FINAL JEE–MAIN EXAMINATION – SEPTEMBER, 2020

(Held On Thursday 03rd SEPTEMBER, 2020) TIME : 9 AM to 12 PM

CHEMISTRY TEST PAPER WITH ANSWER & SOLUTION

1. The complex that can show optical activity is:

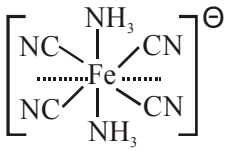
(1) trans-$[Fe(NH_3)_2(CN)_4]^-$

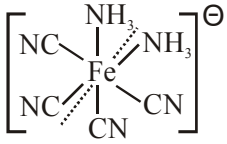
(2) cis-$[Fe(NH_3)_2(CN)_4]^-$

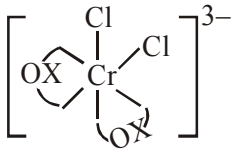
(3) cis-$[CrCl_2(ox)_2]^{3-}$ (ox = oxalate)

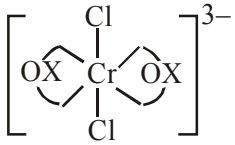
(4) trans-$[Cr(Cl_2)(ox)_2]^{3-}$

Official Ans. by NTA (3)

Sol. (1)  optically inactive

(2)  optically inactive

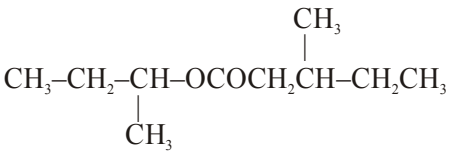
(3)  optically active

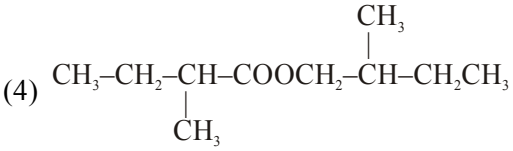
(4)  optically inactive

2. An organic compound [A], molecular formula $C_{10}H_{20}O_2$ was hydrolyzed with dilute sulphuric acid to give a carboxylic acid [B] and alcohol [C]. Oxidation of [C] with $CrO_3 - H_2SO_4$ produced [B]. Which of the following structures are not possible for [A] ?

(1) $(CH_3)_3–C–COOCH_2C(CH_3)_3$

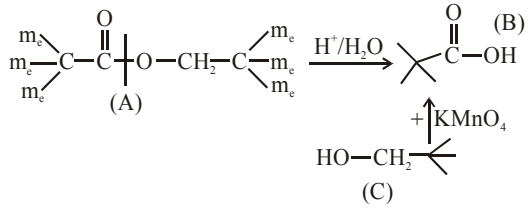
(2) $CH_3CH_2CH_2COOCH_2CH_2CH_2CH_3$

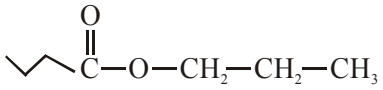
(3) 

(4) 

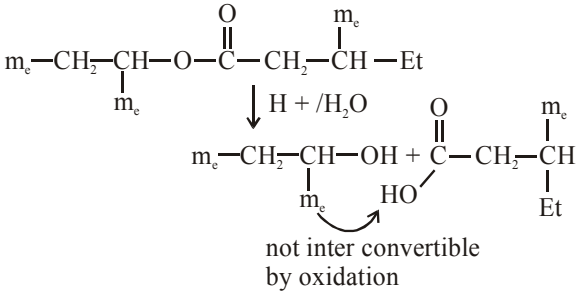
Official Ans. by NTA (3)

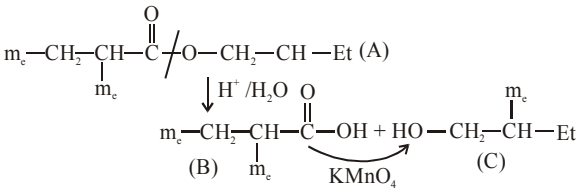
Official Ans. by ALLEN (2 & 3)

Sol. (1) 

(2) 

Total 8 'C' → so molecular formula not matched.

