IIT – JEE: 2024 **TW TEST (ADV)** **DATE: 02/10/22**

TOPIC: KINEMATICS - II

Answer Key

1.	(C)	2.	(B)	3.	(D)	4.	(B)	5.	(A)
6.	(C)	7.	(D)	8.	(B)	9.	(C)	10.	(B)
11.	(A)	12.	(A)	13.	(A)	14.	(B)	15.	(A)
16.	(B)	17.	(C)	18.	(B)	19.	(C)	20.	(B)
21.	(A)	22.	(A)	23.	(C)	24.	(A)	25.	(B)

SOLUTION

1. (C)

$$y = x\tan\theta - \frac{gx^2}{2u^2\cos^2\theta} \Rightarrow \tan\theta = 0.5 \Rightarrow \cos\theta = \frac{2}{\sqrt{5}}$$

Also, $\dfrac{g}{2u^2 \times \frac{4}{5}} = 0.04 \Rightarrow y = 12.5 \text{ m/s}$

2. (B)

$x = 0.3n$; $y = -0.2n$

Equation of trajectory : $y = -\dfrac{gx^2}{2u^2} \Rightarrow n = 9$

3. (D)

Time of flight = 1 + 3 = 4 sec (using symmetry)

4. (B)

$$y = x\tan\theta - \frac{gx^2}{2u^2\cos^2\theta} \Rightarrow \tan\theta = 1$$

5. (A)

Distance travelled = area under the v-t curve

$$= \frac{20\times 2}{2} + 20\times 2 + 20\times 1 + \frac{20\times 1}{2} + \frac{20\times 1}{2} = 100\,\text{m}$$

6. (C)

The displacement of the body during the time *t* as it reaches the point of projection

$\Rightarrow \quad S = 0 \Rightarrow v_0 t - \frac{1}{2}gt^2 = 0 \qquad\qquad \Rightarrow t = \frac{2v_0}{g}$

During the same time *t*, the body moves in absence of gravity through a distance $D' = v.t$, because in absence of gravity *g* = 0

$$\Rightarrow D' = v_0\left(\frac{2v_0}{g}\right) = \frac{2v_0}{g} \qquad ...(1)$$

In presence of gravity, the total distance covered is

$$= D = 2H = 2\frac{v_0^2}{2g} = \frac{v_0^2}{g} \qquad ...(2)$$

$(1) \div (2) \Rightarrow D' = 2D$.

7. (D)

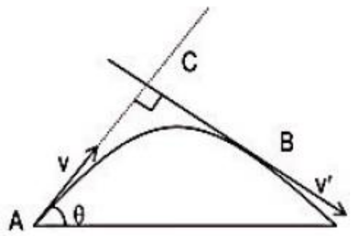
$\vec{v} = \vec{u} + \vec{a}t$

Considering along the line *AC*

$0 = v - g\sin\theta t \Rightarrow t = \frac{v}{g\sin\theta}$

Now, consider along the line *CB*

$v' = 0 + g\cos\theta\frac{v}{g\sin\theta} = v\cot\theta$



8. (B)

Drift $(\Delta x) = (v_{b,x})\Delta t = (v_{b,r}\cos\theta + v_r)\Delta t$

Where $v_{b,x} =$ velocity of boat w.r.t. ground

$v_{\perp,r} =$ velocity of boat w.r.t. ground

$v_r =$ velocity of river w.r.t. ground

For $\Delta x = 0,\ v_r = -v_{br}\cos\theta$

$\Rightarrow (v_r)_{\max} = v_{br}$

For, $v_r > v_{br}$ we can not have zero drift.

9. (C)

Drift $= \frac{d}{2} = \frac{(V_r - V_s\sin 30)d}{V_s\cos 30}$

$\Rightarrow \quad V_s = 4(2-\sqrt{3})V$

10. (B)

When the horizontal range is maximum, the maximum height attained is $\frac{R}{4} = 100\,\text{m}$.

The velocity of the projectile is minimum at the highest point.

$\therefore$ Required point is (200, 100).

