TEST PAPER OF JEE(MAIN) EXAMINATION – 2019

(Held On Saturday 12th JANUARY, 2019) TIME : 02 : 30 PM To 05 : 30 PM

CHEMISTRY

1. 8g of NaOH is dissolved in 18g of H_2O. Mole fraction of NaOH in solution and molality (in mol kg^{-1}) of the solutions respectively are :

(1) 0.167, 11.11 (2) 0.2, 22.20

(3) 0.2, 11.11 (4) 0.167,22.20

Ans. (1)

Sol. 8g NaOH, mol of NaOH = $\frac{8}{40} = 0.2\text{mol}$

18g H_2O, mol of H_2O = $\frac{18}{18} = 1\text{mol}$

$\therefore\ X_{NaOH} = \frac{0.2}{1.2} = 0.167$

Molality = $\frac{0.2\times1000}{18} = 11.11$ m

2. The correct statement(s) among I to III with respect to potassium ions that are abundant within the cell fluids is/are :

I. They activate many enzymes

II. They participate in the oxidation of glucose to produce ATP

III. Along with sodium ions, they are responsible for the transmission of nerve signals

(1) I, II and III (2) I and III only

(3) III only (4) I and II only

Ans. (1)

Sol. All the three statements are correct a/c to NCERT (s-block)

3. The magnetic moment of an octahedral homoleptic Mn(II) complex is 5.9 BM. The suitable ligand for this complex is :

(1) CN^- (2) NCS^-

(3) CO (4) ethylenediamine

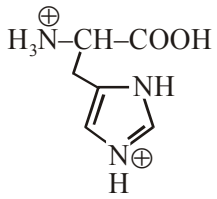
Ans. (2)

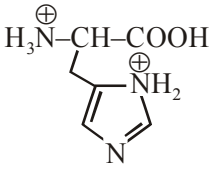
Sol. μ = 5.9 BM $\therefore$ n (no of unpaired.e^-) = 5

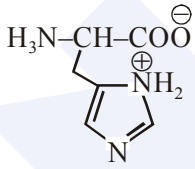
Cation Mn^{II} – $3d^5$ confn only possible for relatively weak ligand.

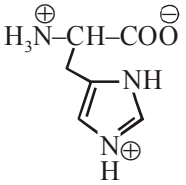
$\therefore$ NCS^-

4. The correct structure of histidine in a strongly acidic solution (pH=2) is

(1) 

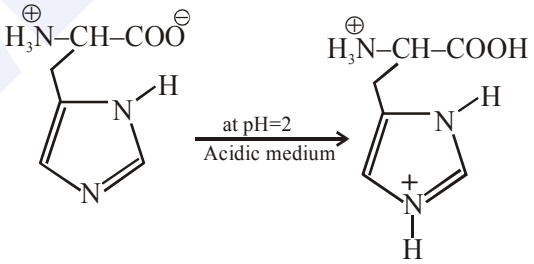
(2) 

(3) 

(4) 

Ans. (1)

Sol. Histidine is



Zwitter ionic form

pIn = 7.59

5. The compound that is NOT a common component of photochemical smog is :

(1) O_3 (2) CH_2=CHCHO

(3) CF_2Cl_2 (4) $H_3C-\underset{\underset{O}{\|}}{C}-OONO_2$

Ans. (3)

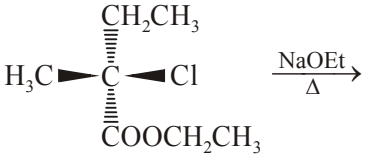
Sol. Freons (CFC's) are not common components of photo chemical smog.

