

## FINAL JEE–MAIN EXAMINATION – JUNE, 2022

(Held On Saturday 25<sup>th</sup> June, 2022)

TIME : 3 : 00 PM to 6 : 00 PM

### CHEMISTRY

### TEST PAPER WITH SOLUTION

#### SECTION-A

1. The minimum energy that must be possessed by photons in order to produce the photoelectric effect with platinum metal is:

[Given: The threshold frequency of platinum is  $1.3 \times 10^{15} \text{ s}^{-1}$  and  $h = 6.6 \times 10^{-34} \text{ J s}$ .]

- (A)  $3.21 \times 10^{-14} \text{ J}$                       (B)  $6.24 \times 10^{-16} \text{ J}$   
 (C)  $8.58 \times 10^{-19} \text{ J}$                       (D)  $9.76 \times 10^{-20} \text{ J}$

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

**Ans. (C)**

- Sol.**  $W = hv$

$$= 6.6 \times 10^{-34} \times 1.3 \times 10^{15}$$

$$= 8.58 \times 10^{-19} \text{ J}$$

2. At  $25^\circ\text{C}$  and 1 atm pressure, the enthalpy of combustion of benzene (l) and acetylene (g) are  $-3268 \text{ kJ mol}^{-1}$  and  $-1300 \text{ kJ mol}^{-1}$ , respectively. The change in enthalpy for the reaction  $3 \text{ C}_2\text{H}_2(\text{g}) \rightarrow \text{C}_6\text{H}_6(\text{l})$ , is

- (A)  $+324 \text{ kJ mol}^{-1}$                       (B)  $+632 \text{ kJ mol}^{-1}$   
 (C)  $-632 \text{ kJ mol}^{-1}$                       (D)  $-732 \text{ kJ mol}^{-1}$

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

**Ans. (C)**

- Sol.**  $\Delta H = \sum \Delta H_{\text{Combustion}} (\text{Reactant}) - \sum \Delta H_{\text{Combustion}} (\text{Product})$

$$= 3 \times (-1300) - [-3268]$$

$$= -632 \text{ kJ mol}^{-1}$$

3. Solute A associates in water. When 0.7 g of solute A is dissolved in 42.0 g of water, it depresses the freezing point by  $0.2^\circ\text{C}$ . The percentage association of solute A in water, is

[Given : Molar mass of A =  $93 \text{ g mol}^{-1}$ . Molal depression constant of water is  $1.86 \text{ K kg mol}^{-1}$ ]

- (A) 50 %                                      (B) 60 %

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

**Ans. (D)**

- Sol.**  $\Delta T = i \cdot k_f \times m$

$$0.2 = i \times 1.86 \times \frac{0.7}{93} \times \frac{1000}{42}$$

$$i = \frac{0.2 \times 93 \times 6}{1.86 \times 100}$$

$$i = 0.60$$

$$2A \rightleftharpoons f A_2$$

$$1 - \alpha \qquad \frac{\alpha}{2}$$

$$i = 1 - \alpha + \frac{\alpha}{2}$$

$$i = 1 - \frac{\alpha}{2}$$

$$1 - \frac{\alpha}{2} = 0.60$$

$$1 - 0.60 = \frac{\alpha}{2}$$

$$\alpha = 0.80$$

4. The  $K_{sp}$  for bismuth sulphide ( $\text{Bi}_2\text{S}_3$ ) is  $1.08 \times 10^{-73}$ . The solubility of  $\text{Bi}_2\text{S}_3$  in  $\text{mol L}^{-1}$  at  $298 \text{ K}$  is

- (A)  $1.0 \times 10^{-15}$                       (B)  $2.7 \times 10^{-12}$   
 (C)  $3.2 \times 10^{-10}$                       (D)  $4.2 \times 10^{-8}$

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

**Ans. (A)**

- Sol.**  $\text{Bi}_2\text{S}_3 \rightleftharpoons 2\text{Bi}^{3+} + 3\text{S}^{2-}$

$$K_{sp} = (2s)^2 (3s)^3$$

$$= 4s^2 \times 27 (s)^3$$

$$= 108 (s)^5$$

$$(s)^5 = \frac{1.08 \times 10^{-73}}{108}$$

$$\Rightarrow s = 10^{-15}$$

5. Match List I with List II.

| List I      | List II      |
|-------------|--------------|
| A. Zymase   | I. Stomach   |
| B. Diastase | II. Yeast    |
| C. Urease   | III. Malt    |
| D. Pepsin   | IV. Soyabean |

Choose the correct answer from the options given below:

- (A) A-II, B-III, C-I, D-IV  
 (B) A-II, B-III, C-IV, D-I  
 (C) A-III, B-II, C-IV, D-I  
 (D) A-III, B-II, C-I, D-IV

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

**Ans. (B)**

**Sol.** Zymase naturally occurs in yeast.

Diastase is found in malt.

