FINAL JEE–MAIN EXAMINATION – APRIL,2019

(Held On Tuesday 09th APRIL, 2019) TIME : 9 : 30 AM To 12 : 30 PM

CHEMISTRY

TEST PAPER WITH ANSWER & SOLUTION

1. The correct order of the oxidation states of nitrogen in NO, N_2O, NO_2 and N_2O_3 is :

(1) $NO_2 < N_2O_3 < NO < N_2O$

(2) $NO_2 < NO < N_2O_3 < N_2O$

(3) $N_2O < N_2O_3 < NO < NO_2$

(4) $N_2O < NO < N_2O_3 < NO_2$

Official Ans. by NTA (4)

Sol. Correct order of oxidation state of nitrogen in oxides of nitrogen is following

$$\overset{+1}{N_2}O < \overset{+2}{N}O < \overset{+3}{N_2}O_3 < \overset{+4}{N}O_2$$

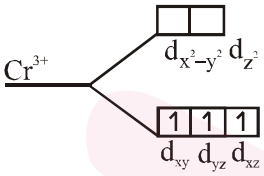
2. The degenerate orbitals of $[Cr(H_2O)_6]^{3+}$ are :

(1) d_{yz} and d_{z^2} (2) d_{z^2} and d_{xz}

(3) d_{xz} and d_{yz} (4) $d_{x^2-y^2}$ and d_{xy}

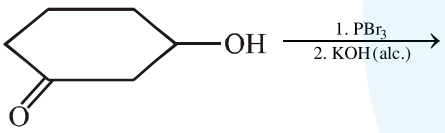
Official Ans. by NTA (3)

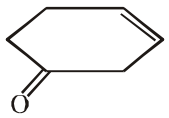
Sol. Degenerate orbitals of $[Cr(H_2O)_6]^{3+}$



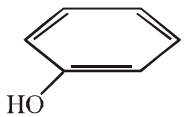
Hence according to the options given, degenerate orbitals are d_{xz} & d_{yz}

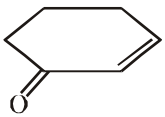
3. The mojor product of the following reaction is :



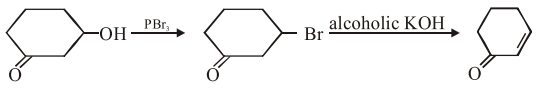
(1) 

(2) 

(3) 

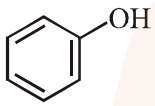
(4) 

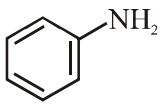
Official Ans. by NTA (4)

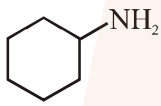
Sol. 

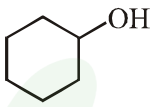
4. The organic compound that gives following qualitative analysis is :

Test	Inference
(a) Dil. HCl	Insoluble
(b) NaOH solution	soluble
(c) Br_2/water	Decolourization

(1) 

(2) 

(3) 

(4) 

Official Ans. by NTA (1)

Sol. 

is insoluble in dil. HCl but soluble in NaOH to form 

decolorise Br_2 water to give 

(2,4,6- tribromophenol)

5. Which of the following statements is not true about sucrose?

(1) On hydrolysis, it produces glucose and fructose

(2) The glycosidic linkage is present between C_1 of α-glucose and C_1 of β-fructose

(3) It is also named as invert sugar

(4) It is a non reducing sugar

Official Ans. by NTA (2)

Sol. Sucrose $\xrightarrow{H_2O}$ α-D-glucose + β-D-fructose also named as invert sugar & it is a example of non-reducing sugar.

The glycosidic linkage is present between C_1 of α-glucose & C_2 of β-fructose.

6. Excessive release of CO_2 into the atomosphere results in :

(1) polar vortex (2) depletion of ozone

(3) formation of smog (4) global warming

Official Ans. by NTA (4)

Sol. Excessive release of CO_2 into the atmosphere results in **global warming**.

7. Among the following, the molecule expected to be stabilized by anion formation is :

C_2, O_2, NO, F_2

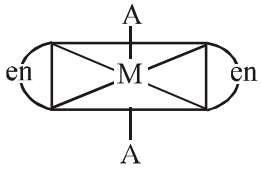
(1) NO (2) C_2 (3) F_2 (4) O_2

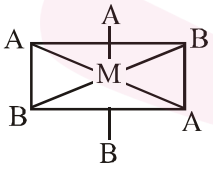
Official Ans. by NTA (2)

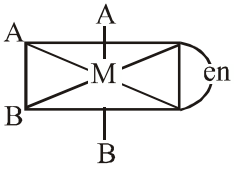
Sol. In case of only C_2, incoming electron will enter in the bonding molecular orbital which increases the bond order and stability too. Whereas rest of all takes electron in their antibonding molecular orbital which decreases bond order and stability.

