

JEE Main Online Exam 2020

Questions & Solutions

7th January 2020 | Shift - II

CHEMISTRY

Q.1 Among the statements(a)-(d), the incorrect ones are :

- (a) Octahedral Co(III) complexes with strong field ligands have very high magnetic moments
 (b) When $\Delta_0 < P$, the d-electron configuration of Co(III) in an octahedral complex is $t_{eg}^4 e_{eg}^2$
 (c) Wavelength of light absorbed by $[\text{Co}(\text{en})_3]^{3+}$ is lower than that of $[\text{CoF}_6]^{3-}$
 (d) If the Δ_0 for an octahedral complex of Co(III) is $18,000 \text{ cm}^{-1}$, the Δ_t for its tetrahedral complex with the same ligand will be $16,000 \text{ cm}^{-1}$

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

Ans. [2]

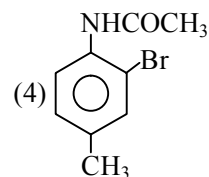
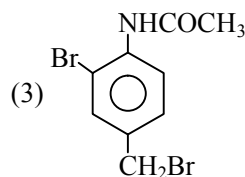
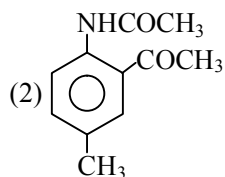
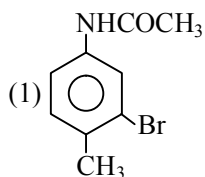
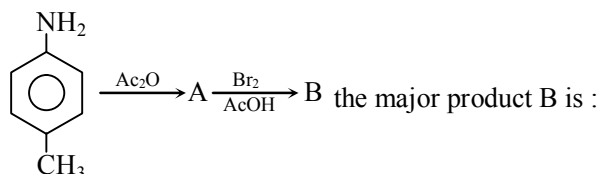
Sol. Strong field ligands have high pairing energy.

For strong field ligand : - $\Delta_0 = \Delta_t \times 1.125$

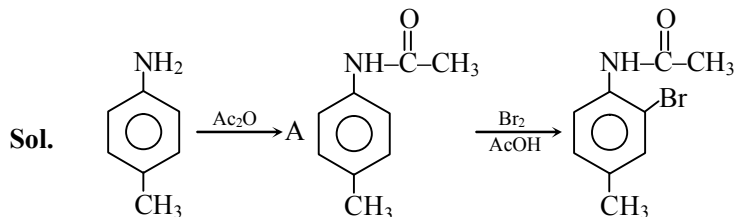
$$\frac{18000}{1.125} = \Delta_t$$

$$16000 = \Delta_t$$

Q.2 If the following reaction sequence,



Ans. [4]



- Q.3** Two open beakers one containing a solvent and the other containing a mixture of that solvent with a non volatile solute are together sealed in a container. Over time :
- (1) the volume of the solution decreases and the volume of the solvent increases
 - (2) the volume of the solution and the solvent does not change
 - (3) the volume of the solution increases and the volume of the solvent decreases
 - (4) the volume of the solution does not change and the volume of the solvent decreases

Ans. [3]

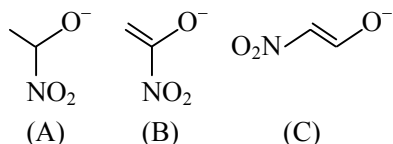
Sol. Lowering of V.P in second Beaker will take place.

- Q.4** Among statement (a) – (d), the correct ones are :
- (a) Decomposition of hydrogen peroxide gives dioxygen.
 - (b) Like hydrogen peroxide, compound, such as KClO_3 , $\text{Pb}(\text{NO}_3)_2$ and NaNO_3 when heated liberate dioxygen.
 - (c) 2-Ethylantraquinone is useful for the industrial preparation of hydrogen peroxide.
 - (d) Hydrogen peroxide is used for the manufacture of sodium perborate.
- (1) (a), (c) and (d) only
 - (2) (a), (b), (c) and (d)
 - (3) (a) and (c) only
 - (4) (a), (b) and (c) only

Ans. [2]

Sol. Theory Based

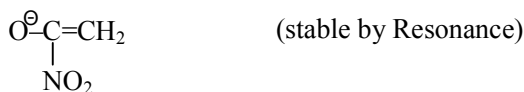
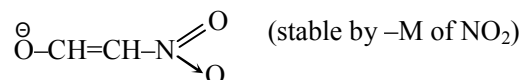
- Q.5** The correct order of stability for the following alkoxides is :



- (1) (C) > (A) > (B)
- (2) (B) > (C) > (A)
- (3) (B) > (A) > (C)
- (4) (C) > (B) > (A)

Ans. [4]

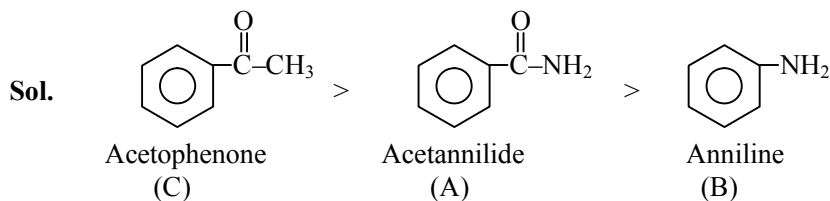
Sol.



