Sri Chaitanya IIT Academy.,India.

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A right Choice for the Real Aspirant

ICON Central Office - Madhapur - Hyderabad

SEC: Sr.S60_Elite, Target & LIIT-BTs	JEE-MAIN	Date: 25-12-2024
Time: 09.00Am to 12.00Pm	GTM-09/04	Max. Marks: 300

KEY SHEET

MATHEMATICS

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

PHYSICS

26	**1**	27	**3**	28	**3**	29	**2**	30	**1**
31	**2**	32	**2**	33	**2**	34	**4**	35	**4**
36	**2**	37	**3**	38	**1**	39	**1**	40	**2**
41	**4**	42	**1**	43	**3**	44	**3**	45	**3**
49	**48**	47	**15**	48	**5**	49	**6**	50	**1**

CHEMISTRY

51	**2**	52	**4**	53	**3**	54	**3**	55	**1**
56	**2**	57	**1**	58	**4**	59	**1**	60	**2**
61	**3**	62	**4**	63	**2**	64	**4**	65	**4**
66	**2**	67	**4**	68	**4**	69	**3**	70	**2**
71	**2091**	72	**58**	73	**9**	74	**4**	75	**4**

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SOLUTION
MATHEMATICS

1. Sol. Let eccentricity of conjugate hyperbola be e'

$$\therefore \frac{1}{e^2}+\frac{1}{e'^2}=1 \Rightarrow \frac{1}{e'^2}=1-\frac{1}{e^2} \Rightarrow e'=\frac{e}{\sqrt{e^2-1}} \quad \therefore f(e)=\frac{e}{\sqrt{e^2-1}}$$

$$\text{and } f(f(e))=\frac{f(e)}{\sqrt{f^2(e)-1}}=\frac{\frac{e}{\sqrt{e^2-1}}}{\sqrt{\frac{e^2}{e^2-1}-1}}=e$$

$$\therefore \text{ Given integral} = \int\left(\frac{e}{\sqrt{e^2-1}}+e\right)de=\left(\sqrt{e^2-1}+\frac{e^2}{2}\right)$$

$$g(e)=\sqrt{e^2-1}+\frac{e^2}{2}+C \quad g\left(\sqrt{2}\right)=1+1+C \quad \Rightarrow C=0 \qquad g(e)=\sqrt{e^2-1}+\frac{e^2}{2}$$

2. Sol. Let $x=\tan\theta$ $\qquad \int_0^{\pi/4}\frac{\theta}{1+\tan\theta}\sec^2\theta\, d\theta$

$$=\theta\log_e(1+\tan)I_0^{\pi/4}-\int_0^{\pi/4}\log_e(1+\tan\theta)d\theta \qquad =\frac{\pi}{4}\log_e 2-I$$

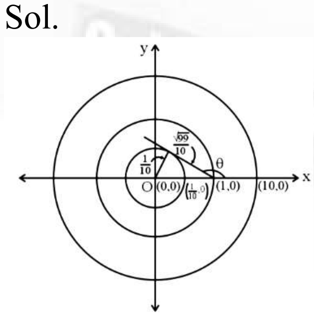
$$I=\int_0^{\pi/4}\log_e(1+\tan\theta)d\theta \ldots.(1)$$

$$I=\int_0^{\pi/4}\log_e\left(1+\tan\left(\frac{\pi}{4}-\theta\right)\right)d\theta$$

$$I=\int_0^{\pi/4}\log_e\left(\frac{2}{1+\tan\theta}\right)d\theta$$

$$\text{By}(1)+(2) \ \Rightarrow 2I=\int_0^{\pi/4}\log_e 2\ d\theta=\frac{\pi}{4}\log_e 2 \ \Rightarrow I=\frac{\pi}{8}\log_e 2$$

3. Sol.



$$\text{Put } \frac{z_1}{z_2}=z \quad \therefore \left|\frac{z_1}{z_2}\right|=|z| \Rightarrow |z|=\frac{1}{10}$$

$$\text{Also, } \theta=\arg\left(\frac{z_1}{z_2}-1\right)=\arg(z-1) \qquad \therefore \tan^2\theta\Big]_{max.}=\frac{1/100}{99/100}=\frac{1}{99}$$

4. Sol. $n(S)=12^6$

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Now, any two months can be chosen in ${}^{12}C_2$ ways. The six birthday can fall in these two months in 2^6 ways. Out of these 2^6 ways there are two ways when all the six birthdays fall in one month so favourable number of ways in ${}^{12}C_2 \times \left(2^6-2\right)$.

