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UDAAN

A QUEST FOR SCIENCE ASPIRANTS

SCIENCE APTITUDE TEST

CLASS - 10

SOLUTIONS

TEST CODE - 28

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PART - I : MENTAL ABILITY

1.

Sol. (c) 129

Pattern: Multiply by 2 and subtract 1:

$5 \rightarrow 9$ $(5 \times 2 - 1 = 9)$

$9 \rightarrow 17$ $(9 \times 2 - 1 = 17)$

$17 \rightarrow 33$ $(17 \times 2 - 1 = 33)$

$33 \rightarrow 65$ $(33 \times 2 - 1 = 65)$

$65 \rightarrow 129$ $(65 \times 2 - 1 = 129)$

2.

Sol. (a) North-East

Starting point O. North 10m to A, then right (east) 5m to B. So B is north-east of O.

3.

Sol. (c) Carrot

Apple, Banana, Orange are fruits; Carrot is avegetable.

4.

Sol. (a) JOL

Each letter is moved one forward: $P \rightarrow Q$, $E \rightarrow F$, $N \rightarrow O$. So $I \rightarrow J$, $N \rightarrow O$, $K \rightarrow L$, JOL.

5.

Sol. (a) Mother

"My mother's only daughter" means the woman herself. So she is the mother of the man.

6.

Sol. (b) O

Pattern: A (+2) $\rightarrow$ C, C (+3) $\rightarrow$ F, F (+4) $\rightarrow$ J, J (+5) 0.

7.

Sol. (b) Two holes symmetric along the diagonal

When folded along the diagonal, punching a hole goes through both layers. Unfolding gives two holes symmetric with respect to the diagonal.

8.

Sol. (d) Neither follows

The red flowers may not include roses, so conclusion I does not follow. Conclusion II is too extreme.

9.

Sol. (a) 35

n(CUF) = n(C) + n(F) - n(CnF) = 20+25-10=35.

10.

Sol. (b) Wednesday

A leap year has 366 days = 52 weeks + 2 days. So from Monday, adding 2 days gives Wednesday.

11.

Sol. (b) 54

125 small cubes $\rightarrow$ large cube is $5 \times 5 \times 5$. Cubes with exactly one face painted = on each face: inner $3 \times 3 = 9$ cubes per face, 6 faces = 54.

12.

Sol. (a)

The sum of no of foces is not 7 so (a) is correct.

13.

Sol. (b) 153

$3 \times 2 + 1 = 7$, $7 \times 2 + 2 = 16$, $16 \times 2 + 3 = 35$,

$35 \times 2 + 4 = 74$, $74 \times 2 + 5 = 153$.

14.

Sol. (a) 13 km

Let starting point be O(0, 0) North = +y, East = +x.

1. 12 km South $\rightarrow$ (0,-12)

2. Turn left (East) 8km $\rightarrow$ (8, - 12)

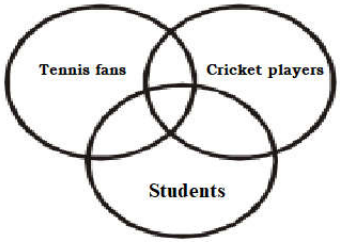
3. Turn left (North) 12km $\rightarrow$ (8, 0)

4. Turn right (East) 5km $\rightarrow$ (13, 0)

Distance from (0,0) to (13, 0) = 13km

15.

Sol. (a)



PART - II : MATHEMATICS

1.

Sol. (c) π

An irrational number cannot be expressed as afraction of integers. is irrational; others are rational.

2.

Sol. (c) 3

The highest power of the variable is 3.

3.

Sol. (c) 3

For many solutions: ratios equal.

$$\Rightarrow \frac{2}{4}=\frac{k}{6}=\frac{7}{14}$$

From $\frac{1}{2}=\frac{k}{6}\Rightarrow k=3$

4.

Sol. (b) 2

Euclid's postulate: given two distinct points, there is exactly one line passing through them.

5.

Sol. (b) 3.81 km/hr

Cliff height = 150 m

Angle changes from 60° to 45° in 1 minute.

Initially (60^0) :

$$\tan 60^0=\frac{150}{d_1}\Rightarrow d_1=\frac{150}{\sqrt{3}}=50\sqrt{3}\approx 86.5,$$

Finally (45°): $\tan 45^0=\frac{150}{d_2}\Rightarrow d_2=150m$

Distance travelled in 1 min = 150 - 86.5 = 63.5 m

Speed in m/s = 63.5/60 m/s $\approx$ 1.058 m/s

In km/hr = 1.058 × 3.6 $\approx$ 3.81 km/hr

6.

Sol. (a) 6

$S= 3n^2 + 2n$

$S_1= 5 = a_1$, $S_2 = 16 \Rightarrow a_2 = 11$, d = 11-5= 6.

