JEE MAIN – 2019

CHEMISTRY

31: Sol. (2)

Given: $Na_2SO_4 \longrightarrow Na^+ = 92\,g$

Molality per kg $= \dfrac{wt.of\ solute}{MW\ of\ solute \times wt.of\ solvent(in\,\text{kg})} = \dfrac{92}{23\times 1} = 4$

32: Sol. (1)

According to Freundlich isotherm,

$\dfrac{x}{m} \propto (P)^{\frac{1}{n}}$ where $\dfrac{1}{n} \Rightarrow 0$ to 1

$\dfrac{x}{m} = k(P)^{\frac{1}{n}}$

Taking log both sides, we get

$\Rightarrow \log\dfrac{x}{m} = \log k + \dfrac{1}{n}\log P$

Slope $= \dfrac{1}{n}$

From the graph, slope $= \tan\theta = \dfrac{2}{4} = \dfrac{1}{n}$

$\Rightarrow n = 2$

So, $\dfrac{x}{m} \propto (P)^{\frac{1}{2}}$

33: Sol. (1)

Millimoles of $H_2SO_4 = 20 \times 0.1 = 2$

Millimoles of $NH_4OH = 30 \times 0.2 = 6$

	H_2SO_4	+	$2NH_4OH$	$\rightarrow$	$(NH_4)_2SO_4$	+	$2H_2O$
$t=0$	2		6		0		0
$t=t$	$2-2=0$		$6-2\times2=2$		2		4

Since it is complete neutralization, buffer formula will be applied.

$$\begin{aligned} pOH &= pK_b + \log\frac{salt}{base} \\ &= 4.7 + \log\frac{4}{2} \\ &= 4.7 + \log 2 \\ &= 4.7 + 0.3010 \\ &= 5.01 \\ &\approx 5 \end{aligned}$$

$pH = 14 - pOH = 14 - 5 = 9$

34: Sol. (2)

According to Henry's law, $P = K_H \times$ solubility

Where $P =$ partial pressure of the gas

$K_H =$ Henry's constant

$\Rightarrow$ Solubility $\propto \dfrac{1}{K_H}$ (K_H is different for different gas)

According to this expression, if the solubility of gas increases the value of K_H decreases

35: Sol. (2)

Rate $= k[A]^x[B]^y$

Now according to question

$$6.93\times10^{-3} = k[0.1]^x[0.20]^y ......(i)$$
$$6.93\times10^{-3} = k[0.1]^x[0.25]^y ......(ii)$$
$$1.386\times10^{-2} = k[0.2]^x[0.30]^y ......(iii)$$

Dividing eq. (i) by (ii), we get

$$\frac{6.93\times10^{-3}}{6.93\times10^{-3}} = \frac{[0.1]^x[0.20]^y}{[0.1]^x[0.25]^y}$$
$$\Rightarrow y = 0$$

Now, dividing eq. (i) by (iii), we get

$$\frac{6.93\times10^{-3}}{1.386\times10^{-2}} = \frac{[0.1]^x[0.25]^0}{[0.2]^x[0.30]^0}$$
$$\Rightarrow \frac{1}{2} = \left(\frac{1}{2}\right)^x$$
$$\Rightarrow x = 1$$

From equation (i) and (iii) we get $x = 1$, so it is first order with respect to A.

$$\Rightarrow 6.93\times10^{-3} = k(0.1)$$
$$\Rightarrow k = 6.93\times10^{-2}\ \text{min}^{-1}$$

Half-life $t_{\frac{1}{2}} = \frac{\ln 2}{k} = \frac{0.693}{6.93\times10^{-2}} = 10\,\text{min}$

36: Sol. (3)

Charge $= 0.05\,\text{F}$

Amount of $PbSO_4$ precipitated $= W$

Molar mass of $PbSO_4 = 303\,\text{g mol}^{-1}$

Method 1:

According to Faraday's 1st law of electrolysis

$$E = \frac{M}{2}; Q = 0.05$$

$$W = E \times Q = \frac{303}{2} \times 0.05 = 7.6\,g$$

Method 2:

$$Pb(s) + SO_4^{2-} \rightarrow PbSO_4 + 2e^-$$

For $2\,\text{F}$ current passed, $PbSO_4$ deposited $= 303\,\text{g mol}^{-1}$

For $0.05\,\text{F}$ current passed, $PbSO_4$ deposited $= W$

$$W = \frac{303 \times 0.05}{2} = 7.6\,g$$

37: Sol. (2)

Transition state from $n = 8$ to $n = n_f$.

