UNIFIED COUNCIL

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SLSTSE

Test • Assess • Achieve

STATE LEVEL SCIENCE TALENT SEARCH EXAMINATION

CLASS - 10

Question Paper Code : US757

KEY

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

SOLUTIONS

MATHEMATICS

1. **(A)** Given $\log_{10}6 = 0.7782$ then

$\log_{10}36 = \log_{10}6^2$

$= 2\log_{10}6$

$= 2 \times 0.7782$

$\log_{10}36 = 1.5564$

2. **(B)** Let $\log_y x = a \Rightarrow \log_x y = \frac{1}{a}$

Given $a + \frac{1}{a} = \frac{10}{3}$

$\frac{a^2+1}{a} = \frac{10}{3}$

$3a^2 - 10a + 3 = 0$

$3a^2 - 9a - a + 3 = 0$

$3a\,(a-3)\,1(a-3) = 0$

$a = 3$ (OR) $a = \frac{1}{3}$

If $a = 3$ then $\Rightarrow \log_y x = 3$

$x = y^3$

Given $xy = 144$

$y^3 \times y = 144$

$y^4 = \left(\sqrt{12}\right)^4$

$y = \sqrt{12} = 2\sqrt{3}$

$x = y^3 = \left(2\sqrt{3}\right)^3 = 8 \times 3\sqrt{3} = 24\sqrt{3}$

$\therefore \frac{x+y}{2} = \frac{24\sqrt{3}+2\sqrt{3}}{2} = 13\sqrt{3}$

If $a = \frac{1}{3}$ then $\log_y x = \frac{1}{3}$

$$x = y^{\frac{1}{3}}$$

$$y = x^3$$

$\therefore$ But $xy = 144$

$$x^4 = 144$$

$$x = \sqrt{12}$$

$$y = 24\sqrt{3}$$

$$\frac{x+y}{2} = \frac{2\sqrt{3}+24\sqrt{3}}{2} = 13\sqrt{3}$$

3. **(D)** Given $x = \sqrt{1+\sqrt{1+\sqrt{1+.....\infty}}}$

$x = \sqrt{1+x}$

Squaring on both sides

$x^2 = 1 + x$

$x^2 - x - 1 = 0$

a = 1, b = – 1, c = – 1

$$x = \frac{-(-1) \pm \sqrt{1+4}}{2}$$

$$= \frac{1 \pm \sqrt{5}}{2}$$

$$= \frac{1+\sqrt{5}}{2} \text{ (OR) } \frac{1-\sqrt{5}}{2}$$

$$= \frac{1+2.236}{2}$$

$$= \frac{3.236}{2}$$

$x = 1.618$

$\therefore$ x lies between 1 & 2

4. **(B)** AM of $\frac{1}{2}, \frac{1}{3} = \frac{\frac{1}{2}+\frac{1}{3}}{2} = \frac{3+2}{6} \times \frac{1}{2} = \frac{5}{12}$

5. **(B)** LHS $= \frac{\sin 9^\circ}{\cos 81^\circ} - \frac{3\cos 17^\circ}{4 \sin 73^\circ} + \frac{\tan 14^\circ}{4 \cot 76^\circ}$

$$= \frac{\sin 9^\circ}{\cos (90^\circ - 9^\circ)} - \frac{3 \cos 17^\circ}{4 \sin (90^\circ - 17^\circ)} + \frac{\tan 14^\circ}{4 \cot (90 - 14^\circ)}$$

$$= \frac{\sin 9^\circ}{\sin 9^\circ} - \frac{3 \cos 17^\circ}{4 \cos 17^\circ} + \frac{\tan 14^\circ}{4 \tan 14^\circ}$$

$$= 1 - \frac{3}{4} + \frac{1}{4} = \frac{1}{2}$$

6. **(D)** Since a, b, c are in A.P $\Rightarrow$ $b = \frac{a+c}{2}$

a, b, c are in G.P $\Rightarrow$ $b = \sqrt{ac}$

$\therefore \frac{a+c}{2} = \sqrt{ac} \Rightarrow (a+c)^2 = 4ac \Rightarrow (a-c)^2 = 0$