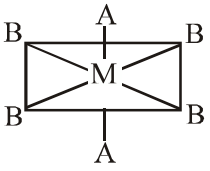
8. The one that will show optical activity is :

(en = ethane-1,2-diamine)

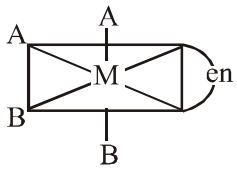
(1) 

(2) 

(3) 

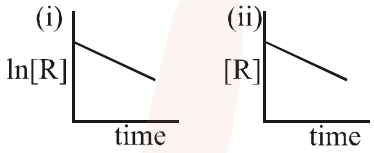
(4) 

Official Ans. by NTA (3)

Sol. 

This structure does not contain plane of symmetry hence it is optically active, rest of all options has plane of symmetry and they are optically inactive.

9. The given plots represent the variation of the concentration of a reactant R with time for two different reactions (i) and (ii). The respective orders of the reactions are :



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

Official Ans. by NTA (1)

Sol. (i) $\ln[R] = \ln[R]_0 - Kt$ (I^{st} order)

$[R] = [R]_0 - Kt$ (zero order)

$\therefore$ Ans.(1)

10. The aerosol is a kind of colloid in which :

(1) gas is dispersed in solid

(2) solid is dispersed in gas

(3) liquid is dispersed in water

(4) gas is dispersed in liquid

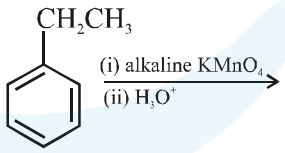
Official Ans. by NTA (2)

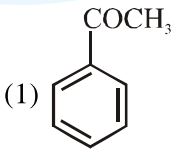
Sol. Aerosol is suspension of fine solid or liquid particles in air or other gas.

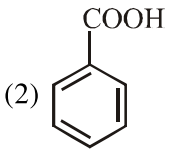
Ex. Fog, dust, smoke etc

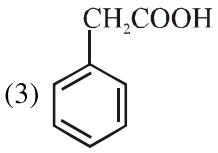
$\therefore$ Ans.(2)

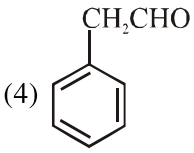
11. The mojor product of the following reaction is :



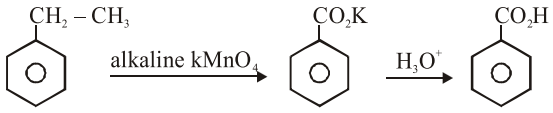
(1) 

(2) 

(3) 

(4) 

Official Ans. by NTA (2)

Sol. 

12. For a reaction,
$N_2(g) + 3H_2(g) \rightarrow 2NH_3(g)$;
identify dihydrogen (H_2) as a limiting reagent in the following reaction mixtures.
(1) 14g of N_2 + 4g of H_2
(2) 28g of N_2 + 6g of H_2
(3) 56g of N_2 + 10g of H_2
(4) 35g of N_2 + 8g of H_2
Official Ans. by NTA (3)

Sol. $N_2(g) + 3H_2(g) \longrightarrow 2NH_3(g)$

(1) 0.5 mol (LR) 2 mol

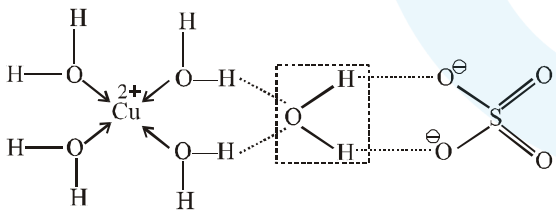
(2) 1 mol 3 mol (completion)

(3) 2 mol 5 mol (LR)

(4) 1.25 mol (LR) 4 mol

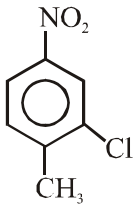
$\therefore$ Ans.(3)

13. The number of water molecule(s) not coordinated to copper ion directly in $CuSO_4.5H_2O$, is :
(1) 4 (2) 3 (3) 1 (4) 2
Official Ans. by NTA (3)

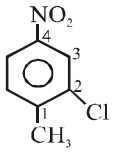
Sol. 