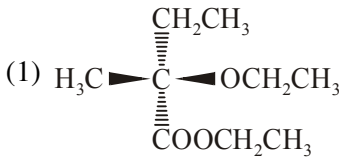
6. The upper stratosphere consisting of the ozone layer protects us from the sun's radiation that falls in the wavelength region of :
(1) 600-750 nm
(2) 0.8-1.5 nm
(3) 400-550 nm
(4) 200-315 nm

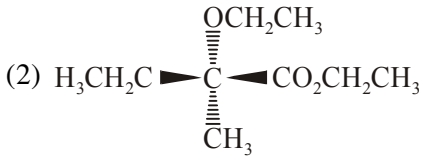
Ans. (4)

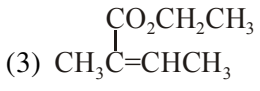
Sol. Ozone protects most of the medium freequnecies ultravoilet light from 200 - 315 nm wave length.

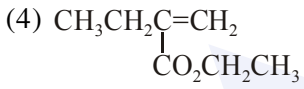
7. The major product of the following reaction is:



(1) 

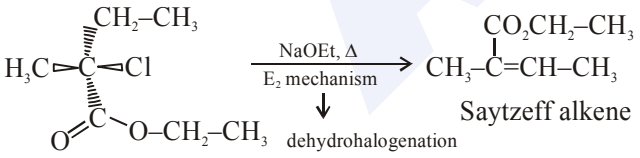
(2) 

(3) 

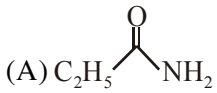
(4) 

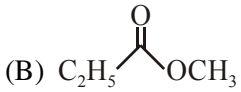
Ans. (3)

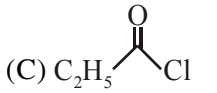
Sol.

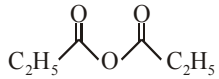


8. The increasing order of the reactivity of the following with $LiAlH_4$ is :

(A) 

(B) 

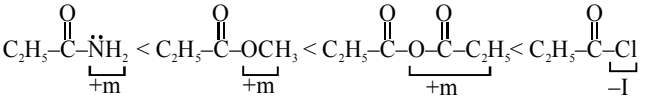
(C) 

(D) 

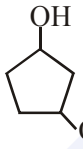
(1) (A) < (B) < (D) < (C)
(2) (A) < (B) < (C) < (D)
(3) (B) < (A) < (D) < (C)
(4) (B) < (A) < (C) < (D)

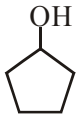
Ans. (1)

Sol. Rate of nucleophilic attack on carbonyl $\propto$ Electrophilicity of carbonyl group

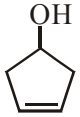


9. The major product of the following reaction is:

(1) 

(2) 

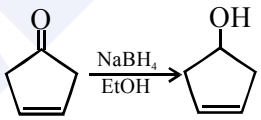
(3) 

(4) 

Ans. (4)

Sol. $NaBH_4$ can not reduce C=C

but can reduce $-\overset{\overset{O}{\|}}{C}-$ into OH.



10. Molecules of benzoic acid (C_6H_5COOH) dimerise in benzene. 'w' g of the acid dissolved in 30 g of benzene shows a depression in freezing point equal to 2K. If the percentage association of the acid to form dimer in the solution is 80, then w is :
(Given that K_f = 5 K kg mol^{-1}, Molar mass of benzoic acid = 122 g mol^{-1})
(1) 1.8 g (2) 2.4 g (3) 1.0 g (4) 1.5 g

Ans. (2)

Sol. $\underset{Wg}{2(C_6H_5COOH)} \xrightarrow[(30g)]{C_6H_6} \underset{diner}{(C_6H_5COOH)_2}$

$\Delta_f T = i\, k_f\, m$

$2 = 0.6 \times 5 \times \frac{w \times 1000}{122 \times 30}$

$(i = 1 - 0.8 + 0.4 = 0.6)$

$w = 2.44$ g

11. Given :
(i) $C(graphite) + O_2(g) \rightarrow CO_2(g)$;
$\Delta rH° = x$ kJ mol^{-1}

(ii) $C(graphite) + \frac{1}{2} O_2(g) \rightarrow CO_2(g)$;

$\Delta rH^\circ = y\ kJ\ mol^{-1}$

(iii) $CO(g) + \frac{1}{2}O_2(g) \rightarrow CO_2(g)$;

$\Delta rH^\circ = z\ kJ\ mol^{-1}$

Based on the above thermochemical equations, find out which one of the following algebraic relationships is correct ?

