Sri Chaitanya IIT Academy.,India.

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A right Choice for the Real Aspirant

ICON Central Office - Madhapur - Hyderabad

SEC: Sr.Super60_NUCLEUS-BT JEE-MAIN Date: 23-08-2025

Time: 09.00Am to 12.00Pm RPTM-07 Max. Marks: 300

KEY SHEET

MATHEMATICS

1	**1**	2	**4**	3	**2**	4	**4**	5	**3**
6	**1**	7	**1**	8	**1**	9	**1**	10	**2**
11	**2**	12	**3**	13	**1**	14	**4**	15	**2**
16	**1**	17	**2**	18	**2**	19	**3**	20	**3**
21	**21**	22	**20**	23	**1**	24	**16**	25	**9**

PHYSICS

26	**2**	27	**1**	28	**4**	29	**1**	30	**4**
31	**3**	32	**4**	33	**3**	34	**3**	35	**4**
36	**2**	37	**2**	38	**1**	39	**2**	40	**2**
41	**1**	42	**3**	43	**2**	44	**1**	45	**4**
46	**20**	47	**5**	48	**180**	49	**42**	50	**8**

CHEMISTRY

51	**3**	52	**1**	53	**2**	54	**3**	55	**1**
56	**1**	57	**3**	58	**2**	59	**2**	60	**2**
61	**2**	62	**2**	63	**4**	64	**4**	65	**1**
66	**4**	67	**4**	68	**2**	69	**1**	70	**2**
71	**3**	72	**4**	73	**3**	74	**19**	75	**5**

SOLUTION
MATHEMATICS

1. $\frac{f(x)}{1+x^2}=1+\int_0^x \frac{f^2(t)}{1+t^2}dt \qquad (f(0)=1)$

Differentiating both the sides with respect x,

$$\frac{(1+x^2)f'(x)-f(x).2x}{(1+x^2)^2}=\frac{f^2(x)}{1+x^2}$$

$$\Rightarrow \frac{dy}{dx}-\frac{2x}{(1+x^2)}y=y^2 \Rightarrow \frac{1}{y^2}\frac{dy}{dx}+\frac{2x}{1+x^2}\left(-\frac{1}{y}\right)=1 \Rightarrow y=\frac{-3(1+x^2)}{x^3+3x-3}=f(x)$$

$$\therefore f(-1)=\frac{-3(1+1)}{-1-3-3}=\frac{-6}{-7}=\frac{6}{7} \qquad f(-2)=\frac{15}{17}$$

$$f(-1)+f(-2)=\frac{6}{7}+\frac{15}{17}=\frac{102+105}{7\times17}=\frac{207}{119}$$

2. $f^1(x)=-\left(\frac{x-1}{x}\right)-(\ln x-1)+f(x) \Rightarrow f'(x)-f(x)=\frac{1}{x}-\ln x$

$f(x)=\ln x+Ce^x$

$Put\ x=1, \Rightarrow f(1)=e \Rightarrow C=1 \qquad \therefore f(x)=e^x+\ln x$

$(i)\, f(e)=1+e^e$

$(ii)\, f'(x)=e^x+\frac{1}{x}>0$ for $x\in R^+$ implies $f(x)$ increases for $x\in R^+$

$(iii)\, f(0^+)=-\infty, f(\infty)=\infty, f(x)=0$ has exactly one real root in $(0,\infty)$