Hence required probability is

$$=\frac{{}^{12}C_2 \times \left(2^6-2\right)}{12^6}=\frac{12\times 11\times \left(2^6-2\right)}{2\times 12^6}=\frac{341}{12^5}$$

5. Ans. B

Sol. Put $\begin{vmatrix} (1-\lambda) & 3 & -4 \\ 1 & -(3+\lambda) & 5 \\ 3 & 1 & -\lambda \end{vmatrix}=0$

$\Rightarrow \lambda(\lambda+1)^2=0 \Rightarrow \lambda=-1,0$

6. Sol. (A) As line is parallel to the plane, the point $(4,2,2k)$ should lie in the given plane

$\therefore 2(4)-4(2)+2k=3 \Rightarrow k=\frac{3}{2}$

(B) Any point on given lines are $(2\lambda+1, 3\lambda-1, 4\lambda+1)$ and $(\mu+3, 2\mu+k, \mu)$ respectively.

By equating the corresponding coordinates $\Rightarrow \mathrm{k}=\frac{9}{2}$

(C) Equation of plane is $\frac{x}{a}+\frac{y}{a}+\frac{z}{a}=1$ satisfy it by given point $\Rightarrow \frac{1}{a}+\frac{1}{a}+\frac{1}{a}=1 \Rightarrow \mathrm{a}=3$

hence $\mathrm{A}(3,0,0), \mathrm{B}(0,3,0), \mathrm{C}(0,0,3) \Rightarrow$ volume of tetrahedron $=\frac{1}{6}\begin{vmatrix} 3 & 0 & 0 \\ 0 & 3 & 0 \\ 0 & 0 & 3 \end{vmatrix}=\frac{9}{2}$ cubic units

(D) The equation of plane is $\mathrm{a}(\mathrm{x}-1)+\mathrm{b}(\mathrm{y}+2)+\mathrm{c}(\mathrm{z}-1)=0$ & $2\mathrm{a}-2\mathrm{b}+\mathrm{c}=0$

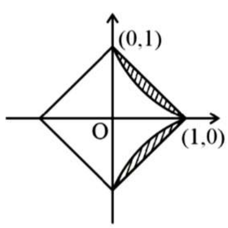
$a-b+2c=0 \quad \Rightarrow \frac{a}{1}=\frac{b}{1}=\frac{c}{0}$ hence equation of plane is $x+y+1=0$

7. Sol. Let $\vec{a}\wedge\vec{b}=\theta$, Now $\vec{x}=\vec{a}-\left(\vec{a}\cdot\vec{b}\right)\vec{b}$ $\Rightarrow |\vec{x}|^2=\vec{a}^2+(\vec{a}\cdot\vec{b})^2\,\mathrm{b}^2-2(\vec{a}\cdot\vec{b})^2$

$\Rightarrow |\vec{x}^2=1+\cos^2\theta-2\cos^2\theta$ $\Rightarrow |\vec{x}|=\sin\theta$, Also $\because \vec{y}=\vec{a}\times\vec{b} \Rightarrow |\vec{y}|=|\vec{a}\times\vec{b}|=\sin\theta$

$\therefore |\vec{x}|=|\vec{y}|$ Also, $\vec{x}\cdot\vec{b}=\vec{a}\cdot\vec{b}-\left(\vec{a}\cdot\vec{b}\right)\vec{b}^2=0$ $\therefore |\vec{x}\cdot\vec{b}|=0$