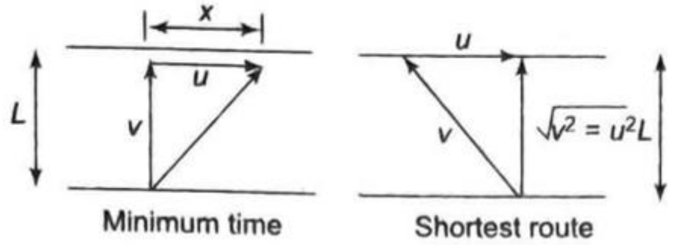
11. (A)

The maximum distance covered by the vehicle before coming to rest $= \frac{v^2}{2a} = \frac{(15)^2}{2(0.3)} = 375\,\text{m}$

The corresponding time $= t = \frac{v}{a} = \frac{15}{0.3} = 50\,\text{sec}$

$\therefore$ The distance of the vehicle from the traffic signal after one minute = 400 – 375 = 25 m

12. (A)



$$10 = \frac{L}{v} \quad ...(i)$$

$$12.5 = \frac{L}{\sqrt{v^2 - u^2}} = \frac{L}{v\sqrt{1 - u^2/v^2}} \quad ...(ii)$$

From (i) and (ii),

$$\frac{1}{12.5} = \frac{L}{v} \times \frac{v\sqrt{1-u^2/v^2}}{L}$$

$$\frac{4}{5} = \sqrt{1 - \frac{12^2}{v^2}}$$

$$\frac{16}{25} = 1 - \frac{12^2}{v^2} \Rightarrow \frac{12^2}{v^2} = 1 - \frac{16}{25} = \frac{9}{25}$$

$$\frac{12}{v} = \frac{3}{5} \Rightarrow v = \frac{12 \times 5}{3} = 20 \text{ m/s}$$

13. (A)

Given, acceleration $a = bt$

$$\Rightarrow \frac{dv}{dt} = bt \Rightarrow v = \frac{bt^2}{2} + c$$

At $t = 0, v = v_0 \Rightarrow c = v_0$

So, $v = \frac{bt^2}{2} + v_0$

$$\Rightarrow \frac{ds}{dt} = \frac{bt^2}{2} + v_0$$

$$\Rightarrow s = \frac{bt^3}{6} + v_0 t$$

14. (B)

At 4 s

$$u = at = 8 \text{ m/s}$$

$$s_1 = \frac{1}{2}at^2 = \frac{1}{2} \times 2 \times 4^2 = 16 \text{ m}$$

From 4 s to 8 s

$a = 0$, v = constant = 8 m/s

$$s_2 = 8 \times 4 = 32 \text{ m}$$

$$u_t = \frac{at^2}{2}$$

From 8s to 12 s

$s_3 = s_1 = 16\,\text{m}$

$\therefore \quad s_{\text{Total}} = s_1 + s_2 + s_3 = 64\,\text{m}$

15. (A)

At the time of overtaking,

$s_1 = s_2$

$\therefore \quad 2ut + \frac{1}{2}at^2 = ut + \frac{1}{2}(2a)t^2$

$\therefore \quad t = \frac{2u}{a}$

$\therefore \quad s_1$ (or s_2) = $(2u)\left(\frac{2u}{a}\right) + \frac{1}{2}(a)\left(\frac{2u}{a}\right)^2$

$= \frac{6u^2}{a}$

16. (B)

s = net area of v-t graph

At 2s, net area = 0

$\therefore \quad s = 0$

and the particle crosses its initial position.

17. (C)

18. (B)

$\sqrt{x} = t + 3$

$\therefore \quad x = (t+3)^2$

or $\quad v = \frac{dx}{dt}$

$= 2(t+3)$

$\therefore \quad v$-t equation is linear.

19. (C)

$\Delta v = v_f - v_i =$ area under a-t graph

$v_i = 0$

$\Rightarrow \quad v_f = \text{area}$

= 40 + 50

= 90 m/s

20. (B)

$v^2 = 25 + 25\text{s}$

or $\quad v^2 = (5)^2 + 2(12.5)\text{s}$

Now compare with $v^2 = u^2 + 2a\text{s}$

21. (A)

22. (A)

$$a = v \cdot \frac{dv}{ds} = (4)(-\tan 60^\circ)$$

$$= -4\sqrt{3}\,\text{m/s}^2$$

23. (C)