3. Equation of tangent at (x,y) on the curve C is $\qquad Y-y=\frac{dy}{dx}(X-x)$

According to the question given the equation of curve C is $\qquad xy=k$

Curve passes through $(2,2)$ hence $k=4$

Equation of curve is $xy=4$

If passes through $\left(3,\frac{4}{3}\right)$

4. General solution is $\frac{y}{x}=\int \left(e^x(x+1)-1\right)dx$

$\frac{y}{x}=xe^x-x+C \qquad$ As $y(1)=e-1 \Rightarrow C=0$

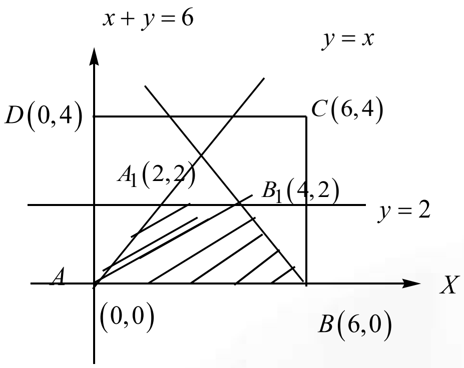
$x+\frac{y}{x}=xe^x \qquad 2+\frac{y(2)}{2}=2e^2 \Rightarrow y(2)=4e^2-4$

$y(1)=e-1$ (Given). Hence, $y(2)=4(e+1)(e-1)=4y(1)(y(1)+2) \qquad \therefore K=4$

5. On differentiation, we get

$3f(x)=xf^1(x)+f(x)-x^2 \quad \Rightarrow f^1(x)-\frac{2}{x}f(x)=x$

$f(x)=x^2\left(\ln x+\frac{1}{3}\right) \quad f(e)=e^2\left(1+\frac{1}{3}\right)=\frac{4e^2}{3}$



6.

$d(P,AB)=y,\ d(P,BC)=6-x,\ d(P,CD)=4-y,\ d(P,AD)=x$

We must have $y\le 6-x,\ y\le 4-y,\ y\le x,$

$\Rightarrow x+y\le 6,\ y\le 2,\ y\le x$

Shaded region represents the required area. This area is equal to the area of trapezium

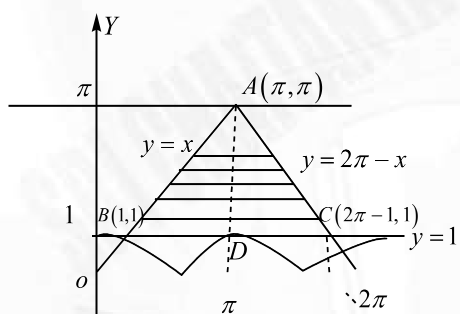
$ABB_1A_1\ ar(ABB_1A_1)=\frac{1}{2}(6+2)2=8$ sq. units

7. $\int_0^1 y(x)dx=c\rightarrow\frac{dy}{dx}=x+c \quad y=\int(x+c)dx=\frac{(x+c)^2}{2}+d$

$y(0)=1\rightarrow d=1-\frac{c^2}{2} \qquad y(x)=1+\frac{(x+c)^2-c^2}{2}=\frac{x^2+2cx+2}{2}$

$c=\int_0^1 y(x)dx=\frac{1}{2}\int_0^1(x^2+2cx+2)dx \qquad \Rightarrow 2c=\frac{1}{3}+c+2\rightarrow c=\frac{7}{3}$

8.



Here $AD=(\pi-1),\ B(1,1),\ C(2\pi-1,1)$

$BC=(2\pi-1-1)=2(\pi-1)$

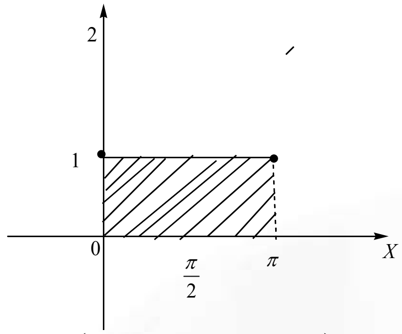
Required area $=\frac{1}{2}.2(\pi-1)(\pi-1)=(\pi-1)^2$ sq. unit $\qquad =\left[(\pi-1)^2\right]=[4.586]=4$

9. $A=\int_0^1(2x-x^2-x^n)dx \quad =\left(x^2-\frac{x^3}{x}-\frac{x^{n+1}}{n+1}\right)_0^1=1-\frac{1}{3}-\frac{1}{n+1}=-\frac{2}{3}-\frac{1}{n+1}$

$\frac{2}{3}-\frac{1}{n+1}=\frac{3}{5}\Rightarrow\frac{1}{n+1}=\frac{2}{3}-\frac{3}{5}=\frac{1}{15}$

$n=14$

10.