- Q.6** A chromatography column, packed with silica gel as stationary phase, was used to separate a mixture of compounds consisting of (A) benzanilide (B) aniline and (C) acetophenone. When the column is eluted with a mixture of solvent, hexane : ethyl acetate (20 : 80), the sequence of obtained compounds is :

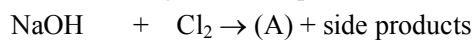
- (1) (B), (C) and (A)
- (2) (C), (A) and (B)
- (3) (A), (B) and (C)
- (4) (B), (A) and (C)

Ans. [2]

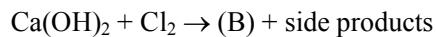


Aniline has higher viscosity due to efficient H-Bonding.

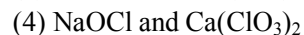
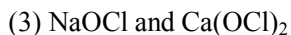
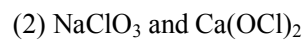
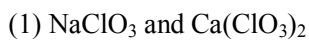
Q.7 In the following reactions, products (A) and (B), respectively, are :



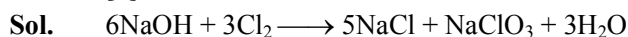
(hot and conc.)



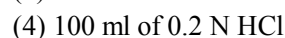
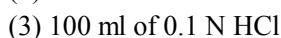
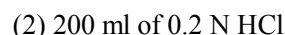
(dry)



Ans. [2]



Q.8 The ammonia (NH_3) released on quantitative reaction of 0.6 g urea (NH_2CONH_2) with sodium hydroxide (NaOH) can be neutralized by :



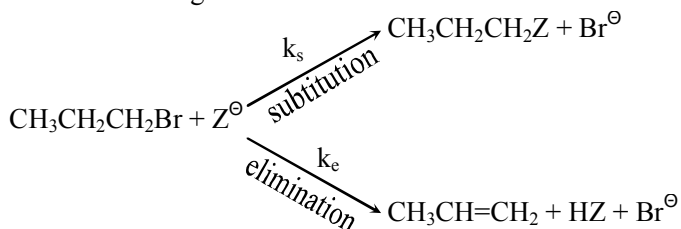
Ans. [4]

Sol. $2 \times \text{moles of urea} = \text{moles of NH}_3$

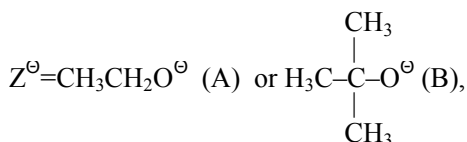
moles of $\text{NH}_3 = \text{moles of HCl}$

$$\frac{100 \times 0.2}{1000} = \text{moles of HCl} = 0.02 \text{ mole of HCl}$$

Q.9 For the following reactions

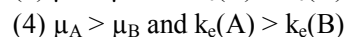
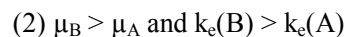
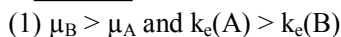


where,



k_s and k_e , are, respectively, the rate constants for substitution and elimination, and $\mu = \frac{k_s}{k_e}$, the correct option

is _____.



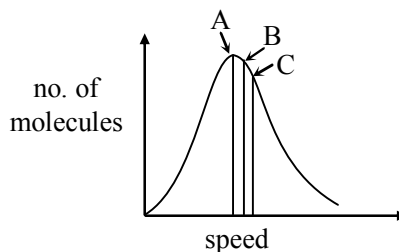
Ans. [3]

Sol. Bulkier the base, elimination will be favoured

$$\mu_A = \frac{k_{sA}}{k_{eA}} \text{ (For A : } k_s > k_e)$$

$$\mu_B = \frac{k_{sB}}{k_{eB}} \text{ (For B : } k_s < k_e)$$

Q.10 Identify the correct labels of A, B and C in the following graph from the option given below :



Root mean square speed (V_{rms}); most probable speed (V_{mp}); Average speed (V_{av})

