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NATIONAL LEVEL SCIENCE TALENT SEARCH EXAMINATION (UPDATED)

CLASS - 10

Question Paper Code : UN487

KEY

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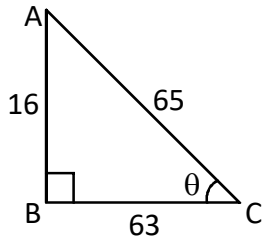
SOLUTIONS

MATHEMATICS

01. (C) Given $\cot\theta = \frac{63}{16} = \frac{\text{adj side to } \theta}{\text{opp side to } \theta}$



$AC^2 = AB^2 + BC^2 = 16^2 + 63^2 = 256 + 3969 = 4225$

$\therefore$ $AC = \sqrt{4225} = 65$

$\therefore$ $\sin\theta + \cos\theta = \frac{16}{65} + \frac{63}{65} = \frac{79}{65}$

02. (D) $LHS = \sin^2 6° + \sin^2 12° + \sin^2 18° + \ldots\ldots\ldots + \sin^2 84° + \sin^2 90°$

$= (\sin^2 6° + \sin^2 84°) + (\sin^2 12° + \sin^2 78°) + (\sin^2 18° + \sin^2 72°) + \ldots\ldots\ldots + (\sin^2 42° + \cos^2 48°) + \sin^2 90°$

$= (\sin^2 6° + \cos^2 6°) + (\sin^2 12° + \cos^2 12°) + \ldots\ldots\ldots + (\sin^2 42° + \cos^2 42°) + 1$

$= 1 + 1 + 1 + 1 + 1 + 1 + 1 + 1$

$= 8$

03. (B) In an equilateral triangle BD:DC = 2:1 & AP⊥BC

$\therefore$ $9AD^2 = 7AB^2$

$9 \times AD^2 = 7 \times 9 \times 9\ cm^2$

$AD^2 = \dfrac{7 \times 9 \times 9 cm^2}{9}$

$AD = \sqrt{7 \times 9}\ cm = 3\sqrt{7}\ cm$

04. (B) L.H.S =

$$\frac{\cos^2(90° - 45° + \theta) + \cos^2(45° - \theta)}{\tan(90° - 30° + \theta)\tan(30° - \theta)}$$

$$= \frac{\cos^2[90° - (45° - \theta)] + \cos^2(45° - \theta)}{\tan[90° - (30° - \theta)]\tan(30° - \theta)}$$

$$= \frac{\sin^2(45° - \theta) + \cos^2(45° - \theta)}{\cot(30° - \theta)\tan(30° - \theta)}$$

$$= \frac{1}{1}$$

$= 1$

05. (A) $\angle BAC = 90°$ [$\because$ Angle in a semi-circle]

$\Rightarrow$ $BC^2 = AB^2 + AC^2 = 28^2 + 21^2 = 784 + 441 = 1225$

$BC = \sqrt{1225} = 35$

Area of shaded region = Area of the circle – Area of the right angled triangle – Area of sector COD.

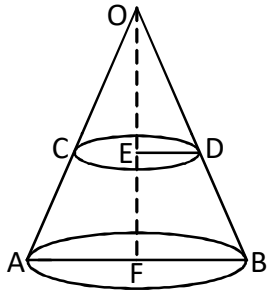
$$= \left(\pi \times \left(\frac{35}{2}\right)^2 - \frac{1}{2} \times 28 \times 21 - \frac{1}{4} \times \pi \left(\frac{35}{2}\right)^2\right) cm^2$$

$$= \left(\frac{22}{2} \times \frac{35}{2} \times \frac{35}{2} - 294 - \frac{1}{4} \times \frac{22}{2} \times \frac{35}{2} \times \frac{35}{2}\right) cm^2$$

$$= \left(\frac{3}{4} \times 55 \times \frac{35}{2} - 294\right) cm^2$$

$= [721.875 - 294]\ cm^2 = 427.875\ cm^2$

06. (C) Let OAB be the given hollow cone cut by the plane CD parallel to base AB and let cone OCD be removed. Then, the remainder to the frustum CABD of the given cone.



[by Thales' theorem]

Let OE = h units, OF = H units

OD = l units, OB = L units

ED = r units, FB = R units

In ΔOED and ΔOFB, we have

$\angle EOD = \angle FOB$ (Common)

$\angle OED = \angle OFB = 90°$.

