Mission:

• Potential for discovering new marine species and understanding the deep-sea ecosystem.

• Exploration of marine resources to support the blue economy, focusing on sustainable use of ocean resources for economic growth.

• The mission aligns with India's strategic and scientific goals, contributing to global ocean research.

Important Points

• Extreme Deep-Sea Conditions:

• At 6,000 metres depth, pressure is nearly 600 times the atmospheric pressure at sea level.

• The temperature is close to freezing, requiring advanced thermal protection and insulation for the vehicle.

• India's Ocean Exploration Achievements:

• India has been conducting oceanographic research for decades, with key infrastructure like the ORV Sagar Nidhi and partnerships with global organizations.

• The Samudrayaan mission represents a major milestone in India's journey towards becoming a leader in oceanographic research and exploration.

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**Q97. Answer: (b) Defense Research and Development Organisation**

The correct answer is Defense Research and Development Organisation (DRDO).

Key Points

• The Defense Research and Development Organisation (DRDO) is the premier agency responsible for the research and development of defense technologies in India.

• In May 2025, the Indian Navy collaborated with DRDO to conduct successful combat trials of the indigenously developed Multi-Influence Ground Mine (MIGM).

• The Multi-Influence Ground Mine (MIGM) is a state-of-the-art mine designed for maritime defense applications. It incorporates multiple sensors to detect and respond to various types of threats.

• The successful trials mark a significant milestone in India's efforts to achieve self-reliance in defense technology under the government's 'Make in India' initiative.

• This achievement reflects the robust partnership between the Indian Navy and DRDO in enhancing India's maritime security capabilities.

Additional Information

• Defense Research and Development Organisation (DRDO):

• Established in 1958, DRDO operates under the Ministry of Defense, Government of India.

• Headquartered in New Delhi, DRDO oversees over 50 laboratories dedicated to research in aeronautics, armaments, electronics, combat vehicles, engineering systems, and more.

• DRDO has been instrumental in developing technologies such as the BrahMos missile, Agni series of ballistic missiles, and Akash surface-to-air missile systems.

• Multi-Influence Ground Mine (MIGM):

• This indigenously developed mine integrates multiple sensors, such as magnetic, acoustic, and seismic sensors, to detect various threats in marine environments.

• MIGM is designed for deployment on the seabed to target enemy ships and submarines effectively.

• It enhances operational flexibility and supports India's maritime defense strategy by safeguarding critical sea routes and installations.

• Indian Navy's Role in Defense Innovation:

• The Indian Navy actively collaborates with DRDO and other defense organizations to develop advanced technologies for maritime security.

• Recent initiatives include the induction of platforms such as the INS Vikrant (India's indigenous aircraft carrier) and advanced frigates and submarines.

• Such collaborations aim to reduce dependence on foreign imports and boost indigenous defense production.

• 'Make in India' Initiative:

• Launched by the Government of India in 2014, the initiative aims to transform India into a global manufacturing hub.

• The defense sector is a key focus area, promoting the indigenization of military hardware and technology.

• Under this initiative, defense organizations like DRDO have been encouraged to innovate and produce cutting-edge systems.

Important Points

• DRDO's Achievements:

• DRDO has successfully developed strategic missile systems like Prithvi, Agni, and BrahMos.

• Advanced radar systems, combat vehicles, and electronic warfare systems are among its notable contributions.

• Indian Navy's Modernization:

• The Indian Navy has consistently focused on modernizing its fleet with indigenous platforms, including submarines, destroyers, and aircraft carriers.

• The induction of sophisticated technologies like MIGM strengthens its capability to protect India's maritime interests.

• Strategic Importance of Maritime Defense:

• India's geographical location makes maritime security crucial for protecting trade routes and ensuring regional stability.

• Developments like MIGM enhance India's ability to deter threats in its territorial waters and Exclusive Economic Zone (EEZ).

**Q98. Answer: (a) Safe and Secure Seas**

The correct answer is Safe and Secure Seas.

Key Points

• The 9^(th) International Maritime Security Conference (IMSC) was held in May 2025, organized by the Republic of Singapore.

