

**FINAL JEE-MAIN EXAMINATION – SEPTEMBER, 2020**

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

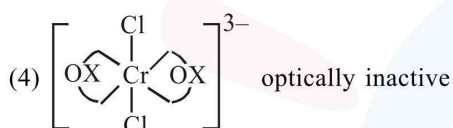
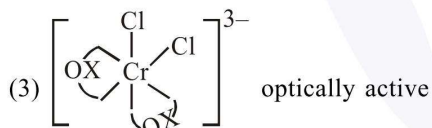
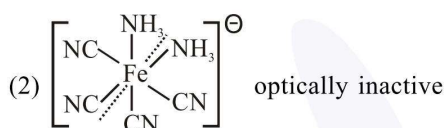
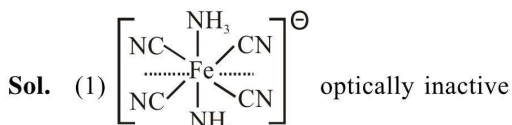
**CHEMISTRY**

**TEST PAPER WITH ANSWER & SOLUTION**

1. The complex that can show optical activity is:

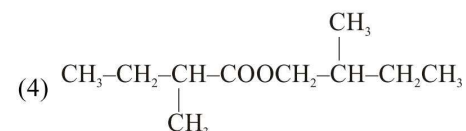
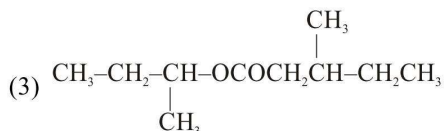
- (1)  $\text{trans}[\text{Fe}(\text{NH}_3)_2(\text{CN})_4]^-$
- (2)  $\text{cis}[\text{Fe}(\text{NH}_3)_2(\text{CN})_4]^-$
- (3)  $\text{cis}[\text{CrCl}_2(\text{ox})_2]^{3-}$  (ox = oxalate)
- (4)  $\text{trans}[\text{Cr}(\text{Cl}_2)(\text{ox})_2]^{3-}$

**Official Ans. by NTA (3)**

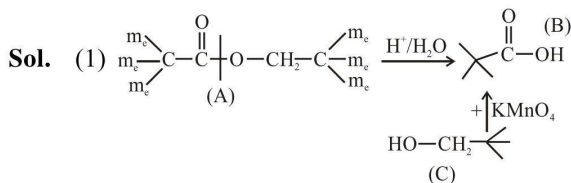


2. An organic compound [A], molecular formula  $\text{C}_{10}\text{H}_{20}\text{O}_2$  was hydrolyzed with dilute sulphuric acid to give a carboxylic acid [B] and alcohol [C]. Oxidation of [C] with  $\text{CrO}_3 - \text{H}_2\text{SO}_4$  produced [B]. Which of the following structures are not possible for [A] ?

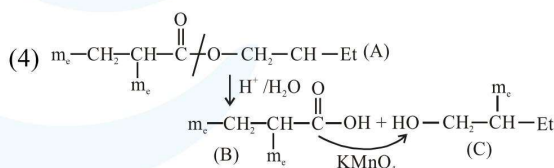
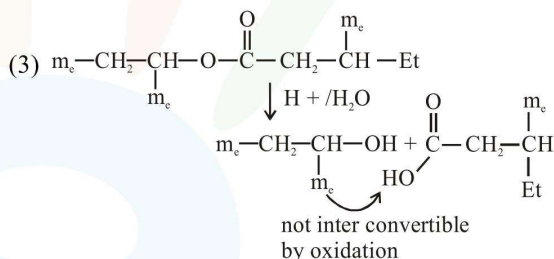
- (1)  $(\text{CH}_3)_3\text{C}-\text{COOCH}_2\text{C}(\text{CH}_3)_3$
- (2)  $\text{CH}_3\text{CH}_2\text{CH}_2\text{COOCH}_2\text{CH}_2\text{CH}_2\text{CH}_3$



**Official Ans. by NTA (3)**



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



3. If the boiling point of  $\text{H}_2\text{O}$  is 373 K, the boiling point of  $\text{H}_2\text{S}$  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)**