$\therefore$ $\Delta OED \sim \Delta OFB$

$$\Rightarrow \frac{OE}{OF} = \frac{OD}{OB} = \frac{ED}{FB} = \frac{h}{H} = \frac{l}{L} = \frac{r}{R} \quad \text{..... (i)}$$

Now, (curved surface area of the frustum CABD)

$= \dfrac{8}{9}$ (curved surface area of the cone OAB) ..... (ii)

$\therefore$ (Curved surface area of the cone OCD)

= (Curved surface area of cone OAB) – (Curved surface area of frustum CABD)

= (Curved surface area of cone OAB) – $\dfrac{8}{9}$(curved surface area of cone OAB) [Using (ii)]

$= \dfrac{1}{9}$(curved surface area of cone OAB)

$= \pi r l = \dfrac{1}{9}\ \pi RL$

$$\Rightarrow \left(\frac{r}{R}\right) \times \left(\frac{l}{L}\right) = \frac{1}{9} \Rightarrow \left(\frac{h}{H} \times \frac{h}{H}\right) = \frac{1}{9}$$

$$\Rightarrow \frac{h}{H} = \frac{1}{3}$$

[Using (ii)]

H = 3h ..... (iii)

Now, EF = (OF – OE) = (H – h) = (3h – h) = 2h [∵ OF = H = 3h and OE = h]

$$\frac{OE}{EF} = \frac{h}{2H} = \frac{1}{2}$$

Thus, the required ratio = OE : EF = 1 : 2

7. (C) $x = 0.\overline{87}$

$\therefore$ $100x = 87.8787....$

$x = 0.8787....$

(–) (–)

$99x = 87$

$$x = \frac{87}{99} = \frac{29}{33} = \frac{p}{q}$$

$\therefore$ q = 33 = 3 × 11

8. (C) Factors of 5 are 1 & 5 (or) –5 & –1

Given $f(x) = x^3 - ax^2 - 69x + 5$

$f(x) = 13 - 9(1)2 - 69(1) + 6$

= –72

$f(1) \neq 0$

$f(-5) = (-5)3 - 9(-5)2 - 69(-5) + 5$

$= -125 - 225 + 345 + 5 = 0$

$(x + 5)$ is a factor of $f(x)$

$x + 5$) $x^3 - 9x^2 - 69x + 5$ ($x^2 - 14x + 1$

$x^3 + 5x^2$

(–) (–)

$-14x^2 - 69x + 5$

$-14x^2 - 70x$

$x + 5$

$x + 5$

0

$x^2 - 14x + 1 = 0$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$= \frac{-(-14) \pm \sqrt{196 - 4 \times 1}}{2}$$

$$= \frac{14 \pm \sqrt{192}}{2}$$

$$= \frac{14 \pm 8\sqrt{3}}{2}$$

$= 7 \pm 4\sqrt{3}$

9. (B) Given $a = 3\sqrt{2}$ & $d = 4\sqrt{2} - 3\sqrt{2} = \sqrt{2}$

$a_{10} = a + ad = 3\sqrt{2} + 9\sqrt{2} = 12\sqrt{2}$

$= \sqrt{144 \times 2} = \sqrt{288}$

10. (D) $$\frac{a_1}{a_2} = \frac{3}{0.06} = \frac{300}{6} = 50$$

$$\frac{b_1}{b_2} = \frac{4}{0.08} = \frac{400}{8} = 50$$

$$\frac{c_1}{c_2} = \frac{-5}{0.1} = -50$$

$$\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$$

$\Rightarrow$ Given lines are parallel lines

$\therefore$ No solution

11. (D) $\Delta ADG \sim \Delta ABC$ [∵ A – A similarity]

$$\therefore \frac{AD}{AB} = \frac{DG}{BC} = \frac{AG}{AC}$$

$$\therefore \frac{18\,cm}{AB} = \frac{DE}{BC} \quad \text{\_\_\_\_\_ (1)}$$

[∵ DG = DE]

$\Delta CEF \sim \Delta CBA$

[∵ A – A similarity]

$$\frac{CE}{CB} = \frac{EF}{BA} = \frac{CF}{AC}$$

$$\frac{32\,cm}{BC} = \frac{DE}{AB} \quad \text{---------- (2)}$$

[$\because$ EF = DE]

