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NATIONAL LEVEL SCIENCE TALENT SEARCH EXAMINATION

CLASS - 10

Question Paper Code : UN484

KEY

1. B	2. D	3. C	4. C	5. D	6. C	7. A	8. D	9. B	10. B
11. D	12. C	13. A	14. D	15. A	16. D	17. C	18. B	19. D	20. A
21. A	22. C	23. D	24. C	25. D	26. D	27. C	28. B	29. D	30. B
31. C	32. A	33. A	34. C	35. C	36. C	37. B	38. D	39. D	40. D
41. C	42. B	43. A	44. A	45. C	46. D	47. A	48. A	49. A	50. C
51. C	52. B	53. C	54. D	55. D	56. A	57. A	58. C	59. C	60. B

SOLUTIONS

MATHEMATICS

01. (B) Given a = 4 and a_5 = 48

$\Rightarrow$ 4 + 4d = 48

4d = 44

d = 11

$\therefore$ x = a + d = 4 + 11 = 15, $y = x$ + d = 26

$\therefore$ $x + y + z$ = 15 + 26 + 37 = 78

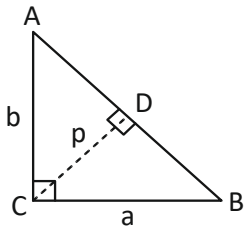
02. (D) Given $\alpha + \beta = -p$ and $\alpha\beta = 12$

But $(\alpha + \beta)^2 = (\alpha - \beta)^2 + 4\alpha\beta$

$(-p)^2 = 1 + 4 \times 12 = 49$

$p = \pm\sqrt{49} = \pm 7$

03. (C) 4.8 cm



$$\frac{1}{2}ab = \frac{1}{2} \times AB \times p$$

$$\frac{1}{p} = \frac{AB}{ab}$$

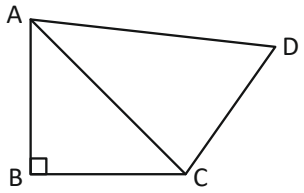
$\therefore \quad \frac{1}{p^2} = \frac{(AB)^2}{a^2b^2} = \frac{a^2+b^2}{a^2b^2} = \frac{a^2}{a^2b^2} + \frac{b^2}{a^2b^2}$

$\frac{1}{p^2} = \frac{1}{a^2} = \frac{1}{b^2} = \frac{1}{b^2} + \frac{1}{8^2} = \frac{64+36}{36\times64}$

$\frac{1}{p^2} = \sqrt{\frac{100}{6^2\times8^2}} = \frac{10}{6\times8} = \frac{10}{48}$

$p = \frac{48}{10} = 4.8$ cm

04. (C) Given $\angle ABC = 90° \Rightarrow AC^2 = AB^2 + BC^2$



But given $AB^2 + BC^2 + CD^2 - AD^2 = 0$

$\therefore \quad AC^2 + CD^2 - AD^2 = 0$

$\Rightarrow AC^2 + CD^2 = AD^2$

$\therefore \quad \angle ACD = 90°$

[$\because$ converce of pythogorus theorem]

05. (D) Given $x + 5y - 9 = 0$ ..... (1)

and $5x - 7 - 19 = 0$ ..... (2)

Equation (1) $\times$ (5) $\Rightarrow$ $5x + 25y - 45 = 0$

$5x - y - 19 = 0$ .... (2)

(–) (+) (+)

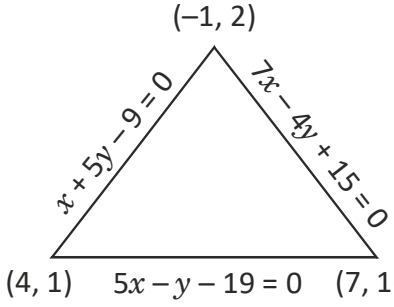
$26y - 26 = 0$

$y = 1$

If $y = 1$ then $x + 5(1) - 9 = 0$

$x = 4$

$\therefore$ Their point of intersection of eq. (1) and (2) is (4, 1)



Given $5x - y - 19 = 0$ ..... (2)

and $7x - 4y + 15 = 0$ ..... (3)