$f(x)=\cos^{-1}\left(\sin\left(\frac{\pi}{2}-1-[\sin x]\right)\right)=\cos^{-1}\cos(1+[\sin x])\quad f(x)=1+[\sin x]\forall x\in R$

Required area $=\pi$ sq. units $\quad\therefore k=1$

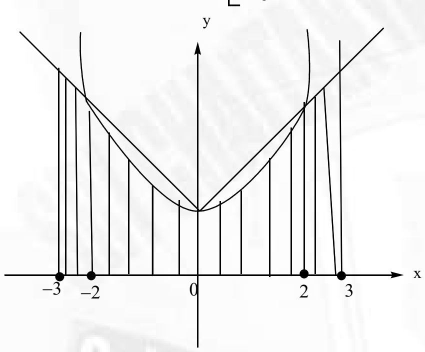
11. $f(x+y)=f(x)f(y)\Rightarrow f(x)=e^{4\alpha x}$

$f''(x)3\alpha f'(x)-f(x)=0\Rightarrow 16\alpha^2-12\alpha^2-1=0$

$\alpha=\frac{1}{2}(given\ \alpha>0)\qquad\therefore f(x)=e^{2x}$

Required area $=\int_0^2 e^x dx=e^2-1\ \beta=1,\gamma=2$

12. Required area $2\left[\int_0^2(x^2+1)dx+\int_2^3(2x+1)dx\right]=\frac{64}{3}$ sq. units



13. $g(x)=|f(|x|)-2|=||x|-1-2|=||x|-3|$

$x^2=4(y-2)\qquad$ On solving $\quad y=3-x,y=\frac{x^2+8}{4}$

$\therefore 12-4x=x^2+8\Rightarrow x^2+4x-4=0\Rightarrow x=2\sqrt{2}-2$

Area $=2\int_0^{2\sqrt{2}-2}\left(3-x-\frac{x^2}{4}-2\right)dx=\frac{4}{3}(4\sqrt{2}-5)$

14. $(x+2y)^2\frac{dy}{dx}=(2(x+2y)+1)$

Let $u=x+2y\Rightarrow\frac{du}{dx}=1+2\frac{dy}{dx}\quad\frac{1}{2}\left(\frac{du}{dx}-1\right)=\frac{2u+1}{u^2}$

$$\frac{du}{dx}-1=\frac{2(2u+1)}{u^2}\Rightarrow\frac{du}{dx}=\frac{u^2+4u+2}{u^2}$$

On solving we get $y=\ln\left((x+2y)^2+4(x+2y)+2\right)-\frac{3}{\sqrt{2}}\log\left|\frac{x+2y+2-\sqrt{2}}{x+2y+2+\sqrt{2}}\right|+C$

$$f(x,y)=(x+2y)^2+4(x+2y)+2 \qquad g(x,y)=\frac{x+2y+2-\sqrt{2}}{x+2y+2+\sqrt{2}}$$

$$f(0,0)=2, g(0,0)=3-2\sqrt{2}, f(1,-1)=-1, g\left(\sqrt{3},0\right)=\sqrt{2}-1$$

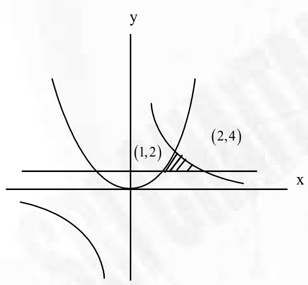
15. Req. Area $=A=2\int_0^{\frac{1}{2}}f^{-1}(x)dx$ Let $f^{-1}(x)=t\Rightarrow x=f(t), dx=f'(t)dt$

$$A=2\int_0^1 tf'(t)dt=2\left(f(1)-\int_0^1\frac{t}{1+t^2}dt\right)=1-\ln 2$$

16. Required area $\int_{e-e^2}^{0}\left(\ln\left(x+e^2\right)-1\right)dx+\int_0^{\ln 2}\left(2e^{-x}-1\right)dx \quad =1+e-\ln 2$

which implies $\beta-\gamma=2$

17.