$\Rightarrow a - c = 0 \Rightarrow a = c$

$\Rightarrow b = \sqrt{c^2} = c \quad \therefore a = b = c$

7. **(C)** Given $\alpha + \beta = -\frac{b}{a}$ & $\alpha\beta = \frac{c}{a}$

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

$$= \left(-\frac{b}{a}\right)^2 - 4\frac{c}{a} = \frac{b^2}{a^2} - \frac{4c}{a}$$

$$(\alpha - \beta)^2 = \frac{b^2 - 4ac}{a^2}$$

$$\alpha - \beta = \sqrt{\frac{b^2-4ac}{a^2}} = \frac{\sqrt{b^2-4ac}}{a}$$

8. **(A)** Given $6x^2 - 1 = 0$

$$\alpha\beta = \frac{c}{a} = -\frac{1}{6}$$

9. **(B)** Solving $x - y = 2$ & $3x + 4y = -15$ we get (–1, –3)

Slope of line joining (2, 3) & (1, 1) is

$$m_1 = \frac{y_2 - y_1}{x_2 - x_1} = \frac{1-3}{1-2} = 2$$

Let slope of line perpendicular to m_1 to m_2

$\therefore$ $m_1 \times m_2 = 1$

$2 \times m_2 = -1 \quad \Rightarrow \quad m_2 = -\frac{1}{2}$

Equation of the line pasing through (–1, –3)

Having slope $\frac{1}{2}$ is $y - y_1 = m_2 (x - x_1)$

$$y + 3 = -\frac{1}{2}(x + 1)$$

$2y + 6 = -x - 1$

$x + 2y + 7 = 0$

10. **(C)** Distance between O (0, 0) & P (–cosθ, sinθ)

$= \sqrt{(-\cos\theta - 0)^2 + (\sin\theta - 0)^2} = \sqrt{\cos^2\theta + \sin\theta} = \sqrt{1} = 1$

11. **(C)** Given $\Delta = 0$

$$\therefore \Delta = \frac{1}{2}\left|-3(6-9) + 7(9-12) + k(12-6)\right| = 0$$

$$|9 - 21 + 6k| = 0$$

$$6k - 12 = 0$$

$$6k = 12$$

$$k = 2$$

12. **(C)** Given AC = 13 cm & AB = 12 cm

$\Rightarrow$ BC = 5 cm $\quad [\because \angle B = 90°]$

$$\therefore S = \frac{a+b+c}{2} = \frac{13\,cm + 12\,cm + 5\,cm}{2} = 15\,cm$$

Area of $\Delta ABC = \frac{1}{2} \times AB \times BC = rs$

$$\Rightarrow \frac{1}{2} \times 12\,cm \times 5\,cm = r \times 15\,cm$$

$$r = \frac{30\,cm^2}{15\,cm} = 2\,cm$$

13. **(B)** Parallel lines are differ by constant term only

14. **(B)** Given sec 8θ = cosec 7θ

sec 8θ = sec (90° – 7θ)

$\therefore$ 8θ = 90° – 7θ

15θ = 90°

θ = 6°

$$\therefore \sin 10\theta = \sin 60° = \frac{\sqrt{3}}{2}$$

15. **(C)** X-axis divides the given line segment in the ratio $-y_1 : y_2 = -(-2) : 3 = 2 : 3$

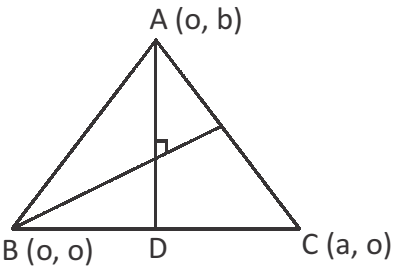
16. **(A)** Volume of solid = volume of pyramid + volume of cuboid

$$= \frac{1}{3} \times 5 \times 3 \times 4\ cm^3 + 5 \times 3 \times 2\ cm^3$$

$= 20\ cm^3 + 30\ cm^3$

$= 50\ cm^3$

17. **(D)**



Mid point of BC = D = $\left(\frac{a}{2}, 0\right)$

Slope of AD = $m_1 = \frac{0-b}{\frac{a}{2}-0} = \frac{-2b}{a}$

Mid point of AC = $\left(\frac{a}{2}, \frac{b}{2}\right)$ = E

Slope of BE = $m_2 = \frac{\left(\frac{b}{2}\right)}{\left(\frac{a}{2}\right)} = \frac{b}{a}$