Equation (2) $\times$ 4 $\Rightarrow$ $20x + 4y - 76 = 0$

$7x - 4y + 15 = 0 \longrightarrow$ (3)

(–) (+) (–)

$13x - 91 = 0$

$x = 7$

If $x = 7$ then $5(7) - y - 19 = 0$

$35 - 19 = y$

$\therefore$ The point of intersection of eq. (2) and eq. (3) = (7, 16)

$x + 5y - 9 = 0$ ..... (1)

and $7x - 4y + 15 = 0$ ..... (3)

Equation (1) $\times$ 8 $\Rightarrow$ $7x + 35y - 63 = 0$

$7x - 4y + 15 = 0 \longrightarrow$ (3)

(–) (+) (–)

$39x - 78 = 0$

$39x = 78$

$y = 2$

If $y = 2$ then $x + 10 - 9 = 0$

$x = -1$

$\therefore$ Point of intersection of eq. (1) and eq. (3) = (–1, 2)

Required points A(4, 1) B(7, 16) C (– 1, 2)

Area of Δ ABC

$= \frac{1}{2}|4(16-2)+7(2-1)+(-1)(1-16)|$

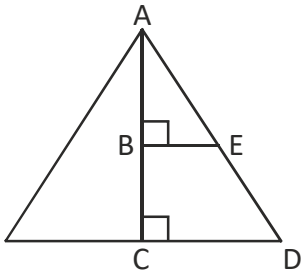
$= \frac{1}{2}|4(14)+7+15|$

$= \frac{1}{2}|56+7+15|$

$= \frac{1}{2}\times 78$ square units

= 39 square units

06. (C) $\Delta ABE \sim \Delta ACD$ [$\because$ A.A similarly]



$$\therefore \quad \frac{AB}{AC}=\frac{BE}{CD} \Rightarrow \frac{\left(\frac{h}{2}\right)}{h}=\frac{BE}{4\,cm}$$

$\therefore$ BE = 2 cm

Volumes of ratio upper cone and frustum

$$=\frac{1}{3}\pi(2\,cm)^2\times\left(\frac{h}{2}\right):\frac{1}{3}\pi(4\,cm)^2h-\frac{1}{3}\pi(2\,cm)^2\times\frac{h}{2}$$

$$=\frac{1}{3}\pi 2h:\frac{\pi}{3}\times 16h-\frac{\pi}{3}\times 2h$$

$$=\frac{2\pi h}{3}:\frac{2\pi h}{3}(8-1)$$

= 1 : 7

07. (A) Given $\sin\theta + \cos\theta = \sqrt{3}$

Squaring on both sides

$\sin^2\theta + \cos^2\theta + 2\sin\theta\cos\theta = 3$

$\therefore$ $1 + 2\sin\theta\cos\theta = 3$

$2\sin\theta\cos\theta = 3 - 1$

$$\therefore \sin\theta\cos\theta = \frac{1}{1}=1$$

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

$$=\frac{\sin^2\theta+\cos^2\theta}{\sin\theta\cos\theta}=\frac{1}{1}=1$$

08. (D) Given x, $(a^2 + b^2)$, $(a + b)^2$ are in AP

$\therefore$ $2(a^2 + b^2) = x + (a + b)^2$

$2a^2 + 2b^2 - a^2 - b^2 - 2ab = x$

$x = (a - b)^2$

09. (B) Given $S_{20} = \frac{\cancel{20}^{10}}{\cancel{2}_{1}}[2a+19d]=40$

$2a + 19d = 4$ ..... (1)

Given $S_{40} = \frac{\cancel{40}^{20}}{\cancel{2}_{1}}[2a+39d]=\cancel{20}^{1}$

$2a + 39d = 1$ ..... (2)

eq (2) – (1) $\Rightarrow$ $20d = -3$

$$d = -\frac{3}{20}$$

$$2a-\frac{57}{20}=4 \qquad \text{..... (1)}$$

$$2a=4+\frac{57}{20}=\frac{137}{20}$$

$$a=\frac{137}{40}$$

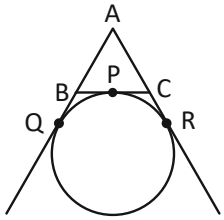
$$S_{60} = \frac{60}{2}[2a+59d]$$

$$=30\left[\frac{137}{20}-\frac{177}{20}\right]$$

$$=30\left[-\frac{40}{20}\right]$$

$S_{60} = -60$

10. (B) BP = BQ and PC = CR



AB + BC + CA = AB + BP + PC + CA

= AB + BQ + CR + AC

= AQ + AR

= AQ + AQ [$\because$ AR = AQ]

