JEE Main Online Exam 2020

Questions & Solution

8th January 2020 | Shift - II

CHEMISTRY

Q.1 The increasing order of the atomic radii of the following elements is :

(a) C (b) O (c) F (d) Cl

(e) Br

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

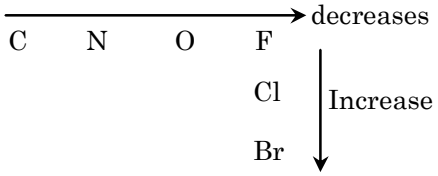
(3) (c) < (b) < (a) < (d) < (e) (4) (b) < (c) < (d) < (a) < (e)

Ans. **[3]**

Sol. Generally in a period L → R Atomic radius decrease

and

in a Group T → B Atomic radius increase



Br > Cl > C > O > F

e > d > a > b > c

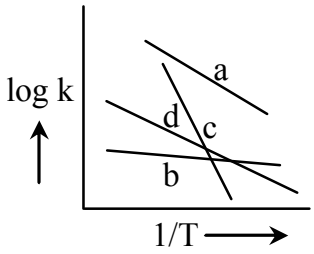
Q.2 Kjeldahl's method cannot be used to estimate nitrogen for which of the following compounds?

(1) $NH_2 - \overset{\overset{O}{\|}}{C} - NH_2$ (2) $C_6H_5NH_2$ (3) $C_6H_5NO_2$ (4) $CH_3CH_2 - C \equiv N$

Ans. **[3]**

Sol. Kjedahl's method cannot be used to Test nitrogen in nitro and diazo present in ring because nitrogen in nitro cannot convert into Ammonium sulphate Hence. does not give Test.

Q.3 Consider the following plots of rate constant versus $\frac{1}{T}$ for four different reactions. which of the following orders is correct for the activation energies of these reactions?



(1) $E_c > E_a > E_d > E_b$ (2) $E_b > E_d > E_c > E_a$ (3) $E_a > E_c > E_d > E_b$ (4) $E_b > E_a > E_d > E_c$

Ans. **[1]**

Sol. We know that

$k = Ae^{-\frac{Ea}{RT}}$

$\log^{k} = \log^{A} - \frac{Ea}{2.303RT}$

$\text{Slope} = -\frac{Ea}{2.303RT}$

Slope $c > a > d > b$.

$E_c > E_a > E_d > E_b$

Q.4 For the following Assertion and Reason, the correct option is :

Assertion : The pH of water increase with increase in temperature.

Reason : The dissociation of water into H^+ and OH^- is an exothermic reaction

(1) Assertion is not true, but reason is true

(2) Both assertion and reason are false

(3) but the reason is not the correct explanation for the assertion

(4) Both assertion and reason are true, and the reason is the correct explanation for the assertion

Ans. **[2]**

Sol. $kw = [H^+]\,[OH^-]$

$T \uparrow\ kw \uparrow$

In water $[H^+] = [OH^-]$

$kw = [H^+]^2 \Rightarrow [H^+] = \sqrt{kw}$

On Increasing T kw $\uparrow$ $[H^+] \uparrow$ $P^H \downarrow$ Assertion is False.

Dissociation of H_2O is endothermic.

$H_2O \rightleftharpoons H^+ + OH^-$ $\Delta H = +\text{ ve}$

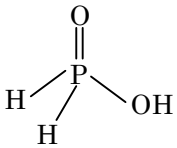
Hence Reason is also false.

Q.5 White phosphorus on reaction with concentrated NaOH solution in an inert atmosphere of CO_2 gives phosphine and compound (X). (X) on acidification with HCl gives compound (Y). The basicity of compound (Y) is :

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

Ans. **[4]**

Sol. $P_4 + NaOH + H_2O \longrightarrow PH_3 + NaH_2PO_2 \xrightarrow{HCl} H_3PO_2$



Basicity = 1

Q.6 The major product [B] in the following sequence is :

$CH_3-\underset{\underset{CH(CH_3)_2}{|}}{C}=CH-CH_2CH_3 \xrightarrow[(ii)\ H_2O_2,\ O\overset{\ominus}{H}]{(i)\ B_2H_6} [A] \xrightarrow[\Delta]{dil.\ H_2SO_4} [B]$

