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UDAAN

A QUEST FOR SCIENCE ASPIRANTS

SCIENCE APTITUDE TEST

CLASS - 10

SOLUTIONS

EXAM DATE : 21.12.25

IIT Ashram

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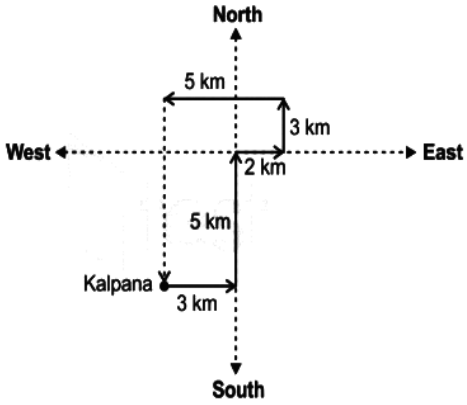
PART - I : MENTAL ABILITY

1.

Sol. (a) North



2.

Sol. (b) 39

Rank from both ends

Girl is 20th from left end → 19 girls before her.

Girl is 20th from right end → 19 girls after her.

Total girls = 19 + 1 + 19 = 39.

3.

Sol. (b) Tuesday

0 odd days till 2000 year (multiple of 400)

Jan 3 odd days

Feb 0 odd days

March 3 odd days

April 2 odd days

May 3 odd day

June 5th hence 5 odd days

Total odd days = 16 odd days (divide by 7)or 2 odd days Hence Tuesday

4.

Sol. (a) 180

Symbols replacement

÷ means –

– means ×

× means +

means ÷

Expression:

132 + 6 - 9 × 13 ÷ 31

So: 132 ÷ 6 × 9 + 13 – 31

BODMAS:

132 ÷ 6 = 22

22 × 9 = 198

198 + 13 = 211

211 – 31 = 180

Answer: (a) 180

5.

Sol. (d) 13, 20, 29

This is combination of 3 series 5, 7, 9,11,.....

12, 14, 16, 18.....13, 17, 19,23.....hence 13,20,29 are next 3 numbers in the series

6.

Sol. (c) MUIDATS

Code language

PANCREAS → SAERCNAP (reverse the word).

STADIUM → reverse: M U I D A T S? Wait, STADIUM reversed: M U I D A T S (M U I D A T S) but letters: S T A D I U M ? reverse: M U I D A T S.

7.

Sol. (d) 150

Red paint is on 2 adjacent faces.

Number of cubes not touching either red face:

Along each red-painted face, 1 layer is affected

So unaffected layers = 6-1 = 5 in each direction

Count = 5 × 5×6=150 Answer: (d) 150

8.

Sol. (c) 33

Small cubes with at least TWO different colours

These are cubes lying on edges where two painted faces meet and 6 corners

Two face painted 9 x 3 = 27

Three face painted = 6

Answer: (c) 33

9.

Sol. (b) Father

"He is the only brother of my father's mother's daughter."

Father's mother = grandmother

Her daughter = father's sister (aunt)

Only brother of that aunt = father

10.

Sol. (b) 3

Legend:

- ○ Tennis players
- □ Swimmers
- △ Tall persons
- ▭ Runners

We need:

Tall persons → Swimmers → Tennis players but NOT Runners

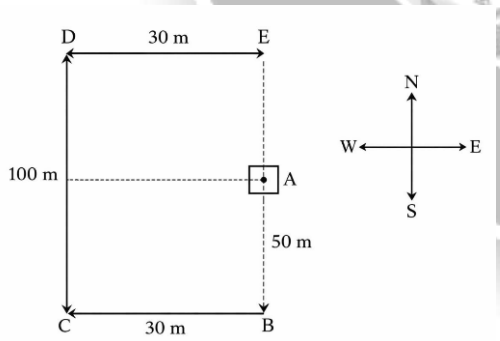
From diagram:

The region common to triangle + square + circle, outside rectangle

That region is numbered 3

11.

Sol. (d) 50 metres, North



12.

