



## JEE-MAIN – JUNE, 2022

(Held On Tuesday 28<sup>th</sup> June, 2022)

TIME : 9 : 00 AM to 12 : 00 PM

### Chemistry

Test Pattern : JEE-MAIN

Maximum Marks : 120

Topic Covered: FULL SYLLABUS

#### Important instruction:

1. Use Blue / Black Ball point pen only.
2. There are three sections of equal weightage in the question paper **Physics**, **Chemistry** and **Mathematics** having 30 questions in each subject. Each paper have 2 sections A and B.
3. You are awarded +4 marks for each correct answer and –1 marks for each incorrect answer.
4. Use of calculator and other electronic devices is not allowed during the exam.
5. No extra sheets will be provided for any kind of work.

Name of the Candidate (in Capitals) \_\_\_\_\_

Father's Name (in Capitals) \_\_\_\_\_

Form Number : in figures \_\_\_\_\_

: in words \_\_\_\_\_

Centre of Examination (in Capitals): \_\_\_\_\_

Candidate's Signature: \_\_\_\_\_

Invigilator's Signature : \_\_\_\_\_

Rough Space

**YOUR TARGET IS TO SECURE GOOD RANK IN JEE-MAIN**

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**FINAL JEE-MAIN EXAMINATION – JUNE, 2022****(Held On Tuesday 28<sup>th</sup> June, 2022)****TIME : 9 : 00 AM to 12 : 00 PM****CHEMISTRY****TEST PAPER WITH SOLUTION****SECTION-A**

1. The incorrect statement about the imperfections in solids is :

- (A) Schottky defect decreases the density of the substance.  
 (B) Interstitial defect increases the density of the substance.  
 (C) Frenkel defect does not alter the density of the substance.  
 (D) Vacancy defect increases the density of the substance.

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

- Sol.** Due to vacancy defect density of the substance will decrease.

2. The Zeta potential is related to which property of colloids?

- (A) Colour  
 (B) Tyndall effect  
 (C) Charge on the surface of colloidal particles  
 (D) Brownian movement

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

- Sol.** The potential difference between the fixed and diffused layer of charges in a colloidal particle is called zeta potential

3. Element "E" belongs to the period 4 and group 16 of the periodic table. The valence shell electron configuration of the element, which is just above 'E' in the group is

- (A)  $3s^2, 3p^4$  (B)  $3d^{10}, 4s^2, 4p^4$   
 (C)  $4d^{10}, 5s^2, 5p^4$  (D)  $2s^2, p^4$

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

- Sol.**  $E \Rightarrow [Ar] 3d^{10} 4s^2 4p^4$

Element above E  $\Rightarrow [Ne] 3s^2 3p^4$ 

4. Given are two statements one is labelled as Assertion A and other is labelled as Reason R.  
 Assertion A : Magnesium can reduce  $Al_2O_3$  at a temperature below  $1350^\circ C$ , while above  $1350^\circ C$  aluminium can reduce MgO.  
 Reason R : The melting and boiling points of magnesium are lower than those of aluminium.  
 In light of the above statements, choose most appropriate answer from the options given below:  
 (A) Both A and R are correct, and R is correct explanation of A.  
 (B) Both A and R are correct, but R is NOT the correct explanation of A.  
 (C) A is correct R is not correct.  
 (D) A is not correct, R is correct.

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

- Sol.** From Ellingham diagram given in NCERT, it can be seen that Mg, MgO line crosses Al,  $Al_2O_3$  line after  $1350^\circ C$  hence assertion is true.

Yes, Mg have lower MP and BP than aluminium but it does not explain the above fact.

5. Dihydrogen reacts with CuO to give  
 (A)  $CuH_2$   
 (B) Cu  
 (C)  $Cu_2O$   
 (D)  $Cu(OH)_2$

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

- Sol.**  $CuO + H_2 \rightarrow Cu + H_2O$  (under hot conditions)

6. Nitrogen gas is obtained by thermal decomposition of  
 (A)  $Ba(NO_3)_2$  (B)  $Ba(N_3)_2$   
 (C)  $NaNO_2$  (D)  $NaNO_3$

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

- Sol.**  $Ba(N_3)_2 \rightarrow Ba + 3N_2$

7. Given below are two statements :  
 Statement -I :The pentavalent oxide of group- 15 element.  $E_2O_5$ . is less acidic than trivalent oxide.  $E_2O_3$ . of the same element.  
 Statement -II :The acidic character of trivalent oxide of group 15 elements.  $E_2O_3$ . decreases down the group.  
 In light of the above statements. choose most appropriate 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 true. but statement II is false.  
 (D) Statement I is false but statement II is true.  
**Official Ans. by NTA (D)**

**Allen Ans. (D)**

- Sol.** As +ve oxidation state increases, EN of element increases hence acidic character increases. Down the group, non-metallic character decreases, acidic character decreases.