Urease is found in soyabean

Pepsin is found in stomach

6. The correct order of electron gain enthalpies of Cl, F, Te and Po is

- (A)  $F < Cl < Te < Po$       (B)  $Po < Te < F < Cl$   
 (C)  $Te < Po < Cl < F$       (D)  $Cl < F < Te < Po$

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

**Ans. (D)**

**Sol.** As Cl has maximum electron affinity among all elements.

| Element | $\Delta_{eg}H$ (kJ/mol) |
|---------|-------------------------|
| F       | -328                    |
| Cl      | -349                    |
| Te      | -190                    |
| Po      | -174                    |

7. Given below are two statements.

Statement I: During electrolytic refining, blister copper deposits precious metals

Statement II: In the process of obtaining pure copper by electrolysis method, copper blister is

In the light of the above statements, choose the correct answer from the options given below.

- (A) Both Statement I and Statement II are true.  
 (B) Both Statement I and Statement II are false.  
 (C) Statement I is true but Statement II is false.  
 (D) Statement I is false but Statement II is true.

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

**Ans. (A)**

**Sol.** In the electro-refining, impure metal (here blister copper) is used as an anode while precious metal like Au, Pt get deposited as anode mud.

8. Given below are two statements one is labelled as **Assertion A** and the other is labelled as **Reason R**:

**Assertion A** : The amphoteric nature of water is explained by using Lewis acid/base concept.

**Reason R** : Water acts as an acid with  $NH_3$  and as a base with  $H_2S$ .

In the light of the above statements choose the correct answer from the options given below :

- (A) Both A and R are true and R is the correct explanation of A.  
 (B) Both A and R are true but R is NOT the correct explanation of A.  
 (C) A is true but R is false.  
 (D) A is false but R is true.

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

**Ans. (D)**

**Sol.** 
$$H_2S + H_2O \rightleftharpoons H_3O^+ + HS^-$$
  
Acid      Base

$$H_2O + NH_3 \rightleftharpoons NH_4OH$$
  
Acid      Base

9. The correct order of reduction potentials of the following pairs is

- A.  $Cl_2/Cl^-$   
 B.  $I_2/I^-$   
 C.  $Ag^+/Ag$   
 D.  $Na^+/Na$   
 E.  $Li^+/Li$

Choose the correct answer from the options given

- (A)  $A > C > B > D > E$   
 (B)  $A > B > C > D > E$   
 (C)  $A > C > B > E > D$   
 (D)  $A > B > C > E > D$

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

**Ans. (A)**

**Sol.**  $E_{\text{Cl}_2/\text{Cl}^-}^\circ = +1.36 \text{ V}$

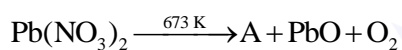
$E_{\text{I}_2/\text{I}^-}^\circ = +0.54 \text{ V}$

$E_{\text{Ag}^+/\text{Ag}}^\circ = +0.80 \text{ V}$

$E_{\text{Na}^+/\text{Na}}^\circ = -2.71 \text{ V}$

$E_{\text{Li}^+/\text{Li}}^\circ = -3.05 \text{ V}$

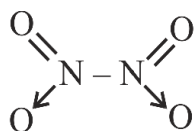
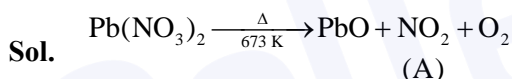
- 10.** The number of bridged oxygen atoms present in compound B formed from the following reactions is



- (A) 0 (B) 1  
 (C) 2 (D) 3

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

**Ans. (A)**



(no bridged oxygen)

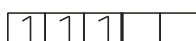
- 11.** The metal ion (in gaseous state) with lowest spin-only magnetic moment value is

- (A)  $\text{V}^{2+}$  (B)  $\text{Ni}^{2+}$   
 (C)  $\text{Cr}^{2+}$  (D)  $\text{Fe}^{2+}$