(1) $A - V_{rms}$; $B - V_{mp}$; $C - V_{av}$

(2) $A - V_{mp}$; $B - V_{av}$; $C - V_{rms}$

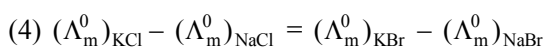
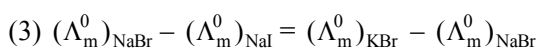
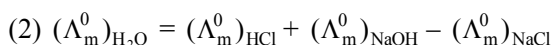
(3) $A - V_{mp}$; $B - V_{rms}$; $C - V_{av}$

(4) $A - V_{av}$; $B - V_{rms}$; $C - V_{mp}$

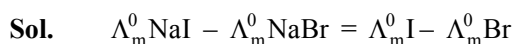
Ans. [2]

Sol. $V_{rms} > V_{av} > V_{mps}$

Q.11 The equation that is incorrect is :



Ans. [3]



Q.12 The redox reaction among the following is :

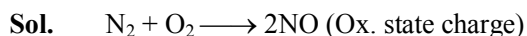
(1) combination of dinitrogen with dioxygen at 200 K

(2) reaction of H_2SO_4 with NaOH

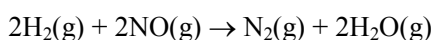
(3) formation of ozone from atmospheric oxygen in the presence of sunlight

(4) reaction of $[Co(H_2O)_6]Cl_3$ with $AgNO_3$

Ans. [1]



Q.13 For the reaction



the observed rate expression is, $rate = k_f [NO]^2 [H_2]$. The rate expression for the reverse reaction is :

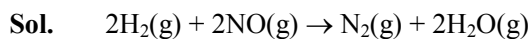
(1) $k_b [N_2][H_2O]^2/[H_2]$

(2) $k_b [N_2][H_2O]$

(3) $k_b [N_2][H_2O]^2/[NO]$

(4) $k_b [N_2][H_2O]^2$

Ans. [1]



According to Rate expression forward

$2\text{NO} + \text{H}_2$ are Reactants

Hence one mole of H_2 is reacted in second step

$$k_b[\text{N}_2][\text{H}_2\text{O}]^2/[\text{H}_2]$$

Q.14 The bond order and the magnetic characteristics of CN^- are :

- (1) $2\frac{1}{2}$, diamagnetic (2) 3, paramagnetic (3) $2\frac{1}{2}$, paramagnetic (4) 3, diamagnetic

Ans. [4]

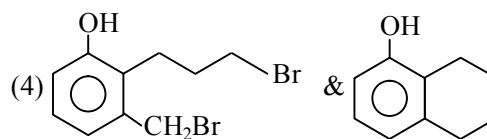
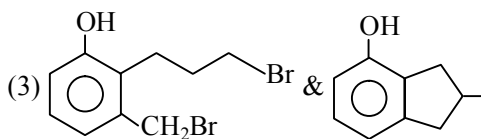
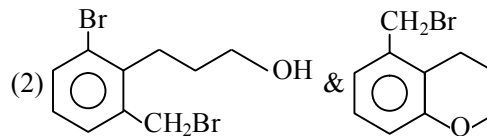
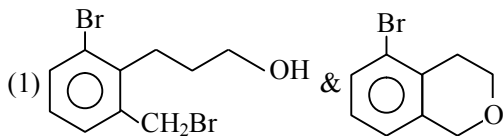
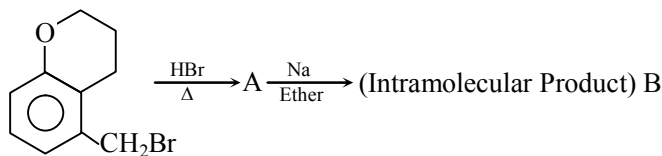
Sol. CN^- has 14 electron

$$\sigma 1s^2, \sigma^* 1s^2 \sigma 2s^2 \sigma^* 2s^2 \pi^2 2p_y = \pi^2 2p_z \pi^* 2p_y = \pi^* 2p_z$$

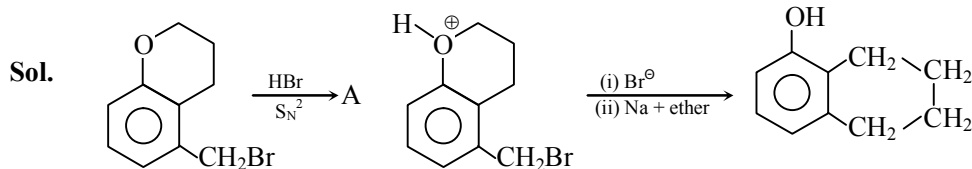
$$\text{Bond order} = \frac{N_b - N_a}{2} = 3 (\text{C} \equiv \text{N})$$

diamagnetic \rightarrow all electrons are paired

Q.15 In the following reaction sequence, structures of A and B, respectively will be :



Ans. [4]



Q.16 Which of the following statements is correct ?

