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SCI -100 | SS -100

99.00%

Kushagrah

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Devansh

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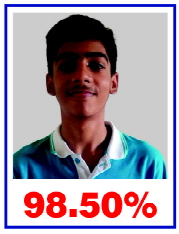

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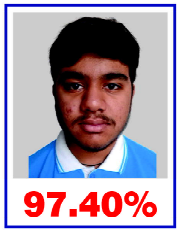

97.40%

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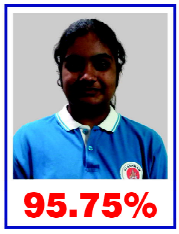

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Swara

95.60%

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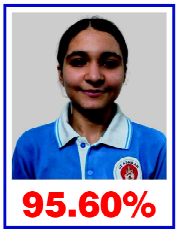

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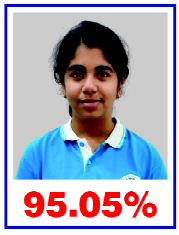

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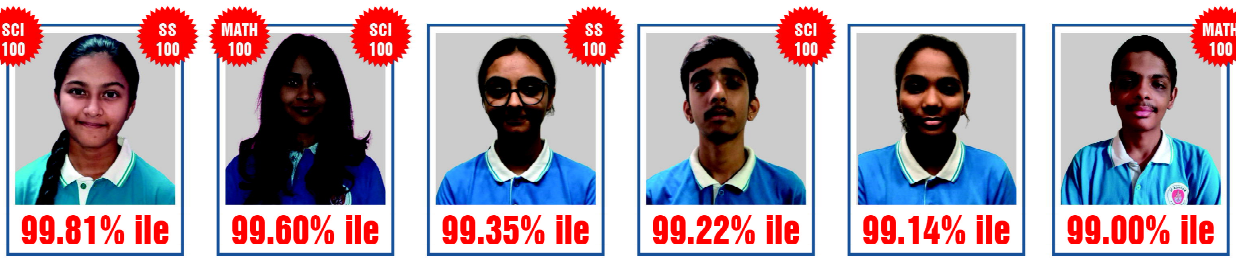

And Many More....

PART - I : MENTAL ABILITY

1.

Sol. (a) 27

125 small cubes → big cube painted. Side = $\sqrt[3]{125}$ = 5..

No face painted = inner cubes = $(5-2)^3 = 3^3 = 27$. → (a).

2.

Sol. (b) 54

Exactly one face painted = number of face-center (non edge/corner) small cubes = $6*(n-2)^2 = 63^2 = 69 = 54$. → (b).

3.

Sol. (c) 36

Exactly two faces painted = edge (but not corner) cubes = 12*(n-2) = 12*3 = 36. → (c).

4.

Sol. (a) NGFLFTPK

Code pattern check: 'REJECTION' → 'S G M I H Z P W W' shows successive letter shifts +1, +2, +3, ...

Apply same to MECHANIC:

M +1 → N

E +2 → G

C +3 → F

H +4 → L

A +5 → F

N +6 → T

I +7 → P

C +8 → K

Result = NGFLFTPK → (a).

5.

Sol. (b) Tuesday

Day of week 5 June 2001.

1 Jan 2001 = Monday. Days from 1 Jan to 5 Jun: 155 days. 155 = 1 (mod 7). Monday + 1 day = Tuesday. → (b).

6.

Sol. (c) North

Kabir's displacements: 15 km North, 10 km West, 5 km South, 10 km East.

Net N = 15-5 = 10 north; net E = -10 + 10 = 0 → North. → (c).

7.

Sol. (b) 17

Procedure (start 8):

Step 1 add 9 → 17

Step 2 subtract 2 → 15

Step 3 15 = 12 so proceed

Step 4 add 5 ? 20

Step 5 >16 so subtract 3 → 17. → (b).

8.

Sol. (a) Regiment

Odd one out: Regiment (a unit) vs Lieutenant/Colonel/Major (ranks). → (a).

9.

Sol. (c) 232

Here 2nd number = (1st number × 1) + 1

3rd number = (2nd number × 2) + 2

4th number = (3rd number × 3) + 3 and so on.

Therefore, 5 number = (4th number × 4) + 4 = 57 × 4 + 4 = 232

10.

Sol. (a) T

Seating problem (5 people around table) — placing R at 0 index, Q two seats to R's right, P two seats to R's left, S sits between Q and R (the adjacent seat). Working through positions gives the person to the immediate right of P = T. → (a).

11.

Sol. (d) 122112

Code: letters in odd alphabet positions → 1, even → 2.