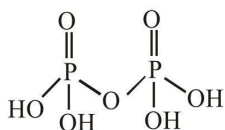
Sol. Boiling point of  $\text{H}_2\text{S} <$  Boiling point of  $\text{H}_2\text{O}$   
(213 K) (373 K)

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

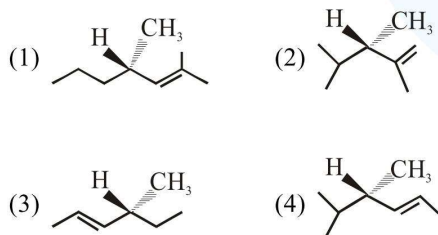
5. It is true that :

- (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

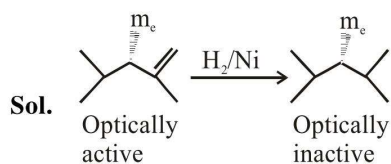
**Official Ans. by NTA (4)**

**Sol.** Zero order reaction is multiple step reaction.

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



**Official Ans. by NTA (2)**



7. Henry's constant (in kbar) for four gases  $\alpha$ ,  $\beta$ ,  $\gamma$  and  $\delta$  in water at 298 K is given below :

	$\alpha$	$\beta$	$\gamma$	$\delta$
$K_H$	50	2	$2 \times 10^{-5}$	0.5

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

This table implies that :

- (1) The pressure of a 55.5 molal solution of  $\gamma$  is 1 bar  
 (2) The pressure of a 55.5 molal solution of  $\delta$  is 250 bar  
 (3) Solubility of  $\gamma$  at 308 K is lower than at 298 K  
 (4)  $\alpha$  has the highest solubility in water at a given pressure

**Official Ans. by NTA (2)**

**Sol.** (1)  $P_\gamma = K_H X_\gamma$

$$P_\gamma = 2 \times 10^{-5} \times \frac{55.5}{55.5 + \frac{1000}{18}} = 2 \times 10^{-5} \text{ K bar}$$

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

(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  $\gamma$ .

8. Tyndall effect is 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 dispersed 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  $[\text{Ti}(\text{H}_2\text{O})_6]^{3+}$  shows a single broad peak with a maximum at  $20,300 \text{ cm}^{-1}$ . The crystal field stabilization energy (CFSE) of the complex ion, in  $\text{kJ mol}^{-1}$ , is :

- (1) 242.5
- (2) 83.7
- (3) 145.5
- (4) 97

**Official Ans. by NTA (4)**

**Sol.**  $\text{CFSE} = 0.4 \Delta_0$

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

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

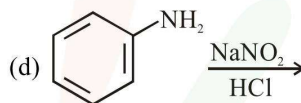
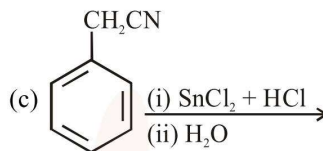
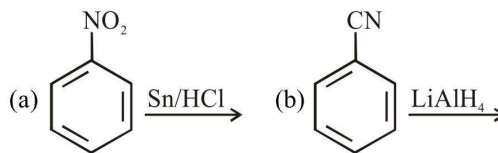
11. Aqua regia is used for dissolving noble metals (Au, Pt, etc). The gas evolved in this process is :

- (1)  $\text{N}_2$
- (2)  $\text{N}_2\text{O}_3$
- (3) NO
- (4)  $\text{N}_2\text{O}_5$

**Official Ans. by NTA (3)**

**Sol.**  $\text{Au} + \text{HNO}_3 + 4\text{HCl} \rightarrow \text{HAuCl}_4 + \text{NO} + 2\text{H}_2\text{O}$

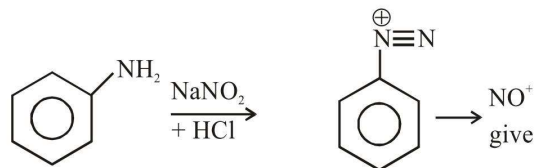
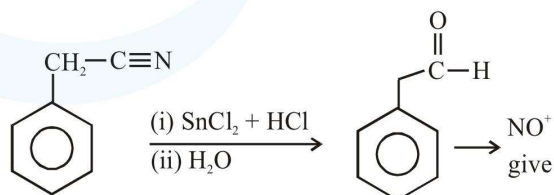
12. The Kjeldahl method of Nitrogen estimation fails for which of the following reaction products ?