Required area $\int_1^4\left(\frac{8}{y}-\sqrt{y}\right)dy$

18. We must have $x\in\left(\frac{1}{2},1\right]\cup\left(\frac{1}{8},\frac{1}{4}\right]\cup\left(\frac{1}{32},\frac{1}{16}\right]\cup......$

and $y\in\left(\frac{1}{5},1\right]\cup\left(\frac{1}{125},\frac{1}{25}\right]\cup\left(\frac{1}{325},\frac{1}{625}\right]\cup.....$ so

$$S=\left(\frac{1}{2}+\frac{1}{8}+\frac{1}{32}+......\right)\left(\frac{4}{5}+\frac{4}{125}+\frac{4}{325}+.....\right)=\frac{\frac{1}{2}}{\left(1-\frac{1}{4}\right)}\times 4\left(\frac{\frac{1}{5}}{1-\frac{1}{25}}\right)=\frac{2}{3}\times\frac{5\times 4}{24}=\frac{5}{9}$$

19. Solution: $xu'+v=0$ ....(1)

$xv'+u=0$ ....(2)

$(1)+(2)\ \rightarrow x\frac{d}{dx}(u+v)+u+v=0\ \rightarrow x(u+v)=A$

$x=1, u=0, v=2 \to A=2 \to u+v=\frac{2}{x}$ ....(3)

$(1)-(2) \to \frac{xd}{dx}(u-v)=u-v \quad \to \int \frac{d(u-v)}{u-v}=\int \frac{dx}{x}$

$\ln(u-v)=\ln x+\ln B \quad u-v=Bx$

$x=1, u=0, v=2 \to B=-2, u-v=-2x$ ....(4)

$(3),(4) \to u=\frac{1}{x}-x, v=\frac{1}{x}+x \int_0^1 \frac{u}{v}dx=\int_0^1 \frac{1-x^2}{1+x^2}dx \quad =\int_0^1\left(\frac{2}{1+x^2}-1\right)dx \quad =\frac{\pi}{2}-1$

20. Conceptual

21. $\frac{dy}{dx}=\frac{2e^{2x}-6e^{-x}+9}{2+9e^{-2x}}$

On solving we get $y=\frac{e^{2x}}{2}-\sqrt{2}\tan^{-1}\left(\frac{\sqrt{2}e^x}{3}\right)+C$

This curve is passing through $\left(0,\frac{1}{2}+\frac{\pi}{2\sqrt{2}}\right)$ which implies $C=\sqrt{2}\left[\frac{\pi}{4}\tan^{-1}\left(\frac{\sqrt{2}}{3}\right)\right]$

Again, this curve is passing through $\left(\alpha,\frac{e^{2\alpha}}{2}\right)$ which will give $e^{2\alpha}=\frac{9}{2}\left(\frac{11+6\sqrt{2}}{11-6\sqrt{2}}\right)$

Here, $l=9$, $m=6$, $n=6$

22. $f(x)=e^{-x}\left(x^3+x^2+4f(x)-36\right)$

$f(x)=\frac{x^3+x^2-36}{e^x-4} \qquad f'(2)=\frac{40e^2-64}{\left(e^2-4\right)^2} \quad \frac{\alpha}{\beta}=20$

23. $g'(x)=2\cos^2\left(x^2+\frac{\pi}{3}\right).2x-2\cos^2 x$

$g'(x)=4\times 2\cos\left(x^2+\frac{\pi}{3}\right)2x.x+4\cos^2\left(x^2+\frac{\pi}{3}\right).1+4\cos x.\sin x$

$=4\cos^2\left(x^2+\frac{\pi}{3}\right)-16x^2\cos\left(x^2+\frac{\pi}{3}\right)\sin\left(x^2+\frac{\pi}{3}\right) \qquad$ ATQ, $g'(t)+4=\int_0^t f(x)dx$