One water molecule as shown in the diagram, is not coordinated to copper ion directly.

14. The correct IUPAC name of the following compound is :



(1) 5-chloro-4-methyl-1-nitrobenzene
(2) 2-methyl-5-nitro-1-chlorobenzene
(3) 3-chloro-4-methyl-1-nitrobenzene
(4) 2-chloro-1-methyl-4-nitrobenzene
Official Ans. by NTA (4)

Sol.  2-chloro–1-methyl–4–nitrobenzene

15. C_{60}, an allotrope of carbon contains :
(1) 20 hexagons and 12 pentagons.
(2) 12 hexagons and 20 pentagons.
(3) 18 hexagons and 14 pentagons.
(4) 16 hexagons and 16 pentagons.
Official Ans. by NTA (1)

Sol. In C_{60} molecule there are 20 hexagons and 12 pentagons
$\therefore$ Ans.(1)

16. Among the following, the set of parameters that represents path function, is :
(A) q + w
(B) q
(C) w
(D) H–TS
(1) (A) and (D) (2) (B), (C) and (D)
(3) (B) and (C) (4) (A), (B) and (C)
Official Ans. by NTA (3)

Sol. (A) q + w = ΔU $\leftarrow$ definite quantity
(B) q $\rightarrow$ Path function
(C) w $\rightarrow$ Path function
(D) H – TS = G $\rightarrow$ state function
$\therefore$ Ans.(3)

17. The osmotic pressure of a dilute solution of an ionic compound XY in water is four times that of a solution of 0.01 M $BaCl_2$ in water. Assuming complete dissociation of the given ionic compounds in water, the concentration of XY (in mol L^{-1}) in solution is :

(1) 6×10^{-2} (2) 4×10^{-4}

(3) 16×10^{-4} (4) 4×10^{-2}

Official Ans. by NTA (1)

Sol. $\pi_{XY} = 4\pi_{BaCl_2}$

$2 \times [XY] = 4 \times 3 \times 0.01$

(Assuming same temperature)

$\Rightarrow [XY] = 0.06$ M

$\therefore$ Ans. is (1)

18. The standard Gibbs energy for the given cell reaction in kJ mol^{-1} at 298 K is :

$Zn(s) + Cu^{2+}(aq) \rightarrow Zn^{2+}(aq) + Cu(s)$,

$E^\circ = 2$ V at 298 K

(Faraday's constant, F = 96000 C mol^{-1})

(1) –384 (2) –192

(3) 192 (4) 384

Official Ans. by NTA (1)

Sol. $\Delta G^\circ = -nFE^\circ_{cell}$

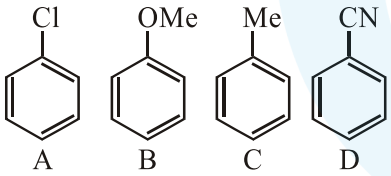
$= -2 \times 96000 \times 2$

$= -384000$ J

$= -384$ kJ

$\therefore$ Ans. is (1)

19. The increasing order of reactivity of the following compounds towards aromatic electrophilic substitution reaction is :

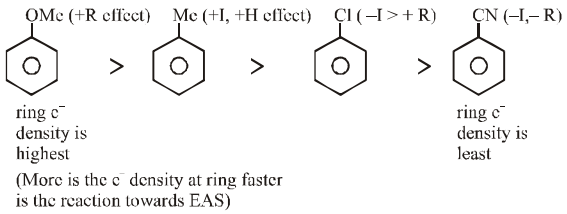


(1) D < B < A < C (2) A < B < C < D

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

Official Ans. by NTA (3)

Sol.



20. The ore that contains the metal in the form of fluoride is :

(1) magnetite (2) sphalerite

(3) malachite (4) cryolite

Official Ans. by NTA (4)

Sol. $Na_3AlF_6 \rightarrow$ Cryolite is the fluoride ore.

Magnetite Fe_3O_4

Sphalerite ZnS

Malachite $Cu(OH)_2.CuCO_3$

21. Consider the van der Waals constants, a and b, for the following gases.

Gas	Ar	Ne	Kr	Xe
a/ (atm dm^6 mol^{-2})	1.3	0.2	5.1	4.1
b/ (10^{-2} dm^3 mol^{-1}	3.2	1.7	1.0	5.0

Which gas is expected to have the highest critical temperature?

