JEE Main Exam 2018 (Paper & Solution)

Code –D **Date: 08-04-2018**

PART- C (CHEMISTRY)

Q.61 For 1 molal aqueous solution of the following compounds, which one will show the highest freezing point?

(1) $[Co(H_2O)_2Cl_3].3H_2O$ (2) $[Co(H_2O)_6]Cl_3$

(3) $[Co(H_2O)_5Cl]Cl_2.H_2O$ (4) $[Co(H_2O)_4Cl_2]Cl.2H_2O$

Ans. **[1]**

Sol. i = 1, minimum depression in freezing point

So, final freezing point will be maximum.

Q.62 Hydrogen peroxide oxidizes $[Fe(CN)_6]^{4-}$ to $[Fe(CN)_6]^{3-}$ in acidic medium but reduces $[Fe(CN)_6]^{3-}$ to $[Fe(CN)_6]^{4-}$ in alkaline medium. The other products formed are, respectively:

(1) H_2O and $(H_2O + OH^-)$ (2) (H_2O+O_2) and H_2O

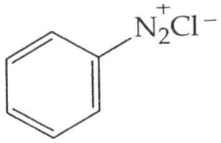
(3) $(H_2O + O_2)$ and $(H_2O + OH^-)$ (4) H_2O and $(H_2O + O_2)$

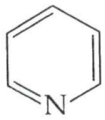
Ans. **[4]**

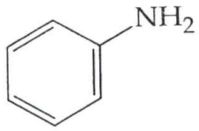
Sol. $2K_4[Fe(CN)_6] + H_2O_2 + \underset{\textbf{(Acidic Medium)}}{H_2SO_4} \longrightarrow K_3[Fe(CN)_6] + K_2SO_4 + 2H_2O$

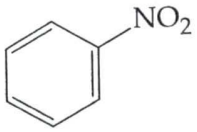
$K_3[Fe(CN)_6] + \underset{\textbf{(Basic Medium)}}{2KOH} + H_2O_2 \longrightarrow 2K_4[Fe(CN)_6] + 2H_2O + O_2$

Q.63 Which of the following compounds will be suitable for Kjeldahl's method for nitrogen estimation?

(1) 

(2) 

(3) 

(4) 

Ans. **[3]**

Sol. Kjeldal method is not applicable to compound containing nitrogen in nitro & Azo group and nitrogen present in ring as nitrogen of these compound does not convert to ammonium sulphate. So aniline is suitable.

Q.64 Glucose on prolonged heating with HI gives:

(1) 6-iodohexanal (2) *n*-Hexane (3) 1-Hexene (4) Hexanoic acid

Ans. **[2]**

Sol. $\text{Glucose} \xrightarrow[\text{Reduction}]{\overset{\text{HI}}{\Delta}} \text{n-Hexane}$

Suggest that Glucose contain 6–carbon [Straight Chain]

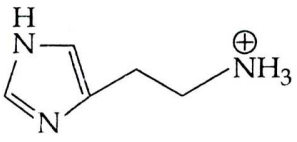
Q.65 An alkali is titrated against an acid with methyl orange as indicator, which of the following is a correct combination?

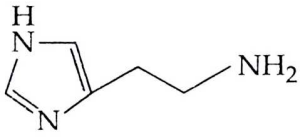
	Base	Acid	End point
(1)	Strong	Strong	Pink to colourless
(2)	Weak	Strong	Colourless to pink
(3)	Strong	Strong	Pinkish red to yellow
(4)	Weak	Strong	Yellow to pinkish red

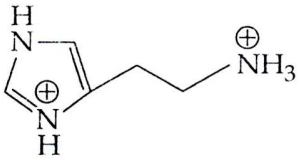
Ans. **[4]**

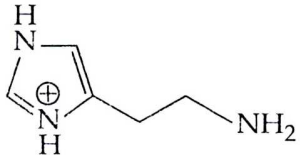
Sol. As pH range of methyl orange is 3 to 5. Below 3 it it pinkish red and above 5 it is yellow. Colour changes when a weak base is titrated against a strong acid, methyl orange will change its colour from yellow to pinkish red.