Sol. (c) 3

Figure A has 3 sided polygon

Figure B has 4 sided polygon (one side increases) and one vertex is common

Similarly C has 5 sides hence

Answer should have 6 sides and one vertex common

13.

Sol. (a) T

Fix R anywhere (since circular).

→ P is 2 seats left of R

→ Q is 2 seats right of R

→ S sits between Q and R

Arrangement (clockwise):

R – S – Q – T – P

Now check:

Immediate right of P is T

14.

Sol. (d) 22

Angle of 180° between hands of a clock

In 12 hours, the minute and hour hands form 180° 11 times

In 24 hours (1 day):

$11 \times 2 = 22$

15.

Sol. (c) 204

Number of squares on an 8 × 8 chessboard

Formula:

$1^2 + 2^2 + 3^2 + \ldots + 8^2 = 204$

Answer: (c) 204

PART - II : MATHEMATICS

1.

Sol. (b) 16

Calculation:

Let the value of sqrt

$\sqrt{(240+\sqrt{(240+\sqrt{(240)}+.....)))}}$ be x

$\Rightarrow \quad x = \sqrt{(240 + x)}$

By squaring both sides we get.

$\Rightarrow \quad x^2 = [\sqrt{(240 + x)}]^2$

$\Rightarrow \quad x^2 = 240 + x$

$\Rightarrow \quad x^2 - x - 240 = 0$

$\Rightarrow \quad x^2 + 15x - 16x - 240 = 0$

$\Rightarrow \quad x(x + 15) - 16(x + 15) = 0$

$\Rightarrow \quad (x - 16)(x + 15) = 0$

So, $x = -15, 16$

But, $x = -15$ is not possible as the whole expression is in square root.

$\sqrt{(240+\sqrt{(240+\sqrt{(240)}+.....)))}}$ is 16

2.

Sol. (c) $x^2 - x + 1$

Given:

$x^4 + x^2 + 1$

Concept used:

$a^2 - b^2 = (a + b)(a - b)$

Calculations:

Factorizing the given expression,

$\Rightarrow \quad (x^2)^2 + 2(x^2) \times 1 + 1^2 - x^2$

$\Rightarrow \quad (x^2 + 1)^2 - x^2$

$\Rightarrow \quad (x^2 + 1 - x)(x^2 + 1 + x)$

One factor of $x^4 + x^2 + 1$ Is $x^2 - x + 1$

3.

Sol. (b) 30 cm

Tangents drawn from an external point to a circle are equal in length.

From external point P, PB = PC

From external point Q, QA = QB

From external point R, RA = RC

The perimeter of ΔPQR is the sum of its sides:

Substitute QR = QA + RA:

Perimeter = PQ + (QA + RA) + RP

Rearrange the terms:

Perimeter = (PQ + QA) + (RP+RA)

Observe that PQ + QA = PB and RP+ RA = PC from the diagram.

Perimeter = PB + PC

Since PB = PC and PB = 15 cm:

Perimeter = 15 cm + 15 cm

Perimeter = 30 cm

4.

Sol. (b) $cx^2 + bx + a = 0$

The new roots are $\frac{1}{\alpha}$ and $\frac{1}{\beta}$.

Sum of new roots: $\frac{1}{\alpha}+\frac{1}{\beta}=\frac{\beta+\alpha}{\alpha\beta}=\frac{-b/a}{c/a}=-\frac{b}{c}$

Product of new roots: $\frac{1}{\alpha}\times\frac{1}{\beta}=\frac{1}{\alpha\beta}=\frac{1}{c/a}=\frac{a}{c}$

$$x^2-\left(-\frac{b}{c}\right)x+\frac{a}{c}=0$$

$$x^2+\frac{b}{c}x+\frac{a}{c}=0$$

5.

