Sri Chaitanya IIT Academy.,India.

A.P ✪ T.S ✪ KARNATAKA ✪ TAMILNADU ✪ MAHARASTRA ✪ DELHI ✪ RANCHI

A right Choice for the Real Aspirant

ICON Central Office - Madhapur - Hyderabad

Sec:Sr.Super60_NUCLEUS-BT	Paper -2(Adv-2022-P2-Model)	Date: 03-09-2023
Time: 02.00Pm to 05.00Pm	GTA-01	Max. Marks: 180

KEY SHEET

MATHEMATICS

1	**7**	2	**6**	3	**4**	4	**8**	5	**3**	6	**2**
7	**8**	8	**8**	9	**BCD**	10	**ABCD**	11	**BCD**	12	**BC**
13	**ABC**	14	**ABD**	15	**D**	16	**B**	17	**C**	18	**D**

PHYSICS

19	**4**	20	**4**	21	**5**	22	**2**	23	**2**	24	**2**
25	**9**	26	**2**	27	**ABCD**	28	**AD**	29	**AD**	30	**BD**
31	**B**	32	**AD**	33	**C**	34	**A**	35	**A**	36	**A**

CHEMISTRY

37	**4**	38	**6**	39	**6**	40	**2**	41	**5**	42	**4**
43	**9**	44	**4**	45	**ABCD**	46	**ABCD**	47	**CD**	48	**AB**
49	**ABD**	50	**ABD**	51	**A**	52	**B**	53	**D**	54	**C**

SOLUTIONS
MATHEMATICS

1. $\log L = \lim_{n\to\infty} \sum_{r=1}^{n} \log\left(1+\frac{r}{n^2}\right) \qquad x-\frac{x^2}{2} < \log(1+x) < x$

So, $\frac{n(n+1)}{2n^2} - \frac{n(n+1)(2n+1)}{12n^4} < \sum_{r=1}^{n} \log\left(1+\frac{r}{n^2}\right) < \frac{n(n+1)}{2n^2}$

Using sandwich theorem, $\log L = \frac{1}{2}$ so $\angle 4 = e^2$

2. $f(x)+g(x) = a(x+1)(x+2)(x+3)$

$f(x)-g(x) = b(x-1)(x-2)(x-3)$

So $f(0) = 3(a-b), g(0) = 3(a+b)$

Hence $f^2(0)+g^2(0) = 18(a^2+b^2) \geq 36$ (equality holds for $a,b\in\{-1,1\}$)

3. Clearly $n = 26.$

4. Let $I_i = \frac{(2x^7+3x^6-10x^5-7x^3-12x^2+x+1)}{(x^2+2)}dx$

$$= \int_{-\sqrt{2}}^{\sqrt{2}} \frac{(2x^7-10x^5-7x^3+x)}{(x^2+2)}dx + \int_{-\sqrt{2}}^{\sqrt{2}} \frac{(3x^6-12x^2+1)}{(x^2+2)}dx$$

$$= 0 + 2\int_0^{\sqrt{2}} \frac{3x^2(x^4-4)+1}{(x^2+2)}dx \qquad = 2\int_0^{\sqrt{2}} \left(3x^2(x^2-2)\frac{1}{x^2+2}\right)dx$$

$$= 2\left\{\frac{3x^5}{5} - 2x^3 + \frac{1}{\sqrt{2}}\tan^{-1}\left(\frac{x}{\sqrt{2}}\right)\right\}_0^{\sqrt{2}} \qquad = 2\left\{\frac{12\sqrt{2}}{5} - 4\sqrt{2} + \frac{1}{\sqrt{2}}.\frac{\pi}{4}\right\}$$

$$= \frac{24\sqrt{2}}{5} - 8\sqrt{2} + \sqrt{2}.\frac{\pi}{4} = \frac{\sqrt{2}}{20}(5\pi+64) \qquad \therefore\ k^2 = 64 \Rightarrow k = 8$$