Differentiating w.r.t 't' $g''(t)=f(t)$

$g''(0)=f(0)=4\cos^2\frac{\pi}{3}=4\times\frac{1}{4}=1$

24. Conceptual

25. $f'(x)f''(x)=f'(x)f(x)$

On solving we get $f'(x)=\sqrt{\left(f(x)\right)^2+4}$

After solving $f(x)=e^x-e^{-x} \quad 6f\left(\log_e 2\right)=6\times\frac{3}{2}=9$

PHYSICS

26. $\vec{v_i}+\vec{v_0}=2\vec{v_m}$ $\quad \vec{v_i}=2\vec{v_m}-\vec{v_0}$

27. Conceptual

28. $m=\dfrac{f}{f-u}$ $\quad 2=\dfrac{-24}{-24-u}$

$or\ u=-12cm$

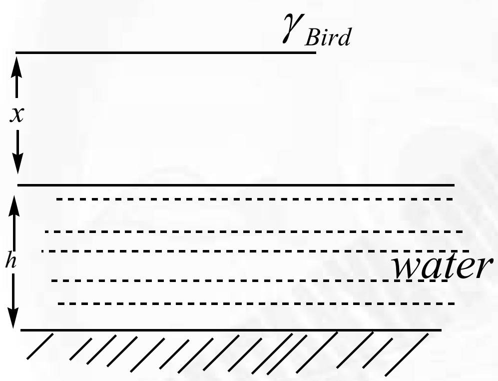
$If\ m=-2, then\ -2=\dfrac{-24}{-24-u}\quad or\ u=-36cm$

Note that the magnification is greater than 1, so mirror cannot be convex

29. The bubble acts as a diverging lens. Image of virtual, erect and diminished

30. Slab only shifts the image of point P by some distance which will remain constant and does not depend upon the location of slab so the final image formed by slab has a fixed separation from 'O' and will not move

31. Distance between the bird and the image of the bird.



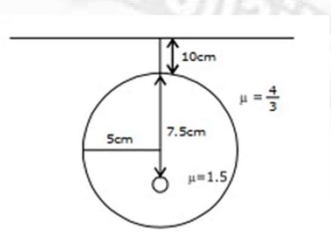
$s=2x+\dfrac{2h}{\mu}\qquad \dfrac{dx}{dt}=+2\,cms^{-1}$

$\dfrac{dh}{dt}=-2\ cms^{-1}\qquad \dfrac{ds}{dt}=2\left(\dfrac{dx}{dt}\right)+\dfrac{2}{\mu}\left(\dfrac{dh}{dt}\right)$

Change in the distance $\dfrac{ds}{dt}=2(2)+\dfrac{2(-2)(3)}{4}=1$

Distance increases by 1 cms every second

32.



For 1st Refraction $u_1=-7.5\,cm\ \ n_1=1.5, n_2=\dfrac{4}{3}$

$R=-5cm$

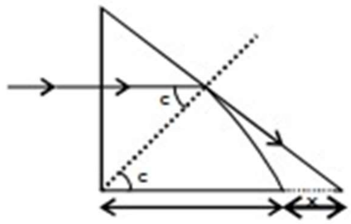
$\dfrac{4/3}{v_1}-\dfrac{1.5}{-7.5}=\dfrac{4/3-1.5}{-5}\qquad \Rightarrow V_1=-8cm$

$for\ 2nd$ Refraction

$\mu_2 = 1 \ \mu_1 = \frac{4}{3} \quad u_2 = -(10+8) = -18cm$

$So\ apparent\ depth = \frac{1}{4/3}(-18) = \frac{-27}{2}cm \quad = -13.5\,cm$

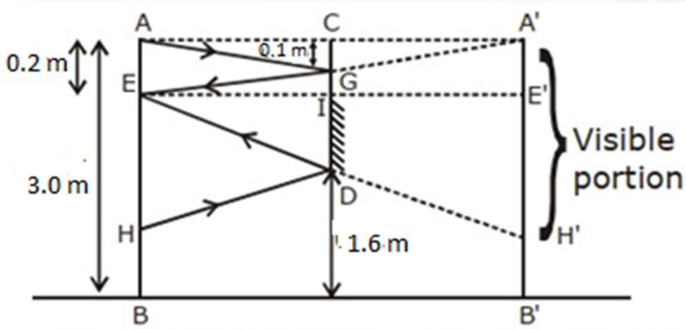
33.