Q.66 The predominant form of histamine present in human blood is (pK_a, Histidine = 6.0)

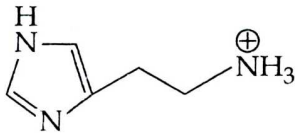
(1) 

(2) 

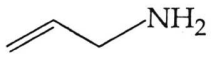
(3) 

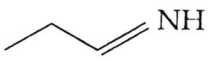
(4) 

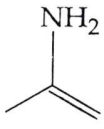
Ans. **[1]**

Sol. In blood ring is not protonated so answer is 

Q.67 The increasing order of basicity of the following compounds is:

(a) 

(b) 

(c) 

(d) 

(1) (d) < (b) < (a) < (c)

(2) (a) < (b) < (c) < (d)

(3) (b) < (a) < (c) < (d)

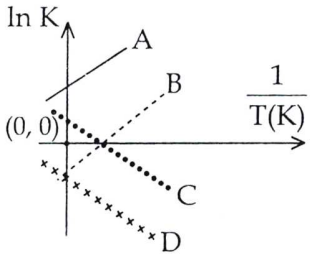
(4) (b) < (a) < (d) < (c)

Ans. **[4]**

Sol. Order of basic strength (b) < (a) < (d) < (c)

Order of basic strength Amidine > Amine > Imine

Q.68 Which of the following lines correctly show the temperature dependence of equilibrium constant, K, for an exothermic reaction ?



(1) A and D (2) A and B (3) B and C (4) C and D

Ans. **[2]**

Sol. $\ln k = \frac{-\Delta H^o}{RT} + \frac{-\Delta S^o}{R}$

For exothermic reaction ΔH= –ve

So slop is positive & correct answer is A & B

Q.69 How long (approximate) should water be electrolysed by passing through 100 amperes current so that the oxygen released can completely burn 27.66 g of diborane ? (Atomic weight of B = 10.8 u)

(1) 1.6 hours (2) 6.4 hours (3) 0.8 hours (4) 3.2 hours

Ans. **[4]**

Sol. $[B_2H_6 + 3O_2 \rightarrow B_2O_3 + 3H_2O]$

moles of $B_2H_6 = \frac{27.669}{27.66} = 1\text{mole}$

1mole B_2H_6 need 3mole O_2 = 96gm O_2

$$W = \frac{E}{96500} \times i \times t$$

$$96 = \frac{8}{96500} \times 100 \times t$$

t = 193min = 3.2 Hours

Q.70 Consider the following reaction and statements:

$$[Co(NH_3)_4Br_2]^+ + Br^- \rightarrow [Co(NH_3)_3Br_3] + NH_3$$

(I) Two isomers are produced if the reactant complex ion is a cis-isomer

(II) Two isomers are produced if the reactant complex ion is a trans-isomer

(III) Only one isomer is produced if the reactant complex ion is a trans-isomer

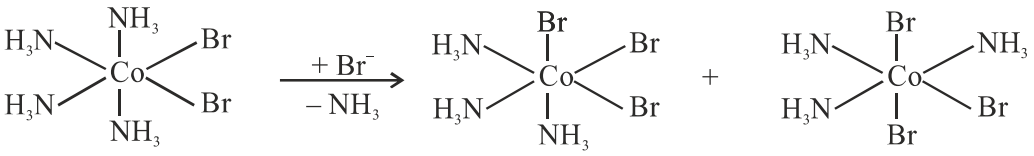
(IV) Only one isomer is produced if the reactant complex ion is a cis-isomer

The correct statements are:

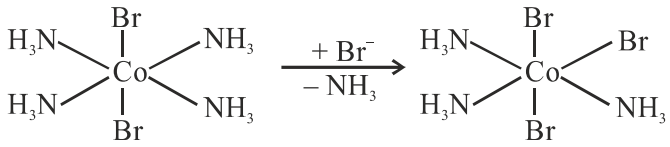
(1) (II) and (IV) (2) (I) and (II) (3) (I) and (III) (4) (III) and (IV)

Ans. **[3]**

Sol.