5. Let $S = \sum_{k=0}^{100}\left(\frac{k}{k+1}\right)\,{}^{100}C_k$

$$= \sum_{k=0}^{100} \frac{((k+1)-1)}{(k+1)}\,{}^{100}C_k = \left(\sum_{k=0}^{100} {}^{100}C_k\right) - \sum_{k=0}^{100} \frac{{}^{100}C_k}{k+1}$$

$$= 2^{100} - \frac{1}{101}\sum_{k=0}^{100}\left(\frac{101}{k+1}\,{}^{100}C_k\right) \qquad = 2^{100} - \frac{1}{101}\sum_{k=0}^{100} {}^{101}C_{k+1}$$

$$2^{100} - \left(\frac{2^{101}-1}{101}\right) = \frac{(101)2^{100}-2^{101}+1}{101} = \frac{99(2^{100})+1}{101} = \frac{a(2^{100})+b}{c}(Given)$$

So, $a = 99, b = 1, c = 101$

Hence, $(a+b+c)_{least} = 99+1+101 = 201.$

6. $\lim_{x\to 0^+}\left[\frac{x}{\pi}\right] = \lim_{x\to 0^+}\left[\frac{h}{\pi}\right] = 0$

$$\lim_{x\to 0^+} \frac{\sin^2 x}{\left[\frac{x}{\pi}\right]+\frac{x^2}{\pi^2}} \times \frac{\sin(\sin x)-\sin x}{ax^5+bx^3+c} = -\frac{\pi^2}{12}$$

$x = 0 + h$

$$\lim_{h\to 0^+} \frac{\frac{\sin^2 h}{h^2}}{\pi^2} \times \frac{2\cos\left(\frac{\sinh + h}{2}\right)\sin\left(\frac{\sinh - h}{2}\right)}{ax^5 + bx^3 + c} = -\frac{\pi^2}{12}$$

$$\lim_{h\to 0^+} \frac{\pi^2 . \sin^2 h}{h^2} \times 2\cos\left(\frac{\sinh + h}{2}\right)$$

$$\frac{\sin\left(\frac{\sinh + h}{2}\right)}{\frac{\sinh - h}{2}} \times \frac{\frac{\sinh - h}{2}}{ah^5 + bh^3 + c} = -\frac{\pi^2}{12} \Rightarrow \lim_{h\to 0} \frac{\sinh - h}{ah^5 + bh^3 + c} = -\frac{1}{12}$$

$$\lim_{h\to 0} \frac{\sinh - h}{(ah^2 + b)} = -\frac{1}{12}(c = 0) \quad -\frac{1}{6(b)} = -\frac{1}{12} \qquad \therefore\ b = 2$$

$a \in R, b = 2, c = 0$

$a \in R, b = 2, c = 0$

7. Let $x + \lambda y - 1 = 0$ be the variable line and (h,k) be the foot of perpendicular on it from $(3,4) \Rightarrow (h-2)^2 + (k-2)^2 = 5$

$\Rightarrow$ Radius of $S(x,y) = 0\, is\, \sqrt{5}$

$\Rightarrow$ Length of tangent from origin to $S(x,y) = 0\, is\, \sqrt{3}$

8. Consider $|x| + 2|y| + 3|z| \le 6$

Volume = 8 × volume of tetrahedron in 1st octane

$$= 8 \times \frac{1}{6} \times 6 \times 3 \times 2 \qquad = 48$$

9. Let $z = x + iy$

$\Rightarrow \left[\sqrt{x^2 + y^2}\right]^3 + 2(x^2 - y^2) + 4x - 8 + i(4xy - 4y) = 0$

If $4xy - 4y = 0 \Rightarrow x = 1 (\because y \ne 0)$

If $x = 1 \Rightarrow \left(\sqrt{1 + y^2}\right)^3 - 2(1 - y^2) + 4 - 8 = 0$

$\Rightarrow \left(\sqrt{1 + y^2}\right)^3 = 2(1 + y^2) \qquad \Rightarrow y^2 + 1 = 4 \Rightarrow y^2 = 3$

$\therefore\ z = (1 + i\sqrt{3})(or)(1 - i\sqrt{3})$

10. $l_1 : r_1 = \lambda(i + j + k) = \bar{a} + \lambda\bar{b}$

$l_2 : \vec{r_2} = j - k + \mu(i + k) = \bar{c} + \mu\bar{d}$

Here, $\left[\bar{a} - \bar{c} \quad \bar{b} \quad \bar{d}\right] = \begin{vmatrix} 0 & 1 & -1 \\ 1 & 1 & 1 \\ 1 & 0 & 1 \end{vmatrix} = 1 \ne 0$

$\Rightarrow l_1$ and l_2 are skew – lines.