Because tangents drawn to the circle from A

$2AQ = (AB + BC + CA)$

$AQ = \frac{1}{2}(AB + BC + CA)$

11. (D) In a parallelogram the diagonals bisect each other

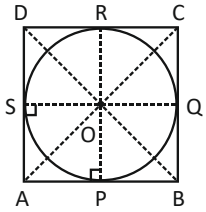
$$\Rightarrow \left(\frac{3+6}{2}, \frac{1+3}{2}\right) = \left(\frac{5+x}{2}, \frac{1+y}{2}\right)$$

$$\frac{9}{2} = \frac{5+x}{2} \Rightarrow x = 4$$

$$\frac{4}{2} = \frac{1+y}{2} \Rightarrow y = 3$$

$\therefore$ $(x, y) = (4, 3)$

12. (C) Const: Join OA, OB, OC, OD, OP, OQ, OR, and OS



$\therefore$ $\angle AOP = \angle AOS = x$ [$\because$ CPCT]

$\Delta AOP \cong \Delta AOS$ [$\because$ RHS congruency]

Similarly $\angle POB = \angle BOQ = y$

$\angle QOC = \angle COR = l$

$\angle ROD = \angle DOS = m$

But $\angle AOP + \angle POB + \angle BOQ + \angle QOC + \angle COR + \angle ROD + \angle DOS = 360°$

$\therefore$ $x + y + y + l + l + m + n + x = 360°$

$x + y + l + m = 180°$

$x + m + y + l = 180°$

$\Rightarrow$ $\angle AOS + \angle SOD + \angle BOQ + \angle QOC = 180°$

$\Rightarrow$ $\angle AOD + \angle BOC = 180°$

13. (A) LCM of fractions

$$= \frac{\text{LCM of numerators}}{\text{HCF of denominators}} = \frac{315}{2}$$

14. (D) Given $\alpha + \beta = \frac{-b}{a} = \frac{-11}{3}$

$$\alpha\beta = \frac{c}{a} = \frac{-4}{3}$$

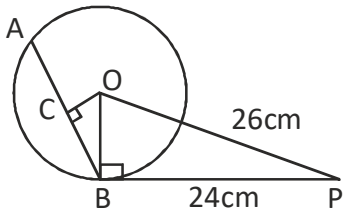
$$\therefore \frac{\alpha}{\beta} + \frac{\beta}{\alpha} = \frac{\alpha^2 + \beta^2}{\alpha\beta}$$

$$\frac{\alpha}{\beta} + \frac{\beta}{\alpha} = \frac{(\alpha+\beta)^2 - 2\alpha\beta}{\alpha\beta} = \frac{\left(\frac{-11}{3}\right)^2 - 2\left(\frac{-4}{3}\right)}{\frac{-4}{3}}$$

$$= \frac{\frac{121}{9} + \frac{8}{3}}{\frac{-4}{3}} = \frac{145}{\cancel{9}_3} \times \frac{-\cancel{3}}{4}$$

$$= \frac{-145}{12}$$

15. (A) In ΔPOB, $B = 90°$



[$\because$ A tangent is perpendicular to radius]

$\therefore$ $OB^2 = OP^2 - PB^2$

$= 676\ cm^2 - 576\ cm^2$

$= 100\ cm^2$

$OB = \sqrt{100\ cm^2} = 10\ cm$

In ΔBOC, $OC = 8$ cm [given] and $\angle C = 90°$

$\therefore$ $BC^2 = OB^2 - OC^2$

$= (10\ cm)^2 - (8\ cm)^2$

$= 36\ cm^2$

$BC = \sqrt{36\ cm^2} = 6\ cm$

$\therefore$ $AC = 2 \times BC = 12$ cm.