7.

Sol. (b) 54

Let the ones digit is be x

Tens digit is y the the numer = 10x + y

Given: 10x + y = 6(x+y)

$\Rightarrow$ 10x + y = 6x + 6y

$\Rightarrow$ 4x = 5y ...(1)

Digits interchanged: 10y + x = (10x + y) -9

$\Rightarrow$ 10y + x = 10x + y - 9

$\Rightarrow$ 9y - 9x = -9

$\Rightarrow$ x - y = 1...(2)

From (1): $x=\frac{5y}{4}$

Substute in (2): $\frac{5y}{4}-y=1\Rightarrow\frac{y}{4}=1\Rightarrow y=4$

$\Rightarrow$ x = 5

Then number be = 10x + y = 10 x 5 + 4 = 54

8.

Sol. (a) 216

$$\text{Sphere volume}=\frac{4}{3}\pi(3)^3=36\pi$$

$$\text{Small ball volume}=\frac{4}{3}\pi(0.5)^3=\frac{0.5\pi}{3}$$

$$\text{Number of ball}=\frac{36\pi}{0.5\pi/3}=36\times 6=216$$

9.

Sol. (d) 90°

It is a right angle triangle ($5^2 + 12^2 = 13^2$)

So each angle of parallelogram is 90^0.

10.

Sol. (b) 2

$\sin\theta + \cos\theta = \sqrt{2}$ square both sides:

$1+ 2\sin\theta\cos\theta = 2 \Rightarrow \sin\theta\cos\theta = 0.5$

$$\tan\theta+\cot\theta=\frac{\sin\theta}{\cos\theta}+\frac{\cos\theta}{\sin\theta}=\frac{1}{\sin\theta\cos\theta}=\frac{1}{0.5}=2$$

11.

Sol. (a) $\frac{21}{36}$

Total outcomes = 36

Sum less than 8: Pairs (1,1) to (6,1), (1,2) to (5,2), ..., count:

Sum = 2: 1 way

Sum = 3: 2 ways

Sum = 4: 3 ways

Sum = 5: 4 ways

Sum = 6: 5 ways

Sum = 7: 6 ways

Total = 1+2+3+4+5+6 = 21

Probability = $\frac{21}{36}$

12.

Sol. (a) 16

First 15 even numbers: 2, 4, 6, ..., 30

Number of terms n=15, sum = 15 × (2 + 30) / 2

= 15 × 16 = 240

Mean = 240/15=16

13.

Sol. (a) 0

$\Rightarrow x = 1+\sqrt{2}$

$\Rightarrow x - 1=\sqrt{2}$

$\Rightarrow (x - 1)^2 =2$

$\Rightarrow x^2-2x+1=2$

$\Rightarrow x^2-2x+1=0$

14.

Sol. (a) 3

One zero is $1 \Rightarrow 1 - 4 + k = 0 \Rightarrow k= 3$

Polynomial: $x^2 - 4x +3 = (x-1)(x -3)$ other zero $\Rightarrow 3$

15.

Sol. (c) Mode = 3 Median – 2 Mean

Empirical relation: Mode = 3 Median - 2 Mean

16.

Sol. (a) 59°

Let angle = x, complement = 90°-x. Then x = (90-x)+28 $\rightarrow 2x = 118 \rightarrow x = 59°$

17.

Sol. (b) 6

$x^4 + 4x^3 + 6x^2 + 4x +1 = (x^2 + 2x +1)^2$

So $(x^2 + ax+b) = (x^2 + 2x +1), (x^2 + cx + d)$

$= (x^2+2x +1)$

$\Rightarrow a = 2, b = 1, c = 2, d = 1$

Sum = 2+1+2+1=6.

18.

Sol. (d) 77°, 50°

Given $AB||CD$, $\angle APQ = 50°$, $\angle PRD = 127°$

$= \angle APR = \angle PRD = 127 (\text{Alt.int.angle})$

$= 50^0 + \angle QPR = 127^0$

$\angle QPR = 127^0 - 50^0$

$\angle QPR = 77^0$

In $\angle PQR = \angle APQ = 50°$ (alt int angles)

19.

Sol. (a) 6 cm

By Pythagoras: radius² = (distance)² - (tangent)² = $10^2 - 8^2 = 100 - 64 = 36 \rightarrow$ radius = 6 cm.

20.

Sol. (d) 8 times

Volume (radius)2. If radius doubles, volume becomes $2^2 = 8$ times.

21.

Sol. (c) $\frac{4}{13}$

Number of kings = 4, hearts = 13, but king of hearts is counted twice. So favourable = 4+13-1 = 16. $P = \frac{16}{52} = \frac{4}{13}$.

22.