(1) $CH_3-\underset{\underset{CH(CH_3)_2}{|}}{CH}-CH=CH-CH_3$

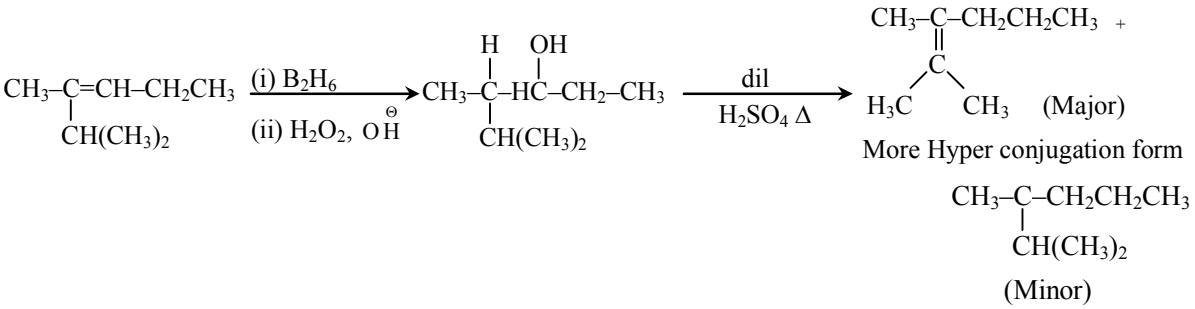
(2) $CH_3-\underset{\underset{CH(CH_3)_2}{|}}{C}=CH-CH_2CH_3$

(3) $CH_2=\underset{\underset{CH(CH_3)_2}{|}}{C}-CH_2CH_2CH_3$

(4) $CH_3-\underset{\underset{C}{\|}}{C}-CH_2CH_2CH_3$ (C bonded to H_3C and CH_3)

Ans. **[4]**

Sol.



Q.7 Among (a) – (d), the complexes that can display geometrical isomerism are :

(a) $[Pt(NH_3)_3Cl]^+$ (b) $[Pt(NH_3)Cl_5]^-$ (c) $[Pt(NH_3)_2Cl(NO_2)]$ (d) $[Pt(NH_3)_4ClBr]^{2+}$

(1) (d) and (a) (2) (c) and (d) (3) (b) and (c) (4) (a) and (b)

Ans. **[2]** (c) and (d)

Sol. $[Pt(NH_3)_2Cl(NO_2)]$ & $[Pt(NH_3)_4ClBr]^{2+}$

$[M A_2 BC]$ type

(AA) (BC)

(AB) (AC)

2 G.I.

$[M A_4 BC]$ type

(AA) (AA) (BC)

(AB) (AC) (AA)

2 G.I.

Hence these two show G.I.

Q.8 For the following Assertion and Reason, the correct option is :

Assertion : For hydrogenation reactions, the catalytic activity increases from Group 5 to Group 11 metals with maximum activity shown by Group 7-9 elements.

Reason : The reactants are most strongly adsorbed on group 7-9 elements.

(1) Both assertion and reason are true and the reason is the correct explanation for the assertion.

(2) The assertion is true, but the reason in false.

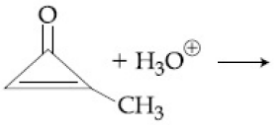
(3) Both assertion and reason are true but the reason is not the correct explanation for the assertion.

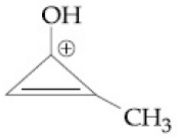
(4) Both assertion and reason are false.

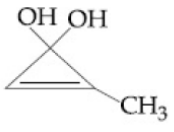
Ans. **[1]**

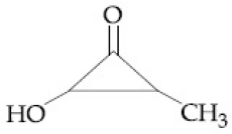
Sol. For hydrogenation reaction catalytic activity increase because reactants are more strongly adsorbed on group 7-9 element, So Assertion & Reason both are correct.

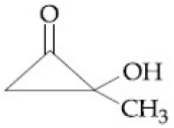
Q.9 The major product in the following reaction is :



(1) 

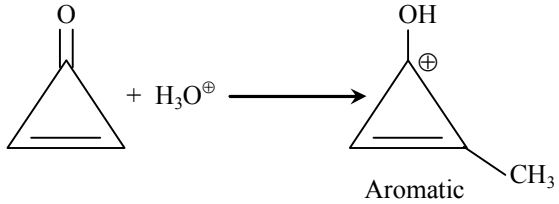
(2) 

(3) 

(4) 

Ans. **[1]**

Sol.