(3) 

(4) 

3. If the boiling point of H_2O is 373 K, the boiling point of H_2S will be :

(1) Greater than 300 K but less than 373 K

(2) Less than 300 K

(3) Equal to 373 K

(4) More than 373 K

Official Ans. by NTA (2)

Sol. Boiling point of H_2S < Boiling point of H_2O

(213 K) (373 K)

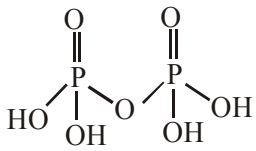
4. In a molecule of pyrophosphoric acid, the number of P–OH, P=O and P–O–P bonds/ moiety(ies) respectivey are :

(1) 3, 3 and 3 (2) 2, 4 and 1

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

Official Ans. by NTA (4)

Sol. Pyrophosphoric acid.



P – OH linkages = 4

P = O linkages = 2

P–O–P linkages = 1

5. It is true that :

(1) A zero order reaction is a single step reaction

(2) A second order reaction is always a multistep reaction

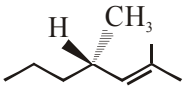
(3) A first order reaction is always a single step reaction

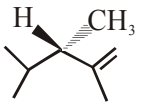
(4) A zero order reaction is a multistep reaction

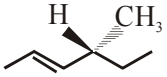
Official Ans. by NTA (4)

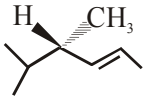
Sol. Zero order reaction is multiple step reaction.

6. Which of the following compounds produces an optically inactive compound on hydrogenation ?

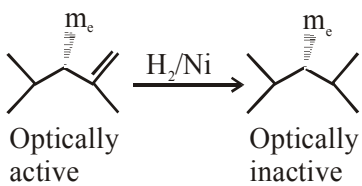
(1) 

(2) 

(3) 

(4) 

Official Ans. by NTA (2)

Sol. 

7. Henry's constant (in kbar) for four gases α, β, γ and δ in water at 298 K is given below :

	α	β	γ	δ
K_H	50	2	2×10^{-5}	0.5

(density of water = 10^3 kg m^{-3} at 298 K)

This table implies that :

(1) The pressure of a 55.5 molal solution of γ is 1 bar

(2) The pressure of a 55.5 molal solution of δ is 250 bar

(3) Solubility of γ at 308 K is lower than at 298 K

(4) α has the highest solubility in water at a given pressure

Official Ans. by NTA (2)

Sol. (1) $P_\gamma = K_H X_Y$

$$P_\gamma = 2\times10^{-15}\times\frac{55.5}{55.5+\frac{1000}{18}} = 2\times10^{-5}\text{ K bar}$$

$= 2 \times 10^{-2}$ bar

(2) $P_\delta = K_H\, X_\delta$

$$P_\delta = 0.5\times\frac{55.5}{55.5+\frac{1000}{18}} = .249\text{ K bar} = 249\text{ bar}$$

(3) On increasing temperature solubility of gases decreases

(4) $K_H \downarrow$ solubility $\uparrow$ and lowest K_H is for γ.

8. Tyndall effect of observed when :

(1) The diameter of dispersed particles is much smaller than the wavelength of light used

(2) The diameter of dispersed particles is much larger than the wavelength of light used

(3) The diameter of dispersed particles is similar to the wavelength of light used

(4) The refractive index of dispersed phase is greater than that of the dispersion medium

Official Ans. by NTA (3)

Sol. The diameter of disperseed particles is similar to wavelength of light used.

9. Thermal power plants can lead to :

(1) Ozone layer depletion

(2) Eutrophication

(3) Acid rain

(4) Blue baby syndrome

Official Ans. by NTA (3)

Sol. Thermal power plants lead to acid rain.