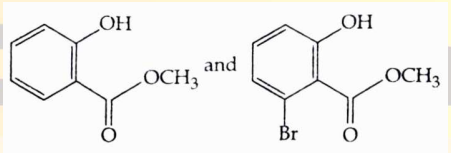


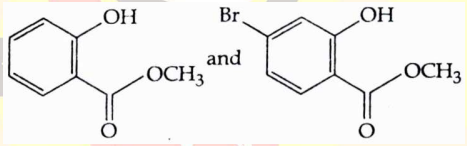
cis-form **Fac-isomer** **Mer-isomer**

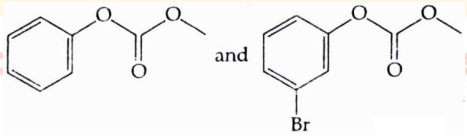


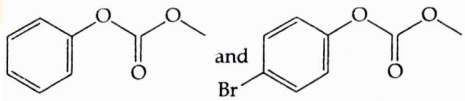
trans-form **Mer-isomer**

Q.71 Phenol reacts with methyl chloroformate in the presence of NaOH to form product A. A reacts with Br_2 to form product B. A and B are respectively:

(1) 

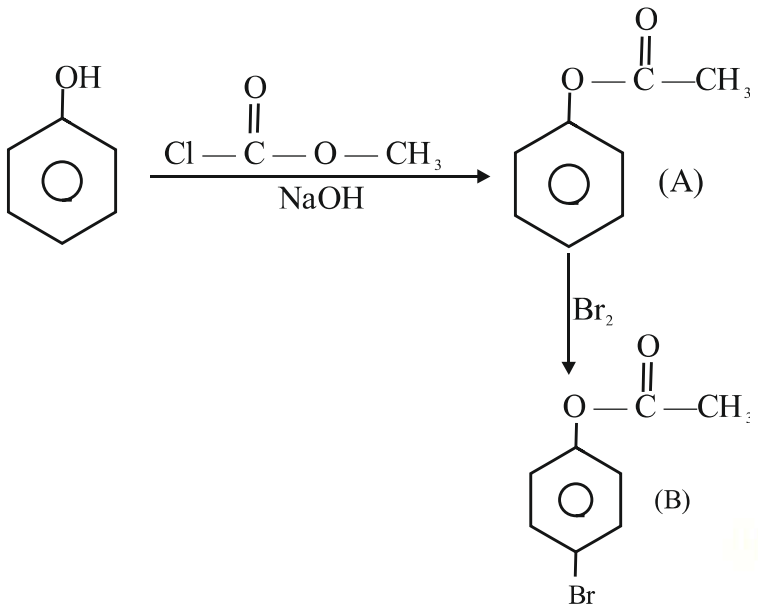
(2) 

(3) 

(4) 

Ans. **[4]**

Sol. First Acylation take place followed by Bromination.



Q.72 An aqueous solution contains an unknown concentration of Ba^{2+}. When 50 mL of a 1 M solution of Na_2SO_4 is added, $BaSO_4$ just begins to precipitate. The final volume is 500 mL. The solubility product of $BaSO_4$ is 1×10^{-10}. What is the original concentration of Ba^{2+} ?

(1) 1.0×10^{-10} M (2) 5×10^{-9} M (3) 2×10^{-9} M (4) 1.1×10^{-9} M

Ans. **[4]**

Sol. New conc. of $SO_4^{-2} = \frac{50 \times 1}{500} = 0.1$

For $BaSO_4$ $K_{SP} = \left[Ba^{+2}\right]\left[SO_4^{-2}\right]$

$1 \times 10^{-10} = \left[Ba^{+2}\right] \times 0.1$

$\left[Ba^{+2}\right] = 10^{-9}$ in final solution

So initially concentration of Ba^{+2} ion is $= \frac{10^{-9} \times 500}{450}$

$= 1.1 \times 10^{-9} M$

Q.73 At 518ºC, the rate of decomposition of a sample of gaseous acetaldehyde, initially at a pressure of 363 Torr, was 1.00 Torr s^{-1} when 5% had reacted and 0.5 Torr s^{-1} when 33% had reacted. The order of the reaction is:

(1) 0 (2) 2 (3) 3 (4) 1

Ans. **[2]**

Sol. Acetaldehyde $\rightarrow$ Product

$t = 0$ $\quad P_0 = 363$ torr

$t = t_1$; $\quad 0.95\ P_0$; $\quad R_{t_1} = 1.00\ \text{torr.sec}^{-1}$

$t = t_2$; $\quad 0.67\ P_0$; $\quad R_{t_2} = 0.5\ \text{torr.sec}^{-1}$

Let rate law :