$\therefore\ H_0$ is the plane containing l_1 and parallel to l_2

$\Rightarrow$ Equation of H_2 is $\begin{vmatrix} x & y & z \\ 1 & 1 & 1 \\ 1 & 0 & 1 \end{vmatrix} = 0 \Rightarrow x - z = 0$

P) $d(H_0) =$ Shortest distance between $d(H_0) =$ and $l_2 = \frac{1}{\sqrt{2}}$

Q) $d = \left|\frac{0-2}{\sqrt{2}}\right| = \sqrt{2}$

R) $d = \left|\frac{0-0}{\sqrt{2}}\right| = 0$

H_0 passes through $(0,0,0)$

S) Point of intersection of given planes and H_0 is $(1,1,1)$

Distance from origin $= \sqrt{(1-0)^2 + (1-0)^2 + (1-0)^2} = \sqrt{3}$

11. For $2ax^2 + bx + c = ax + c$

$x = 0, \frac{a-b}{2a}; so\, a = b$

Now, $2ax^2 + bx + c = ax + b$

Putting $a = b, x^2 = \frac{1}{2}\left(1 - \frac{c}{a}\right); so \frac{c}{a} \ge 1$

Again $2ax^2 + bx + c = cx + a$

Putting $a = b$, Diseriminant $= \left(\frac{c}{a} - 1\right)\left(\frac{c}{a} - 9\right) \le 0$

So $\frac{c}{a} \le 9.$

12. Clearly $S \equiv (4,0)$; Let $P = (\alpha, \beta)$

$\Rightarrow a + e\alpha = 7 \Rightarrow 5 + \frac{4}{5}\alpha = 7 \Rightarrow \alpha = \frac{5}{2} and\ \beta = \frac{3\sqrt{3}}{2}$

Hence, equation of tangent at P is $\alpha = \frac{5}{2}$ and $\beta = \frac{3\sqrt{3}}{2}$

As tangent is bisector of angle between SP and $S'P$

$\Rightarrow PQ = PS = 3.$ As $PS + PS' = 10 =$ Length of major axis

When P is variable then $S'Q = S'P + PQ = S'P + PS = 10$

$\Rightarrow$ Variable point Q is at a fixed distance from S'

$\Rightarrow$ Locus is a circle with centre S' and radius = 10 units

13. *Diffe* $f'(x) = (x+y)^2 - 1 \Rightarrow \frac{d(x+y)}{(x+y)^2} = dx \Rightarrow \frac{-1}{x+y} = x + c$

Since $f(0) = 1 \Rightarrow C = -1 \Rightarrow \frac{-1}{x+y} = x - 1 \Rightarrow y = \frac{1}{1-x} - x$

$y' = \frac{1}{(1-x)^2} - 1$

14. $8P^3 + I = (2P + I)(4P^2 - 2P + I) = I$

Taking determinant $|2P + I| \ne 0, |4P^2 - 2P + I| \ne 0$

Again $I - 8P^3 = (I - 2P)(4P^2 + 2P + I) = I$

Taking determinant $|I - 2P| \ne 0$

So $|I + 2P||I - 2P| \ne 0$

$\Rightarrow \ \left|I-4P^2\right| \neq 0$

If P has integral entries $|I-2P|$ and $|I+2P|$ can be 1 or – 1. So $\left\|I-4P^2\right\|=1$.

