

## FINAL JEE–MAIN EXAMINATION – JUNE, 2022

(Held On Friday 24<sup>th</sup> June, 2022)

TIME : 9 : 00 AM to 12 : 00 PM

### CHEMISTRY

#### SECTION-A

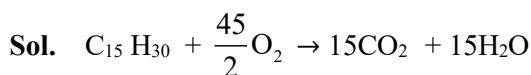
1. If a rocket runs on a fuel ( $C_{15}H_{30}$ ) and liquid oxygen, the weight of oxygen required and  $CO_2$  released for every litre of fuel respectively are:

(Given: density of the fuel is 0.756 g/mL)

- (A) 1188 g and 1296 g    (B) 2376 g and 2592 g  
 (C) 2592g and 2376 g    (D) 3429 g and 3142 g

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

**Ans. (C)**



Mass of fuel =  $0.756 \times 1000$  g

No. of moles of fuel =  $\frac{0.756 \times 1000}{210}$

Wt. of oxygen =  $\frac{0.756 \times 1000}{210} \times \frac{45}{2} \times 32 = 2592$ g

Wt of  $CO_2$  =  $\frac{0.756 \times 1000}{210} \times 15 \times 44 = 2376$  g

2. Consider the following pairs of electrons

(A) (a)  $n = 3, l = 1, m_l = 1, m_s = +\frac{1}{2}$

(b)  $n = 3, l = 2, m_l = 1, m_s = +\frac{1}{2}$

(B) (a)  $n = 3, l = 2, m_l = -2, m_s = -\frac{1}{2}$

(b)  $n = 3, l = 2, m_l = -1, m_s = -\frac{1}{2}$

(C) (a)  $n = 4, l = 2, m_l = 2, m_s = +\frac{1}{2}$

(b)  $n = 3, l = 2, m_l = 2, m_s = +\frac{1}{2}$

The pairs of electron present in degenerate orbitals is/are:

- (A) Only A  
 (B) Only B  
 (C) Only C

### TEST PAPER WITH SOLUTION

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

**Ans. (B)**

**Sol.** Based on “ $n + l$ ” rule only (B) has pair of electron in degenerate orbitals

3. Match List – I with List - II

List – I		List – II	
(A)	$[PtCl_4]^{2-}$	(I)	$sp^3d$
(B)	$BrF_5$	(II)	$d^2sp^3$
(C)	$PCl_5$	(III)	$dsp^2$
(D)	$[Co(NH_3)_6]^{3+}$	(IV)	$sp^3d^2$

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

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

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

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

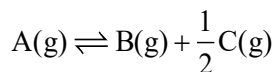
**Official Ans. by NTA (B)**

**Ans. (B)**

**Sol. Answer (B)**

List – I		List – II	
(A)	$[PtCl_4]^{2-}$	(III)	$dsp^2$
(B)	$BrF_5$	(IV)	$sp^3d^2$
(C)	$PCl_5$	(I)	$sp^3d$
(D)	$[Co(NH_3)_6]^{3+}$	(II)	$d^2sp^3$

4. For a reaction at equilibrium



the relation between dissociation constant (K), degree of dissociation ( $\alpha$ ) and equilibrium pressure (p) is given by :

$$(A) K = \frac{\alpha^{\frac{1}{2}} p^{\frac{3}{2}}}{\left(1 + \frac{3}{2}\alpha\right)^{\frac{1}{2}} (1-\alpha)}$$

$$(B) K = \frac{\alpha^{\frac{3}{2}} p^{\frac{1}{2}}}{(2 + \alpha)^{\frac{1}{2}} (1-\alpha)}$$

$$(C) K = \frac{(\alpha p)^{\frac{3}{2}}}{\left(1 + \frac{3}{2}\alpha\right)^{\frac{1}{2}} (1-\alpha)}$$

$$(D) K = \frac{(\alpha p)^{\frac{3}{2}}}{(1 + \alpha)(1-\alpha)^{\frac{1}{2}}}$$