10. The electronic spectrum of $[Ti(H_2O)_6]^{3+}$ shows a single broad peak with a maximum at 20,300 cm^{-1}. The crystal field stabilization energy (CFSE) of the complex ion, in kJ mol^{-1}, is :

(1) 242.5

(2) 83.7

(3) 145.5

(4) 97

Official Ans. by NTA (4)

Sol. CFSE = 0.4 Δ_0

$$= 0.4 \times \frac{20300}{83.7}$$

$$= 97 \text{ kJ/mol}$$

11. Aqua regia is used for dissolving noble metals (Au, Pt, etc). The gas evolved in this process is :

(1) N_2

(2) N_2O_3

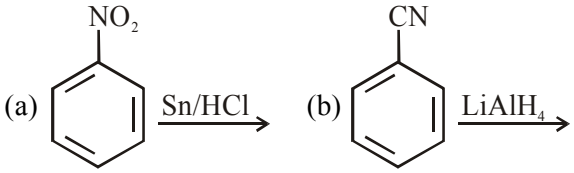
(3) NO

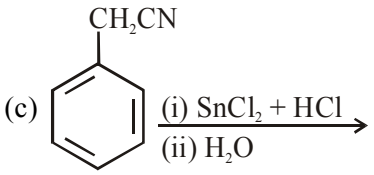
(4) N_2O_5

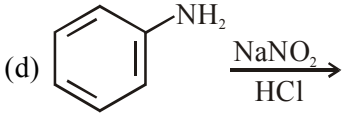
Official Ans. by NTA (3)

Sol. $Au + HNO_3 + 4HCl \rightarrow HAuCl_4 + NO + 2H_2O$

12. The Kjeldahl method of Nitrogen estimation fails for which of the following reaction products ?





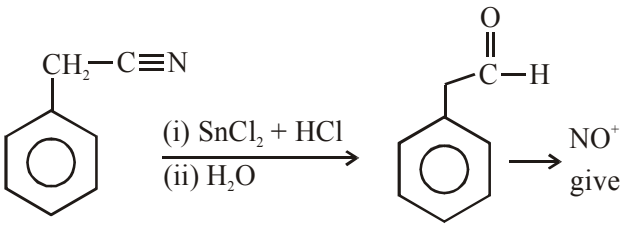


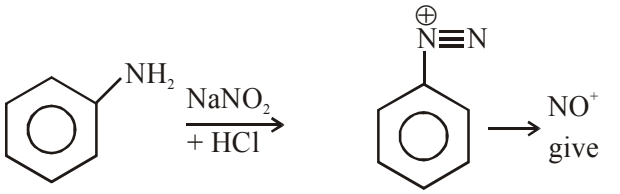
(1) a and d (2) c and d

(3) a, c and d (4) b and c

Official Ans. by NTA (2)

Sol. Kjeldahl method is used for N estimation But not given by 'Diazo' compounds





13. The mechanism of S_N1 reaction is given as :

$$R-X \rightarrow \underset{\text{Ion pair}}{R^{\oplus}X^{\ominus}} \rightarrow \underset{\text{Solvent separated ion pair}}{R^{\oplus}||X^{\ominus}} \xrightarrow{Y^{\ominus}} R-Y+X^{\ominus}$$

A student writes general characteristics based on the given mechanism as :

(a) The reaction is favoured by weak nucleophiles

(b) $R^{\oplus}$ would be easily formed if the substituents are bulky

(c) The reaction is accompained by recemization

(d) The reaction is favoured by non-polar solvents.

Which observations are correct ?

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

(3) a, b and c (4) a and b

Official Ans. by NTA (2)

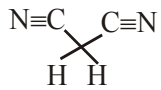
Sol. S_N1 favours

(a) The reaction is favoured by weak nucleophiles

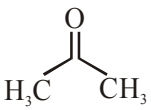
(b) $R^{\oplus}$ would be easily formed if the substituents are bulky

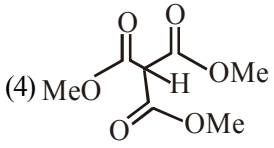
(c) The reaction is accompained by recemization

14. Which one of the following compounds possesses the most acidic hydrogen ?

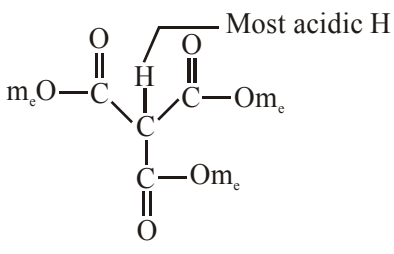
(1) 

(2) $H_3C-C\equiv C-H$

(3) 

(4) 

Official Ans. by NTA (4)

Sol. 