Given $m_1 \times m_2 = -1$

$$\frac{-2b}{a} \times \frac{b}{a} = -1$$

$$a^2 = 2b^2$$

$$a = \pm\sqrt{2}\,b$$

18. **(C)** $f(x) = x^2 + 2x - 15$

$f(x+h) = (x+h)^2 + 2(x+h) - 15 = x^2 + 2hx + h^2 + 2x + 2h - 15$

$$\therefore \frac{f(x+h) - f(x)}{h}$$

$$= \frac{\left(x^2 + 2hx + h^2 + 2x + 2h - 15\right) - \left(x^2 + 2x - 15\right)}{h}$$

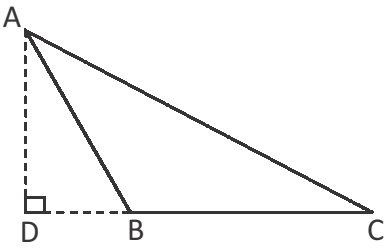
$$= \frac{x^2 + 2hx + h^2 + 2x + 2h - 15 - x^2 - 2x + 15}{h}$$

$$= \frac{2hx + h^2 + 2h}{h}$$

$$= \frac{h(2x + h + 2)}{h}$$

$= 2x + h + 2$

19. **(A)**



In $\Delta ADC, \angle D = 90°$

$\therefore AC^2 = AD^2 + (DB)^2$

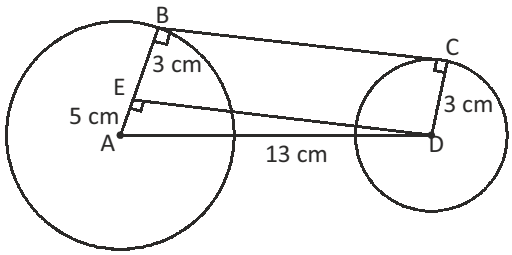
$= AD^2 + (BD + BC)^2$

$AC^2 = AD^2 + BD^2 + BC^2 + 2\ BC \times BD$

$AC^2 = AB^2 + BC^2 + 2\ BC \times BD$

$\left[\because \text{In } \Delta ADB, \angle D = 90° \therefore AB^2 = AD^2 + DB^2\right]$

20. **(D)**



Given AB = 8 cm & CD = 3 cm

AD = 13 cm

AE = AB – EB [$\because$ const CD = BE]

= 8 cm – 3 cm = 5 cm

In $\Delta ADE, \angle AED = 90° \Rightarrow ED^2 = AD^2 - AE^2$

$= 132 - 52$

$= 169 - 25$

$ED = \sqrt{144}$

ED = 12 cm

$\therefore$ BC = ED = 12 cm

21. **(D)** $\dfrac{1+2+3+4+.....+n}{1+3+5+.....+(2n-1)} = \dfrac{n\left(\dfrac{n+1}{2}\right)}{n^2} = \dfrac{n+1}{2n}$

22. **(C)** Given $s_n = 2n^2 + 3n$

$s_1 = 2(1) + 3(1) = 5 = 6$

$s_2 = 2(2^2) + 3(2) = 8 + 6 = 14 = t_1 + t_2$

$\therefore\ t_2 = s_2 - s_1 = 14 - 5 = 9$

$\therefore$ 5, 9, 13, 17 .....