$R = k.\ [\text{Acetaldehyde}]^x$

$R_{t_1} = K(0.95P_0)^x = 1 \quad .....(1)$

$R_{t_2} = K(0.67P_0)^x = 0.5 \quad .....(2)$

$$\frac{\text{eq.(1)}}{\text{eq.(2)}} = \left(\frac{0.95}{0.67}\right)^x = \frac{1}{0.5} = 2$$

$$\Rightarrow \left(\sqrt{2}\right)^x = 2$$

$$\Rightarrow x = 2$$

Q.74 The combustion of benzene (l) gives $CO_2(g)$ and $H_2O(l)$. Given that heat of combustion of benzene at constant volume is –3263.9 kJ mol^{-1} at 25ºC; heat of combustion (in kJ mol^{-1}) of benzene at constant pressure will be: (R = 8.314 JK^{-1} mol^{-1})

(1) –3267.6 (2) 4152.6 (3) –452.46 (4) 3260

Ans. **[1]**

Sol. $$C_6H_{6(l)} + \frac{15}{2}O_{2(g)} \rightarrow 6CO_{2(g)} + 3H_2O_{(l)}$$

$$\Delta n_g = 6 - \frac{15}{2}$$

$$= \frac{-3}{2}$$

$$\Delta H = \Delta U + \Delta n_g RT$$

$$= -3263.9 + \left(\frac{-3}{2}\right)\frac{(8.314)(298)}{1000}$$

$$= -3267.6 \text{ kJ mol}^{-1}$$

Q.75 The ratio of mass percent of C and H of an organic compound ($C_XH_YO_Z$) is 6 : 1. If one molecule of the above compound ($C_XH_YO_Z$) contains half as much oxygen as required to burn

one molecule of compound C_XH_Y completely to CO_2 and H_2O. The empirical formula of compound $C_XH_YO_Z$ is:

(1) $C_2H_4O_3$ (2) $C_3H_6O_3$ (3) C_2H_4O (4) $C_3H_4O_2$

Ans. **[1]**

Sol. $C_XH_YO_Z$ C_XH_Y

$$\text{Mass percent} = \frac{12X}{Y} = \frac{6}{1}$$

$$2X = Y \quad \text{.....(1)}$$

$$C_XH_Y + \left(x + \frac{Y}{4}\right)O_2 \rightarrow XCO_2 + \frac{Y}{2}H_2O$$

$$Z = \left(X + \frac{Y}{4}\right) \quad \text{.....(2)}$$

$$Z = X + \frac{2X}{4}$$

$2Z = 3X$

$X : Y : Z$

$1 : 2 : \frac{3}{2}$

$2 : 4 : 3$

$C_2H_4O_3$

Q.76 The trans-alkenes are formed by the reduction of alkynes with:

(1) Sn – HCl (2) H_2–Pd/C, $BaSO_4$ (3) $NaBH_4$ (4) Na/liq.NH_3

Ans. **[4]**

Sol. Birch reduction

Q.77 Which of the following are Lewis acids?

(1) BCl_3 and $AlCl_3$ (2) PH_3 and BCl_3 (3) $AlCl_3$ and $SiCl_4$ (4) PH_3 and $SiCl_4$

Ans. **[1]**

Sol. BCl_3 and $AlCl_3$ are lewis acid, because B and Al can accept lone pair electrons in their vacant orbitals.

Q.78 When metal 'M' is treated with NaOH, a white gelationous precipitate 'X' is obtained, which is soluble in excess of NaOH. Compound 'X' when heated strongly gives an oxide which is used in chromatography as an adsorbent. The metal 'M' is:

(1) Fe (2) Zn (3) Ca (4) Al

Ans. **[4]**

Sol. $\underset{\textbf{(M)}}{Al} + NaOH \longrightarrow \underset{\textbf{(White ppt.)}\ \textbf{(X)}}{Al(OH)_3}$

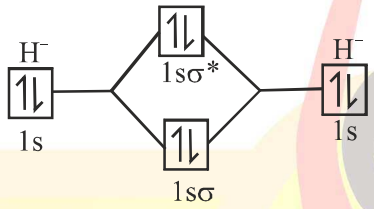
$\underset{\textbf{(White ppt.)}\ \textbf{(X)}}{Al(OH)_3} + NaOH \longrightarrow Na[Al(OH)_4] \xrightarrow{\Delta} Al_2O_3$ **[Used in Chromatography]**

Q.79 According to molecular orbital theory, which of the following will not be a viable molecule ?