8. $\sqrt{x}+\sqrt{|y|}=1$. Above curve is symmetric about x-axis $\sqrt{|y|}=1-\sqrt{x}$ and $\sqrt{x}=1-\sqrt{|y|}$



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$\Rightarrow x>0,\ y=0\ \sqrt{y}=1=1-\sqrt{x}\quad \frac{1}{2\sqrt{y}}\frac{dy}{dx}=-\frac{1}{2\sqrt{x}}\quad \frac{dy}{dx}=-\sqrt{\frac{y}{x}}<0,$

Function is decreasing required area $=2\int_0^1\left(2\sqrt{x}-2x\right)=\frac{2}{3}$

9. Sol. On solving $\frac{\pi}{2}-\sin^{-1}\left(\frac{2\times 4x}{1+(4x)^2}\right)\quad =-\frac{\pi}{2}+2\tan^{-1}(4x)$

$\Rightarrow 2\tan^{-1}4x=\pi-\sin^{-1}\left(\frac{2(4x)}{1+(4x)^2}\right)\quad 4x\ge 1;\ x\ge\frac{1}{4}$

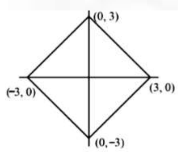
10. Sol. Let $p(h,k)$ be the point of contact $\quad 2y\frac{dy}{dx}=4a\ \&\ 2x=4a\frac{dy}{dx}$

both $\frac{dy}{dx}$ are same $\quad\Rightarrow\frac{4a}{2y}=\frac{2x}{4a}\Rightarrow xy=4a^2$

11. Sol. $A\cdot \text{Adj}A=|A|I_n\quad (\text{Adj}A)(\text{AdjAdj}A)=|\text{Adj}A|In=|A|^{n-1}I_n$

$(\text{adjadj}A)(\text{adjadjadj}A)=|A|^{(n-1)^2}I_n\quad\Rightarrow(\text{adjadj.....}A)(\text{AdjAdjAdj...}A]=|A|^{(n-1)^{(n-1)}}\cdot I_n$

12. Sol. favorable points $\to$ (1, 1) (1, 2) (2, 1) Prob. $=\frac{3}{26}=\frac{1}{12}$



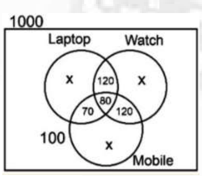
13. Let the plane be $(x+y+z-1)+\lambda(2x+3y+4z-5)=0$

$\Rightarrow(2\lambda+1)x+(3\lambda+1)y+(4\lambda+1)$

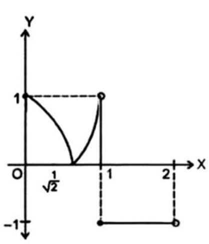
$z-(5\lambda+1)=0\perp$ to the plane $x-y+z=0\quad\Rightarrow\lambda=-\frac{1}{3}$

$\Rightarrow$ the required plane is $x-z+2=0$

14. Sol. $3x+120+120+70+80=900\quad 3x=510,\quad x=170$



15. Sol. By the graph of $y=f(x)$ clearly, $f(x)$, is discontinuous at $x=1$ and $f(x)$ is non – differentiable at $x=\frac{1}{\sqrt{2}}$ and $x=1$



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16. Sol. Area $=\int_0^{\frac{\pi}{4}}\frac{\sqrt{1+\sin x}-\sqrt{1-\sin x}}{\sqrt{\cos x}}dx \quad =\int_0^{\frac{\pi}{4}}\frac{2\sin\frac{x}{2}dx}{\sqrt{\cos^2\frac{x}{2}-\sin^2\frac{x}{2}}}$

By putting $\tan\frac{x}{2}=t$ integral will become $\int_0^{\sqrt{2}-1}\frac{4t}{\left(1+t^2\right)\sqrt{1-t^2}}dt$

17. Sol. $r=\frac{h}{2}\Rightarrow v=\frac{1}{3}\pi r^2 h=\frac{\pi h^3}{12}$

$\frac{dv}{dt}=\frac{\pi}{4}h^2\frac{dt}{dt}=5\Rightarrow\left.\frac{dt}{dt}\right]_{h=4}=\frac{20}{\pi}\times\frac{1}{16}=\frac{35}{88}$ m / h