For hydrogen emission spectrum, $Z = 1$

$$\bar{v} = R_H z^2 \left[\frac{1}{n_1^2} - \frac{1}{n_2^2}\right] = R_H \times 1^2 \left[\frac{1}{n_f^2} - \frac{1}{8^2}\right] = R_H \times \frac{1}{n_f^2} - \frac{R_H}{64}$$

Comparing with $y = mx + c$

$\text{Slope} = R_H$

38: Sol. (1)

Mixture $\rightarrow$ Gas $A(0.5\,\text{mol})+$ Gas $B(X\text{ mol})$

Total pressure $=200\,\text{Pa}$, $T=1000\,\text{K}, \text{V}=10\,\text{m}^3$

From ideal gas law, $PV=nRT$

$$200\times10=(X+0.5)\times R\times1000$$
$$2=(X+0.5)R$$
$$\Rightarrow X=\frac{2}{R}-\frac{1}{2}=\frac{4-R}{2R}$$

39: Sol. (3)

Protium $\longrightarrow {}_1H^1$

Deuterium $\longrightarrow {}_1H^2$

Tritium $\longrightarrow {}_1H^3$

40: Sol. (3)

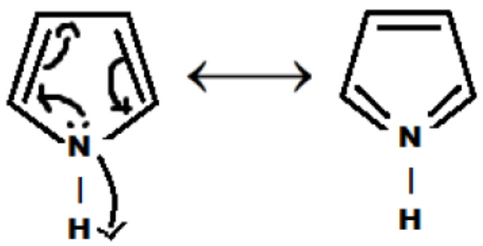
In (P), nitrogen is sp^2 hybridized ($l.p.$ is consider for hybridization). The lone pair is not conjugation.

In (Q), nitrogen contains 3σ bond and its hybridization is sp^2. Since the lone pair is delocalized inside the ring it doesn't take part in hybridization and make this compound to be aromatic in nature.

In (R), nitrogen is sp^3 hybridized and no delocalization of lone pair.

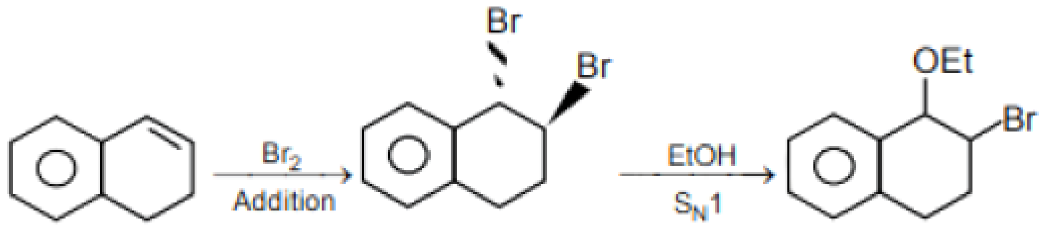
Higher the $p-$ character, more it is basic in nature

Hence the order is $R>P>Q$.



41: Sol. (3)

It involves electrophilic addition of alkenes, followed by nucleophilic substitution mechanism.



42: Sol. (2)

Based on the order of $-I$ effect.

More the $-I$ effect greater its acidic strength hence more is value K_a .

$-NO_2 > CN > F > Cl$

Hence the correct order is $R > S > P > Q$.

43: Sol. (3)

Presence of $Mn \geq 0.5$ ppm concentration makes water unsuitable for drinking.

44: Sol. (4)

Order lies with $-I$ and $-M$ effect.