INDIAN: I(9) → 1, N(14) → 2, D(4) → 2, I → 1, A(1) → 1, N → 2 → 122112. → (d).

Venn / pilgrims (Q12–15): use total 245, given counts and relationships.

Let x = number who visited none. Then exactly-two = 3x. Given exactly-one = 190 and exactly-three = 15.

190 + 3x + 15 + x = 245 ⇒ 205 + 4x = 245 ⇒ 4x = 40 ⇒ x = 10.

12.

Sol. (b) 10

None Visited = 10

13.

Sol. (d) 200

Not more than one shrine = exactly one + none = 190 + 10 = 200. ⇒ (d).

14.

Sol. (b) W

Except W, all other letters are at even places in the English alphabet.

15.

Sol. (d)

Minute-hand overlaps hour-hand per 24 hours = 11 times per 12 hours → 22 times per day.

→ (d).

PART - II : MATHEMATICS

1.

Sol. (d) $\frac{x^2}{a^2}-\frac{y^2}{b^2}=1$

Given $x = a\sec\theta$,; $y = b\tan\theta$. Use identity $\sec^2\theta - \tan^2\theta = 1$.

2.

Sol. (c) 24 cm

Tangent drawn from external point are of equal length.

PC = PB = 12 (Given)

RC = RA = x, QA = QB = y,

PR = PC - x = 12 - x

PQ = PB - y = 12 - y

So, Perimeter = PR + RA + AQ + PQ = (12 - x) + x + y + (12 - y) = 24cm

3.

Sol. (b)

Graph of quadratic intersects x-axis at two points iff discriminant D > 0 (b).

4.

Sol. (b) $x^2 + (b^2 - 2ac) / a^2 x + c^2/a^2=0$

If roots are α,β, new roots are α^2,β^2. Sum = $\alpha^2+\beta^2=(\alpha+\beta)^2-2\alpha\beta=\frac{b^2-2ac}{a^2}$.

Product = $\alpha^2+\beta^2=(\alpha\beta)^2=\frac{c^2}{a^2}$. So the quadratic is $x^2+\frac{b^2-2ac}{a^2}x+\frac{c^2}{a^2}=0$.

5.

Sol. (d) 8

Given $\alpha^2+\beta^2=2D$ $\Rightarrow \alpha+\beta=\frac{-b}{a}=6$ $\Rightarrow \alpha\beta=\frac{c}{a}=k$

Now $(\alpha+\beta)^2=\alpha^2+\beta^2+2\alpha\beta$ $\Rightarrow 36 = 20 + 2k$ $\Rightarrow 16 = 2k$ $\Rightarrow K = 8$

6.

Sol. (b)

Let age of father and son be F and S.““According to given condition:

F = 3S + 5 —— (i)

After 5 years

F + 5 = 2(S + 5)

F + 5 = 2S + 10

F = 2S + 5 —— (ii)

From (i) and (ii):

3S + 5 = 2S + 5

$\Rightarrow$ S = 0 Not possible

7.

Sol. (b)

In ΔPQR: AB||QR. Given PA = 2x + 3 AQ = 6x - 16 and PB : BR = 3:4.

Because AB||QR, A divides PQ in same ratio as B divides PR.

From PA: AQ = PB:BR = 3:4 $\Rightarrow$ PA:AQ = 3:4.

So (2x + 3):(6x - 16) =3:4 $\Rightarrow$ cross-multiply: 4(2x+3)=3(6x-16)

$\Rightarrow$ 8x + 12 = 18x - 48 $\Rightarrow$ 60 = 10x $\Rightarrow$ x = 6 .

8.

Sol. (a)

Radius = 7/2 = 3.5cm

Height of the cone = h = 14.5 - 3.5 = 11 cm

Total volume of the toy = Volume of Hemisphere + Volume of cone

$\Rightarrow$ Volume = $\frac{1}{3}\pi r^2(2r+h) = \frac{1\times 22\times 3.5\times 3.5}{3\times 7}(7+11)$

Volume = $22\times 1.75\times 6 = 231\ cm^3$

9.

Sol. (a)

Let numbers be x and y. x = 2y + 3 and x+y=27 $\Rightarrow$ (2y + 3) + y = 27 $\Rightarrow$ 3y + 3 =27 $\Rightarrow$ 3y = 24 $\Rightarrow$ y = 8, x = 19. So numbers (19,8) (ordered as)

10.