18. Sol. 'n' should be multiple of 9 for favourable event.

So, $x_1+x_2+x_3=9$ or 18 If $x_1+x_2+x_3=9, 1\le x_i\le 6$

No. of solution of $(1)=$ coefficient of x^9 in

$$\left(x+x^2+\ldots..+x^6\right)^3=\left[x\left(1-x^6\right)\right]^3(1-x)^{-3}$$

$=$ coefficient of x^6 in $\left(1-3x^6\right)(1-x)^{-3}$ $={}^8C_6+(-3)\times 1=25$

And, there is only one solution of $x_1+x_2+x_3=18, 1\le x_i\le 6$

Hence, $n(E)=26$, Also $n(S)=6^3$ $\Rightarrow P(E)=\frac{13}{108}$

19. Sol. Let $z=x+iy$ $-8\left((x+iy)^2+(x-iy)^2\right)+20\left(x^2+y^2\right)=144$

$-8\left(2\left(x^2-y^2\right)\right)+20\left(x^2+y^2\right)=144$

$4x^2+36y^2=144$, $\frac{x^2}{36}+\frac{y^2}{4}=1$, $a=6, b=2$. Area $=\pi ab=12\pi$

20. Sol. put $x=0$ and $y=0\Rightarrow f^2(0)=2$

$$f'(x)=\text{Limit}_{h\to 0}\frac{f(x+h)-f(x)}{h}=\text{Limit}_{h\to 0}\frac{f^2(x+h)-f^2(x)}{\left[f(x+h)+f(x)\right]\cdot h}$$

$$=\frac{1}{2f(x)}\text{Limit}_{h\to 0}\frac{f^2(h)+2(xh-1)}{h}=\frac{1}{2f(x)}\text{Limit}_{h\to 0}\left[\frac{2xh}{h}+\frac{f^2(h)-2}{h}\right]$$

$$=\frac{1}{2f(x)}\left[2x+\text{Limit}_{h\to 0}\frac{f^2(h)-f^2(0)}{h}\right]=\frac{1}{2f(x)}\left[2x+\text{Limit}_{h\to 0}\frac{f(h)-f(0)}{h}\cdot\left(f(h)+f(0)\right)\right]$$

$$f'(x)=\frac{1}{2f(x)}\left[\cancel{2}x+\cancel{2}f(0)\cdot f'(0)\right]\quad\therefore\ f(x)\cdot f'(x)=x+f(0)\cdot f'(0)$$

$\Rightarrow f(x)\cdot f'(x)=x+\lambda$, where $\lambda=f(0)\cdot f'(0)$

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integrating both sides $\therefore \dfrac{f^2(x)}{2}=\dfrac{x^2}{2}+\lambda x+C$

$f^2(x)=x^2+2\lambda x+C$ at $x=0, f^2(0)=2 \Rightarrow C=2$

at $x=\sqrt{2}, f^2(\sqrt{2})=4 \Rightarrow \lambda=0$ $\therefore f^2(x)=x^2+2$ $\Rightarrow f(x)=\sqrt{x^2+2}(f(x)>0)$

21. Sol. Let $x_1,x_2,x_3 \ldots x_4$ are 9 items then their mean $\Rightarrow \dfrac{x_1+x_2+x_3+\ldots+x_9}{9}=15$

$\therefore \sum_{i=1}^{9} x_i=135$ if one more item x_{10} is added then $\sum_{i=1}^{10} x_i=135+x_{10}$

$\therefore$ mean $\bar{x}=\dfrac{135+x_{10}}{10}=16$ $\therefore x_{10}=160-135=25$

22. Sol. $a_1,a_2,a_3,\ldots$ are in A.P

$d=2, a_{10}=21 \Rightarrow a_1=3, a_n=2n+1$ $\sum_{r=1}^{\infty} b_r=\sum_{n=1}^{\infty}\dfrac{1}{(2n+1)(2n+5)}$

