IITJEE-2009

TS7 Paper 1
Chemistry Solutions

48. (A)

49. (C) Reduction Potentials: $Br_2 + 2e^- \rightarrow 2Br^-$; $E^\circ = 1.09V$

$I_2 + 2e^- \rightarrow 2I^-$; $E^\circ = 0.54V$

$Fe^{2+} + 2e^- \rightarrow Fe$; $E^\circ = -0.44\,V$

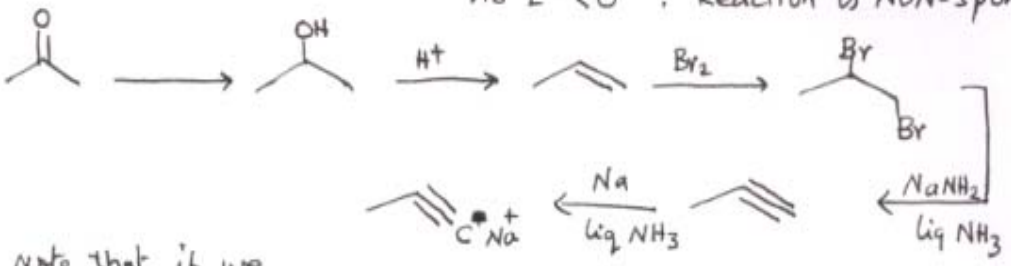
$Fe + Br_2 \rightarrow FeBr_2$: $E^\circ_{cell} = 1.09 - (-0.44) = +1.53\,V$

$Fe + I_2 \rightarrow FeI_2$: $E^\circ_{cell} = 0.54 - (-0.44) = +0.98V$

$I_2 + 2Br^- \rightarrow 2I^- + Br_2$: $E^\circ_{cell} = 0.54 - (1.09) = -0.45V$

As $E^\circ < 0$: Reaction is NON-spontaneous

50. (D)



Note that if we use: H_2 in $Na/liq\,NH_3$ ≡ hydrogenation of alkyne

51.

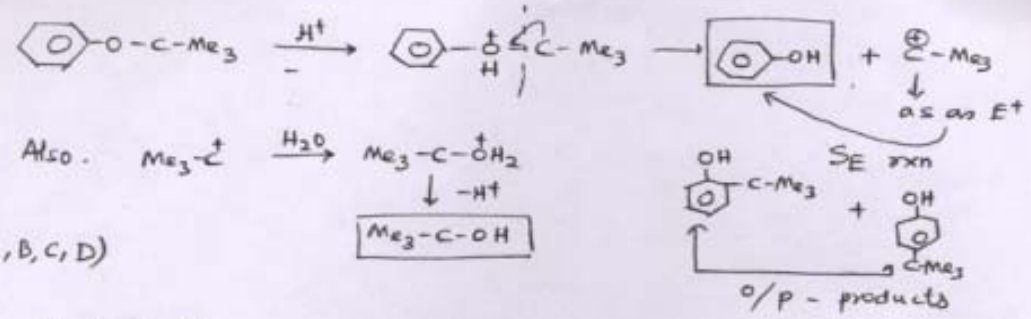
51 (B)

52. $\left(\frac{T_2}{T_1}\right) = \left(\frac{V_1}{V_2}\right)^{\gamma-1}$

$\Rightarrow T_2 = T_1\left(\frac{1}{32}\right)^{7/5-1} = 600\left(\frac{1}{2^2}\right) = 150\,K$

$\Rightarrow \Delta H = \frac{7}{2}R(150-600) = -1575\,R$

53.



(A, B, C, D)

54. (A, B, C, D)

55. $A + B_2 \xrightarrow{K_1} AB + B$ (slow : RDS)

$\Rightarrow$ Rate $= K_1[A][B_2]$

$A_2 \overset{K_{eq}}{\rightleftharpoons} A + A \quad \Rightarrow [A] = \sqrt{K_{eq}} \cdot [A]^{1/2}$

$\Rightarrow$ Rate $= K_1\left(\sqrt{K_{eq}}\,[A]^{1/2}\right)[B_2]$

$= K\,[A]^{1/2}[B_2]^1 \quad \Rightarrow$ overall order $= \frac{3}{2}$

(A, B)

57. (A) I : True (down the group, solubility increases)

II : True (with increasing size induced dipole interactions increase)

58 (B) I : True.

II : False: dichlorocarbene is intermediate with $CHCl_3$ & KOH.

59. (B) I: True : Due to increase in α (due to dilution), molar conductivity increases.

II: False: Due to dilution, inter-ionic attraction $\downarrow$.