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

**Ans. (B)**



**Initial : P<sub>i</sub>**                      **0**                      **0**

**At eq.:** P<sub>i</sub>(1- $\alpha$ )                      P<sub>i</sub>· $\alpha$                       P<sub>i</sub> $\frac{\alpha}{2}$

Now, equilibrium pressure (p) ,

$$P = P_i \times \left(1 + \frac{\alpha}{2}\right)$$

$$\therefore P_A = \left(\frac{1-\alpha}{1 + \frac{\alpha}{2}}\right) P$$

$$P_B = \left(\frac{\alpha}{1 + \frac{\alpha}{2}}\right) P$$

$$P_C = \left(\frac{\frac{\alpha}{2}}{1 + \frac{\alpha}{2}}\right) P$$

$$\therefore K = \frac{P_C^{\frac{1}{2}} \times P_B}{P_A}$$

$$K = \frac{\alpha^{\frac{3}{2}} p^{\frac{1}{2}}}{(2 + \alpha)^{\frac{1}{2}} (1-\alpha)}$$

5. Given below are two statements :

Statement I : Emulsions of oil in water are unstable and sometimes they separate into two layers on standing.

Statement II :For stabilisation of an emulsion, excess of electrolyte is added.

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

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

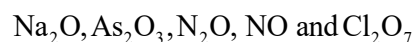
**Official Ans. by NTA (C)**

**Ans. (C)**

**Sol.** Statement I : Fact

Statement II: The principle emulsifying agents for O/W emulsions are proteins, gums natural and synthetic soaps etc...

6. Given below are the oxides:



Number of amphoteric oxides is:

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

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

**Ans. (B)**

**Sol.** Na<sub>2</sub>O = Basic                      As<sub>2</sub>O<sub>3</sub> = Amphoteric  
 N<sub>2</sub>O = Neutral                      NO = Neutral  
 Cl<sub>2</sub>O<sub>7</sub> = Acidic

7. Match List – I with List – II

	List - I		List - II
(A)	Sphalerite	(I)	FeCO <sub>3</sub>
(B)	Calamine	(II)	PbS
(C)	Galena	(III)	ZnCO <sub>3</sub>
(D)	Siderite	(IV)	ZnS

Choose the most appropriate answer from the options given below:

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

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

**Ans. (A)**

**Sol.**

	List - I		List - II
(A)	Sphalerite	(IV)	ZnS
(B)	Calamine	(III)	ZnCO <sub>3</sub>
(C)	Galena	(II)	PbS
(D)	Siderite	(I)	FeCO <sub>3</sub>

8. The highest industrial consumption of molecular hydrogen is to produce compounds of element:

- (A) Carbon (B) Nitrogen  
 (C) Oxygen (D) Chlorine

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

**Ans. (B)**

**Sol.** Nitrogen . Around 55% of hydrogen around would goes to ammonia production

9. Which of the following statements are correct ?

- (A) Both LiCl and MgCl<sub>2</sub> are soluble in ethanol.  
 (B) The oxides Li<sub>2</sub>O and MgO combine with excess of oxygen to give superoxide.  
 (C) LiF is less soluble in water than other alkali metal fluorides.  
 (D) Li<sub>2</sub>O is more soluble in water than other alkali

Choose the most appropriate answer from the options given below:

- (A) (A) and (C) only (B) (A), (C) and (D) only  
 (C) (B) and (C) only (D) (A) and (C) only

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

**Ans. (A)**

- Sol.** (A) Both LiCl and MgCl<sub>2</sub> are soluble in ethanol  
 (B) Li and Mg do not form superoxide  
 (C) LiF has high lattice energy  
 (D) Li<sub>2</sub>O is least soluble in water than other alkali metal oxides

10. Identify the correct statement for B<sub>2</sub>H<sub>6</sub> from those given below.

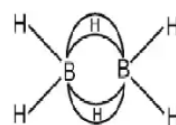
- (A) In B<sub>2</sub>H<sub>6</sub>, all B-H bonds are equivalent.  
 (B) In B<sub>2</sub>H<sub>6</sub> there are four 3-centre-2-electron bonds.  
 (C) B<sub>2</sub>H<sub>6</sub> is a Lewis acid.  
 (D) B<sub>2</sub>H<sub>6</sub> can be synthesized form both BF<sub>3</sub> and NaBH<sub>4</sub>.  
 (E) B<sub>2</sub>H<sub>6</sub> is a planar molecule.