Acidic character :  $E_2O_5 > E_2O_3$

Down the group, acidic character of  $E_2O_3$  decreases

8. Which one of the lanthanoids given below is the most stable in divalent form?  
 (A) Ce (Atomic Number 58)  
 (B) Sm (Atomic Number 62)  
 (C) Eu (Atomic Number 63)  
 (D) Yb (Atomic Number 70)  
**Official Ans. by NTA (C)**

**Allen Ans. (C)**

- Sol.**  $E_{M^{3+}/M^{2+}}^{\circ} \Rightarrow \begin{matrix} \text{Eu} & \text{Yb} \\ -0.35 & -1.05 \end{matrix}$

Hence, due to more reduction potential in Eu as compared to Yb, it can be concluded that  $Eu^{2+}$  is more stable than  $Yb^{2+}$ .

9. Given below are two statements :  
 Statement I :  $[Ni(CN)_4]^{2-}$  is square planar and diamagnetic complex. with  $dsp^2$  hybridization for Ni but  $[Ni(CO)_4]$  is tetrahedral. paramagnetic and with  $sp^3$ -hybridization for Ni.  
 Statement II:  $[NiCl_4]^{2-}$  and  $[Ni(CO)_4]$  both have same d-electron configuration have same geometry and are paramagnetic.  
 In 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 correct but statement II is false.  
 (D) Statement I is incorrect but statement II is true.  
**Official Ans. by NTA (B)**

**Allen Ans. (B)**

- Sol.**  $[Ni(CN)_4]^{2-}$  :  $d^8$  configuration, SFL, sq. planar splitting ( $dsp^2$ ), diamagnetic.

$[Ni(CO)_4]$  :  $d^{10}$  config (after excitation), SFL, tetrahedral splitting ( $sp^3$ ), diamagnetic.

$[NiCl_4]^{2-}$  :  $d^8$  config, WFL, tetrahedral splitting ( $sp^3$ ), paramagnetic (2 unpaired  $e^-$ ).

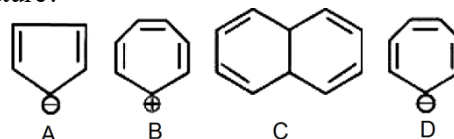
10. Which amongst the following is not a pesticide ?  
 (A) DDT  
 (B) Organophosphates  
 (C) Dieldrin  
 (D) Sodium arsenite  
**Official Ans. by NTA (D)**

**Allen Ans. (D)**

11. Which one of the following techniques is not used to spot components of a mixture separated on thin layer chromatographic plate?  
 (A)  $I_2$  (Solid)  
 (B) U.V. Light  
 (C) Visualisation agent as a component of mobile phase  
 (D) Spraying of an appropriate reagent  
**Official Ans. by NTA (C)**

**Allen Ans. (C)**

12. Which of the following structures are aromatic in nature?



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

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

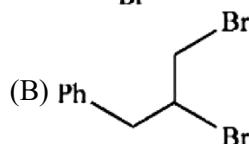
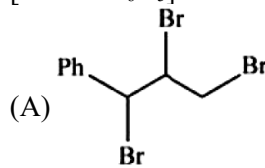
**Allen Ans. (B)**

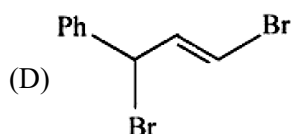
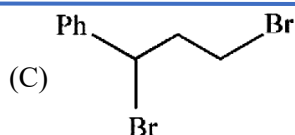
- Sol.** A, B aromatic

C, D is nonaromatic

13. The major product (P) in the reaction  
 $\text{Ph}-\text{CH}=\text{CH}-\text{CH}_2\text{Br} \xrightarrow{\text{HBr}}$  ? (P)