Eq (1) × (2) $\Rightarrow$ $\frac{18\,cm}{AB} \times \frac{32\,cm}{BC} = \frac{DE}{AB} \times \frac{DE}{BC}$

$$\frac{DE^2}{AB \times BC} \times AB \times BC = 576\ cm^2$$

$$DE = \sqrt{576\ cm^2} = 24\ cm$$

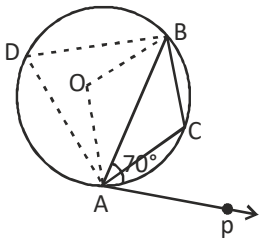
12. (B) Centroid ΔABC = Centroid of ΔDEF

$$= \left(\frac{x_1 + x_2 + x_3}{3}, \frac{y_1 + y_2 + y_3}{3}\right)$$

$$= \left(\frac{5 - 5 + 6}{3}, \frac{-3 + 3 + 6}{3}\right)$$

= (2, 2)

13. (B)



Construction: Notice the centre of the circle as 'O'. Join OA, OB. Notice a point 'D' on the major are join AD & BD.

Proof: A tanget is perpendicular to the radius.

$\therefore$ $\angle OAB + \angle BAP = 90°$

$\angle OAB + 70° = 90°$

$\therefore$ $\angle OAB = 20°$

$\therefore$ $\angle OBA = 20°$

In ΔAOB, $20° + 20° + \angle AOB = 180°$

$\angle AOB = 140°$

$\therefore$ $\angle ADB = \frac{\angle AOB}{2} = \frac{140°}{2} = 70°$

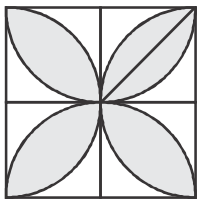
But ACBD is a cyclic quadrilateral.

$\therefore$ $\angle D + \angle BCA = 180°$

$70° + \angle BCA = 180°$

$\angle BCA = 180° - 70° = 110°$

14 (B) Radius = 14 cm ÷ 2 = 7 cm



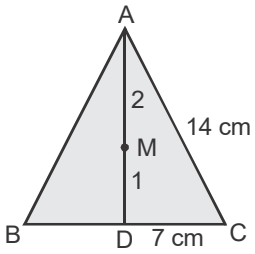
Area of a  $= \frac{1}{4} \times \frac{22}{7} \times 7\ cm \times 7\ cm$

$= 38.5\ cm^2$

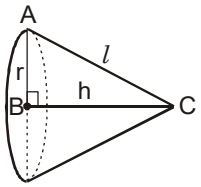
Area of a  $= \frac{1}{2} \times 7\ cm \times 7\ cm = 24.5\ cm^2$

Area of a  = 38.5 cm² – 24.5 cm² = 14 cm²

Area of shaded region = 14 cm² × 8 = 112 cm²



15. (A) Given, h = 16 cm and l = 20 cm.



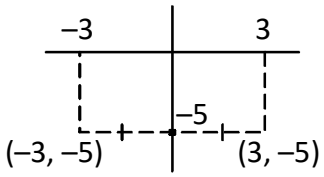
$\therefore$ $r = \sqrt{l^2 - h^2} = \sqrt{20^2 - 16^2}\ cm = 12\ cm$

$\therefore$ Volume $= \frac{1}{3}\pi r^2 h$

$= \frac{1}{3} \times \frac{22}{7} \times 12^2 \times 16\ cm^3$

$= \frac{16896}{7}\ cm^3 = 2413{:}7D\ cm^3$

16. (D)



17. (C) Side of square = HCF of length and breadth of the room.

1763 cm & 1927 cm

HCF = 41 cm

$$\begin{array}{r} 1783)\ 1927\ (1 \\ \underline{1763} \\ 164)\ 1763\ (10 \\ \underline{1640} \\ 123)\ 164\ (1 \\ \underline{123} \\ 41)\ 123\ (3 \\ \underline{123} \\ 0 \end{array}$$

$\therefore$ Least number of square tiles =

$$\frac{\cancel{1763}^{43}\ \text{cm} \times \cancel{1927}^{47}\ \text{cm}}{\cancel{41}_{1}\ \text{cm} \times \cancel{41}_{1}\ \text{cm}}$$