Q.10 Among the reactions (a)-(d), the reaction(s) that does/do not occur in the blast furnace during the extraction of iron is/are :

(a) $CaO + SiO_2 \rightarrow CaSiO_3$ (b) $3Fe_2O_3 + CO \rightarrow 2Fe_3O_4 + CO_2$

(c) $FeO + SiO_2 \rightarrow FeSiO_3$ (d) $FeO \rightarrow Fe + \frac{1}{2}O_2$

(1) (c) and (d) (2) (a) (3) (a) and (d) (4) (d)

Ans. **[1]**

Sol. $CaO + SiO_2 \rightarrow CaSiO_3$

Used as flux.

$3Fe_2O_3 + CO \rightarrow 2Fe_3O_4 + CO_2$

Reduction done by CO.

Hence these two r × n take place but

$FeO \rightarrow Fe + \frac{1}{2}O_2$ & $FeO + SiO_2 \rightarrow FeSiO_3$

does not take place.

Q.11 A metal (A) on heating in nitrogen gas gives compound B. B on treatment with H_2O gives a colourless gas which when passed through $CuSO_4$ solution gives a dark blue-violet coloured solution. A and B respectively, are :

(1) Mg and $Mg(NO_3)_2$ (2) Na and $NaNO_3$ (3) Mg and Mg_3N_2 (4) Na and Na_3N

Ans. **[3]**

Sol. $A + N_2 \longrightarrow$ nitride (B) $\xrightarrow{H_2O} NH_3 + CuSO_4 \longrightarrow$ Blue-violet coloured sol.

$\underset{(A)}{3Mg} + N_2 \longrightarrow \underset{(B)}{Mg_3N_2} \xrightarrow{H_2O} Mg(OH)_2 + NH_3$

Q.12 Two monomers in maltose are :

(1) α-D-glucose and α-D-galactose (2) α-D-glucose and β-D-glucose

(3) α-D-glucose and α-D-glucose (4) α-D-glucose and α-D-Fructose

Ans. **[3]**

Sol. Maltose on hydrolysis give 2 mole of α-D Glucose.

because in maltose glucosidic linkage is present in between C_1 & C_4 of α-D glucose.

Q.13 The correct order of the calculated spin-only magnetic moments of complexes (A) to (D) is :

(A) $Ni(CO)_4$ (B) $[Ni(H_2O)_6]Cl_2$ (C) $Na_2[Ni(CN)_4]$ (4) $PdCl_2(PPh_3)_2$

(1) (C) ≈ (D) < (B) < (A) (2) (A) ≈ (C) < (B) ≈ (D)

(3) (A) ≈ (C) ≈ (D) < (B) (4) (C) < (D) < (B) < (A)

Ans. **[3]**

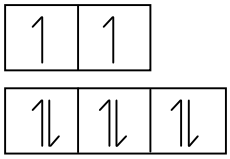
Sol. (a) $Ni(CO)_4$

$Ni = 3d^8\ 4s^2$ [S F L] M = 0

(b) $[Ni(H_2O)_6]\ Cl_2$

$Ni^{2+} = 3d^8\ 45°$

Weak field ligand



No. of unpaired electron = 2

$M = \sqrt{n(n+2)} = \sqrt{2(2+2)} = \sqrt{8}$ B.M

(c) $Na_2[Ni(CN)_4]$

$Ni^{2+} - 3d^8$ (S F L)

paining take place (n = 0)

M = 0

(d) $Pd\,Cl_2(PPh_3)_2$

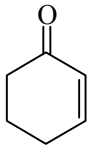
$Pd^{2+} = 4d^8$

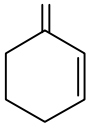
square plane

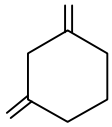
M = 0

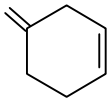
Q.14 An unsaturated hydrocarbon X absorbs two hydrogen molecules on catalytic hydrogenation, and also gives following reaction :

$X \xrightarrow[Zn/H_2O]{O_3} A \xrightarrow{[Ag(NH_3)_2]^+} B$(3-oxo-hexanedicarboxylic acid) X will be :

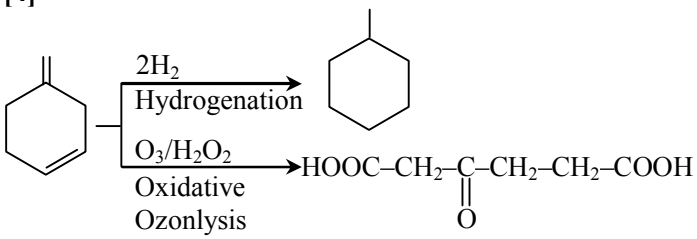
(1) 

(2) 

(3) 

(4) 

Ans. **[4]**

Sol. 