(1) z = x + y (2) x = y – z

(3) x = y + z (4) y = 2z – x

Ans. (3)

Sol.

$$C_{(graphite)} + O_2(g) \rightarrow CO_2(g)\Delta_r H^\circ = xkJ/mol \ldots(1)$$

$$C_{(graphite)} + \frac{1}{2}O_2(g) \rightarrow CO(g)\Delta_r H^\circ = ykJ/mol \ldots(2)$$

$$CO(g) + \frac{1}{2}O_2(g) \rightarrow CO_2(g)\Delta_r H^\circ = zkJ/mol \ldots..(3)$$

(1) = (2) + (3)

x = y + z

12. An open vessel at 27°C is heated until two fifth of the air (assumed as an ideal gas) in it has escaped from the vessel. Assuming that the volume of the vessel remains constant, the temperature at which the vessel has been heated is :

(1) 750°C (2) 500°C

(3) 750 K (4) 500 K

Ans. (4)

Sol. $\frac{2}{5}$ air escaped from vessel, $\therefore \frac{3}{5}$ air remain is vessel. P, V constant

$n_1T_1 = n_2T_2$

$$n_1(300) = \left(\frac{3}{5}n_1\right)T_2 \Rightarrow T_2 = 500\ K$$

13. $\wedge_m^\circ$ for NaCl, HCl and NaA are 126.4, 425.9 and 100.5 S cm^2mol^{-1}, respectively. If the conductivity of 0.001 M HA is 5×10^{-5} S cm^{-1}, degree of dissociation of HA is :

(1) 0.75 (2) 0.125 (3) 0.25 (4) 0.50

Ans. (2)

Sol.

$$\Lambda_m^0(HA) = \Lambda_m^0(HCl) + \Lambda_m^0(NaA) - \Lambda_m^0(NaCl)$$

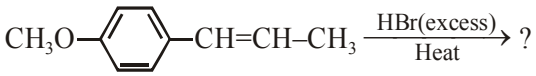
= 425.9 + 100.5 - 126.4

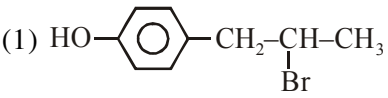
= 400 S $cm^2\ mol^{-1}$

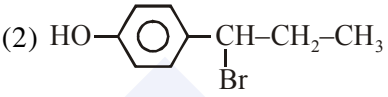
$$\Lambda_m = \frac{1000K}{M} = \frac{1000\times5\times10^{-5}}{10^{-3}} = 50\ S\ cm^2\ mol^{-1}$$

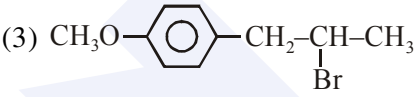
$$\alpha = \frac{\Lambda_m}{\Lambda_m^0} = \frac{50}{400} = 0.125$$

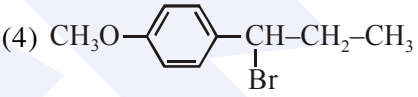
14. The major product in the following conversion is :



(1) 

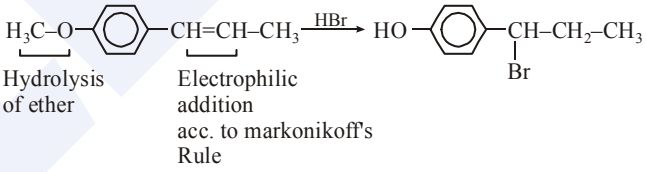
(2) 

(3) 

(4) 

Ans. (2)

Sol.