(1) H_2^{2-} (2) He_2^{2+} (3) He_2^{+} (4) H_2^{-}

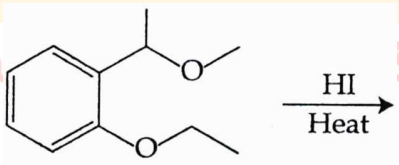
Ans. **[1]**

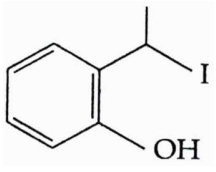
Sol. H_2^{2-} will not be a viable molecule because it has zero bond order according to M.O.T.

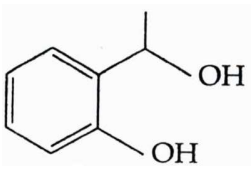


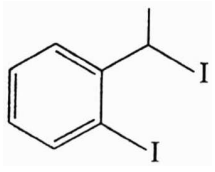
$$\text{Bond Order} = \frac{N_b - N_a}{2} = \frac{2-2}{2} = 0$$

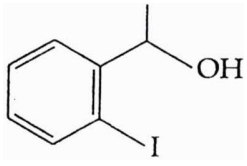
Q.80 The major product formed in the following reaction is:



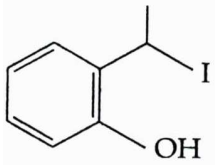
(1) 

(2) 

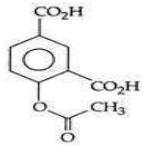
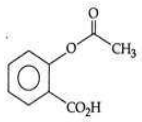
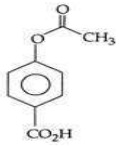
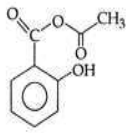
(3) 

(4) 

Ans. **[1]**

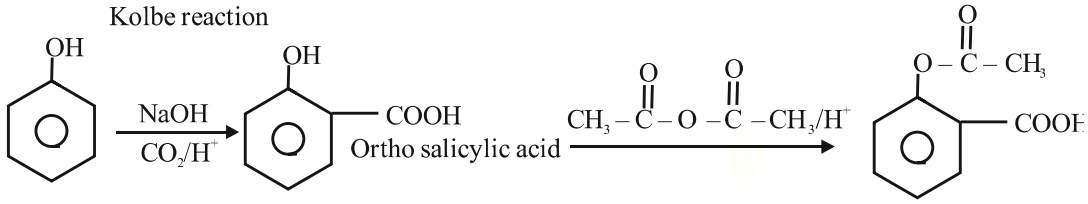
Sol. 

Q.81 Phenol on treatment with CO_2 in the presence of NaOH followed by acidification produces compound X as the major product . X on treatment with $(CH_3CO)_2O$ in the presence of catalytic amount of H_2SO_4 produces:

(1)  (2)  (3)  (4) 

Ans. **[2]**

Sol.



Q.82 Which of the following compounds contain(s) no covalent bond(s) ?

KCl, PH_3, O_2, B_2H_6 , H_2SO_4

(1) KCl, B_2H_6 (2) KCl, B_2H_6, PH_3 (3) KCl , H_2SO_4 (4) KCl

Ans. **[4]**

Sol. KCl compound contain only ionic bond.

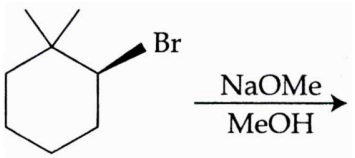
Q.83 Which type of 'defect' has the presence of cations in the interstitial sites?

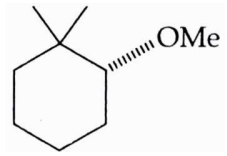
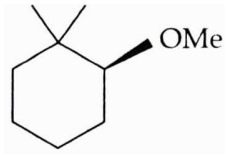
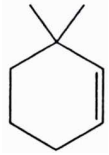
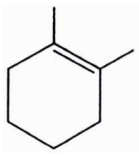
(1) Metal deficiency defect (2) Schottky defect (3) Vacancy defect (4) Frenkel defect