• The theme of the conference was "Safe and Secure Seas", focusing on the importance of maritime security and collaboration in ensuring freedom of navigation and protection of maritime trade routes.

• This theme highlighted global concerns around piracy, maritime terrorism, and illegal activities in international waters, emphasizing the need for cooperation among nations.

• The IMSC brought together naval chiefs, policymakers, and maritime industry leaders to discuss evolving challenges and strategies for maintaining maritime peace and security.

• The conference served as a platform to reinforce commitments to international maritime laws and promote regional stability through collaborative measures.

Additional Information

• Importance of Maritime Security:

• Maritime security involves the prevention of unlawful acts such as piracy, smuggling, human trafficking, and terrorism in international waters.

• It also includes safeguarding sea lanes of communication (SLOCs), which are vital for global trade and energy transportation.

• Ensuring maritime security is critical for maintaining economic stability and supporting the growth of international trade.

• Role of the Republic of Singapore:

• Singapore, as a major maritime hub, plays a pivotal role in promoting regional and global maritime security.

• The country is strategically located along the Strait of Malacca, one of the world's busiest waterways, making its efforts in hosting the IMSC significant.

• Other Themes Discussed at Maritime Conferences:

• Maritime Connectivity and Economic Growth: Focuses on the role of maritime trade in fostering global economic development and the importance of connectivity between ports.

• Navigating New Horizons in Maritime Innovation: Explores advancements in maritime technology, including autonomous ships and green shipping initiatives.

• Emerging Challenges in Undersea Technologies: Addresses the growing complexities of undersea warfare, infrastructure security, and submarine technologies.

• International Maritime Laws:

• Maritime security efforts are supported by frameworks such as the United Nations Convention on the Law of the Sea (UNCLOS), which provides legal guidelines for maritime activities.

• UNCLOS emphasizes the principle of freedom of navigation and promotes cooperation among nations to ensure safe and secure seas.

Important Points

• Global Concerns:

• Piracy hotspots such as the Gulf of Guinea and Somalia remain key challenges for international maritime security.

• Illegal, unreported, and unregulated (IUU) fishing is another pressing issue affecting marine ecosystems and coastal economies.

• Technological Advancements:

• Countries are deploying maritime surveillance systems and using artificial intelligence to enhance security measures.

• Development of smart ports and digitization of maritime operations are transforming the industry.

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**Q99. Answer: (c) Behind the Mask: Who Heals the Healers?**

The correct answer is Behind the Mask: Who Heals the Healers?.

Key Points

• National Doctor’s Day in India is celebrated every year on July 1st to honor the contributions of doctors in society and to pay homage to Dr. Bidhan Chandra Roy, a renowned physician and the second Chief Minister of West Bengal, whose birth and death anniversary coincide on this date.

• The theme of National Doctor’s Day in 2025 was "Behind the Mask: Who Heals the Healers?". This theme aimed to highlight the mental health challenges, emotional stress, and well-being of doctors, especially during the post-pandemic era.

• This theme brought attention to the need for providing support systems for healthcare professionals, who often experience burnout, anxiety, and depression due to their demanding roles.

• The global pandemic emphasized the critical role of doctors as front-line warriors, but it also revealed the emotional toll they endure while saving lives. The 2025 theme emphasized creating awareness and empathy for their struggles.

• Several healthcare organizations, governments, and institutions organized campaigns, seminars, and workshops on this day to address the importance of the mental health of medical professionals, ensuring their physical and emotional well-being.

Additional Information

• Significance of National Doctor’s Day:

• Celebrated annually to recognize the services and contributions of doctors to society.

• It is a day to honor the role of medical professionals in improving health outcomes and saving lives.

• It also serves as a reminder of the importance of healthcare accessibility and medical advancements.

• Importance of the 2025 Theme:

• The theme "Behind the Mask: Who Heals the Healers?" shed light on the increasing cases of stress and mental health concerns among medical professionals.

• It highlighted the need for addressing issues like workplace stress, long working hours, and lack of emotional support in the healthcare industry.