$=\dfrac{1}{4}\sum_{n=1}^{\infty}\left(\dfrac{1}{2n+1}-\dfrac{1}{2n+5}\right)=\dfrac{1}{4}\left[\dfrac{1}{3}+\dfrac{1}{5}\right]=\dfrac{2}{15}$

23. Sol. Let the variable chord be $x\cos\alpha+y\sin\alpha=p$ which intersect the hyperbola in A and B the joint equation of OA and OB is $\dfrac{x^2}{4}-\dfrac{y^2}{8}=\left(\dfrac{x\cos\alpha+y\sin\alpha}{p}\right)^2$

$\Rightarrow\left(\dfrac{1}{4}-\dfrac{\cos^2\alpha}{p^2}\right)x^2-\left(\dfrac{1}{8}+\dfrac{\sin^2\alpha}{p^2}\right)y^2-\left(\dfrac{2\sin\alpha\cos\alpha}{p^2}\right)x\cdot y=0$

$\Rightarrow \dfrac{1}{4}-\dfrac{\cos^2\alpha}{p^2}-\dfrac{1}{8}-\dfrac{\sin^2\alpha}{p^2}=0 \Rightarrow p^2=8$

The variable line touches the fixed circle, thus perpendicular distance of $(0,0)=$ Radius

$r=\left|\dfrac{0+0-p}{\sqrt{\cos^2\alpha+\sin^2\alpha}}\right|$ $r=|p|=\sqrt{8}$ $\therefore$ equation of the circle is $x^2+y^2=8$.

24. $\int\dfrac{5\sin x\,dx}{\sin x-2\cos x}$ $=\int dx+2\int\dfrac{\cos x+2\sin x}{\sin x-2\cos x}dx=x+2\ln|\sin x-2\cos x|+C$

25. Sol. $\lim\limits_{x\to0^-}\sum_{r=1}^{2n+1}\left[x^r\right]=\lim\limits_{x\to0^-}[x]+\left[x^2\right]+\left[x^3\right]+\ldots+\left[x^{2n+1}\right]$

$=(-1)+0+(-1)+\ldots+0+(-1)=(-1)(n+1)=-n-1$

$\Rightarrow L=\lim\limits_{n\to\infty}\dfrac{-n-1+n+3}{n\ln\left(\dfrac{1+n}{n}\right)}=\lim\limits_{n\to\infty}\dfrac{2\left(\dfrac{1}{n}\right)}{\ln\left(1+\dfrac{1}{n}\right)}$ $\Rightarrow \dfrac{1}{n}=t \Rightarrow L=\lim\limits_{t\to0}\dfrac{2t}{\ln(1+t)}=2$

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PHYSICS

26. Sol. Least count = 1MSD − 1VSD

27. Sol. $Y = \overline{(\overline{\overline{A}+\overline{B}})} = \overline{A.B}$ This is NAND gate

28. Sol. $E_b = \left(2m_H + 2m_n - m_\alpha\right)c^2 \quad = 28.8\ MeV = 29 MeV$

29. Sol. Conceptual

30. Sol. Elastic hysteresis loss

31. Sol. $V_s = 300 \qquad V_p i_p \times \frac{3}{4} = V_s i_s$

32. Sol. $\frac{1}{2} \in_0 E_0^2 c = I$

33. Sol. At half speed, back emf reduced to half $e = \frac{Bwr^2}{2}$

So $i = \frac{120-54}{12} = \frac{66}{15} = 4.4$

34. Sol. $\frac{hc}{\lambda} = KE_{\max} = \varphi$

35. Sol. $f = n.\frac{V}{4\ell} \qquad n = 1, 3, 5......$

Possible frequencies are 100, 300, 500, 700, 900, 1100

36. Sol. In all three orbits, length of semi major axis is same

37. Sol. $V = \frac{\omega}{k}$

38. Sol. For any value of finite value of charge, $\frac{kQ}{R} \to 0$ as radius R is very large

39. Sol. According to Gauss law

$\oint \vec{E}.d\vec{s} = \frac{q_{in}}{\in_0} \qquad q_{in} = \int_0^{R/2} d \cdot 4\pi r^2 dr, \qquad$ Solving $\frac{A}{16} = 2$