15. $I_r=\int_0^1 \frac{(2+x)-(1+x)}{(1+x)^r(2+x)}dx=\int_0^1 \frac{dx}{(1+x)^r}-\int_0^1 \frac{dx}{(1+x)^{r-1}(2+x)}$

$I_r+I_{r-1}=\frac{2^{1-r}}{1-r}=\frac{1-2^{1-r}}{r-1}$

$I_{10}+I_9=\frac{1-2^{-9}}{9} \Rightarrow 9(I_{10}+I_9)=1-2^{-9}$

$I_9+I_8=\frac{1-2^{-8}}{8} \Rightarrow 8(I_9+I_8)=1-2^{-8}$

$\Rightarrow \ 9I_{10}+I_9-8I_8=\frac{1}{2^9}$

16. $\left|a+b\omega+c\omega^2\right|^2=\left(a+b\omega+c\omega^2\right)\left(a+b\omega^2+c\omega\right)$

$=a^2+b^2+c^2-ab-bc-ca$

$=\frac{1}{2}\left((a-b)^2+(b-c)^2+(c-a)^2\right)$

Now to minimize, choose $a=3, b=4, c=5$.

17. Let repeated roots be α

$\alpha^4+p\alpha^2+q\alpha+r=0$ ____(1)

$4\alpha^3+2p\alpha+q=0$ ____(2)

$12\alpha^2+2p=0$ ____(3)

So $\alpha^2=-\frac{p}{6}$

Putting in (2), $\frac{4p\alpha}{3}=-q$

Putting in (1), $\frac{p^2}{36}-\frac{p^2}{6}-\frac{4p}{3}\times\left(-\frac{p}{6}\right)+r=0$

$\Rightarrow \quad p^2=-12r$

Hence semilatus rectum = 6.

18. Let $Q(h,k)$

Equation of chord of contact to auxiliary circle $\frac{hx}{a^2}+\frac{by}{a^2}=1$

Equation of tangent to ellipse $\frac{x\cos\theta}{a}+\frac{y\sin\theta}{b}=1$

Comparing $h=a\cos\theta, k=\frac{a^2}{b}\sin\theta$

So clearly locus is an ellipse of same eccentricity.

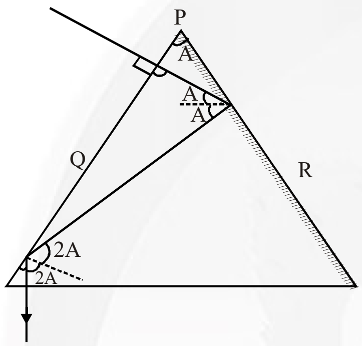
PHYSICS

19. $V_0 = \sqrt{\dfrac{2eR_0\sigma \ln(r/R_0)}{\varepsilon_0 m_e}} \simeq 3.7\times10^5\, m/s$

20. $mg - qE = mg_{eff}$ $\quad g - \dfrac{qE}{m} = g_{eff}$

$T = 2\pi\sqrt{\dfrac{l}{g - q\dfrac{E}{m}}}$ $\quad T = 2\pi\sqrt{\dfrac{1}{10 - \dfrac{10^{-6}\times7.5}{10^{-6}}}} = 4\,\text{sec}.$

21. $\dfrac{\pi}{2} - \dfrac{A}{2} + \dfrac{\pi}{2} - 2A = \dfrac{\pi}{2}$



$\dfrac{5A}{2} = \dfrac{\pi}{2}$ $\quad A = \dfrac{\pi}{5}$

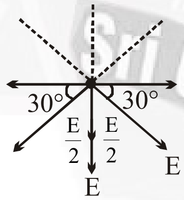
22. $\dfrac{Mgr}{2} = \dfrac{1}{2}\dfrac{Mr^2}{3}\omega^2$ $\quad \omega = \sqrt{\dfrac{3g}{r}}$

$\sqrt{5gr}\,m\times r = \dfrac{Mr^2}{3}\times\sqrt{\dfrac{3g}{r}}$

$m = 2\,kg$

23. The magnitude of electric field intensity due to each part of the hemispherical surface at the centre 'O' is same. Suppose, It is E.