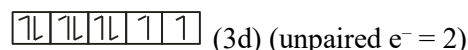
**Official Ans. by NTA (B)**

**Ans. (B)**

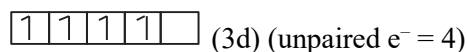
**Sol.**  $\text{V}^{2+} : 1s^2 2s^2 2p^6 3s^2 3p^6 3d^3$



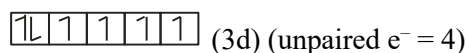
$\text{Ni}^{2+} : 1s^2 2s^2 2p^6 3s^2 3p^6 3d^8$



$\text{Cr}^{2+} : 1s^2 2s^2 2p^6 3s^2 3p^6 3d^4$



$\text{Fe}^{2+} : 1s^2 2s^2 2p^6 3s^2 3p^6 3d^6$



- 12.** Given below are two statements: one is labelled as **Assertion A** and the other is labelled as **Reason R**  
**Assertion A:** Polluted water may have a value of BOD of the order of 17 ppm.

**Reason R:** BOD is a measure of oxygen required to oxidise both the biodegradable and non-biodegradable organic material in water.

In the light of the above statements, choose the most appropriate answer from the options given below.

- (A) Both A and R are correct and R is the correct explanation of A.  
 (B) Both A and R are correct but R is NOT the correct explanation of A.  
 (C) A is correct but R is not correct.  
 (D) A is not correct but R is correct.

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

**Ans. (C)**

- Sol.** Clean water have BOD less than 5 ppm while highly polluted water has BOD greater or equal to 17 ppm. So, assertion is correct.

BOD is measure of oxygen required to oxidise only bio-degradable organic matter. So, reason is false.

- 13.** Given below are two statements: one is labelled as **Assertion A** and the other is labelled as **Reason R**.

**Assertion A:** A mixture contains benzoic acid and naphthalene. The pure benzoic acid can be separated out by the use of benzene.

**Reason R:** Benzoic acid is soluble in hot water.

In the light of the above statements, choose the most appropriate answer from the options given below.

(A) Both A and R are true and R is the correct explanation of A.

(B) Both A and R are true but R is NOT the correct explanation of A.

(C) A is true but R is false.

(D) A is false but R is true.

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

**Ans. (D)**

**Sol.** Benzoic acid and Napthalene can be effectively separated by crystallization. Benzoic acid is soluble in hot water whereas Napthalene is insoluble.

Hence assertion is incorrect but reason is correct

14. During halogen test, sodium fusion extract is boiled with concentrated  $\text{HNO}_3$  to

(A) remove unreacted sodium

(B) decompose cyanide or sulphide of sodium

(C) extract halogen from organic compound

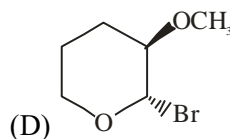
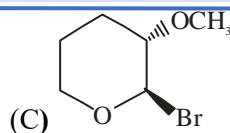
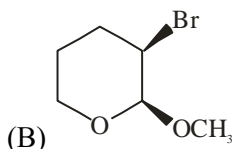
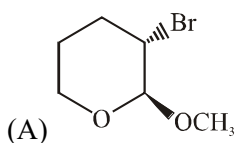
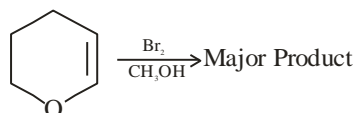
(D) maintain the pH of extract

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

**Ans. (B)**

**Sol.** Sodium fusion extract is boiled with concentrated  $\text{HNO}_3$  to remove sodium cyanide and sodium sulphide

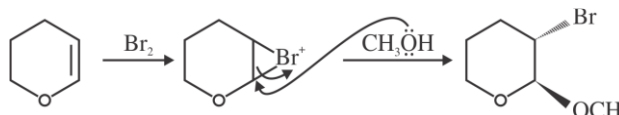
15. Amongst the following, the major product of the given chemical reaction is



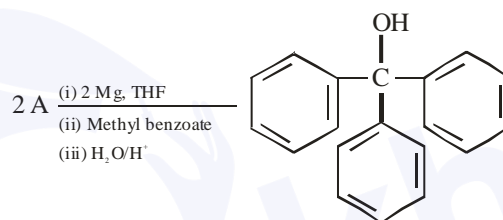
**Official Ans. by NTA (A)**

**Ans. (A)**

**Sol.**



16. In the given reaction



'A' can be

(A) benzyl bromide

(B) bromobenzene

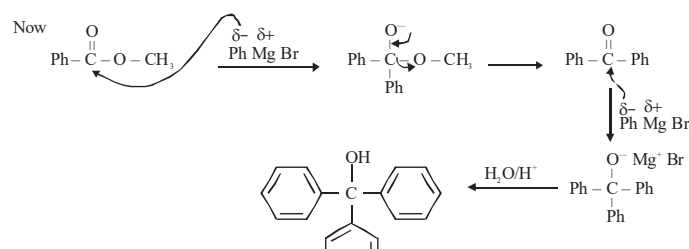
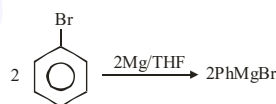
(C) cyclohexyl bromide