$-I$ and $-M$ effect in CN is more when compared to Cl, I and Br. After losing H^+ the negative ion on the C will be delocalized to CN making it more stable and acidic.

45: Sol. (4)

It depends on the polarization power of cation. The atom which is having larger size will have lesser polarization power and does not have water of crystallization.

Ba^{2+} ion is larger in size in comparison to Ca^{2+}, Sr^{2+} and Mg^{2+} ion.

Hence, $Ba(NO_3)_2$ is the correct option.

46: Sol. (3)

Malachite – $CuCO_3.Cu(OH)_2$, Copper only

Azurite – $2CuCO_3.Cu(OH)_2$

Copper pyrite – $CuFeS_2$, Copper + Iron

47: Sol. (3)

$Li_2^+(5e^-) \rightarrow \sigma_{1s}^2 \sigma_{1s}^{*2} \sigma_{2s}^1$

Bond order $= \frac{N_b - N_a}{2} = \frac{3-2}{2} = \frac{1}{2}$

$Li_2^-(7e^-) \rightarrow \sigma_{1s}^2 \sigma_{1s}^{*2} \sigma_{2s}^2 \sigma_{1s}^{*1}$

Bond order $= \frac{N_b - N_a}{2} = \frac{4-3}{2} = \frac{1}{2}$

Both Li_2^+ and Li_2^- have same bond order. Unlikely 0.5 bond order does not exist so both Li_2^+ and Li_2^- are unstable.

The species which is having lesser number of electrons present in antibonding orbital will be more stable so $Li_2^+ > Li_2^-$.

48: Sol. (1)

On moving down, the group electronegativity decreases.

On moving down, the group atomic shell increases there by atomic radius increases.

Electron gain enthalpy decreases down the group.

49: Sol. (2)

$W = -nRT \ln \frac{V_f}{V_i} \rightarrow$ constant is given same in all case.

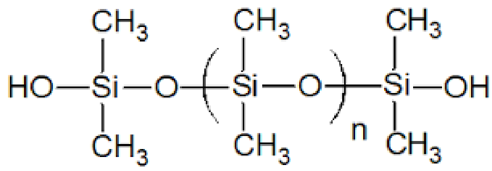
Taking magnitude for W,

$|W| = nRT \ln V_f - nRT \ln V_i$

Since, $T_2 > T_1$, lines cannot intersect and slope of 2 will be higher than 1. Intercept will be negative ($-nRT \ln V_i$).

50: Sol. (4)

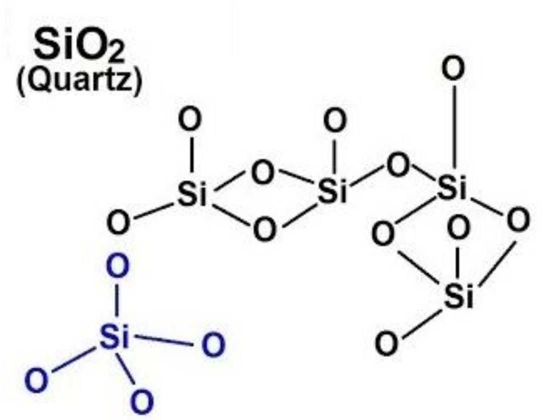
All given statements are true for the silicone polymer.



51: Sol. (2)

Piezoelectric are the material that produce electrical potential when pressure is applied on parallel and perpendicular phases.

The most well-known, and the first piezoelectric material used in electronic devices is the quartz.



52: Sol. (1)

Due to inert pair effect thallium exist both $+1 \& +3$ oxidation state. But Thallium is stable in $+1$ oxidation state. Going down the group tendency of electrons present in ns orbitals do not participate in hybridization as the energy require to unpaired them is much more than the energy released during the bond formation.