= 2021

18. (A) Give $\alpha + \beta = \frac{1}{2}\ \alpha\beta$

$-[-(k + 4)] = \frac{1}{2} \times 2(2k + 1)$

$k + 4 = 2k + 1$

$4 - 1 = 2k - k$

$k = 3$

19. (C) Given $1 + \sin^2\theta = 3\sin\theta\cos\theta$

$\therefore$ $\sin^2\theta + \cos^2\theta + \sin^2\theta - 3\sin\theta\cos\theta = 0$

$2\sin^2\theta - 2\sin\theta\cos\theta - \sin\theta\cos\theta + \cos^2\theta = 0$

$2\sin\theta(\sin\theta - \cos\theta) - \cos\theta(\sin\theta - \cos\theta) = 0$

$\therefore$ $(\sin\theta - \cos\theta)(2\sin\theta - \cos\theta) = 0$

$\therefore$ $\sin\theta = \cos\theta = 5m(90 - \theta)$

$\therefore$ $\theta = 90 - \theta$

$2\theta = 90°$

$\sin\theta - \cos\theta = 0$ (or)

$\theta = \frac{90°}{2} = 45°$

$2\sin\theta - \cos\theta = 0$ (or)

$2\sin\theta = \cos\theta$

$\sin\theta - \cos\theta = 0$

$\sin\theta = 50(90° - \theta)$ (or)

$2 = \frac{\cos\theta}{\sin\theta} = \cos\theta$

$\theta = 90° - \theta$

$2\theta = 90°$

$\theta = \frac{90°}{2} = 45°$

20. (B) Given $a_{18} = a + 17d = 18$ _____ (1)

$\therefore$ $s_{35} = \frac{35}{2}\ [2a + 34d]$

$= \frac{35}{2} \times 2(a + 17d)$

$= 35 \times 18$

$= 630$

21. (A) $18(6x^4 + x^3 - x^2) = 18x^2(6x^2 + x - 1)$

$= 18x^2\ (6x^2 + 3x - 2x - 1)$

$= 18x^2[3x(2x + 1) - 1(2x + 1)]$

$= 9x^2\ (2x + 1)(3x - 1)$

$45(2x^6 + 3x^5 + x^4) = 45x^4(2x^2 + 3x + 1)$

$= 45x^2(2x^2 + 2x + x + 1)$

$= 45x^2[2x(x + 1) + 1(x + 1)]$

$= 9 \times 5x^2\ (x + 1)(2x + 1)$

$\therefore$ HCF of $18(6x^4 + x^3 - x^2)$ and $45(2x^6 + 3x^5 + x^4) = 9x^2(2x + 1)$

22. (D) Given $\cos^2\theta - 3\cos\theta + 2 = \sin^2\theta$

$\cos^2\theta - 3\cos\theta + 2 = 1 - \cos^2\theta$

$\cos^2\theta + \cos^2\theta - 3\cos\theta + 2 - 1 = 0$

$2\cos^2\theta - 2\cos\theta - \cos\theta + 1 = 0$

$2\cos\theta(\cos\theta - 1) - 1(\cos\theta - 1) = 0$

$(\cos\theta - 1)(2\cos\theta - 1) = 0$

$\therefore$ $\cos\theta - 1 = 0$ and $2\cos\theta - 1 = 0$

$\cos\theta = 1 = \cos 0°$ and $2\cos\theta = 1$

$\cos\theta = \frac{1}{2} = \cos 60°$

$\therefore$ $\theta = 60°$

[$\theta = 0°$ is rejected because in the question denominator = $\sin\theta = \sin 0° = 0$]

23. (C) Let the two numbers be x & y when $x > y$

$\therefore$ $x + y = 1000$ _____ (1)

Given $x^2 - y^2 = 256{,}000$

$(x + y)(x - y) = 2{,}56{,}000$

$1000(x - y) = 25{,}6000$

$x - y = \frac{256000}{1000}$

$x - y = 256$

_____ (2)

$x + y = 1000$ _____ (1)