16. (D) Given $a^2 + b^2 = (3\sqrt{5})^2 = 45$ ..... (1)

Given $(3a)^2 + (2b)^2 = 15^2$

$\Rightarrow$ $9a^2 + 4b^2 = 225$ ..... (2)

eq(2) – eq(1) × 4 $\Rightarrow$ $5a^2 = 45$

$a^2 = 9$

$a = \sqrt{9} = 3$ cm

$9 + b^2 = 45$ ..... (1)

$b^2 = 36$

$b = \sqrt{36} = 6$

$\therefore$ a + b = (3 + 6) cm = 9 cm.

17. (C) Let speed of the boat in still water be 'x' and speed of the stream be 'y'

Given $\frac{100}{x+y} + \frac{30}{x-y} = 6$ hours

Let $\frac{1}{x+y} = a$ and $\frac{1}{x-7} = 6$

100a + 30b = 6 ..... (1)

Given $\frac{75}{x+y} + \frac{75}{x-y} = 8$

75a + 75b = 8 ..... (2)

Eq (1) × 3 $\Rightarrow$ 300a + 90b = 18

Eq (2) × 4 $\Rightarrow$ 300a + 300b = 32

(–) (–) (–)

+210b = +14

$b = \frac{14}{210}$

$100a + 30^2 \times \frac{1}{15} = 6$

100a = 4

$a = \frac{4}{100} = \frac{1}{25}$

$\therefore$ a = x + y = 25 ..... (3)

$\therefore$ b = x – y = 15 ..... (4)

eq (3) + (4) $2x = 40$

x = 20 kmph

18. (B) Given $6x + 6y = 5xy$ ..... (1)

$6x - 6y = xy$ ..... (2)

Eq (1) + (2) $\Rightarrow$ $12x = 6xy$

$y = 2$

$6x - 12 = 2x$ ..... (2)

$4x = 12$

$x = 3$

$\therefore$ $3x - 2y = 9 - 4 = 5$

19. (D) Let GK be the upper surface of the lake, C be the position of the cloud and O be the point of observation. Let D be the reflection of the cloud C in the lake.

Then, in the figure we have :

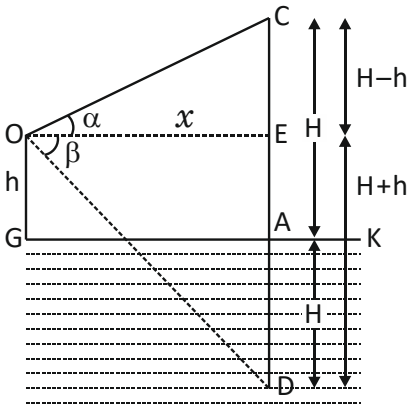
OG = h, $\angle COE = \alpha$ and $\angle EOD = \beta$

Let OE = x and CA = AD = H

Then, CE = CA – EA = CA – OG = H – h

and ED = AD + EA = AD = OG = H + h

In rt. ΔOCE, we have :



$\frac{CE}{OE} = \tan\alpha \quad \Rightarrow \frac{H-h}{x} = \tan\alpha$

$\Rightarrow$ H – h = x tanα

$\Rightarrow$ H = h + x tanα ..... (i)

In rt. ΔODE, we have :

$\frac{ED}{OE} = \tan\beta \Rightarrow \frac{H+h}{x} = \tan\beta$

$\Rightarrow$ H + h = x tanβ

$\Rightarrow$ H = x tanβ – h ..... (ii)

From (i) and (ii), we get :

$h + x\tan\alpha = x\tan\beta - h$

$\Rightarrow x = \dfrac{2h}{(\tan\beta - \tan\alpha)}$ .... (iii)

Now, in rt. ΔOCE, we have :

$\dfrac{OC}{OE} = \sec\alpha \Rightarrow OC = x\sec\alpha$

$\Rightarrow OC = \dfrac{2h\sec\alpha}{(\tan\beta - \tan\alpha)}$ [Using (ii)]

Thus, the distance of the cloud from the point of observation is $\dfrac{2h\sec\alpha}{(\tan\beta - \tan\alpha)}$.