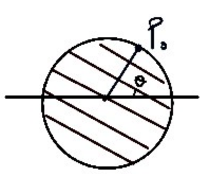
40. Sol. $m.\lambda_1 = m.\lambda_2 \qquad m = 5$ and $n = 6 \qquad$ So $y = \frac{5D\lambda_1}{d}$

41. Sol. Since relative acceleration is zero so relative velocity will remain constant and hence separation keeps on increasing

42. Sol. Based on theory

43. Sol. $i_{\max}$ (After long time) = $\frac{10V}{5\Omega} = 2A \qquad i_{\min}$ (at t=0) = $\frac{10}{10} = 1A$

44. Sol.



$g_{eff} = g\sqrt{5}$

$\tan\theta = 2$

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45. Sol. In all situations of column (I), linear momentum will be conserved as no impulsive force acts during placement. Time period will definitely increase mechanical energy will be conserved only in situation (A) as no slipping, in other situations mechanical energy will decrease and so as amplitude.

46. Sol. Suppose m and n loops respectively in the two strings respectively

$$\frac{m}{2l_1}\sqrt{\frac{T}{\mu_1}}=\frac{n}{2l_2}\sqrt{\frac{T}{\mu_2}}$$

Solving, $\frac{m}{n}=\frac{6}{1}$

Now $f=\frac{6}{2l_2}\sqrt{\frac{216}{6\times10^{-2}}}$

$=48\,\text{Hz}$

47. Sol. $F\Delta t=|\Delta|\vec{p}|=mv\sqrt{3}$

$=10\sqrt{3}\,\text{kg m/s}$

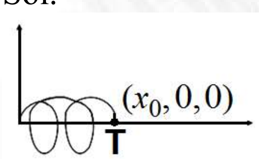
Now $F\Delta t=5mV_0$

$$K=\frac{1}{2}5mV_0^2=15J$$

48. Sol. Possible loss $=\frac{1}{2}\frac{4m}{5}V^2=W_0$

$$KE_{He}=\frac{1}{2}4mV^2=5W_0$$

49. Sol.



$\vec{E}\,||\,\vec{B}$

Motion will be helical with increasing pitch, particle should hit the target in third round

$$x_0=\frac{1}{2}\frac{qE}{m}(3T)^2$$

$\Rightarrow B=6T$

50. Sol. $P=\frac{V^2}{R_{eq}}$ at $t=0$ (Switch closed)

$$=\frac{(100)^2}{10000}=1W$$

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CHEMISTRY

51.

Ion	H^+	K^+	Cl^-	CH_3COO
Λ_m^{∞} Sm²/mole	349.8	73.5	76.3	40.9

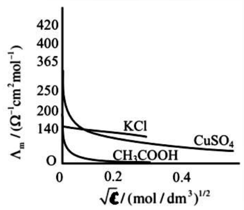
So, $\Lambda^{\infty}_{mCH_3COOH} = \Lambda^{\infty}_{m\left(H^+\right)} + \Lambda_{mCH_3COO^-} = 349.8 + 40.9$

$= 390.7 Scm^2 / mole$ $\quad \Lambda^{\infty}_{mKCl} = \Lambda^{\infty}_{m\left(K'\right)} + \Lambda^{\infty}_{m\left(Cl^{\ominus}\right)}$

$= 73.5 + 76.3$ $\quad = 149.3 Scm^2 / mole$

So statement-I is wrong or False.

As the concentration decreases, the dilution increases which increases the degree of dissociation, thus increasing the no. of ions, which increases the molar conductance



52. Sol. Electrolysis of dilute/concentrated of NaCl : Water is reduced at cathode to give hydrogen gas and chloride ion is oxidized at anode (due to over potential of oxygen) to give chlorine gas.