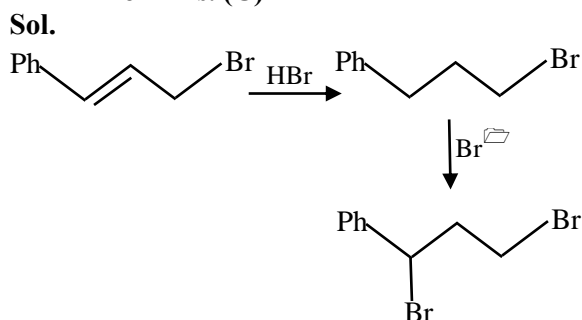
[Ph is  $-C_6H_5$ ] is



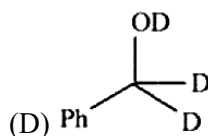
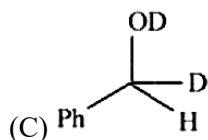
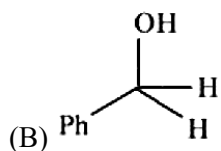
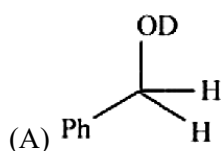
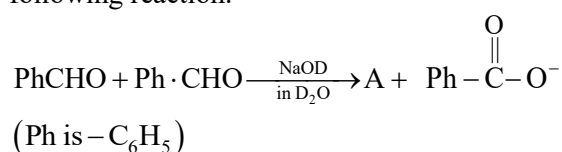


Official Ans. by NTA (C)

Allen Ans. (C)

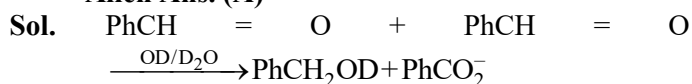


14. The correct structure of product 'A' formed in the following reaction.

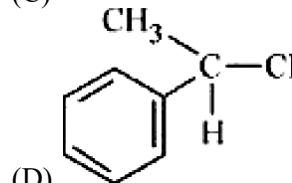
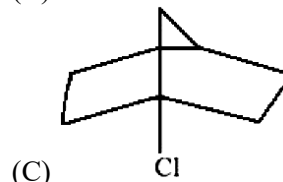
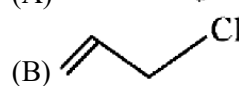
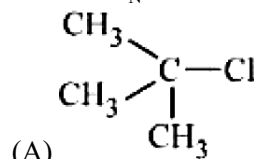


Official Ans. by NTA (A)

Allen Ans. (A)



15. Which one of the following compounds is inactive towards  $\text{S}_{\text{N}}1$  reaction?



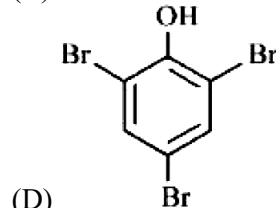
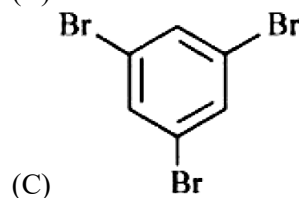
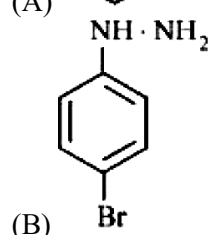
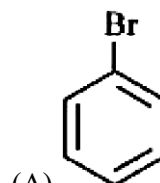
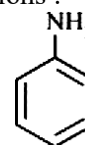
Official Ans. by NTA (C)

Allen Ans. (C)

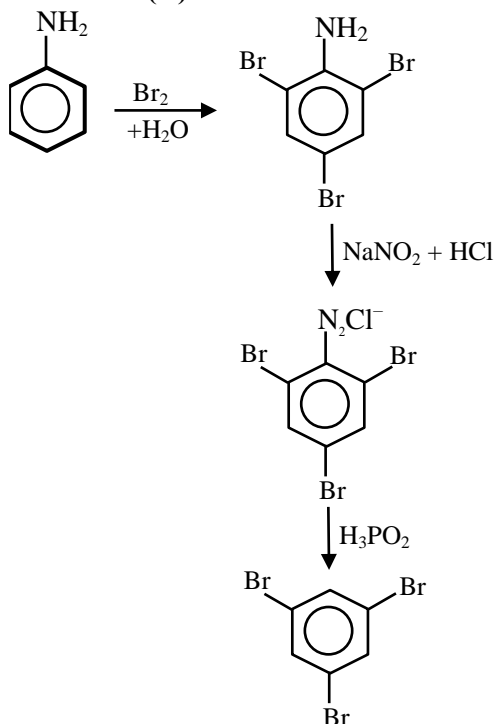
Sol. Sol. The carbocation formed is very unstable.