15. If K_{sp} of Ag_2CO_3 is 8×10^{-12}, the molar solubility of Ag_2CO_3 in 0.1M $AgNO_3$ is :

(1) 8×10^{-12} M (2) 8×10^{-10} M

(3) 8×10^{-11} M (4) 8×10^{-13} M

Ans. (2)

Sol. $Ag_2CO_3\ (s) \rightleftharpoons \underset{(0.1+\ 2S)\ M}{2Ag^+(aq.)} + \underset{S\ M}{CO_3^{-2}(aq)}$

$Ksp = [Ag^+]^2[CO_3^{-2}]$

$8 \times 10^{-12} = (0.1 + 2S)^2\ (S)$

$S = 8 \times 10^{-10}$ M

16. Among the following, the false statement is :

(1) Latex is a colloidal solution of rubber particles which are positively charged

(2) Tyndall effect can be used to distingush between a colloidal solution and a true solution.

(3) It is possible to cause artificial rain by throwing electrified sand carrying charge opposite to the one on clouds from an aeroplane.

(4) Lyophilic sol can be coagulated by adding an electrolyte.

Ans. (1)

Sol. Colloidal solution fo rubber are negatively charged.

17. The pair that does NOT require calcination is:

(1) ZnO and MgO

(2) Fe_2O_3 and $CaCO_3.MgCO_3$

(3) ZnO and $Fe_2O_3.xH_2O$

(4) $ZnCO_3$ and CaO

Ans. (1)

Sol. ZnO & MgO both are in oxide form therefore no change on calcination.

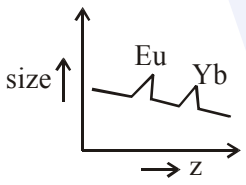
18. The correct order of atomic radii is :

(1) Ce > Eu > Ho > N (2) N > Ce > Eu > Ho

(3) Eu > Ce > Ho > N (4) Ho > N > Eu > Ce

Ans. (3)

Sol.



Eu > Ce > Ho > N.

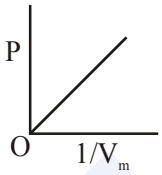
19. The element that does NOT show catenation is:

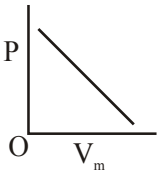
(1) Sn (2) Ge (3) Si (4) Pb

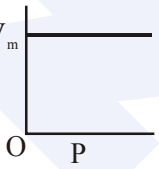
Ans. (4)

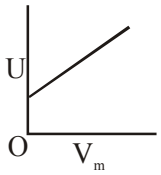
Sol. Catenation is not shown by lead.

20. The combination of plots which does not represent isothermal expansion of an ideal gas is:

(A) 

(B) 

(C) 

(D) 

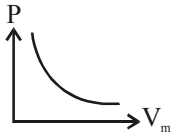
(1) (A) and (C) (2) (A) and (D)

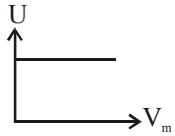
(3) (B) and (D) (4) (B) and (C)

Ans. (3)

Sol. Isothermal expansion $PV_m = K$(Graph-C)

$$P = \frac{K}{V_m} \text{ (Graph-A)}$$





21. The volume strength of 1M H_2O_2 is:

(Molar mass of H_2O_2 = 34 g mol^{-1})

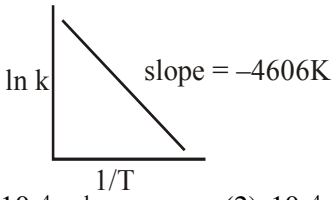
(1) 16.8 (2) 11.35

(3) 22.4 (4) 5.6

Ans. (2)

Sol. 1L – 1M H_2O_2 solution will produce 11.35 L O_2 gas at STP.