Sol. (c) (3,1)

Add the two equations:

(101x + 99y) + (99x + 101y) = 402 + 398

200x + 200y = 800

Dividing by (200) gives:

x + y = 4

Subtracting equation (2)) from equation (1) (101x + 99y) - (99x + 101y) = 402 - 398

2x - 2y = 4

x - y = 2

Solving above equation we get x = 3, y = 1

11.

Sol. (a)

Find a common denominator:

Let speed = x kmph

New 8pad= (x + 10) K mph

$T_1 - T_2 = 36\ min \Rightarrow \frac{120}{x} - \frac{120}{x+10} = \frac{36}{60}hr \Rightarrow 120\left[\frac{x+10-x}{x(x+10)}\right] = \frac{6}{10} \Rightarrow \frac{200}{x(x+10)} = \frac{1}{10}$

$x^2 + 10x - 2000 = 0$

(x + 50) (x - 40) = 0

x = - 50 Not possible

Or x = 40 Ans (a)

12.

Sol. (a) $1/2$ area(ΔABC)

Triangle with AD median: median divides triangle into two triangles of equal area $\Rightarrow$ area(ABD) = 1/2 area (ABC). $\Rightarrow$ (a).

13.

Sol. (a) 343

Sphere radius 7 melted into small spheres radius 1. Volume ratio = (7^3) / (1^3) = 343. So 343 small spheres. $\Rightarrow$ (a).

14.

Sol. (a) 1/4

If similarity ratio AB/DE = 1/2, linear ratio = 1/2 area ratio = $(1/2)^2$ = 1/4 . $\Rightarrow$ (a).

15.

Sol. (b) $20\sqrt{3}$

Height building 20m; shadow at elevation 30°: tan30° = height/shadow

$\Rightarrow$ shadow = height / tan30° = 20/ $(1\sqrt{3})$ = $20\sqrt{3}$. (b) $\left(20\sqrt{3}\right)$

16.

Sol. (b) $x^2 - 6x + 7 = 0$

If one root is $3+\sqrt{2}$ the other conjugate $3+\sqrt{2}$ Quadratic: $(x-(3-\sqrt{2}))\,(x-(3-\sqrt{2}))$ = $x^2 - 6x + 7$ (b).

17.

Sol. (c) 40

18.

Sol. (b) $\frac{2}{\sqrt{3}}+1.5$

Compute $2\tan 30^0 + 3\cos 60^0$.

tan 30° = $1/\sqrt{3}$. So 2*(1/3) = $2/\sqrt{3}$.

$\cos 60_0$ = 1/2, So 3*(1/2) = 1.5

Sum = 1.5 + 2 $/\sqrt{3}$. Which matches option (b)

19.

Sol. (c) 1

20.

Sol. (b) 2/13

Draw a card from 52. Probability of king or queen = number of kings + queens = 4+4 = 8 out of 52 = 8/52 = 2/13 $\Rightarrow$ (b).

21.

Sol. (b) 2

Remainder of $2^{103} \div 7$. Use modulus cycle: $2^3 \equiv 8 \equiv 1$, (mod 7). So powers of 2 mod 7 repeat every 3. 103 = 103 mod3 = 103-3*34 = 103-102 =1 $\Rightarrow$ $21 \equiv 2$ (mod7). So remainder 2. $\Rightarrow$ (b).

22.

Sol. (a) 243

Smallest N such that N mod 12 = 3 N mod16 =3, N mod20 3. So N-3 divisible by Icm (12,16,20). LCM (12,16,20) = Icm(34,16,45) = Icm(3,16,5,4) = 240. So N = 3 + 240k, smallest positive = 243. 243. $\Rightarrow$ (a).

23.

Sol. (a) 1728

Given $S_n = 3n^2 + S_n$

$a_n = S_n - S_n\text{-}1$

$a_{20} = S_{20} - S_{19}$

$S20 = 3(20)^2 + S(20) = 1300$

$S_{19} = 3(19)^2 + 5(19) = 1178$

$\therefore$ $G_{20} = 1300 - 117.8 = 122$

24.

Sol. (a) $-2\sqrt{3}$

Given line

$2x + 3y - 5 = 0$

$x - y + 1 = 0$

Solving above equation we get

$$x = \frac{2}{5} \qquad y = \frac{7}{5}$$

Distance of $\left(\frac{2}{5}, \frac{7}{5}\right)$ from origin

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2} \qquad \Rightarrow \qquad d = \sqrt{\left(\frac{2}{5} - 0\right)^2 + \left(\frac{7}{5} - 0\right)^2} = \sqrt{\frac{53}{25}} = \frac{\sqrt{53}}{5} \text{ Units}$$

25.