(1) Kr (2) Ne

(3) Ar (4) Xe

Official Ans. by NTA (1)

Sol. $T_c = \frac{8a}{27Rb}$

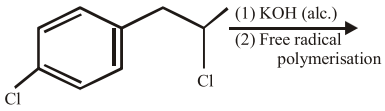
Greater value of $\frac{a}{b} \Rightarrow$ higher is 'T_c'

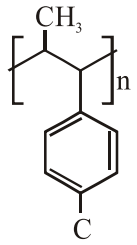
Gas	a/b
Ar	$\frac{1.3}{3.2} = 0.406$
Ne	$\frac{0.2}{1.7} = 0.118$
Kr	$\frac{5.1}{1} = 5.1$
Xe	$\frac{4.1}{5} = 0.82$

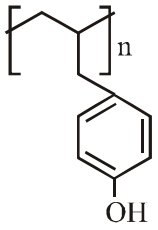
$\therefore$ T_c has order : Kr > Xe > Ar > Ne

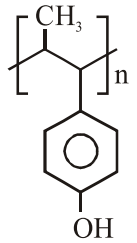
$\therefore$ Ans. is (1)

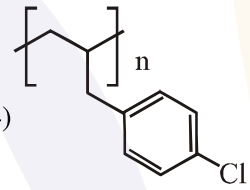
22. The major product of the following reaction is :



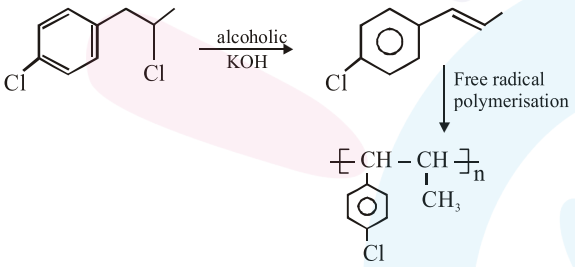
(1) 

(2) 

(3) 

(4) 

Official Ans. by NTA (1)

Sol. 

23. The major product of the following reaction is :

$CH_3CH=CHCO_2CH_3 \xrightarrow{LiAlH_4}$

(1) $CH_3CH_2CH_2CHO$

(2) $CH_3CH = CHCH_2OH$

(3) $CH_3CH_2CH_2CO_2CH_3$

(4) $CH_3CH_2CH_2CH_2OH$

Official Ans. by NTA (2)

Sol. $CH_3 - CH = CH - \underset{\underset{O}{\|}}{C} - OCH_3$

$\downarrow LiAlH_4$

$CH_3 - CH = CH - CH_2OH$

24. Magnisium powder burns in air to give:

(1) MgO only

(2) MgO and $Mg(NO_3)_2$

(3) MgO and Mg_3N_2

(4) $Mg(NO_3)_2$ and Mg_3N_2

Official Ans. by NTA (3)

Sol. $Mg + \underset{O_2/N_2}{air} \xrightarrow{\Delta} MgO + Mg_3N_2$

25. Liquid 'M' and liquid 'N' form an ideal solution. The vapour pressures of pure liquids 'M' and 'N' are 450 and 700 mmHg, respectively, at the same temperature. Then correct statement is:
(x_M = Mole fraction of 'M' in solution ;
x_N = Mole fraction of 'N' in solution ;
y_M = Mole fraction of 'M' in vapour phase ;
y_N = Mole fraction of 'N' in vapour phase)

(1) $(x_M - y_M) < (x_N - y_N)$

(2) $\frac{x_M}{x_N} < \frac{y_M}{y_N}$

(3) $\frac{x_M}{x_N} > \frac{y_M}{y_N}$

(4) $\frac{x_M}{x_N} = \frac{y_M}{y_N}$

Official Ans. by NTA (3)

Sol. $\because P_N^\circ > P_M^\circ$

$\therefore y_N > X_N$

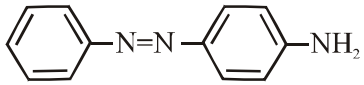
& $X_M > y_M$

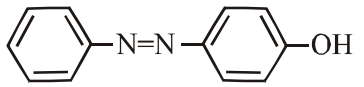
Multiply we get

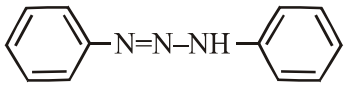
$y_N X_M > X_N y_M$

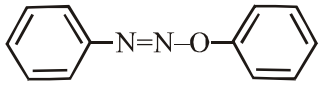
$\therefore$ Ans. is (3)

26. Aniline dissolved in dilute HCl is reacted with sodium nitrite at 0°C. This solution was added dropwise to a solution containing equimolar mixture of aniline and phenol in dil. HCl. The structure of the major product is :

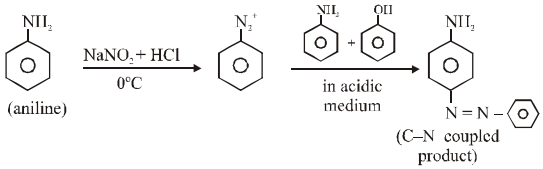
(1) 

(2) 

(3) 

(4) 

Official Ans. by NTA (1)

Sol. 