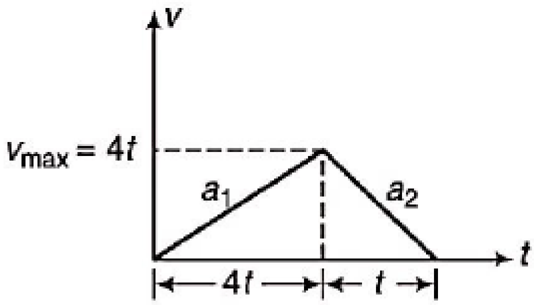
Relative velocity of A with respect to B should be along AB or absolute velocity components perpendicular AB should be same.

$\therefore \quad \frac{2u}{3}\sin\theta = u\sin 30^\circ$

$\therefore \quad \theta = \sin^{-1}\left(\frac{3}{4}\right)$

24. (A)

Deceleration is four times. Therefore, deceleration time should be $\frac{1}{4}$th.



$v_{\text{max}} = (a_1)(4t) = (1)(4t) = 4t$

Area of v-t graph = displacement

$\therefore \quad 200 = \frac{1}{2}(5t)(4t)$

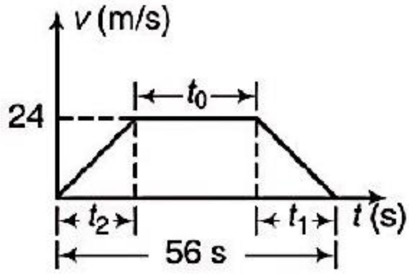
or $\quad t = \sqrt{20}\,\text{s}$

Total journey time $= 5t = 22.4\,\text{s}$

25. (B)

Area of v-t graph = displacement

$\therefore \quad 1032 = \frac{1}{2}(56 + t_0)(24) \quad \text{or} \quad t_0 = 30\,\text{s}$



Deceleration time $t_1 = \frac{24}{4} = 6\,\text{s}$

$\therefore$ Acceleration time $t_2 = 56 - t_0 - t_1 = 20\,\text{s}$

$\therefore$ Acceleration $= \dfrac{24}{20} = 1.2\ \text{m/s}^2$

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TOPIC: ATOMIC STRUCTURE & MOLE CONCEPT

Answer Key

26.	(A)	27.	(A)	28.	(D)	29.	(A)	30.	(D)
31.	(A)	32.	(C)	33.	(C)	34.	(D)	35.	(A)
36.	(B)	37.	(C)	38.	(B)	39.	(D)	40.	(C)
41.	(B)	42.	(A)	43.	(D)	44.	(B)	45.	(C)
46.	(A)	47.	(B)	48.	(B)	49.	(A)	50.	(D)

SOLUTION

26. (A)

Molar mass of $C_{12}H_{22}O_{11}$ = 342 g

342 g sugar has = 12 N atoms of C

$\therefore$ 1.71 g sugar has $= \frac{12\times 6.02\times 10^{23}\times 1.71}{342}$ atoms

$= 3.6\times 10^{22}$ atoms

27. (A)

Per cent of oxygen in NaOH $= \frac{16\times 100}{40} = 40$.

28. (D)

1 mole P_4 = N molecules of P_4 = 4 N atoms of P_4.

29. (A)

Mole fraction $= \frac{n_1}{n_1+n_2} = \frac{\text{Molecules of solute}}{\text{Total molecules of solute and solvent}}$

$= \frac{10^{24}}{10^{24}+10^{25}} = \frac{1}{11} = 0.09$

30. (D)

$3BaCl_2 + 2Na_3PO_4 \rightarrow Ba_3(PO_4)_2\downarrow + 6NaCl$

0.50	0.20	0	0
0.20	0.00	0.10	0.60

31. (A)

$$\text{Molality} = \frac{\text{Moles of solute}}{\text{wt. of solvent in kg}}$$

32. (C)

milli mole of solution I = $750 \times 0.5 = 375$

milli mole of solution II = $250 \times 2 = 500$

total milli mole in mixture = 375 + 500 = 875

$$\therefore \text{ Molarity } = \frac{875}{1000} = 0.875\ \text{M}$$

33. (C)

Mole of N_2 is $= \frac{4}{28} = \frac{1}{7}$ (the lowest value)