Choose the most appropriate answer from the options given below :

- (A) (A) and (E) only (B) (B), (C) and (E) only  
 (C) (C) and (D) only (D) (C) and (E) only

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

**Ans. (C)**



**Sol.** (A) (B)

- Two 3 centre – 2 – electron bonds  
 (C) B<sub>2</sub> H<sub>6</sub> is e<sup>-</sup> deficient species  
 (E) B<sub>2</sub>H<sub>6</sub> is non – Planar molecule  
 (D) BF<sub>3</sub> + LiAlH<sub>4</sub> → 2B<sub>2</sub>H<sub>6</sub> + 3LiF + 3AlF<sub>3</sub>  
 NaBH<sub>4</sub> + I<sub>2</sub> → B<sub>2</sub>H<sub>6</sub> + 2NaI + H<sub>2</sub>

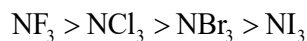
11. The most stable trihalide of nitrogen is:

- (A) NF<sub>3</sub> (B) NCl<sub>3</sub>  
 (C) NBr<sub>3</sub> (D) NI<sub>3</sub>

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

**Ans. (A)**

Sol. Order of stability: -



12. Which one of the following elemental forms is not present in the enamel of the teeth?

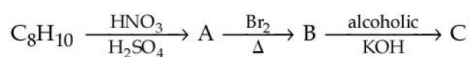
- (A)  $\text{Ca}^{2+}$  (B)  $\text{P}^{3+}$   
(C)  $\text{F}^-$  (D)  $\text{P}^{5+}$

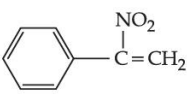
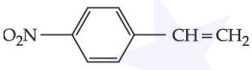
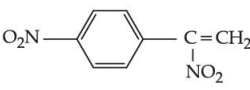
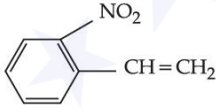
Official Ans. by NTA (B)

Ans. (B)

Sol. Calcium and phosphate are the major components of teeth enamel

13. In the given reactions sequence, the major product 'C' is :

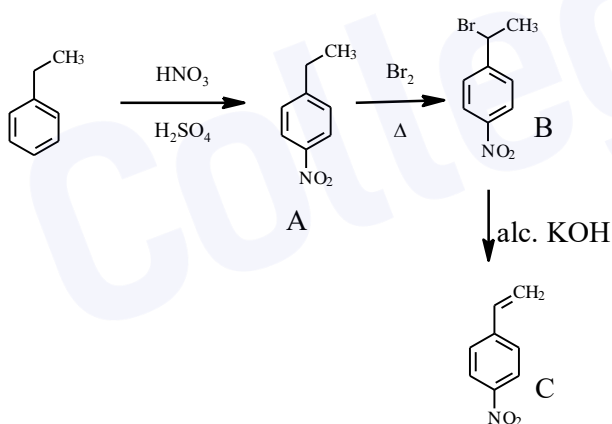


- (A)  (B)   
(C)  (D) 

Official Ans. by NTA (B)

Ans. (B)

Sol.  $\text{C}_8\text{H}_{10}$  DU =  $9 - 5 = 4$



14. Two statements are given below :

Statement I: The melting point of monocarboxylic acid with even number of carbon atoms

is higher than that of with odd number of carbon atoms acid immediately

Statement II : The solubility of monocarboxylic acids in water decreases with increase in molar mass.