Total internal reflection occurs when light rays pass through the medium above the one shown in the figure.

Sin $C = \frac{\sqrt{3}}{2} \Rightarrow C = 60^0 \qquad x = R$

34.



Let AB be the boy with his eye level at E and $A'B'$ be the image then the visible portion is AH. ` $\Delta EID \sim \Delta EE'H \ \frac{EI}{ID} = \frac{EE'}{E'H}$

Now we know that $EE' = 2EI, ID = 1.2m \& AH = A'H' = A'E' + E'H'$

$E'H = 2.4\ and\ AH = 2.4 + 0.2 = 2.6m$

Hence boy cannot see his feet

35. The optic axis of a lens does not change even on cutting it so in this case as magnification is 2, image of P will be produced 1 cm below optic axis of lens which is 1.5cm below line XY.

36. Deviation by prism.

$\delta_1 = A(\mu - 1) = 4^0(1.5-1) \Rightarrow \delta_1 = 2^0$

$for\ plane\ mirror \qquad i = 2^0$

$\delta_2 = 180^0 - 2i = 176^0 \Rightarrow \delta = \delta_1 + \delta_2 = 178^0$

37. $r_2 = \sin^{-1}\left(\frac{1}{\mu}\right) = 45^0$

$r_1 = A - r_2 = 75^0 - 45^0 = 30^0$

$\frac{\sin i}{\sin r_1} = \sqrt{2} \Rightarrow \sin i = \sqrt{2}\sin 30^0 = \sqrt{2} \times \frac{1}{2} \Rightarrow i = 45^0$

38. LC=1 MSD-1VSD

300 msd=15 cm

$1\,msd = \frac{15}{300}cm = 0.05cm$

$50\,vsd = 49\,msd$

$1\,vsd = \frac{49}{50}msd$

$LC = 1\,msd - 1\,vsd$

$LC = 1\,msd - \frac{49}{50}msd = \frac{1}{50}\,msd$

$LC = \frac{1}{50} \times 0.05 = 0.001\,cm$

39. *By Newton's formula*

$uv = f^2$

40. $\beta = \mu\alpha$

$\beta = \frac{4}{3} \times 9 = 12$

$\alpha + \gamma = \beta$

41. $V_{IM} = -V_{OM}, V_I = 2V_M - V_0$

42. Conceptual

43. The converging nature has nothing to do with the $u-v$ relation.

44. Using lens formula

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

When object is at centre of curvature of lens,

u=-2f

$\Rightarrow \frac{1}{v} - \frac{1}{-2f} = \frac{1}{-f}$

For concave lens focal length is negative

$\Rightarrow \frac{1}{v} = \frac{-3}{2f} \Rightarrow v = \frac{-2f}{3}$

Concave lens always forms a virtual and erect image. Hence, image is not formed at the centre of curvature

45. The medium of object and observer are same so length of scale remains same.

46. $m = -\frac{v}{u} = -\left(\frac{f}{u-f}\right)$

$Now\ m_1 = -\left(\frac{f}{25-f}\right)$ ....(i)

$and\ m_2 = -\left(\frac{f}{40-f}\right)$ ....(ii)

$\therefore \frac{m_1}{m_2} = \frac{40-f}{25-f}$

$or\ 4 = \frac{40-f}{25-f}$

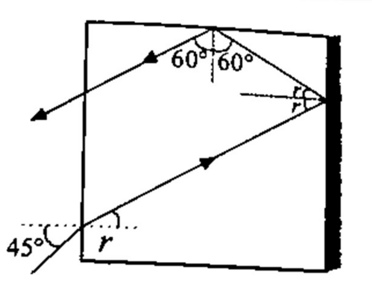
$or\ f = 20\ cm$

47. Using, $\frac{1}{f}=\frac{1}{v}-\frac{1}{u} \Rightarrow \frac{df}{f^2}=\frac{dv}{v^2}+\frac{du}{u^2}$

For small charge df=Δf

$\therefore \Delta f = f^2\left(\frac{\Delta v}{v^2}+\frac{\Delta u}{u^2}\right)$

48.