Ans. **[4]**

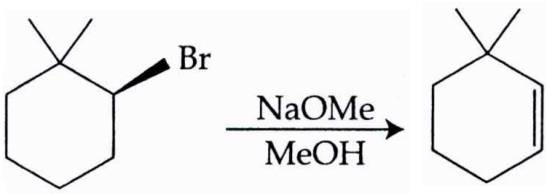
Sol. Frenkel defect $\rightarrow$ Cations move to interstitial sites from lattice point

Q.84 The major product of the following reaction is :



(1)  (2)  (3)  (4) 

Ans. **[3]**



Sol. **E_2-Elimination**

Q.85 The compound that does not produce nitrogen gas by the thermal decomposition is :

(1) $(NH_4)_2SO_4$ (2) $Ba(N_3)_2$ (3) $(NH_4)_2Cr_2O_7$ (4) NH_4NO_2

Ans. **[1]**

Sol. Thermal decomposition of $(NH_4)_2SO_4$.

$$(NH_4)_2SO_4 \xrightarrow{\Delta} 2NH_3 + H_2SO_4$$

Q.86 An aqueous solution contains 0.10 M H_2S and 0.20 M HCl. If the quilbrium constants for the formation of HS^- from H_2S is 1.0 X 10^{-7} and that of S^{-2} from HS^- ions is 1.2×10^{-13} then the concentration of S^{2-} ions in aqueous solution is :

(1) $5X10^{-19}$ (2) $5\ X10^{-8}$ (3) $3\ X10^{-20}$ (4) $6X10^{-21}$

Ans. **[3]**

Sol. $H_2S \rightleftharpoons H^+ + HS^- \qquad K_1 = 1\times10^{-7}$

$HS^- \rightleftharpoons H^+ + S^{2-} \qquad K_2 = 1.2\times10^{-13}$

$$\underset{0.1(1-\alpha)\approx0.1}{H_2S} \rightleftharpoons \underset{0.2\alpha+0.2\approx0.2}{2H^+} + \underset{0.2\alpha}{S^{2-}} \qquad K_1\times K_2 = 1.2\times10^{-20}$$

$$K_{eq} = K_1\times K_2 = \frac{[S^{2-}][H^+]^2}{[H_2S]}$$

$$1.2\times10^{-20} = \frac{[S^{2-}][0.04]}{0.1}$$

$$[S^{2-}] = 3\times10^{-20}\,M$$

Q.87 The oxidation states of Cr in $[Cr(H_2O)_6]Cl_3$,$[Cr(C_6H_6)_2]$, and $K_2[Cr(CN)_2(O)_2(O)_2(NH_3)]$ respectively are :

(1) +3, 0, and +4 (2) +3, +4, and +6 (3) +3 , +2, and +4 (4)+3, 0, and +6

Ans. **[4]**

Sol. $[Cr(H_2O)_6]Cl_3$ $[Cr(C_6H_6)_2]$

$x + (0\times6) = -3$ $x + (0\times2) = 0$

$x = +3$ $x = 0$

$K_2[Cr(CN)_2(O)_2(O_2)NH_3]$

$x + (-1 \times 2) + (-2 \times 2) + (-2 \times 1) + (1 \times 0) = -2$

$x = +6$

Q.88 The recommended concentration of fluoride in drinking water is up to 1ppm as fluoride ion is required to make teeth enamel harder by converting $[3Ca_3(PO_4)_2.Ca(OH)_2]$ to:

(1) $[3\{Ca(OH)_2\}.CaF_2]$ (2) $[CaF_2]$

(3) $[3(CaF_2).Ca(OH)_2]$ (4) $[3Ca_3(PO_4)_2.CaF_2]$

Ans. **[4]**

Sol. $Ca_3(PO_4)_2.Ca(OH)_2 + 2F^- \xrightarrow{1PPM} [Ca_3(PO_4)_2.CaF_2] + 2OH^-$

Q.89 Which of the following salts is the most basic in aqueous solution ?

(1) $Pb(CH_3COO)_2$ (2) $Al(CN)_3$ (3) CH_3COOK (4) $FeCl_3$

Ans. **[3]**

Sol. CH_3COOK is salt of strong base and weak acid.

Q.90 Total number of lone pair of electrons in I_3^- ion is:

(1) 12 (2) 3 (3) 6 (4) 9

Ans. **[4]**

Sol. No. of lone pair of electrons in I_3^- are 9.