Due to presence of 3 (–R) groups

15. Glycerol is separated in soap industries by :

(1) Steam distillation

(2) Differential extraction

(3) Distillation under reduced pressure

(4) Fractional distillation

Official Ans. by NTA (3)

Sol. Glycerol is separated by reduced pressure distillation in soap industries.

16. Of the species, NO, NO^+, NO^{2+}, NO^-, the one with minimum bond strength is :

(1) NO^{2+} (2) NO^+ (3) NO (4) NO^-

Official Ans. by NTA (4)

Sol. Bond order of NO^{2+} = 2.5

Bond order of NO^+ = 3

Bond order of NO = 2.5

Bond order of NO^- = 2

Bond order α bond strength.

17. The atomic number of the element unnilennium is :

(1) 119 (2) 108 (3) 102 (4) 109

Official Ans. by NTA (4)

Sol. 1 0 9

un nil enn

Hence correct name $\rightarrow$ unnilennium

18. An acidic buffer is obtained on mixing :

(1) 100 mL of 0.1 M CH_3COOH and 200 mL of 0.1 M NaOH

(2) 100 mL of 0.1 M CH_3COOH and 100 mL of 0.1 M NaOH

(3) 100 mL of 0.1 M HCl and 200 mL of 0.1 M CH_3COONa

(4) 100 mL of 0.1 M HCl and 200 mL of 0.1 M NaCl

Official Ans. by NTA (3)

Sol.

HCl	$+ CH_3COONa \rightarrow$	CH_3COOH	$+$	$NaCl$
10 mili mol	20 mili mol	—		—
—	10 mili mol	10 mili mol		10 mili mol

So finaly we get mixture of $CH_3COOH + CH_3COONa$ that will work like acidic buffer solution.

19. Let C_{NaCl} and C_{BaSO_4} be the conductances (in S) measured for saturated aqueous solutions of NaCl and $BaSO_4$, respectively, at a temperature T. Which of the following is false ?

(1) Ionic mobilities of ions from both salts increase with T

(2) $C_{NaCl} >> C_{BaSO_4}$ at a given T

(3) $C_{NaCl}(T_2) > C_{NaCl}(T_1)$ for $T_2 > T_1$

(4) $C_{BaSO_4}(T_2) > C_{BaSO_4}(T_1)$ for $T_2 > T_1$

Official Ans. by NTA (3)

Official Ans. by ALLEN (Bonus)

Sol. Dissolution of $BaSO_4$ is an endothermic reaction 50 on increasing temperature number of ions of $BaSO_4$ decrease so it's conduction also decrease.

20. The antifertility drug 'Novestrol" can react with :

(1) Br_2/water; $ZnCl_2$/HCl; $FeCl_3$

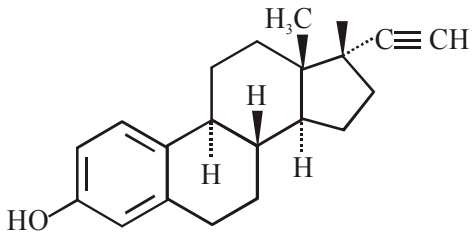
(2) Alcoholic HCN; NaOCl; $ZnCl_2$/HCl

(3) Br_2/water; $ZnCl_2$/HCl; NaOCl

(4) $ZnCl_2$/HCl; $FeCl_3$; Alcoholic HCN

Official Ans. by NTA (1)

Sol.



Ethynylestradiol (novestrol)

gives (1) $Br_2 + H_2O$ test

(2) Lucas test with $ZnCl_2$ + HCl

(3) $FeCl_3$ test of phenolic group.

21. The volume strength of 8.9 M H_2O_2 solution calculated at 273 K and 1 atm is _____. (R=0.0821 L atm K^{-1} mol^{-1}) (rounded off to the nearest integer)

Official Ans. by NTA (100)

Sol. Volume strength of H_2O_2 at 1 atm

273 kelvin = M × 11.2 = 8.9 × 11.2 = 99.68

Ans : 100

22. The mole fraction of glucose ($C_6H_{12}O_6$) in an aqueous binary solution is 0.1. The mass percentage of water in it, to the nearest integer, is _____.