Choose the most appropriate option:

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

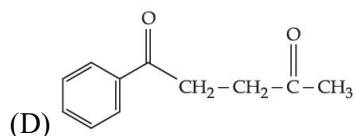
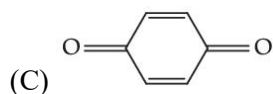
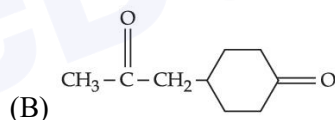
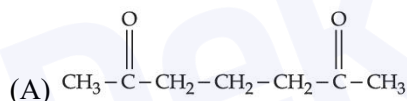
Official Ans. by NTA (A)

Ans. (A)

Sol. I . Better packing efficiency of monocarboxylic acids with even number of carbon atoms results in higher M.P

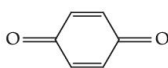
II. As molar mass increases hydrophobic part size increase hence solubility decreases.

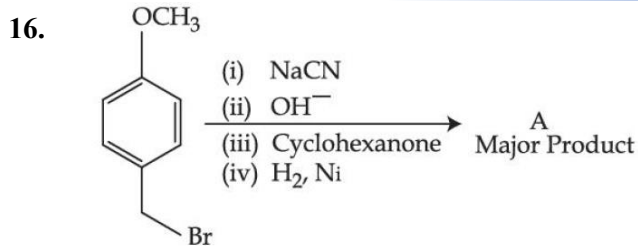
15. Which of the following is an example of conjugated diketone?



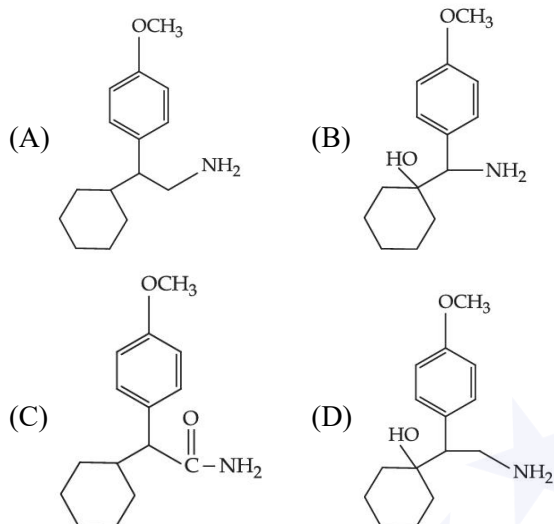
Official Ans. by NTA (C)

Ans. (C)

Sol.  is a conjugated diketone



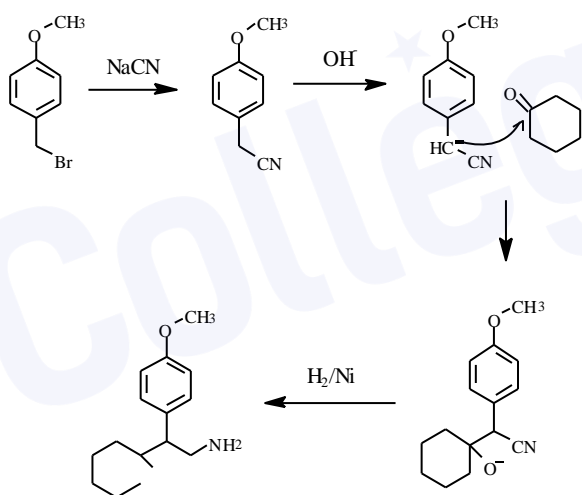
The major product of the above reaction is



Official Ans. by NTA (D)

Ans. (D)

Sol.



17. Which of the following is an example of polyester?

- (A) Butadiene-styrene copolymer  
 (B) Melamine polymer  
 (C) Neoprene  
 (D) Poly- $\beta$ -hydroxybutyrate-co- $\beta$ -hydroxy valerate

Official Ans. by NTA (D)

Ans. (D)

Sol. Factual

18. A polysaccharide 'X' on boiling with dil  $H_2SO_4$  at 393 K under 2-3 atm pressure yields 'Y'.

'Y' on treatment with bromine water gives gluconic acid. 'X' contains  $\beta$ -glycosidic linkages only.