34. (D)

9.108×10^{-31} kg = 1 electron

$$\therefore\ 1\,\text{kg} = \frac{1}{9.108 \times 10^{-31}} \text{ electron}$$

$$= \frac{1}{9.108 \times 10^{-31}} \times \frac{1}{6.023 \times 0^{23}} \text{ mole electron}$$

35. (A)

558.5 g Fe $\frac{558.5}{55.85}$ mole Fe = 10 mole Fe

= 2 × 5 mole C = 2 × 60 g C

36. (B)

$$M = \frac{\text{moles of urea}}{\text{volume in litre}} = \frac{6.02 \times 10^{20}}{6.02 \times 10^{23} \times \frac{100}{1000}} = 0.01\ \text{M}$$

37. (C)

$$m = \frac{\text{moles of } CH_3COOH}{\text{wt. of solvent in kg}} = \frac{2.05 \times 1000}{897} = 2.285$$

Wt. of solvent = wt. of solution – wt. of solute

= [1000 × 1.02 – 2.05 × 60] = 897 g

38. (B)

Let the formula of hydrocarbon be C_aH_b

$$C_aH_b + \left(a + \frac{b}{4}\right)O_2 = a\,CO_2 + \frac{b}{2}H_2O$$

mole of CO_2 (a) formed $= \frac{3.08}{44} = 0.07$

mole of H_2O formed $\left(\frac{b}{2}\right) = \frac{0.72}{18} = 0.04$

$\therefore \quad \dfrac{a}{b/2} = \dfrac{0.07}{0.04}$

or $\quad \dfrac{a}{b} = \dfrac{0.07}{0.08} = \dfrac{7}{8}$

$\therefore$ mole ratio of C and H : : 7 : 8

Thus empirical formula is C_7H_8.

39. (D)

Average isotopic wt. $= \Sigma\% \times$ isotopic wt.

$$= \frac{(\text{per cent} \times \text{wt. of isotope}) + (\text{per cent} \times \text{wt. of other isotope})}{100}$$

$$\therefore \quad 20.2 = \frac{a \times 20 + (100 - a) \times 22}{100}$$

$$\therefore \quad a = 90$$

Per cent of heavier isotope = 100 – 90 = 10

40. (C)

$$\frac{1}{\lambda_{\text{Lyman}}} = R_H\left[\frac{1}{1^2} - \frac{1}{\infty^2}\right] = R_H$$

$$\frac{1}{\lambda_{\text{Balmer}}} = R_H\left[\frac{1}{2^2} - \frac{1}{\infty^2}\right] = \frac{R_H}{4}$$

$$\frac{\lambda_{\text{Balmer}}}{\lambda_{\text{Lyman}}} = 4 \text{ or } \lambda_B = 4 \times 912 \text{ Å}$$

41. (B)

Angular momentum for n and $(n + 1)$ shells are $\dfrac{nh}{2\pi}$ and $(n+1)\dfrac{h}{2\pi}$.

Thus, difference in angular momentum of two successive orbitsl is $(n+1)\dfrac{h}{2\pi} - \dfrac{nh}{2\pi} = \dfrac{h}{2\pi}$

42. (A)

For longest λ of Balmer series $n_1 = 1$ and $n_2 = 2$,

$$\frac{1}{\lambda} = R_H\left[\frac{1}{n_1^2} - \frac{1}{n_2^2}\right]$$

Because $\Delta E = \dfrac{hc}{\lambda}$ is minimum when λ is longest.

Thus, $\Delta E = E_2 - E_1$.

Thus, $\dfrac{1}{\lambda} = R_H \times \left[\dfrac{1}{1^2} - \dfrac{1}{2^2}\right] = \dfrac{3}{4} \times 109678$

$\therefore \ \lambda = 1.215 \times 10^{-15} \text{ cm} = 1215 \text{ Å}$

43. (D)

$$\Delta u = \frac{0.1}{100} \times 10 = 10^{-2} \text{ m sec}^{-1}; \text{ Now } \Delta u \cdot \Delta X = \frac{h}{4\pi m}$$

$$\therefore \quad \Delta X = \frac{6.625 \times 10^{-34}}{4 \times 10^{-2} \times 3.14 \times 200 \times 10^{-3}} = 2.64 \times 10^{-32} \text{ m}$$

44. (B)

All the three electrons are to be kept in 1*s*.