$\underline{x - y = 256}$

_____ (2)

$2x = 1256$

$x = \frac{1256}{2} = 628$

$\therefore$ $y = 1000 - x = 1000 - 628 = 512$

$\therefore$ Greater number = 628

24. (A) Given $2(l + b) = 98$ m

$l + b = \frac{98}{2}$ m = 49 m

$l + b = 49$

S.O.B.S

$l^2 + b^2 + 2lb = 2401$

$41^2 + 2lb = 2401$

$1681 + 2lb = 2401$

$2lb = 2401 - 1681 = 720$

$lb = \frac{720}{2} = 360$

$40 + 9 = 49$ and $40 \times 9 = 360$

$\therefore$ $l = 40$ m

25. (D) Given $a = 23$ $d = a_2 - a_1 = 22\frac{1}{4} - 23$

$= \frac{-3}{4}$

Given $a_n < 0$

$a + (n - 1)d < 0$

$23 + (n - 1)\left(\frac{-3}{4}\right) < 0$

$23 - (n - 1)\frac{3}{4} < 0$

$23 < (n - 1)\frac{3}{4}$

$23 \times \frac{4}{3} < n - 1$

$\frac{92}{3} < n - 1$

$30.6 + 1 < n$

$n > 31.6$

$\therefore$ Next integer of 31.6 is '32'

$\therefore$ N = 32

$\therefore$ a_{32} is the first negative term

$\therefore$ $a_{32} = 23 + 31 \times \left(-\frac{3}{4}\right) = \frac{92 - 93}{4} = \frac{-1}{4}$

$a_{31} = a + 30d = 23 + 30\left(\frac{-3}{4}\right)$

$= \frac{92 - 90}{4} = \frac{2}{4} = \frac{1}{2}$

PHYSICS

26. (D) $R = \frac{\rho l}{A} \therefore \frac{R_A}{R_B} = \frac{\rho_A l_A}{\rho_B l_B}$

For copper wires $\rho_A = \rho_B$,

So, $\frac{R_A}{R_B} = \frac{l_A}{l_B} = \frac{3}{5} < 1$ or $R_A < R_B$

27. (A) Here, x = u + v

As $m = \frac{f}{f+u} = \frac{f-v}{f}$

and image is real, magnification is negative.

$\therefore \quad -m = \frac{f}{f+u}, \; u = \frac{-(m+1)f}{m}$

From $-m = \frac{f-v}{f} \; v = (m+1)\, f$

Put in (i)

$x = \frac{-(m+1)}{m} f + (m+1) f$

Solving, we get, $f = \frac{mx}{(m+1)^2}$

28. (C) For reading purposes :

u = – 25 cm, v = – 50 cm, f = ?

$\frac{1}{f} = \frac{1}{v} - \frac{1}{u} = -\frac{1}{50} + \frac{1}{25} = \frac{1}{50}$

$P = \frac{100}{f} = +2\,D$

For distant vision,

f' = Distance of far point = – 3 m

$P = \frac{1}{f'} = -\frac{1}{3}\,D = -0.33\,D$

29. (A) $n_{QP} = \frac{v_1}{v_2}$

V_1 = Speed of light in medium P.

V_2 = Speed of light in medium Q.

As a ray of light bends towards the normal, when it goes from medium P to medium Q, therefore, medium P is rarer and medium Q is denser medium. Speed of light in rarer medium (v_1) is greater than the speed of light in denser medium (v_2). Hence, $n_{QP} > 1$.

30. (B) Houses have three thick copper wires. One wire is called earth wire (in green insulation cover) and second wire is called live wire (in red insulation cover) and the third wire is neutral wire (in black insulation cover). The appliances are connected to the earth wire by using the top pin of 3-pin-plug. Earthing saves us from electrical shocks.

31. (C) Statements I, II and V are correct. Myopia and short sightedness are the same defects. Iris is a flat, coloured, ring-shaped membrane present behind the cornea of the eye.

32. (B) As a convex lens alone can form a real image as well as a virtual image, therefore, the lens is a convex lens. Let f be the focal length of the lens and m be the magnification produced.

In the first case, when the image is real,

u = – 16 cm, v = + 16 m

As $\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$

$\therefore \quad \frac{1}{16\,m} + \frac{1}{16} = \frac{1}{f}$ or $1 + \frac{1}{m} = \frac{16}{f}$ ..... (i)

In the second case, when the image is virtual,

u = – 6 cm, v = – 6 m

From $\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$

$$\frac{1}{-6m}+\frac{1}{6}=\frac{1}{f} \text{ or } 1-\frac{1}{m}=\frac{6}{f} \quad \text{..... (ii)}$$

Add (i) and (ii)

$$2=\frac{22}{f} \text{ or } f=\frac{22}{2}=11 \text{ cm}$$

33. (C) Statements I, III and V are true and II and IV are false.