$E + \dfrac{E}{2} + \dfrac{E}{2} = E_0$



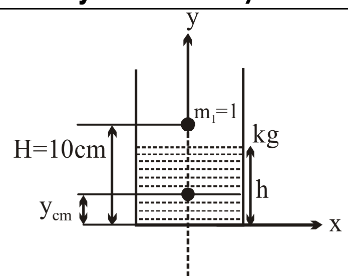
$2E = E_0$ $\quad E = \dfrac{E_0}{2}$

24. The position of centre of mass of the system is y_{cm}.

$$y_{cm} = \frac{m_1\times H + m_2\times\dfrac{h}{2}}{m_1 + m_2}$$

Where $m_1 = 1kg, m_2 = \left(0.4\times h\times10^3\right)kg$

$= \left(400\,h\right)kg$



$$y_{cm}=\frac{1\times H+(400h)\times\frac{h}{2}}{(1+400h)}=\frac{H+200h^2}{(1+400h)}$$

for y_{cm} to be lowest (minimum)

$\frac{dy_{cm}}{dh}=0$ 200 h^2 + h –H = 0 h = 2 cm

25. In uniform electric in vertical direction if (+ve) charge feels extra acceleration in downward direction, then (–ve) charge will feel acceleration in upward direction.

$v_{uncharged}=5\sqrt{5}\,m/\sec$

v = 0, h = height

$v^2-u^2=-2(g)h \qquad =-2gh$

$u_{q+}=13\,m/\sec$

v = 0, h = h

$v^2-u^2=2\left(g+\frac{F_E}{m}\right)h$

$0-(13)^2=-2\left(g+\frac{F_E}{m}\right)h$

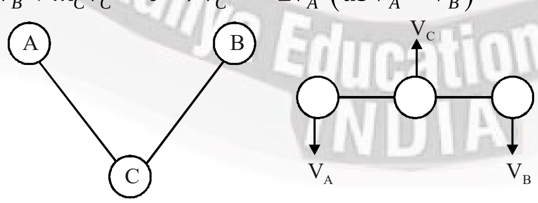
Let $u_{q-}=u(say)$

v = 0 h = ht

$v^2-u^2=-2\left(g-\frac{F_E}{m}\right)h$

$-u^2=-2\left(g-\frac{F_E}{m}\right)h;u=9\,m/\sec$

26. Takes all three bodies as system electrostatic force
(1) Apply law of conservation of momentum in direction
(2) Apply law of conservation of energy,
So $m_A\vec{v}_A+m_B\vec{v}_B+m_C\vec{v}_C=0\Rightarrow v_C=-2v_A\ (as\,V_A=V_B)$



Change in electrostatic P.E. = Increase in KE

$$\frac{kQ^2}{l}-\frac{kQ^2}{2l}=\frac{1}{2}m_Av_A^2+\frac{1}{2}m_Bv_B^2+\frac{1}{2}m_Cv_C^2\ \left[v_A=v_B,v_c=-2v_A\right]$$

So $v_C=2\,m/s$

27. Conceptual

$$\frac{2\pi}{\lambda}\left(\frac{dy}{D+v}\right)=4\pi+\frac{\pi}{3} \qquad \frac{2\pi}{\lambda}\left(\frac{dy}{D+v'}\right)=6\pi-\frac{\pi}{3}$$

$$\frac{dy}{D}=3\lambda \qquad \frac{dy}{D}=3\lambda$$

$$\frac{2\pi.3D}{dx}\left(\frac{dy}{D+v}\right)=\frac{13\pi}{3} \qquad \frac{2\pi.3D}{dx}\left(\frac{dy}{D+v'}\right)=\frac{17\pi}{3}$$

$$\frac{6D}{D+v}=\frac{13}{3} \qquad \frac{6D}{D+v'}=\frac{17}{3}$$

$$18D=13D+13v \qquad 18D=17D+17v'$$

$$\frac{5D}{13}=v \qquad \frac{D}{17}=v'$$

28.

29. The magnetic field due to the outer loop is into the paper. The force on an element of the inner loop has the direction given by $\vec{ds}\times\vec{B}$ where $\vec{ds}$ is the element length in the direction of current. Thus the force is radially outward.