From Snell's law,

$\frac{\sin 45^0}{\sin r}=\sqrt{2}$

$or\ \sin r=\frac{1}{2}$

$\therefore r=30^0$

$Critical\ angle, \sin C=\frac{1}{\mu}=\frac{1}{\sqrt{2}}$

$C = 45^0$

So ray comes out antiparallel to the incident ray.

49. The shift produced by the slab towards mirror

$$=t\left(1-\frac{1}{\mu}\right)$$

$$=6\left(1-\frac{1}{1.5}\right)=2\,cm$$

If the object is placed at $40+2=42\,cm$, its apparent distance from mirror will be 40cm and so its image coincide with the object.

50. The angle of prism, $A=180^0-\left(67^0+53^0\right)=60^0$

The deviation,

$$A+\delta=i+e$$

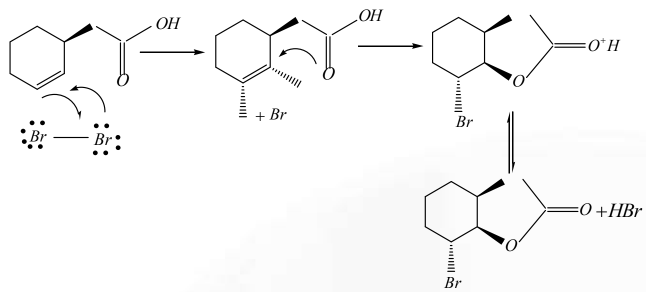
$or\ 60^0+\delta=36^0+32^0$

$\therefore \delta=8^0$

For minimum deviation i=e, and so angle of deviation should be less than 8^0

CHEMISTRY

51.

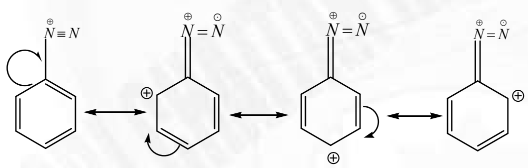


52. Releasing $CO_2 \uparrow$ From $\beta - Keto\,ester$
53. Primary amine formed by Gabrial Phthlimide reaction
54.

$$Ph-\overset{O}{\overset{\|}{C}}-OCH_3 \xrightarrow{H_3O^+} \underset{(P)}{Ph-\overset{O}{\overset{\|}{C}}-OH} + \underset{(Q)}{CH_3-OH} \xrightarrow{Ca(OH)_2} \underset{(R)}{\left(Ph-\overset{O}{\overset{\|}{C}}-O\right)_2 Ca}$$

$$\xrightarrow[(CH_3COO)_2 Ca]{Dry\,distillation} \underset{(S)}{Ph-\overset{O}{\overset{\|}{C}}-CH_3} \xrightarrow{mcPBA} \underset{(T)}{Ph-O-\overset{O}{\overset{\|}{C}}-CH_3}$$

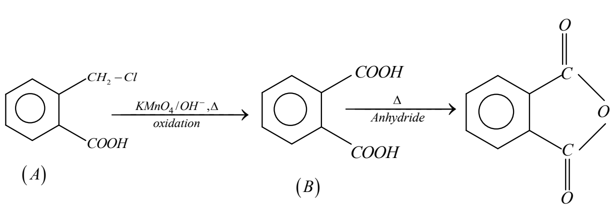
55. Conceptual
56. Aromatic diazonium salts are stabilized by resonance



57. in decarboxylation reaction (soda lime reactions and n) carbanion produced as an intermediate
58. Intra molecular cannizzaro reactions
59. Rate of nucleophilic substitutions elimination order
60. Alkane having no any polarity
61. Nucleophile attack on more electrophilic site