An AC generator can be converted into DC generator by replacing the slip rings of an AC generator with the commutator of a DC generator with brushes.

In India, AC changes its direction after every 1/100 s.

34. (D) Here, $i_1 = 60°$, $A = 30°$, $\delta = 30°$

As $i_1 + i_2 = A + \delta$, $\therefore \; i_2 = 0$.

Hence, angle between the ray and the face from which it emerges = 90° – 0 = 90°.

35. (C) As the lamp (of resistance, $R_1 = 20\ \Omega$) and conductor (of resistance, $R_2 = 4\ \Omega$) are in series,

Total resistance in the circuit, $R_s = 20\ \Omega + 4\ \Omega = 24\ \Omega$

Current through the circuit,

$$I=\frac{V}{R_s}=\frac{6\text{ V}}{24\ \Omega}=0.25\text{ A}$$

Pd across the lamp, $V_1 = IR_1 = 0.25\text{ A} \times 20\ \Omega = 5\text{ V}$

Pd across the conductor, $V_2 = IR_2 = 0.25\text{ A} \times 4\ \Omega = 1\text{ V}$

CHEMISTRY

36. (A) Magnesium reacts quite rapidly with dilute hydrochloric acid forming magnesium chloride and hydrogen gas :

$$\underset{\text{Sodium}}{2Na\,(s)} + \underset{\text{Hydrochloric acid}}{2HCl\,(aq)} \longrightarrow \underset{\text{Magnesium chloride}}{MgCl_2\,(aq)} + \underset{\text{Hydrogen}}{H_2\,(g)}$$

Aluminium metal at first reacts slowly with dilute hydrochloric acid due to the presence of a tough protective layer of aluminium oxide on its surface. But when the thin, outer oxide layer gets dissolved in acid, then fresh aluminium metal is exposed which reacts rapidly with dilute hydrochloric acid.

Aluminium metal reacts rapidly with dilute hydrochloric acid to form aluminium chloride and hydrogen gas :

$$\underset{\text{Aluminium}}{2Al\,(s)} + \underset{\text{Hydrochloric acid}}{6HCl\,(aq)} \longrightarrow \underset{\text{Aluminium chloride}}{2AlCl_3\,(aq)} + \underset{\text{Hydrogen}}{3H_2\,(g)}$$

The reaction of aluminium with dilute hydrochloric acid is less rapid than that of magnesium, so aluminium is less reactive than magnesium.

Zinc reacts with dilute hydrochloric acid to form zinc chloride and hydrogen gas (but the reaction is less rapid than that of aluminium)

$$\underset{\text{Zinc}}{Zn\,(s)} + \underset{\text{Hydrochloric acid}}{2HCl\,(aq)} \longrightarrow \underset{\text{Zinc chloride}}{ZnCl_2\,(aq)} + \underset{\text{Hydrogen}}{H_2\,(g)}$$

This reaction shows that zinc is less reactive than aluminium.

Iron reacts slowly with cold hydrochloric acid to form iron (II) chloride and hydrogen gas.

$$\underset{\text{Iron}}{Fe\,(s)} + \underset{\text{Hydrochloric acid}}{2HCl\,(aq)} \longrightarrow \underset{\text{Iron (II) chloride}}{FeCl_2\,(aq)} + \underset{\text{Hydrogen}}{H_2\,(g)}$$

This shows that iron is less reactive than zinc.

37. (D) The by product of chlor-alkali process which absorbs moisture is sodium hydroxide (NaOH).

As sodium hydroxide is a strong base and CO_2 is acidic in nature, so reaction occurring between them is called the neutralisation reaction.

38. (B) In order to restore silverware, the tarnished silver layer containing silver ions needs to be reduced to metallic silver. Aluminium is a rather reactive metal and thus a good reducing agent. Sodium carbonate has no known redox property.