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

$\sec\theta - \tan\theta = \sqrt{2}$...(1)

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

$\Rightarrow (\sec\theta - \tan\theta)(\sec\theta + \tan\theta) = 1$

$\sec\theta + \tan\theta = \frac{1}{\sqrt{2}}$.....(2)

Add (1) and (2): $2\sec\theta = \sqrt{2} + \frac{1}{\sqrt{2}} = \frac{3}{\sqrt{2}}$

$\Rightarrow \sec\theta = \frac{3}{2\sqrt{2}}$

23.

Sol. (a) 2, 3

$x^2 - 5x + 6 = 0 \Rightarrow x^2 - 2x - 3x + 6 = 0$

Factorising: $(x - 2)(x - 3) = 0 \rightarrow x = 2, 3.$

24.

Sol. (a) 3

Distance formula: $(13 - 5)^2 + (m + 3)^2 = 10^2$

$\Rightarrow 64 + (m+3)^2 = 100 \Rightarrow (m+3)^2 = 36$

$\Rightarrow m + 3 = \pm 6 \Rightarrow m = 3$ or $m = -9$

From options: m = 3

25.

Sol. (c) 7

Let first term = a, common difference = d.

$T_{10} = a + 9d = 52$...(1)

$T_{17} = a + 16d$, $T_{13} = a + 12d$.

Given $a + 16d = (a + 12d) + 20 \rightarrow 4d = 20$

$\Rightarrow d = 5.$

From (1): $a + 45 = 52$, $a = 7$.

26.

Sol. (b) -2

$\alpha + \beta = 6$, $\alpha\beta = k$. $\alpha^2 + \beta^2 = (\alpha+\beta)^2 - 2\alpha\beta$

$= 36 - 2k = 40 - 2k = 4k = -2.$

27.

Sol. (a) 7.5 cm

By Basic Proportionality Theorem:

$\frac{AD}{AB} = \frac{AE}{AC} \Rightarrow \frac{4}{10} = \frac{5}{AC}$

$\Rightarrow AC = \frac{(5 \times 10)}{4} = 12.5\text{cm}$

28.

Sol. (a) 30°

Since TP = TQ, ΔTPQ is Isosceles.

$\angle TPQ = \angle TQP = \frac{180° - 60°}{2} = 60°.$ But

$\angle OPT = 90°$ (radius 1. tangent).

So $\angle OPQ = \angle OPT - \angle TPQ = 90° - 60° = 30°.$

29.

Sol. (b) 2

For equal roots, discriminant = 0.

Discriminant $= 4(k-1)^2 - 4(k-1)(1) = 0$

$\Rightarrow 4(k - 1)[(k - 1) - 1] = 4(k-1)(k-2) = 0$

$\Rightarrow k = 1$ or $k = 2$.

But if k=1, equation becomes $0x^2 + 0x + 1 = 0$

$\rightarrow 1 = 0$ (no roots). So k=2.

30.

Sol. (a) x = 6, y = 0

Diagonals ofa parallelogram bisect each other. Midpoint of AC = midpoint of BD.

Midpoint of $AC = \left(\frac{1+x}{2}, \frac{2+4}{2}\right) = \left(\frac{1+z}{2}, 3\right)$

Midpoint of $BD = \left(\frac{4+3}{2}, \frac{6+y}{2}\right) = \left(\frac{4}{2}, \frac{6+y}{2}\right)$

Equate: $\frac{1+x}{2} = \frac{7}{2} \rightarrow 1 + x = 7 \rightarrow x = 6$

$3 = \frac{6+y}{2} \rightarrow 6 + y = 6 \rightarrow y = 0.$

PART - III : PHYSICS & CHEMISTRY

1.

Sol. (c) Momentum

Magnetic force changes direction of velocity, not speed $\Rightarrow$ momentum changes.

2.

Sol. (a) same

power = I^2R

Change in power dissipation

Current $100 \Rightarrow I' = 2I$

Resistance 1 to 25% $\Rightarrow R' = R / 4$

$P' = I'^2 R' = (2I)^2 \times \frac{R}{4} = I^2R = P$

3.

Sol. (a) 256 times.

Diameter $\rightarrow \frac{1}{4}$, so area $\rightarrow \frac{1}{16}$ Length becomes 16 times (volume constant)

$R \propto \frac{L}{A} = \frac{16}{1/16} = 256$

Answer: (a) 256 times

4.

Sol. (c)

Positive magnification $\rightarrow$ virtual, erect image Occurs when object is between pole and focus

5.

Sol. (d) Convex lens.

As fig shows parallel beam converging at a point hence the correct answer is (D) Convex lens.

6.

Sol. (d) All of the above

Depending on convergence, output may be converging / parallel / diverging.

7.

Sol. (b)

Rays appear to diverge from image but do not actually pass through it.