$Th \rightarrow [Xe]4f^{14}5d^{10}6s^{2}6p^{1}$

53: Sol. (1)

In Transition metal complex maximum number of unpaired electron possible is 5 and it will be present in $d-$sub-shell

$\mu=\sqrt{n(n+2)}\,\text{BM}$, $n\rightarrow$no. of impaired electron

So, $\mu_{\text{max.}}=\sqrt{5(5+2)}=\sqrt{35}=5.92\,\text{BM}$

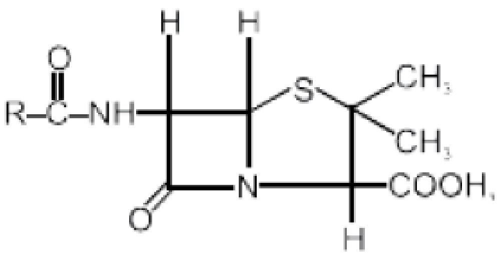
54: Sol. (3)

Penicillin contains carboxylic group, hence respond to sodium hydrogen sulphate test.

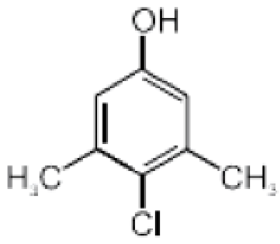
Chloroxylenol contains $-OH$ group, hence respond to neutral $FeCl_3$ test.

Sulpha pyridine NH_2 group, hence, respond to carbylamines test.

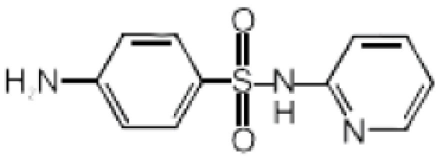
Norethindrone $C\equiv CH$ group, hence, respond to Bayer's test.