Electrolysis of dil. $HCl : H^+$ is reduced at cathode and chloride ion is oxidised at anode (due to over potential of oxygen) to give chlorine gas.

Electrolysis of concentrated of $AgNO_3$: Silver ion is reduced at cathode to deposit silver and water is oxidized at anode to give oxygen gas.

53. Sol. The compound which contains $-COCH_3$ group in its structure, give positive iodoform test and the compound which contains $-CHO$ group give positive Fehling test. In ethanol, CH_3CHO both the groups are present, hence it responds to both iodoform test and Fehling's test. Iodoform test

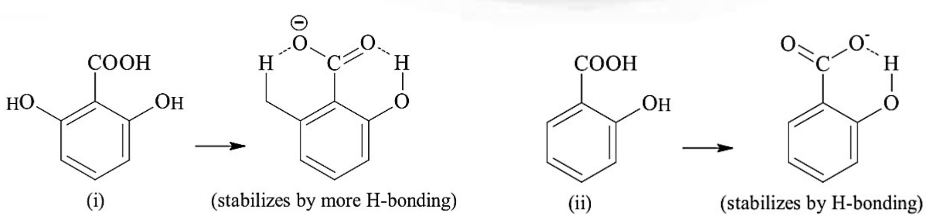
$CH_3CHO + I_2 + NaOH \rightarrow CHI_3 + NaI + H_2O$

Fehling's test

$CH_3CHO + Cu\left(OH_2\right)_2 \rightarrow CH_3COOH + \underset{\text{(red ppt.)}}{Cu_2O\downarrow} + 2H_2O$

54. Sol. Factual

55. Sol.



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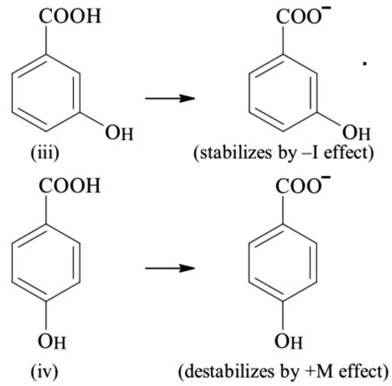
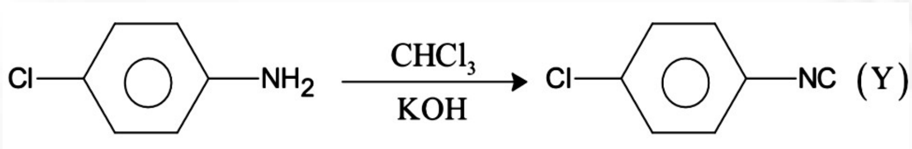
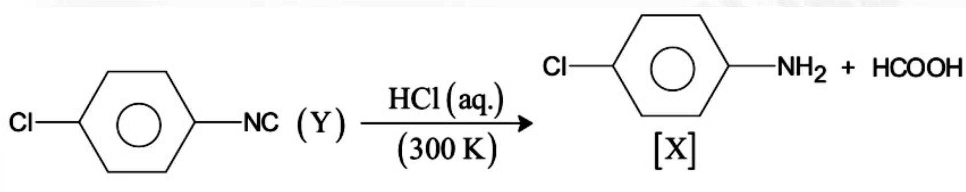


$\therefore$ Acidity order is $I > II > III > IV$

56. Sol. N_2O, NO and CO are neutral oxides.

57. Sol.





58. Sol. $A \rightleftharpoons 2B \quad K_c = \dfrac{[B]^2}{[A]}$

$$\frac{K_f}{K_b} = \frac{(100/10)^2}{(10^{-5}/10)} \Rightarrow \frac{1.5\times10^{-3}}{K_b} = \frac{100}{\left(10^{-6}\right)} \Rightarrow K_b = 1.5\times10^{-11}$$

59. Sol. Factual

60. Sol. H.O.M.O of O_2 is $\pi^* 2p$ and L.U.M.O of N_2 is $\pi^* 2p$.

Bond strength of $B_2 > F_2$. Lower bond strength of F_2 is due to repulsion between lone pairs of the bonded F atoms.