8.

Sol. (a)

As the direction of motion and direction of magnetic field is opposite to each other the force will be zero.

9.

Sol. (a) 2000N

$F = \frac{m(v-u)}{t} = \frac{1(7-5)}{10^{-3}} = 2000N$

10.

Sol. (a)

Minimum scattering as sunlight travels shortest path in atmosphere

11.

Sol. (a) 1.76×10^{11} C/kg

Specific charge = charge / mass of electron

charge of $1e^-$ = - 1.602×10^{-19} C

mass of 1e- = 9.11×10^{-31}kg

So, Specific charge = 1.76×10^{11} C/kg

12.

Sol. (a) 9.30

concentration is 2×10^{-5} M

pOH = -log[OH^-]

pOH = -log(2×10^{-5}) = 4.699

pH = 14 - 4.699 = 9.30

13.

Sol. (b) 3.12

Volume of solution = mass / density

Volume = 200 / 1.25 = 160 cm^3 = 0.16 L

Moles of H_2SO_4 = 49 / 98 = 0.5 mol

Molarity = moles / volume

M = 0.5 / 0.16 = 3.12 M

14.

Sol. (c) James Chadwick

Neutron was discovered by James Chadwick.

15.

Sol. (c) Same in chemical properties but different in physical properties

Isotopes have the same chemical properties because they have the same atomic number. Hence, they have the same number of electrons and identical electronic configuration. Chemical properties depend on electrons, not on neutrons.

16.

Sol. (a) All ores are minerals

Ores are minerals from which metals can be extracted profitably.

Therefore, all ores are minerals.

17.

Sol. (c) $V \propto \frac{1}{p}$

Boyle's law: Volume is inversely proportional to pressure at constant temperature. $V \propto \frac{1}{p}$

18.

Sol. (b) 2 g H_2

7 g N_2 = 7/28 = 0.25 mol

2 g H_2 = 2/2 = 1 mol

16 g O_2 = 16/32 = 0.5 mol

16 g NO_2 = 16/46 ~ 0.35 mol

Maximum moles = 1 mol (H_2)

19.

Sol. (c) 1 mole

$H_2SO_4 + 2NaOH \rightarrow Na_2SO_4 + 2H_2O$

1 mole H_2SO_4 reacts with 2 moles NaOH

Required H_2SO_4 = 1 mole

20.

Sol. (b) DecompAosition reaction

Wate decomposes into hydrogen and oxygen using electricity.

This is a decomposition reaction.

PART - IV : BIOLOGY

1.

Sol: (c) The solution is isotonic

When the cell neither swells nor shrinks but still exchanges water rapidly, it means the external solution has equal solute concentration to the cell sap. This is an isotonic condition with dynamic equilibrium of water movement.

2.

Sol: (b) Inner mitochondrial membrane

The inner membrane contains the electron transport chain and ATP synthase. If this membrane is damaged, oxidative phosphorylation stops despite adequate oxygen, leading to no ATP generation.

3.

Sol: (b) Collenchyma

Collenchyma has characteristic unevenly thickened primary walls, provides flexibility, and is found in young stems and petioles. It is the only supporting tissue with living cells.

4.

Sol: (c) Sclerenchyma fibres

Sclerenchyma fibres are long, thick-walled, dead cells with narrow lumen. Parenchyma and collenchyma are living, and companion cells are also living.

5.

Sol: (b) CO_2 release increases

In the dark, photosynthesis stops instantly but respiration continues. Therefore, CO_2 release increases because only respiration is occurring and CO_2 consumption (photosynthesis) has stopped.

6.

Sol: (c) Only the region exposed to light synthesized starch

Dark treatment for 48 hours removes all stored starch from the leaf (destarching). When the leaf is later exposed to light only in one region, that particular area performs photosynthesis and produces starch. During the iodine test, only the starch-producing region turns blue-black, showing that photosynthesis is light-dependent and occurs only in illuminated parts.

7.

Sol: (c) Muscle contracts to withdraw hand

The reflex arc sequence ends with the effector (muscle) responding by contracting. Sensory receptor $\rightarrow$ sensory neuron $\rightarrow$ spinal cord $\rightarrow$ motor neuron $\rightarrow$ muscle.

8.

Sol: (b) Auxin moves to the dimly lit side

Auxin accumulates on the shaded or dimly lit side, causing more cell elongation there. This results in bending toward light.

9.

Sol: (b) Vegetative propagation by tuber

Potato tubers contain buds (eyes) which can give rise to new plants. This is vegetative propagation through tubers.

10.

Sol: (c) Development and growth of embryo

AAfter fertilisation, the zygote undergoes multiple mitotic divisions to form an embryo. This process is mitotic growth and is essential for dAevelopment, not for generating variation.