45. (C)

(n + l) for rest all is = 7;

For 3*s* it is 3 + 0 = 3.

46. (A)

$$E_{2(\text{Be}^{3+})} = E_{2(\text{H})} \times Z^2; \qquad \text{Also } E_{2(\text{H})} = \frac{E_{1(\text{H})}}{2^2}$$

$$\therefore \quad E_{2(\text{Be}^{3+})} = \frac{E_{1(\text{H})}}{2^2} \times 4^2 = 4 \times E_{1(\text{H})}$$

47. (B)

$$r_n = r_1 \times n^2$$

$$r_3 = 3^2 x = 9x$$

Also, $mur_3 = \frac{3h}{2\pi}$

or $\quad mu = 3\frac{h}{2\pi \cdot 9x} = \frac{h}{6\pi x}$

or $\quad \lambda = \frac{h}{mu} = \frac{h \cdot 6\pi x}{h} = 6\pi x$

48. (B)

Electronic configuration of atom with atom no. 105 is : $1s^2, 2s^2 2p^6, 3s^2 3p^6 3d^{10}, 4s^2 4p^6 4d^{10}, 5s^2 5p^6 5d^{10} \underline{5f^{14}}, 6s^2 6p^6 \underline{6d^3}, 7s^2$.

The underlined orbitals have (n + l) = 8.

49. (A)

Pd : [Kr]$4d^{10}$. An exception.

50. (D)

Ground state of hydrogen atom, *i.e.*, 1*s*

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TOPIC: INEQUATIONS & EQUATIONS

Answer Key

51.	(A)	52.	(C)	53.	(C)	54.	(D)	55.	(A)
56.	(D)	57.	(B)	58.	(A)	59.	(B)	60.	(B)
61.	(D)	62.	(B)	63.	(C)	64.	(C)	65.	(C)
66.	(A)	67.	(D)	68.	(C)	69.	(D)	70.	(A)
71.	(D)	72.	(D)	73.	(A)	74.	(A)	75.	(C)

SOLUTIONS

51. (A)

$a = \log_2 3$

$b = \log_9 4$

$\Rightarrow\ ab = \log_2 3 \log_3 2 = 1$.

52. (C)

Let $4 + \log_3(x) = N \ \Rightarrow\ \log_2 N = 3 \ \Rightarrow\ N = 2^3$

$N = 4 + \log_3 x = 8$

$\therefore\ N = 8$

$\log_3 x = 4 \ \Rightarrow\ x = 81$.

Sum of digits of x = 9.

53. (C)

Using $\log_{10} p + \log_{10} r - \log_{10} s = \log_{10}\left(\frac{pr}{s}\right)$

$$\log_{10}\left(\frac{x(x+2)}{5x+4}\right) = 0$$

$\Rightarrow\ x^2 + 2x = 5x + 4$

$\Rightarrow\ x = 4,\ x = -1$

(reject)

54. (D)

$x^{(1+\log_{10} x)} = 10^5 \cdot x$

Taking log on both sides to base 10 :

$(1 + \log_{10} x)(\log_{10} x) = 5 + \log_{10} x$

$\log_{10} x = t \;\Rightarrow\; t(1+t) = 5+t$

$\Rightarrow\; t^2 + t = 5 + t$

$\Rightarrow\; t = 5^{1/2}$ or $t = -5^{1/2}$

$\Rightarrow\; \log_{10} x = 5^{1/2};\; \log_{10} x = -5^{1/2}$

$\Rightarrow\; x = 10^{5^{1/2}};\; x = 10^{-5^{1/2}}$

Product = 10^o = 1

55. (A)

Take log on both sides

$\frac{3}{2} + 2(\ln x)^2 = 4\ln x$

$t = \ln x \qquad ...(1)$

$2t^2 - 4t + \frac{3}{2} = 0 \begin{cases} t_1 \to t_1 \ln x_1 \\ t_2 \to t_2 \ln x_2 \end{cases}$

$t_1 + t_2 = 2$

$\ln x_1 + \ln x_2 = 2$ (from Eqs. (1))

$\ln(x_1 x_2) = 2 \;\Rightarrow\; x_1 x_2 = e^2$

Note: $\log_e x = \ln x$; where 'e' is Napier's constant. Its irrational quantity.