Sol. (a) 1

Condition of parallel lines $\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$

$$\therefore \frac{2}{k} = \frac{3}{-1} \neq \frac{7}{2}$$

On equating $\frac{2}{k} = \frac{3}{-1}$ $\Rightarrow$ $k = \frac{-2}{3}$ Ans (a)

26.

Sol. (b)

Compute GCD of p and q where prime-power representations are given:

$p = 2^3\ 3^2\ 7^2\ 11^6$ and $q = 2^2\ 3^1\ 5^4\ 11^2\ 13^2$

GCD uses minimum exponents of common primes: common primes are 2,3,11. Min exponents:

$2 \rightarrow \min(3, 2) = 2$; $3 \rightarrow \min(2, 1) = 1$; $11 \rightarrow \min(6,2) = 2$.

So GCD = $2^2*3^1*11^2 = 4*3*121 = 12 * 121 = 1452$.

27.

Sol. (a) 10

Triangle formed by line 5x + 4y - 20 = 0 with axes has intercepts: x-intercept when $y = 0 \rightarrow x = 4$ y-intercept when $x = 0 \rightarrow y = 5$. Area = (1/2) * 45 = 10

28.

Sol. (a) (–9, 5)

Vertices of parallelogram in order (-7,8), (-3,9), (-5,6), and unknown D.

For parallelogram, vector sum of opposite vertices: if A,B,C,D in order, then D = A + C - B

Let A = (- 7, 8) B = (- 3, 9) C=(-5,6)

Rightarrow D = A + C - B =(-7-5-(-3), 8+6-9)= ((- 12) + 3, 14 - 9) =(-9,5). (a).

29.

Sol. (b) 194400

Let numbers be m and n. Given LCM + HCF = 1260 and LCM = HCF + 900. Let g =HCF, L=LCM= g + 900 Then g + (g + 900) =1260

$\Rightarrow$ 2g + 900= 1260 $\Rightarrow$ 2g = 360 $\Rightarrow$ g = 180

$\Rightarrow$ L = 1080.

For two numbers, product = g* L =180 * 1080 = 194400 $\Rightarrow$ (b).

30.

Sol. (c)

$QP^2 = QB \times QA$

$12^2 = x(x + 10)$

$144 = x(x + 10)$

$x^2 + 10x - 144 = 0$

x = 8 Arya

PART - III : PHYSICS & CHEMISTRY

1.

Sol. (d)

Uniform acceleration from rest: $a = 0.01\ m\ s^{-2}$, $t = 10\ s$.

Final speed $v = a\ t = 0.01 \times 10 = 0.1\ m\ s^{-1}$.

For motion from rest with constant a, average speed $= v/2 = 0.1/2 = 0.05\ m\ s^{-1}$

2.

Sol. (a)

Number of electrons per second $\frac{n}{t} = 10^{19}$; charge $e = 1.6\times10^{-19}$ C.

Current $I = \frac{ne}{t} = 10^{19} \times 1.6\times10^{-19} = 1.6$ A. $\Rightarrow$ $V = I\ R = 1.6 \times 20 = 32$ V.

3.

Sol. (d)

Glancing angle with surface for the reflected ray = 30°

$\Rightarrow$ angle with normal r = 90° - 30° = 60°.

i = r = 60°.

Deviation in reflection δ = 180° - 2i = 180° - 120° = 60°.

4.

Sol. (c)

Power of corrective lens +2 D (converging lens) is used for hypermetropia (long-sightedness).

5.

Sol. (a)

For a convex lens, Focal length depends on wavelength of light, Refractive index n is least for red light

$\Rightarrow$ f is maximum for red.

6.

Sol. (b)

Amplitude has unit of length, frequency has unit Hz, time period has unit s.

Pitch is a perceptual quality

$\Rightarrow$ no SI unit.

7.

Sol. (a)

As same current is flowing in all 4 circuits, the power dissipated will be proportional to net resistance of the circuit. So net resistance in each circuit will be

3R, 2R/3 , R/3 and 3R/2 respectively.

So Power dissipation in decreasing order will be in I > IV > II > III

8.

Sol. (c)

n(glass w.r.t. air) = 3/2 $\Rightarrow$ n(air w.r.t. glass) = 1 / (3/2) = 2/3.

9.

Sol. (b)

Stars twinkle due to atmospheric refraction by layers of varying refractive index.

10.

Sol. (d)

Wire melted and recast to length L′ = (2/5) L;

volume constant $\Rightarrow$ A′ = A × (L/L′) = A × (5/2).