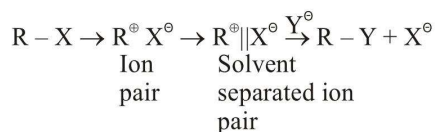
- (1) a and d
- (2) c and d
- (3) a, c and d
- (4) b and c

**Official Ans. by NTA (2)**

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



13. The mechanism of  $S_N^1$  reaction is given as :



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

- The reaction is favoured by weak nucleophiles
- $R^{\oplus}$  would be easily formed if the substituents are bulky
- The reaction is accompanied by racemization
- The reaction is favoured by non-polar solvents.

Which observations are correct ?

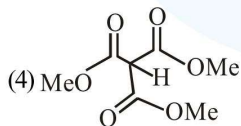
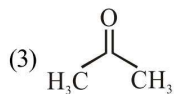
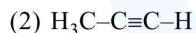
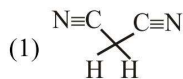
- b and d
- a and c
- a, b and c
- a and b

**Official Ans. by NTA (2)**

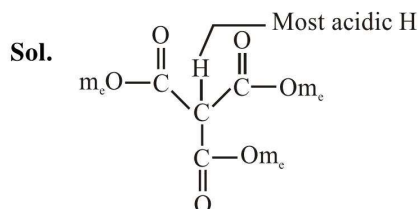
**Sol.**  $S_N^1$  favours

- The reaction is favoured by weak nucleophiles
- $R^{\oplus}$  would be easily formed if the substituents are bulky
- The reaction is accompanied by racemization

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



**Official Ans. by NTA (4)**



Due to presence of 3 (-R) groups

15. Glycerol is separated in soap industries by :

- Steam distillation
- Differential extraction
- Distillation under reduced pressure
- 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 :

- $NO^{2+}$
- $NO^+$
- NO
- $NO^-$

**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  $\propto$  bond strength.

17. The atomic number of the element unnilennium is :

- 119
- 108
- 102
- 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 :

- 100 mL of 0.1 M  $CH_3COOH$  and 200 mL of 0.1 M NaOH
- 100 mL of 0.1 M  $CH_3COOH$  and 100 mL of 0.1 M NaOH
- 100 mL of 0.1 M HCl and 200 mL of 0.1 M  $CH_3COONa$
- 100 mL of 0.1 M HCl and 200 mL of 0.1 M NaCl

**Official Ans. by NTA (3)**



So finally we get mixture of

$CH_3COOH + CH_3COONa$  that will work like acidic buffer solution.



19. Let  $C_{\text{NaCl}}$  and  $C_{\text{BaSO}_4}$  be the conductances (in S) measured for saturated aqueous solutions of NaCl and  $\text{BaSO}_4$ , respectively, at a temperature T. Which of the following is false ?

- (1) Ionic mobilities of ions from both salts increase with T
- (2)  $C_{\text{NaCl}} \gg C_{\text{BaSO}_4}$  at a given T
- (3)  $C_{\text{NaCl}}(T_2) > C_{\text{NaCl}}(T_1)$  for  $T_2 > T_1$
- (4)  $C_{\text{BaSO}_4}(T_2) > C_{\text{BaSO}_4}(T_1)$  for  $T_2 > T_1$

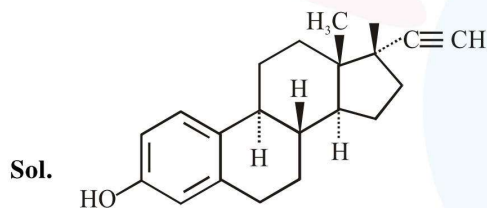
**Official Ans. by NTA (3)**

**Sol.** Dissolution of  $\text{BaSO}_4$  is an endothermic reaction so on increasing temperature number of ions of  $\text{BaSO}_4$  decrease so its conduction also decrease.