Official Ans. by NTA (47)

Sol. $X_{C_6H_{12}O_6} = 0.1$

Let total mole is 1 mol then mole of glucose will be 0.1 and mole of water will be 0.9

$$\text{so mass \% of water} = \frac{0.9\times18}{0.1\times180+0.9\times18}\times100$$

$$= 47.36$$

Ans : 47

23. The photoelectric current from Na (work function, w_0 = 2.3 eV) is stopped by the output voltage of the cell

$Pt(s)|H_2(g, 1bar)|HCl(aq., pH = 1)|AgCl(s)|Ag(s)$

The pH of aq. HCl required to stop the photoelectric current from K(w_0 = 2.25eV), all other conditions remaining the same, is_____ × 10^{-2} (to the nearest integer).

Given, $2.303\frac{RT}{F} = 0.06V; E^0_{AgCl|Ag|Cl^-} = 0.22V$

Official Ans. by NTA (58)

Official Ans. by ALLEN (142)

Sol.

$$\frac{1}{2}H_2 \rightarrow H^+ + e^\ominus$$

$$e^\ominus + AgCl_{(s)} \rightarrow Ag_{(s)} + Cl^\ominus$$

$$\frac{1}{2}H_2 + AgCl_{(s)} \rightarrow H^+_{(aq)} + Ag_{(s)} + Cl^\ominus_{(aq)}$$

$$E = \varepsilon^0 - \frac{.06}{1}\log\frac{[H^+][Cl^\ominus]}{P_{H_2}^{\frac{1}{2}}}$$

$$E = 0.22 - .06\log\frac{(10^{-1})(10^{-1})}{1^{\frac{1}{2}}}$$

E = 0.22 + .12 = .34 volt

$\Rightarrow$ total energy of photon will be (for Na)

= 2.3 + 0.34 = 2.64 eV

$\Rightarrow$ stopping potential required for K

= 2.64 – 2.25 = 0.39 volt

$$E = \varepsilon^0 - \frac{.06}{1}\log\frac{[H^+][Cl^-]}{P_{H_2}^{\frac{1}{2}}}$$

as $[H^+] = [Cl^{\ominus}]$ so

$$0.39 = 0.22 - .06 \log \frac{[H^+]^2}{1^{\frac{1}{2}}}$$

0.17 = + .12 pH

pH = 1.4166 $\Rightarrow$ 1.42

24. An element with molar mass 2.7×10^{-2} kgmol^{-1} forms a cubic unit cell with edge length 405 pm. If its density is 2.7×10^3 kgm^{-3}, the radius of the element is approximately ____ $\times 10^{-12}$ m (to the nearest integer).

Official Ans. by NTA (143)

Sol. $$d = \frac{z\left(\frac{M}{N_A}\right)}{a^3}$$

$$2.7\times10^3 = z\frac{\left(\frac{2.7\times10^{-2}}{6\times10^{23}}\right)}{\left(405\times10^{-12}\right)^3}$$

$$2.7\times10^3 = z\frac{\left(2.7\times10^{-2}\right)}{6\times10^{23}\left(4.05\times10^{-10}\right)^3}$$

$$2.7\times10^3 = z\frac{\left(2.7\times10^{-2}\right)}{6\times10^{23}\times66.43\times10^{-30}}$$

3.98 = z

$z \approx 4$ structure is fcc

$$\frac{a}{\sqrt{2}} = 2r$$

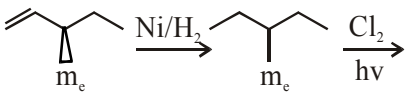
$$r = \frac{a}{2\sqrt{2}} = \frac{\sqrt{2}a}{4} = \frac{1.414\times405\times10^{-12}}{4}$$

$r = 143.16 \times 10^{-12}$

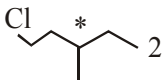
25. The total number of monohalogenated organic products in the following (including stereoisomers) reaction is _____.

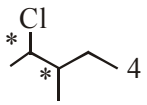
A (simplest optically active alkene) $\xrightarrow[(ii)\ X_2/\Delta]{(i)\ H_2/Ni/\Delta}$

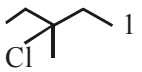
Official Ans. by NTA (8)

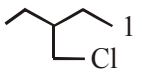
Sol. 

Simplest O.A. Alkene









Alter

Str. of Tri peptide