(D) methyl bromide

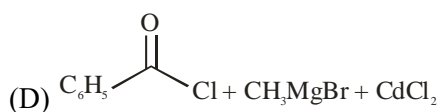
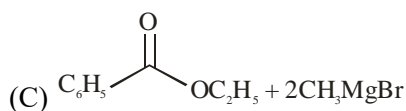
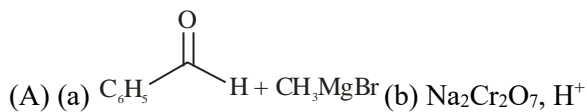
**Official Ans. by NTA (B)**

**Ans. (B)**

**Sol.**



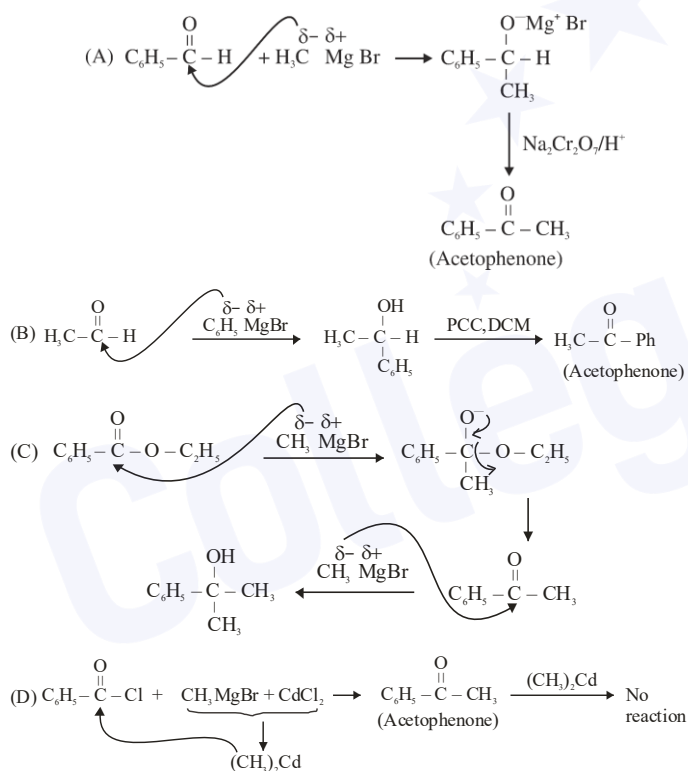
17. Which of the following conditions or reaction sequence will NOT give acetophenone as the major product ?



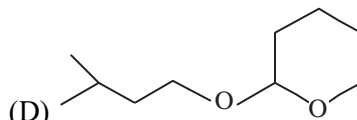
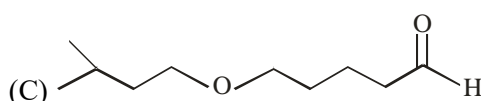
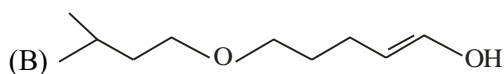
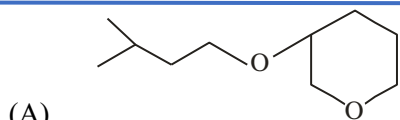
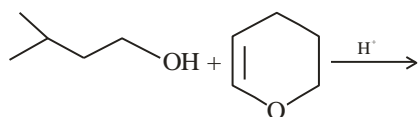
Official Ans. by NTA (C)

Ans. (C)

Sol.