Compound 'X' is :

- (A) starch (B) cellulose  
 (C) amylose (D) amylopectin

Official Ans. by NTA (B)

Ans. (B)

Sol. Cellulose contains  $\beta$ -glycosidic linkages only

19. Which of the following is not a broad spectrum antibiotic?

- (A) Vancomycin (B) Ampicillin  
 (C) Ofloxacin (D) Penicillin G

Official Ans. by NTA (D)

Ans. (D)

Sol. Penicillin G following is a narrow spectrum antibiotic

20. During the qualitative analysis of salt with cation  $y^{2+}$ , addition of a reagent (X) to alkaline solution of the salt gives a bright red precipitate. The reagent (X) and the cation ( $y^{2+}$ ) present respectively are:

- (A) Dimethylglyoxime and  $Ni^{2+}$   
 (B) Dimethylglyoxime and  $Co^{2+}$   
 (C) Nessler's reagent and  $Hg^{2+}$   
 (D) Nessler's reagent and  $Ni^{2+}$

Official Ans. by NTA (A)

Ans. (A)

Sol.  $Ni^{2+} + DMG^- \rightarrow [Ni(DMG)_2] \downarrow$

(Bright red precipitate)

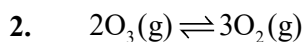
### SECTION-B

1. Atoms of element X form hcp lattice and those of element Y occupy  $\frac{2}{3}$  of its tetrahedral voids. The percentage of element X in the lattice is \_\_\_\_\_ (Nearest integer)

Official Ans. by NTA (43)



$$\% X = \frac{6}{14} \times 100 = 42.8 \approx 43\%$$

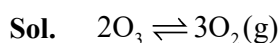


At 300 K, ozone is fifty percent dissociated. The standard free energy change at this temperature and 1 atm pressure is (–) \_\_\_ J mol<sup>-1</sup> (Nearest integer)

[Given:  $\ln 1.35 = 0.3$  and  $R = 8.3 \text{ J K}^{-1} \text{ mol}^{-1}$ ]

**Official Ans. by NTA (747)**

**Ans. ( 747)**



$$\frac{2}{5} \quad \frac{3}{5}$$

$$k_p = \frac{P_{O_2}^3}{P_{O_3}^2}$$

$$k_p = 1.35$$

$$\Delta G^\circ = -RT \ln k_p$$

$$= -8.3 \times 300 \times \ln 1.35$$

$$= -747 \text{ J/mol}$$

3. The osmotic pressure of blood is 7.47 bar at 300 K. To inject glucose to a patient intravenously, it has to be isotonic with blood. The concentration of glucose solution in gL<sup>-1</sup> is \_\_\_\_\_ (Molar mass of glucose = 180 g mol<sup>-1</sup>)

$$R = 0.083 \text{ L bar K}^{-1} \text{ mol}^{-1} \text{ (Nearest integer)}$$

**Official Ans. by NTA (54)**

**Ans. (54)**

**Sol.**  $\pi = C.R.T$

$$7.47 = C \times 0.083 \times 300$$

$$C = 0.3 \text{ M}$$

$$= 0.3 \times 180 \text{ gL}^{-1}$$

$$= 54 \text{ gL}^{-1}$$

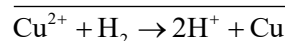
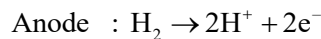
4. The cell potential for the following cell



is 0.576 V at 298 K. The pH of the solution is \_\_\_\_\_. (Nearest integer)