20. (A) Diameter of the circle

$= \sqrt{l^2 + b^2} = \sqrt{14^2 + 10.5^2}$

$= \sqrt{306.25} = 17.5$ cm

$\therefore$ Area of the shaded region = Area of the circle – Area of the rectangle

$= \left[\pi\left(\dfrac{17.5}{2}\right)^2 - 14 \times 10.5\right] cm^2$

$= \left[\dfrac{\cancel{22}^{11}}{\cancel{7}_{1}} \times \dfrac{\cancel{17.5}^{2.5}}{\cancel{2}} \times \dfrac{17.5}{\cancel{2}_{1}} - 147\right] cm^2$

$= (240.625 - 147)\ cm^2$

$= 93.625\ cm^2$

21. (A) Given $\cos\theta = 1 - \cos^2\theta = \sin^2\theta$

$\therefore$ $\sin^{12}\theta + 3\sin^{10}\theta + 3\sin^8\theta + \sin^6\theta = (\sin^4\theta)^3 + 3\sin^8\theta\sin^2\theta + 3\sin^4\theta\sin^4\theta + (\sin^2\theta)^3$

$= (\sin^4\theta + \sin^2\theta)^3$

$= (\cos^2\theta + \cos\theta)^3$

$= 1^3 = 1$

22. (C) Given volume of the wire = Volume of the sphere

$\cancel{\pi}(0.1)^2 \times h\ cm^3 = \dfrac{4}{3}\cancel{\pi}(9)^3\ cm^3$

$h = \dfrac{4}{\cancel{3}_{1}} \times \cancel{9}^{3} \times 9 \times 9 \times \dfrac{1}{0.1} \times \dfrac{1}{0.1}$

= 9,72,00 cm = 0.972 km

23. (D) Area of the path = $\dfrac{3}{\cancel{5}_{1}} \times 100 \times 60^{12}\ m^2$

$= 3600\ m^2$

Let width of the path be x metres

$\therefore$ Total area = $(100 + 2x)(60 + 2x)$

$= 6000 + 3600$

$\Rightarrow$ $6000 + 200x + 120x + 4x^2 = 9600$

$4x^2 + 320x = 3600$

$x^2 + 80x = \dfrac{\cancel{3600}}{\cancel{4}} 900$

$x^2 + 90x - 10x - 900 = 0$

$x(x + 90) - 10(x + 90) = 0$

$\therefore$ $x = -90$ (or) $x = 10$

$\therefore$ Width of the path = $(x) = 10$ m

24. (C) Given $p(x) = x^3 - 9x^2 - 69x + 5$

Given $\alpha\beta\gamma = \dfrac{-d}{a} = -5$

$p(-5) = (-5)^3 - 9(-5)^2 - 69(-5) + 5$

$= -125 - 225 + 345 + 5$

$= -350 + 350$

$p(-5) = 0$

$\therefore$ -5 is the zero of $p(x)$

$$
\begin{array}{r|l}
x + 5 & x^2 - 14x + 1 \\
\hline
 & \cancel{x^3} - 9x^2 - 69x + 5 \\
 & \cancel{x^2} + 5x^2 \\
\hline
 & 14x^2 - 69x + 5 \\
 & \cancel{-14x^2} - 70x \\
\hline
 & \cancel{x} + 5 \\
 & \cancel{x} + 5 \\
\hline
 & 0
\end{array}
$$

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

a = 1, b = –14, c = 1

$\therefore \quad x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

$= \dfrac{-(-14) \pm \sqrt{(-14)^2 - 4 \times 1 \times 1}}{2}$

$= \dfrac{14 \pm \sqrt{196 - 4}}{2}$

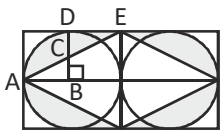
$= \dfrac{14 \pm \sqrt{64 \times 3}}{2}$

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

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

$\therefore$ –5, $7 + 4\sqrt{3}$ & $7 - 4\sqrt{3}$ are the zeros of p(x)

25. (D) In ΔABC and EDC



$\angle CAB = \angle CED$ (angle)

AB = DE (side)

$\angle B = \angle D = 90°$ (angle)

$\therefore$ $\Delta ABC \cong \Delta EDC$ ($\because$ ASA congruency)