61. Sol. Reduction of RNC will produce $R-NH-CH_3$.

62. Sol. Factual

63. Sol. ClF_3 have Trigonal bipyramidal geometry and T-shape. One short equatorial bond and two long axial bonds and $F_a - Cl - F_a$ bond angle of 175°.

64. Sol. For isothermal $\Delta S_{sys} = nR\ell n\dfrac{V_f}{V_i}$.

65. Sol. Factual

66. Sol. $Eu^{2+}:[Xe]4f^7; Ce^{3+}:[Xe]4f^1$

67. Sol. $P_{solution} = 160$

Solution have positive deviation from Raoult's law.

$P_{total} = 200\times0.5 + 100 + 0.5 = 150$

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$\Delta G_{mix} < 0 \quad \Delta V_{mix} > 0 \quad \Delta H_{mix} > 0$

$\Delta S_{surr} < 0$

68. Sol. DOW's reaction, see NCERT

69. Sol. Hint: On moving left to right acidic strength of oxide increases

Sol.: Correct order of 2nd I.P. : $Mg < Si < Al < P < S$

Correct order of electron affinity: $N < C < O < F$

70. Sol. Hint: m. moles of $Na_3PO_4 = 50$

M moles of $HCl = 100$

Sol.: Final solution will have NaH_2PO_4 (amphoteric salt)

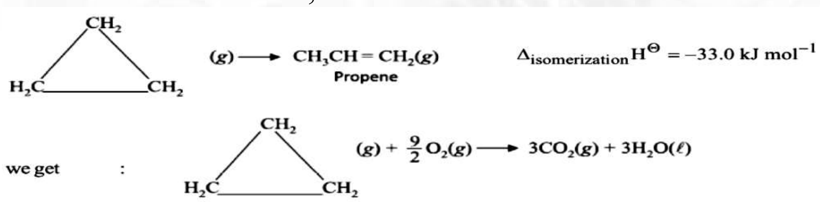
$$\therefore pH = \frac{pKa_1 + pK_{a_2}}{2} = 4$$

71. Sol. $CH_3CH = CH_2(g) + \frac{9}{2}O_2(g) \rightarrow 3CO_2(g) + 3H_2O(\ell)$

$$\Delta_c H^{\Theta}_{(Propene)} = \left[3\Delta_f H^{\Theta}_{(CO_2)} + 3\Delta_f H^{\Theta}_{(H_2O)}\right] - \left[\Delta_f H^{\Theta}_{(Propene)} + \frac{9}{2}\Delta_f H^{\Theta}_{O_2}\right]$$

$= 3(-393.5) + 3(-285.8) - (20.42) = -2058.32 \text{ kJ mol}^{-1}$

To the above reaction, if we add the reaction:



Hence, $\Delta_c H^{\Theta}_{(cyclopropane)} = (-2058.32 - 33.0)\text{kJmol}^{-1} = -2091.32 \text{ kJ mol}^{-1}$

72. Sol. Create Cell as:

Cathode : $Ag^+ + e^- \longrightarrow Ag$ $\qquad E^0_{reduction} = 0.8V$

Anode: $C_6H_{12}O_6 + H_2O \longrightarrow C_6H_{12}O_7 + 2H^+ + 2e^-$ $\qquad E^0_{reduction} = 0.0.5V$

$$2Ag^+ + C_6H_{12}O_6 + H_2O \longrightarrow 2Ag + C_6H_{12}O_7 + 2H^+$$

When the reaction reaches equilibrium, $Q_{cell} = K_{eq}$ and $E_{cell} =$

Using: $\ell n k_{eq} = E^0_{cell}.n_{cell}.\frac{E}{RT} = 0.75 \times 2 \times 38.90 = 58.35 \quad (E^0_{cell} = 0.8 - 0.05 = 0.75V)$

73. Sol. $a = 0, b = 5, c = 14$

74. Sol.

75. Sol. number of de-Broglie waves = principal quantum number of the orbit

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