$\because$ R = ρ L / A, so R′ = ρL′ / A′

R′ = (ρL / A) × ((2/5) / (5/2)) = R × (4/25). $\Rightarrow$ $\frac{\rho\left(\frac{2}{5}l\right)}{\frac{5}{2}.A} = \frac{4}{25}\frac{\rho l}{A} = \frac{4}{25}R$

11.

Sol. (a)

Isotopes having same protons and electrons number but different in neutrons number.

12.

Sol. (c) Na_2CO_3

This method is used for manufacture of Na_2CO_3.

13.

Sol. (a)

$H_2 + \frac{1}{2}O_2 \rightarrow H_2O$ $\Rightarrow$ 2g + 16g $\rightarrow$ 18g

Given – 4g 16g 18g

Reactive amount of H_2 is 2gm so overall 18gm water is formed.

14.

Sol. (b)

A + B $\rightarrow$ C + D (g)

$D + NH_3 + NaOH + H_2O \rightarrow NaHCO_3 + NH_4Cl$

$2HCl + Na_2CO_3 \rightarrow 2NaCl + CO_2 + H_2O$ (g)

A B C D

A $\rightarrow$ HCl

B $\rightarrow$ Na_2CO_3

C $\rightarrow$ NaCl

15.

Sol: (b)

$n = \frac{4}{2} = 2mol$

No. of molecules = $2\times6.022\times10^{23}=1.204\times10^{24}$

16.

Sol. (c)

Tin (Sn) is a chemical element. Fog and soil are mixtures; methane is a compound.

17.

Sol. (a)

$$\text{Mass of one atom} \frac{\text{gram atomic mass of oxygen atom}}{6.022\times10^{23}}$$

18.

Sol. (b)

$pH = -\log[H^+] = -\log(2\times10^{-4}) \approx 3.69$

$pOH=14-pH=14-3.69=10.31 \approx 10.30$

19.

Sol. (d)

Copper is less reactive than hydrogen, so it does not displace hydrogen from dilute acids.

20.

Sol. (d)

$2Pb(NO_3)_2 \rightarrow 2PbO + 4NO_2 + O_2$

So, coefficient of NO_2 = 4

PART - IV : BIOLOGY

1.

Sol. (a) 1-C, 2-D, 3-A, 4-B

Sclerenchyma has lignified walls for strength (C). Phloem transports food (D). Parenchyma is a fundamental tissue for storage (A). Aerenchyma is a modified parenchyma with air spaces for buoyancy (B).

2.

Sol. (b)

Ribosomes are the sites of protein synthesis (B). Lysosomes contain digestive enzymes (A). Mitochondria generate ATP through respiration (D). The Golgi apparatus modifies and packages proteins and lipids (C).

3.

Sol. (b)

Villi increase the surface area of the small intestine, which is critical for efficient absorption of nutrients (B). The circular folds and villi also slow down the movement of digested food, providing more time for absorption to occur (D). Villi do not directly increase digestion rate or peristaltic movement.

4.

Sol. (a) A and C

A reflex arc is an involuntary, rapid response to a stimulus. Pulling your hand away from a hot object and the knee-jerk reflex are classic examples of this. The other two options are voluntary, conscious actions.

5.

Sol. (a)

The assertion is correct. The reason correctly explains why; a male produces two types of gametes (X and Y), whereas a female produces only one (X). The type of gamete contributed by the father determines the sex of the offspring.

6.

Sol. (a)

The rigid cell wall provides mechanical support by exerting wall pressure that balances turgor pressure, hence preventing plant cell bursting in hypotonic conditions.

7.

Sol. (b)

A neuron transmits information via electrical impulses that travel from the dendrite (the receiving part) through the cell body and down the axon to the axon terminal.

8.

Sol. (b)

Deoxygenated blood from the body enters the heart through the vena cava and goes into the right atrium. From there, it is pumped to the right ventricle, which then pumps it into the pulmonary artery to be carried to the lungs for oxygenation.

9.

Sol. (a)

Statements I, II, and III are all correct. Statement IV is incorrect; reflex actions are involuntary, not conscious, responses.

10.

Sol. (a)

Statements I and III are correct. The human male produces two types of gametes (X and Y), making him heterogametic (I). The placenta is a composite organ of maternal and fetal tissue (III). Statement II is incorrect; fertilization occurs in the fallopian tubes. Statement IV is incorrect; the menstrual cycle is regulated by a complex interplay of multiple hormones.