• Organizations encouraged doctors to seek professional help and emphasized the importance of peer support and counseling programs.

• Other Recent Themes:

• 2023: "Celebrating Resilience and Healing Hands" – Focused on honoring the relentless efforts of doctors during challenging times.

• 2024: "Healing Hands, Caring Hearts" – Highlighted the compassionate role of doctors in patient care.

• 2025: "Behind the Mask: Who Heals the Healers?" – Emphasized the emotional and mental well-being of doctors.

• Dr. Bidhan Chandra Roy:

• Born on 1 July 1882, Dr. Roy was a celebrated physician, freedom fighter, and politician.

• He was instrumental in establishing medical institutions such as the Indian Medical Association and the Medical Council of India.

• He was posthumously awarded the Bharat Ratna, India’s highest civilian award, in 1961.

Important Points

• Mental Health of Doctors:

• Studies indicate that a significant percentage of doctors experience burnout due to the high-pressure nature of their profession.

• The World Health Organization (WHO) emphasizes the importance of providing mental health support and resources for healthcare workers.

• In India, initiatives like helplines and counseling services have been introduced to address these issues.

• Global Perspective:

• Countries worldwide are taking steps to ensure the well-being of healthcare professionals, including mandatory counseling sessions and reduced working hours.

• The COVID-19 pandemic further accelerated discussions around the mental health of doctors and the need for systemic changes.

**Q100. Answer: (b) Parul Chaudhary**

The correct answer is Parul Chaudhary.

Key Points

• Parul Chaudhary is an Indian middle and long-distance runner known for her achievements in various track events.

• In 2025, she set a new national record in the 3000 m steeplechase event, showcasing her exceptional talent and determination in athletics.

• The steeplechase is a highly challenging track and field event that includes hurdles and water jumps, requiring speed, endurance, and technical proficiency.

• Parul Chaudhary has consistently performed well in domestic and international competitions, earning recognition as one of India's top athletes in middle-distance running.

• Her achievements have inspired young athletes across India and have highlighted the country's growing presence in track and field sports.

Additional Information

• 3000 m Steeplechase:

• The 3000 m steeplechase is a distance running event that incorporates barriers and water jumps.

• It is considered one of the most demanding events in athletics due to the combination of running and jumping skills required.

• The event originated from horse racing steeplechases and was adapted for human competitors in the 19th century.

• Internationally, the event is governed by the World Athletics, which sets the rules and standards for competition.

• Parul Chaudhary's Background:

• Parul hails from Uttar Pradesh, India, and began her career as a runner specializing in middle and long-distance events.

• Her training and dedication have earned her a place among India's elite athletes, representing the country in various international tournaments.

• Parul has worked under the guidance of experienced coaches and has participated in numerous national and international meets.

• India's Presence in Athletics:

• India has been steadily improving in track and field events, with athletes like Parul Chaudhary achieving success in global competitions.

• Organizations like the Athletics Federation of India (AFI) are actively working to promote and support track and field sports in the country.

• Athletes are provided access to advanced facilities, coaching, and funding to help them compete internationally.

• Other Prominent Athletes:

• Jyothi Yarraji: An Indian hurdler specializing in the 100 m hurdles event; she has set national records in her domain.

• Hima Das: Known as the "Dhing Express," she is an Indian sprinter who gained fame for her performances in 400 m races, including winning a gold medal at the IAAF World U20 Championships.

• Annu Rani: A javelin thrower who holds the national record in the women's javelin event and has represented India in multiple global competitions.

Important Points

• Steeplechase Records:

• The world record for the women's 3000 m steeplechase event is held by Beatrice Chepkoech of Kenya, set in 2018 with a time of 8:44.32.

• India continues to make progress in steeplechase events, with athletes like Parul Chaudhary setting national benchmarks.

• Training for Steeplechase:

• Steeplechase athletes require a combination of endurance, speed, and agility training.

• Specialized coaching focuses on improving hurdle technique and water jump efficiency.

• Indian athletes have access to state-of-the-art facilities and international exposure to enhance their performance.

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