Sol. (d) 6

Given that $AB \,||\, QR$ in triangle ΔPQR, by Thales' theorem, the sides are divided proportionally:

$$\frac{PA}{AQ} = \frac{PB}{BR}$$

Step 2: Substitute the given values into the equation

PA = 2x + 3 AQ = 6x - 16 and $\frac{PB}{BR}=\frac{3}{4}$.

$$\frac{2x + 3}{6x - 16}=\frac{3}{4}$$

Step 3: Solve the equation for x

Cross-multiply to solve for x:

$4(2x + 3) = 3(6x - 16)$

$8x + 12 = 18x - 48$

$12 + 48 = 18x - 8x$

$60 = 10x$

$x = 6$

6.

Sol. (a) 231 cm³

The toy is a cone surmounted on a hemisphere.

Hemisphere diameter: 7 cm, so radius

$r=\frac{7}{2}cm = 3.5cm$.

Cone height: h = 11 cm. The cone shares the same radius as the hemisphere, r = 3.5cm .

Volume of a hemisphere: $V_{hemisphere}=\frac{2}{3}\pi r^3$

Volume of a cone: $V_{cone}=\frac{1}{3}\pi r^2 h$

Total volume of the toy: V total =V hemisphere +V cone

$V_{total}=\frac{1}{3}\times\frac{22}{7}\times(3.5)^2\times(2\times3.5+11)$.

7.

Sol. (a) 40 km/h

$$\frac{120}{S}-\frac{120}{S+10}=\frac{3}{5}$$

$$120\left(\frac{1}{S}-\frac{1}{S+10}\right)=\frac{3}{5}$$

$$120\left(\frac{(S+10)-S}{S(S+10)}\right)=\frac{3}{5}$$

$$120\left(\frac{10}{S^2+10S}\right)=\frac{3}{5}$$

$$\frac{1200}{S^2+10S}=\frac{3}{5}$$

$3(S^2+10S) = 1200\times 5$

$3S^2 + 30S = 6000$

$S^2 + 10S = 2000$

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

(S + 50)(S - 40) = 0 Possible solutions are S = - 50 or S = 40 Since speed cannot be negative, S = 40km / h

Answer: (a) 40 km/h

8.

Sol. (c) 40

The fundamental trigonometric identity is

$\sec^2\theta - \tan^2\theta = 1$.

The given equation is $\sec^2(2x - 10) - \tan^2 (x + 30) = 1$. For the equation to hold true, the angles must be equal:

2x - 10 = x + 30

2x - x = 30 + 10

x = 40

9.

Sol. (c) 1

Given: $\sin\theta + \cos\theta = 1$

$(\sin\theta + \cos\theta)^2 = 1$

$\sin^2\theta + \cos^2\theta + 2\sin\theta\cos\theta = 1$

$1 + 2\sin\theta\cos\theta = 1 \Rightarrow \sin\theta\cos\theta = 0$

$\sin^3\theta + \cos^3\theta =$

$(\sin\theta + \cos\theta)^3 - 3\sin\theta\cos\theta(\sin\theta + \cos\theta) = 1$

10.

Sol. (b) 3/13

Face cards = 12, Total cards = 52

Probability 12/52 - 3/13 Ans: 3/13

11.

Sol. (d) 122

$S_n = 3n^2 + 5n$

$a_n = S_n - S_n - 1$

$a_{20} = [3(20)^2 + 5(20)] - [3(19)^2 + 5(19)]$

= 1300 - 1178 = 122 Ans: 122

12.

Sol. (a) –2/3

Line 1: $2x + 3y = 7 \Rightarrow m_1 = -2/3$

Line 2: $kx - y = 2 \Rightarrow y = kx - 2$

$\Rightarrow$ $m_2 = k$

Parallel $\Rightarrow k = -2/3$ Ans: -2/3

13.

Sol. (a) 776

Common factors: $2^1, 3^1, 7^2, 11^2$

GCD = $2 \times 3 \times 49 \times 121 = 776$ Ans: 776

14.

Sol. (a) 90

Line: $5x + 4y - 60 = 0$

x-intercept = 12, y-intercept = 15

Area = $\frac{1}{2} \times 12 \times 15 = 90$ Ans: 90 sq units

15.