56. (D)

57. (B)

Wavy curve method

58. (A)

Domain: $1 - \sqrt{1+x} > 0$ & $3 - \sqrt{1+x} > 0$

$\Rightarrow\; \sqrt{1+x} < 1$

Put $\sqrt{1+x} = t \;\Rightarrow\; t \ge 0$

$(1-t)^2 = 3 - t$

$t^2 - t - 2 = 0$

$t = 2, -1$ (both rejected)

$\Rightarrow$ No real solution

59. (B)

$t = \log_3 x$

$\sqrt{(1+2t)\left(2+\frac{t}{2}\right)} = \frac{3}{2}t$

$t > 0$

Squaring

$2 + \frac{t}{2} + 4t + t^2 = \frac{9}{4}t^2$

$5t^2 - 18t - 8 = 0$

$5t^2 - 20t + 2t - 8 = 0$

$(5t+2)(t-4) = 0$

$\Rightarrow\ t = 4$

$\Rightarrow\ \log_3 x = 4$

$x = 81$

60. (B)

$7^{x^2} = a,\ 7^{x+12} = b$

$a^2 - 2ab + b^2 = 0$

$(a-b)^2 = 0$

$\Rightarrow\ a = b$

$\Rightarrow\ x^2 = x + 12$

$x^2 - x - 12 = 0$

$x^2 - 4x + 3x - 12 = 0$

$(x+3)(x-4) = 0$

$x = 4, -3.$

61. (D)

$\frac{x-3}{11-x} \geq 0$

$\frac{x-3}{x-11} \leq 0$

$x \in [3, 11)$

62. (B)

$0 < x^2 - 5x + 6 \leq 2$

63. (C)

$x = \log_2 \sqrt{56 + \sqrt{56 + \sqrt{56 + \sqrt{56 + ...\infty}}}}$

$2^x = \sqrt{56 + \sqrt{56 + \sqrt{56 + ...}}}$

$2^x = \sqrt{56 + 2^x}$

$2^{2x} - 2^x = 56 \Rightarrow 2^{2x} - 2^x - 56 = 0$

Let $2^x = t$ $\quad\quad \therefore\ t^2 - t - 56 = 0$

$t = 8$ & $t = -7x$

$2^x = 8 \quad \therefore\ 2^x = 2^3 \Rightarrow x = 3$

$\therefore\ 2 < x < 4$

64. (C)

$-2 < x - 5 < 2$

$3 < x < 7$

65. (C)

Let $\log_2 7$ be rational then $\log_2 7 = \frac{p}{q}$ $(q \neq 0)$

$7 = 2^{p/q} \Rightarrow 2^p = 7^q$

Here all power of 2 is even but 7 is odd.

$\therefore$ our assumption is wrong

$\therefore$ $\log_2 7$ is irrational.

66. (A)

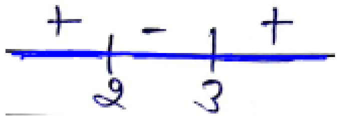
Case (1) : $t < 2$

$-2t + 4 = 2 - t + 3$

$t = -1$

$\log_5 x = -1$

$\Rightarrow x = \frac{1}{5}$



Case (2) : $2 \leq t < 3$

$2t - 4 = 2 - t + 3$

$3t = 9$

$t = 3$

$\log_5 x = 3$

Case (3) : $t \geq 3$

$2t - 4 = 2 + t - 3$

$t = 3$

$\log_5 x = 3$

$x = 125$

67. (D)

68. (C)

69. (D)

$(\log_2 x)^2 + 4(\log_2 x)^2 - 1 = 0$

Let $\log_2 x = t$

$t^2 + 4t - 1 = 0$

$t = \frac{-4 \pm \sqrt{16+4}}{2}$

$t = -2 \pm \sqrt{5}$

$\log_2 x = -2 \pm \sqrt{5}$

$x = 2^{-2 \pm \sqrt{5}}$

$\therefore$ $\beta = 2^{-2-\sqrt{5}}$

$\alpha = 2^{-2+\sqrt{5}}$

$\alpha\beta = 2^{-4} = \frac{1}{16}$

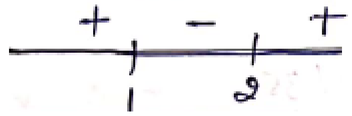
70. (A)