So it is inactive towards  $\text{S}_{\text{N}}1$

16. Identify the major product formed in the following sequence of reactions :

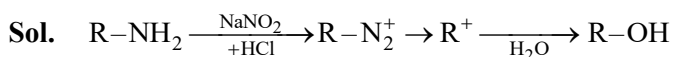


Official Ans. by NTA (C)

**Allen Ans. (C)****Sol.**

17. A primary aliphatic amine on reaction with nitrous acid in cold (273 K) and there after raising temperature of reaction mixture to room temperature (298 K). Gives a/an

(A) nitrile (B) alcohol  
(C) diazonium salt (D) secondary amine

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

18. Which one of the following is **NOT** a copolymer ?

(A) Buna-S (B) Neoprene  
(C) PHBV (D) Butadiene-styrene

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

**Sol.** Buna-S, PHBV and Butadiene-styrene are copolymer. Only neoprene is homopolymer.

19. Stability of  $\alpha$  - Helix structure of proteins depends upon

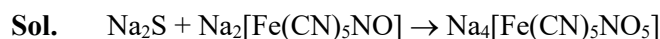
(A) dipolar interaction  
(B) H-bonding interaction  
(C) van der Waals forces  
(D)  $\pi$  -stacking interaction

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

20. The formula of the purple colour formed in Laissaigne's test for sulphur using sodium nitroprusside is

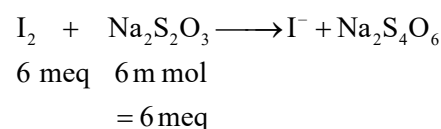
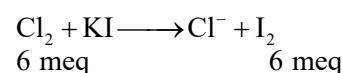
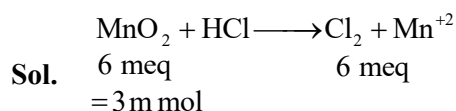
(A)  $NaFe[Fe(CN)_6]$  (B)  $Na[Cr(NH_3)_2(NCS)_4]$

(C)  $Na_2[Fe(CN)_5(NO)]$  (D)  $Na_4[Fe(CN)_5(NOS)]$

**Official Ans. by NTA (D)****Allen Ans. (D)****SECTION-B**

1. A 2.0 g sample containing  $MnO_2$  is treated with HCl liberating  $Cl_2$ . The  $Cl_2$  gas is passed into a solution of KI and 60.0 mL of 0.1 M  $Na_2S_2O_3$  is required to titrate the liberated iodine. The percentage of  $MnO_2$  in the sample is \_\_\_\_\_. (Nearest integer)

[Atomic masses (in u) Mn = 55; Cl = 35.5; O = 16, I = 127, Na = 23, K = 39, S = 32]

**Official Ans. by NTA (13)****Allen Ans. (13)**

$$\%MnO_2 = \frac{3 \times 10^{-3} \times 87}{2} \times 100$$

$$= 13.05\%$$

Ans. 13

2. If the work function of a metal is  $6.63 \times 10^{-19}$  J, the maximum wavelength of the photon required to remove a photoelectron from the metal is \_\_\_\_\_ nm. (Nearest integer)

[Given :  $h = 6.63 \times 10^{-34}$  J s, and  $c = 3 \times 10^8$  m s<sup>-1</sup>]

**Official Ans. by NTA (300)****Allen Ans. (300)**

**Sol.**  $\phi = 6.63 \times 10^{-19} \text{ J} = \frac{hc}{\lambda} = \frac{6.63 \times 10^{-34} \times 3 \times 10^8}{\lambda}$

$$\Rightarrow \lambda = 3 \times 10^{-7} \text{ m} = 300 \text{ nm}$$

3. The hybridization of P exhibited in  $\text{PF}_5$  is  $\text{sp}^x\text{d}^y$ .

The value of y is \_\_\_\_\_.

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

**Allen Ans. (1)**

**Sol.**  $\text{PF}_5 \Rightarrow \text{sp}^3\text{d}$  hybridisation

(5 sigma bonds, zero lone pair on central atom)

Value of y = 1

4. 4.0 L of an ideal gas is allowed to expand isothermally into vacuum until the total volume is 20 L. The amount of heat absorbed in this expansion is \_\_\_\_\_ L atm.

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

**Allen Ans. (0)**

**Sol.** For free expansion:  $P_{\text{ext}} = 0$ ,  $w = 0$   
 $q = 0$ ,  $\Delta U = 0$

Ans. 0

5. The vapour pressures of two volatile liquids A and B at  $25^\circ\text{C}$  are 50 Torr and 100 Torr, respectively. If the liquid mixture contains 0.3 mole fraction of A, then the mole fraction of liquid B in the vapour phase is  $\frac{x}{17}$ . The value of x is \_\_\_\_\_.