22. For a reaction consider the plot of ln k versus 1/T given in the figure. If the rate constant of this reaction at 400 K is 10^{-5} s^{-1}, then the rate constant at 500 K is :



(1) 2×10^{-4} s^{-1} (2) 10^{-4} s^{-1}
(3) 10^{-6} s^{-1} (4) 4×10^{-4} s^{-1}

Ans. (2)

Sol. $$\ell n\frac{K_2}{K_1}=\frac{E_a}{R}\left[\frac{1}{T_1}-\frac{1}{T_2}\right]$$

$$2.303\log\frac{K_2}{10^{-5}}=4606\left[\frac{1}{400}-\frac{1}{500}\right]$$

$\Rightarrow K_2 = 10^{-4}$ s^{-1}

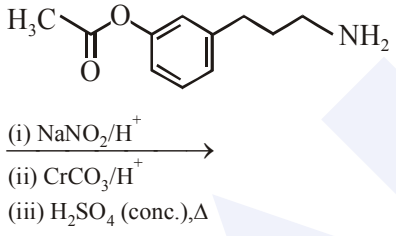
23. The element that shows greater ability to form pπ-pπ multiple bonds, is :

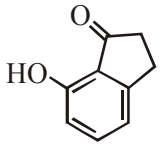
(1) Si (2) Ge (3) Sn (4) C

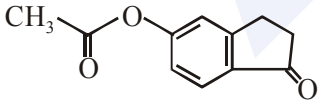
Ans. (4)

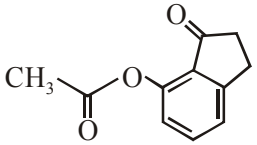
Sol. carbon atom have 2p orbitals able to form strongest pπ - pπ bonds

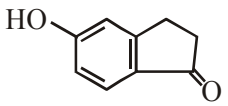
24. The major product of the following reaction is:



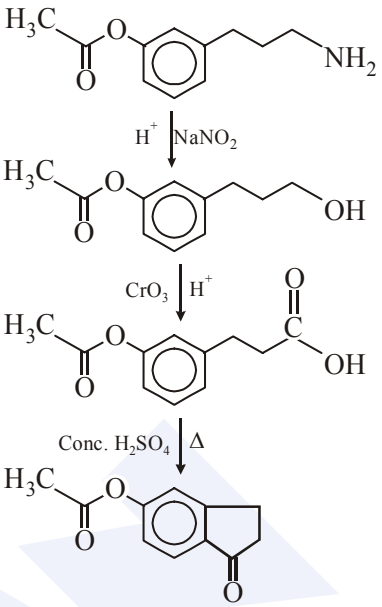
(1) 

(2) 

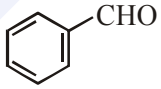
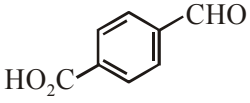
(3) 

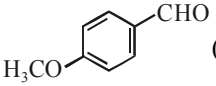
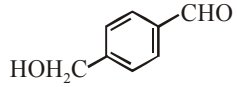
(4) 

Ans. (2)

Sol. 

25. The aldehydes which will not form Grignard product with one equivalent Grignard reagents are :

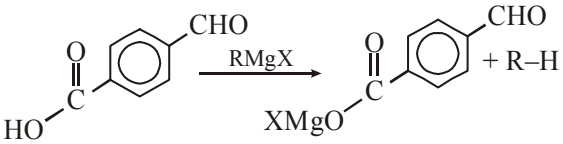
(A)  (B) 

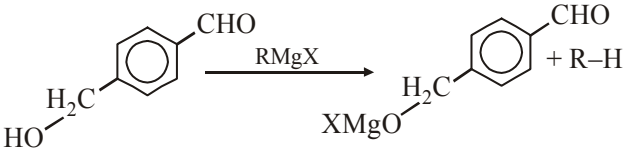
(C)  (D) 

(1) (B), (C), (D) (2) (B), (D)
(3) (B), (C) (4) (C), (D)

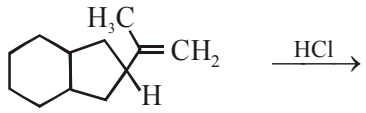
Ans. (2)

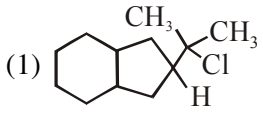
Sol. Acid-base reaction of G.R are fast.