$\log_{0.3}(x-1) < \frac{1}{2}\log_{0.3}(x-1)$

$x-1 > (x-1)^{1/2}$

$x^2+1-2x > x-1$

$x^2-3x+2>0 \Rightarrow (x-2)(x-1)>0$



$x \in (-\infty, 1) \cup (2, \infty)$ ...(1)

& $x-1>0 \Rightarrow x>1 \Rightarrow x \in (1, \infty)$ ...(2)

$\therefore$ (1) & (2)

$\Rightarrow (2, \infty)$

71. (D)

$-5x+6 \le x+1$ $x \ge \frac{5}{6}$

$x^2-5x+6 \ge 0$ $x \in (-\infty, 2] \cup [3, \infty)$

Intersection

$\left[\frac{5}{6}, 2\right] \cup [3, \infty)$ Ans.

72. (D)

Domain: $x-3>0,\ x-3 \ne 1\ \&\ x^3-3x^2-4x+8>0$

$x^3-3x^2-4x+8 = (x-3)^3$

$6x^2-31x+35=0$

$x = \frac{31 \pm \sqrt{(31)^2-4(6)(35)}}{12}$

$\Rightarrow x = \frac{31 \pm 11}{12} \quad \Rightarrow x = \begin{cases} \frac{42}{12} = \frac{7}{2} \\ \frac{20}{12} = \frac{5}{3} \end{cases}$

$\therefore$ No. of solution = 1 as $x = \frac{5}{3}$ is rejected

73. (A)

Domain: $\log_2 x > 0$ i.e. $x > 1$

$9^{\log_3(\log_2 x)} = \log_2 x - (\log_2 x)^2 + 1$

$3^{2^{\log 3(\log_2 x)}} = \log_2 x - (\log_2 x)^2 + 1$

$(\log_2 x)^2 + (\log_2 x)^2 - (\log_2 x) - 1 = 0$

$\therefore$ By property $a^{\log_a} = 1$

Let $\log_2 x = t$

$\therefore$ $2t^2 - t - 1 = 0$

$2t(t-1) + 1(t-1) = 0$

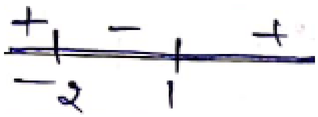
$t = 1, -\frac{1}{2} \Rightarrow$ only $t = 1$ acceptable

$\Rightarrow \log_2 x = 1 \Rightarrow x = 2 \Rightarrow$ Sum of roots = 2

74. (A)

$\frac{1}{2}\log_5 x^2 + (\log_5 x)^2 - 2 < 0$

Let $\log_5 x = t$



$\log_5 x + (\log_5 x)^2 - 2 < 0$

$t^2 + t - 2 < 0$

$(t+2)(t-1) < 0$

$t \in (-2, 1)$

$\therefore$ $\log_5 x \in (-2, 1)$

$\therefore$ $x \in \left(\frac{1}{25}, 5\right)$

75. (C)

$2 \cdot \log_9 \left(3^{1-x} + 2\right) = 1 + \log_3 \left(4 \cdot 3^x - 1\right)$

$\frac{2}{2} \cdot \log_3 \left[\frac{3}{3^x} + 2\right] = \log_3 3 + \log_3 \left(4 \cdot 3^x - 1\right)$

Let $3^x = t \Rightarrow t > 0$

$\log_3 \left[\frac{3}{t} + 2\right] = \log_3 \left[3 \cdot \left(4 \cdot 3^x - 1\right)\right]$

$3 + 2t = 12t^2 - 3t$

$12t^2 - 5t - 3 = 0$

$(4t-3)(3t+1) = 0$

$t = \frac{3}{4}, \frac{-1}{3}$ $\quad\quad$ $\therefore$ $3^x = \frac{3}{4}$

$x \log 3 = \log 3 - \log 4$

$\Rightarrow x = 1 - \log_3 4$