**Official Ans. by NTA (14)**

**Allen Ans. (14)**

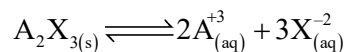
**Sol.**  $\frac{y_B}{1-y_B} = \frac{P_B^0}{P_A^0} \left[ \frac{X_B}{1-X_B} \right]$   
 $\Rightarrow \frac{y_B}{1-y_B} = \frac{100}{50} \left[ \frac{0.7}{0.3} \right] = \frac{14}{3}$   
 $\Rightarrow y_B = \frac{14}{17}$

**Ans. 14**

6. The solubility product of a sparingly soluble salt  $\text{A}_2\text{X}_3$  is  $1.1 \times 10^{-23}$ . If specific conductance of the solution is  $3 \times 10^{-5} \text{ S m}^{-1}$ , the limiting molar conductivity of the solution is  $x \times 10^{-3} \text{ S m}^2 \text{ mol}^{-1}$ . The value of x is \_\_\_\_\_.

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

**Allen Ans. (3)**



$$\text{solubility} = s \text{ M} \quad 2s \quad 3s$$

$$(2s)^2(3s)^3 = 1.1 \times 10^{-23}$$

$$108 s^5 = 1.1 \times 10^{-23}$$

$$s \approx 10^{-5} \text{ M} = 10^{-5} \frac{\text{mol}}{\text{L}} = 0.01 \frac{\text{mol}}{\text{m}^3}$$

$$\text{Now } \wedge_m \approx \wedge_m^\infty = \frac{k}{m} = \frac{k}{s}$$

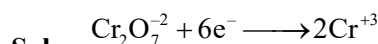
$$\Rightarrow \wedge_m^\infty = \frac{3 \times 10^{-5}}{0.01} = 3 \times 10^{-3} \text{ S-m}^2/\text{mol}$$

Ans. 3

7. The quantity of electricity in Faraday needed to reduce 1 mol of  $\text{Cr}_2\text{O}_7^{2-}$  to  $\text{Cr}^{3+}$  is \_\_\_\_\_.

**Official Ans. by NTA (6)**

**Allen Ans. (6)**



$$1\text{mol} \quad 6\text{mol}$$

$$\Rightarrow \text{number of faradays} = \text{moles of electrons} = 6$$

8. For a first order reaction  $\text{A} \rightarrow \text{B}$ , the rate constant,  $k = 5.5 \times 10^{-14} \text{ s}^{-1}$ . The time required for 67% completion of reaction is  $x \times 10^{-1}$  times the half life of reaction. The value of x is \_\_\_\_\_ (Nearest integer)

(Given :  $\log 3 = 0.4771$ )

**Official Ans. by NTA (16)**

**Allen Ans. (16)**

**Sol.**  $t_{67\%} = \frac{1}{k} \ln \left( \frac{1}{1-0.67} \right) = \frac{t_{1/2}}{\ln 2} \times \ln \left( \frac{1}{1-\frac{2}{3}} \right)$

$$t_{67\%} = \frac{t_{1/2}}{\log 2} \times \log 3 = \frac{t_{1/2} \times 0.4771}{0.301}$$

$$\Rightarrow t_{67\%} = 1.585 \times t_{1/2}$$

$$X \times 10^{-1} = 1.585$$

$$\Rightarrow X = 15.85$$

Ans. 16

9. Number of complexes which will exhibit synergic bonding amongst,  $[\text{Cr}(\text{CO})_6]$ ,  $[\text{Mn}(\text{CO})_5]$  and  $[\text{Mn}_2(\text{CO})_{10}]$  is \_\_\_\_\_.

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

**Allen Ans. (3)**

**Sol.** Carbonyl complex compounds have tendency to show synergic bonding.

10. In the estimation of bromine, 0.5 g of an organic compound gave 0.40 g of silver bromide. The percentage of bromine in the given compound is \_\_\_\_\_ % (nearest integer)

(Relative atomic masses of Ag and Br are 108u and 80u, respectively).

**Official Ans. by NTA (34)**

**Allen Ans. (34)**

**Sol**

|                            |
|----------------------------|
| O.C $\longrightarrow$ AgBr |
| 0.5 g      0.4 g           |

$$\text{mol of Br} = \text{mol of AgBr} = \frac{0.4}{188}$$

$$\% \text{ Br} = \% \text{Br} = \frac{\frac{0.4}{188} \times 80}{0.5} \times 100$$

$$= 34.04\%$$