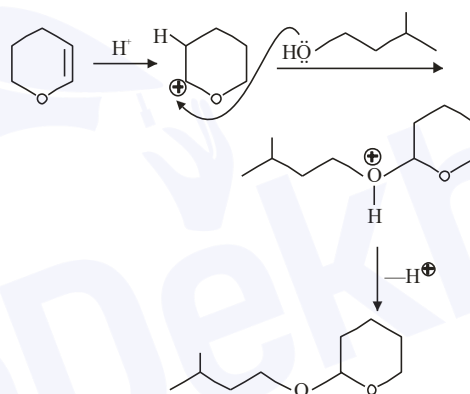
18. The major product formed in the following reaction, is



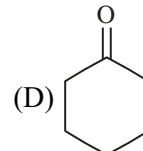
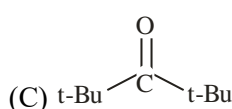
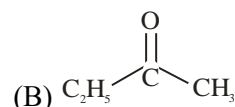
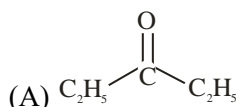
Official Ans. by NTA (D)

Ans. (D)

Sol.



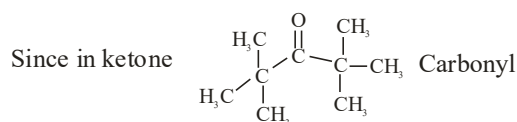
19. Which of the following ketone will NOT give enamine on treatment with secondary amines? [where t-Bu is  $-\text{C}(\text{CH}_3)_3$ ]



Official Ans. by NTA (C)

Ans. (C)

Sol. Enamine formation is an example of nucleophilic addition elimination reaction



Group is highly sterically hindered hence attack of

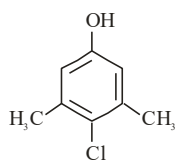
20. An antiseptic dettol is a mixture of two compounds 'A' and 'B' where A has  $6\pi$  electrons and B has  $2\pi$  electrons. What is 'B'?

- (A) Bithionol  
 (B) Terpineol  
 (C) Chloroxylenol  
 (D) Chloramphenicol

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

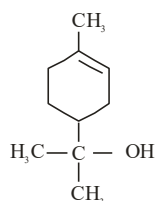
**Ans. (B)**

**Sol.** Dettol is mixture of



Chloroxylenol  
(Compound A)  
It has  $6\pi e^-$

and



Terpineol  
(Compound B)  
It has  $2\pi e^-$

Hence compound 'B' is Terpineol.

### SECTION-B

1. A protein 'A' contains 0.30% of glycine (molecular weight 75). The minimum molar mass of the protein 'A' is   $\times 10^3$  g mol<sup>-1</sup> [nearest integer]

**Official Ans. by NTA (25)**

**Ans. (25)**

**Sol.** 0.30 % glycine is equal to 75

$$1\% \longrightarrow \frac{75}{0.30}$$

$$100\% \longrightarrow \frac{75}{0.30} \times 100 \\ = 25000 \text{ g}$$

2. A rigid nitrogen tank stored inside a laboratory has a pressure of 30 atm at 06:00 am when the temperature is 27 °C. At 03:00 pm, when the temperature is 45°C, the pressure in the tank will be  atm. [nearest integer]

**Official Ans. by NTA (32)**

**Ans. (32)**

**Sol.**  $\frac{P_1}{T_1} = \frac{P_2}{T_2}$

$$\frac{30}{300} = \frac{P_2}{318}$$

$$P_2 = \frac{30}{300} \times 318$$

$$= \frac{1}{10} \times 318$$

$$= 32$$

3. Amongst BeF<sub>2</sub>, BF<sub>3</sub>, H<sub>2</sub>O, NH<sub>3</sub>, CCl<sub>4</sub> and HCl, the number of molecules with non-zero net dipole moment is .

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

**Ans. (3)**

**Sol.** BeF<sub>2</sub>, BF<sub>3</sub> and CCl<sub>4</sub>  $\Rightarrow \mu_{\text{net}} = 0$

H<sub>2</sub>O, NH<sub>3</sub> and HCl  $\Rightarrow \mu_{\text{net}} \neq 0$

4. At 345 K, the half life for the decomposition of a sample of a gaseous compound initially at 55.5 kPa was 340 s. When the pressure was 27.8 kPa, the half life was found to be 170 s. The order of the reaction is . [integer answer]

**Official Ans. by NTA (0)**

**Ans. (0)**

**Sol.**  $t_{1/2} \propto \frac{1}{[P_0]^{n-1}}$

$$\frac{t_1}{t_2} = \frac{(P_2)^{n-1}}{(P_1)^{n-1}}$$

$$\frac{340}{170} = \left( \frac{27.8}{55.5} \right)^{n-1}$$

$$\Rightarrow 2 = \frac{1}{(2)^{n-1}}$$

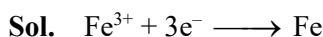
$$n = 0$$

5. A solution of Fe<sub>2</sub>(SO<sub>4</sub>)<sub>3</sub> is electrolyzed for 'x' min with a current of 1.5 A to deposit 0.3482 g of Fe. The value of x is . [nearest integer]