Since the force is symmetric, i.e. radially outwards everywhere and the loops are concentric, there is no net force on the inner loop.

30. Note that the intensity of light in the region AB (when the lens is absent) now gets distributed over the region CD. In the regions AC and BD light intensity is due to both the direct beam and the diverged light from the lens.

31. For both the atoms the second excited state corresponds to $n=3$. Therefore, the angular momentum for each of them is $3(h/2\pi)$. The energy, however, is proportional to Z^2 where Z is the atomic number and hence numerical value of energy for hydrogen is less than that for lithium.

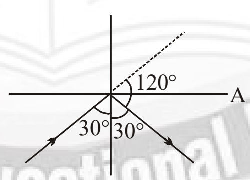
32. For T.I.R. at A

$4\sin 30° = \mu_2 \sin 90°$

$\mu_2 = 2$

Case–I

If $\mu_2 < 2,$ then always T.I.R. takes place & in this situation



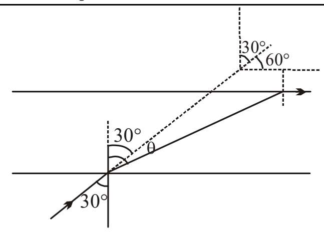
angle of deviation is 120°.

Case–II

$_2$> 2, then for the given angle of incidence no. T.I.R. takes place at A, so light strikes on interface B for T.I.R.

$\mu_2 \sin\alpha = 2\sin 90°$

or $\mu_2 = \sin\alpha < 1$



$\mu_2 > 2$

33. Let A be the work function of metal.

$$\frac{hc}{\lambda_1} = A + \frac{mv_1^2}{2} \quad \frac{hc}{\lambda_2} = A + \frac{mv_2^2}{2}$$

$$hc\left[\frac{1}{\lambda_1} - \frac{1}{\lambda_2}\right] = \frac{m}{2}\left(v_1^2 - v_2^2\right) = \frac{m}{2}\left[4v_2^2 - v_2^2\right] \qquad = \frac{3mv_2^2}{2}$$

$$\frac{mv_2^2}{2} = \frac{hc}{3}\left[\frac{1}{\lambda_1} - \frac{1}{\lambda_2}\right]$$

$$A = \frac{hc}{\lambda_2} - \frac{mv_2^2}{2} = \frac{hc}{\lambda_2} - \frac{hc}{3}\left[\frac{1}{\lambda_1} - \frac{1}{\lambda_2}\right] = \frac{4hc}{3\lambda_2} - \frac{hc}{3\lambda_1}$$

$$= -\frac{hc}{3}\left[\frac{1}{\lambda_1} - \frac{4}{\lambda_2}\right] \qquad = \frac{6.62\times10^{-34}\times3\times10^8}{3}\left[\frac{4}{450\times10^{-9}} - \frac{1}{350\times10^{-9}}\right]$$

$A = 3.93\times10^{-19}\,J.$

34. The least common multiple of resonant frequencies is 30 and it represent the fundamental frequency. here odd multiples $\Rightarrow$ string is free at one end.

$$\therefore\ v = \frac{1}{4l}\sqrt{\frac{T}{\mu}} \quad \therefore\ 30 = \frac{1}{4\times0.8}\sqrt{\frac{T}{\mu}} \quad \Rightarrow \quad \sqrt{\frac{T}{\mu}} = 1.6\times60 = 96\,m/s$$

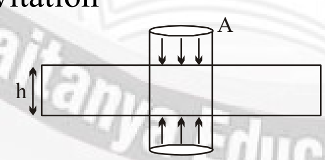
35. $u = f\left(x \pm c.t\right)$ is the general wave equation

At $t = 0, y = f\left(x\right) \Rightarrow y = \dfrac{1}{\sqrt{1+x^2}}$

$$y = \frac{1}{\sqrt{2-2x+x^2}} = \frac{1}{\sqrt{1+\left(x-1\right)^2}} = f\left(x-1\right)$$

$$\Rightarrow \quad f\left(x-ct\right) = f\left(x-1\right) at\, t = 1 \qquad \Rightarrow c = 1\,m/s.$$