Q.15 Hydrogen has three isotopes (A), (B) and (C). If the number of neutron(s) in (A), (B) and (C) respectively, are (x), (y) and (z), the sum of (x), (y) and (z) is :

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

Ans. **[2]**

Sol.

	^1_1H	^2_1H	^3_1H
no. of neutron	0 (x)	1 (y)	1 (z)

= x + y + z

= 0 = 1 + 2 = 3

Q.16 Which of the following compound is likely to show both Frenkel and Schottky defects in its crystalline form?

(1) CsCl (2) AgBr (3) ZnS (4) KBr

Ans. **[2]**

Sol. AgBr show both Frenkel and Schottky defect.

Q.17 Arrange the following bonds according to their average bond energies in descending order:

C–Cl, C–Br, C–F, C–I

(1) C–F > C–Cl > C–Br > C–I (2) C–I > C–Br > C–Cl > C–F

(3) C–Cl > C–Br > C–I > C–F (4) C–Br > C–I > C–Cl > C–F

Ans. **[1]**

Sol. Bond energy $\propto \frac{1}{\text{Bond length}}$.

Down the group size increases

Bond energy C–F > C–Cl > C–Br > C–I

Q.18 Preparation of Bakelite proceeds via reactions :

(1) Electrophilic substitution and dehydration (2) Condensation and elimination

(3) Electrophilic addition and dehydration (4) Nucleophilic addition and dehydration

Ans. **[1]**

Sol. Formation of Bakelite follows electrophillic substitution of phenol and formaldehyde followed by dehydration .

Q.19 The radius of the second Bohr orbit, in terms of the Bohr radius, a_0, in Li^{2+} is :

(1) $\frac{4a_0}{3}$ (2) $\frac{2a_0}{9}$ (3) $\frac{2a_0}{3}$ (4) $\frac{4a_0}{9}$

Ans. **[1]**

Sol. We know

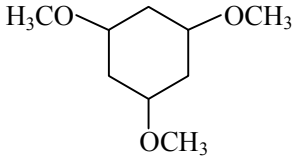
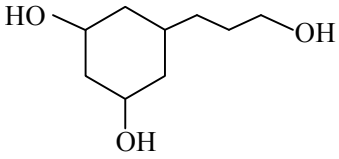
$$r = 0.529 \times \frac{n^2}{z} Å$$

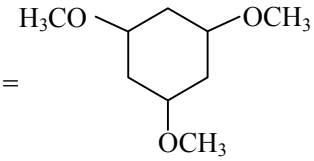
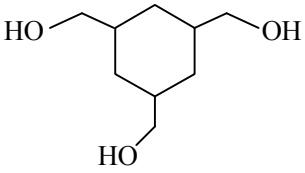
$$r = a_0 \times \frac{n^2}{z}$$

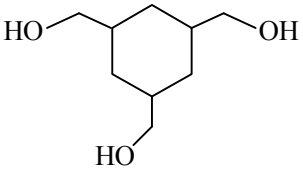
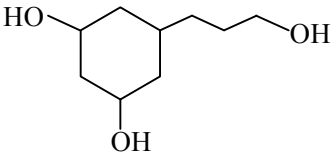
$n = 2$ $z = 3$

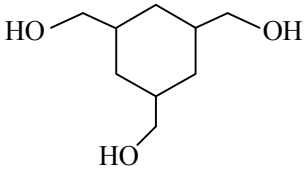
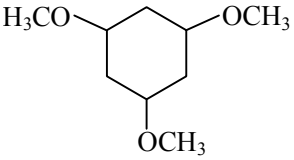
$r = r = \frac{a_0 \times 4}{3} = \frac{4a_0}{3}$

Q.20 Among the compounds A and B with molecular formula $C_9H_{18}O_3$, A is having higher boiling point the B. The possible structures of A and B are :