Sol. (c) (–8, 5)

Fourth vertex D = A + C - B

(- 7, 8) + (- 4, 6) - (- 3, 9) = (- 8, 5)

Ans: (-8, 5)

16.

Sol.(a) 8 cm

Radius r = AB / 2 = 5

$OP \perp PQ$

In right ΔOPQ

$OQ = \sqrt{12^2+5^2} = 13$

QB = OQ - OB = 13 - 5 = 8 Ans: 8 cm

17.

Sol. (c) 4

Polynomial: $16x^2 - 20x + k$

One zero = -4

$16(-4)^2 - 20(-4) + k = 0$ $256 + 80 + k = 0$

$\Rightarrow$ k=4 Ans: 4

18.

Sol. (a) 26

Two-digit number = 10x + y

Product of digits = 12 -> xy = 12

Digits interchange when 36 added:

$10x + y + 36 = 10y + x$ $9x - 9y = -36$

Rightarrow x - y = - 4

Possible digit pairs with product 12:

(2,6), (3,4)

Only (2,6) satisfies x - y = - 4

19.

Sol. (a) $\frac{1}{2}\left(x + \frac{1}{x}\right)$

Given:

$\sec\theta + \tan\theta = x$

Identity: $\sec\theta + \tan\theta = \frac{1}{x}$

Add both: $2\sec\theta = x + \frac{1}{x}$

$\sec\theta = \frac{1}{2}\left(x + \frac{1}{x}\right)$ Answer: (a)

20.

Sol. (c) 72^o

$\frac{\theta}{360} \times \pi r^2 = 5\pi \Rightarrow \frac{\theta}{360} \times \pi \times 25 = 5\pi$

$\theta = 72^0$ Answer: 72°

21.

Sol. (d) 13

Empirical relation:

Mode = 3(Median)-2(Mean)

= 3(11)-2(10) = 33 - 20 = 13 Answer: 13

22.

Sol. (c) 14

$p = \frac{\text{Bad eggs}}{400}$

$0.035 = \frac{x}{400} \Rightarrow x = 14$ Answer: 14

23.

Sol. (a) 30°

BD = internal bisector of $\angle B$

CD = external bisector of $\angle C$

$\angle BAC = 60°$

Property:

$\angle BAC = 90° - \frac{1}{2}\angle A$

= 90° - 30° = 30 Answer: 30°

24.

Sol. (b) (3,2)

Given:

$101x + 99y = 501$

$99x + 101y = 499$

Add:

$200x + 200y = 1000 \Rightarrow x + y = 5$

Subtract:

$2x - 2y = 2 \Rightarrow x - y = 1$

Solve:

$x = 3, y = 2$ Answer: (3,2)

25.

Sol. (d) $49.5m^2$

Given:

Square side = 21m

4 cows at 4 corners

Adjacent cows just reach $\rightarrow$ rope length = half side = 10.5m.

Pond area = 45m ^ 2

Area grazed by cows:

Each cow grazes $\frac{1}{4}$ circle of radius 10.5 m

Total grazed area area of 1 full circle

$= \pi r^2 = \frac{22}{7} \times 10.5^2 = 346.5m^2$

Area of square: $21^2 = 441m^2$

Ungrazed area (excluding pond):

$441 - 346.5 - 45 = 49.5m^2$

Answer: $49.5\ m^2$

26.

Sol. (c) 5

$3y - 1, 3y + 5, 5y + 1$

$(3y + 5) - (3y - 1) = (5y + 1) - (3y + 5)$

$6 = 2y - 4 \Rightarrow 2y = 10 \Rightarrow y = 5$

Answer: 5

27.

Sol. (d) 12

Vertices:

A(0,4), B(0,0), C(3,0)

Using distance formula:

AB4, BC = 3, AC = 5

Perimeter: 4 + 3 + 5 = 12

Answer: 12

28.