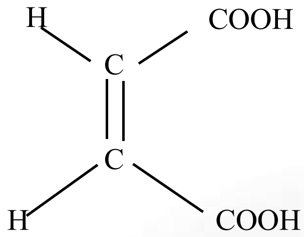
$$CH_3-\overset{O}{\overset{\|}{C}}-Cl\ (-I > +M) \qquad CH_3-\overset{O}{\overset{\|}{C}}-\ddot{N}H-CH_3\ (+M > -I) \qquad CH_3-\overset{O}{\overset{\|}{C}}-\ddot{\underset{\cdot\cdot}{O}}-CH_3\ (+M > -I)$$

62. Contain LP un delocalised more basic nature
63.
64.

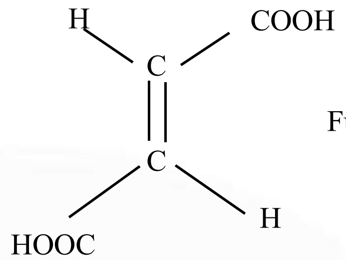


65. P is malic acid which is more acidic, than fumeric acid (Q) due to intra molecular H-bonding with its conjugate base (chelation)

Malic acid



P



Q

Fumeric acid

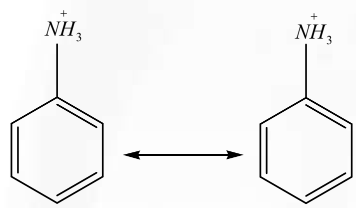
66. Primary amine Aliphatic /Aromatic can show carbylamines test

67. HIO_4 as oxidizing agent , make oxidation on glycolic bond

68. Basic strength of nitrogen .3>4>1>2 contain 1-chiral centre c-atom

69. BP proportional to intermolecular force of attraction like H-Bonding

70.

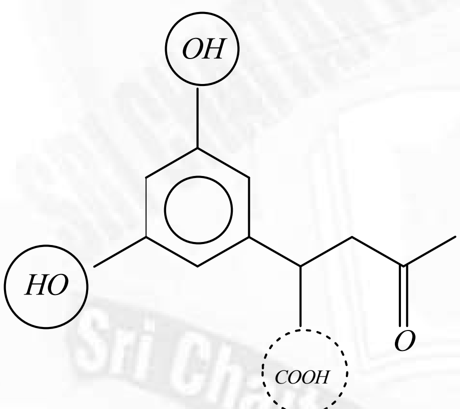


I II

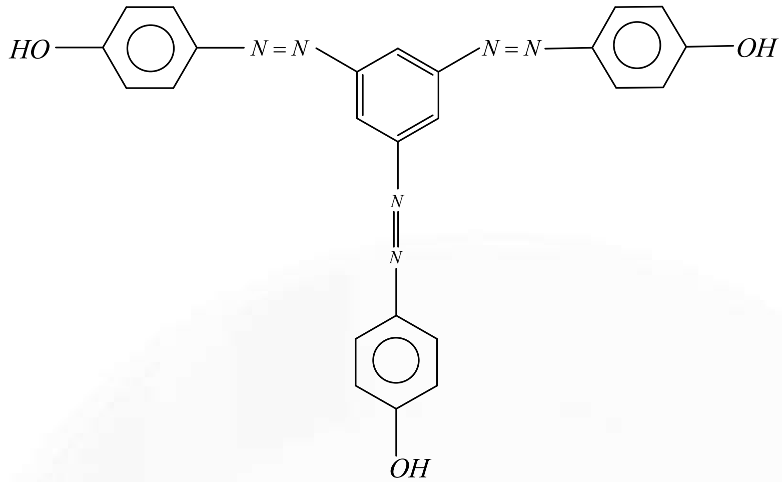
71. (A,B,D) are the reactions which gives amine

72. $Fe/HCl, Sn/HCl, H_2Ni, LiAlH_4, Zn-Hg+HCl$

73.



74.



75.