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

- (1)  $\text{Br}_2/\text{water}$ ;  $\text{ZnCl}_2/\text{HCl}$ ;  $\text{FeCl}_3$
- (2) Alcoholic HCN;  $\text{NaOCl}$ ;  $\text{ZnCl}_2/\text{HCl}$
- (3)  $\text{Br}_2/\text{water}$ ;  $\text{ZnCl}_2/\text{HCl}$ ;  $\text{NaOCl}$
- (4)  $\text{ZnCl}_2/\text{HCl}$ ;  $\text{FeCl}_3$ ; Alcoholic HCN

**Official Ans. by NTA (1)**



Ethynylestradiol (novestrol)

gives (1)  $\text{Br}_2 + \text{H}_2\text{O}$  test

- (2) Lucas test with  $\text{ZnCl}_2 + \text{HCl}$
- (3)  $\text{FeCl}_3$  test of phenolic group.

21. The volume strength of 8.9 M  $\text{H}_2\text{O}_2$  solution calculated at 273 K and 1 atm is \_\_\_\_\_. ( $R=0.0821 \text{ L atm K}^{-1} \text{ mol}^{-1}$ ) (rounded off to the nearest integer)

**Official Ans. by NTA (100)**

**Sol.** Volume strength of  $\text{H}_2\text{O}_2$  at 1 atm

$$273 \text{ kelvin} = M \times 11.2 = 8.9 \times 11.2 = 99.68$$

Ans : 100

22. The mole fraction of glucose ( $\text{C}_6\text{H}_{12}\text{O}_6$ ) 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)**

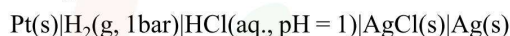
**Sol.**  $X_{\text{C}_6\text{H}_{12}\text{O}_6} = 0.1$

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

$$\begin{aligned} \text{so mass \% of water} &= \frac{0.9 \times 18}{0.1 \times 180 + 0.9 \times 18} \times 100 \\ &= 47.36 \end{aligned}$$

Ans : 47

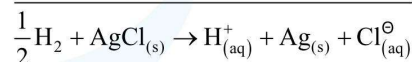
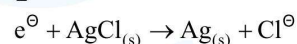
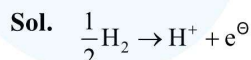
23. The photoelectric current from Na (work function,  $w_0 = 2.3 \text{ eV}$ ) is stopped by the output voltage of the cell



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

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

**Official Ans. by NTA (58)**



$$E = \epsilon^0 - \frac{.06}{1} \log \frac{[\text{H}^+][\text{Cl}^\ominus]}{P_{\text{H}_2}^{\frac{1}{2}}}$$

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

$$E = 0.22 + .12 = .34 \text{ volt}$$

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

$$= 2.3 + 0.34 = 2.64 \text{ eV}$$

⇒ 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  $[H^+] = [Cl^-]$  so

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

$$0.17 = + .12 \text{ pH}$$

$$\text{pH} = 1.4166 \Rightarrow 1.42$$

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

**Official Ans. by NTA (143)**

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

$$2.7 \times 10^3 = z \frac{\left( \frac{2.7 \times 10^{-2}}{6 \times 10^{23}} \right)}{\left( 405 \times 10^{-12} \right)^3}$$

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

$$2.7 \times 10^3 = z \frac{(2.7 \times 10^{-2})}{6 \times 10^{23} \times 66.43 \times 10^{-30}}$$

$$3.98 = z$$

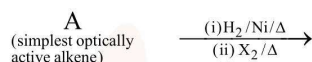
$z \approx 4$  structure is fcc

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

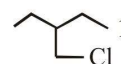
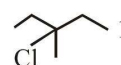
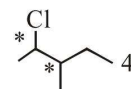
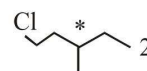
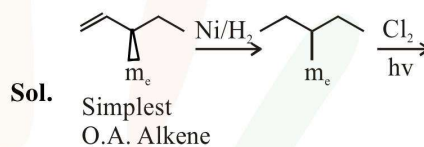
$$r = \frac{a}{2\sqrt{2}} = \frac{\sqrt{2}a}{4} = \frac{1.414 \times 405 \times 10^{-12}}{4}$$

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

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



**Official Ans. by NTA (8)**



Alter

Str. of Tri peptide