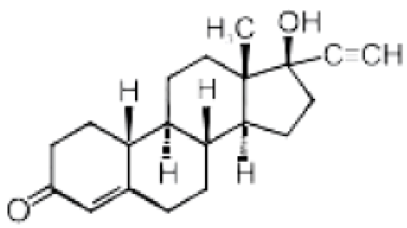
Penicillin



Chloroxylenol

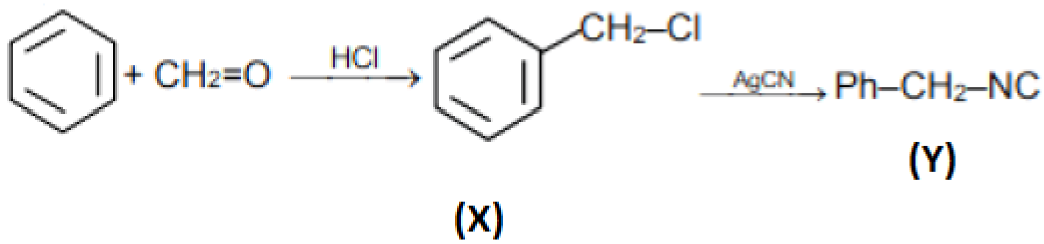


Sulphapyridine

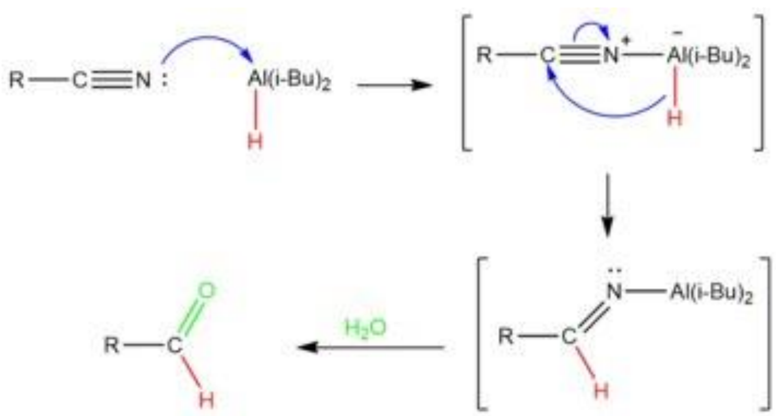


Norethindrone

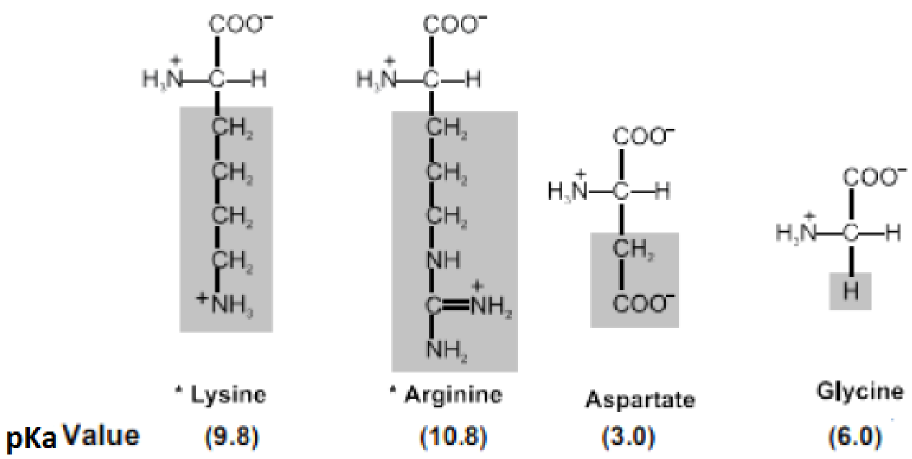
55. **Sol. (1)**



56: Sol. (1)

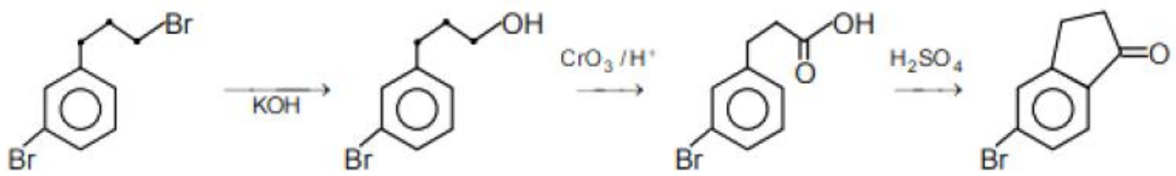


57: Sol. (4)

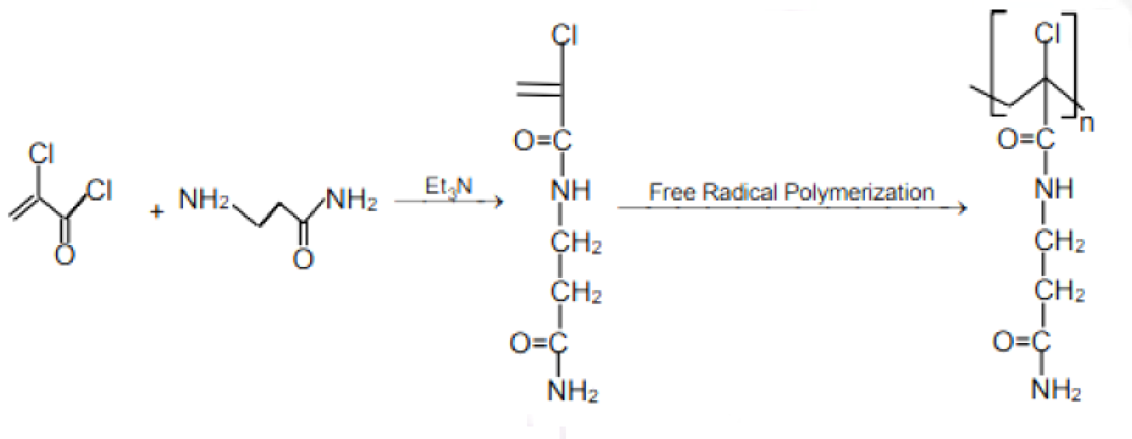


58: Sol. (1)

It involves nucleophilic substitution reaction (S_N2) followed by oxidation with oxidizing agent and removal of water molecule.



59: Sol. (1)



60. Sol. (4)

The crystal field splitting parameter can't be measured by wavelength of yellow and violet colors for (A) and (B) respectively.