$\therefore$ Area of ΔEDC = area of ΔABC

Area of the quadrant ABD = $\dfrac{1}{4} \times \pi r^2$

$= \dfrac{1}{4} \times 3.14 \times 20 \times 20 \text{ cm}^2$

Total area of the shaded region

$= \cancel{4} \times \dfrac{1}{\cancel{4}} \times 3.14 \times 400 \text{ cm}^2$

$= 1256 \text{ cm}^2$

PHYSICS

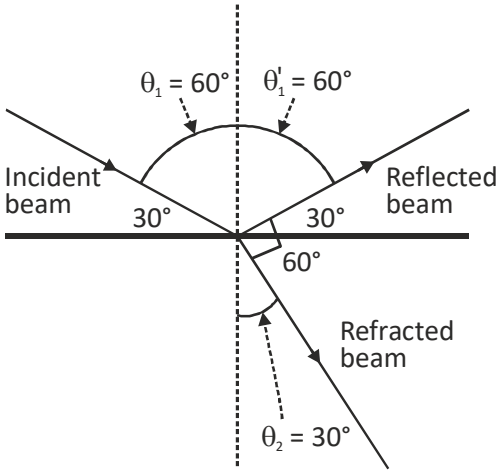
26. (D) $R = \dfrac{\rho l}{A}$

So, $R_1 = \dfrac{\rho(4a)}{(2a)(a)} = \dfrac{2\rho}{a}$

$R_2 = \dfrac{\rho(a)}{(4a)(2a)} = \dfrac{\rho}{8a}$ and $R_3 = \dfrac{\rho(2a)}{(4a)(a)} = \dfrac{\rho}{2a}$

$\therefore \quad R_1 > R_3 > R_2$

27. (C) The index of refraction is never small than 1.



As the reflected and refracted beams are perpendicular to each other, we have $\theta_2 = 30°$. Snell's law then becomes

$n_1 \sin\theta_1 = n_2 \sin\theta_2$

$1 \times \sin 60° = n_2 \sin 30°$

$\dfrac{1}{2}\sqrt{3} = n_2 \cdot \dfrac{1}{2}$

$\sqrt{3} = n_2$

28. (B) To observe objects at infinity, the eye uses its least converging power, P = 40 + 20 = 60 D

$\therefore$ Distance between cornea/eye lens and retina

$f = \dfrac{100}{P}\text{cm} = \dfrac{100}{P}\text{cm} = \dfrac{100}{60}\text{cm} = \dfrac{5}{3}\text{cm}$

To focus an object at near point u = – 25 cm, $v = \dfrac{5}{3}\text{cm}$; f = ?

From $\frac{1}{f}=\frac{1}{v}-\frac{1}{u}=\frac{3}{5}+\frac{1}{25}=\frac{16}{25}$

$f=\frac{25}{16}$cm, Power $P'=\frac{100}{f}=\frac{100}{25/16}=64$ D

Power of eye lens P' = 64 – 40 = 24 D

Hence, range of accommodation of normal eye i.e., eye lens is roughly 20 D to 24 D.

29. (D) From mirror M_2, $\angle i = 0°$

$\therefore$ $\angle r = 0°$ i.e., the reflected ray would retrace its path turning through 180°. Mirror M_2 has no effect.

30. (B) Using right hand grip rule for a solenoid, the direction of the curled fingers and thumb represent the current and magnetic North pole.

The magnetic pole of P and Q is North and South respectively.

The magnetic pole of R and S is North and South respectively.

31. (C) As eye is relaxed, focal length of eye lens is effectively decreased.

32. (A) Here, u = –20 cm, v = 12 + 12 – 20 = 4 cm

$\frac{1}{f}=\frac{1}{v}+\frac{1}{u}=\frac{1}{4}-\frac{1}{20}=\frac{4}{20}=\frac{1}{5}$

f = 5 cm.

33. (A) For one wire of cable,

Resistance, R = $\rho l/\pi(9\times10^{-3})^2=5\,\Omega$

For other wire of cable

Resistance

$R'=\rho l/\pi\,(3\times10^{-3})^2$

$= 9^2 \times 5 / 3^2 = 45\,\Omega$

When six wires each of resistance R' are connected in parallel, their effective resistance will be

$R_p=\frac{R'}{6}=\frac{45}{6}=7.5\ \Omega$

34. (C) A 'cross' signifies current going into the page. The force created is perpendicular to the current and magnetic field direction. Using Fleming's Left Hand Rule, the direction of the force is downwards.