39. (D) The correct match is P-IV, Q-I, R-II, S-III

P.	Addition of O and removal of H	Oxidation
Q.	Complete addition of H_2	Addition
R.	Substitution of H by —— Cl	Substitution
S.	Complete combustion into CO_2 and water	Combustion

40. (C) When electricity is passed through an aqueous solution of sodium chloride (called brine), it decomposes to form sodium hydroxide, chlorine and hydrogen :

$$\underset{\text{Sodium chloride (Brine)}}{2NaCl\,(aq)} + \underset{\text{Water}}{2H_2O\,(l)} \xrightarrow[\text{(Electrolysis)}]{\text{Electricity}} \underset{\text{Sodium hydroxide (Caustic soda)}}{2NaOH\,(aq)} + \underset{\text{Chlorine}}{Cl_2\,(g)} + \underset{\text{Hydrogen}}{H_2\,(g)}$$

During electrolysis, chlorine gas is produced at the anode (positive electrode) and hydrogen gas is produced at the cathode (negative electrode). Sodium hydroxide solution is formed near the cathode.

41. (B) Statements (A), (C) and (D) are true.

Metals high in reactivity series are very reactive. They are obtained by electrolysis of their molten chlorides.

42. (B) The correct matching is

P-(iii), Q-(i), R-(iv), S-(ii)

$2Mg + O_3 \rightarrow 2MgO$

$Ca(OH)_2 + CO_2 \rightarrow CaCO_3 + H_2O$

$Zn + FeSO_4 \rightarrow ZnSO_4 + Fe$

$4Fe + 3O_2 + 2H_2O \rightarrow 2Fe_2O_3.xH_2O$

43. (B) Acids (compounds containing — COOH group) react with ethanol to form a sweet smelling liquid called esters.

44. (A)

Salts	Composition	Salt type	pH
Blue vitriol	$CuSO_4\,5H_2O$	Strong acid + Weak base	pH < 7
Common salt	$NaCl$	Strong acid + Strong base	pH = 7
Baking soda	$NaHCO_3$	Strong base + Weak acid	pH > 7
Washing soda	Na_2CO_3	Strong base + Weak acid	pH > 7 and > baking soda

Thus, the increasing order of pH of given salts is Blue vitriol < Common salt < Baking soda < Washing soda

45. (B) A metal which can replace another metal from its salt solution is more reactive than that metal.

As R can replace silver, lead and iron, so it is more reactive than these three. S can replace only former two and Q only former one, so these are less reactive as compared to R. P cannot displace any of these metals, so it is least reactive among the given metals.

Hence, the ascending order of reactivity (or tendency to form positive ions) in the given metals is P, Q, S, R.

BIOLOGY

46. (C) Dental formula of human adult is $\frac{2123}{2123} \times 2$

47. (D) P - iii; Q - iv; R - i; S - ii

48. (C) Cohesion of water and transpiration pull contributed most to transport of water from the ground to the leaves of a tall tree.

49. (D) The pituitary controls the functions of most of other endocrine glands.

50. (D) Fertilization occur in fallopian tube.

51. (D) Sex chromosomes in human females are XX and in males are XY.

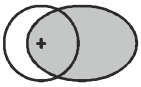
52. (D) Cerebrospinal fluid protects brain from mechanical shocks.

53. (B) Abscisic acid induces dormancy.

54. (D) Drooping of touch me not plant touch is a response to stimulus.

55. (A) Ptyalin is the enzyme of saliva that help in breakdown of starch.

CRITICAL THINKING

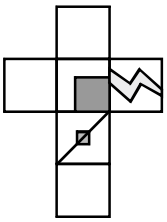
56. (A) 

57. (A) The first five positive powers of 11 are $11^1 = 11$; $11^2 = 121$; $11^3 = 1331$; $11^4 = 14641$; $11^5 = 161051$. So 3 across is 14641, since this is the only five-digit power of 11. Therefore the solution to 2 down is a two-digit square with units digit 4 and so is $8^2 = 64$, as the only other two-digit squares are 16, 25, 36, 49, 81. Hence 1 across is a three-digit cube with units digit 6 and so is $6^3 = 216$, as the only other three-digit cubes are $5^3 = 125$, $7^3 = 343$, $8^3 = 512$, $9^3 = 729$. So the sum of the digits in the completed cross number is 2 + 1 + 6 + 1 + 4 + 6 + 4 + 1 = 25.

	1 **2**	**1**	2 **6**	
3 **1**	**4**	**6**	**4**	**1**

58. (D) Both statements (I and II) are the effects of same cause.

59. (D) If Geetha always tells the truth, then both Anu and Geetha have cats (statements I and II), and Anu is lying (statement III). So all the statements are facts.

60. (C) 

The End