- (1) Gluconic acid is obtained by oxidation of glucose with HNO_3
 (2) Gluconic acid is a partial oxidation product of glucose
 (3) Gluconic acid can form cyclic (acetal/hemiacetal) structure
 (4) Gluconic acid is a dicarboxylic acid

Ans. [2]

Ans. [2]

Sol. Vinyl halides and Aryl halides do not give Friedel Craft Reaction due to partial double bond character.

Q.21 The flocculation value of HCl for arsenic sulphide sol. is 30 m mol L^{-1} . If H_2SO_4 is used for the flocculation of arsenic sulphide, the amount, in grams, of H_2SO_4 in 250 ml required for the above purpose is _____. (molecular mass of $\text{H}_2\text{SO}_4 = 98 \text{ g/mol}$)

Ans. [0.3675]

Sol. \rightarrow 1 litre solution of 30 m mol of HCl is required

\rightarrow For 1 litre solution 15 m mol H_2SO_4 is required.

$$\begin{aligned} 250 \text{ ml of solution required : } & - \frac{15}{4} \times 10^{-3} \text{ (m mol) of } \text{H}_2\text{SO}_4 \\ & = 0.3675 \text{ gm} \end{aligned}$$

Q.22 3 g of acetic acid is added to 250 mL of 0.1 M HCl and the solution made up to 500 mL. To 20 mL of this solution $\frac{1}{2}$ mL of 5 M NaOH is added. The pH of the solution is _____.

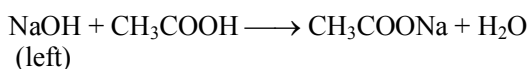
[Given : pK_a of acetic acid = 4.75, molar mass of acetic acid = 60 g/mol, $\log 3 = 0.4771$]
Neglect any changes in volume.

Ans. [5.22]

Sol. m mole of acetic acid in 20 ml = 2

m mole of HCl in 20 ml = 1

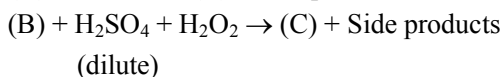
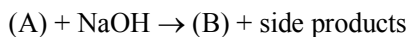
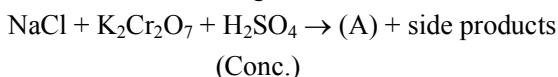
m mole of NaOH 20 ml = 2.5



$$\begin{array}{cccc} 1.5 & 2 & 0 & 0 \\ 0 & 0.5 & 1.5 & \end{array}$$

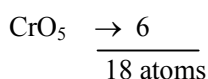
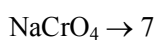
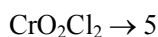
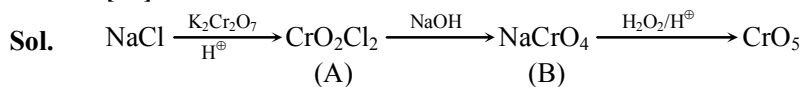
$$\begin{aligned} \text{pH} &= \text{pK}_a + \log \frac{3/2}{2} \\ &= 4.74 + \log 3 = 5.22 \end{aligned}$$

Q.23 Consider the following reactions :



The sum of the total number of atoms in one molecule each of (A), (B) and (C) is _____.

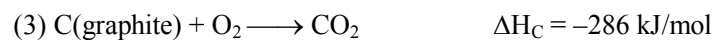
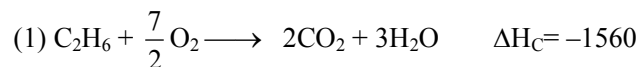
Ans. [18]



Q.24 The standard heat of formation ($\Delta_f H_{298}^0$) of ethane (in kJ/mol), if the heat of combustion of ethane, hydrogen and graphite are -1560 , -393.5 and -286 kJ/mol, respectively is _____.

Ans. [192.5]

Sol. $2C(\text{graphite}) + 3H_2(g) \longrightarrow 1C_2H_6$ $\Delta H_f(C_2H_6)$



$$\begin{aligned} \Delta H_f(C_2H_6) &= 3(-393.5) + 2(-286) + 1560 \\ &= -1180.5 + (-572) + 1560 \\ &= 192.5 \end{aligned}$$

Q.25 The number of sp^2 hybridised carbons present in "Aspartame" is _____.

Ans. [9]

Sol.