$t_n = a + (n-1)\ d = 5 = (n-1)^4 = (4n+1)$

23. **(B)** $\cot 29° \times \cot 61° = \cot (90° - 61°) \times \cot 61°$

$= \tan 61° \times \cot 61°$

$= \tan 61° \times \cot 61°$

$= 1$

$= (\cot 45°)^2$

$\therefore\ b^2 = ac \Rightarrow$ a, b, c are in GP

24. **(C)** In $\Delta ABC, \angle C = 90° \Rightarrow$ AB2 = AC2 + CB2

$\therefore$ AB = 5 cm

Area of $\Delta ABC = \dfrac{1}{2}\ AC \times CB = \dfrac{1}{2} \times AB \times CD$

3 cm × 4 cm = 5 cm × CD

$CD = \dfrac{12\ cm}{5}$

25. **(A)** $3\pi Vh^3 - c^2h^2 + 9v^2$

$= 3 \times \pi \times \dfrac{1}{3}\pi r^2 h \times h^3 - (\pi rl)^2 h^2 + 9\left(\dfrac{1}{3}\pi r^2 h\right)^2$

$= \pi^2 r^2 h^4 - \pi^2 r^2 (h^2 + r^2)\ h^2 + 9 \times \dfrac{1}{9}\pi^2 r^4 h^2$

$= \pi^2 r^2 h^4 - \pi^2 r^2 h^4 - \pi^2 r^4 h^2 + \pi^2 r^4 h^2$

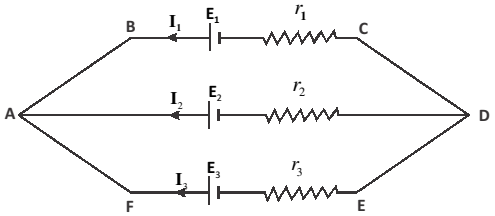
$= 0$

PHYSICS

26. **(D)** Here, $E_1 = 2$ V; $E_2 = 1$ V; $E_3 = 4$ V

and $r_1 = 4\ \Omega$; $r_2 = 3\ \Omega$; $r_3 = 2\ \Omega$

Suppose the currents I_1, I_2 and I_3 flow from the three cells as shown below.



Then by applying Kirchhoff's First law at point A, we have $I_1 + I_2 + I_3 = 0$ ....(*i*)

Applying Kirchhoff's second law to the closed part ABCDA of the circuit, we have

$I_1 r_1 - I_2 r_2 = E_1 - E_2$ or $I_1 \times 4 - I_2 \times 3 = 2 - 1$

or $4I_1 - 3I_2 = 1$ ....(*ii*)

Applying Kirchhoff's second law to the closed part ADEFA of the circuit, we have

$I_2 r_2 - I_3 r_3 = E_2 - E_3$ or $I_2 \times 3 - I_3 \times 2 = 1 - 4$

or $3I_2 - 2I_3 = -3$ ....(*iii*)

Solving the equations (*i*), (*ii*) and (*iii*), we obtain

$$I_1 = -\frac{2}{13}A;\ I_2 = -\frac{7}{13}A \text{ and } I_3 = \frac{9}{13}A$$

27. **(A)** A convex mirror always produces only virtual and diminished images of objects.

28. **(A)** The focal length of the required concave lens is 60 cm.

$$\text{Power } P = \frac{1}{f} = \frac{1}{-0.6} = -1.66\ D$$

29. **(D)** Magnetic field does not change with change in diameter of a wire carrying current.

30. **(C)** When a light ray travels from one medium to another medium, the more the light ray is refracted away from the normal, the lesser is the refractive index of that medium.

31. **(C)** Current flowing through the lamp

= V ÷ R

= 12 V ÷ 6 Ω = 2 A

Power dissipated by the lamp

= VI = 12 × 2 = 24 W

32. **(D)** All the given mirrors form a virtual image of a real object according to the given positions.

33. **(D)** A convex lens of focal length 50 cm is to be used.

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

$$-\frac{1}{50}+\frac{1}{25}=\frac{1}{f},\frac{-1+2}{50}=\frac{1}{f},\frac{1}{50}=\frac{1}{f}$$

f = 50 cm

34. **(A)** The deflection in the galvanometer occurs when the magnet is pushed into the coil due to relative motion between the two to induce emf.