Aniline undergoes diazo coupling in acidic medium with $Ph\overset{+}{N}_2$

27. The element having greatest difference between its first and second ionization energies, is :

(1) Ca (2) K (3) Ba (4) Sc

Official Ans. by NTA (2)

Sol. K = 2, 8, 8 ,1

After removal of one electron, second electron we have to remove from another shell, hence there is large difference between first and second ionization energies.

28. For any given series of spectral lines of atomic hydrogen, let $\Delta\bar{\nu} = \bar{\nu}_{max} - \bar{\nu}_{min}$ be the difference in maximum and minimum frequencies in cm^{-1}. The ratio $\Delta\bar{\nu}_{Lyman} / \Delta\bar{\nu}_{Balmer}$ is :

(1) 27 : 5 (2) 4 : 1

(3) 5 : 4 (4) 9 : 4

Official Ans. by NTA (4)

Sol. For Lyman

$$\bar{\nu}_{max} = R_H\left(\frac{1}{1^2} - \frac{1}{\infty^2}\right) = R_H$$

$$\bar{\nu}_{min} = R_H\left(\frac{1}{1^2} - \frac{1}{2^2}\right) = \frac{3}{4}R_H$$

$$\Delta\bar{\nu}_{Lyman} = \frac{R_H}{4}$$

For Balmer

$$\bar{\nu}_{max} = R_H\left(\frac{1}{2^2} - \frac{1}{\infty^2}\right) = \frac{R_H}{4}$$

$$\bar{\nu}_{min} = R_H\left(\frac{1}{2^2} - \frac{1}{3^2}\right) = \frac{5}{36}R_H$$

$$\Delta\bar{\nu}_{Balmer} = \frac{R_H}{4} - \frac{5R_H}{36} = \frac{4R_H}{36} = \frac{R_H}{9}$$

$$\frac{\Delta\bar{\nu}_{Lyman}}{\Delta\bar{\nu}_{Balmer}} = \frac{R_H/4}{R_H/9} = \frac{9}{4}$$

$\therefore$ Ans. is (4)

29. The mojor product of the following reaction is :

$$CH_3C{\equiv}CH \xrightarrow[(ii)\ DI]{(i)\ DCl\ (1\ equiv.)}$$

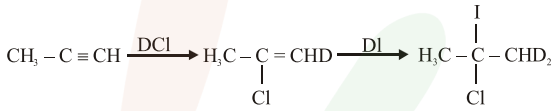
(1) $CH_3CD(Cl)CHD(I)$

(2) $CH_3CD_2CH(Cl)(I)$

(3) $CH_3CD(I)CHD(Cl)$

(4) $CH_3C(I)(Cl)CHD_2$

Official Ans. by NTA (4)

Sol. 

30. Match the catalysts **(Column I)** with products **(Column II)**.

Column I	Column II
(A) V_2O_5	(i) Polyethylene
(B) $TiCl_4/Al(Me)_3$	(ii) ethanal
(C) $PdCl_2$	(iii) H_2SO_4
(D) Iron Oxide	(iv) NH_3

(1) (A)-(ii); (B)-(iii); (C)-(i); (D)-(iv)

(2) (A)-(iii); (B)-(i); (C)-(ii); (D)-(iv)

(3) (A)-(iii); (B)-(iv); (C)-(i); (D)-(ii)

(4) (A)-(iv); (B)-(iii); (C)-(ii); (D)-(i)

Official Ans. by NTA (2)

Sol. V_2O_5 is catalyst $\rightarrow$ contact process for H_2SO_4

$TiCl_4/Al(Me)_3 \rightarrow$ Ziegler Natta salt used as catalyst for polymerisation of ethene.

$PdCl_2 \rightarrow$ used as catalyst for ethanal (Wacker process).

Iron oxide $\rightarrow$ is used as catalyst in Haber's synthesis.