35. (C) Angle 1 of prism - It is the angle between the two refracting faces of the prism.

Angle 9 of prism - Angle between the incident ray and emergent ray is called the angle of deviation.

CHEMISTRY

36. (C) The melting point of an alloy is usually lesser as compared to the metals present in it. Further alloying results in increased strength.

37. (B) The correct matching as

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

Burning of magnesium ribbon in air - Synthesis reaction

Reaction of iron with copper sulphate solution - Displacement reaction

Reaction of an acid with base - Double displacement reaction

Electrolysis of water - Decomposition reaction

38. (D) C_5H_{12} (Pentane) has three isomers only.

Isomer given in option (D) is not an isomer of pentane.

39. (D) pH value of a strong base is generally higher than 10.

Thus U and V are most likely to be household cleaning agents.

40. (D) Iron oxide is reduced to iron while carbon monoxide is oxidised to carbon dioxide.

$Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$

41. (C) NaOH being a strong base provides OH^- ions in solution and they are responsible for electrolytic conduction.

42. (B) The correct matching is

1 - q; 2 - r; 3 - p; 4 - s; 5 - t

1 - q

$$\underset{\text{Carbon Coal}}{C(s)} + \underset{\text{Oxygen (From air)}}{O_2(g)} \xrightarrow{\text{Combination}} \underset{\text{Carbon dioxide}}{CO_2(g)}$$

In this reaction two elements, carbon and oxygen are combining together to form a single compound, carbon dioxide. So, this is a combination reaction.

2 - r

$$\underset{\text{Silver bromide (Pale yellow)}}{2AgBr(s)} \xrightarrow[\text{(Decomposition)}]{\text{Light}} \underset{\text{Silver (Grevish yellow)}}{2Ag(s)} + \underset{\text{Bromine (Red–brown)}}{Br_2(g)}$$

In this reaction, pale yellow colour of silver bromide changes to greyish white due to the formation of silver metal. The decomposition of silver bromide is caused by light. The light may be sunlight or bulb light.

It is decomposition reaction.

3 - p

$$\underset{\text{Zinc (Silvery–white)}}{Zn(s)} + \underset{\text{Copper sulphate (Blue solution)}}{CuSO_4(aq)} \longrightarrow \underset{\text{Zinc sulphate (Colourless solution)}}{ZnSO_4(sq)} + \underset{\text{Copper (Red–brown)}}{Cu(S)}$$

In this reaction, zinc displaces copper from copper sulphate compound so that copper is set free (or liberated). The blue colour of copper sulphate solution fades due to the formation of zinc sulphate (which is colourless).

It is a displacement reaction.

4 - s

When copper is heated in air, it reacts with the oxygen of air to form a black compound copper oxide:

$$\underset{\text{Copper (Red brown)}}{2Cu} + \underset{\text{Oxygen (From air)}}{O_2} \xrightarrow{\text{Heat}} \underset{\text{Copper oxide (Black)}}{2CuO}$$

In this reaction, Cu is changing into CuO. This is the addition of oxygen and it is called oxidation.

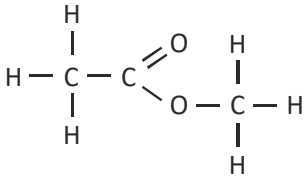
5 - t

When barium chloride solution is added to sodium sulphate solution, then a white precipitate of barium sulphate is formed alongwith sodium chloride solution:

$$\underset{\text{Barium chloride}}{BaCl_2(aq)} + \underset{\text{Sodium sulphate}}{Na_2SO_4(aq)} \longrightarrow \underset{\text{Barium sulphate (White ppt.)}}{BaSO_4(s)} + \underset{\text{Sodium chloride}}{2NaCl(aq)}$$

In this displacement reaction, two new compounds, barium sulphate and sodium chloride are formed. An exchange of ions takes place in this reaction. For example, the barium ions (Ba^{2+}) of barium chloride react with sulphate ions (SO_4^{2-}) of sodium sulphate to form barium sulphate ($Ba^{2+}SO_4^{2-}$ or $BaSO_4$). In this reaction, barium sulphate is formed as a white, insoluble solid (called precipitate)