Given : 1 F = 96500 C mol<sup>-1</sup>

Atomic mass of Fe = 56 g mol<sup>-1</sup>

**Official Ans. by NTA (20)**



$3\text{F} \longrightarrow 1 \text{ mole Fe is deposited}$

For 56 g  $\longrightarrow 3 \times 96500$  (required charge)

For 1g  $\longrightarrow \frac{3 \times 96500}{56}$  (required charge)

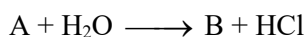
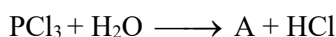
For 0.3482 g  $\longrightarrow \frac{3 \times 96500}{56} \times 0.3482$   
 $= 1800.06$

$Q = it$

$1800.06 = 1.5 \text{ t}$

$t = 20 \text{ min}$

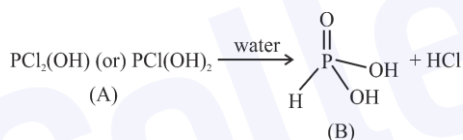
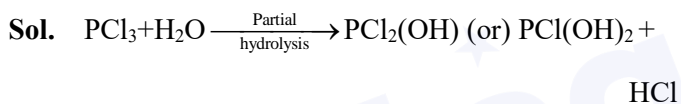
6. Consider the following reactions :



number of ionisable protons present in the product B \_\_\_\_\_.

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

**Ans. (2)**

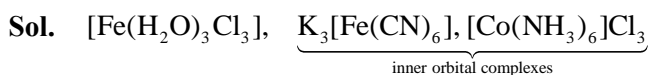


no. of ionisable protons in B = 2

7. Amongst  $\text{FeCl}_3 \cdot 3\text{H}_2\text{O}$ ,  $\text{K}_3[\text{Fe}(\text{CN})_6]$  and  $[\text{Co}(\text{NH}_3)_6]\text{Cl}_3$ , the spin-only magnetic moment value of the inner-orbital complex that absorbs light at shortest wavelength is \_\_\_\_\_ B.M. [nearest integer]

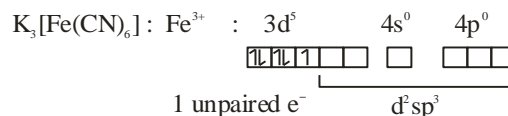
**Official Ans. by NTA (2)**

**Ans. (2)**



$\text{K}_3[\text{Fe}(\text{CN})_6]$  has more value of  $\Delta_0$  than that of  $\bar{\text{C}}\text{N}$

More  $\Delta_0 \Rightarrow$  smaller value of absorbed  $\lambda$



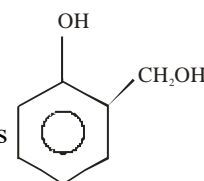
Spin only magnetic moment ( $\mu$ ) =  $\sqrt{3}$  BM  
 $= 1.732 \text{ BM}$

Rounding off  $\Rightarrow 2$

8. The Novolac polymer has mass of 963 g. The number of monomer units present in it are

**Official Ans. by NTA (9)**

**Ans. (9)**



**Sol.** Monomer unit of Novolac is \_\_\_\_\_ its

molecular mass is 124 amu.

Upon considering molecular weight of polymer as 963 amu (In question its given as 963 gram) Now if during formation of Novolac, (n-1) unit of water are removed then

$n \times 124 = 963 + [18 \times (n-1)]$

$n = 9$

9. How many of the given compounds will give a positive Biuret test \_\_\_\_\_ ? Glycine, Glycylalanine, Tripeptide, Biuret

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

**Ans. (2)**

**Sol.** Biuret test is given by all proteins and peptides having atleast two peptide linkages.

Hence positive test must be given by tripeptide and Biuret.

10. The neutralization occurs when 10 mL of 0.1 M acid 'A' is allowed to react with 30 mL of 0.05 M base  $\text{M}(\text{OH})_2$ . The basicity of the acid 'A' is \_\_\_\_\_. [M is a metal]

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

**Ans. (3)**



0.1 M  $\text{M}(\text{OH})_2$

10ml 0.05 M

30 ml

at equivalence point

equivalent of acid = equivalent of base

$0.1 \times 10 \times n = 30 \times 0.05 \times 2$