60. (A) I: True: For any reversible adiabatic expansion, $\Delta S_{Total} = 0$

II: True : $\Delta S_{surr.} = 0$; $\Delta S_{sys.} = nR\ln\frac{V_2}{V_1} + nC_V\ln\frac{T_2}{T_1} = 0$ $[\because TV^{\gamma-1} = \text{const.}]$

56. d_{xy} lies in XY Plane. Ans: A, D

For $d_{x^2-y^2}$, nodal Planes are Plane $\perp$ to XY but inclined at 45° w.r.t. both X & Y.

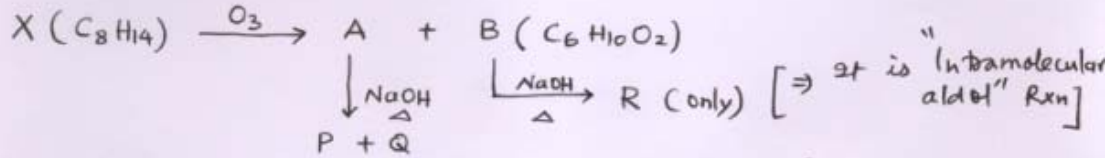
d_{xy} has two nodal Planes. Energy of e^- in the orbital remains same.

61. (D)

62. (B) Also, number of P=O (ie unprotonated oxygen) bonds are same in these acids.

63. (B) Greater the number of P-H bonds, greater is the reducing nature.

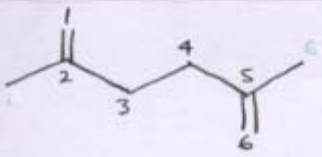
64 - 66.



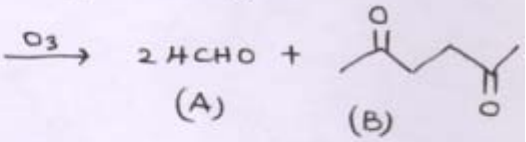
⇒ A is an aldehyde with no α-H (ie Cannizzaro Rxn) Hence it is very likely that A is HCHO. In the above reaction two mol of A are produced & hence X is a diene.

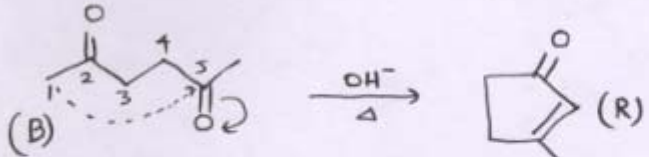
* Also note that 'B' resists oxidation, hence B is a di-ketone.

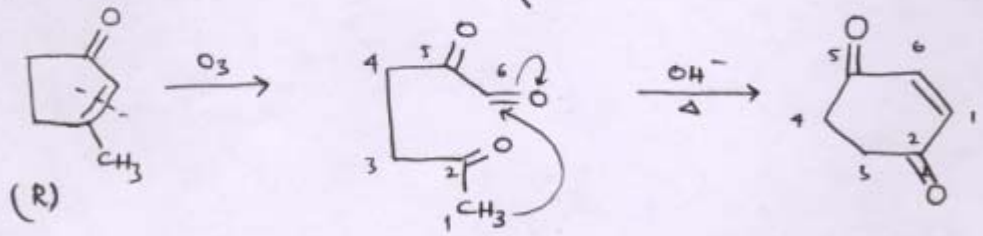
⇒ X is :



2, 5 - Dimethyl-1,5-hexadiene







≡

(S)

64. C

65. B

66. C

67 - 68 :

$1\ mol\ NaCl \rightleftharpoons 1\ mol\ Na^+ + 1\ mol\ Cl^-$ ions

At anode: $2Cl^- \longrightarrow 1\ Cl_2 + 2e^-$

$\Rightarrow 2\ mol\ Cl^- \equiv 1\ mol\ Cl_2$

500 mL of 4.0M NaCl

$\equiv \left(\frac{500}{1000} \times 4\right) = 2\ mol\ NaCl \equiv 2\ mol\ Cl^- \equiv 1\ mol\ Cl_2$ (is evolved).

Also; $2F \equiv 2\ mol\ Cl^-$

$\Rightarrow$ Charge used up is 2×96500 coul.

$= \underline{193000}$ coulombs.

$Na + Hg \longrightarrow Na\text{-}Hg$

1 mol 1 mol (223 gms)

$2\ mol\ NaCl \equiv 2\ mol\ Na^+ \equiv 2\ mol\ Na \quad [Na^+ + 1e^- \rightarrow Na]$

$\Rightarrow (2 \times 223) = 446$ gm of [sodium Mercury] amalgam

$\Rightarrow$ 67: (B)

68: (B)

69: (D)