(1) A =  ; B = 

(2) A =  ; B = 

(3) A =  ; B = 

(4) A =  ; B = 

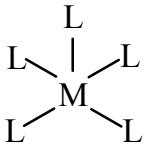
Ans. **[4]**

Sol. A is having higher boiling point than B. in case of A inter molecular H-bonding is possible while in case of B. intermolecular H-bonding is not possible hence have lower boiling point

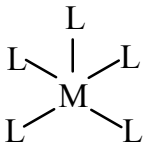
Q.21 Complexes (ML_5) of metals Niand Fe have ideal square pyramidal and trigonal bipyramidal geometries, respectively. The sum of the 90°, 120° and 180° L-M-L angles in the two complexes is _____

Ans. **[20.00]**

Sol.



90° = 8
180° = 8
total = 10



12° = 3
90° = 6
total = 1

Q.22 At constant volume, 4 mol of an ideal gas when heated from 300 K to 500 K changes its internal energy by 5000 J. The molar heat capacity at constant volume is _____

Ans. **[6.25]**

Sol. $\Delta U = ncv\,\Delta T$

$5000 = 4 \times C_v\,(500 - 300)$

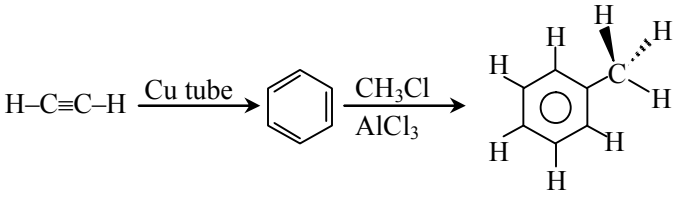
$C_v = 6.25\ J\ k^{-1}\ mol^{-1}$

Q.23 In the following sequence of reactions the maximum number of atoms present in molecule 'C' in one plane is _____.

$$A \xrightarrow[\text{Cu tube}]{\text{Red hot}} B \xrightarrow[\text{Anhydrous } AlCl_3]{CH_3Cl(1.eq.)} C$$ (A is a lowest molecular weight alkyne)

Ans. **[13.00]**

Sol.



Q.24 For an electrochemical cell $Sn(s)|Sn^{2+}$ (aq, 1M)$||Pb^{2+}$ (aq, 1M)$|Pb(s)$ the ratio $\frac{[Sn^{2+}]}{[Pb^{2+}]}$ when this cell attains equilibrium is _____.

$$\left(\text{Given}: E^0_{Sn^{2+}|Sn} = -0.14V, E^0_{Pb^{2+}|Pb} = -0.13V, \frac{2.303RT}{F} = 0.06\right)$$

Ans. **[2.15]**

Sol. At eqll^{m}

$E_{Cell} = 0$

$E^0_{Cell} = 0.01$ V

$Sn + Pb^{2+} \longrightarrow Sn^{2+} + Pb$

$$E_{Cell} = E^0_{Cell} - \frac{0.06}{n} \log^{Q}$$

$$0 = 0.01 - \frac{0.06}{2} \log \frac{[Sn^{2+}]}{[Pb^{2+}]}$$

$$0.01 = \frac{0.06}{2} \log \frac{[Sn^{2+}]}{[Pb^{2+}]}$$

$$\frac{1}{3} = \log \frac{[Sn^{2+}]}{[Pb^{2+}]}$$

$$\frac{[Sn^{2+}]}{[Pb^{2+}]} = 10^{1/3} = 2.15$$

Q.25 $NaClO_3$ is used, even in spacecraft, to produce O_2. The daily consumption of pure O_2 by a person is 492L at 1 atm, 300 K. How much amount of $NaClO_3$, in grams, is required to produce O_2 for the daily consumption of a person at 1 atm, 300 K? _____.

$NaClO_3(s) + Fe(s) \rightarrow O_2(g) + NaCl(s) + FeO(s)$

$R = 0.082$ L atm mol^{-1} K^{-1}

Ans. **[2130.00]**

Sol. Mole of $NaCl_3$ = mole of O_2

$$\text{mole of } O_2 = \frac{PV}{RT} = \frac{1 \times 492}{0.082 \times 300} = 20 \text{ mole}$$

mass of $NaClO_3 = 20 \times 106.5 = 2130$ g