36. Gauss law for gravitation



$$\int \vec{g}.d\vec{s} = -m_{in}.4\pi G$$

$$g = \frac{GM}{R^2} \qquad 2\times\frac{GM}{R^2}\times A = \frac{M}{\frac{4}{3}\pi R^3}\left(h\times A\right)\times4\pi G \quad \Rightarrow h = \frac{2R}{3}$$

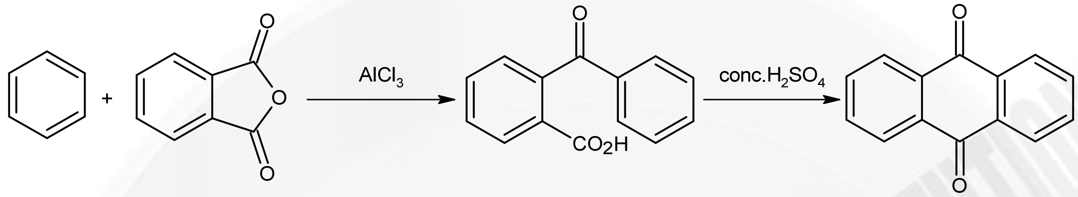
CHEMISTRY

37. $BaSO_4, MgCO_3, Mg(OH)_2$ and CaF_2 are sparingly soluble $BeCl_2, Mg(ClO_4), BaCl_2$ and $Ca(NO_3)_2$ dissolve in water without reaction CaO, SrH_2 dissolve in water by reacting with water.

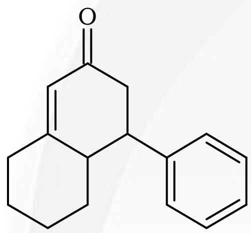
38. Refer to fig. structure of boric acid

39. $(PO_3^-)_6$

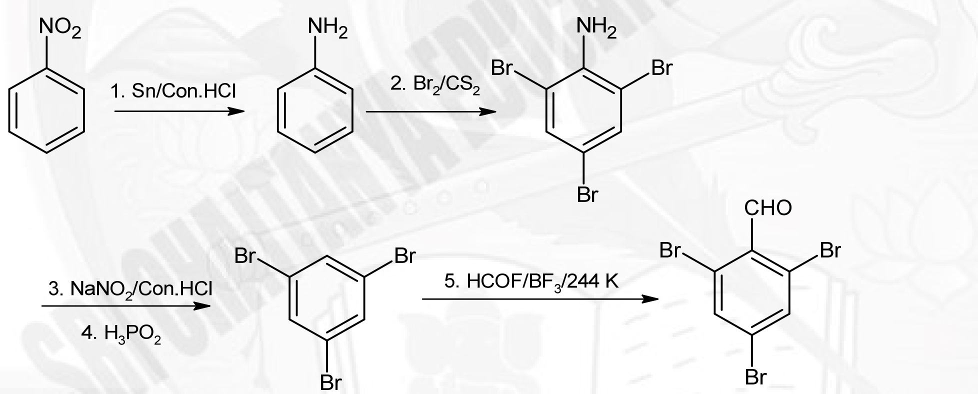
40.



41. Michael addition of enolate of cyclohexanone followed by aldol condensation gives



42.



43.