Sol. (c) 15^0

$\tan 3x = \sin 45^0 \cos 45^0 + \sin 30^0$

$= \frac{1}{2} + \frac{1}{2} = 1$

$\tan 3x = 1 \Rightarrow 3x = 45° \Rightarrow x = 15°$

29.

Sol. (d) -24

Quadratic: $x^2 + 5x + a = 0$

Roots: α, β

$\alpha + \beta = -5, \quad \alpha\beta = a$

Given.

$2\alpha + 5\beta = -1$

Solve system:

$\alpha = -5 - \beta$

Substitute:

$2(-5 - \beta) + 5\beta = -1$

$\Rightarrow -10 - 2\beta + 5\beta = -1$

$\Rightarrow 3\beta = 9 \Rightarrow \beta = 3$

$a = -8$

$a = \alpha\beta = -24$ Answer: -24

30.

Sol. (b) 9:8

Given ratios:

Radii = 3:4

Heights = 2:3

Volume:

Cylinder = $\pi r^2 h$

Cone = $\frac{1}{2}\pi r^2 h$

Ratio:

$\frac{V_c}{V_{come}} = \frac{\pi(3)^2(2)}{\frac{1}{3}\pi(4)^2(3)} = \frac{18}{16} = \frac{9}{8}$

Answer: 9:8

PART - III : PHYSICS & CHEMISTRY

1.

Sol. (a)

Reason: Anticlockwise current (top view)

$\Rightarrow$ field outwards

$\Rightarrow$ upper face is North. According to Clock face rule.

2.

Sol. (a)

Given: I=2 A, V=12 V, t=20 min=1200 s

E = VIt = 12 x 2 x 1200 = 28800 J

= 22.8 kJ

3.

Sol. (c)

Reading of voltmeter 4 V so voltage drop across other resistance is 6 V and applying ohm's law, the current in circuit will be 3 mA Using P = VI = 12 mW

4.

Sol. (a) away from the lens

As object approaches focus, image distance increases.

5.

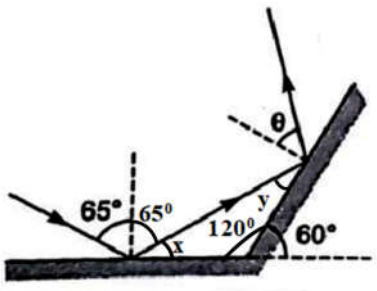
Sol. (d)

Using m = v/u and lens formula

1/f = 1/v – 1/u , answer will be D

6.

Sol. (c)



7.

Sol. (a) circular

Reason: Using Right-hand thumb rule

8.

Sol. (b)

Reason: Atmospheric refraction due to varying refractive index layers.

9.

Sol. (d) As value of g is maximum at the surface of earth.

10.

Sol. (a) Given: Resultant $R = 3\Omega$ with 12Ω

Parallel case: $\frac{1}{3} = \frac{1}{12} + \frac{1}{R} \Rightarrow R - 4\Omega$

11.

Sol. (b) Decomposition reaction

Black and white photography uses decomposition of silver halides.

12

Sol. (a) I_2

In $H_2S + I_2 \rightarrow 2HI + S$, I_2 is reduced (0 to -1), so it is the oxidizing agent.

13.

Sol. (a)

$CaCO_2 \rightarrow CaO + CO_2$ requires heat $\rightarrow$ endothermic.

14.

Sol. (c) 3 mole of HCl

$Al(OH)_3 + 3HCl \rightarrow AlCl_3 + 3H_2O \rightarrow 3$ moles HCl per mole $Al(OH)_3$.

15.

Sol. (c) NaCl

NaCl from strong acid + strong base ? neutral salt.

16.

Sol. (a) Slaked lime

Acidic soil neutralized by base: slaked lime ($Ca(OH)_2$).

17.

Sol. (d) Hydrochloric acid

Turns red litmus blue $\rightarrow$ basic. Reverse by adding acid $\rightarrow$ HCl.

18.