35. **(D)** As per the given figure n_i, sin i = n_r sin r,

(1.3) sin 60° = (1.5) sin (r) $\frac{13}{10}\times\frac{\sqrt{3}}{2}=\frac{3}{2}$ = sinr, sinr = 0.577, r = 48.6°

CHEMISTRY

36. **(B)** According to Hund's rule, 2 electrons of 2*p* will be $2p_x^1 2p_y^1$.

37. **(C)** The correct matching is

a-5, b-4, c-3, d-2, e-1

The general formula of : alkanes is C_nH_{2n+2}. The formula of Hexane - C_6H_{14}, Ethane - C_2H_6, Butane C_4H_{10}. Alkenes have general formula C_nH_{2n}. The formula of Pentene is C_5H_{10} and Hexene is C_6H_{12}.

38. **(B)** Plaster of Paris is used in all the given applications.

39. **(B)** Let the given ratio of atomic weights of X, Y, Z be $5x$, $11x$, $17x$ respectively.

Sum of extreme elements
$(5x + 17x)$ = 176 (given).

$22x = 176,\ x = \frac{176}{22} = 8$

∴ At wt. of X = 5 × 8 = 40,

Y = 11 × 8 = 88,

Z = 17 × 8 = 136.

40. **(C)** $K^{+-}C \equiv N$ contains both ionic and covalent bonds.

41. **(A)** During polling process, wood gas reduces Cu_2O to Cu. Hence, it is employed for the removal of Cu_2O from Cu.

42. **(D)** 1 mole of acetic acid reacts with 1 mole of ethyl alcohol to form 1 mole of ester.

43. **(D)** Calcium sulphate is an insoluble salt that does not react with acidic soil and increase its pH.

44. **(C)** The correct matching is

a-3, b-5, c-2, d-1, e-4

Dobereiner - Law of triads

Mendeleev - Periodic table

Neils Bohr - Long form of periodic table

Linus Pauling - Electronegativity scale

Newland - Law of octaves.

45. **(A)** As per the given chemical reaction, Calcium carbonate on heating forms calcium oxide and carbon dioxide gas is evolved. The physical quantity required to form the given products is heating. Without heating, the products are not formed.

BIOLOGY

46. **(B)** Complementary base of adenine is thymine in DNA.

47. **(C)** Honey bees help in pollination.

48. **(B)** X represent synaptic cleft.

49. **(B)** Phloem tissue is present beneath the bark it carries sugars. Due to the removal of outregions of a tree phloem tissue get damage and the tree is deprived of sugars.

50. **(C)** Euglena exhibits mixotrophic nutrition.

51. **(A)** Chromosome of sperm determines the sex of a baby. It X of sperm fuses with X of egg it results in XX a baby girl.

52. **(C)** Archaeopteryx is the connecting link between birds and replits

53. **(B)** Sun $\rightarrow$ grass $\rightarrow$ Insects $\rightarrow$ frog.

54. **(C)** The procedure of cleaning blood using artificial kidney machine is called dialysi.

55. **(B)** The aim of the given experiment is to prove that carbon dioxide is estenilial for photosynthesis.

CRITICAL THINKING

56. **(B)** $P \times Q \rightarrow$ P is the wife of Q

$Q \,\%\, R \rightarrow$ Q is the father of R

$R - T \rightarrow$ R is the brother of T

$T + S \rightarrow$ T is the sister of S

Therefore, T is the daughter of P

57. **(B)** From the first two statements, we know that of the three classes, Class A has the highest enrollment, so the third statement must be false.

58. **(A)** All mothers are women and some mothers and some women may be engineers

59. **(C)** $\frac{1988}{7} \Rightarrow 284$ R 0, 1988 = V, 1987 = u, 1986 = T

60. **(C)** $(10 + 8 + 14) \div 2 = 16$

The meteorologist recorded 16 days.

THE END