43. (A) **(I)**

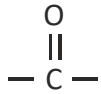


Molecular formula = $C_3H_6O_2$

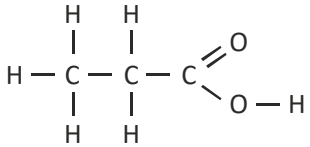
Relative molecular mass

= 12 × 3 + 6 + 16 × 2

= 36 + 6 + 32 = 74

Functional group  (Ester)

(II)



Molecular formula = $C_3H_6O_2$

Relative molecular mass = 74

Functional group  (Carboxylic acid)

Thus, these two compounds have same molecular formula but differ in the chemical reactions due to the presence of different functional groups.

44. (A) pH is a measure of the concentration of hydrogen ions in a solution. The lowest pH is the most acidic solution, the highest pH is the most alkaline solution. Sulfuric acid is a dibasic acid and will have twice the concentration of hydrogen ions than hydrochloric acid. Aqueous calcium hydroxide ($Ca(OH)_2 \rightarrow Ca^{2+} + 2OH^-$) will also give twice the concentration of hydroxide ions than aqueous sodium hydroxide ($NaOH \rightarrow Na^+ + OH^-$) and is thus more alkaline.

45. (C) Very reactive metals displace hydrogen on reaction with dilute HCl vigorously. They form very stable compounds that cannot be reduced to its metal by heating with a reducing agent, so Z is the most reactive. Unreactive metals have no reaction with dilute hydrochloric acid. So, Y is the least reactive.

BIOLOGY

46. (D) The photochemical phase of photosynthesis is also known as light reaction. It include light absorption water splitting and release of oxygen and the formation of ATP and NADPH.

47. (A) Tooth labelled as part P are incisors. Incisors help in cutting and biting food.

48. (A) P - iii; Q - i; R - iv; S - ii

49. (A) 12 pairs of cranial nerves and 31 pairs of spinal nerves.

50. (C) Regeneration reproduction in planaria.

51. (C) The given organism is Euglena. Euglena exhibits Mixotrophic nutrition.

52. (B) The process is respiration.

53. (C) X - Motor neuron; Y - Relay neuron; Z - Sensory neuron.

54. (D) Occipetal lobe interpretes vision.

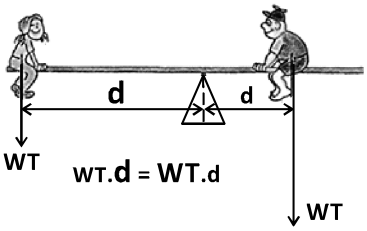
55. (D) X - Anther; Y - Stigma; Z - Ovary.

CRITICAL THINKING

56. (A) $(235)^2 + (1002)^2 = 1059229$

= 55225 + 1004004

57. (A) The short broom part is heavier. It balances the long handle just as kids of unequal weights can balance on a seesaw when the heavier kid sits closer to the fulcrum. Both the balanced broom and seesaw are evidence of equal and opposite torques - not equal weights.



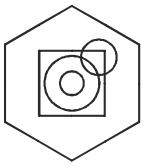
58. (C)

	Department			Color						
Person	CISF	BSF	CRPF	Green	Blue	Red	Pink	Black	Violet	Purple
A	✔	✘	✘	✘	✘	✘	✘	✘	✔	✘
B	✘	✔	✘	✔	✘	✘	✘	✘	✘	✘
C	✘	✘	✔	✘	✔	✘	✘	✘	✘	✘
D	✔	✘	✘	✘	✘	✔	✘	✘	✘	✘
E	✘	✔	✘	✘	✘	✘	✘	✘	✘	✔
F	✔	✘	✘	✘	✘	✘	✘	✔	✘	✘
G	✘	✘	✔	✘	✘	✘	✔	✘	✘	✘

Person	Department	Colour
A	CISF	Violet
B	BISF	Green
C	CRPF	Blue
D	CISF	Red
E	BSF	Purple
F	CISF	Black
G	CRPF	Pink

Following the explanation we get G's favourite colour is pink. Hence, the correct answer is option (C).

59. (C) So that the dot appears in two circles and the square;



60. (B)