Sol. (d) only 1

(1) 32 g O: molar mass 16 g/mol $\rightarrow$ 2 mol

(2) 32 g O2 same 1 mol (typo in question - likely meant 32 g O3?) If it's O_3 $\rightarrow$ 32/48 $\approx$ 0.667 mol

(3) 2 g H_2: molar mass 2 g/mol $\rightarrow$ 1 mol

(4) 2 g He: molar mass 4 g/mol $\rightarrow$ 0.5 mol

Max moles: (1) and (3) both 1 mol. Possibly the list meant: 32 g O_2 (1 mol), 32 g O_2 repeated (typo), 2 g H_2 (1 mol), 2 g He (0.5 mol)

So max moles = 1 mol, shared by 1 and 3.

19.

Sol. (a) 12.6 lit

14 g N2 at 27°C, 1 atm.

Molar mass N2 = 28 g/mol moles n = 14/28 = 0.5 mol.

T = 27 + 273 = 300K R = 0.0821 L-atm-$mol^{-1}.K^{-1}$, P = 1 atm.

V=nRT/P = 0.5 × 0.0821 × 300/1 = 12.315 L $\approx$ 12.6 L.

20.

Sol. (a) 7 protons and 7 neutrons

Nitride ion is N^{3-}, from nitrogen atom (Z = 7) with 3 extra electrons. Protons = atomic number = 7. Neutrons: most common nitrogen isotope is ^{14}N (mass 14), neutrons = 14-7 = 7. If referring to 14 N3-: 7 protons, 7 neutrons.

PART - IV : BIOLOGY

1.

Sol. (b) Protein synthesis required for enzyme formation

Ribosomes are the only cellular structures directly responsible for *protein synthesis*. Without them, the cell cannot form enzymes or structural proteins. Other processes like lipid synthesis (SER), DNA replication (nucleus), and ATP production (mitochondria) can still occur temporarily.

2.

Sol. (b) The solution is hypertonic to the cell sap

Plasmolysis (membrane pulling away) occurs when water moves *out* of the cell. This only happens if the surrounding solution is *hypertonic* (higher solute concentration), causing exosmosis.

3.

Sol. (c) Tracheid

The listed features — tapering ends, lignified walls, bordered pits — are characteristic of trachides, the water-conducting elements in xylem. Sclereids are not elongated, and fibres are not involved in water conduction.

4.

Sol. (c) Lactic acid in skeletal muscles

During heavy exercise, skeletal muscles perform anaerobic respiration, producing lactic acid, which causes muscle pain and fatigue. Smooth and cardiac muscles do not produce lactic acid in this context.

5.

Sol. (c) Electron transport chain

The electron transport chain (ETC) generates the maximum ATP (~ 32 ATP) via oxidative phosphorylation. Glycolysis and Krebs cycle produce only small amounts of ATP directly.

6.

Sol. (b) Low humidity, windy and warm

Transpiration increases when:

Humidity is low (steeper diffusion gradient)

Wind is high (removes water vapour)

Temperature is warm (evaporation increases)

Thus, option B gives maximum transpiration.

7.

Sol. (c) Sensory neuron carries impulse to spinal cord

Reflex action sequence: Stimulus $\rightarrow$ Sensory neuron $\rightarrow$ Spinal cord $\rightarrow$ Motor neuron $\rightarrow$ Effector.

The brain is informed later. Hence sensory neuron transmission occurs first.

8.

Sol. (c) Auxin increases cell elongation on the shaded side

Auxin accumulates on the shaded side $\rightarrow$ more cell elongation $\rightarrow$ the plant bends toward light. This is classic phototropism*.

9.

Sol. (d) Spirogyra

Spirogyra uses fragmentation. Sucker-based vegetative propagation occurs in ginger, which has rhizomes.

Bryophyllum uses leaf buds; yeast uses budding;

10.

Sol. (b) Fertilisation between male and female gametes

Fertilization brings together gametes from two individuals, mixing paternal and maternal DNA.

This creates genetic variation, essential for evolution. Mitosis and regeneration do not add variation.