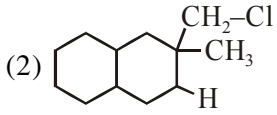


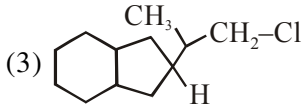


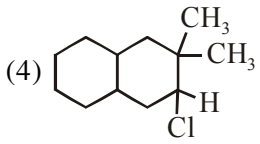
26. The major product of the following reaction is:



(1) 

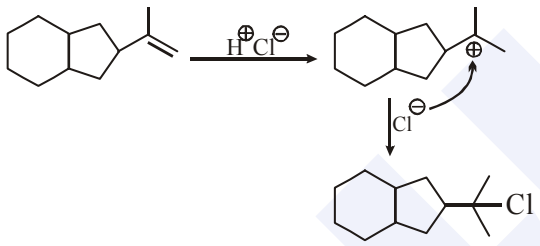
(2) 

(3) 

(4) 

Ans. (1)

Sol.



27. Chlorine on reaction with hot and concentrated sodium hydroxide gives :

(1) Cl^- and ClO_2^- (2) Cl^- and ClO_3^-

(3) Cl^- and ClO^- (4) ClO_3^- and ClO_2^-

Ans. (2)

Sol. $3Cl_2 + 6\ OH^- \rightarrow 5Cl^- + ClO_3^- + 3H_2O$

28. The major product of the following reaction is:

$$CH_3CH_2\underset{Br}{\underset{|}{C}}H-\underset{Br}{\underset{|}{C}}H_2 \xrightarrow[\text{(ii) } NaNH_2 \text{ in liq } NH_3]{\text{(i) KOH alc.}}$$

(1) $CH_3CH_2C{\equiv}CH$

(2) $CH_3CH_2\underset{NH_2}{\underset{|}{C}}H-\underset{NH_2}{\underset{|}{C}}H_2$

(3) $CH_3CH{=}C{=}CH_2$

(4) $CH_3CH{=}CHCH_2NH_2$

Ans. (1)

Sol.

$$CH_3-CH_2-\underset{Br}{\underset{|}{C}}H-\underset{Br}{\underset{|}{C}}H_2$$

$$\downarrow \text{Alc. KOH}$$

$$CH_3-CH_2-\underset{Br}{\underset{|}{C}}=CH_2$$

$$\downarrow NaNH_2 \text{ in liq. } NH_3$$

$$CH_3-CH_2-C{\equiv}CH$$

29. If the de Broglie wavelength of the electron in n^{th} Bohr orbit in a hydrogenic atom is equal to $1.5\ \pi a_0$ (a_0 is Bohr radius), then the value of n/z is :

(1) 1.0 (2) 0.75 (3) 0.40 (4) 1.50

Ans. (2)

Sol. According to de-broglie's hypothesis

$$2\pi r_n = n\lambda \Rightarrow 2\pi \cdot a_0 = \frac{n^2}{z} = n \times 1.5\pi a_0$$

$$\frac{n}{z} = 0.75$$

30. The two monomers for the synthesis of Nylone 6, 6 are :

(1) $HOOC(CH_2)_6COOH$, $H_2N(CH_2)_6NH_2$

(2) $HOOC(CH_2)_4COOH$, $H_2N(CH_2)_4NH_2$

(3) $HOOC(CH_2)_6COOH$, $H_2N(CH_2)_4NH_2$

(4) $HOOC(CH_2)_4COOH$, $H_2N(CH_2)_6NH_2$

Ans. (4)

Sol. Nylon-6,6 is polymer of

Hexamethylene diamine & Adipic acid

$\downarrow$ $\downarrow$

$H_2N-(CH_2)_6-NH_2$ $HOOC-(CH_2)_4-COOH$