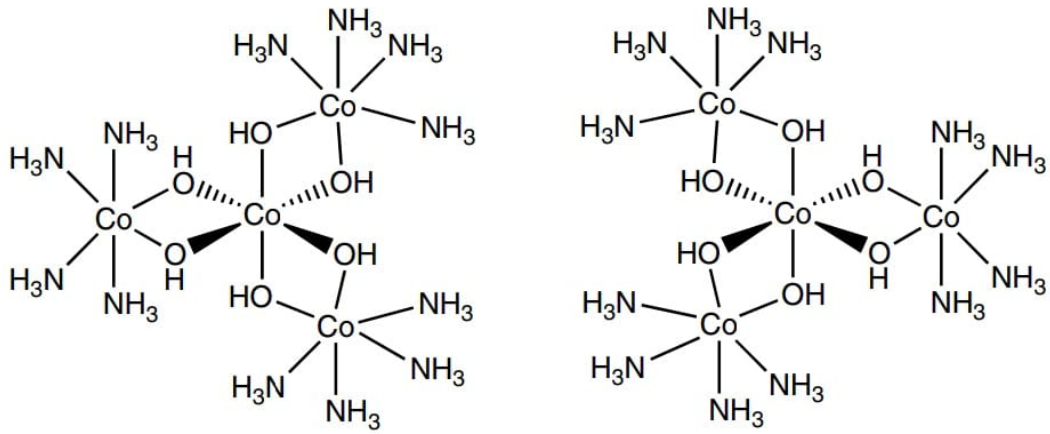
$$A^- + H_2O \longrightarrow HA + OH^-; K_b = 10^{-9}$$

$$[OH^-] = \sqrt{K_b C} = 10^{-5} \Rightarrow [H^+] = 10^{-9}$$

44. $0.6 = 5 \times \frac{15.168}{79x} \times \frac{1000}{200} \Rightarrow x = 8$

45. The situation in B is well known and may be explained in terms of sp^3d hybridization or the VSEPR theory.
For $Ni(CN)_5^{3-}$ in (C) the highest d-orbital $d_{x^2-y^2}$ is empty, thus allowing the basal lingads to move in closer to the metal. For $CuCl_5^{3-}$ the highest d-orbital d_{z^2} is only half filled leading to shorter axial bonds.
The lone pair in BrF_5 is below the basal plane and repel the in-plane ligands upward. On the other hand no such effect is found in $Ni(CN)_5^{3-}$. In addition ligands repulsions will force the basal ligands downward.

46. View of the cationic part of the two enantiomers of



47. All have the formula C_8H_{12} all give single product on ozonolysis, but B exhibits geometrical isomerism.

48. PCC and Cu can oxidize alcohols without affecting double bonds.

49. A) Decrease in size of graphite pieces, increases the surface area which in turn increases the rate.

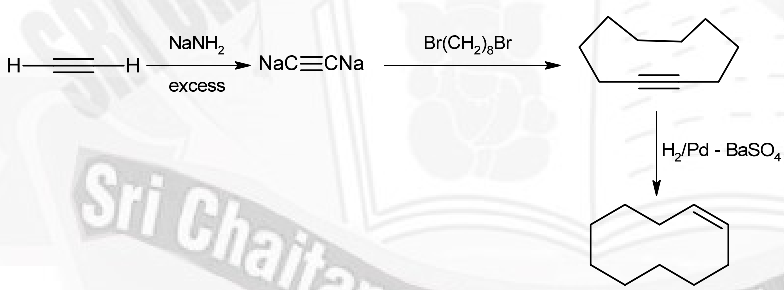
B) Increase in temperature increases the rate due to increase in molecules with energy of activation.

50. Energy of activation is not the criteria for a process to be spontaneous and most of the reactions have non-zero energy of activation. Entropy of the **universe** increases during a spontaneous change. ΔG keeps on becoming less negative and becomes zero at equilibrium. Work is maximum when the process is carried out reversibly.

51. In Bayer's process bauxite is heated with NaOH solution in an autoclave at about 150^0C for few hours. If this process is carried at normal pressure the water evaporate. To prevent the boiling and evaporation of water, the process is carried at high pressure.

52. AgF is soluble but SrF_2 is sparingly soluble

53.



54. $K_2Cr_2O_7 + 14HCl \longrightarrow 2CrCl_3 + 3Cl_2 + 7H_2O + 2KCl$

$n_{Cr_2O_7^{2-}} = 49 \times \frac{96}{100} \times \frac{1}{294} = 0.16$

$w_{HCl} = 325 \times 1.15 \times 0.301 = 112.5\ g$

$n_{HCl} = \frac{112.5}{36.5} = 3.08$

Limiting reagent is dichromate.

$w_{Cl_2} = \frac{3}{1} \times 0.16 \times 71 = 34.08\ g$