**Official Ans. by NTA (5)**

**Ans. (5)**

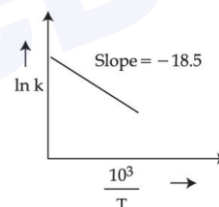


$$E_{\text{cell}} = E_{\text{cell}}^0 - \frac{0.06}{2} \log \frac{[H^+]^2}{[Cu^{2+}]}$$

$$0.576 = 0.34 - \frac{0.06}{2} \log \left\{ \frac{[H^+]^2}{(0.01)} \right\}$$

$$+ 3.93 - \log(H^+) + \log 0.1 \Rightarrow \text{pH} = 4.93 \approx 5$$

5. The rate constants for decomposition of acetaldehyde have been measured over the temperature range 700–1000 K. The data has been analysed by plotting  $\ln k$  vs  $\frac{10^3}{T}$  graph. The value of activation energy for the reaction is \_\_\_ kJ mol<sup>-1</sup>. (Nearest integer) (Given :  $R = 8.31 \text{ J K}^{-1} \text{ mol}^{-1}$ )



**Official Ans. by NTA (154)**

**Ans. (154)**

**Sol.**  $\ln k = \ln A - \frac{E_a}{10^3 RT} \times 10^3$

$$= \ln A + \frac{10^3}{T} \left[ -\frac{E_a}{10^3 RT} \right]$$

From the graph

$$\frac{-E_a}{1} = -18.5$$

$$E_a = 153.735 \text{ kJ/mol}$$

6. The difference in oxidation state of chromium in chromate and dichromate salts is \_\_\_\_\_

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

**Ans. (0)**

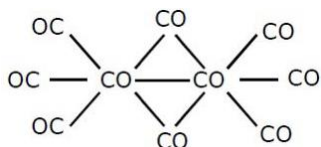
**Sol.**  $\text{CrO}_4^{2-}$ ,  $\text{Cr}_2\text{O}_7^{2-}$  difference is zero

7. In the cobalt-carbonyl complex:  $[\text{Co}_2(\text{CO})_8]$ , number of Co-Co bonds is "X" and terminal CO ligands is "Y".  $X + Y =$  \_\_\_\_\_

**Official Ans. by NTA (7)**

**Ans. (7)**

**Sol.**



$X = 1$

$Y = 6$

8. A 0.166 g sample of an organic compound was digested with conc.  $\text{H}_2\text{SO}_4$  and then distilled with NaOH. The ammonia gas evolved was passed through 50.0 mL of 0.5 N  $\text{H}_2\text{SO}_4$ . The used acid required 30.0 mL of 0.25 N NaOH for complete neutralization. The mass percentage of nitrogen in the organic compound is \_\_\_\_\_.

**Official Ans. by NTA (63)**

**Ans. (Bonus)**

**Sol.**  $m_{\text{eq}}$  of NaOH used =  $30 \times 0.25$

$m_{\text{eq}}$  of  $\text{H}_2\text{SO}_4$  taken =  $50 \times 0.5$

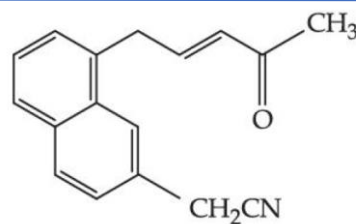
$\therefore m_{\text{eq}}$  of  $\text{H}_2\text{SO}_4$  used

=  $50 \times 0.25 \times 30 \times 0.25 = 17.5$  m mol of  $\text{NH}_3$

$\therefore \% \text{N} = \frac{17.5 \times 10^{-3} \times 14}{0.166} \times 100 = 147.59\%$

(Not possible)

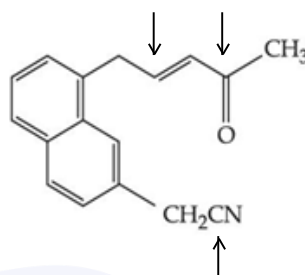
9. Number of electrophilic centre in the given compound is \_\_\_\_\_



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

**Ans. (3)**

**Sol.**



10. The major product 'A' of the following given reaction has \_\_\_\_\_  $\text{sp}^2$  hybridized carbon atoms.

2,7 - Dimethyl - 2, 6 - octadiene



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

**Ans. (2)**

**Sol.** Answer (2)

